

U.S. Health Reform—Monitoring and Impact

Education and Health: Long-Term Trends by Race, Ethnicity, and Geography, 1997–2017

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With support from the Robert Wood Johnson Foundation (RWJF), the Urban Institute is undertaking a comprehensive monitoring and tracking project to examine the implementation and effects of health reform. The project began in May 2011 and will take place over several years. The Urban Institute will document changes to the implementation of national health reform to help states, researchers and policymakers learn from the process as it unfolds. Reports that have been prepared as part of this ongoing project can be found at www.rwjf.org and www.healthpolicycenter.org.

IN BRIEF

Adults with less education have lower life expectancy, increased risk for chronic conditions, and lower self-reported health status than their more-educated counterparts. More education is associated with higher incomes, stronger health literacy, and lower chronic stress, all of which may lead to improvements in physical and mental health. However, these effects of education are likely to change over time and vary across populations, with associated implications for the relationship between education and health.

In this study, we assess trends in self-reported measures of general health, mental health, activity limitations, and obesity by educational attainment from 1997 to 2017, using data from the National Health Interview Survey. We examine these trends separately for non-Hispanic white, non-Hispanic black, and Hispanic adults, as well as for those living in urban and rural areas. We also assess how health disparities by educational attainment have changed over time, including whether changes in these disparities are concentrated in particular racial, ethnic, or geographic groups. Finally, we consider whether there is evidence that the Affordable Care Act contributed to a narrowing of health disparities by education.

We find the following:

- Adults with a high school degree or less face significant health disparities compared with those who have attended or completed college, and these disparities have persisted over the past two decades.
- Less-educated adults from all racial, ethnic, and geographic groups we studied have seen worsening health from 1997 to 2017, but increases in obesity have been particularly stark across all groups.
- Between 1997 and 2017, racial disparities in health outcomes between black and white adults with a high school degree or less declined, but these reductions were largely driven by steeper declines in health for white adults.
- Disparities in health outcomes between white adults with a high school degree or less and their more-educated white counterparts have also widened over time.
- Since 2011, health disparities facing black adults and rural adults with a high school degree or less have narrowed slightly relative to their more-educated counterparts.
- Coverage gains under the Affordable Care Act appear to have played a modest role in reducing health disparities facing less-educated adults since 2011.

INTRODUCTION

There is a well-established relationship between education and health.¹ Adults with less education have lower life expectancy² and an increased risk for chronic conditions, including heart disease and diabetes.¹ Though there are several proposed mechanisms through which more education may affect health, the most obvious is that education raises incomes and improves access to health insurance coverage and care. Indeed, adults who have attended college are more likely to have health insurance³ and report better access to care than adults without a college degree.⁴ In addition, adults with more education have greater economic resources to support healthy behaviors, like eating nutritious food and exercising.⁵

However, studies have shown that differences in income and access to health care do not fully explain the effects of education on health. Increased knowledge and skills obtained through education may also contribute to better health, and evidence suggests that more education leads to greater health literacy, more effective self-management of chronic conditions, and better adherence to treatment plans.⁵ More education may also reduce sources of emotional stress in various ways, including by raising one's perceived social standing, expanding social networks, and reducing financial anxiety. Chronic stress has direct, detrimental effects on health,⁶ and studies have found that adults with more education are less likely to experience chronic stress than those without a college degree.^{7,8}

The effects of education on income, ability to navigate the health system, and emotional stress are likely to change over time and vary across different populations, with associated implications for the relationship between education and health. For example, lifetime earnings for adults with a college degree are far higher than for adults with a high school degree or less,⁹ and the income premium associated with higher education has increased over time.¹⁰ This suggests that health disparities driven by differences in income might be increasing. Evidence shows that life expectancy gaps by

educational attainment have widened over time,¹¹ as have education-related gaps in disease prevalence and self-reported health status among white adults ages 40 to 64.¹² Moreover, these patterns are not consistent across racial and ethnic subgroups, with recent research finding increasing middle-age mortality among non-Hispanic white adults with a high school degree or less without corresponding increases among racial and ethnic minorities.¹³ Trends in overall age-adjusted mortality are also not consistent by geography, with rural areas experiencing age-adjusted increases in mortality relative to urban areas between 1999 and 2014.¹⁴

Though recent studies have shown some evidence of increasing health disparities by education status over time, none have examined a period that includes the years leading up to and following the implementation of the Affordable Care Act (ACA). The ACA expanded access to and affordability of health insurance for millions of Americans, thereby affecting one important mechanism through which education affects health, and evidence suggests that the law disproportionately reduced uninsurance among those with less education.⁴ Moreover, few studies have considered how the effects of education on health vary for different subpopulations, especially by geography.

In this study, we assess trends in self-reported measures of general health, mental health, activity limitations, and obesity by educational attainment from 1997 to 2017. Because each of the mechanisms through which education affects health may also vary by race, ethnicity, and geography, we examine these trends separately for non-Hispanic white, non-Hispanic black, and Hispanic adults, as well as for those living in urban and rural areas. We also assess how health disparities by educational attainment have changed over time, including whether changes in these disparities are concentrated in particular racial, ethnic, or geographic groups. Finally, we consider whether there is evidence that the ACA contributed to narrowing health disparities by education.

DATA AND METHODS

We use data from the National Health Interview Survey (NHIS) to examine changes in four measures of self-reported health from 1997 to 2017. The NHIS is the primary source of nationally representative data on the nation's health and provides consistent measures of demographic, socioeconomic, and health characteristics over a long period. We use public use data obtained through the University of

Minnesota's Integrated Public Use Microdata Series and obtain restricted access to geographic identifiers at the National Center for Health Statistics Research Data Center.¹⁵

We focus our analysis on nonelderly adults ages 19 to 64, and we divide the sample into adults with a high school degree or less and those with some postsecondary education (i.e., some

college or more).^{*} Hereafter, we refer to these groups as less-educated and more-educated adults, respectively.

We constructed measures of general health, activity limitation, obesity, and mental health. First, we identified adults who reported being in fair or poor health and those who reported any activity limitation. Adults with any activity limitation reported being limited in any way because of a physical, mental, or emotional problem. We defined obese adults as those with a body mass index over 30. To measure mental health status, we constructed the Kessler K6 Psychological Distress Scale and examined those reporting moderate or severe distress (i.e., a score of 8 or higher).¹⁶ Details on obesity and psychological distress are only available for one sampled adult per household on the NHIS, and some changes to the order of the survey questions may make comparisons of psychological distress before and after 2013 imperfect.¹⁷

We examined trends in our health outcomes of interest for less- and more-educated adults from 1997 to 2017. We then compared the trends in outcomes for less-educated adults by race and ethnicity, including separate estimates for non-Hispanic white (hereafter “white”), non-Hispanic black (hereafter “black”), and Hispanic adults. We also compared the trends in outcomes for less-educated adults by geography, including separate estimates for those living in urban and rural areas. Urban and rural were defined using the county-based rural-urban continuum code that classifies counties as metropolitan (urban) or nonmetropolitan (rural). We report unadjusted trends in the text, but because differences in population demographics over time and across groups may contribute to trends in health outcomes, we also report trends adjusted for age, sex, and race/ethnicity in the appendix.

We also estimated the absolute disparity in each outcome between less- and more-educated adults overall and within each racial, ethnic, and geographic group. All reported estimates of the gap in health status between less- and more-educated adults are adjusted for the differences in age, sex, and racial/ethnic distribution over time and across education groups.

We report these education disparities in 1999, 2005, 2011, and 2017. We chose these years to capture disparities at even intervals throughout the last two decades and to reflect differing economic and health care market dynamics. The two earlier periods represent times of relative economic prosperity, and 2011 captures lingering economic effects of the Great Recession. By 2017, economic growth had returned, and the major coverage expansions of the ACA had been in place for three full years.

We also performed some crude calculations to consider whether the expansion of insurance coverage under the ACA was associated with narrowing health disparities for less-educated adults by comparing disparities that were and were not adjusted for changes in insurance coverage over time and across education groups in 2011 and 2017.

This study has several limitations. All health measures are self-reported and subject to social desirability bias. In addition, though we perform some adjustments to account for the role of changing demographics in the relationship between education and health, we do not adjust for many other factors that affect this relationship, such as income. Thus, none of the estimates presented reflect the causal effects of education on health. All analyses used NHIS survey weights, and standard errors were adjusted to account for the complex survey design.

