Published in final edited form as:

Health Psychol. 2017 December ; 36(12): 1109–1125. doi:10.1037/hea0000534.

Is subjective social status a unique correlate of physical health?: A meta-analysis

Jenny M. Cundiff[1] and **Karen A. Matthews**[2]

[1]Texas Tech University

[2]University of Pittsburgh

Abstract

Objective—Both social stratification (e.g., social rank) as well as economic resources (e.g., income) are thought to contribute to socioeconomic health disparities. It has been proposed that subjective socioeconomic status (an individual's perception of his or her hierarchical rank) provides increased predictive utility for physical health over and above more traditional, well-researched socioeconomic constructs such as education, occupation, and income.

Method—PsychINFO and PubMed databases were systematically searched for studies examining the association of subjective SES and physical health adjusting for at least one measure of objective SES. The final sample included thirty-one studies and ninety-nine unique effects. Meta-analyses were performed to: a) estimate the overlap among subjective and objective indicators of socioeconomic status (SES) and b) estimate the cumulative association of subjective SES with physical health adjusting for objective SES. Potential moderators such as race and type of health indicator assessed (global self-reports vs. more specific and biologically-based indicators) were also examined.

Results—Across samples, subjective SES shows moderate overlap with objective indicators of SES, but associations are much stronger in Whites than Blacks. Subjective SES evidenced a unique cumulative association with physical health in adults, above and beyond traditional objective indicators of SES (Z=.07, SE=.01, p<.05). This association was stronger for self-rated health than for biologically-based and symptom-specific measures of health. Almost all available data were cross-sectional and do not allow for strong causal inference.

Conclusions—Subjective SES may provide unique information relevant to understanding disparities in health, especially self-rated health.

Major health disparities in the United States persist despite enormous health care expenditures, and reducing such disparities is a major public health concern (Healthy People 2020). Socioeconomic status (SES) is perhaps the most significant disparity, where rates of morbidity and mortality from a variety of causes are higher among individuals of lower SES (e.g., Adler, 2009; Chetty et al. 2016). Further, this relationship does not seem to simply reflect the effects of poverty. Rather, there is considerable evidence that the SES-health

---

Corresponding Author: Jenny M. Cundiff, Ph.D., Department of Psychological Sciences, PO Box 42051, Texas Tech University, Lubbock, Texas 79409-2051, t: 806.834.7314, jenny.cundiff@ttu.edu.

association is monotonic, extending beyond poverty to explain relative differences in health among higher status groups as well (e.g., Adler, 2009; Marmot, Stansfeld, Patel, & North, 1991). Evidence for this graded relationship between SES (measured in various forms) and health has been interpreted as evidence that social stratification, not simply objective socioeconomic resources, has a meaningful impact on physical health (e.g., Quon & McGrath, 2014). Instead of the term *socioeconomic status*, researchers now often use the term *socioeconomic position* (SEP), which highlights that the social and economic resources one has and where one falls in the social hierarchy may both influence health (Galobardes, Shaw, Lawlor, et al., 2006; Krieger, 2001).

An increasingly common way of measuring an individual's SEP is to assess his or her subjective social status or subjective SES. Subjective SES refers to an individual's perceived standing in a status hierarchy, and hence reflects appraisals of social status relative to others (Adler, Epel, Castellazzo, & Ickovics, 2000). The most commonly used measure of subjective SES presents respondents with the image of a ladder, and asks them to indicate the rung that best represents their standing in the specified group, most-commonly the population of their country (Adler et al., 2000; Adler, 2009). Subjective SES, like objective SES, has been linked to a number of important physical health outcomes, such as hypertension and the metabolic syndrome (e.g., Manuck, 2010). However, there are no reviews examining whether lower subjective SES is associated with greater risk for poor physical health independent of its overlap with traditional objective measures of SES (e.g., education, income, occupational class) in adults (*cf.*, Quon & McGrath, 2014). Likely because high quality early studies appeared promising and spawned considerable interest in subjective SES (Singh-Manoux, Adler, & Marmot, 2003), there is now a significant literature to be evaluated. For example, a PubMed search for "subjective social status" returns 162 citations, 152 of which were published in the past ten years.

The question of whether lower subjective SES is associated with greater risk for poor physical health independent of its overlap with traditional objective measures is useful for theoretical refinement as well as more practical issues (e.g., should both measures be administered in examinations of physical health). Although rarely clearly stated, there appear to be two causal models most commonly invoked in the current literature. The first is subjective SES as a partial mediator; objective SES may influence perceptions of social rank, which, in turn, influence stress physiology directly (e.g., Cundiff, Smith, Baron, & Uchino, 2016) and/or indirectly through alterations in psychosocial resources (e.g., optimism, hostility, social connection; Matthews, Gallo, & Taylor, 2010). The second is subjective SES as a separate and distinct cause of variations in health, such that pathways linking subjective and objective SES to health may be non-overlapping (e.g., monetary resources and access to care vs. social subordination and negative self-concept).

Theoretically, if perceptions of social rank are associated with physical health independent of objective socioeconomic resources, this suggests that the social and psychological processes linked to these perceptions may be incrementally useful for understanding physical health disparities above and beyond their association with socioeconomic resources. If not, then there is less support for the idea that social psychological processes associated with perceptions of social rank may be potential explanatory pathways for SES health disparities.

If incremental utility is found, then candidate factors that may provide this incremental link must be related to both social rank and physical health. Although such incremental utility has not yet been established, it has been suggested, for example, that lower perceived social rank may influence physical health independent of financial resources due to negative emotions associated with viewing oneself as lower in the social hierarchy (e.g., negative social comparison) (*cf.*, Matthews, Gallo, & Taylor, 2010) or perceiving one's lower rank as unfair (such as in relative deprivation theories; Smith, Pettigrew, Pippin, & Bialosiewicz, 2012). Additionally, such social comparison processes are inherently socially contextualized and may capture stressful aspects of social interactions and relationships not captured by objective SES, such as exposure to dominance and interpersonal conflict (e.g., Cundiff, Kamarck, & Manuck, 2016; Cundiff & Smith, 2017).

Findings could also help us better understand the construct itself, which is also important in guiding thinking about potential causal models. For example, some frameworks suggest that subjective SES may be more closely related to physical health because it is either a more fine-grained assessment of SES (e.g., not just high school degree vs. college degree but the prestige of one's college relative to others') or an evaluation of both relative social rank and objective resources, which combined have greater predictive utility. Subjective SES may also capture future expectancies (e.g., earning potential), which are not captured with assessment of objective SES (e.g., students training to enter a lucrative field). If analyses do not reveal incremental utility, then there is less support for the incremental importance of relative SES over and above absolute SES.

Thus, examining whether or not subjective SES predicts physical health indicators over and above objective SES can significantly contribute to refinement of theoretical and empirical models of socioeconomic health disparities (*cf.,* Eutener, 2014). A large part of the enthusiasm for subjective SES and other measures of social rank is their potential ability to explain (e.g., mediate) well-established associations between objective SES and physical health (e.g., Daly, Boyce, & Wood, 2015). Thus, if subjective SES is not associated with physical health independent of objective SES, then it may be argued that this measure has little to offer in the quest to understand and reduce socioeconomic disparities in physical health. Alternatively, perhaps it is so highly overlapping with objective SES that it provides a more parsimonious (and more easily assessed) measure of socioeconomic resources; though this would only be supported if objective SES also had no independent association after controlling for subjective SES.

If subjective SES *is* associated with physical health independent of objective SES, then understanding the mechanisms for this increased predictive utility would be important for future work and hold exciting promise as subjective SES may be a malleable psychological phenomenon, and so some amelioration of health disparities may be possible without, for example, the unlikely substantial redistribution of wealth (e.g., Cundiff et al., 2016). However, if subjective SES is associated with physical health outcomes independent of objective SES only in instances when objective SES is *not* associated with these outcomes on its own (i.e., without adjustment for subjective SES), then subjective SES would be most accurately thought of as a non-overlapping predictor of health, rather than as a potential explanatory variable in the objective SES-health relationship.

In addition to the question of incremental utility, it would be helpful to better understand the amount of shared variance between subjective and objective SES. As mentioned, it has been proposed that subjective SES is a more fine-grained cognitive averaging of objective SES information (Singh-Manoux et al., 2003), suggesting that subjective SES should be significantly correlated with measures of objective SES. If objective and subjective SES are very highly correlated then subjective SES may be less likely to have incremental predictive utility due to the substantial overlap between the two predictive variables. On the other hand, if subjective and objective SES show little overlap, then researchers may need to revise conceptual models of the subjective SES construct. Further, some large studies suggest that associations between subjective SES and objective indicators of SES may differ by race (e.g., Adler et al., 2008), and such discrepancies are important for understanding potential differences in construct validity between racial groups as well as race differences in plausible mechanisms linking subjective SES to physical health.

In a recent meta-analysis of the effects of subjective SES on health (not controlling for objective SES) in adolescents, the association between subjective SES and physical health was stronger for self-rated health and general health symptoms compared to more objective measures of health or disease risk such as biomarkers (Quon & McGrath, 2014). One important concern here is that subjective SES and subjective reports of physical health could show stronger covariation simply due to common method variance and/or reporting bias. Although there is some evidence that subjective SES and its association with physical health does not simply reflect trait negative affect (e.g., Krause, Adler, & Chen, 2013), it seems important to show that the independent association between subjective SES and physical health is not *only* apparent among indicators that share such common method variance.

In response to the issues in the literature described above, the primary purpose of this meta-analysis is two-fold. First, there is an evaluation of whether measures of objective SES are significantly correlated with subjective SES across studies, the size of such effects, and whether or not they are moderated by race. Second, there is an evaluation, across studies, of whether subjective SES offers additional utility in accounting for variance in physical health measures above and beyond well-established objective measures of SES in adults. Analyses examine the overall magnitude of the adjusted association of subjective SES and physical health across studies on average (cumulative effect size) and examine the impact of study characteristics that may partially explain differences in effect sizes (e.g., type of physical health indicator assessed).

