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Socioeconomic Status, Income Inequality, and Health Complaints: A Basic Psychological Needs Perspective

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Abstract Socioeconomic status (SES) and income inequality are now recognized as important determinants of health, and there is growing interest in uncovering the intermediary psychosocial pathways through which the socioeconomic context affects physical well-being (Marmot in The status syndrome: how social standing affects our health and longevity, Henry Holt, New York, 2004; Wilkinson and Pickett in The Spirit Level: why more equal societies almost always do better, Allen Lane, London, 2009). We adopted the applied framework of self-determination theory (SDT; Deci and Ryan in Psychol Inq 11:227–268, 2000) and hypothesized that fulfillment of the basic psychological needs for autonomy, competence, and relatedness would mediate the relationships that SES and income inequality have to self-rated health. An online community sample of American participants ($N = 1{,}139$) completed a detailed demographic survey and provided self-reports of need fulfillment and health complaints. Structural equation models controlled for impression management and self-deceptive enhancement. Controlling for sex and age, need fulfillment was predicted positively by subjective SES and objective household income and negatively by state-level income inequality; in turn, need fulfillment predicted lower levels of health complaints. These findings suggest that SDT provides a useful framework for the study of SES, income inequality, and health, and that basic psychological needs are an important mechanism through which socioeconomic contexts influence health.

Keywords Socioeconomic status · Income inequality · Health · Self-determination theory · Basic psychological needs

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1 Introduction

Over the last several years, two landmark publications have challenged the way we think about the socioeconomic determinants of health. In *The Status Syndrome*, Marmot (2004) argued that socioeconomic status (SES) is an important determinant of one's health. In *The Spirit Level*, Wilkinson and Pickett (2009) argued that the extent of income inequality within a society is an important determinant of the population's health. Although both arguments stress the importance of the socioeconomic context, they emphasize different features of the socioeconomic hierarchy. Marmot focuses on one's socioeconomic position, and the implications of this position for one's physical health. Wilkinson and Pickett focus on the extent of socioeconomic dispersion within a society, and the implications of this dispersal for the health of the population. Crucially, both perspectives argue the idea that socioeconomic circumstances affect health through psychosocial pathways. However, because there are many intermediary psychosocial possibilities for both SES and income inequality, the field is faced with the challenge of developing a parsimonious account that could also prove useful in the design of targeted interventions. In the present research, we draw on the applied framework of self-determination theory (SDT; Deci and Ryan 2000) and its conception of *basic psychological needs* as an integrative approach with which to simultaneously examine how both SES and income inequality influence health.

2 Basic Psychological Needs: A Unifying Concept for Health Research

Epidemiologists and public health specialists have developed broad theoretical models to conceptualize and research how psychosocial variables may link people's socioeconomic contexts to their health outcomes. Dovetailing the work of Marmot (2004), the *reserve capacity model* (Gallo and Matthews 2003) assembles a wide host of individual difference characteristics (e.g., perceived control, self-esteem, optimism) and social factors (e.g., social support, social integration, social capital) under the banner of "reserve capacity," which is formulated as both a potential mediator and a potential moderator of the relationship between low SES and poor health. A similarly broad framework has been developed by the MacArthur Network on SES and Health (e.g., see Adler and Ostrove 1999). This model not only emphasizes the influence of psychosocial factors on people's immune and cardiovascular functioning, it also highlights the role of psychosocial processes on people's health-relevant behavior. The importance of psychosocial factors in the SES-health gradient is further highlighted by the fact that subjective SES predicts increased risk of illness above and beyond traditional indicators of objective SES, such as education attainment, income, and occupational prestige (Adler et al. 2000). Fewer psychosocial models have been developed to explain the link between income inequality and health, but Wilkinson and Pickett (2009) have specifically argued that, within more unequal societies, social class differences are more salient and provoke a host of social comparison processes and evaluation anxieties. This preoccupation with relative status increases people's social insecurities and breeds a culture of competition in which people are more self-promoting, more antagonistic, and more driven to conspicuously adorn themselves with material indicators of success.

The frameworks described above are broad in scope, encompassing a wide range of psychosocial constructs to better understand how socioeconomic contexts influence health. However, as investigators continue to identify the various psychosocial mechanisms through which SES and income inequality influence health, the need for a parsimonious

framework becomes increasingly important for the purposes of integrating diverse research findings as well as identifying appropriate targets for social programming and intervention. In working toward a basic set of psychosocial variables for modeling the relationships between SES, income inequality, and health, insights may be gleaned from the fields of motivational psychology and personality development, and in particular from the applied framework of SDT (Deci and Ryan 2000). The main purpose of the present article is to bridge research in epidemiology and public health with SDT to examine the unifying construct of *basic psychological needs* as a possible mechanism through which SES and income inequality influence health.

2.1 The Nature of Basic Psychological Needs in Self-Determination Theory

Within SDT, basic psychological needs are defined as the universal experiential requirements for ongoing psychological growth, integrity, and well-being (Deci and Ryan 2000). To distinguish SDT's basic psychological needs construct from other psychosocial variables, it is useful to outline two ways in which the construct diverges from the more general concept of "desire" (Ryan 1995). First, while individuals may vary greatly in the content of their specific desires, basic psychological needs are believed to be innate and all people are believed to be characterized by the same set of psychological nutriments to develop and function in a healthy manner. Second, basic psychological needs are defined as psychosocial experiences that are essential for healthy functioning; because many desires can often be satisfied (or dissatisfied) without influencing people's psychological health, not all desires bespeak the operation of psychological needs. Given its very stringent and exacting conception of basic psychological needs, SDT may prove useful in helping to specify a core system of psychosocial variables through which socioeconomic contexts may get "under people's skin" (Adler and Ostrove 1999, p. 11) to produce variations in their physical health.