RESULTS

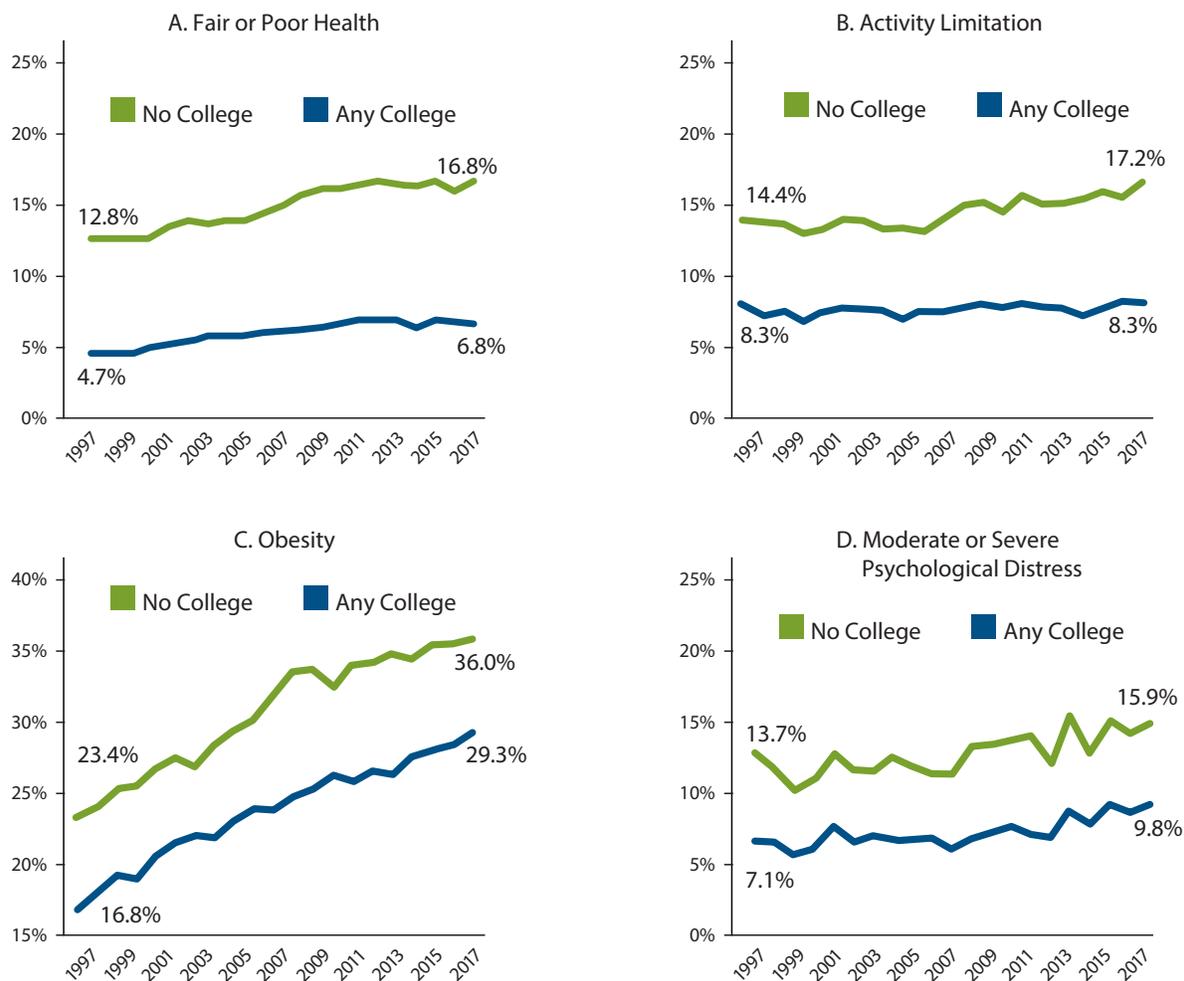
Trends in Health by Educational Attainment

Nonelderly adults reported worsening health between 1997 and 2017, regardless of education level (Figure 1). However, across all measures, adults with a high school degree or less reported significantly worse health than adults with any college education throughout the study period. For example, the share of adults with less education in fair or poor health increased 31 percent from 1997 to 2017, from 12.8 percent to 16.8 percent. Less-educated adults also experienced a 19

percent increase in activity limitations (from 14.4 percent to 17.2 percent) and a 16 percent increase in moderate or severe psychological distress (from 13.7 percent to 15.9 percent). Finally, obesity increased more than 50 percent among less-educated adults, growing from 23.4 percent in 1997 to 36.0 percent in 2017. Among adults with any college education, health also declined from 1997 to 2017, except on the measure of activity limitations, which remained relatively flat.

^{*}We chose to limit our less-educated group to those with a high school degree or less to emphasize the health status trends among this population by race, ethnicity, and geography. Those with some college generally report better health than their high school-educated counterparts but worse health than those with a bachelor's degree.

Figure 1. Trends in Self-Reported Health Measures for Nonelderly Adults, by Educational Attainment, 1997–2017



Source: Authors' analysis of National Health Interview Survey, 1997–2017.

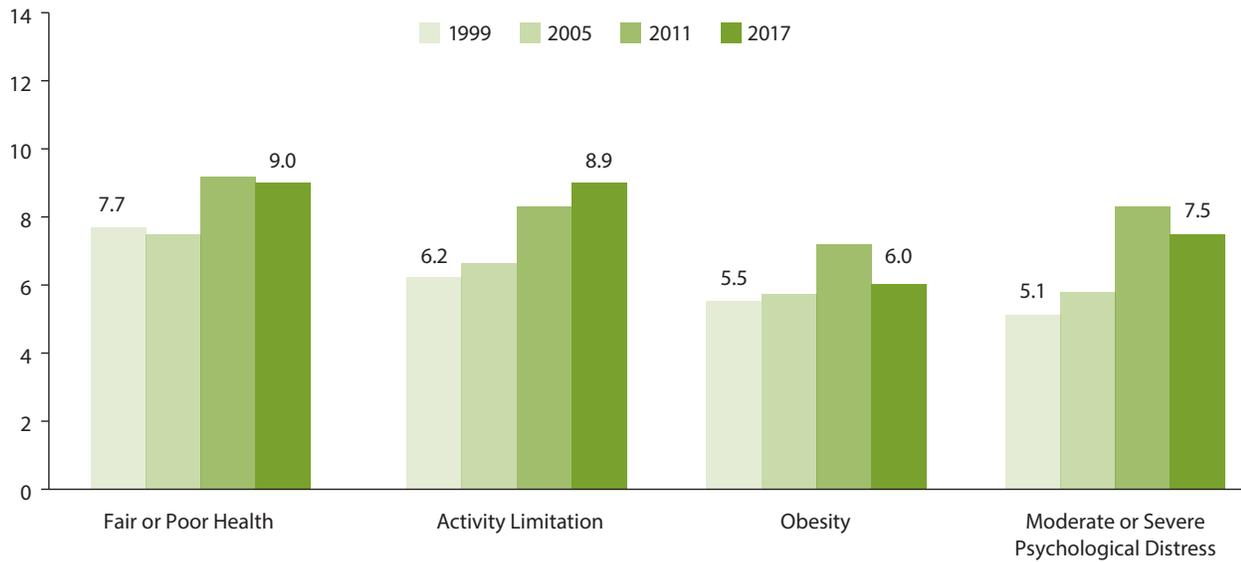
Notes: “No college” refers to adults with a high school degree or less. “Any college” refers to those with some college or more education. “Activity limitation” refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale.

Between 1997 and 2017, the composition of the less- and more-educated groups changed considerably, potentially affecting observed trends in health. Over this period, adults with a high school degree or less became more likely to be aged 45 to 64, male, and a racial or ethnic minority (Appendix Table 1). Simultaneously, more-educated adults were also growing more likely to be aged 55 to 64 and less likely to be white, but they were also more likely to be female. After adjusting for these changes in the age, sex, and racial/ethnic distribution of the population over time and across education groups, we find that some of the increases in fair or poor health status and activity limitations may be attributable to shifting population demographics (Appendix Table 2). Increases in obesity were not affected by these adjustments, but after adjusting estimates of psychological distress for

changing demographics, we find larger increases over time among less-educated adults and smaller increases over time among more-educated adults (Appendix Table 2). This appears to be driven by the changing shares of women, who are more likely to report psychological distress, across the education groups.

