

# Does Relative Deprivation Predict the Need for Mental Health Services?

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## Abstract

**Background:** Several studies postulate that psychological conditions may contribute to the link between low relative income and poor health, but no one has directly tested the relationship between relative deprivation and mental health disorders. In this paper, we investigate whether low income relative to a reference group is associated with a higher probability of depressive disorders or anxiety disorders. Reference groups are defined using groups of individuals with similar demographic and geographic characteristics. We hypothesize that perceptions of low social status relative to one's reference group might lead to worse health outcomes.

**Aims:** We attempt to determine whether an individual's income status *relative* to a reference group affects mental health outcomes. Our contributions to the literature include (i) defining reference groups using demographic characteristics in addition to geographic area, (ii) looking at an individual's relative income status rather than low income or aggregate-level income inequality, and (iii) focusing specifically on mental-health related outcomes.

**Methods:** Our primary data source is the national household survey component of HealthCare for Communities (HCC), funded by the Robert Wood Johnson Foundation to track the effects of the changing health care system on individuals at risk for alcohol, drug abuse, or mental health disorders. HCC is a complement to the Community Tracking Survey (CTS) and reinterviews participants of the main study. To construct relative deprivation measures, we used data from the 5% Public Use Micro Data Sample of the 2000 Census. Our measure of relative deprivation is defined using Yitzhaki's index, a term that measures the expected income difference between an individual and others in his or her reference group that are more affluent. We evaluate the relationship between relative deprivation and mental health using conditional logit models with reference group random effects.

**Results:** Even after controlling for an individual's absolute income status, those with low relative income are at higher risk of experiencing a mental health disorder. Our findings hold for both depressive disorders and anxiety/panic disorders.

**Discussion/Limitations:** Our findings suggest that relative deprivation is associated with an increased likelihood of probable depression and anxiety or panic disorders. Simulations suggest that a 25 percent decrease in relative deprivation could decrease the probability of any likely mental health disorder by as much as 9.5 percent. Limitations of this study include the fact that we only have one measure of relative deprivation, and that reference groups are defined using relatively large geographic areas.

**Implications for Health Policy:** Low relative income may contribute to socioeconomic disparities in mental health. Efforts to eradicate socioeconomic differentials should take into account psychological perceptions and self-esteem in addition to absolute material resources.

**Implications for Future Research:** Future work should explore whether mental health disorders explain the link between relative deprivation and poor physical health.

Received 17 March 2004; accepted 16 September 2004

## Introduction

Health is the complex outcome of numerous biological, cultural, and economic forces. Many vexing problems for health policy, including racial and ethnic health disparities, involve contextual and environmental factors beyond the individual. In the United States, the Institute of Medicine, one of the national academies of sciences, has started to promote the need to examine population and environmental level factors.<sup>1,2</sup> In the fall of 2003, the Secretary of Health and Human Services announced the creation of eight research centers with over \$50 million of initial funding to study population health and health disparities from an environmental and contextual perspective.<sup>3</sup> This constitutes a departure from the predominant research paradigm that focuses on individual level characteristics.

The income and health link is a particularly important topic to be examined from a population perspective. The relationship between individual or family income and mental health is well known, even if the causal pathways are not entirely clear. The prevalence of mental health disorders is

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**Source of Funding:** This research was supported by NIMH grant R01MH62124 and NIEHS grant 1P50ES012383. The data collection for HealthCare for Communities was funded by the Robert Wood Johnson Foundation.

highly correlated with low socioeconomic status,<sup>4-6</sup> making mental health a major contributor to socioeconomic health disparities. Among individuals in the bottom 20 percent of the income distribution, for example, the prevalence of depressive disorders is almost 3 times as high as among individuals in the top 20 percent of the income distribution; diabetes is the only major chronic health problem with a stronger income gradient.<sup>4</sup> The relationship between an individual's mental health and the distribution of income among others, however, is largely unknown. In this paper, we use data from the HealthCare for Communities survey linked with the 2000 US Census data and take a somewhat different approach that may reconcile seeming contradictions in the research literature.

