



HEALTH

- THE ARTS
- CHILD POLICY
- CIVIL JUSTICE
- EDUCATION
- ENERGY AND ENVIRONMENT
- HEALTH AND HEALTH CARE
- INTERNATIONAL AFFAIRS
- NATIONAL SECURITY
- POPULATION AND AGING
- PUBLIC SAFETY
- SCIENCE AND TECHNOLOGY
- SUBSTANCE ABUSE
- TERRORISM AND HOMELAND SECURITY
- TRANSPORTATION AND INFRASTRUCTURE
- WORKFORCE AND WORKPLACE

This PDF document was made available from www.rand.org as a public service of the RAND Corporation.

[Jump down to document](#) ▼

The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world.

Support RAND

[Browse Books & Publications](#)

[Make a charitable contribution](#)

For More Information

Visit RAND at www.rand.org

Explore [RAND Health](#)

View [document details](#)

This product is part of the RAND Corporation reprint series. RAND reprints reproduce previously published journal articles and book chapters with the permission of the publisher. RAND reprints have been formally reviewed in accordance with the publisher's editorial policy.

Income and Mental Health: Unraveling Community and Individual Level Relationships

Carole Roan Gresenz,^{1*} Roland Sturm² and Lingqi Tang³

¹Ph. D., Economist, RAND, Arlington, Virginia, USA ²Ph. D., Senior Economist RAND, Santa Monica, CA, USA
³Ph. D., Senior Statistician Health Services Research Center UCLA Neuropsychiatric Institute, Los Angeles, CA, USA

Abstract

Background: The association between individual socioeconomic status (SES) and mental disorder is well-documented, but studies to date have provided limited and sometimes conflicting evidence on the relationship between aspects of socioeconomic environment, including the role of income inequality, and mental disorder.

Aims of the Study: This paper explores the relationships between mental disorder and individual SES and socioeconomic environment, with particular attention to both the level and dispersion of community income and to their interactions with individual income.

Methods: Cross sectional study using nationally representative, individual level data from the Healthcare for Communities survey merged with supplemental information. Dependent variable is individual mental health status, measured by the 5 item Mental Health Inventory (MHI-5; average 80.6) and an indicator of probable anxiety or mood disorder based on clinical screening instruments (positive for 14.3 percent of respondents in the sample).

Results: MHI-5 decreases (indicating worse mental health), and the probability of an anxiety or depressive disorder increases continuously from the highest to the lowest quintiles of family income. Compared to those in the highest income quintile, MHI-5 is more than 10 points lower and the probability of disorder is much greater among individuals in the lowest income quintile. Within-quintile own income level is also strongly associated with mental health among lower income individuals. We find no evidence that higher levels of income *inequality* are associated with poor mental health outcomes, measured either by the probability of disorder or MHI-5. Regarding income *level*, MHI-5 is 3.4 to 3.5 points higher among low income individuals in medium or high income states compared to those in low income states.

Discussion: The qualitative conclusions are stable across various specifications reported (two different measures of mental health, two geographic levels, and among all individuals and low income individuals alone), and in specifications with alternative parameterizations of the community variables (continuously measured, included as quintiles instead of tertiles, and using other indicators of inequality). Individual income is highly correlated with mental health

status; level of state income has some association; community or state income *inequality* has no detectable relationship with mental health. This analysis provides no support for the hypothesis that income inequality is a stronger determinant of health than individual or family income, a hypothesis that in recent years has received much attention in the popular press and policy debates. Limitations of our analysis include the cross-sectional nature of the analysis, the sample sizes used in derivation of the site variables (though sensitivity analyses showed robust results) and the age of the state data.

Conclusions: The association between individual income and mental health is strong. No support for the income inequality hypothesis is found.

Implications for Health Policy Formulation: Our findings point to a need for better understanding of the relationship between individual income and mental health outcomes. Our research does not support the notion that policies aimed at diminishing income inequality are an important lever in improving mental health outcomes for individuals.

Implications for Further Research: This research does not address whether and how different sources of income-at the individual or community level-may affect mental health, and whether the associations observed cross-sectionally also bear out longitudinally. In addition, more research into the relationship between other community characteristics, such as service availability, and mental health outcomes is needed.