Using these adjusted estimates, we calculate the gap in health outcomes between adults with a high school degree or less and those who have attended college (Figure 2, Appendix Table 3). We find that the disparity widened over time for measures of general health, activity limitation, and psychological distress. In 1999, less-educated adults were 7.7 percentage points more likely than more-educated adults to report being in fair or poor health, and this gap widened to 9.0 percentage points by 2017. Similarly, the gap in activity

Figure 2. Disparities for Self-Reported Health Measures between Nonelderly Adults with No College Education and Any College Education, 1999, 2005, 2011, and 2017



Source: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: “No college” refers to adults with a high school degree or less. “Any college” refers to those with some college or more education. “Activity limitation” refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale. Estimates reflect the percentage-point difference between less- and more-educated adults reporting each outcome, adjusted for age, sex, and racial/ethnic differences across education groups and over time.

limitation by educational attainment widened from 6.2 percentage points in 1999 to 8.9 percentage points in 2017, and the gap in moderate or severe psychological distress increased from 5.1 percentage points to 7.5 percentage points over the same period. For obesity, the education disparity remained relatively flat from 1999 to 2017.

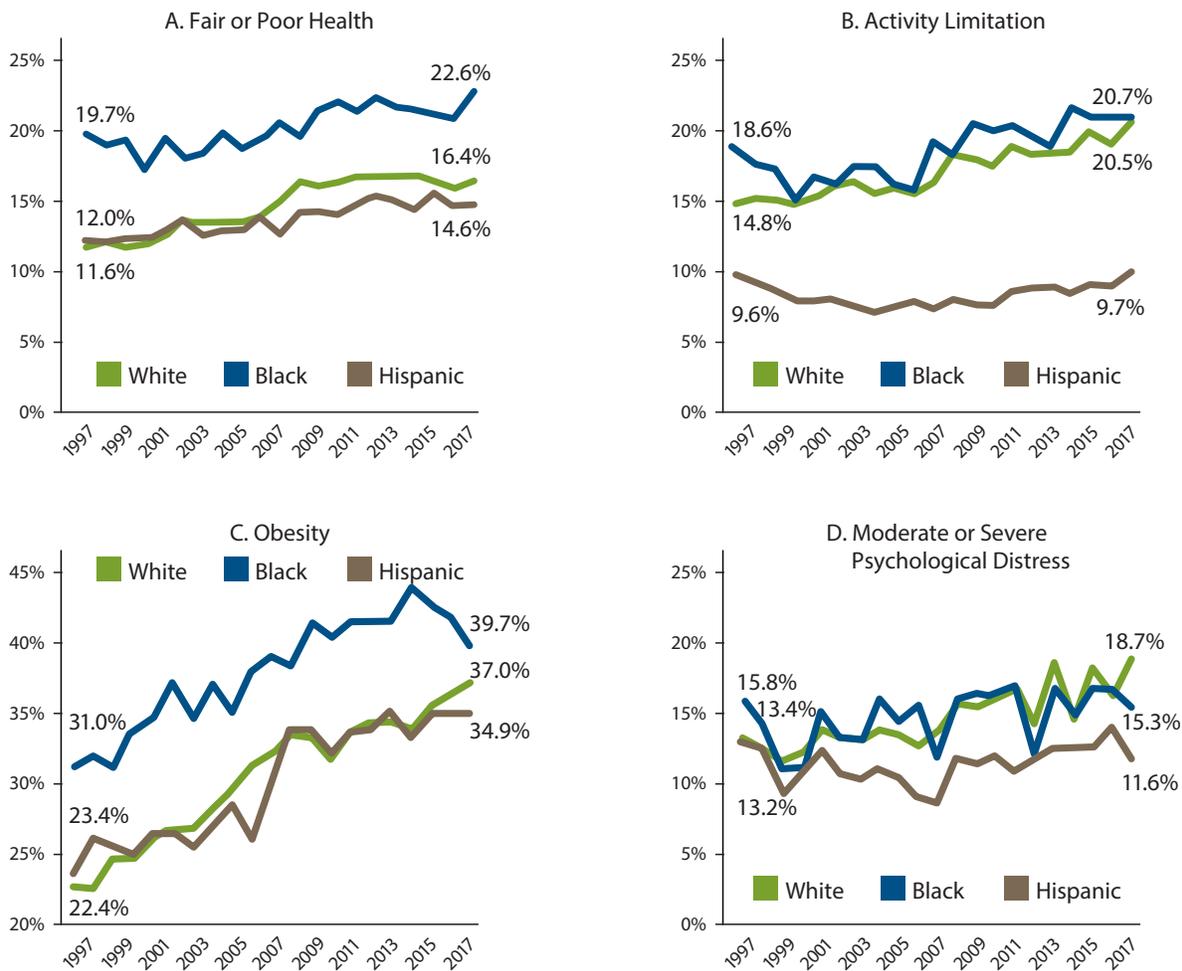
Changes in Health Among Less-Educated Adults by Race and Ethnicity

Health outcomes among adults with less education varied by racial and ethnic group (Figure 3). For example, black adults with a high school degree or less reported worse general health and obesity outcomes than white or Hispanic adults from 1997 to 2017. However, black and white adults reported more similar outcomes on activity limitations and psychological distress over time, with Hispanic adults generally reporting better outcomes, particularly for activity limitations.

Though adults with less education showed some declines in health over time in all racial and ethnic groups we studied, the patterns varied by race/ethnicity and health measure.

In general, white adults with a high school degree or less experienced larger declines in health from 1997 to 2017 than other racial and ethnic groups (Figure 3, Appendix Table 4). For example, the share of white adults in fair or poor health increased by 41 percent between 1997 and 2017 (11.6 percent to 16.4 percent), compared with 15 percent for black adults (19.7 percent to 22.6 percent) and 22 percent for Hispanic adults (12.0 percent to 14.6 percent). In addition, less-educated adults reporting activity limitations increased by 39 percent among white adults (14.8 percent to 20.5 percent) and 12 percent among black adults (18.6 percent to 20.7 percent) and remained relatively flat for Hispanic adults (9.6 percent to 9.7 percent). Adjusting for age and sex differences over time and across racial, ethnic and education groups reduced the slope of the declines in these measures over time for all racial and ethnic groups, but white adults still saw larger relative declines than their black and Hispanic counterparts (Appendix Table 4).

Figure 3. Trends in Self-Reported Health Measures for Nonelderly Adults Without Any College Education, by Race and Ethnicity, 1997–2017



Source: Authors' analysis of National Health Interview Survey, 1997–2017.

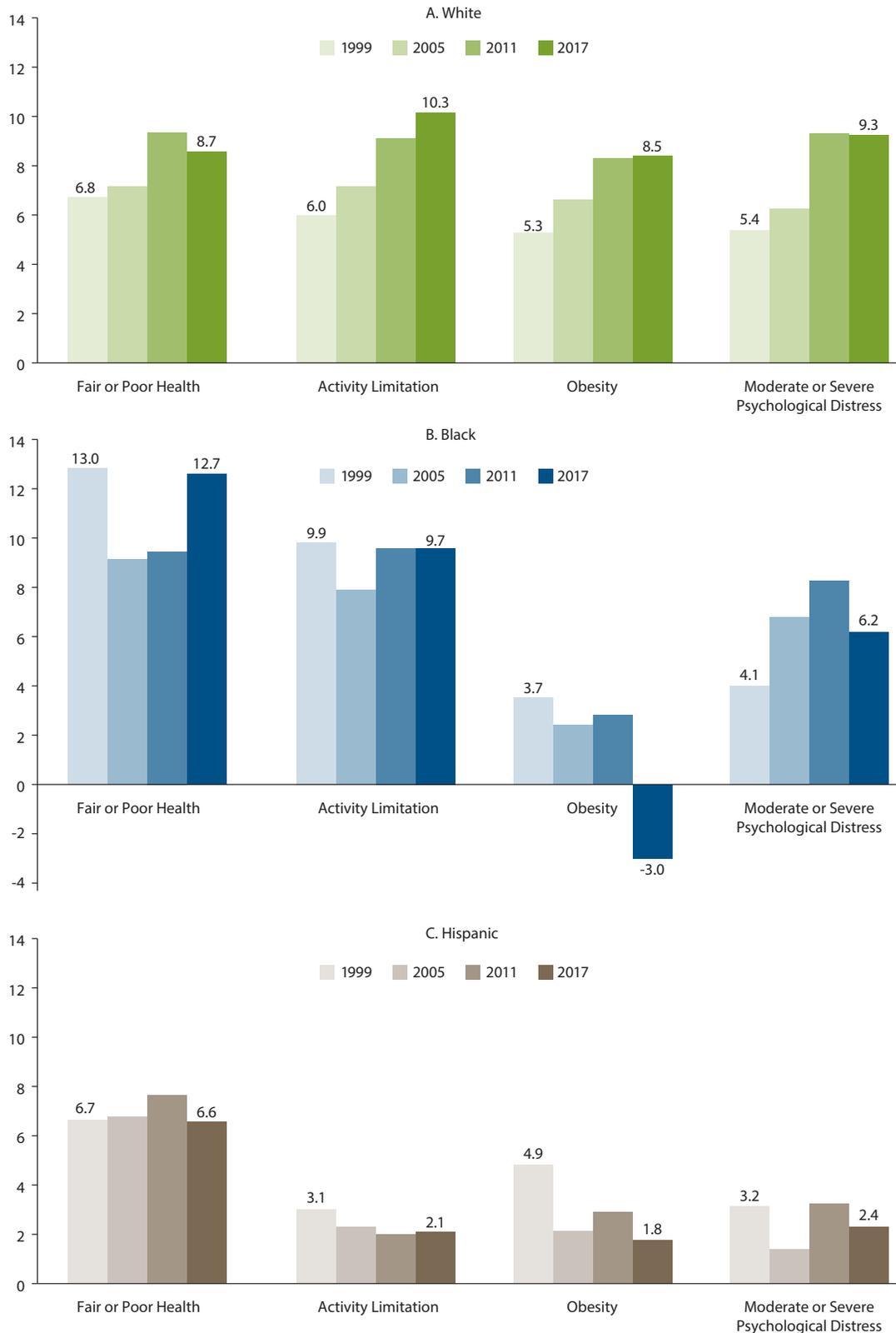
Notes: “No college” refers to adults with a high school degree or less. “Any college” refers to those with some college or more education. White and black are non-Hispanic. “Activity limitation” refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale.