The social psychology literature has long argued that an individual's well-being is related to perceptions of deprivation *relative* to a reference person or reference group.<sup>7-11</sup> Relative deprivation is distinct from low income because individuals with average or even high income might be relatively deprived if they are lagging behind their peers. However, although it is related to the distribution of income within a reference group, relative deprivation is an individual level measure. This fact distinguishes relative deprivation from community-level factors that might pose a health risk for all members of society, such as income inequality.<sup>12-15</sup> This also distinguishes our measure from indices of community-level deprivation that have been used in British studies such as the Townsend Score, the Index of Multiple Deprivation, and the Carstairs Index.<sup>16,17</sup>

Although initial research on relative deprivation focused on military hierarchies,<sup>7,8</sup> Runciman articulated a general theory of relative deprivation, positing that individuals are relatively deprived if (i) they do not have X, (ii) they see an other or others who have X, (iii) they want X, and (iv) they see it as feasible that they should have X.<sup>9</sup> While "X" could be defined using any number of attributes, our focus on relative income deprivation is motivated by our desire to shed light on the income gradient in mental health. Many studies have argued that relative income deprivation could contribute to socioeconomic health gradients.<sup>13,19-22</sup> These studies often posit that low relative income exacerbates feelings of low-self worth, depression, and hostility, suggesting that relative deprivation is particularly relevant for mental health related outcomes. However, to date, few studies empirically investigate the link between relative deprivation and health,<sup>23,24</sup> and none explore the relationship between relative deprivation and mental health.

In this paper, we explore the relationship between relative income deprivation and mental health, using individual level data from the HealthCare for Communities Study (HCC). Relative deprivation is defined using a mathematical articulation of Runciman's theory, developed by Yitzhaki.<sup>25</sup> Other studies measure relative deprivation using a dichotomous variable for whether or not the individual's income is below the median for her age/sex/occupation group,<sup>24</sup> or by using a self-reported variable indicating whether or not the individual perceived himself to be lacking a basic material need.<sup>23</sup> We choose to use Yitzhaki's index because this measure was specifically developed to reflect

Runciman's theory. In addition, since the Yitzhaki measure is a continuous rather than a dichotomous variable, it should allow us to capture subtler changes in the individual's socioeconomic position relative to his or her referents.

In addition to exploring the link between relative deprivation and mental health, we analyze whether defining reference groups using demographic characteristics as well as geography affects our conclusions. The rationale is that individuals are likely to compare themselves to others with similar demographic characteristics in addition to those who are nearby geographically. The Whitehall study, for example, looked at British civil servants, defined by a common employer.<sup>26-28</sup> While the social psychology literature suggests many possible groupings,<sup>29</sup> we are limited by the data and therefore explore how constructing reference groups according to demographic characteristics changes results compared to a definition based on geography alone. We use Health Care for Communities (HCC) data linked with 2000 Census data to study the relationship between relative income deprivation and mental health, and we define reference groups using a combination of characteristics including geographic area, age, education, marital status, and sex. Further, we test the robustness of our results to the way in which reference groups are constructed.

## Methods

### Data

Our primary data source is the national household survey component of HealthCare for Communities, funded by the Robert Wood Johnson Foundation to track the effects of the changing health care system on individuals at risk for alcohol, drug abuse, or mental health disorders.<sup>30</sup> HCC is a complement to the Community Tracking Survey (CTS) and re-interviews participants of the main study. In wave 1 (1997/1998), HCC completed 9,585 interviews (64 percent response rate), in wave 2 (2000-2001), HCC re-interviewed 6,659 of them (66 percent of attempts) and also added a new cross section (n = 5,499). We only use the initial wave and the new cross-section (n = 15,084).

Constructing relative deprivation requires detailed information on the income distribution for individuals in the same geographic area, and in some cases, for age/education/sex specific groups of individuals within a given area. This cannot be done with the survey data as there are very few individuals within any geographic area and demographic group. Instead, we use information on household income distribution from the 5% Public Use Micro Data Sample of the 2000 Census (PUMS) to construct relative deprivation measures.