Method

Literature Search Strategy

A literature search was conducted in PsychINFO and PubMed databases for articles appearing between January 1980 and June 2015 using the following search criteria: (“subjective social status” or “subjective social position” or “subjective socioeconomic status" or "subjective socioeconomic position") AND ("socioeconomic status" or "social standing" or "objective social status" or "education" or "income" or "occupation") and ("physical health" or "disease" or "death" or "health"). The search returned 113 possible articles (see Figure 1). Each article was reviewed in detail to ensure the presence of a physical health indicator and analyses that examined the unique effects of subjective SES controlling for *at least one* measure of objective SES. Papers written in another language but available in English were included. If not available in English (N=2), papers were not translated. Unpublished data was not sought out or included; only papers vetted for quality by the peer-review process were included. Thirty-nine reports were excluded due to lack of a physical health indicator. Health behaviors (the vast majority of which were studies of smoking) were not include in this review. Thirty-four more studies were excluded because they did not control for at least one objective measure of SES when examining the effects of subjective SES on physical health. Of the remaining forty reports, two were not available in English, six analyzed individuals under the age of 18, and one study examined differences in health among geographic regions (not individuals) based on aggregate reports of the subjective SES of spouses. Thus, thirty-one studies met inclusion criteria. To summarize, each study included examined the association between subjective SES and a health indicator in an adult population and simultaneously controlled for at least one objective measure of SES. Studies also had to be available in English and examine associations between subjective SES and physical health at the level of the individual.

Data Extraction

The first author (JC) performed the data searches and coding in consultation with the second author (KM) who also independently coded a random subsample of studies as a check (see Table 1). No discrepancies were found between coder extracted information. The following objectively verifiable information was extracted from each study:1) measure of subjective SES evaluated, 2) indicator(s) of objective SES covaried, 3) physical health measure(s) evaluated, 4) number and class of additional covariates included in analyses, 5) geographic region of the sample, 6) sample size and other demographics (age, race, gender), and 7) study design. Study design does not appear in the table because there was very little variability, with the vast majority of studies being cross-sectional (see "Study Design" in the "Measures" section below).

For each health measure examined, the reported effect size was extracted. When data presented in the published manuscript were not adequate to produce an effect size (the most common reason was lack of reporting standard errors), first and/or second authors were contacted for this additional information. Either an effect size could be extracted from the published record or an author provided the additional statistics requested. Effect sizes were most often reported as partial correlations, regression coefficients, or odds ratios. Hence, Fisher's Z was used as the common metric for effect sizes across studies as all metrics could be transformed into Fisher's Z units for comparison. Transformations were completed with the help of the statistical program Comprehensive Meta-Analysis (version 3; BiostatTM, USA), which provides transformations within a study as well as estimation of cumulative effect sizes across studies. Fisher's Z also has the added benefit of being easy to interpret as it is similar to a correlation (Cooper & Hedges, 1994). The direction of the Fisher Z was consistently coded such that positive values indicate a positive relationship between subjective SES and physical health (higher subjective SES, better health).

If multiple effects of interest were reported in a study, each of these effects was coded. It was common for studies to analyze multiple subjective SES-health relationships (i.e., multiple health measures were tested) or the same SES-health relationship within multiple subgroups (men vs. women; Blacks vs. Whites). Nonoverlapping groups were treated as independent effects. If multiple comparisons were tested within the same group for the same health measure (e.g., low subjective SES vs. middle subjective SES and low subjective SES vs. high subjective SES), the most extreme comparison was retained (this was applicable to fewer than 5 studies). Ninety-nine total effects were reported within the thirty-one studies that met inclusion criteria.

Treating multiple effects from the same study sample as independent can artificially reduce the standard error, making it more likely that results will be accompanied by a lower *p*-value. However, aggregating across effects reduces power, could artificially deflate estimates, and makes it more difficult to adequately test whether the strength of the association may vary depending on the type of health measure examined (e.g., global self-rated health vs. biological and specific clinical symptoms). Thus, meta-analytic results are presented in two ways: 1) using a conservative approach which aggregated effects within studies by averaging effect sizes across dependent measures (K=31), and 2) using a less conservative approach which treated each subjective SES-health effect as independent (k=99). By necessity, moderators were tested using this less conservative approach.

Measures

Subjective SES—Subjective SES is commonly measured in health research using a visual analogue scale with a picture of a ladder that asks individuals to place themselves on one of the ten possible rungs reflecting hierarchical stratification of a defined social group (e.g., one's country, one's community) (e.g., Adler, 2000). This 10-rung ladder scale has shown good test-retest reliability as well as construct validity (Cundiff, et al. 2013; Operario, Adler, & Williams, 2004). Higher scores indicate higher social standing. Every study included in this review and meta-analysis uses this subjective social status ladder to measure subjective SES. Most studies used this measure to assess subjective SES relative to others in participants' country of residence; though, a few studies assessed subjective SES relative to others in participants' self-defined community or created an aggregate score using ratings from both ladder measures (see Table 1). Studies were not included if the operational definition of subjective SES did not ask participants to make a relative social comparison of themselves against others (e.g., Macleod, Davey Smith, Metcalfe, & Hart, 2005).

Objective SES—Every study reported here examined the association of subjective SES controlling for at least one of the following: 1) years or level of education, 2) annual household income, and/or 3) occupational class. A number of studies control for more than one of these traditional indices of SES, a composite of one or more (e.g., Hollingshead Index), or all three. One study (Allen, McNeely, Waldstein, Evans, & Zonderman, 2014) used a specific income level (the poverty line) to control for objective SES. Some studies additionally controlled for other measures of resources (e.g., wealth), home ownership, or neighborhood SES. Specific measures for each study can be found in Table 1.

Physical Health Measures—As previously noted, both general subjective and more specific objective health measures were included. General reports of subjective health included participants' single-item ratings of overall self-rated health using one-item (Idler & Benyamini, 1997) and participant's ratings of health-related quality of life (e.g., SF-12; Ware, Kosinski, & Keller, 1996). Objective health indicators were more varied and included multiple physiologic measures (e.g., blood pressure, cortisol) as well as different disease diagnoses (e.g., hypertension, diabetes), and physical symptoms (e.g., fatigue, headache). Although specific physical symptoms of fatigue and headache were measured by self-report, a decision was made to categorize them with other biologically and clinically specific measures on the basis that they can only be self-reported and are clinically specific, thus more closely resembling a clear indication of physical disorder/disease than a general, global interpretation of physical health. Specific dependent measures for each study are included in Table 1.

Covariates in addition to objective SES—A number of studies also included other demographics (age, race, sex, marital status) and potential mediators or confounds (e.g., optimism, depression, alcohol use, BMI, negative affect, perceived stress, feelings of financial security) in their analyses. Additional covariates for each study are listed in Table 1.

Study Design—The vast majority of studies that met inclusion criteria were cross-sectional in nature (27 studies out of 31). Although some performed a manipulation (e.g., exposure to the common cold), no study that met inclusion criteria experimentally manipulated subjective SES (*cf.*, Mendelson, Thurston, & Kubzansky, 2008; Cundiff, Smith, Baron, & Uchino, 2016, Kraus, Piff, & Keltner, 2009), because such experimental studies do not control for objective SES. Thus, the four studies (three samples; six reported effects) that were classified as relatively stronger study designs were prospective or longitudinal in nature (Cohen et al., 2008; Singh-Manoux et al., 2005; Thompson, Gaglani, Naleway, Thaker, & Ball, 2014; Thompson, Naleway, et al., 2014).

Overview of Analyses

Random effects models were analyzed using Comprehensive Meta-Analysis analytic software version 3 (BiostatTM, USA). Random effects models assume that the samples are drawn from populations with different effect sizes and allows for both random variance and variance due to true differences between populations. In practice, this means that the number of participants in a study carries *less* weight in random effects models compared to fixed effects models, so that sample size has less of an influence on the estimated cumulative effect size in random effects models (Borenstein, Hedges, & Rothstein, 2007). It has been suggested that random effects models yield more accurate confidence intervals in meta-analysis (Schmidt, Oh, & Hayes, 2009). Further, the I^2 statistic provides an estimate of heterogeneity under the assumptions of a fixed effects model, and the I^2 for the effects examined here was .85, indicating that 85% of the variance can be attributed to between (rather than within) study variability, further suggesting the use of a random effects model. In random effects models, the heterogeneity statistic (Q_T) provides an estimate of variability of effects sizes. If there is significant heterogeneity of effects in random models (i.e., significant Q_T coefficient), then moderators are often examined as a potential explanation for variability of effect size. Prior to analyses, the following moderators were coded: 1) global self-reports vs. more specific and biologically-based outcomes, 2) United States sample vs. Non-United States sample, 3) cardiovascular vs. other disease indicators, 4) strength of study design (prospective/longitudinal/experimental designs vs. all others), 5) race of the sample, and 6) sex of the sample. For both race and sex, greater than 80% of the sample had to be of the same race/sex or results presented separately by race or sex in order to be included in moderation analyses. If racial/ethnic category was not provided and could not be discerned based on the sample characteristics found elsewhere in the literature (e.g., Whitehall-II), then the study was not included in analyses of moderation by race. All Black samples were from the U.S., and all White samples were from the U.S. or U.K., with the exception of one Swedish sample (Miyakawa et al., 2012). Potential effects of the number of indices of SES that were covaried and the total number of covariates included in the models were also examined, with the expectation that samples examining more adjusted models would show smaller effects. While there are some variables that are outcomes in one study and treated as covariates in another, the variable was treated in the meta-analysis consistent with how it was treated in the analytic strategy of the original manuscript. Seven reports (Allen et al., 2014; Cooper et al., 2010; Euteneuer et al., 2012; Ghaed et al., 2007; Subramanyam et al., 2012; Thompson, Gaglani et al., 2014; Wright et al., 2005) include covariates that would qualify as a physical health outcome in their own right in this meta-analysis (7 of 31 studies).