Though the trend in psychological distress was less smooth over time than other health measures, we saw no significant increase in psychological distress for less-educated black and Hispanic adults between 1997 and 2017, compared with a 40 percent increase for less-educated white adults (13.4 percent to 18.7 percent). Obesity increases over the study period were stark for all racial and ethnic groups, with the share of adults with a high school degree or less who reported being obese growing 28 percent for black adults (31.0 percent to 39.7 percent), 65 percent for white adults (22.4 percent to 37.0 percent), and 49 percent for Hispanic adults (23.4 percent to 34.9 percent) between 1997 and 2017. However, obesity among black adults has been declining since reaching a high of 43.9 percent in 2014. Adjusting for changing demographics

had no meaningful effects on trends in psychological distress or obesity among less-educated adults (Appendix Table 4).

These patterns have implications for racial and ethnic disparities within the population of adults with no college education. Over this 20-year period, several health disparities between black and white adults have narrowed, as the relative declines in health for white adults have exceeded those for black adults. By 2017, the black-white gaps in activity limitation and obesity were no longer statistically significant, and the gap in psychological distress had reversed, with less-educated white adults reporting higher rates of psychological distress than their black counterparts. These patterns are consistent even after adjustments for age and sex differences over time and across racial, ethnic, and education groups (Appendix Table 4).

Figure 4. Disparities for Self-Reported Health Measures Between Nonelderly Adults with No College Education and Any College Education, by Race and Ethnicity, 1999, 2005, 2011, and 2017



Source: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: “No college” refers to adults with a high school degree or less. “Any college” refers to those with some college or more education. White and black are non-Hispanic. “Activity limitation” refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale. Estimates reflect the percentage-point difference between less- and more-educated adults reporting each outcome, adjusted for age and sex differences across education groups and over time.

Changes in Education Disparities in Health by Race and Ethnicity

Though the patterns in Figure 3 suggest some troubling trends, particularly for less-educated white adults, they do not capture how each group has fared compared with higher-educated adults of their own race/ethnicity over time. Figure 4 explores the absolute disparity in each health outcome between adults with no college education and those who have attended college within each racial and ethnic group over time. These estimates are all adjusted for demographic differences across education groups and over time.

Overall, health disparities between white adults with and without a college education increased for every outcome between 1999 and 2017. For example, the gap in fair/poor health by educational attainment grew from 6.8 percentage points in 1999 to 8.7 percentage points in 2017, and the gaps in activity limitation, obesity, and moderate or severe psychological distress increased by 4.3 percentage points, 3.2 percentage points, and 3.9 percentage points, respectively (Appendix Table 5).

Among black adults, in contrast, the patterns of health disparities by education differed by outcome. For example, the education disparity in reporting fair or poor health for black adults decreased from 1999 to 2011 but increased again in 2017, resulting in no significant change between 1997 and 2017. We see the opposite pattern for the disparity in psychological distress among black adults, which increased from 1999 to 2011 and then appeared to decrease between 2011 and 2017, though the decline was not statistically significant. The obesity disparity by education among black adults decreased significantly between 2011 and 2017 after a relatively stable gap from 1999 to 2011.

Among Hispanic adults, the health disparities between those with and without any college education were often smaller than those for white and black adults, and the education disparities in the share reporting fair or poor health and activity limitations were both relatively stable over time. For obesity and psychological distress, the education disparity narrowed between 1999 and 2005 but was followed by slight increases in 2011 and decreases in 2017. Only the drop from 1999 to 2005 was marginally significant ($p < 0.10$), however (Appendix Table 5).

When we considered the potential role of increases in insurance coverage under the ACA (Appendix Figure 1), we found that if insurance coverage had remained constant between 2011 and 2017, the disparities in fair or poor health and psychological distress by education would have been

slightly higher for all racial and ethnic groups in 2017 (data not shown). This suggests that the ACA may have been a factor in the observed declines in these disparities in 2017, but a more complex analysis would be necessary to truly isolate the role of insurance in the disparities for each group and outcome over time. Our preliminary analysis suggests, however, that the improvement in obesity among less-educated black adults relative to more-educated black adults was likely driven by factors other than insurance coverage.

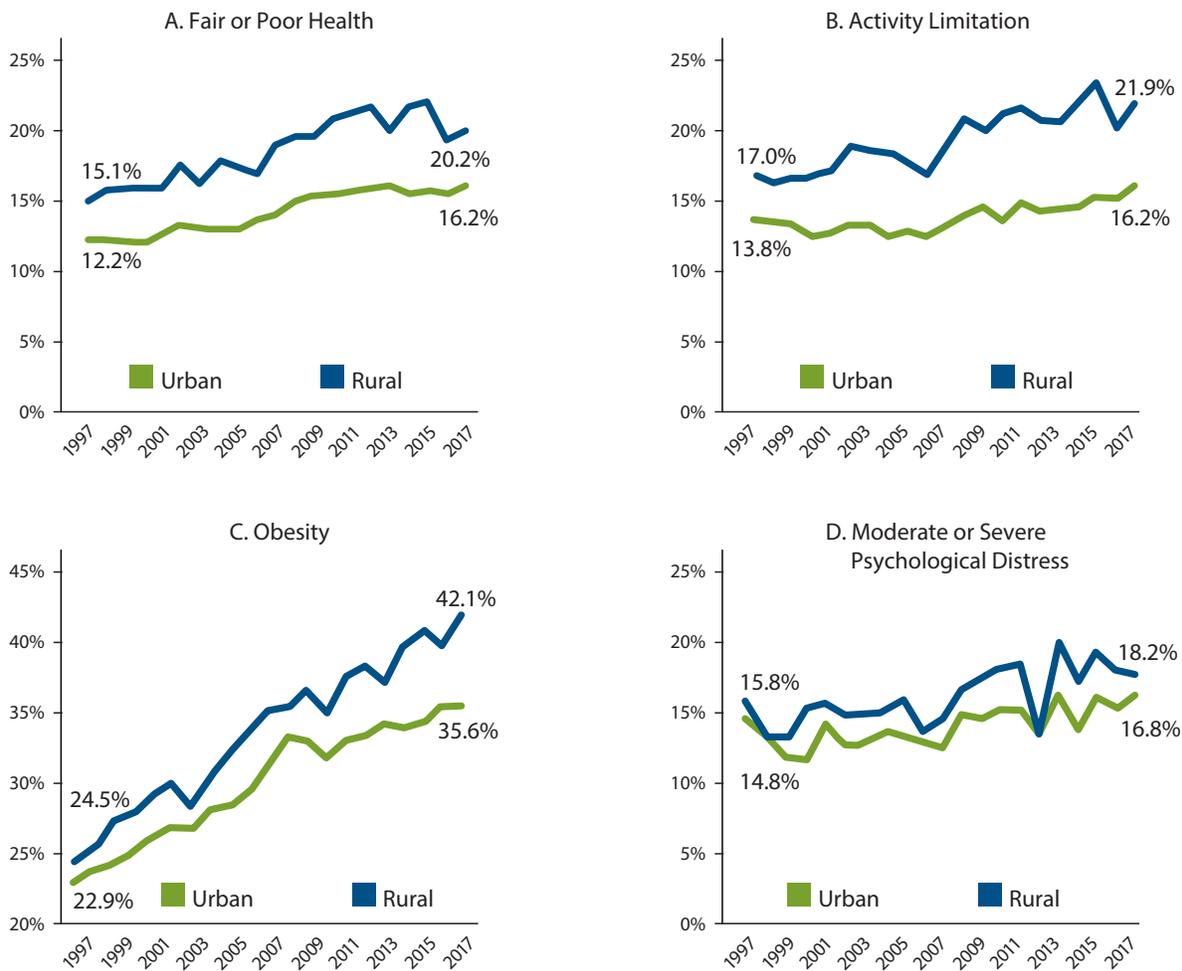
Changes in Health Among Less-Educated Adults by Geography

Adults with less education living in rural areas generally reported worse health than their urban counterparts from 1997 to 2017, though this relationship was weaker for psychological distress (Figure 5, Appendix Table 6).