### Measures of Mental Health

The dependent variables in the analyses are measures of mental health. Mental health status is assessed by the short-form Composite International Diagnostic Interview (CIDI-

SF)<sup>31</sup> and stem items from clinical interviews for specific disorders (major depressive disorder, dysthymia, generalized anxiety disorder, panic disorder, bipolar disorder, psychotic disorder). Screening instruments are more sensitive than specific, so individuals exceeding the screener are likely to have the corresponding disorder, but there will be more false positives than false negatives. We use dichotomous indicators for two clusters of disorders: any unipolar depressive disorder (major depressive or dysthymic disorder) or anxiety disorders (generalized anxiety and panic disorder). We also construct a dichotomous summary variable that equals one if the individual screens for any depression, dysthymia, anxiety, or panic disorder. We exclude bipolar disorder and psychotic disorder because these conditions have a large genetic component and are less likely than anxiety and unipolar depressive disorders to be affected by environmental conditions.<sup>32-35</sup> **Table 1** provides descriptive statistics for the outcome variables.

### Measures of Relative Deprivation

The key independent variable is an individual's income deprivation relative to the reference group. We define relative deprivation using Yitzhaki's index,<sup>25</sup> which derives from Runciman's theory. The index measures the difference between individual *i*'s income ( $y_i$ ) and the average income in *i*'s reference group given that income is greater than  $y_i$ . Formally:

$$\text{Yitzhaki}_{ir} = \frac{1}{N_r} \times \sum_j (y_{jr} - y_{ir}) \quad \forall y_{jr} > y_{ir} \quad (1)$$

where  $N_r$  is the total number of individuals in reference group *r*. This equation can be rewritten as follows:

$$\text{Yitzhaki}_{ir} = [E(y_{jr}|y_{jr} > y_{ir}) - y_{ir}] \times \text{prob}(y_{jr} > y_{ir}) \quad (2)$$

Intuitively, individual *i* feels deprived whenever he meets someone with a higher income, and the amount of *i*'s deprivation is proportional to the difference between  $y_{ir}$  and  $y_{jr}$ . Relative deprivation falls as the gap between  $y_{jr}$  and  $y_{ir}$  falls, and it also falls as the probability of coming into contact with individual *j* falls. High values of this measure of relative deprivation indicate that either there are many people

in *i*'s reference group with incomes greater than  $y_i$ , or that those above *i* in the income distribution have much higher incomes than *i*. Since high relative deprivation means that the individual is worse off compared to his or her peers, we expect a positive association between relative deprivation and the probability of poor mental health.

### Construction of Reference Groups

We construct seven different reference groups. Each includes individuals living in the same Super-PUMA, which is a Census-defined contiguous geographic area containing at least 400,000 individuals, but the various reference groups exclude some individuals in the same Super-PUMA depending on age, education, sex, or marital status. The 7 reference group constructs include: (i) all individuals in the same Super-PUMA, regardless of age, sex, or other demographic characteristics (ii) individuals in the same Super-PUMA of the same sex, (iii) individuals in the same Super-PUMA, of the same sex, and same level of education, (iv) individuals in the same Super-PUMA, of the same sex and marital status (v) individuals in the same Super-PUMA and of the same age, (vi) individuals in the same Super-PUMA, of the same age and sex, and (vii) individuals in the same Super-PUMA, of the same marital status, sex, and age. **Table 2** shows the average relative deprivation in each of the various reference groups. Using reference groups defined by Super-PUMA only, the average Yitzhaki measure is equal to \$29,229 with a standard deviation of \$18,089. Based on equation (2), this implies that—after adjusting for the probability of comparison—the average difference between individual *i*'s income and reference group incomes greater than  $y_i$  is \$29,229. Average relative deprivation diminishes somewhat when we add additional characteristics to the reference group, such as sex and age. For instance, when reference groups consist of Super-PUMA, sex, and marital status (row 4), average relative deprivation is \$24,623.