Results

Association between Subjective SES and Indicators of Objective SES

Using random effects models, the cumulative effect sizes (r) of the association between subjective SES and objective indicators of SES were moderate; $r = .25$, .33, and .34 for education, occupation, and income, respectively. Twenty of the thirty-one unique studies identified for this meta-analysis included relevant information for these analyses. Whether race moderated associations between subjective SES and objective indicators of SES was also examined (Table 2). The cumulative effect sizes of the association between subjective SES and all three objective indicators of SES were significantly smaller in Black samples compared to White samples. However, this is based on fewer reported effects in Black samples. Lastly, it was examined whether gender moderated associations between subjective SES and objective SES (Table 3); cumulative effect sizes between subjective SES and objective SES did not differ by gender.

Is Subjective SES an Independent Correlate of Physical Health?

Results of random effects meta-analysis are presented in Table 4. A forest plot of the individual effects aggregated within study is pictured in Figure 2 and a forest plot examining all effects individually is presented in Figure 3, with Panel A depicting specific symptoms and biologically-based measures and Panel B depicting global self-reports of health. Results treating all effects as independent (k=99) and results aggregating effects within studies (K=31) both revealed a statistically significant positive effect of subjective SES on health indicators after controlling for objective SES. Notably, the cumulative effect size was doubled when effects were averaged within study compared to analyses treating all effects (k=99) as independent. Examining the forest plot raised the possibility that the large sample size, large number of effects tested, and relatively small effects across multiple indicators in the Demakakos et al. (2008) study may account for this difference in cumulative effect size when aggregating within studies versus across all tested effects. Thus, analyses were rerun treating all effects as independent but excluding the Demakakos 2008 study (resulting in 82 effects tested). With this exclusion, results revealed a cumulative effect size of Z=.075 (SE=.008, p<.05), an effect size very similar to that found when effects were aggregated within studies (Z=.071, SE=.01, p<.05), suggesting that this one large study which tested many effects (and found relatively small effects) had a particularly large influence on the estimated cumulative effect size when all effects were treated as independent.

Whether effect sizes were smaller in analyses that adjusted for a larger number of objective SES indicators was also examined. Most tested effects adjusted for either two (k=21) or three (k=65) indicators of objective SES. When these two groups were compared, the cumulative effect size was significantly larger in analyses that controlled for two objective SES indicators compared to three indicators (Z=.068 vs. .031; Q_M=6.68, p<.05). When all covariates were examined (not just objective SES indicators), there was no indication that the total number of covariates included in the analyses reduced the independent effect of subjective SES on physical health (e.g. 4 covariates showed a larger effect size than 5, but 5 covariates showed a smaller effect size than 6), perhaps because these covariates often differed across studies. Hence, effect size was smaller when analyses adjusted for more indicators of SES, but not when analyses adjusted for a heterogeneous mix of other covariates.

Moderators

Results of moderator analyses are also presented in Table 4 and revealed significant between group differences for four of the six moderators tested. The independent association between subjective SES and physical health was larger for global self-reports than for symptom specific and biologically-based indicators (Z = .11 vs. .02) and larger in U.S. (vs. non-U.S.) samples (Z = .09 vs. .03). The cumulative independent association between subjective SES and physical health was also significantly larger for women relative to men (Z = .05 vs. .02) and Blacks relative to Whites (Z = .07 vs. .03). However, there was no significant difference in the independent associations between subjective SES and cardiovascular relative to non-cardiovascular outcomes (Z = .03 vs. .04) or studies with stronger research designs relative to cross-sectional studies (Z = .05 vs. .04). Importantly, 34 of 72 effects categorized as non-cardiovascular were self-rated health indicators, which generally showed stronger effects, and there were very few effects that met inclusion criteria and were not cross-sectional (k=6).

Publication Bias

It is possible that null and negative findings are less likely to be submitted for publication by authors or less likely to be accepted for publication by editors and reviewers, leading to biased effects in published work. Proposed guidelines (Rothstein, Sutton, & Borenstein, 2006) were used to examine the likely presence and magnitude of publication bias in results. First, the forest plot (Figure 2) was examined for individual effects that appear to be outliers and may significantly bias results, but none were found. Second, a funnel plot of analyzed effects (Figure 4) (Light & Pillemer, 1984) was examined. Funnel plots allow for comparison of published effect sizes by sample size. If there is no publication bias, then studies to the right and left side of the cumulative effect size should be mirror images. However, if there is publication bias, then smaller studies (i.e., studies closer to the bottom of the plot) would show larger effects (because effects would need to be larger in order to reach statistical significance) and effects would be less symmetrically distributed about the mean. Similar to the use of Scree plots to determine the number of factors in factor analyses, funnel plots are based on a combination of analyses and scientific judgment (Rothstein et al., 2006). Thus, whether standard errors and standardized effect sizes are significantly associated was also tested using Kendall's tau (which is similar to a correlation; Begg & Mazumdar, 1994) and Egger's regression (where the intercept reflects the slope of the association; Egger et al., 1997). Results for Tau did not suggest significant publication bias (Tau = .006, $p = .93$); however, results for Egger's regression did (Intercept = 1.8, $SE = .23$, $p < .05$).

Given evidence that results may be influenced by publication bias, the magnitude of this bias was evaluated in a number of ways. Rosenthal's fail-safe *N* (Rosenthal, 1979) was used to estimate how many unpublished effect sizes with a mean effect of zero would be needed to bring the cumulative effect size below statistical significance. Results revealed that 8,658 additional unreported effects would be needed to result in a non-significant cumulative effect of subjective SES on physical health, after controlling for objective SES. Duval and Tweedie's (2000) trim and fill procedure was also examined, which provides a bias-corrected estimate of the cumulative effect size. The black circles observed on the funnel plot (Figure 4) provide a visual representation of the trim and fill procedure (Rothstein et al., 2006, Chapter 11). Results revealed little difference between this bias-corrected estimate ($Z = .032$, 95%CI: .02 to .04) and the original observed estimate ($Z = .038$, 95%CI: .03 to .05), suggesting that although publication bias may be present it does not appear to have a substantive influence on the results.

Discussion

Moderate associations were found between subjective SES and objective indicators of SES (education, income, and occupation) for the 20 studies (k=73) that met inclusion criteria and reported these associations. Furthermore, results also revealed race differences in cumulative correlations between subjective SES and objective indicators of SES, such that objective SES was less closely associated with subjective SES in Black individuals across the samples examined here. Hence, what is being measured by subjective SES appears to differ by race (Adler et al., 2008; Cundiff, Smith, Uchino, & Berg, 2013), in that perceived social rank and objective resources are more closely related in White samples. This pattern suggests that personal perceptions of prestige may be less predicated on objective resources in Black samples. This may be somewhat surprising as the stem for the subjective SES measure specifically anchors all respondents to objective SES indicators. Given these differences, it seems likely that the mechanisms linking subjective SES to physical health may differ by race.

No significant difference was found in the association between subjective SES and objective indicators of SES by gender. This does not answer the question of whether women generally rate themselves lower on the ladder than men. Rather, it suggests that personal perceptions of prestige appear similarly influenced by objective resources for both men and women.

On their face, moderate correlations between subjective and objective SES seem to argue against the idea that subjective SES (based on comparison with others in the country) is a cognitive averaging of objective SES indicators. However, it is also possible that such cognitive averaging leads to only modest correlations with any one indicator of objective SES, as indicators of objective SES are typically only modestly correlated with one another. Nonetheless, modest correlations between objective SES and subjective SES renders the idea that subjective SES may be a significant pathway through which objective SES influences physical health somewhat less plausible (*cf.*, Daly et al., 2015).

Despite moderate overlap between subjective and objective SES, the present meta-analysis found a significant cumulative association between the ladder McArthur scale of subjective SES and physical health, independent of objective SES (see Figure 5). Hence, it appears that this commonly used measure of an individual's perception of his or her social rank offers some unique cross-sectional utility for understanding variation in physical health indices between persons. This finding supports the currently popular notion that objective resources and hierarchical rank may be distinguishable constructs that each independently contributes to socioeconomic health disparities (e.g., Adler, 2009). Although this incremental association is small, as a general point of comparison, the cumulative effect size found here is similar to cumulative associations between income and hypertension, but smaller than cumulative associations between education or occupation and hypertension (Leng, Jin, Li, Chen, & Jin, 2015). Also, the effect here is held to quite a high standard, being estimated *after* controlling for objective SES (e.g., examinations of the cumulative association between income and hypertension, of course, do not control for education and/or occupation). Further, the cumulative effect here (Z=.071) is similar to a recently reported effect size of subjective SES and physical health in adolescents (Z=.064) (Quon & McGrath, 2014). Although this previous meta-analysis in adolescents included all reported effects whether or not objective SES was controlled, this simple comparison of effect size across the two meta-analyses suggests that subjective SES-health associations may be similar in adolescence and adulthood, or perhaps stronger in adulthood as cumulative effects are similar but the adult meta-analysis reported here controls for objective SES whereas the adolescent meta-analysis did not.

As discussed in the introduction, subjective SES could show unique associations with self-rated health due to response bias and/or the shared method of assessment by self-report (especially when assessed cross-sectionally), so it is important to show that subjective SES is not only associated with self-reported health measures. Effect sizes were significantly larger for global self-reports of physical health (Table 4). Although the cumulative effect size was still significant and positive for biologically-based and specific physical symptoms, it seems unlikely that an effect size of $Z = .02$ has much practical significance. The Quon and McGrath (2014) meta-analysis in adolescents also found stronger associations between subjective SES and self-reported health compared to biologically-based measures in adolescents (Z=.18 vs. 06). Again, results here appear consistent with meta-analytic results from adolescent samples though meta-analyses were not conducted in exactly the same manner (e.g., control for objective SES).

The relatively stronger association of subjective SES with self-rated health does not diminish the potential utility of subjective SES for understanding variations in physical health. Although self-rated health is often considered a poorer measure of physical health than biologically-based measures, the association of self-rated health with mortality has been shown to be similar to or greater than a panel of biomarkers (Haring et al., 2011) and may account for or capture much of the association between positive psychological factors and mortality (Liu et al., 2016). Further, self-rated health has consistently been found to predict morbidity, mortality, and other important health measures (Benyamini & Idler, 1999; see Pinquart, 2001 for a meta-analysis), over and above many known risk factors for poor health, including potentially confounding personality characteristics (Benyamini & Idler, 1999; Chapman, Duberstein, Sorensen, & Lyness, 2006).