Received 26 November 2001; accepted 14 May 2002

Introduction

The roots of mental illness, like those of physical illness, involve a complex web of biological, psychological, and sociocultural factors. The roles of these factors may vary by disorder and across individuals, but the vulnerability of certain groups of individuals to mental disorder is well-documented.¹ In particular, a strong association has been observed between individual socioeconomic status (SES) and mental disorder.²⁻⁵

Recent studies have expanded the focus from individual SES to the socioeconomic environment in which individuals live. The "income inequality hypothesis," which posits that economically more egalitarian communities or societies have better health outcomes than more unequal communities, has received much attention in the popular press and policy debates.⁶⁻⁸ Some of its prominent proponents have gone so far

*Correspondence to: Carole Roan Gresenz, 1200 South Hayes Street, Arlington, Virginia 22202-5050, USA
Tel.: +1 703-413-1100 x5419
Fax: +1 703-414-4726
E-mail: gresenz@rand.org

Source of Funding: Financial support was provided from the Robert Wood Johnson foundation, sponsor of Healthcare for Communities, and NIMH grant R01MH62124.

as to claim that, at least in developed societies, income inequality is a stronger determinant of health than individual or family income.⁶ The empirical evidence is more limited, especially for mental health. Four recent studies have considered income inequality and mental health,⁹⁻¹² but findings were inconsistent. Kahn et al.⁹ find that high income inequality confers an increased risk of depressive symptomatology on new mothers and that its association is strongest among the low income, but Weich et al.¹⁰ report that inequality is related to poor mental health outcomes among wealthier people. Fiscella and Franks¹¹ find a small (relative to individual income) association between income inequality and depressive symptoms, and Sturm and Gresenz¹² find no evidence of a relationship between income inequality and the probability of a mood or anxiety disorder. Some of the inconsistencies of prior studies may be due to methodological differences. For example, three prior studies used a nonspecific psychological distress measure,⁹⁻¹¹ and the fourth used clinical screeners for specific mental health disorders.¹² Adequate control for other important confounding factors has also varied, with some studies neglecting or overlooking the level of community income, and in other studies, data quality has been an issue for individual income measures.

This paper examines anew the roles of individual SES and socioeconomic environment in the U.S., with particular attention to both the level and dispersion of community income and to their interactions with individual income. The most significant contributions are that we consider income level and distribution at both the community and at the state level; analyze as dependent variables both a non-specific measure of psychological distress and more clinical diagnostic screeners; and use data that contain more precisely measured individual income.

Methods

Data

We use data from the 1997/1998 national household survey component of Healthcare for Communities (HCC). HCC was funded by the Robert Wood Johnson Foundation and was designed to track the effects of the changing health care system on individuals at risk for alcohol, drug abuse, or mental health disorders. The sample for the HCC household survey (n = 14,985) was drawn from a pool of approximately 31,000 respondents to the Community Tracking Survey (CTS).¹³ HCC oversampled CTS respondents with psychological distress and/or low income, thereby increasing the number of individuals with mental illness in the sample by over 40% compared to a completely random sample. The data include 9585 completed interviews (64 percent response rate).¹⁴ CTS respondents were either part of a small national sample of individuals randomly selected from across the US, or were clustered in a set of 60 US "communities."¹³ *

* A community is defined as a Census primary metropolitan statistical area (PMSA) if the population in the PMSA is more than 350,000, and if less, as a group of counties within a state that are part of the same Economic Area as defined by the Bureau of Economic Analysis.

Likewise, most HCC respondents (8248) were located in one of the 60 main sites, and the remaining (1377) were in other locations across the US. To facilitate linking community and individual data, we include only individuals in the 60 main communities in our analysis. The sample comprises 6925 individuals under age 65.