Among adults without any college education, those in both urban and rural areas experienced health declines between 1997 and 2017 (Figure 5). For example, among less-educated adults in rural areas, the share in fair or poor health rose 34 percent over this period (15.1 percent to 20.2 percent), and the share with any activity limitation rose 29 percent (17.0 percent to 21.9 percent). The share of rural adults without a college education reporting moderate or severe psychological distress increased from 15.8 percent to 18.2 percent, not a statistically significant difference. As with all other groups we studied, obesity among less-educated rural adults increased sharply, rising 72 percent from 1997 to 2017 (from 24.5 percent to 42.1 percent). Adjusting for changes in the age, sex, and racial/ethnic distribution over time and across education and geographic groups suggests that some of the increases in fair or poor health and activity limitations among less-educated rural adults can be attributed to changing demographics, but the trends in obesity and psychological distress are less sensitive to these adjustments (Appendix Table 6).

Adults in urban areas without any college education also experienced declines in health over the past 20 years. For example, the share in fair or poor health increased 32 percent (from 12.2 percent to 16.2 percent), the share with an activity limitation increased 18 percent (from 13.8 percent to 16.2 percent), and the share reporting moderate or severe psychological distress rose 14 percent (from 14.8 percent to 16.8 percent). Similar to less-educated rural adults, urban adults' obesity rate climbed by 55 percent over the past 20 years, from 22.9 percent to 35.6 percent. After adjusting for changing demographics, the increase in fair or poor health among less-educated urban adults was not as stark, but the patterns for other outcomes were similar (Appendix Table 6).

Figure 5. Trends in Self-Reported Health Measures for Nonelderly Adults Without Any College Education, by Geography, 1997–2017



Source: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: “Urban” (rural) refers to adults living within any metropolitan (nonmetropolitan) county as defined by the rural-urban continuum code. “No college” refers to adults with a high school degree or less. “Activity limitation” refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale.

Between 1997 and 2017, health disparities between urban and rural adults without a college education remained relatively stable. However, the obesity gap between rural and urban adults without a college education grew over this period from 1.6 percentage points to 6.5 percentage points. When these estimates are adjusted for age, sex, and race differences over time and across education and geographic groups, the patterns are relatively consistent (Appendix Table 6).

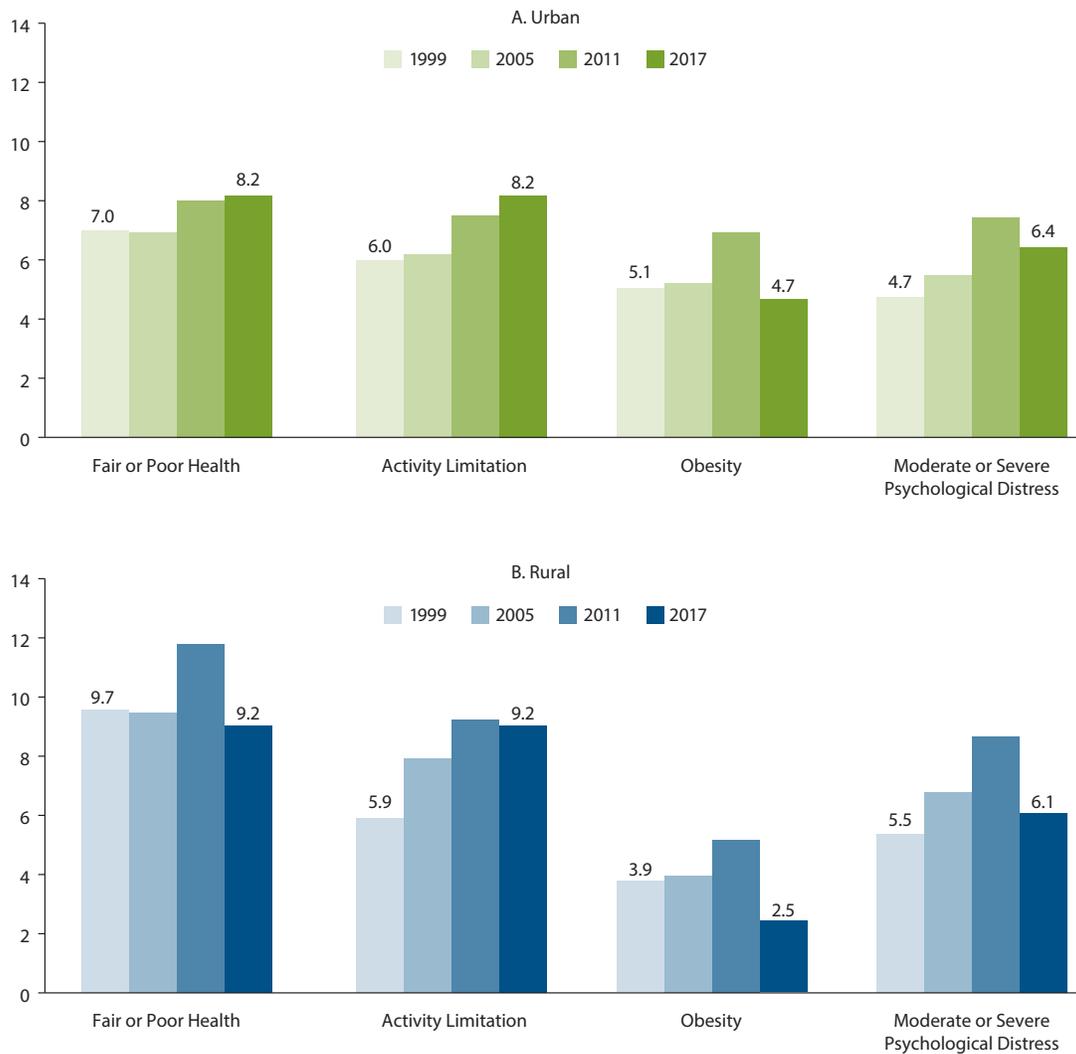
Changes in Education Disparities in Health by Geography

We also explored changes in health disparities between adults with and without a college education in both urban and rural areas, adjusting for the different demographics across education groups and over time. As shown in Figure 6, the gaps in health between those with and without a college

education grew between 1999 and 2017 in both urban and rural areas, though the patterns differed. In urban areas, the education disparities in fair/poor health, activity limitation, and psychological distress all grew between 1999 and 2017. The small declines in the education disparities in obesity and psychological distress between 2011 and 2017 were not statistically significant (Appendix Table 7).

In contrast, in rural areas, there were statistically significant increases in the education disparity in fair/poor health, activity limitations, and psychological distress between 1999 and 2011, but each disparity narrowed between 2011 and 2017. Consequently, only the increase in the disparity in activity limitation between 1999 and 2017 was statistically significant in rural areas (Appendix Table 7).

Figure 6. Disparities for Self-Reported Health Measures Between Nonelderly Adults with No College Education and Any College Education, by Geography, 1999, 2005, 2011, 2017



Source: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: “Urban” (rural) refers to adults living within any metropolitan (nonmetropolitan) county as defined by the rural-urban continuum code. “No college” refers to adults with a high school degree or less. “Activity limitation” refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale. Estimates reflect the percentage-point difference between less- and more-educated adults reporting each outcome, adjusted for age, sex, and race differences across education groups and over time.

Again, when we considered the possible role of coverage gains in explaining these disparities, we found that if insurance coverage had remained constant between 2011 and 2017, the disparities in fair or poor health and psychological distress would have been slightly higher in 2017 (data not shown). However, our preliminary analysis did not suggest a stronger effect of insurance in rural areas despite the

observed improvements in disparities for less-educated adults in these areas between 2011 and 2017. Additional analysis is needed to better understand the role of insurance and other factors in explaining the changes in health disparities by education, particularly in rural areas.