Results also revealed other important moderators; there was greater incremental utility of subjective SES for physical health in women compared to men and Blacks compared to Whites. The stronger independent association in Black samples could reflect the fact that subjective SES and objective SES are less overlapping in Black samples (this was not true for women v. men, see Table 3), and, hence, larger effect sizes remain after adjusting for objective SES (as less shared variance is removed). Alternatively, larger effect sizes in both Blacks and women could be interpreted to mean that perceptions of social rank are more health-relevant above and beyond objective SES in these historically disenfranchised groups of individuals.

Another moderator was country of origin. Associations in United States samples were larger compared to associations in all other countries. This could indicate that perceptions of social rank are more closely related to physical health in the United States compared to other countries, an effect that could be due to substantive differences across geographic regions (e.g., culture, ethnic variation) or methodological or construct differences across countries. For example, subjective SES and objective SES may have less overlapping variance in the United States, leading to a larger independent effect size after controlling for objective SES. It is also possible that studies in low income countries, where some scholars have suggested subjective SES may be particularly useful, were not able to control for an objective indicator of SES as defined here, and so would not have been included in this meta-analysis. Lastly, socioeconomic measures (both objective and subjective) may be more closely linked to physical health in the U.S. relative to other countries, because the U.S. has both high inequality in objective indicators of SES and also does not ensure access to healthcare for its citizens.

Limitations

In general, research up to this point examining whether subjective SES offers additional utility provides weak tests of causal inference. Although the term effect size suggests influence of one variable on another, virtually all effects examined here were derived from cross-sectional studies. The available literature cannot establish that subjective SES influences physical health above and beyond objective SES. Instead, it establishes that subjective SES appears to improve the cross-sectional prediction of physical health (i.e., incremental utility) above and beyond objective SES indicators. Thus, reverse causality, bidirectional relationships, and third-variable confounds are certainly possible, and they are a significant concern as such alternate interpretations are plausible and have been found in certain samples. For example, aging leads to declines in health and declines in subjective SES independent of changes in objective SES (Nobles, Weintraub, Adler, 2013), and so is an important covariate in any analysis (also see discussion in Quon & McGrath, 2014).

Studies included in this meta-analysis had little variation in the assessment of subjective SES, which was self-reported. However, there was large variation in the assessment of physical health measures and inclusion of control variables. Whether such heterogeneity in study methods may account for differences in effect sizes across studies was examined by testing moderators. Although there were significant moderating factors, these factors did not fully explain the heterogeneity in the literature, making definitive interpretation of the findings more difficult. Like many literatures, consistency in methods and statistical tests linked to specific theoretical hypothesis has significant room for improvement. Hopefully, the hypotheses laid out here as well as drawing attention to the paucity of research directly examining the primary hypotheses in the field (e.g., subjective SES as a mediator of objective SES-health associations) with strong causal inference will promote increased consistency and stronger study design in future research.

The current literature did not allow us to statistically test whether the incremental utility of subjective SES may be due to any one specific candidate third-variable confound. For example, only 5 studies controlled for some form of negative affect (this number increases to 8 if general life satisfaction and perceived stress are included; see Table 1). Such studies will be important in future work as stronger incremental associations with global self-reports of health could very well suggest that common method variance, self-report bias, or a third variable such as self-esteem is accounting for much of the additional cross-sectional variance explained by subjective SES for physical health. These alternative explanations are of particular concern given that subjective SES is measured by self-report. Alternatively, one could argue that pathways linking subjective SES to physical health may not be disease or biomarker specific, and thus broad measures of health, such as self-rated health, show larger effects; however, very few studies examined composite biological outcomes that are multiply determined.

Future Research Directions: Unpacking Subjective SES

A better understanding of what shapes individual's ratings of subjective SES would help provide clues about why individual differences in subjective SES show incremental utility with respect to physical health and why this appears to be stronger for self-rated measures of health. Additionally, given this association, testable conceptual models linking subjective SES with physical health are warranted. For example, subjective SES may provide incremental utility because, unlike objective SES, it captures participants' sense of self in social context. A large literature confirms that social hierarchies create context for and constrain the social behavior of individuals as well as their interaction partners (e.g., Fiske, 2010; Johnson, Leedom, & Muhtadie, 2012). Hence, one reason social rank may be incrementally related to illness and disease (compared to economic resources) is because it is more closely related to patterns of social behavior and interpersonal experiences that either promote disease or protect against it (for an integrative review of such factors see Cundiff & Smith, 2017). For example, daily social experiences plausibly related to perceptions of social rank, such as experiences of social subordination, may be correlated with subjective SES. If such experiences are also associated with physical health then they may be viable pathways linking subjective SES to physical health (e.g., Ewart et al., 2015). Despite the inherent social comparison process involved in the rating of subjective SES, interpersonal influences (e.g., social relationships and experiences) have rarely been examined as potential confounders or mediators of this association (*cf.*, Cundiff, Kamarck, & Manuck, 2016). Instead, researchers have typically been more concerned with intra-individual influences (e.g., negative affect), in large part conceptualized as potential confounds rather than mediators (Krause et al., 2013). Daily experience paradigms examining associations among subjective SES and interpersonal experiences that may alter perceived social rank as well as acute measures of biology that may indicate a pathway to disease (e.g., cardiovascular reactivity) would help elucidate whether or not proximal social experiences may plausibly explain health disparities associated with perceived social rank and provide stronger causal evidence.

The community measure of subjective SES may be most conceptually relevant to the idea that experiences of social rank (social subordination, etc.) in day-to-day social interactions influence psychobiological pathways and contribute to socioeconomic health disparities. However, studies examining independent associations between the community measure of subjective SES and physical health are mostly absent from the literature (*cf.*, Saban, Hoppensteadt, Bryant, & DeVon, 2014). If scholars theorize that subjective SES may influence health through the psychological sequelae of lower social rank in individual's local social environment, then the community measure of subjective SES holds much unexplored promise for testing these hypotheses and comparing local and distal social rank as well as their associations with health and objective measures of SES across samples.

Conclusions

This meta-analysis revealed a significant independent association between the most widely-used measure of subjective SES and physical health in adults, above and beyond traditional objective indicators of SES (see Figure 5 for summary). Subjective SES appears to provide unique information relevant to understanding disparities in physical health, especially in the

United States and especially when health is measured by global self-report. Conclusions must remain tentative given the available literature; subjective SES has had very few strong tests (e.g., few prospective studies, few studies examining clinical diagnoses). However, the cumulative effect size found here was similar to associations found for other SES-health disparities such as income and hypertension. Additionally, data do not seem to overwhelmingly support prevailing theories concerning why subjective SES may be associated with physical health (e.g., subjective SES mediating objective SES-health relationships), and this is especially true for Black participants in these samples. Instead of a very closely associated or mediating factor for objective SES-health associations, associations between subjective SES and physical health may operate through non-overlapping, rather than shared, pathways.

Acknowledgments

Funding Acknowledgment:

This work was supported by NIH T32 #HL07560.

References

Adler N. Health disparities through a psychological lens. American Psychologist. 2009; 64(8):663–673. [PubMed: 19899862]

Adler N, Epel E, Castellazzo G, Ickovics J. Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, White women. Health Psychology. 2000; 19:586–592. [PubMed: 11129362]

Adler N, Singh-Manoux A, Schwartz J, Stewart J, Matthews K, Marmot MG. Social status and health: A comparison of British civil servants in Whitehall-II with European- and African-Americans in CARDIA. Social Science and Medicine. 2008; 66(5):1034–1045. DOI: 10.1016/j.socscimed.2007.11.031 [PubMed: 18180089]

Allen AJ, McNeely JM, Waldstein SR, Evans MK, Zonderman AB. Subjective socioeconomic status predicts framingham cardiovascular disease risk for whites, not blacks. Ethnicity and Disease. 2014; 24(2):150–154. [PubMed: 24804359]

Begg C, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics. 1994; 50(4):1088–1101. [PubMed: 7786990]

Benyamini Y, Idler EL. Community studies reporting association between self-rated health and mortality additional studies, 1995 to 1998. Research on Aging. 1999; 21(3):392–401.

Borenstein, M., Hedges, L., Rothstein, H. Meta-analysis: Fixed effect vs. random effects. Meta-Analysis. Com. 2007. Retrieved from https://www.meta-analysis.com/downloads/Meta-analysisfixed effect vs random effects 072607.pdf

Camelo LDV, Giatti L, Barreto SM. Subjective social status, self-rated health and tobacco smoking: Brazilian Longitudinal Study of Adult Health (ELSA-Brasil). Journal of Health Psychology. 2014; 19(11):1388–99. DOI: 10.1177/1359105313490772 [PubMed: 23818507]

Cene CW, Halladay JR, Gizlice Z, Roedersheimer K, Hinderliter A, Cummings DM, … DeWalt DA. Associations between subjective social status and physical and mental health functioning among patients with hypertension. Journal of Health Psychology. 2015; doi: 10.1177/1359105315581514

Chapman BP, Duberstein PR, Sörensen S, Lyness JM. Personality and perceived health in older adults: the five factor model in primary care. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2006; 61(6):362–365.

Chetty R, Stepner M, Abraham S, Lin S, Scuderi B, Turner N, Bergeron A, Cutler D. The association of income and life expectancy in the United States, 2001–2014. JAMA. 2016:E1–E17.

Cohen S, Alper CM, Doyle WJ, Adler N, Treanor JJ, Turner RB. Objective and subjective socioeconomic status and susceptibility to the common cold. Health Psychology. 2008; 27(2):268–74. DOI: 10.1037/0278-6133.27.2.268 [PubMed: 18377146]

Cooper, H., Hedges, LV. The handbook of research synthesis. New York, NY: Robert Sage Foundation; 1994.

Cooper DC, Milic MS, Mills PJ, Bardwell WA, Ziegler MG, Dimsdale JE. Endothelial function: the impact of objective and subjective socioeconomic status on flow-mediated dilation. Annals of Behavioral Medicine. 2010; 39(3):222–231. DOI: 10.1007/s12160-010-9181-9 [PubMed: 20376585]

Cundiff JM, Kamarck TW, Manuck SB. Daily interpersonal experience partially accounts for the association between social rank and physical health. Annals of Behavioral Medicine. (epub ahead of print).