Dependent Variables

The dependent variables in the analyses are measures of mental health. One measure is the Mental Health Inventory-5 or MHI-5, a psychological distress scale based on the five items that best predict a summary score from the longer 38 item Mental Health Inventory.¹⁵ The MHI-5 assesses general mood or affect, including depression, anxiety, and positive well-being in the last month. The index runs from 0 to 100 (sample mean = 80.6), where a lower score indicates greater psychological distress (worse mental health), and a higher score indicates better mental health. The second measure of mental health is a dichotomous variable indicating whether the individual is likely to have one or more of four mental health disorders: Generalized anxiety disorder, major depressive disorder, dysthymia, or panic disorder (percentage of sample with positive indicator = 14.3%). The indicators for the first three conditions are based on screening versions of the Composite International Diagnostic Interview (CIDI-SF) for those disorders. Probable panic disorder is coded based on the CIDI stem items for panic disorder, but is only coded positively if the individual also reports a limitation in role functioning on the SF-12.

Key Independent Variables

Key independent variables of interest are own income, community level income, and community income inequality. We measure income at the individual level as family income. * To improve total family income estimates, each major component of income was asked about separately, and respondents were asked to respond with actual dollar amounts. Unfolding follow-up brackets were adopted to reduce item non-response.¹⁶ † We allow for non-linearities in the association between income and mental disorder with income quintiles.

We derive community income level and inequality from CTS data. Because the CTS sampling frame is identical to that of the HCC, the CTS provides a higher effective sample for the sites in this study than other national data, and the CTS are relatively recent data (1996/1997). Our primary measure of income inequality is the Gini coefficient,¹⁷⁻¹⁹ though we

* Family income includes earnings from work, retirement and disability income, cash transfers from means tested government programs, unemployment benefits, alimony, child support, and other miscellaneous sources of income.

† Individuals who refused or could not estimate specific amounts were asked a sequence of questions about whether income was greater or less than certain amounts. Respondents' answers to the follow up questions were used to improve imputation, which was conducted separately by major income component.

Table 1. MHI-5 and anxiety or depressive disorder, by own income level, level of community income, and level of community income inequality

	Sites		States	
	MHI-5	Anxiety or Depressive Disorder	MHI-5	Anxiety or Depressive Disorder
Own Income				
Very Low	73.4	24.6%	**	**
Low	79.3	17.3%	**	**
Medium	81.2	13.5%	**	**
High	82.8	10.5%	**	**
Very High	84.0	9.2%	**	**
Community Income Level				
Low	80.1	13.8%	79.5	16.2%
Medium	80.4	16.2%	80.6	14.7%
High	81.4	13.1%	81.0	13.3%
Community Income Inequality				
Low	80.7	15.0%	80.0	14.7%
Medium	81.0	14.4%	80.7	15.1%
High	80.2	13.7%	80.8	13.8%

**Same as for all sites.

construct and test alternative measures of inequality.^{20*} The Gini coefficient is calculated as the ratio of the area between the Lorenz curve, which shows the shares of income earned by successive deciles of households, and the 45 degree line. The greater the curvature of the Lorenz curve, the greater is inequality and the greater is the distance between curve and the 45 degree line. Gini values range from 0 to 1, in principle, and from .38 to .54 across the 60 communities in the analysis. Level of community income is measured as median family income (range is from \$13,500 to \$38,300 across the 60 sites). We also use measures of income inequality and income level based on data from the 1990 US Census. †

The state measures are somewhat older, but are useful for testing the sensitivity of results to geographic level, which has been shown to matter in some studies of income inequality and physical health. We developed indicators of community/state income level and inequality based on tertiles and quintiles of their respective distributions. We performed analyses using the continuous measures of income inequality and income level, as well as with indicator variables for the distribution thresholds. For comparability to other studies, we report results for the analyses that use tertiles of the distribution.

Data Analytic Procedures

Statistical techniques, variously known as multi-level or hierarchical models, are useful for appropriate estimation of models that rely on nested data, such as the HCC data, where

individuals are clustered within a set of communities.^{21*} We used robust or “sandwich” estimators for the computation of the estimated variance-covariance matrix of the parameters.^{22,23}

To account for missingness in the individual level income measure, we used an extended hot-deck multiple imputation technique.²⁴ Instead of filling in a single value for each missing value, we created five imputed data sets.²⁵ Each of the data sets was analyzed, and results were combined by averaging. Standard errors were then derived that accounted for both within-imputation variability and between-imputation variability.²⁵

An important limitation is that our data only allow us to explore the point-in-time, or cross-sectional, association between community income and inequality and mental health, which could be subject to unmeasured confounding factors.