**Table 3** provides some additional statistics to give a sense of how relative deprivation changes depending on the incomes of others in one's reference group. In this example, we highlight two Super-PUMAs: (i) Hidalgo County, Texas, which is a low-income area, and (ii) part of New York County, which is unusually wealthy. Reference groups are

Table 1. Mental and Physical Health Outcome Measures, Descriptive Statistics (N = 9270)

Condition	Mean (Std Dev)
Any probable mental health disorder (Depression, dysthymia, panic, or anxiety disorder)	12.9% (33.5)
Probable major depressive disorder	10.5% (30.6)
Probable anxiety disorder	6.2% (24.1)

Note. Means are taken from HCC wave 1 only, to facilitate the use of sample weights.

Table 2. Relative Income, Descriptive Statistics (N = 9159\*)

Reference Groups Defined Using	Mean (Std. Dev.)
(i) Super-PUMA	29,228 (18,089)
(ii) Super-PUMA, Sex	29,237 (18,007)
(iii) Super-PUMA, Sex, Education	27,623 (19,368)
(iv) Super-PUMA, Sex, Marital Status	24,623 (19,112)
(v) Super-PUMA, Age	26,697 (18,584)
(vi) Super-PUMA, Age, Sex	26,486 (18,546)
(vii) Super-PUMA, Age, Sex, Marital Status	23,253 (19,321)

\* Means are taken from HCC wave 1 only, to facilitate the use of sample weights.

Table 3. Relative Deprivation, Representative Income Levels - Reference Groups based on Super-PUMA and age

Income	Hidalgo County, TX		New York County (Manhattan), NY	
	Age 21-25	Age 46-50	Age 21-25	Age 46-50
\$10,000	\$11,867	\$36,848	\$23,979	\$116,119
\$25,000	\$4725	\$25,480	\$17,374	\$103,999
\$50,000	\$1381	\$13,831	\$10,215	\$87,335
\$75,000	\$611	\$8296	\$6738	\$74,958
\$100,000	\$379	\$5384	\$5186	\$65,282

defined using Super-PUMA and age, and we focus on two age groups in particular; 21-25 (an age group where people are likely to have lower incomes) and 46-50 (an age group where people tend to be at the peak of their earnings capacity). **Table 3** shows how relative deprivation varies across reference groups for a given level of income. For example, row 1 shows that, when income is \$10,000 average relative deprivation for 21-25 year olds in Hidalgo is \$11,867, whereas average relative deprivation for 46-50 year olds in Manhattan is \$116,119. Differences in relative deprivation are pronounced within age-category as well. Forty-six to fifty year-olds in Hidalgo with \$10,000 have relative deprivation equal to \$36,848, about a third the size of their age counterparts in New York.

One concern about these statistics is that high-income areas like New York might have amenities such as better hospitals and easier access to health care than areas such as Hidalgo, Texas. To the extent that high relative deprivation is correlated with reference-group level wealth and the external amenities that wealth can provide, our estimate of the impact

of relative deprivation on mental health might be biased downward. To address this bias, all regressions include a control variable for mean reference-group income. Mean reference group income is distinct from relative deprivation, since relative deprivation measures deviations between an individual's income and the incomes of others *above* him or her in the income distribution. Relative deprivation varies within reference group based on both individual i's own income and the distribution of income given that income is greater than i's own income. Mean income, in contrast, is constant for everyone in the reference group. In the final analysis, both relative deprivation and mean income are scaled by dividing by 10,000.

### Other Control Variables

Demographic controls include age group (21-25, 26-30, . . . , 71-75, 76+), race (white, black, Hispanic, and other), education (less than high school, high school graduate with

less than 4 years of college, and college graduate), marital status (married, partnered, or unmarried/unpartnered), sex, HCC wave (1 or 2), and number of people in family. All regressions include a Super-PUMA random effect, which makes our results more generalizable since we are dealing with a subset of Super-PUMAs within the United States. The HCC contains a detailed, continuous family income variable that gives us an advantage because most studies of income and health are forced to rely on broadly grouped income categories. We control for individual income using a spline function, with knots at the 20<sup>th</sup>, 40<sup>th</sup>, 60<sup>th</sup>, and 80<sup>th</sup> percentiles of the HCC income distribution. In addition to controlling for family income, we also include average reference-group level income in each of our regressions. As with the relative deprivation term, family income and mean income are scaled by dividing by 10,000.