Cundiff J, Smith T, Baron C, Uchino B. Hierarchy and health: Physiological effects of interpersonal experiences associated with socioeconomic position. Health Psychology. 2016; 35(4):356–365. [PubMed: 27018727]

Cundiff J, Smith T, Uchino B, Berg C. Subjective social status: construct validity and associations with psychosocial vulnerability and self-rated health. International Journal of Behavioral Medicine. 2013; 20(1):148–158. [PubMed: 22200973]

Daly M, Boyce C, Wood A. A social rank explanation of how money influences health. Health Psychology. 2015; 34(3):222–230. [PubMed: 25133843]

De Castro AB, Gee GC, Takeuchi DT. Examining alternative measures of social disadvantage among Asian Americans: The relevance of economic opportunity, subjective social status, and financial strain for health. Journal of Immigrant and Minority Health. 2010; 12(5):659–671. DOI: 10.1007/s10903-009-9258-3 [PubMed: 19434494]

Demakakos P, Nazroo J, Breeze E, Marmot M. Socioeconomic status and health: The role of subjective social status. Social Science and Medicine. 2008; 67(2):330–340. DOI: 10.1016/j.socscimed.2008.03.038 [PubMed: 18440111]

Dennis EF, Webb DA, Lorch SA, Mathew L, Bloch JR, Culhane JF. Subjective social status and maternal health in a low income urban population. Maternal and Child Health Journal. 2012; 16(4):834–843. DOI: 10.1007/s10995-011-0791-z [PubMed: 21487843]

Duval S, Tweedie R. Trim and fill: a simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. Biometrics. 2000; 56(2):455–463. [PubMed: 10877304]

Egger, M., Smith, G., Schneider, M., Minder, C. Bias in meta-analysis detected by a simple, graphical test; British Medical Journal. 1997. p. 315-369.http://dx.doi.org/10.1136/bmj.315.7109.629

Euteneuer F, Mills PJ, Rief W, Ziegler MG, DJ. Subjective social status predicts in vivo responsiveness of β-adrenergic receptors. Health Psychology. 2012; 31(4):525–529. DOI: 10.1037/a0025990 [PubMed: 22023437]

Ewart CK, Elder GJ, Smyth JM. How neighborhood disorder increases blood pressure in youth: agonistic striving and subordination. Journal of Behavioral Medicine. 2014; 37(1):113–126. [PubMed: 23229689]

Fernald LCH. Socio-economic status and body mass index in low-income Mexican adults. Social Science and Medicine. 2007; 64(10):2030–2042. DOI: 10.1016/j.socscimed.2007.02.002 [PubMed: 17368895]

Fiske ST. Interpersonal stratification: Status, power, and subordination. Handbook of Social Psychology. 2010

Franzini L, Fernandez-Esquer ME. The association of subjective social status and health in low-income Mexican-origin individuals in Texas. Social Science and Medicine. 2006; 63(3):788–804. DOI: 10.1016/j.socscimed.2006.01.009 [PubMed: 16580107]

Friestad C. Socio-economic status and health in a marginalized group: The role of subjective social status among prison inmates. European Journal of Public Health. 2010; 20(6):653–658. DOI: 10.1093/eurpub/ckp242 [PubMed: 20123684]

Galobardes B, Shaw M, Lawlor DA, Lynch JW, Davey Smith G. Indicators of socioeconomic position (part 1). Journal of Epidemiology and Community Health. 2006; 60(1):7–12. DOI: 10.1136/jech.2004.023531

Gersten O, Timiras PS, Boyce WT. Does Lower Subjective Social Status Yield Riskier Biomarker Profiles? Journal of Biosocial Science. 2015; 47(06):746–761. DOI: 10.1017/S002193201400042X [PubMed: 25287447]

Ghaed S, Gallo L. Subjective social status, objective socioeconomic status, and cardiovascular risk in women. Health Psychology. 2007; 26(6):668–674. [PubMed: 18020837]

Gong F, Xu J, Takeuchi DT. Beyond conventional socioeconomic status: Examining subjective and objective social status with self-reported health among Asian immigrants. Journal of Behavioral Medicine. 2012; 35(4):407–419. DOI: 10.1007/s10865-011-9367-z [PubMed: 21720827]

Haring R, Feng YS, Moock J, Völzke H, Dörr M, Nauck M, et al. Self-perceived quality of life predicts mortality risk better than a multi-biomarker panel, but the combination of both does best. BMC Medical Research Methodology. 2011; 11(1):1–10. [PubMed: 21208427]

Healthy People 2020. Washington, DC: U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion; Available from: https://www.healthypeople.gov/2020

Hu P, Adler NE, Goldman N, Weinstein M, Seeman TE. Relationship between subjective social status and measures of health in older Taiwanese persons. Journal of the American Geriatrics Society. 2005; 53(3):483–488. DOI: 10.1111/j.1532-5415.2005.53169.x [PubMed: 15743294]

Hyde M, Jones IR. The long shadow of work - does time since labour market exit affect the association between socioeconomic position and health in a post-working population. Journal of Epidemiology and Community Health. 2007; 61(6):533–539. DOI: 10.1136/jech.2006.051284 [PubMed: 17496263]

Idler E, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. Journal of Health and Social Behavior. 1997; 38:21–37. [PubMed: 9097506]

Johnson SL, Leedom LJ, Muhtadie L. The dominance behavioral system and psychopathology: Evidence from self-report, observational, and biological studies. Psychological Bulletin. 2012; 138(4):692–743. [PubMed: 22506751]

Kraus M, Piff P, Keltner D. Social class, sense of control, and social explanation. Journal of Personality and Social Psychology. 2009; 97(6):992–1004. [PubMed: 19968415]

Kraus M, Piff P, Keltner D. Social class as culture the convergence of resources and rank in the social realm. Current Directions in Psychological Science. 2011; 20:246–250.

Kraus MW, Adler N, Chen TWD. Is the association of subjective SES and self-rated health confounded by negative mood? An experimental approach. Health Psychology. 2013; 32:138–145. [PubMed: 22329426]

Krieger N. A glossary for social epidemiology. Journal of Epidemiology and Community Health. 2001; 55(10):693–700. [PubMed: 11553651]

Leng B, Jin Y, Li G, Chen L, Jin N. Socioeconomic status and hypertension: a meta-analysis. Journal of Hypertension. 2015; 33(2):221–9. DOI: 10.1097/HJH.0000000000000428 [PubMed: 25479029]

Light, R., Pillemer, D. Summing Up: The Science of Reviewing Research. Cambridge: Harvard University Press; 1984.

Liu B, Floud S, Pirie K, Green J, Peto R, Beral V. Does happiness itself directly affect mortality? the prospective UK Million Women Study. The Lancet. 2016; 387(10021):874–881. DOI: 10.1016/S0140-6736(15)01087-9

Macleod J, Smith GD, Metcalfe C, Hart C. Is subjective social status a more important determinant of health than objective social status? Evidence from a prospective observational study of Scottish men. Social Science & Medicine. 2005; 61(9):1916–1929. [PubMed: 15916842]

Manuck S, Phillips J, Gianaros P. Subjective socioeconomic status and presence of the metabolic syndrome in midlife community volunteers. Psychosomatic Medicine. 2010; 72:35–45. [PubMed: 19933505]

Marmot M, Stansfeld S, Patel C, North F. Health inequalities among British civil servants: the Whitehall II study. The Lancet. 1991; 337(8754):1387–1393.

Matthews KA, Gallo LC, Taylor SE. Are psychosocial factors mediators of socioeconomic status and health connections? A progress report and blueprint for the future. Annals of the New York Academy of Sciences. 2010; 1186:146–73. DOI: 10.1111/j.1749-6632.2009.05332.x [PubMed: 20201872]

Mendelson T, Thurston R, Kubzansky L. Affective and cardiovascular effects of experimentally-induced social status. Health Psychology. 2008; 27:482–489. [PubMed: 18643006]

Miyakawa M, Magnusson Hanson LL, Theorell T, Westerlund H. Subjective social status: Its determinants and association with health in the Swedish working population (the SLOSH study). European Journal of Public Health. 2012; 22(4):593–597. DOI: 10.1093/eurpub/ckr064 [PubMed: 21646364]

Nobles J, Weintraub MR, Adler NE. Subjective socioeconomic status and health: relationships reconsidered. Social Science & Medicine (1982). 2013; 82:58–66. DOI: 10.1016/j.socscimed.2013.01.021 [PubMed: 23453318]

Operario D, Adler N, Williams D. Subjective social status: Reliability and predictive utility for global health. Psychology & Health. 2004; 19:237–246.

Ostrove JM, Adler NE, Kuppermann M, Washington aE. Objective and subjective assessments of socioeconomic status and their relationship to self-rated health in an ethnically diverse sample of pregnant women. Health Psychology. 2000; 19(6):613–618. DOI: 10.1037/0278-6133.19.6.613 [PubMed: 11129365]

Pinquart M. Correlates of subjective health in older adults: A meta-analysis. Psychology and Aging. 2001; 16(3):414–426. [PubMed: 11554520]

Quon EC, McGrath JJ. Subjective socioeconomic status and adolescent health: a meta-analysis. Health Psychology. 2014; 33(5):433–47. DOI: 10.1037/a0033716 [PubMed: 24245837]

Rosenthal R. The file drawer problem and tolerance for null results. Psychological Bulletin. 1979; 86:638–641.

Rothstein, H., Sutton, A., Borenstein, M. Publication bias in meta-analysis: Prevention, assessment and adjustments. 2006.