Research in SDT has been able to identify three specific psychological needs by examining how interpersonal, institutional, and cultural contexts influence healthy functioning (Deci and Ryan 2000). *Autonomy* refers to feelings of freedom and volition, the sense that one's behavior is choicefully initiated and personally endorsed rather than pressured or coerced. *Competence* refers to feelings of effectance, the sense of accomplishment and growing mastery in one's activities. *Relatedness* refers to feelings of social connectedness, the sense of being accepted and sharing meaningful experiences with others. Within SDT, these three psychological needs are considered "necessary conditions for psychological health" (Deci and Ryan 2000, p. 229). Indeed, across cultural contexts and developmental epochs, researchers have consistently found that the experiences of autonomy, competence, and relatedness are associated with a range of positive outcomes, including higher levels of subjective well-being, more fulfilling relationships, and better overall psychological health (Chirkov et al. 2011).

Importantly, research has also shown that experiences of autonomy, competence, and relatedness are positively related to physical health. For example, people who report higher levels of need fulfillment experience fewer physical symptoms (e.g., runny nose, difficulty breathing, soreness) in daily diary studies (e.g., Reis et al. 2000; Ryan et al. 2010). Need fulfillment also predicts a variety of objective health indices, including healthier patterns of physiological arousal (e.g., Bartholomew et al. 2011) and cortisol reactivity in the face of psychosocial stressors (Quested et al. 2011; Reeve and Tseng 2011). We accordingly

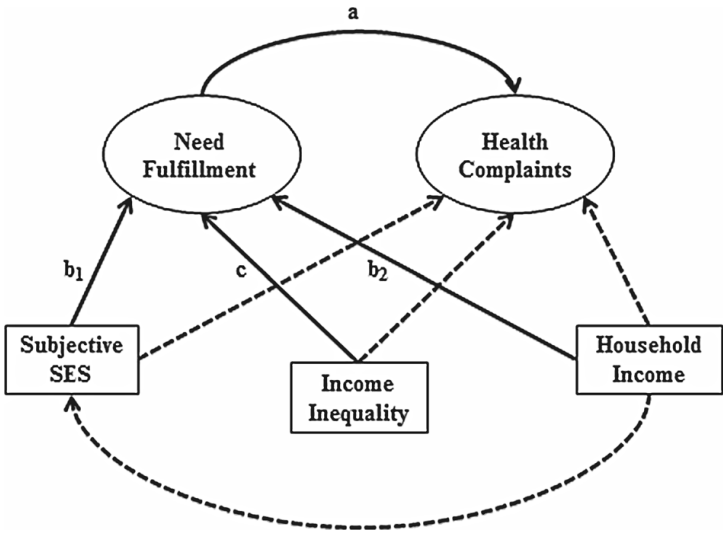

Fig. 1 Conceptual model of need fulfillment as a pathway through which household income, subjective SES, and income inequality are linked to health complaints. The main hypotheses of the current study are represented by *solid lines*. *Dashed lines* represent empirical relationships that have been previously established. *a* the hypothesized negative relationship between need fulfillment and health complaints, b_1 the hypothesized positive relationship between subjective SES and need fulfillment, b_2 the hypothesized positive relationship between household income and need fulfillment, *c* the hypothesized negative relationship between income inequality and need fulfillment

hypothesized in the present research that higher levels of need fulfillment would predict lower levels of health complaints (path "a" in Fig. 1).

2.2 Need Fulfillment as a Potential Mediator Linking SES to Health Complaints

Epidemiologists and public health specialists have previously come close to the concept of basic psychological needs, but research has yet to consider need fulfillment as a possible mechanism linking people's socioeconomic contexts to their physical health. Decades of work based on the Whitehall studies of British civil servants led Marmot himself to surmise that "the lower individuals are in the social hierarchy, the less likely it is that their *fundamental human needs* [emphasis added] for autonomy and to be integrated into society will be met" (2006, p. 1304). In correspondence with SDT, Marmot's perspective implicitly rests on the idea of there being very specific qualities of experience that are necessary for health. Notwithstanding this important point of convergence, the construct of basic psychological needs, specified as a set of innate psychological nutriments, has yet to be examined as a mechanism underlying social gradients in health. In this regard, it is important to compare and contrast Marmot's (2004, p. 11) colloquial notion of autonomy as "how much control one has over one's life" with SDT's phenomenologically based definition rendered above. Although both perspectives highlight the capacity for self-direction, the concept of autonomy within SDT additionally encompasses the ability of people to "…reflectively select behaviors that are congruent with their needs, values, and interests" (Ryan and Deci 2006, p. 1575). Crucially, SDT maintains that people's reflective capacities for self-endorsed action are vulnerable to being disrupted by environmental stressors and strained social relationships, as can be their sense of competence and relatedness.