### Data Analytic Procedures

We use random effects logistic regression models for each of the three dependent variables discussed above (any probable mental health disorder, probable depression, and probable anxiety or panic disorder). To facilitate interpretation of our results, we calculate predicted probabilities in addition to reporting marginal effects from the logit models. We then simulate the change in predicted mental health status that results from increasing or decreasing relative deprivation by 25 percent. As discussed earlier, when reference groups are defined using Super-PUMA only, average relative deprivation is \$29,229, so a 25% increase in relative deprivation would increase average relative deprivation to \$36,536. To put this number in perspective, the difference in

average relative deprivation between Manhattan and Brazoria County, Texas is \$36,470.

### Limitations

One limitation of this study is that the Super-PUMA is a relatively broad geographic unit. It is possible that the relevant reference group is based on a smaller unit of geography, such as neighborhood. An additional limitation is that, since there are only 2 waves in the HCC, we do not have a lot of information on the timing of events. This means we cannot tell whether relative deprivation precedes changes in mental health, or if having mental health problems causes income to fall relative to one's peers. While the evidence on the labor market consequences of depression and dysthymia are mixed,<sup>36</sup> it is possible that part of our findings may be driven by reverse causality. As a result, readers should use caution when interpreting our results, as they are likely to be an upper bound estimate of the effect of relative deprivation on mental health outcomes.

### Results

**Table 4** reports results from the random effects logit model for all three of our dependent variables. Marginal effects (computed at the mean of the dependent variable) are for relative deprivation only, but all models include demographic controls, family income, mean reference-group level income, and a Super-PUMA random effect.

For all reference groups, we observe a positive association

Table 4. Relative Deprivation and Mental Health Outcomes - Results from Logistic Regressions, Super-PUMA Random Effects (N = 14,435) [Includes Control for Mean Income]

Reference Group	Marginal Effect After Logit		
	Probable Depression or Anxiety?	Probable Depressive Disorder	Probable Anxiety Disorder
Super-PUMA Only	0.012 (1.59)	0.006 (0.90)	0.007 (1.17)
Super-PUMA, Sex	0.013 (1.66)	0.007 (1.08)	0.008 (1.46)
Super-PUMA, Sex, Education	0.009 (1.58)	0.003 (0.97)	0.001 (0.66)
Super-PUMA, Sex, Marital Status	0.017* (3.48)	0.011 (2.54)	0.012* (3.25)
Super-PUMA, Age	0.027* (4.78)	0.019* (3.81)	0.017* (3.98)
Super-PUMA, Age, Sex	0.025* (4.48)	0.019* (3.68)	0.015* (3.50)
Super-PUMA, Age, Sex, Marital status	0.021* (4.78)	0.015* (3.83)	0.013* (4.18)

Note. Table reports marginal effects taken at the mean of the dependent variables. Z-statistics in parentheses. \* indicates  $p < 0.001$ .

Table 5. Predicted Probability of Any Mental Health Disorder, Depression, or Anxiety - Simulated Changes in Relative Deprivation Reference Groups Defined Using Super-PUMA, Age, and Sex

Dependent Variable	Baseline	Decrease Everyone's RD by 25%	Increase Everyone's RD by 25%
A. Predicted Probabilities			
Any Mental Health Disorder? ±	17.9	16.2	19.7
Depression/Dysthymia?	14.5	13.3	16.0
Anxiety/Panic Disorder?	8.8	7.7	10.0
B. Predicted % Deviation from the Mean			
Any Mental Health Disorder? ±		9.5%	10.1%
Depression/Dysthymia?		8.3%	10.3%
Anxiety/Panic Disorder?		12.5%	13.6%

Note. ± Includes probable anxiety disorder, panic disorder, depression, or dysthymia. Predictions are based on HCC 1 sample only, N = 9135.

between relative deprivation and the probability of having a mental health disorder (column 1), suggesting that low relative income is related to worse psychological health. However, the association is statistically significant only for particular reference group constructs (Super-PUMA, sex and marital status; Super-PUMA and age; Super-PUMA, age, and sex; and Super-PUMA, age, sex and marital status). These effects suggest that a one standard deviation (\$19,000, or 1.9 point) increase in relative deprivation would be associated with a 3.2 percentage point (24.8 percent, in the Super-PUMA, sex, and marital status model) to a 5.1 percentage point (39.8 percent, in the Super-PUMA and age model) increase in the probability of having a mental health disorder.