Saban KL, Hoppensteadt D, Bryant FB, DeVon HA. Social determinants and heat shock protein-70 among African American and non-Hispanic white women with atherosclerosis: a pilot study. Biological Research for Nursing. 2014; 16(3):258–65. DOI: 10.1177/1099800413491422 [PubMed: 23749050]

Sanchon-Macias MV, Prieto-Salceda D, Bover-Bover A, Gastaldo D. Relationship between subjective social status and perceived health among Latin American immigrant women. Revista Latino-Americana de Enfermagem. 2013; 21(6):1353–1359. DOI: 10.1590/0104-1169.2943.2374 [PubMed: 24402346]

Schmidt F, Oh I, Hayes T. Fixed-versus random-effects models in meta-analysis: Model properties and an empirical comparison of differences in results. British Journal of Mathematical and Statistical Psychology. 2009; 62:97–128. [PubMed: 18001516]

Singh-Manoux A, Adler NE, Marmot MG. Subjective social status: Its determinants and its association with measures of ill-health in the Whitehall II study. Social Science and Medicine. 2003; 56(6):1321–1333. DOI: 10.1016/S0277-9536(02)00131-4 [PubMed: 12600368]

Singh-Manoux A, Marmot MG, Adler NE. Does subjective social status predict health and change in health status better than objective status? Psychosomatic Medicine. 2005; 67:855–861. DOI: 10.1097/01.psy.0000188434.52941.a0 [PubMed: 16314589]

Smith HJ, Pettigrew TF, Pippin GM, Bialosiewicz S. Relative deprivation a theoretical and meta-analytic review. Personality and Social Psychology Review. 2012; 16(3):203–232. [PubMed: 22194251]

Subramanyam MA, Diez-Roux AV, Hickson DA, Sarpong DF, Sims M, Taylor HA, … Wyatt SB. Subjective social status and psychosocial and metabolic risk factors for cardiovascular disease among African Americans in the Jackson Heart Study. Social Science and Medicine. 2012; 74(8):1146–1154. DOI: 10.1016/j.socscimed.2011.12.042 [PubMed: 22381684]

Thompson MG, Gaglani MJ, Naleway A, Thaker S, Ball S. Changes in self-rated health and subjective social status over time in a cohort of healthcare personnel. Journal of Health Psychology. 2014; 19(9):1185–1196. DOI: 10.1177/1359105313485486 [PubMed: 23682064]

Thompson MG, Naleway A, Ball S, Henkle EM, Sokolow LZ, Williams J, … Gaglani MJ. Subjective social status predicts wintertime febrile acute respiratory illness among women healthcare personnel. Health Psychology. 2014; 33(3):282–91. DOI: 10.1037/a0032764 [PubMed: 23795705]

Ware J, Kosinski M, Keller S. A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity. Medical Care. 1996; 34(3):220–233. [PubMed: 8628042]

Wright CE, Steptoe A. Subjective socioeconomic position, gender and cortisol responses to waking in an elderly population. Psychoneuroendocrinology. 2005; 30(6):582–590. DOI: 10.1016/j.psyneuen.2005.01.007 [PubMed: 15808928]

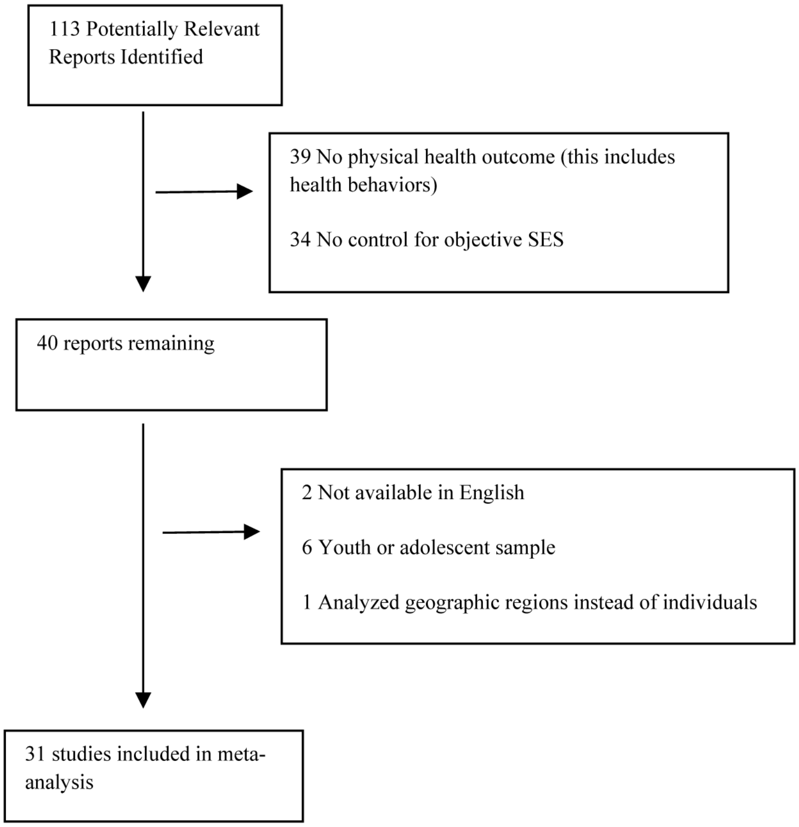


Figure 1.

Flow chart showing inclusion/exclusion of studies identified from initial search.

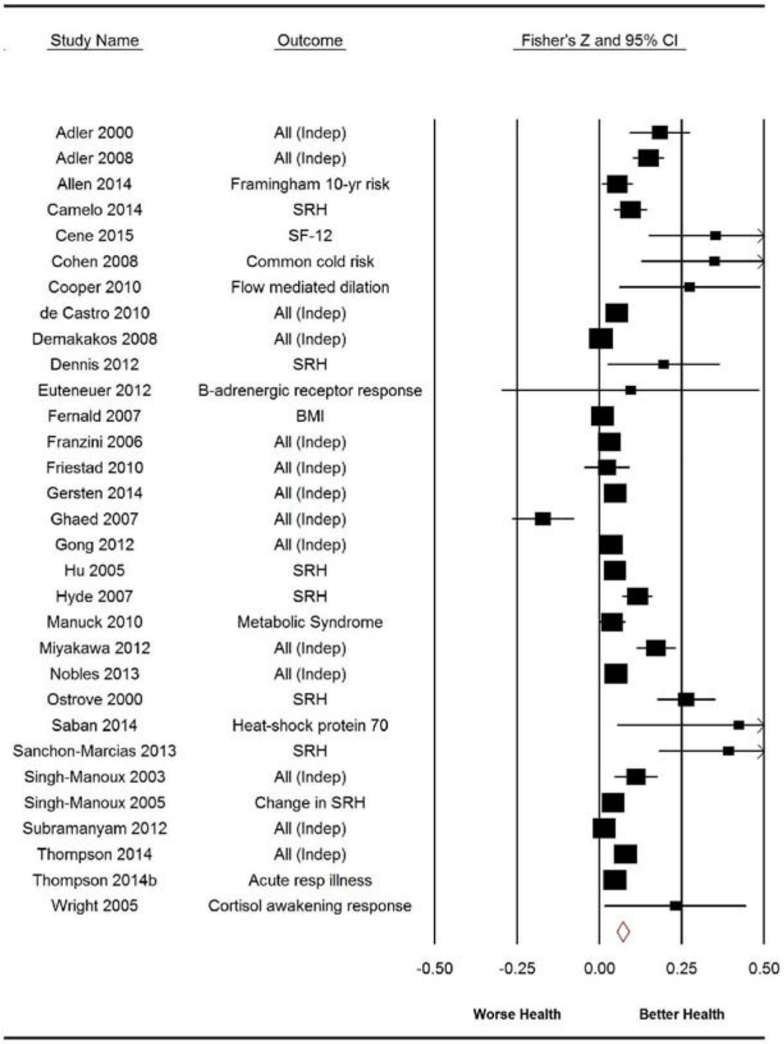
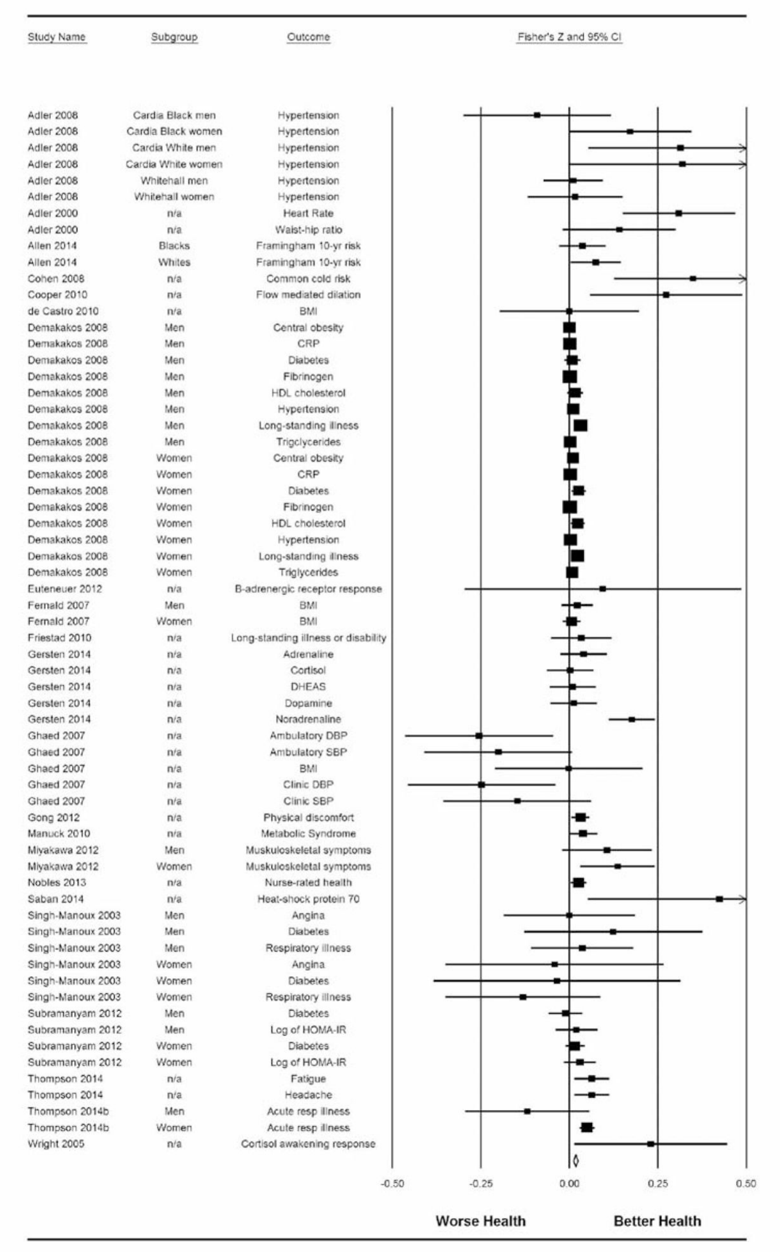


Figure 2.