DISCUSSION

Overall, adults without any college education face significant health disparities compared with those who have attended or completed college, and these disparities have persisted over the past two decades. Less-educated adults from all racial, ethnic, and geographic groups we studied have seen declines in health over time, though the patterns vary somewhat by group and health measure. Across all groups, obesity increases have been particularly stark.

Between 1997 and 2017, racial disparities in health between black and white adults with a high school degree or less declined, but these reductions appear to be largely driven by steeper declines in health for white adults. White adults with less education have also fallen further behind their more-educated white counterparts, resulting in increasing education disparities over time across all health metrics we examined. Education disparities for those in urban areas have also increased significantly since the late 1990s and have remained quite stable in recent years. In general, our findings by race align with literature showing increasing middle-age mortality for white adults with a high school degree or less, compared with decreasing middle-age mortality for all other racial, ethnic, and education groups.¹³ Similarly, our findings by geography align with recent work that shows that the wage gap between workers with and without a college education has widened more in urban areas, leaving low-skilled workers in urban areas at a greater disadvantage.¹⁸

In contrast, we see some evidence of narrowing health disparities since 2011 among less-educated black adults and those in rural areas. Though our preliminary analysis found that the ACA likely played a minor role in driving these changes, additional analysis of the role of insurance and other factors in explaining these patterns is warranted. Given the large coverage gains under the ACA for all groups we examined and only modest improvements in disparities for a few groups, our results clearly imply that insurance is not the only solution to the health disparities facing less-educated adults. This further suggests the need for interventions aimed at reducing noninsurance-related resource constraints, improving health literacy, and alleviating sources of chronic stress among adults with a high school degree or less.

Moreover, the persistence of education disparities in health both over time and across various groups suggests that real progress will likely require serious investments in educational and skill-building opportunities, including federal funding for community colleges, online learning opportunities, apprenticeship programs, and alternative credentialing for those without a college degree.¹⁹ Such investments would allow more people to capture the health and economic benefits that more education offers.

Appendix Table 1. Changes in Demographic and Socioeconomic Characteristics of Nonelderly Adults, by Educational Attainment, 1997 and 2017

	No College		Any College	
	1997	2017	1997	2017
Age				
19-25	15.7%	16.0%	15.3%	15.2%
26-34	21.7%	18.2%*	23.6%	21.5%*
35-44	26.4%	19.3%*	28.3%	21.8%*
45-54	19.8%	22.4%*	21.9%	21.3%
55-64	16.4%	24.0%*	10.9%	20.1%*
Sex				
Male	49.1%	53.8%*	48.9%	46.5%*
Female	50.9%	46.2%*	51.1%	53.5%*
Race/Ethnicity				
White	67.0%	50.7%*	78.7%	66.6%*
Black	13.6%	14.6%	9.7%	11.2%*
Hispanic	15.8%	27.5%*	6.3%	12.2%*
Other race	3.6%	7.1%*	5.1%	10.0%*
Income (% FPL)				
<100	20.7%	23.9%*	9.6%	10.8%*
100-138	8.4%	9.3%*	4.0%	4.2%
138-250	23.0%	23.0%	13.6%	13.2%
250-400	22.9%	19.0%*	21.7%	18.1%*
400+	25.0%	24.8%	51.1%	53.6%*
Marital Status				
Married	60.4%	48.6%*	62.6%	56.4%*
Live with Partner	6.8%	11.4%*	4.9%	8.1%*
Widowed, Divorced, or Separated	14.5%	13.7%*	10.9%	10.6%
Never Married	18.3%	26.3%*	21.6%	24.8%*
Uninsured	26.5%	21.8%*	11.7%	7.9%*
Rural	20.2%	16.4%*	13.8%	10.2%*

Sources: Authors' analysis of National Health Interview Survey, 1997 and 2017.

Notes: "No college" refers to adults with a high school degree or less. "Any college" refers to those with some college or more education. White, black, and other race are non-Hispanic. Income is reported as a percentage of the federal poverty level (FPL) within a health insurance unit. Uninsured is at the time of survey. Urban (rural) refers to adults living within any metropolitan (nonmetropolitan) county as defined by the rural-urban continuum code. * indicates the difference between 1997 and 2017 is significant at $p < 0.05$.

Appendix Table 2. Unadjusted and Adjusted Trends in Self-Reported Health Measures for Nonelderly Adults, by Educational Attainment, 1997–2017

	1997	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	Percent change 1997 to 2017
Fair or Poor Health												
Unadjusted												
No college	12.8%	12.9%	13.6%	13.9%	14.0%	15.1%	16.3%	16.8%	16.8%	16.8%	16.8%	31%
Any college	4.7%	4.8%	5.2%	5.8%	5.7%	6.3%	6.4%	7.0%	7.0%	7.1%	6.8%	44%
Adjusted												
No college	13.1%	13.1%	13.6%	13.8%	13.6%	14.7%	15.7%	16.2%	15.8%	15.8%	15.6%	19%
Any college	5.6%	5.4%	5.9%	6.4%	6.1%	6.5%	6.5%	7.0%	7.0%	7.0%	6.7%	20%
Activity Limitation												
Unadjusted												
No college	14.4%	14.1%	13.8%	14.4%	13.8%	14.4%	15.7%	16.2%	15.6%	16.6%	17.2%	19%
Any college	8.3%	7.7%	7.7%	7.9%	7.3%	7.7%	8.3%	8.3%	8.0%	7.9%	8.3%	0.2%
Adjusted												
No college	14.8%	14.4%	14.1%	14.8%	14.0%	14.5%	15.9%	16.4%	15.6%	16.8%	17.2%	16%
Any college	9.2%	8.2%	8.2%	8.2%	7.4%	7.7%	8.3%	8.1%	7.9%	7.7%	8.2%	-10%
Obesity												
Unadjusted												
No college	23.4%	25.4%	26.8%	27.0%	29.5%	32.0%	33.9%	34.2%	35.0%	35.6%	36.0%	54%
Any college	16.8%	19.3%	20.6%	22.0%	23.1%	23.9%	25.3%	25.9%	26.4%	28.1%	29.3%	74%
Adjusted												
No college	23.0%	25.1%	26.3%	26.6%	29.2%	31.5%	33.2%	33.7%	34.4%	35.0%	35.8%	56%
Any college	17.2%	19.6%	21.2%	22.6%	23.6%	24.6%	25.8%	26.5%	26.7%	28.6%	29.8%	74%
Moderate or severe psychological distress												
Unadjusted												
No college	13.7%	10.9%	13.7%	12.3%	12.7%	12.1%	14.4%	15.1%	16.6%	16.1%	15.9%	16%
Any college	7.1%	6.0%	8.2%	7.5%	7.1%	6.4%	7.7%	7.6%	9.4%	9.8%	9.8%	37%
Adjusted												
No college	13.7%	11.1%	13.8%	12.5%	13.0%	12.6%	14.9%	15.8%	17.6%	17.2%	17.1%	25%
Any college	7.5%	6.0%	8.3%	7.7%	7.2%	6.5%	7.8%	7.6%	9.5%	9.8%	9.7%	29%

Sources: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: Adjusted estimates adjust for age, sex, and racial/ethnic differences over time and across education groups. "No college" refers to adults with a high school degree or less. "Any college" refers to those with some college or more education. Activity limitation refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale.

Appendix Table 3. Health Disparities by Education for Nonelderly Adults, 1999, 2005, 2011, and 2017

					Change in Disparities Over Time			
	1999	2005	2011	2017	2005-1999	2011-1999	2017-1999	2017-2011
Fair or poor health								
No college	13.1%	13.6%	16.2%	15.6%				
Any college	5.4%	6.1%	7.0%	6.7%				
Disparity	7.7 ^{††}	7.5 ^{††}	9.1 ^{††}	9.0 ^{††}	-0.2	1.5 ^{**}	1.3 ^{**}	-0.2
Activity Limitation								
No college	14.4%	14.0%	16.4%	17.2%				
Any college	8.2%	7.4%	8.1%	8.2%				
Disparity	6.2 ^{††}	6.6 ^{††}	8.3 ^{††}	8.9 ^{††}	0.5	2.1 ^{**}	2.8 ^{**}	0.7
Obesity								
No college	25.1%	29.2%	33.7%	35.8%				
Any college	19.6%	23.6%	26.5%	29.8%				
Disparity	5.5 ^{††}	5.6 ^{††}	7.2 ^{††}	6.0 ^{††}	0.1	1.7	0.5	-1.2
Moderate or severe psychological distress								
No college	11.1%	13.0%	15.8%	17.1%				
Any college	6.0%	7.2%	7.6%	9.7%				
Disparity	5.1 ^{††}	5.8 ^{††}	8.2 ^{††}	7.5 ^{††}	0.7	3.1 ^{**}	2.4 ^{**}	-0.8

Sources: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: Estimates adjust for age, sex, and racial/ethnic differences over time and across education groups. Disparity estimates reflect the percentage-point difference between less- and more-educated adults reporting each outcome. "No college" refers to adults with a high school degree or less. "Any college" refers to those with some college or more education. Activity limitation refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale ^{††} (†) indicates that the disparity at a point in time is different from zero at $p < 0.05$ (0.10). ^{**}(*) indicates that the change in disparity over time is different from zero at $p < 0.05$ (0.10).