Similar results are found when we consider major depressive disorder and anxiety or panic disorders separately (columns 2 and 3). For example, if reference groups are defined using Super-PUMA, age, and sex, a one standard deviation increase in relative deprivation is associated with a 3.6 percentage point (34 percent) increase in the probability of depression and a 2.9 percentage point (46 percent) increase in the probability that an individual screens for anxiety or panic disorder.

**Table 5** shows the predicted probability of having a likely mental health disorder when we simulate a 25 percent change in relative deprivation while holding each individual's own income constant. Baseline predicted probabilities taken from the logit models in **Table 4** are presented in column 1. Results from a simulated 25 percent decrease in relative deprivation and from a 25 percent increase are shown in columns 2 and 3. Predicted probabilities are shown only for the case where reference groups are defined using Super-PUMA, age, and sex.\* We present both the actual predictions (Panel A) and the percent deviations from the

mean that result from a 25 percent change in relative deprivation (Panel B).

When reference groups are defined using Super-PUMA, age, and sex, decreasing everyone's relative deprivation by 25 percent is associated with a 1.7 percentage point (9.5 percent) drop in the predicted probability of having probable depression, dysthymia, panic or anxiety disorder. When we break these results down by considering depression and dysthymia separately from anxiety and panic disorder, we find that a 25 percent decrease in relative deprivation is associated with a 1.2 percentage point drop in the probability of depression, and a 1.1 percentage point drop in the probability of anxiety/panic disorder. In percentage point terms these results are similar, but because the baseline probability of anxiety disorder is lower than the baseline probability of depression, a 25 percent decrease in relative deprivation leads to a larger *percent* change in the probability of screening for anxiety/panic disorder (12.5 percent decrease versus 8.3 percent decrease).

**Table 4**, and **Table 5** highlight the effects of relative deprivation on mental health, but all models control for mean reference group income, family income, and other covariates. In order to provide a sense of how mean income and family income are related to mental health, **Table 6** shows marginal effects on relative deprivation and the income variables for models where reference groups are defined using Super-PUMA, age, and sex. For all three of the mental health related outcomes, higher mean reference-group income is associated with a lower probability of poor mental health. A 10,000 increase in mean reference group income is associated with a 1.9 percentage point decline in the probability of any mental health disorder, a 1.4 percentage point decline in the probability of depression, and a 1.3 percentage point decline in the probability of anxiety disorder.

The family income splines show a non-linear relationship between income and mental health. For any probable mental health disorder (column 1) and depressive disorder (column 2), income is strongly protective against poor mental health

\* Similar results were found when reference groups were defined using Super-PUMA, sex, and marital status, Super-PUMA and age, or Super-PUMA, age, sex, and marital status.

Table 6. Effects of Mean Reference Group Income and Family Income. Reference Group is Super-PUMA, Age, and Sex

	Marginal Effect After Logit		
	Probable Depression or Anxiety Disorder?	Probable Depressive Disorder	Probable Anxiety Disorder
Relative Deprivation	0.025* (4.48)	0.019* (3.68)	0.015* (3.50)
Mean Reference Group Income	-0.019* (3.89)	-0.014* (3.25)	-0.013* (3.35)
Family Income			
Lowest fifth	-0.023 (1.81)	-0.026 (2.35)	0.002 (0.021)
Second fifth	-0.000 (0.03)	0.002 (0.26)	-0.012 (1.66)
Middle fifth	-0.006 (0.74)	-0.001 (0.17)	0.009 (1.65)
Fourth fifth	-0.002 (0.26)	0.002 (0.40)	-0.005 (1.16)
Highest fifth	0.003 (2.96)	0.002 (2.52)	0.001 (0.74)

Note. Table reports marginal effects taken at the mean of the dependent variables. Relative deprivation and income variables are scaled by dividing by 10,000. Z-statistics in parentheses. \* indicates  $p < 0.001$ .