Forest plot for effects aggregated within samples (K=31).

Panel A. Effects examining biologically-based and symptom-specific measures of health.



Panel B. Effects examining global self-report measures of health.

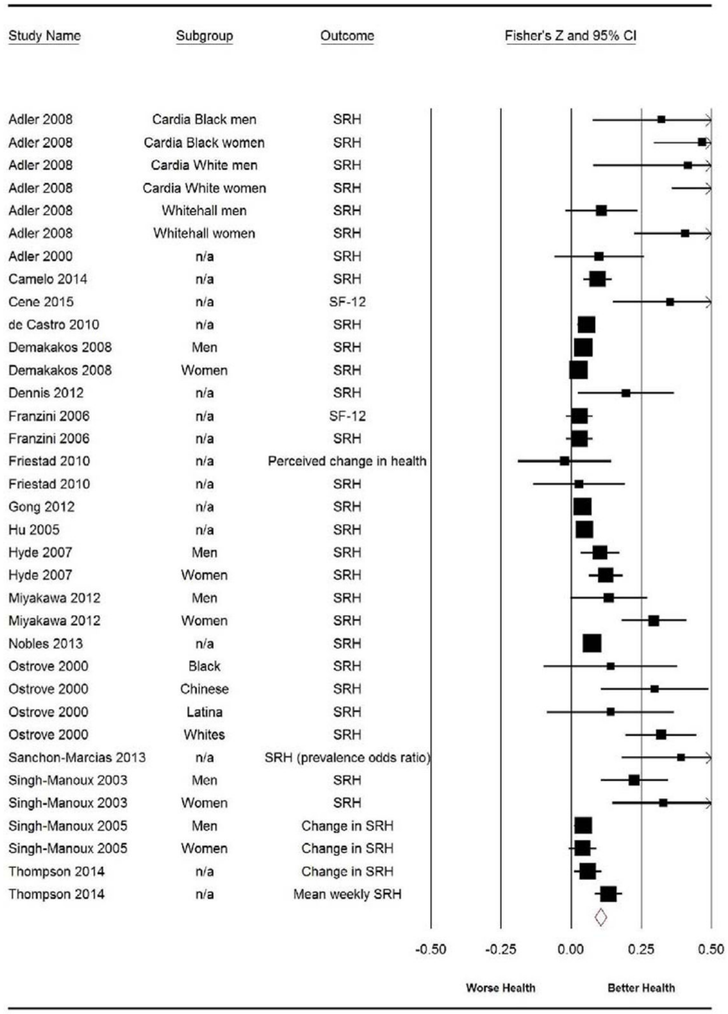


Figure 3.

Forest plots for all effects by type of outcome.

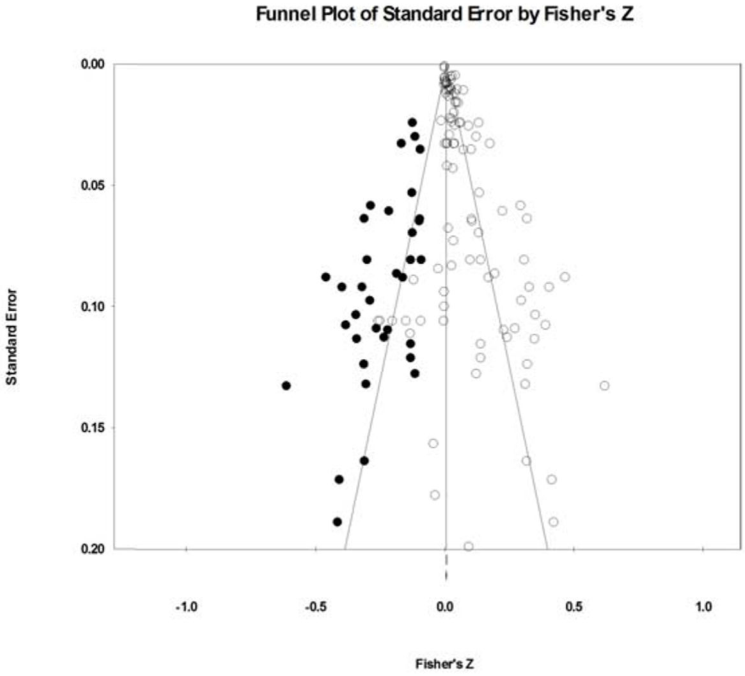


Figure 4.
Funnel plot examining the likelihood of publication bias. Open circles are observed values and black circles are values imputed in order to correct for potential publication bias.

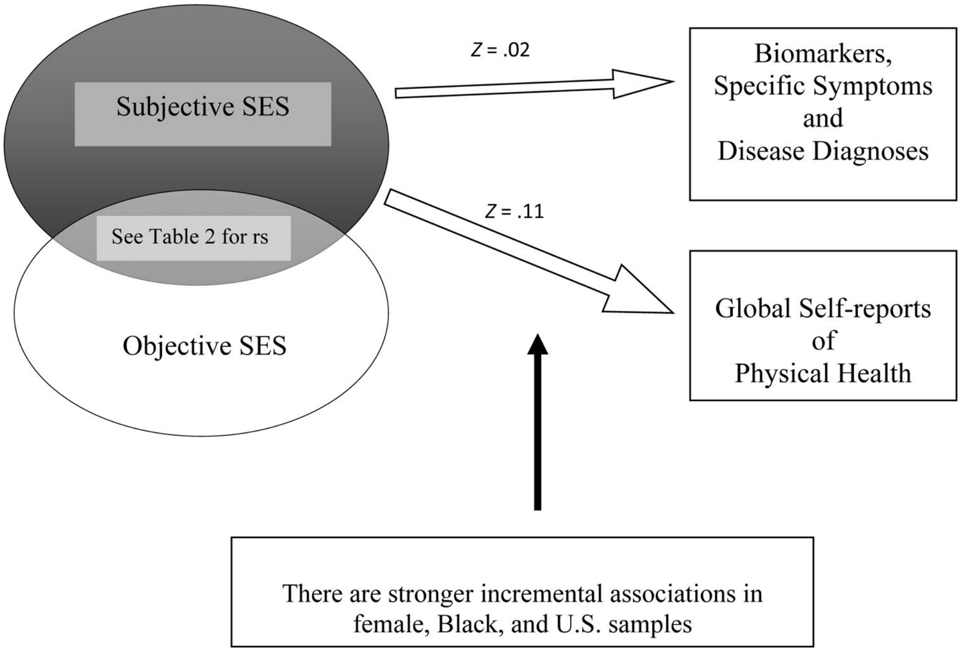


Figure 5.
Pictorial summary of the cumulative association of subjective SES with physical health independent of objective SES.

Table 1

List of included studies and description of sample and measures.

First Author	Year	Measure(s) of Subjective SES	Measure(s) of Objective SES	Physical Health Measure(s)	Additional Covariates	Geographic Region	Sample Characteristics
Adler	2008	SSS	Education, Income, Occupation	Global Health, Hypertension	Age	U.K. and U.S. samples	**Cardia**: 1003 Black women, 1025 White women, 703 Black men, 901 White men; age range 33 to 48. **Whitehall-II**: Primarily White, 4609 men, 2372 women; age range 47 to 67.
Adler	2000	SSS	Education, Income, Occupation	SRH, Heart rate, Waist-hip ratio	Negative affect	U.S.	N=156. 100% women. 100% White. Mean age =37.4 (range 30–46). Very health sample physically and mentally due to exclusion criteria.
Allen	2014	SSS	Poverty Status	10-year Framingham risk	Prescription drug use, tobacco and illicit drug use, alcohol use, BMI, depression, antihypertensive medications, cancer, neurological, metabolic and inflammatory diseases	U.S.	N=1722. Mean age = 47. 57% female; 56% Black, 35.9% below poverty; excluded participants with a history of CVD.
Camelo	2014	SSS	Education, Income	SRH (peers, one-item, dichotomized)	Age, race, sex, depression	Brazil	N=15,105 Brazilian civil servants. 52% White and 54% Female. Age range 35–74.
Cene	2015	SSSc and SSSus	Education, Income Employment Status	Health related quality of life (SF-12, 4-week recall)	Age, race, marital status	U.S.	N=518. Mean age = 58; 59%Black and 41% White; 32%male; all patients with hypertension.
Cohen	2008	SSS	Education, Income	Development of a clinical cold	Virus type, antibody level, race	U.S.	N=193; mean age = 37.3 (range=21–55); 56% White and 37% Black; 51% female
Cooper	2010	SSS and SSSc	Income and Hollingshead Index (composite of education and occupation)	Brachial-artery flow mediated dilation	Age, resting mean arterial pressure, exercise, socially desirable responding	U.S.	N=72. Mean age=36, 57% White, 50% female. Very physically healthy sample.
de Castro	2010	SSS and SSSc were averaged	Education, Income, Occupation	SRH, BMI	Gender, ethnicity, age, marital status, region of residence, nativity (U.S.	U.S.	100% Asian American. 53% female. N=2095;