Appendix Table 4. Change in Self-Reported Health Measures for Nonelderly Adults with a High School Degree or Less, by Race/Ethnicity, 1997–2017

	Fair or Poor Health			Activity Limitation			Obesity			Moderate or Severe Psychological Distress		
	1997	2017	Percent change 1997 to 2017	1997	2017	Percent change 1997 to 2017	1997	2017	Percent change 1997 to 2017	1997	2017	Percent change 1997 to 2017
White												
Unadjusted	11.6%	16.4%	41%	14.8%	20.5%	39%	22.4%	37.0%	66%	13.4%	18.7%	40%
Adjusted	11.5%	14.6%	27%	14.8%	18.3%	24%	22.2%	36.5%	64%	13.4%	19.0%	42%
Black												
Unadjusted	19.7%	22.6%	15%	18.6%	20.7%	12%	31.0%	39.7%	28%	15.8%	15.3%	-3%
Adjusted	21.1%	22.0%	4%	19.9%	20.0%	1%	31.4%	39.8%	27%	15.7%	15.5%	-1%
Hispanic												
Unadjusted	12.0%	14.6%	22%	9.6%	9.7%	2%	23.4%	34.9%	49%	13.2%	11.6%	-12%
Adjusted	14.2%	15.2%	7%	11.4%	10.1%	-11%	24.5%	35.1%	43%	13.4%	11.8%	-12%
	1997	2017	Percentage point change 1997 to 2017	1997	2017	Percentage point change 1997 to 2017	1997	2017	Percentage point change 1997 to 2017	1997	2017	Percentage point change 1997 to 2017
Black-white disparity												
Unadjusted	8.1*	6.2†	-1.9	3.8†	0.2	-3.6*	8.6†	2.7	-5.9*	2.4†	-3.4	-5.9*
Adjusted	9.5*	7.4†	-2.2	5.2†	1.7	-3.4*	9.2†	3.3	-5.9*	2.3†	-3.5	-5.7*
Hispanic-white disparity												
Unadjusted	0.4	-1.8	-2.1	-5.3†	-10.8†	-5.6*	1.0	-2.1	-3.1	-0.2	-7.1†	-7.0*
Adjusted	2.7*	0.6	-2.2	-3.4†	-8.2†	-4.8*	2.3†	-1.4	-3.6	0.0	-7.2†	-7.2*

Sources: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: Adjusted estimates adjust for age and sex differences over time and across education and racial/ethnic groups. Disparity estimates reflect the percentage-point difference between white adults and black/Hispanic adults reporting each outcome. White and black are non-Hispanic. Activity limitation refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale † indicates that the disparity at a point in time is different from zero at $p < 0.05$. * indicates that the change in disparity over time is different from zero at $p < 0.05$.

Appendix Table 5. Health Disparities by Education for Nonelderly Adults, by Race and Ethnicity, 1999, 2005, 2011, 2017

					Change in Disparities Over Time			
	1999	2005	2011	2017	2005-1999	2011-1999	2017-1999	2017-2011
White Adults								
Fair or poor health								
No college	11.4%	12.5%	15.4%	14.6%				
Any college	4.7%	5.2%	5.9%	6.0%				
Disparity	6.8 ^{††}	7.3 ^{††}	9.4 ^{††}	8.7 ^{††}	0.5	2.7 ^{**}	1.9 ^{**}	-0.8
Activity Limitation								
No college	14.5%	14.7%	17.2%	18.3%				
Any college	8.5%	7.5%	8.0%	8.0%				
Disparity	6.0 ^{††}	7.2 ^{††}	9.2 ^{††}	10.3 ^{††}	1.2 [*]	3.2 ^{**}	4.3 ^{**}	1.1
Obesity								
No college	24.1%	28.8%	32.9%	36.5%				
Any college	18.8%	22.1%	24.4%	28.0%				
Disparity	5.3 ^{††}	6.7 ^{††}	8.4 ^{††}	8.5 ^{††}	1.4	3.1 ^{**}	3.2 ^{**}	0.1
Moderate or severe psychological distress								
No college	11.3%	13.2%	16.8%	19.0%				
Any college	5.9%	6.9%	7.4%	9.6%				
Disparity	5.4 ^{††}	6.4 ^{††}	9.4 ^{††}	9.3 ^{††}	1.0	4.0 ^{**}	3.9 ^{**}	-0.1
Black Adults								
Fair or poor health								
No college	20.5%	19.1%	21.5%	22.0%				
Any college	7.5%	9.9%	11.9%	9.3%				
Disparity	13.0 ^{††}	9.2 ^{††}	9.6 ^{††}	12.7 ^{††}	-3.8 ^{**}	-3.4 ^{**}	-0.3	3.1 ^{**}
Activity Limitation								
No college	18.2%	16.6%	20.3%	20.0%				
Any college	8.3%	8.5%	10.5%	10.3%				
Disparity	9.9 ^{††}	8.0 ^{††}	9.8 ^{††}	9.7 ^{††}	-1.9 [*]	-0.2	-0.2	0.0
Obesity								
No college	31.4%	35.4%	42.1%	39.8%				
Any college	27.7%	32.9%	39.2%	42.8%				
Disparity	3.7 ^{††}	2.5 [†]	2.9 [†]	-3.0	-1.2	-0.7	-6.6 ^{**}	-5.9 ^{**}
Moderate or severe psychological distress								
No college	10.7%	14.2%	16.8%	15.5%				
Any college	6.6%	7.2%	8.4%	9.3%				
Disparity	4.1 ^{††}	7.0 ^{††}	8.5 ^{††}	6.2 ^{††}	2.9 ^{**}	4.4 ^{**}	2.1	-2.3

Appendix Table 5. Health Disparities by Education for Nonelderly Adults, by Race and Ethnicity, 1999, 2005, 2011, 2017 *continued*

					Change in Disparities Over Time			
	1999	2005	2011	2017	2005-1999	2011-1999	2017-1999	2017-2011
Hispanic								
Fair or poor health								
No college	14.2%	15.1%	16.5%	15.2%				
Any college	7.5%	8.3%	8.8%	8.6%				
Disparity	6.7 ^{††}	6.9 ^{††}	7.8 ^{††}	6.6 ^{††}	0.2	1.1	-0.1	-1.2
Activity Limitation								
No college	10.1%	8.9%	9.5%	10.1%				
Any college	7.0%	6.5%	7.4%	8.0%				
Disparity	3.1 ^{††}	2.3 ^{††}	2.1 ^{††}	2.1 ^{††}	-0.7	-1.0	-0.9	0.1
Obesity								
No college	26.6%	29.5%	34.4%	35.1%				
Any college	21.6%	27.3%	31.4%	33.3%				
Disparity	4.9 ^{††}	2.2 ^{††}	3.0 ^{††}	1.8	-2.7 [*]	-2.0	-3.1	-1.2
Moderate or severe psychological distress								
No college	9.3%	10.5%	10.9%	11.8%				
Any college	6.2%	9.0%	7.6%	9.4%				
Disparity	3.2 ^{††}	1.4 ^{††}	3.3 ^{††}	2.4 ^{††}	-1.7 [*]	0.2	-0.8	-1.0

Source: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: Estimates adjust for age and sex differences over time and across education and racial/ethnic groups. Disparity estimates reflect the percentage-point difference between less- and more-educated adults reporting each outcome. White and black are non-Hispanic. "No college" refers to adults with a high school degree or less. "Any college" refers to those with some college or more education. Activity limitation refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale †† (†) indicates that the disparity at a point in time is different from zero at $p < 0.05$ (0.10). *(*) indicates that the change in disparity over time is different from zero at $p < 0.05$ (0.10).