Although researchers have yet to examine need fulfillment as a mediator linking people's SES to their physical health, previous studies do suggest that opportunities experience autonomy, competence, and relatedness follow a social gradient. Data from the Gallup World Poll surveys indicate that household income is positively associated with need fulfillment (Diener et al. 2010). Similarly, higher status positions in the workplace (e.g., managers vs. employees) entail higher levels of job autonomy (Prottas 2008). Data from the Midlife in the U.S. national survey show that higher levels of educational attainment are positively associated with eudaimonic well-being (Ryff and Singer 2008), a construct that has strong ties with SDT's basic psychological needs for autonomy, competence, and relatedness (Ryan 1995).

The concept of need fulfillment also has clear relations to many of the psychosocial variables that have been previously modeled as mediators of the association between low SES and poor health. Some of these variables include increased levels of stress and decreased levels of social support (e.g., Adler et al. 2000), decreased sense of control (e.g., Lachman and Weaver 1998), chronic negative emotions and cognitions (e.g., Gallo and Matthews 2003), perceived discrimination (e.g., Fuller-Rowell et al. 2012), and feelings of inferiority (Charlesworth et al. 2004), just to list a few. Traditionally, the concept of basic psychological needs has been used by SDT researchers to parsimoniously integrate a variety of otherwise disparate psychosocial phenomena (Deci and Ryan 2000). In the present research, we sought to examine the utility of SDT's concept of basic psychological needs for epidemiology and public health research by testing whether need fulfillment acts as a mechanism through which SES influences health. We hypothesized that higher levels of subjective SES and higher levels of household income would predict higher levels of need fulfillment (paths "b_1" and "b_2" in Fig. 1, respectively). Moreover, we hypothesized that need fulfillment constitutes a mediational pathway linking higher levels of subjective SES and higher levels of household income to lower levels of health complaints.

2.3 Need Fulfillment as a Potential Mediator Linking Income Inequality to Health Complaints

Wilkinson and Pickett (2009) argue that income inequality produces negative health outcomes through people's social experiences. Specifically, Wilkinson and Pickett argue that more pronounced levels of economic stratification render the status differences between individuals more salient which, in turn, influences people to become more materialistic and concerned with their relative social standing. In regions of greater inequality, status insecurity and status striving become commonplace and people become accustomed to mistrusting others and to perceiving others as competitors. Consistent with these ideas, recent findings indicate that people residing in more unequal regions are more self-enhancing (Loughnan et al. 2012), less friendly (de Vries et al. 2011), less trusting (Wilkinson and Pickett 2009), and less satisfied with their lives (Oishi et al. 2011). Wilkinson and Pickett (2009) emphasize that the social competition and the concomitant social evaluation anxieties fostered by income inequality are stressful and erode people's health.

There are at least two reasons why higher levels of income inequality are likely to frustrate people's fulfillment of autonomy, competence, and relatedness. First, as explicated above, people residing in more economically stratified regions are more likely to endorse self-enhancing and materialistic values (Wilkinson and Pickett 2009). Previous SDT studies have shown that the more people endorse self-enhancing and materialistic values, the less likely they are to help foster the need fulfillment of others (Kasser 2011).

On the one hand, they are less likely to be empathic, nurturing, and cooperative toward others. On the other hand, they are more likely to be controlling, manipulative, and antisocial toward others. Second, research in SDT has shown that competitive and socially evaluative settings directly thwart people's fulfillment of autonomy, competence, and relatedness because such contexts: (a) compel people to prioritize external approval over their personal interests and values, thereby thwarting their sense of autonomy; (b) threaten to deliver negative feedback and punishment, thereby thwarting their sense of competence; and (c) interfere with the development of trusting and secure relationships, thereby thwarting their sense of relatedness (Deci and Ryan 2000). Indeed, need-thwarting contexts spur the development of unhealthy qualities of behavioral regulation and can even compel people to defensively move away from life aspirations that are inherently need fulfilling (e.g., personal growth, intimacy, and community) toward a mindset that is instead focused on obtaining signs of external approval (e.g., financial success, fame, attractiveness). These "need substitutes" or "compensatory motives" do not directly afford the fulfillment of autonomy, competence, and relatedness, and can ironically instigate a self-perpetuating cycle of need thwarting (Deci and Ryan 2000). We accordingly hypothesized that higher levels of income inequality would predict lower levels of need fulfillment (see path "c" in Fig. 1). Moreover, we hypothesized that lower levels of need fulfillment constitute a mediational pathway linking higher levels of income inequality to higher levels of health complaints.

3 Method

3.1 Participants

The study received institutional review board approval from the Social Sciences, Humanities, and Education Research Ethics Board at the University of Toronto. Participants were 1,139 American adults recruited online from a national retail website data collection service who were compensated financially for their participation (www.mturk.com; Buhrmester et al. 2011). Participants completed an online consent form before entering the study. Table 1 summarizes the general demographic information of the current sample. Table 1 of the Supplemental Materials lists the proportions of participants residing in each U.S. state. All U.S. states were represented in the current study except for South Dakota.

3.2 Measures

A complete listing of the questionnaires included in this study is provided in Table 2. In the paragraphs that follow, we provide a brief description of each questionnaire and provide details concerning the administration of each one.