Results

Table 1 provides mean MHI-5 and probability of having an anxiety or depressive disorder for individuals grouped by own income level, community income level, and level of community income inequality. The pattern with regard to own income is consistent: MHI-5 scores are lowest among people with low incomes, and rise with successive levels of income. Likewise, the probability of mental disorder falls consistently with higher and higher income levels. For both measures of mental health, the differences in mental health outcomes are not linear with quintile; rather, the differences between quintiles are most pronounced in the lowest ones and are flatter thereafter.

* Other inequality measures are the Robin Hood index and share of total income earned by 50 percent of families with lowest income.

† The state Gini is as reported by Kahn et al⁹ and ranges from .38-.48; median family income ranges from \$20,100 to \$41,700.

* We implemented our multi-level analyses using the SAS “proc mixed” procedure for the continuous outcome MHI5 and the SAS “glimmix” macro for probable mood or anxiety disorder.

Table 2. Own income, community income, and income inequality and their associations with MHI-5: all individuals and low income individuals only

	Site		State		
	Coefficient	Standard error	Coefficient	Standard error	
All Individuals					
Income Inequality					
Medium vs. low	0.36	(0.531)	0.41	(0.645)	
High vs. low	-0.45	(0.688)	1.27	(0.628)	*
Community Income					
Medium vs. low	0.06	(0.635)	1.55	(0.782)	*
High vs. low	-0.25	(0.600)	0.94	(0.732)	
Own Family Income					
Very low vs. very high	-10.86	(0.882)	-10.84	(0.894)	***
Low vs. very high	4.59	(0.587)	-4.56	(0.603)	***
Medium vs. very high	2.98	(0.602)	-2.96	(0.547)	***
High vs. very high	-0.65	(0.779)	-0.66	(0.723)	
Low Income Individuals Only					
Income Inequality					
Medium vs. low	0.12	(1.258)	0.62	(1.485)	
High vs. low	0.98	(1.418)	1.06	(1.181)	
Community Income					
Medium vs. low	-0.94	(1.147)	3.58	(1.541)	**
High vs. low	0.75	(1.18)	3.44	(1.430)	**
Own Income	3.71	(0.442)	3.70	(0.428)	***

Notes: *** $p < .01$, ** $p < .05$, * $p < .1$; All specifications include age, race, gender and family size.

The patterns of mental disorder are not consistent across communities with varying income or income inequality levels. MHI 5 is slightly higher in higher income communities, but the probability of a mental disorder is actually greatest in medium income communities compared to high or low income communities. For income inequality, MHI-5 does not consistently rise with lower levels of inequality, while the probability of disorder actually falls with higher levels of inequality. We repeated these analyses using income level and inequality measured at the state, instead of the community, level and found the same inconsistencies for income inequality. However, mental health measures were consistently better in higher income states.

Table 2 reports results from regression analysis of MHI-5. (All specifications include controls for age, race, gender, and number of family members). Akin to the descriptive statistics, the results show a clear and consistent relationship between MHI-5 and an individual's socioeconomic status: MHI-5 scores are lower with each quintile of family income. Comparing the extreme ends of the spectrum, MHI-5 scores are 10.9 points lower among individuals with income in the first quintile of the income distribution, compared to those in the highest income quintile. To put these numbers in perspective, the difference between primary care patients with only subthreshold depressive symptoms and patients with current major depressive disorder is around 12 points on the MHI-5.¹⁵ Even within quintile (own) income is a significant predictor of MHI-5 among individuals in the lowest two income quintiles:

Each \$10,000 in income is associated with MHI-5 scores that are 3.7 points higher.