for individuals with low levels of income. A \$10,000 increase in income is associated with a 2.3 percentage point decline in the probability of any mental health problem and a 2.6 percentage point decline in the probability of depression for individuals in the lowest family income quintile. However, as income increases, the protective effect of income diminishes. For individuals in the second, third, and fourth quintiles of the income distribution, there is no relationship between family income and either any probable mental health disorder or probable depression. Finally, for individuals in the highest income quintile, additional family income has a small but statistically significant *positive* impact on the probability of any mental health disorder or probable depression. A 10,000 increase in family income for those in the top quintile is associated with a 0.3 percentage point increase in the probability of any mental health problem, and a 0.2 percentage point increase in the probability of depression.

After controlling for both relative deprivation and mean reference group-level income, we find little evidence of a relationship between family income and probable anxiety disorder (column 3). The relationship between family income and health is of borderline statistical significance at all knots of the spline function, and the pattern of the marginal effects is non-monotonic as family income increases.

### Sensitivity

In additional robustness checks we experimented with altering the choice of income control variables and included state and Super-PUMA level characteristics in addition to

Super-PUMA random effects. Using alternative income controls such as a quadratic term in income or a series of income dummy variables had little effect on either the magnitude of the statistical significance of the results. Adding state and local characteristics to our models did not change the estimated effect of relative deprivation.

### Discussion

Growing evidence suggests that the link between socioeconomic environment and health is driven at least in part by psychosocial factors.<sup>37,38</sup> To this end, it might not simply be the ability to purchase material resources that affects health, but feelings of anxiety and depression that may derive from individuals' socioeconomic environment. We test whether relative deprivation – having a low income relative to others in one's comparison group – affects the probability of having any or specific types of mental health disorders. While previous work has examined whether or not relative deprivation is linked to poor physical health, this is the first study to look specifically at the relationship between relative deprivation and psychological health. This is an important area of investigation, since psychosocial factors are thought to be the primary mechanism linking low relative income to health.

A key issue in developing measures of relative deprivation is how to define individuals' reference groups. Our results suggest that relative deprivation is related to poor mental health—including the probability that an individual has any

disorder as well as specific types of disorders, but show sensitivity to the reference group used. In particular, relative income is associated with mental health when reference groups are age specific. Thus, age may be an important part of social comparisons. That is, individuals compare their achievements to those of similar age, but not to individuals ahead or behind them in their income lifecycle. The finding also suggests that, while social context may be an important predictor of health, studies that look at neighborhoods and geographic regions without considering other demographic factors may be missing part of the social comparison process.

Our findings suggest that relative deprivation is associated with an increased likelihood of probable depression, anxiety, and overall poor mental health. Depending on how reference groups are defined, the effect of relative deprivation can be quite pronounced. For example, our simulations suggest that a 25 percent decrease in relative deprivation could decrease the probability of either anxiety disorder or depression by as much as 9.4 percent. Although there is some evidence that low family income is more highly related to depression than to anxiety disorder, it appears that the relative deprivation effect is similar for both disorders. The marginal effects reported in **Table 3** indicate that a one point (\$10,000) increase in relative deprivation could increase the probability of likely depression by 1.1 to 1.9 percentage points, or the probability of anxiety disorder by 1.2 to 1.7 percentage points. However, since the baseline probability of anxiety disorder is lower than the baseline probability of depression, the *percent* change in the probability of anxiety disorder due to an increase in relative deprivation is slightly higher than the percent change in the probability of depression.

An important caveat is that this study is based on cross-sectional data, and we cannot address the alternative explanation that worse mental health leads to lower relative income. An ideal framework for assessing causality would be a pre/post experimental design in which the reference group income distribution is altered while holding individual income and all else constant. In practice, this type of experiment would be nearly impossible to conduct in a controlled trial, and it is difficult to think of a viable “natural” experiment that would produce a similar exogenous change in reference group income. Future studies might attempt to address the causality issue using a longitudinal design, in which previous relative deprivation is used to predict current mental health status, controlling for previous mental health.

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