Appendix Table 6. Change in Self-Reported Health Measures for Nonelderly Adults with a High School Degree or Less, by Geography, 1997–2017

	Fair or Poor Health			Activity Limitation			Obesity			Moderate or Severe Psychological Distress		
	1997	2017	Percent change 1997 to 2017	1997	2017	Percent change 1997 to 2017	1997	2017	Percent change 1997 to 2017	1997	2017	Percent change 1997 to 2017
Urban												
Unadjusted	12.2%	16.2%	32%	13.8%	16.2%	18%	22.9%	35.6%	55%	14.8%	16.8%	14%
Adjusted	12.4%	14.5%	17%	14.4%	16.1%	12%	22.5%	33.3%	48%	13.4%	15.9%	19%
Rural												
Unadjusted	15.1%	20.2%	34%	17.0%	21.9%	29%	24.5%	42.1%	72%	15.8%	18.2%	15%
Adjusted	15.9%	18.7%	18%	16.7%	19.7%	18%	25.0%	42.6%	70%	15.0%	18.0%	20%
	1997	2017	Percentage point change 1997 to 2017	1997	2017	Percentage point change 1997 to 2017	1997	2017	Percentage point change 1997 to 2017	1997	2017	Percentage point change 1997 to 2017
Urban-rural disparity												
Unadjusted	2.9 [†]	4.1 [†]	1.2	3.2 [†]	5.7 [†]	2.5	1.6	6.5 [†]	4.9*	1.0	1.3	0.3
Adjusted	3.4 [†]	4.2 [†]	0.8	2.3 [†]	3.6 [†]	1.3	2.5 [†]	9.3 [†]	6.8*	1.6	2.1	0.5

Sources: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: Adjusted estimates adjust for age, sex, and racial/ethnic differences over time and across education and geographic groups. Disparity estimates reflect the percentage-point difference between rural and urban adults reporting each outcome. Urban (rural) refers to adults living within any metropolitan (nonmetropolitan) county as defined by the rural-urban continuum code. Activity limitation refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale. † indicates that the disparity at a point in time is different from zero at $p < 0.05$. * indicates that the change in disparity over time is different from zero at $p < 0.05$.

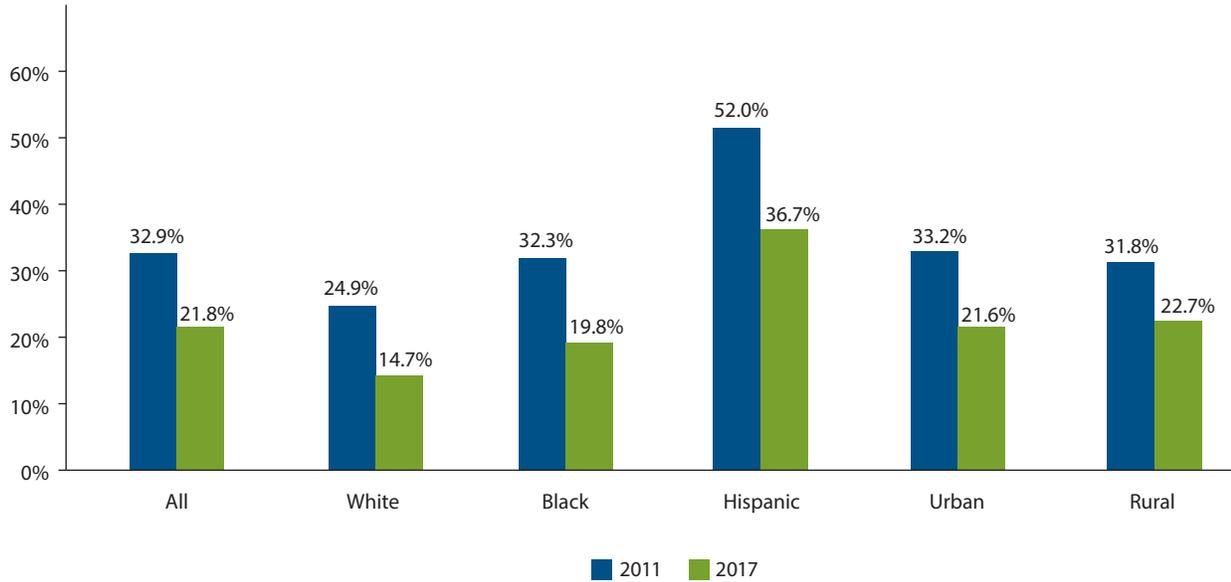
Appendix Table 7. Health Disparities by Education for Nonelderly Adults, by Geography, 1999, 2005, 2011, 2017

					Change in Disparities Over Time			
	1999	2005	2011	2017	2005-1999	2011-1999	2017-1999	2017-2011
Urban								
Fair or poor health								
No college	12.2%	12.8%	14.8%	14.5%				
Any college	5.2%	5.8%	6.8%	6.3%				
Disparity	7.0 ^{††}	6.9 ^{††}	8.0 ^{††}	8.2 ^{††}	-0.1	1.0 ^{**}	1.2 ^{**}	0.1
Activity Limitation								
No college	13.8%	13.3%	15.2%	16.1%				
Any college	7.8%	7.1%	7.7%	7.9%				
Disparity	6.0 ^{††}	6.2 ^{††}	7.5 ^{††}	8.2 ^{††}	0.2	1.5 ^{**}	2.2 ^{**}	0.7
Obesity								
No college	24.2%	27.9%	32.4%	33.3%				
Any college	19.1%	22.7%	25.6%	28.6%				
Disparity	5.1 ^{††}	5.2 ^{††}	6.8 ^{††}	4.7 ^{††}	0.1	1.8	-0.4	-2.2
Moderate or severe psychological distress								
No college	10.5%	12.4%	14.8%	15.9%				
Any college	5.8%	7.0%	7.4%	9.5%				
Disparity	4.7 ^{††}	5.5 ^{††}	7.4 ^{††}	6.4 ^{††}	0.8	2.7 ^{**}	1.7 [*]	-1.0
Rural								
Fair or poor health								
No college	16.2%	17.0%	20.8%	18.7%				
Any college	6.5%	7.3%	8.8%	9.5%				
Disparity	9.7 ^{††}	9.6 ^{††}	12.0 ^{††}	9.2 ^{††}	-0.1	2.3 [*]	-0.5	-2.8 [*]
Activity Limitation								
No college	16.1%	16.5%	20.2%	19.7%				
Any college	10.2%	8.5%	10.8%	10.5%				
Disparity	5.9 ^{††}	8.0 ^{††}	9.4 ^{††}	9.2 ^{††}	2.1	3.5 ^{**}	3.2 ^{**}	-0.2
Obesity								
No college	27.2%	32.6%	37.4%	42.6%				
Any college	23.3%	28.7%	32.2%	40.1%				
Disparity	3.9 ^{††}	3.9 ^{††}	5.2 ^{††}	2.5	0.0	1.4	-1.4	-2.8
Moderate or severe psychological distress								
No college	12.8%	14.6%	17.7%	18.0%				
Any college	7.3%	7.7%	8.9%	11.8%				
Disparity	5.5 ^{††}	6.9 ^{††}	8.8 ^{††}	6.1 ^{††}	1.4	3.3 [*]	0.6	-2.7

Source: Authors' analysis of National Health Interview Survey, 1997–2017.

Notes: Estimates are adjusted for age, sex, and racial/ethnic differences over time and across education and geographic groups. Disparity estimates reflect the percentage-point difference between less- and more-educated adults reporting each outcome. "No college" refers to adults with a high school degree or less. "Any college" refers to those with some college or more education. Urban (rural) refers to adults living within any metropolitan (nonmetropolitan) county as defined by the rural-urban continuum code. Activity limitation refers to those who reported being limited in any way because of a physical, mental, or emotional problem. Obesity is a body mass index of 30 or more. Moderate or severe psychological distress is a score of 8 or higher on the Kessler K6 Psychological Distress Scale. †† (†) indicates that the disparity at a point in time is different from zero at $p < 0.05$ (0.10). **(*) indicates that the change in disparity over time is different from zero at $p < 0.05$ (0.10).

Appendix Figure 1. Uninsurance Rates for Less-Educated Adults by Race, Ethnicity, and Geography



Source: Authors' analysis of National Health Interview Survey, 2011 and 2017.

Notes: Uninsured is at the time of survey. White and black are non-Hispanic. Urban (rural) refers to adults living within any metropolitan (nonmetropolitan) county as defined by the rural-urban continuum code. "Less educated" refers to adults with a high school degree or less.

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