In comparison, we find mixed evidence regarding the association between MHI-5 and local area income level. With site variables, we find no evidence of an association between MHI-5 and community income level for all individuals or low income individuals alone. The state variables provide evidence that higher income states are associated with higher MHI-5 scores. For low income individuals, the state level analysis reveals 3.4 to 3.6 point differences in MHI 5 among individuals in medium or high income states compared to those in low income states, and the findings were supported by a test of their grouped significance ($F = 4.2$, $df = 2$, $p = .02$). Among all individuals, the results are not consistent across tertiles (difference in MHI 5 between individuals in medium versus low income states is significant, difference between high and low income states is not), and a test of the joint significance of the income level variables could not reject the null hypothesis that there was no association ($F = 2.15$, $df = 2$, $p = .13$). We find no evidence in support of the hypothesis that income inequality is negatively associated with MHI-5. Moreover, the state level analysis shows the opposite result—individuals in high inequality communities have somewhat higher MHI 5 scores—but the finding is not consistent for individuals in medium versus low inequality sites, and is not observed among only poor individuals.

Table 3 reports results (odds ratios) from logistic regressions where the dependent variable is any probable

Table 3. Own income, community income, and income inequality and their associations with the probable presence of an anxiety or depressive disorder: all individuals and low income individuals only

	Site		State	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
All Individuals				
Income Inequality				
Medium vs. low	0.91	(0.74,1.13)	1.07	(0.82,1.38)
High vs. low	0.89	(0.70,1.12)	0.93	(0.71,1.21)
Community Income				
Medium vs. low	1.21	(0.98,1.49)	0.85	(0.64,1.14)
High vs. low	1.03	(0.81,1.30)	0.87	(0.65,1.16)
Own Family Income				
Very low vs. very high	3.00	(2.30,3.92)	3.02	(2.31,3.95)
Low vs. very high	1.91	(1.45,2.52)	1.91	(1.45,2.52)
Medium vs. very high	1.45	(1.12,1.87)	1.46	(1.12,1.89)
High vs very high	1.04	(0.73,1.46)	1.04	(0.74,1.48)
Low Income Individuals Only				
Income Inequality				
Medium vs. low	0.94	(0.70,1.26)	1.03	(0.72,1.47)
High vs. low	1.01	(0.74,1.36)	0.96	(0.66,1.38)
Community Income				
Medium vs. low	1.42	(1.08,1.85)	0.73	(0.49,1.07)
High vs. low	1.04	(0.76,1.42)	0.75	(0.51,1.09)
Own Income	0.72	(0.63,0.83)	0.72	(0.63,0.83)

Notes *** $p < .01$, ** $p < .05$, * $p < .1$; All specifications include age, race, gender and family size.

anxiety or depressive disorder. (Again, all specifications include controls for age, race, gender, and number of family members). The findings are similar to those for mental health measured by the MHI-5. In particular, we find that the lower is individuals' income level, the higher is their probability of anxiety or depressive disorder. The result is consistent across quintiles, except we find no difference in the probability of disorder between individuals in the two highest income quintiles. And, among just low income individuals (bottom two quintiles), the probability of disorder is lower the greater is individual income.

We find no evidence that community or state income inequality is associated with the probability of disorder, among all individuals or among low income individuals alone. Similarly, we find no evidence of an association between state income level and the probability of a mood or anxiety disorder. The site results show that individuals in medium compared to low income communities have a somewhat higher probability of disorder, as do individuals in medium compared to high income communities (latter comparison not shown in **Table 3**). But, for all individuals, the result is not supported by a test of the joint significance of the income level variables ($F=1.99, df=2, p=.14$). Among low income individuals, a test of the joint significance of the community income level variables rejects the null hypothesis of no association ($F=4.4,$

$df=2, p < .01$), despite the inconsistency of the result across tertiles, as the probability of disorder in low versus high income communities is not significantly different.

Discussion and Conclusions

A main result from this analysis is the confirmation of a strong association between individual income and mental health (as measured by either the MHI-5 or the probability of having a depressive or anxiety disorder), which is by no means subordinate to that between mental health and socioeconomic environment.

In addition, our findings reject the notion that higher levels of inequality in communities are associated with poor mental health outcomes-measured either with an indicator of general mental well-being or the probable presence of a mood or anxiety disorder for all individuals, regardless of their own income, or for lower income individuals alone.

Third, we find evidence that local area income level plays a role in vulnerability to mental disorder, though our evidence is not as consistent as for individual SES.