3.2.1 Household Income

Participants reported their *Household Income* for the 2010 calendar year by selecting one of seven categories that corresponded most closely with their annual household earnings (i.e., "the combined income of all the people with whom one lives before deduction of tax"). The frequency distribution of this variable is presented in Table 1. The response categories are represented (from top to bottom) in the ordinal manner in which they were coded and entered

Table 1 Frequency distribution of demographic information

N	1,139
Female (%)	69
Range in age	18–76
Median age	30
Standard deviation of age	11.95
Ethnicity (%)	
Born in U.S.	88
White	78
Black	6
Other	16
Current employment status (%)	
Employed full-time	36
Employed part-time	17
Self-employed	12
Unemployed	16
Retired	2
Students	22
Homemakers	6
Other	3
Household income (%)	
<$15,000	14
$15,001–$25,000	11
$25,001–$35,000	15
$35,001–$50,000	19
$50,001–$75,000	17
$75,001–$100,000	13
>$100,000	10
Highest level of educational attainment (%)	
Some high school	2
High school diploma or equivalent	11
Business or trade school	3
Some college	32
Associate's degree	10
Bachelor's degree	24
Some graduate or professional school	5
Graduate or professional degree	13

All percentages are rounded to the nearest whole number

in all subsequent analyses. The average household income of our sample was very similar to the median income of $52,762 for American households between 2007 and 2011 (USA QuickFacts, from the U.S. Census Bureau website, http://quickfacts.census.gov/qfd/states/00000.html).

3.2.2 Subjective SES

We administered the MacArthur Scale of Subjective Socioeconomic Status (Adler et al. 2000). This instrument presents a 10-rung ladder and instructs participants to think of it in

Table 2 Means, standard deviations, and internal reliabilities for measures of need fulfillment, physical illness, and social desirability

	M	SD	α
Subjective SES			
MacArthur Scale of SES	5.11	1.79	–
Need fulfillment			
BPNS-autonomy	4.80	1.01	.77
BPSN-competence	4.88	1.11	.77
BPNS-relatedness	5.08	.99	.83
BMPN-autonomy	4.68	1.07	.75
BMPN-competence	5.13	1.12	.84
BMPN-relatedness	4.86	1.13	.78
Health complaints			
PILL	1.84	.59	.96
SMUHQ	5.61/6.68	5.11/5.27	.83/.84
Subjective illness	2.65	.96	–
Sick days	1.77	1.31	.67
Socially desirable responding			
BIDR-impression management	5.72	4.06	.78
BIDR-Self-deceptive enhancement	5.42	3.97	.74

For the SMUHQ, descriptive statistics to the left of the diagonal pertain to the first 525 participants

BPNS Basic Psychological Needs Scale, *BMPN* balanced measure of psychological needs, *PILL* Pennebaker Inventory of Limbic Languidness, *SMUHQ* Southern Methodist University Health Questionnaire, *BIDR* balanced inventory of desirable responding

terms of social, economic, and cultural class stratification. Participants are asked to indicate where they believe they stand relative to others in the United States using the ladder provided. The descriptive statistics for this single-item scale is presented in Table 2 along with those for all the remaining measures in the study.

3.2.3 Income Inequality

A commonly used measure of income inequality is the Gini coefficient, which equals 0 when all households within a geographical region have an identical income and equals 1 when one household has all the income within a society. We objectively indexed income inequality with the 2010 household Gini coefficients for U.S. states obtained from the U.S. Census Bureau (Noss 2011).

3.2.4 Need Fulfillment

To assess participants' fulfillment of autonomy, competence, and relatedness, we administered the 21-item *Basic Psychological Needs Scale* (BPNS; Gagné 2003) and the 18-item *balanced measure of need satisfaction* (BMPN; Sheldon and Hilpert 2012). The BPNS and BMPN are the only two previously validated instruments for the global assessment of basic psychological needs and we utilized both to ensure maximal construct coverage given that the items on these tests might emphasize slightly different aspects of need fulfillment. We

modified the instruction set of the BMPN so that it would match that of the BPNS, which asks participants to indicate the extent to which a number of statements are personally true on a scale ranging from 1 (*Not at all true*) to 7 (*Very true*). The BPNS contains seven items for autonomy, six items for competence, and eight items for relatedness. The BMPN contains six items each for autonomy, competence, and relatedness. Sample items from the BPNS include: "I feel like I am free to decide for myself how to live my life" (autonomy), "I have been able to learn interesting new skills recently" (competence), and "People I interact with on a daily basis tend to take my feelings into consideration" (relatedness). Sample items from the BMPN include: "I do what really interests me" (autonomy), "I take on and master hard challenges" (competence), and "I frequently have disagreements or conflicts with people I am close to" (relatedness). As can be seen in Table 2, the different subscales measures of autonomy, competence, and relatedness evidenced good internal reliability.

The correlation matrix for the subscale measures of autonomy, competence, and relatedness is presented in Table 2 of the Supplemental Materials. As expected, the correlations between each of the three need subscales were substantial. Nonetheless, the specific need measures evidenced convergent and discriminant validity, as correlations were highest among those subscales purported to measure the same psychological attribute. These results suggest that both the BPNS and the BMPN provided valid measures of people's need fulfillment. In subsequent analyses, we accordingly utilized composite measures that were formed by standardizing and summing participants' scores for autonomy ($SD = 1.91$), competence ($SD = 1.88$), and relatedness ($SD = 1.86$) across the BPNS and BMPN.