First Author	Year	Measure(s) of Subjective SES	Measure(s) of Objective SES	Physical Health Measure(s)	Additional Covariates	Geographic Region	Sample Characteristics
					born vs immigrant), years in the U.S.		most of the sample younger than 44 (62%).
Demakakos	2008	SSS	Education, Wealth, Occupation	SRH, long-standing illness, hypertension, diabetes, central obesity, HDL cholesterol, triglycerides, fibrinogen, CRP	Age, marital status	U.K.	3368 men and 4065 women. Age range 52 and older; primarily White
Dennis	2012	SSS	Education, Income	Postpartum physical health	None	U.S.	N=1322. 70% Black. 100% women. Age=23.9 (range13 to 43); more than 90% received public assistance
Euteneuer	2012	SSS and SSSc	Hollingshead Index (composite of education and occupation)	In vivo responsiveness of B-adrenergic receptors	Age, gender, ethnicity, body mass index (BMI), smoking status, depression, and physical activity	U.S.	N=94. Mean age=35 (range19–51). 20 White women and 30 White men and 20 Black women and 24 Black men.
Fernald	2007	SSS and SSSc were averaged	Education, Income, Occupation	BMI	Housing conditions and household assets	Mexico	N=12,873; low income participants selected from the poorest rural communities in Mexico
Franzini	2006	SSS	Education, Income, Work Status,Reliance on Public Assistance, Home Ownership, Car Ownership	SRH, self-reported physical health	Age, gender, acculturation	U.S.	N=1745; 100% Mexican-American; 13 low income neighborhoods in Texas (11 from Houston). Mean age=39 (range18–93); 74% female.
Friestad	2010	SSS	Childhood SES, Education, Income, Occupation	SRH, long-standing illness or disability, drug use, perceived change in health	Age	Norway	N=225. 100% male. 100% currently imprisoned. Most (62%) between 25–44 years old.
Gersten	2014	SSS	Years of education of spouse, Occupational prestige of males and of husbands of females	Neuroendocrine biomarker profiles; cortisol, DHEAS, adrenaline, noradrenaline, dopamine	Diet, exercise, smoking, alcohol consumption, betel nut chewing, education use, age, sex	Taiwan	N= 1013; subsample randomly selected from a Taiwanese population-based sample. 57% male; mean age = 66 (range54–91).
Ghaed	2007	SSS and SSSc	Education, Income, Occupation	BMI, clinic/resting blood pressure and ambulatory blood pressure	Age and ethnicity for BMI outcome. Age, ethnicity, BMI, smoking, monopausal status, use of hormone replacement therapy or	U.S.	N=92. 100% female, 90% White. Mean age = 41. Participants were required to be employed 35 hours or more per week, married or living with a partner, and free

First Author	Year	Measure(s) of Subjective SES	Measure(s) of Objective SES	Physical Health Measure(s)	Additional Covariates	Geographic Region	Sample Characteristics
					birth control for blood pressure outcomes		from CVD and medications with autonomic effects.
Gong	2012	SSS and SSSc	Education, Income, Occupation	SRH, physical discomfort	Socially desirable responding, age, sex, marital status, ethnicity, length of residence in the U.S., English language proficiency	U.S.	N=1570, all Asian immigrants (primarily Chinese and Philipino), mean age=42.3 (range 18–95), 53% female, 44% college education or more
Hu	2005	SSS	Education, Income, Occupation	SRH and activities of daily living	Race, marital status, depression, cigarette smoking, alcohol consumption	Taiwan	N=991. 58%male. Mean age =68.
Hyde	2007	SSS	Education, Income, Occupation, Wealth, Tenure (property ownership), Area Deprivation	SRH	Time since labor market, marital status, age, stratified by sex	U.K.	2617 men and 2619 women. Primarily White, 100% retired. Mean age = 71.
Manuck	2010	SSS	Education, Income	Metabolic Syndrome	Age, race, sex, level of physical activity, smoking status	U.S.	N=981. Age range 30–54 years; 52% female; 84% white, 16% African American.
Miyakawa	2012	SSS	Education, Income, Occupation	SRH, sleep disturbance, muskuloskeletal symptoms	Age, life satisfaction,	Sweden	N=5023; 2358 men and 2665 women.
Nobles	2013	SSS (6-rung ladder)	Education, Assets and Expenditures,	Nurse-rated health and SRH	Age, gender, urban vs rural, depression	Indonesia	N=8430, 46% male. Mean age = 48.5 (range: 42 and older)
Ostrove	2000	SSS	Education, Income, Occupation, Partner’s Occupation	SRH	None	U.S.	100% women all of whom were pregnant; mean age = 32.7.
Saban	2014	SSSc	Education	heat-shock protein 70	Race, age, perceived stress and discrimination	U.S.	N=31. 100% female. 10 Black and 21 White. Mean age = 67 (range 50–85). Sample selected from patients admitted to hospital for elective percutanous cardiac intervention or carotid endarterectomy; diagnosis of obstructive coronary or caotid artery disease.
Sanchon-Marcias	2013	SSS	Education, Income, Occupation	SRH	Age, legal status, social support, residence time	Spain	N=371. 100% Latina women. Mean age = 36.7 (SD=10).

First Author	Year	Measure(s) of Subjective SES	Measure(s) of Objective SES	Physical Health Measure(s)	Additional Covariates	Geographic Region	Sample Characteristics
Singh-Manoux	2005	SSS	Education, Occupation, Individual income, and Household Income	SF-36 and SRH (concurrent and changes)	Age, childhood SES, feeling of financial security	U.K.	N= 5486, primarily White. 71.5% female, but analyses stratify by gender. Mostly white collar respondents.
Singh-Manoux	2003	SSS	Education, Income, Occupation	Angina, diabetes, respiratory illness, SRH	Age, general life satisfaction	U.K.	N=6981, 4609 men, 2372 women, and analyses were gender stratified. Mostly white collar respondents.
Subramanyam	2012	SSS and SSSc	Education, Income	Waist circumference, Insulin resistance, Diabetes	Age, SRH, discrimination, self-esteem	U.S.	N=5301. 100% Black, 63%women. Mean age = 55.6 (range=21–95).
Thompson, Naleway et al.	2014	SSS	Education, Neighborhood Income, Occupation	Acute respiratory illness; SRH, Presence of chronic illness	Age, sex, health behaviors	U.S.	n=1373 women and n=346 men. 80% White. All healthcare workers. Age range 18–65, mean = 41 and 42 for men and women respectively.
Thompson, Gaglani et al.	2014	SSS	Education, Income, Occupation	SRH, Fatigue, Headache	Age, race, sex, smoking, exercise, sleep, BMI, medical visits, work characteristics	U.S.	n=1354 women and n=347 men. 80%female. 80% White. Mean age =42.
Wright	2005	SSS	Education and Financial Strain	Cortisol waking response	Optimism, depression, cigarette smoking, chronic illness, medication use, alcohol use, physical activity, BMI, wasit-to-hip ratio	U.K.	N=93 men and women. Age range 65–80. Physically healthy sample.

SSS = subjective SES relative to the others in participants' country of residence. SSSc = subjective SES relative to others in participants' self-defined "community." SRH = prototypical 1-item self-rated health measure. BMI = body mass index. HDL = high-density lipoprotein. U.S. = United States.

Table 2

Cumulative effect sizes (r) of the association between subjective SES and indicators of objective SES by race.

	Income	Education	Occupation
Associations with Subjective SES in White samples	.46 [.43, .49]	.32 [.25, .40]	.44 [.35, .52]
	k=12	k=13	k=8
Associations with Subjective SES in Black samples	.17 [.15, .19]	.13 [.08, .17]	.14 [.09, .18]
	k=7	k=7	k=3
Test of Moderation by Race (Q_M)	**207.9**[*]	**18.7**[*]	**32.0**[*]

Values are cumulative correlations as estimated by random effects models. Values in brackets represent 95% confidence intervals of the cumulative correlation estimate. k = the number of effects included in the analysis for the corresponding cell. Q_M = test of between group differences.

[*] $p < .05$.

Table 3

Cumulative effect sizes (r) of the association between subjective SES and indicators of objective SES by gender.

	Income	**Education**	**Occupation**
Associations with Subjective SES in Female samples	.36 [.26, .44]	.26 [.17, .34]	.32 [.19, .44]
	k=12	k=13	k=10
Associations with Subjective SES in Male samples	.36 [.24, .46]	.29 [.20, .37]	.30 [.01, .54]
	k=6	k=6	k=4
Test of Moderation by Gender (Q_M)	0	.27	.01

Values are cumulative correlations as estimated by random effects models. Values in brackets represent 95% confidence intervals of the cumulative correlation estimate. k = the number of effects included in the analysis for the corresponding cell. Q_M = test of between group differences.

[*] $p < .05$.

Table 4

Cumulative effect sizes of subjective SES on physical health above and beyond objective SES.

	Cumulative Effect Size (SE)	95%CI	Q_T (heterogeneity)
All effects (k=99)	.038 (.004)*	.030 – .045	658.16*
Using study as the unit of analysis (K=31)	.071 (.01)*	.053 – .090	369.68*
Type of Health Measure			
Biological/Specific symptom (k=64)	.018 (.003)*	.012 – .024	236.68*
Self-rated health (k=35)	.105 (.01)*	.084 – .126	198.23*
Q_M (1, 97)			**59.8***
Geography/Culture			
Non-US (k=56)	.027 (.004)*	.020 – .034	381.05*
US (k=43)	.085 (.013)*	.059 – .110	185.86*
Q_M (1, 97)			**16.9***
Cardiovascular vs. Other Outcomes			
Non-cardiovascular (k=72)	.042 (.004)*	.034 – .050	561.94*
Cardiovascular (k=27)	.025 (.009)*	.008 – .042	95.19*
Q_M (1, 97)			2.99
Study Design			
Not Prospective or Longitudinal (k=93)	.036 (.004)*	.029 – .044	617.96*
Prospective or Longitudinal (k=6)	.049 (.015)*	.020 – .078	10.99*
Q_M (1, 97)			.67
Race			
Blacks (k=11)	.071 (.025)*	.022–.120	42.89*
Whites (k=60)	.031 (.004)*	.023 – .038	440.01*
Q_M (1, 69)			**7.01***
Sex			
Women (k=49)	.047 (.007)*	.034 – .060	350.87*
Men (k=29)	.023 (.006)*	.011 – .034	154.27*

	Cumulative Effect Size (SE)	95%CI	Q_T (heterogeneity)
Q_M (1, 76)			**7.72** *

Cumulative effect sizes are represented using Fisher's *Z*, which can be interpreted similar to correlations. K denotes studies and k denotes effects (i.e., subjective SES on one health outcome). Q_M = test of between group difference. Bolded values highlight significant moderator variables.

[*] $p<.05$.