The results were robust to numerous sensitivity tests we conducted, including using alternative measures of inequality and with income inequality divided into fifths instead of thirds

and measured continuously. Thus, the findings provide no evidence for claims that the scale of income inequality is one of the most powerful determinants of health and that policies aimed specifically at diminishing income inequality will be effective in improving individuals' mental health.^{6,26,27}

How can we reconcile our findings with earlier results showing an association between income inequality and mental health? There are numerous differences to be considered, including sample (men and women, here, compared to mothers in Kahn et al⁹) and measure of mental health (depressive symptoms in Kahn et al⁹ and Fiscella and Franks,¹¹ compared to MHI 5 and anxiety or depressive disorder here); but other analytic factors may be important. For example, while our study and Kahn et al's stratify results according to individuals' quintile of income, we find an important association between *within quintile* individual income and mental health. Thus, the role of inequality may vary depending on whether the association between individual income level and mental health is adequately accounted for, as well as whether controls for the potential confounding influences of community income level are included. However, other recent studies in general health also cast doubt on the robustness and strength of a possible link between the scale of income inequality and health.²⁸⁻³¹

While our findings evidence the lack of a relationship between the size of income inequality and mental health, they highlight the powerful relationship between individual income and mental health. While we can not definitively say what explains the observed relationship, one possibility is that rank in the social hierarchy, as measured here by family income, is associated with mental health. The relationship between individual income and mental health income is not confined to a difference between those with the lowest incomes and other groups (which would point towards a material explanation), but show a gradient that only flattens well above the median income level. This is similar to the Whitehall studies of British civil servants, where social gradients in morbidity and mortality ran from the bottom to the top of the hierarchy.³²⁻³⁴

For future research, there remain questions about the sensitivity of these findings and those from prior studies to factors not considered so far. One question is whether the results would bear out similarly in longitudinal analysis of changes in own income, community income level, and income inequality and changes in mental well being. No research has yet addressed whether the source of income is important to consider when deriving measures of individual income, community income, or income inequality. For instance, the association between low income and mental health may vary depending on whether income is earned or received from a transfer program such as Temporary Assistance to Needy Families (TANF). Likewise, localities that appear very egalitarian by standard inequality measures may reflect communities with nondispersed earned incomes, or dispersed earned incomes but substantial income transfers to low earning households. This aspect of the relationship between income and mental health may be an important area for future research.