3.2.5 Health Complaints

Participants completed four scales that were intended as indicators of a latent health complaints construct. The *Pennebaker Inventory of Limbic Languidness* (PILL; Pennebaker 1982) presents a 54-item list of common physical symptoms and bodily complaints (e.g., eyes water, indigestion, tightness in chest, sore throat) and asks participants to report the frequency with which they experience each symptom or complaint on a scale ranging from 1 (*have never experienced the symptom*) to 5 (*more than once every week*). The *Southern Methodist University Health Questionnaire* (SMUHQ; Watson and Pennebaker 1989) presents a 63-item checklist of common symptoms and complaints (e.g., headache, sore throat), minor illness (e.g., cold or flu, appendicitis), as well as more serious and chronic health problems (e.g., cancer, paralysis). Scores on this instrument are produced by summing positive item responses. As validated measures of physical illness, both the PILL and the SMUHQ have been shown to predict objective health outcomes such as physician visits, aspirin usage, and absenteeism (Pennebaker 1982; Watson and Pennebaker 1989). An undetected error with our questionnaire prevented the first 525 participants from responding on two items in the SMUHQ. These items were "cold or flu" and "significant weight gain." This administrative error produced a mean difference on the SMUHQ between our two otherwise identical subsamples (see Table 2). We accordingly standardized participants' scores on the SMUHQ within each subsample to correct for the artificial differences in the means and variances.

We also administered a 3-item appendage of the PILL to assess participants' *Sick Days* over the past 6 months. Participants reported the number of (a) days that they had been sick, (b) visits to their physician, and (c) days that their activities were restricted due to

illness. Participants' responses on these items were summed to obtain total scores. Thirty-two participants did not input responses to these questions and their data were listwise deleted prior to the main analyses reducing the total sample to $N = 1{,}107$. Because participants' scores were strongly skewed (5.82), we transformed their responses by adding 1 and taking the common logarithm of each participant's total score. This transformation reduced the scale's skew (.34) and increased its convergent validity with both the PILL (from $r = .34$ to $r = .43$) and the SMUHQ (from $r = .39$ to $r = .49$). Finally, we administered the widely used, single item self-rated heath measure that asks participants, "In general, how would you describe your health?" to which they respond on a scale ranging from 1 ("*Poor*") to 5 ("*Excellent*"). Numerous studies have validated this self-report scale as a predictor of sickness and mortality (e.g., Idler and Benyamini 1997). We reverse-scored this item so that higher scores would indicate higher levels of *subjective illness*.

3.2.6 Socially Desirable Responding

To account for a potentially important source of systematic measurement error in the data, we administered the 40-item research version of the Balanced Inventory of Desirable Responding (BIDR Version 6-Form 40; Paulhus 1991). The BIDR distinguishes two types of socially desirable responding, *impression management* (IM) and *self-deceptive enhancement* (SDE). IM entails exaggerated attempts to present oneself as having socially valued characteristics. SDE entails holding an unrealistically positive or grandiose self-image. Sample items on the BIDR included "I don't gossip about other people's business" (IM) and "I am a completely rational person" (SDE). Each subscale contained twenty items to which participants responded on a scale ranging from 1 (*disagree*) to 7 (*agree*). Subscale scores were calculated by counting the number of extreme positively-scored responses (i.e., 6s and 7s) and extreme negatively-scored responses (i.e., 1s and 2s).

3.3 Analytic Technique

We used structural equation modeling (SEM; Kline 2011) to explicitly model both random and systematic sources of error in the dataset. The structural equation models were estimated in *R* version 2.14.1 (R Development Core Team 2011) using the `sem` package (Fox 2006). We first planned confirmatory factor analyses to examine whether our measurements were satisfactory indicators of need fulfillment and health complaints. After establishing adequate measurement models (see Supplemental Materials, pp. 3–5), we fit a series of structural models to test our main hypotheses. To evaluate our measurement and structural models, we utilized commonly used indicators of model fit, namely, the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean squared residual (SRMR). Acceptable fit is provided by a model when CFI $\geq .95$, RMSEA $\leq .08$, and SRMR $\leq .10$, and good fit is provided when $.97 \leq$ CFI ≤ 1.00, $0 \leq$ RMSEA $\leq .05$, and $0 \leq$ SRMR $\leq .05$ (Schermelleh-Engel et al. 2003). Along with the point estimate of the RMSEA, we report the 90 % confidence interval. Although we report the Chi square statistic (χ^2) for all estimated models, the χ^2 does not function as a good indicator of fit in larger samples as even small discrepancies from expected values can attain conventional levels of statistical significance (Kline 2011). For the comparison of non-nested models, we report the Bayesian Information Criterion (BIC), with lower BIC values indicating better fit.

4 Results

4.1 Correlational Analyses

The correlations between all the primary variables are displayed in Table 3. Both subjective SES and household income were associated with the composite measures of autonomy, competence, and relatedness and, to a lesser extent, with the measures of health complaints. The measures of need fulfillment and health complaints were negatively associated, as expected. Males reported lower levels of health complaints, highlighting the importance of controlling for sex in subsequent analyses. It is important to point out that neither IM nor SDE exhibited a significant relation to the measures of SES, suggesting that participants did not distort their responses to these survey questions. However, IM and SDE exhibited moderately sized positive correlations with the need fulfillment measures and negative associations with the health complaint measures. This pattern of correlations highlights the importance of also controlling for desirable responding in our test of basic psychological needs as mediators of the relationships that SES and income inequality have to health complaints.

Table 3 Correlation matrix for all observed variables (below the diagonal) and matrix of correlation residuals for Model 2 (above the diagonal)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	–	−.08	−.01	.00	.00	.03	.02	−.02	−.03	.04	−.06	.15	.11	−.04
2. Sex	−.08	–	.04	−.01	.00	−.02	.03	−.05	.02	.00	.01	−.01	−.14	.02
3. Income inequality	−.01	.04	–	.06	.05	.00	.02	.02	−.02	−.04	.01	.02	−.05	.01
4. Household income	.11	.03	.06	–	.00	−.04	.02	−.01	.00	.01	.00	−.05	−.03	.00
5. Subjective SES	−.05	.06	.05	.49	–	.03	.04	−.02	.03	−.01	.01	−.14	.00	.09
6. Autonomy	.18	−.06	−.05	.16	.28	–	.02	.02	−.03	−.04	−.06	.00	−.03	.03
7. Competence	.17	−.01	−.03	.23	.29	.71	–	.01	−.01	.00	−.03	−.03	−.03	.07
8. Relatedness	.13	−.09	−.03	.19	.23	.71	.72	–	.03	.03	.05	.01	−.02	−.03
9. PILL	−.11	−.19	−.02	−.16	−.16	−.32	−.30	−.27	–	.01	.01	−.01	.00	.00
10. SMUHQ	−.01	−.27	−.05	−.13	−.19	−.23	−.18	−.16	.58	–	.00	−.01	.03	−.01
11. Sick days	−.10	−.18	.00	−.11	−.12	−.19	−.17	−.09	.43	.49	–	.04	.04	−.05
12. Subjective illness	.09	−.09	.04	−.21	−.35	−.35	−.38	−.34	.36	.35	.30	–	.05	−.06
13. BIDR–IM	.26	−.10	−.03	−.01	−.01	.26	.27	.28	−.13	−.06	−.03	−.04	–	.00
14. BIDR–SDE	.16	.08	.05	.03	.08	.46	.51	.42	−.19	−.14	−.14	−.18	.54	–

$N = 1{,}107$; sex: female = −1, male = 1; autonomy, competence, and relatedness represent composite measures

PILL Pennebaker Inventory of Limbic Languidness, *SMUHQ* Southern Methodist University Health Questionnaire, *BIDR* balanced inventory of desirable responding, *IM* impression management, *SDE* self-deceptive enhancement

$p < .001$ for rs ≥ |.10|; $p < .01$ for rs ≥ |.08|; $p < .05$ for |.08| > rs ≥ |.06|

4.2 Structural Analyses Testing the Mediational Role of Need Fulfillment

4.2.1 Model 1: The Basic Conceptual Model

Having established viable measurement models for need fulfillment and health complaints (see Supplemental Materials, pp. 3–5), we next tested the model illustrated in Fig. 1, in which subjective SES and household income were specified as predictors of need fulfillment and need fulfillment was in turn specified as a predictor of health complaints. This model further specified household income as a predictor of participants' subjective SES (cf. Singh-Manoux et al. 2003) and also featured direct predictive paths from both SES variables to health complaints. This model also featured direct predictive paths from income inequality to need fulfillment and health complaints. Model 1 exhibited good fit with CFI = .9719, RMSEA = .0551 (.0456–.0649), SRMR = .0337, χ^2 (30) = 130.78, $p < .0001$ and BIC = 306.01. The parameter estimates for Model 1 are summarized in Table 4. Both subjective SES and household income were positively associated with need fulfillment but negatively associated with health complaints (see Table 4A). Income inequality predicted lower levels of need fulfillment but the direct effect of income inequality on health complaints was not significant. To examine whether or not SES and income inequality influenced health complaints through need fulfillment, we conducted Sobel tests of mediation (1982). In keeping with our main predictions, the indirect effects of household income and subjective SES on participants' health complaints through need fulfillment were significant, and the indirect effect of income inequality on participants' health complaints through need fulfillment was marginally significant (see Table 4B).

4.2.2 Model 2: Controlling for Socially Desirable Responding, Sex, and Age

We examined the robustness of the above results by modeling socially desirable responding as a source of systematic measurement error. Specifically, Model 2 estimated a latent social desirability factor with primary loadings on participants' IM and SDE scores and secondary loadings on those measures that were susceptible to response distortion, namely, the composite measures of need fulfillment and the self-report health complaints measures (see Table 5D). To increase the degrees of freedom and parsimony of our models, we constrained the cross-loadings of social desirability to be equal across the indicators of need fulfillment and physical illness, respectively. These constraints were plausible because there was no a priori reason to suppose that social desirability would be differentially associated with measures of specific psychological needs or with specific measures of health complaints. Income inequality was specified as a predictor of socially desirable responding because recent findings indicate that income inequality is associated with self-enhancement (Loughnan et al. 2012). Given the observed correlations in Table 3, Model 2 also featured predictive paths from sex and age to all the other variables in the model except for income inequality.

Although Model 2 exhibited appreciably worse fit compared to Model 1 with CFI = .9441, RMSEA = .0622 (.0556–.0690), SRMR = .0391, χ^2 (61) = 322.38, $p < .001$ and BIC = 630.80, the overall fit of the model was acceptable. The matrix of correlation residuals for Model 2 is displayed above the diagonal in Table 3. The path estimates of Model 2 (see Table 5) were generally consistent with those of Model 1, but we note the pronounced increase in the prediction of need fulfillment from income inequality. Because income inequality is positively associated with socially desirable responding, these results suggest