References

1. Surgeon General, U.S. Department of Health and Human Services. *Mental Health: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institute of Mental Health, 1999.
2. Gazmararian JA, James SA, Lepkowski JM. Depression in black and white women: The role of marriage and socioeconomic status. *Ann Epidemiol* 1995; **5**(6): 455-463.
3. Bruce ML, Takeuchi DT, Leaf PJ. Poverty and psychiatric status: Longitudinal evidence from the New Haven Epidemiologic Catchment Area study. *Arch Gen Psychiatry* 1991; **48**(5): 470-474.
4. Robins LN, Regier DA. *Psychiatric Disorders in America: The Epidemiologic Catchment Area Study*. New York: Free Press, 1991.
5. Holzer CE, Shea B, Swanson JW, Leaf PJ, Myers JK, George L, Weissman MM, Bednarski P. The increased risk of specific psychiatric disorders among persons of low socioeconomic status. *Am J Soc Psychiatry* 1986; **6**: 259-271.
6. Wilkinson RG. *Unhealthy Societies: The affliction of inequality*. Routledge: London, 1996.
7. Lynch JW, Smith GD, Kaplan GA, House J. Income inequality and mortality: Importance to health of individual income, psychosocial environment, or material conditions. *Br M Journal* 2000; **320**(7243): 1200-1204.
8. Marmot M, Wilkinson RG. Psychosocial and material pathways in the relation between income and health. *Br M Journal* 2001; **322** (7296): 1233-1236.
9. Kahn RS, Wise PH, Kennedy BP, Kawachi I. State income inequality, household income, and maternal mental and physical health: Cross sectional national survey. *Br M Journal* 2000; **321**(7272): 1311-1315.
10. Weich S, Lewis G, Jenkins SP. Income inequality and the prevalence of common mental disorders in Britain. *Br J Psychiatry* 2001; **178**: 222-227.
11. Fiscella K, Franks P. Individual income, income inequality, health and mortality: What are the relationships? *Health Serv Res* 2000; **34**(1) Part II: 307-318.
12. Sturm R, Gresenz CR. Relations of income inequality and family income to chronic medical conditions and mental health disorders: National survey. *Br M Journal* 2002; **324**: 20-33.
13. Kemper P, Blumenthal D, Corrigan JM, Cunningham PJ, Felt SM, Grossman JM, Kohn LT, Metcalf CE, St Peter RF, Strouse RC, Ginsburg PB. The design of the Community Tracking Study: A longitudinal study of health system change and its effect on people. *Inquiry* 1996; **33**: 195-206.
14. Sturm R, Gresenz CR, Sherbourne CD, Minnium K, Klap R, Bhattacharya J, Farley D, Young AS, Burnam MA, Wells KB. The design of Healthcare for Communities: A study of health care delivery for alcohol, drug abuse and mental health conditions. *Inquiry* 1999; **36** (2): 221-233.
15. Wells KB, Sturm R, Sherbourne CD, Meredith L. *Caring for Depression*. Boston: Harvard University Press, 1996.
16. Juster FT, Smith JP. Improving the quality of economic data: lessons from the HRS and AHEAD. *JASA* 1997; **92**(440): 1268-1278.
17. Sen, A. *On Economic Inequality*. Oxford: Oxford University Press, 1973.
18. Cowell FA. *Measuring Inequality*. Oxford: Allan, 1977.
19. Nygard F, Sandstrom A. The estimation of the Gini and the entropy inequality parameters in finite populations. *J Off Stat* 1985; **11** (4): 399-412.
20. Kennedy BP, Kawachi I, Prothrow-Stith D. Income distribution and mortality: cross-sectional ecological study of the Robin-Hood Index in the United States. *Br M Journal* 1996; **312**(7037): 1004-1007.
21. Bryk AS, Raudenbush SW. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Newbury Park, CA: Sage Publications, Inc, 1992.
22. Huber PJ. The behavior of maximum likelihood estimates under nonstandard conditions. *Proc. Fifth Berkeley Sym Math Stat. Prob* 1976; **1**: 221-233.
23. White H. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 1980; **48**: 817-838.

24. Little RJ. Missing-data adjustments in large surveys. *JBES* 1988; **6**(3): 287-301.
25. Rubin DB. *Multiple Imputation for Nonresponse in Surveys*. New York: J. Wiley & Sons, 1987.
26. Soobader MJ, LeClere FB. Aggregation and the measurement of income inequality: effects on morbidity. *Soc Sci Med* 1999; **48**(6):733-744.
27. Kawachi I, Kennedy BP. Income inequality and health: pathways and mechanisms. *Health Serv Res* 1999; **34**(1, Part II): 215-227.
28. Mellor JM, Milyo J. Income inequality and health status in the United States: evidence from the Current Population Survey. *J of Hum Resour* Forthcoming 2002.
29. Daly MC, Duncan GJ, Kaplan GA, Lynch JW. Macro-to-micro links in the relation between income inequality and mortality. *Milbank Q* 1998; **76**(3): 315-339, 303-304.
30. Deaton A. Health, inequality and economic development. Princeton University Research Program in Development Studies and Center for Health and Wellbeing Working Paper, 2001.
31. Deaton A, Lubotsky D. Mortality, inequality and race in American cities and states. Princeton University Center for Health and Wellbeing Working Paper, 2001.
32. Marmot MG, Shipley MJ, Rose G. Inequalities in death-specific explanations of a general pattern? *Lancet* 1984; **1**(8384): 1003-1006.
33. Marmot MG, Smith GD, Stansfeld S, Patel C, North F, Head J, White I, Brunner E, Feeney A. Health inequalities among British civil servants: The Whitehall II Study. *Lancet* 1991; **337**(8754): 1387-1393.
34. Marmot MG, Shipley MJ. Do socioeconomic differences in mortality persist after retirement? 25-year follow-up of civil servants from the first Whitehall study. *BMJ* 1996; **313**(7066): 1177-1180.