Table 4 Parameter estimates for Model 1

	Unstandardized	*SE*	Standardized
A. Direct effects			
Household income → subjective SES	.47	.03	.49***
Subjective SES → need fulfillment	.17	.02	.28***
Household income → need fulfillment	.06	.02	.10**
Income inequality → need fulfillment	−4.04	1.99	−.06*
Subjective SES → health complaints	−.07	.02	−.13**
Household income → health complaints	−.04	.02	−.06†
Income inequality → health complaints	−2.44	2.14	−.04
Need fulfillment → health complaints	−.22	.04	−.23***
		Sobel's *Z*	
B. Test of theoretically relevant indirect effects			
Household income → need fulfillment → health complaints		−2.55, $SE = .01$, $p < .05$	
Subjective SES → need Fulfillment → health complaints		−4.56, $SE = .01$, $p < .001$	
Income inequality → need fulfillment → health complaints		1.91, $SE = .47$, $p = .056$	
C. R^2 for endogenous variables			
Subjective SES			.24
Need fulfillment			.12
Health complaints			.10
	Need fulfillment		Health complaints
D. Standardized factor loadings for latent constructs			
Autonomy	.83		
Competence	.85		
Relatedness	.85		
Subjective illness	−.33		.36
PILL	−.16		.67
Sick days			.61
SMUHQ			.81

Single arrowheads (→) represent direct effects; all listed parameter estimates rounded to the nearest hundredth

*** $p < .001$,** $p < .01$, * $p < .05$, † $p < .10$

that social desirability suppresses the observed relationship between income inequality and need fulfillment. As indicated by the Sobel tests reported in Table 5B, need fulfillment was a significant mediator of the effects of subjective SES, household income, and income inequality on health complaints even when controlling for individual differences in socially desirable responding, sex, and age.

5 Discussion and Conclusion

Social gradients and regional differences in population health are now salient concerns in epidemiology and public health research (Marmot 2004; Wilkinson and Pickett 2009). The

Table 5 Parameter estimates for Model 2

	Unstandardized	*SE*	Standardized
A. Direct effects			
Household income → subjective SES	.48	.03	.50***
Subjective SES → need fulfillment	.20	.02	.33***
Household income → need fulfillment	.07	.02	.12**
Income inequality → need fulfillment	−6.86	2.11	−.10**
Subjective SES → health complaints	−.06	.02	−.11**
Household income → health complaints	−.03	.02	−.06
Income inequality → health complaints	−2.06	2.18	−.03
Need fulfillment → health complaints	−.19	.04	−.19***
Income inequality → social desirable responding	2.49	.06	.04***
Sex → subjective SES	.06	.05	.03
Sex → household income	.08	.06	.04
Sex → need fulfillment	−.15	.04	−.13***
Sex → health complaints	−.39	.04	−.33***
Sex → social desirable responding	.08	.02	.07***
Age → subjective SES	−.02	.00	−.11***
Age → household income	.02	.01	.11***
Age → need fulfillment	.01	.00	.05
Age → health complaints	.00	.00	−.02
Age → social desirable responding	.02	.03	.23

	Sobel's *Z*
B. Test of theoretically relevant indirect effects	
Household income → need fulfillment → health complaints	−2.52, $SE = .01$, $p < .05$
Subjective SES → need fulfillment → health complaints	−3.83, $SE = .01$, $p < .001$
Income inequality → need fulfillment → health complaints	−2.51, $SE = .52$, $p < .05$

C. R^2 for main endogenous variables	
Subjective SES	.25
Need fulfillment	.18
Health complaints	.18

	Need fulfillment	Health complaints	Social desirable responding
D. Standardized factor loadings for latent constructs			
Autonomy	.67		.49
Competence	.69		.50
Relatedness	.67		.50
Subjective illness	−.35	.35	−.13
PILL	−.13	.65	−.20
Sick days		.59	−.09
SMUHQ		.80	−.12
BIDR–IM			.60
BIDR–SDE			.88

Single arrowheads (→) represent direct effects; all listed parameter estimates rounded to the nearest hundredth; sex: female = −1, male = 1

*** $p < .001$,** $p < .01$

present research utilized SDT (Deci and Ryan 2000) and its conception of basic psychological needs to further elucidate the psychosocial pathways between people's socioeconomic contexts and their self-reported health. In an online community sample of Americans, we found that higher individual levels of subjective SES and household income and lower regional levels of income inequality predicted higher levels of need fulfillment; in turn, higher levels of need fulfillment predicted lower levels of health complaints. These results provide the first evidence that need fulfillment serves as a potential explanatory variable linking SES and income inequality to self-rated health. In the present section, we discuss the significance of the present results for future applied work by demonstrating the relevance of SDT to research in two life domains that epidemiologists and public health specialists have previously identified as being critical for social intervention: the workplace and the healthcare clinic.

Marmot (2004) emphasized status disparities in the workplace as an important source of psychological strain that produces social gradients in health. Although Marmot (2004) did not explicitly cast his argument in the language of SDT's basic psychological needs, his ideas concerning the role of workplace environments can be productively summarized in terms of fewer opportunities to fulfill autonomy, competence, and relatedness in low-SES jobs. Marmot noted, for example, that whereas higher-status jobs entail more opportunities to make meaningful decisions, to experience a sense of challenge and personal satisfaction from productivity, and for enhanced social integration, lower-status jobs typically entail fewer opportunities for personal discretion, increased boredom and alienation, and reduced levels of social contact. Indeed, research suggests that lower job status can thwart people's need fulfillment (e.g., Prottas 2008).

For the past two decades, researchers have applied the principles of SDT to examine how need-facilitating supervisory practices (e.g., encouraging employee initiative, providing meaningful rationales, and acknowledging subordinates' perspectives) promote positive workplace attitudes, work engagement, and psychological and physical well-being (Gagné and Deci 2005). It is worth highlighting that although such practices appear "hierarchy attenuating," they neither disrupt the organizational order nor diminish employee motivation, two purported functions of hierarchy in the workplace (e.g., Magee and Galinsky 2008). On the contrary, need-facilitating workplace environments enhance motivation by fostering stronger organizational commitment and employee engagement (Gagné and Bhave 2011). Future research should therefore not only examine the mediational role of need fulfillment in the workplace in the relationship between low SES and poor health outcomes, it should also examine the potentially ameliorating influence of need-supportive workplace supervision.

Another well-researched life domain in SDT that is most relevant for targeted intervention is healthcare and the promotion of health-relevant behaviors among patient groups. We highlight this applied domain because previous research has demonstrated that adherence to prescribed medical treatment varies as a function of SES. Specifically, research has shown that people of lower SES have increased difficulties adhering to treatment regimens (e.g., Goldman and Smith 2002). This fact likely reflects the added social-contextual constraints and psychological stresses that adversely affect the performance and maintenance of health-relevant behaviors among people of lower SES (Adler and Snibbe 2003). Moreover, higher levels of income inequality are also associated with more health-damaging behaviors (e.g., illicit drug use and unhealthy eating) possibly, in part, as a maladaptive strategy to cope with the increased stress and anxiety within a culture of social competition (Wilkinson and Pickett 2009). While there are many reasons why people may fail to maintain their treatment regimens, a substantial body of work

within SDT has specifically highlighted the role of ambient supports for autonomy, competence, and relatedness as critical factors in promoting people's motivation and adherence to health-relevant behaviors.

According to the SDT's model of health behavior change and maintenance (Williams et al. 2011), the extent to which people are able to personally adopt and adhere to a health-related treatment regime depends on the extent to which healthcare practitioners provide active supports for the fulfillment of their clients' basic psychological needs. Need-supportive healthcare describes a treatment atmosphere that "encourages individuals to engage in health-conducive behaviors for their own reasons" (thereby supporting autonomy), "facilitates success in dealing with barriers to change" (thereby supporting competence), and "conveys feelings of acceptance and respect" (thereby supporting relatedness) and is contrasted with healthcare that "controls people's behaviors through means such as offering tangible rewards or externally pressuring them toward practitioner valued behaviors or outcomes" (Ng et al. 2012, p. 327). A recent meta-analysis synthesizing data from 184 SDT-based studies found support for this model of health behavior change and maintenance across a variety of treatment regimens (e.g., for smoking abstinence, exercise, diet, glycemic control, medication usage, etc.) showing that need-supportive healthcare delivery improves clients' treatment motivation and adherence (Ng et al. 2012). The present research found that lower levels of SES and higher levels of income inequality were associated with lower levels of need fulfillment and therefore highlights the SDT model of health behavior change and maintenance as a particularly promising framework for healthcare delivery in disadvantaged and stratified communities.

The current study is not without its limitations. Although we utilized well-validated health questionnaires, future research should use more objective measures of physical health to more precisely examine the mediational role of need fulfillment in the prediction of physical illness from socioeconomic factors.[1] In a related vein, our global assessment of need fulfillment and the accordingly high interrelations between measures of autonomy, competence, and relatedness, meant foregoing an examination of the unique roles that each of these needs have to SES, income inequality, and health complaints. In this regard, it is worth highlighting that need fulfillment was more strongly associated with subjective SES than it was with household income. This suggests that people's feelings of autonomy, competence, and relatedness are more closely related to their evaluation of where they stand on the socioeconomic ladder than to their actual socioeconomic position. Given our global assessment of need fulfillment, however, it remains unclear whether need fulfillment in specific life domains is similarly related to subjective and objective SES. Future research should test the mediational role of basic psychological needs in more circumscribed contexts (e.g., workplace environments) in which there may be greater differentiation in people's fulfillment of autonomy, competence, and relatedness. Another limitation concerns the demographic characteristics of the present sample. We recruited an exclusively American sample and the majority of the participants identified themselves as Caucasian. Although previous research in SDT attests to the cross-cultural significance of basic psychological needs for healthy psychological functioning (e.g., Chirkov et al. 2011), future studies should test whether need fulfillment similarly mediates the relationship that

[1] In this regard, it is worth noting that the SMUHQ contains items for common health symptoms and minor illnesses as well as items for more serious and chronic health problems. In the Supplemental Materials we consider a more nuanced set of analyses using participants' responses on this instrument. These ancillary analyses are detailed in the Supplemental Materials, pp. 6–13. The results of these ancillary analyses do not substantively differ from those obtained from our main models.

SES and income inequality have with health in other cultural groups. Finally, we highlight the cross-sectional nature of these data. The present findings are consistent with the idea that need fulfillment mediates the relationships between SES and health on the one hand and income inequality and health on the other, but longitudinal data are required to decisively evaluate this account.

We believe that the present findings advance research on the socioeconomic determinants of health outcomes and demonstrate the potential utility of SDT as a framework within which to formalize the psychosocial accounts offered by Marmot (2004) and Wilkinson and Pickett (2009). Importantly, the results of the current study may also bear important implications for the design of effective interventions as SDT's perspective on basic psychological needs may help in improving the physical health of socioeconomically disadvantaged individuals and communities.

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