

## Research Article

# Diminished Protective Effects of Education, Income and Employment against Obesity Risk in Black Women at Reproductive Age: National Health and Nutrition Examination Survey (NHANES 1999-2016)

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**Background:** Socioeconomic status (SES) indicators protect individuals and populations against health problems such as obesity. Marginalization-related Diminished Returns (MDRs), however, refer to the weaker economic and health returns of education, employment, and income for Black than the returns for White people.

**Aims:** To test the effects of three major SES indicators, namely educational attainment, employment, and income, on obesity for women at reproductive age, and to test variation in these associations by race.

**Methods:** We used cross-sectional data from the National Health and Nutrition Examination Survey (NHANES). Sample was limited to non-Latino White and Black women at reproductive age (age between 20 and 44). Analytical sample was composed of 5237 women. Survey regressions were used to test the effects of education, employment, and income (independent variables) on obesity (dependent variable) and by race (moderator).

**Results:** Overall, educational attainment and income were inversely associated with odds of obesity in our sample, however, we found significant interactions indicating that the effects of education, employment, and income were all weaker for Black than White women.

**Conclusions:** In line with MDRs, and probably due to structural racism, social stratification, labor market discrimination, and different food options, obesity remains higher than expected in highly educated, employed, and high-income Black women, a pattern that is not seen in White women. Black middle-class women at reproductive age remain at risk for obesity. To eliminate racial disparities in perinatal outcomes, we need to go beyond low SES and address the perinatal needs of middle-class Black women, for whom obesity remains a health risk.

**Keywords:** Obesity; Body mass index; Race; Racism; Social determinants; Socioeconomic status

**Background**

While socioeconomic status (SES) indicators such as educational attainment, employment, and income are among major protective factors of individuals and populations against disease and illness [1-4], recent studies have shown that SES indicators may show that these health effects are weaker for non-Hispanic Black than non-Hispanic White people. This phenomenon is known as Marginalization-related Diminished Returns (MDRs), also called Minorities' Diminished Returns (MDRs) or Blacks' Diminished returns [5,6]. This framework suggests that racialization and minoritization of may alter the relevance of SES indicators and social determinants of health (SDoH) [7-12] and fundamental causes [13-16] for health across social groups. Most of this literature, however, is on education rather than employment and income.

Marginalization-related Diminished Returns (MDRs) [5,6] can be defined as weaker health returns of education, employment, and income for marginalized people, particularly Black individuals, than the returns for White people [5,6]. MDRs framework argues that systemic racism, social stratification, and other sources of inequalities, intentionally or unintentionally provides an unjust condition for Black and Brown people, while the same processes maintain the relatively higher status of privileged White people in the society. According to the MDRs, White privilege comes with the cost of minoritized and marginalized groups. As a result, even when the non-White groups climb up the social ladder, their health status is not great because the process of social mobility is far more taxing for them, and the real live consequences of SES and mobility are not comparable between non-White and White people. In the US society, White privilege is maintained by "Whites' written laws, regulation,

rules, norms, and standards”.

In this view, MDRs framework has provided a paradigm shift for studying health disparities that are not due to poverty but glitches in the system and social processes such as systemic racism that contribute to health inequalities. Unlike most of the research on health disparities that has traditionally - focused on the role of poverty and low SES as the mechanism for racial health inequalities, MDRs seek to understand how economic and health effects of available SES indicators vary across Whites and racial/ethnic minorities. In addition, MDRs explore racial/ethnic disparities across the full SES spectrum and allow SES returns to vary by race/ethnicity. An assumption that SES is similarly protective for all social groups is naïve and not supported by the evidence. In addition, MDRs explain why racial/ethnic health gap may widen, rather than narrow, as SES increases [5,6]. This framework provides a new explanation for why Black-White economic and health gaps extend to educated and employed (middle-class) Black communities [17,18].

Although not always called MDRs, weaker health effects of SES indicators such as education, income, and employment among Black than White individuals are reported by Williams, Hudson [19-21], Fuller-Rowel [22-25], Kaufman [26], Shapiro [27,28], Williams [29,30], Ceci [31], Ferarro [32], Navarro [33-35], Assari [5,6], and Thorpe [36-38]. These findings can be referred to as MDRs [5,6] a systemic phenomenon that is related to marginalization and holds for various SES indicators and health outcomes. The MDRs framework attributes worse-than-expected health of middle-class people of color not to poverty but the diminished effects of education, income, and employment in the lives of middle-class people of color. This phenomenon has recently attracted attention and has provided a novel approach to research on health disparities [39,40].

Extensive empirical evidence has supported the existence of MDRs and the contribution of such MDRs to racial and ethnic health disparities in the US. Previous work shows that due to MDRs, highly educated, employed, and high income Black people show worse mental [41], behavioral [42,43], and physical health [17], and unmet healthcare needs [44,45]. These patterns are non-specific and can be seen for mental health [46,47], chronic diseases [48-50], substance use [43,51,52], and mortality [53,54]. Recent studies have also shown that due to MDRs, diet [55], exercise [56], obesity [57,58] are also worse for Black middle-class. A recent study used the National Health and Nutrition Examination Survey (NHANES) data and showed that highly educated White people have low risk of cardiometabolic conditions, while highly educated, employed, and high-income Black people have a higher risk of cardiometabolic conditions. While the results varied for various conditions, obesity was not included in the study [59].

While MDRs are well-described, most of the MDRs literature on obesity as an outcome is focused on children and youth rather than adults [57,60,61]. As social determinants of obesity differ in age groups, there is a need to test the same MDRs for obesity in adults. In addition, most of the MDRs literature has used both genders. However, social determinants of obesity may vary between men and women. Thus, there is a need to test whether these MDRs hold for women as well.

To expand the literature, we conducted a secondary analysis

of individual-level data from National Health and Nutrition Examination Survey (NHANES) with the following specific aims: Aim 1 was to determine the associations between educational attainment, employment, income, and obesity, and Aim 2 was to test diminished returns of education, employment, and income for Black women over the returns for White women at reproductive age. We focused on obesity in women at reproductive age because this outcome is a risk to the health of newborn and the mother [62]. Our first hypothesis was that education, income, and employment are inversely associated with odds of obesity, and our second hypothesis was that the inverse associations between education, income, and employment with the odds of obesity on health are weaker for Black than White women.

## Methods

This cross-sectional study used the National Health and Nutrition Examination Survey (NHANES) data between 1999-2016 [63]. The NHANES is a state-of the art cross-sectional survey that provides nationally representative health estimates for the US population. The NHANES 1999-2016 response rate was 73.2% [64,65]. For this analysis, we included 5237 women at their reproductive age. All women were between 20 and 44 years of age. All participants were non-Hispanic Black or non-Hispanic White.

### Outcome variable

We used obesity as the outcome. We used a dummy variable for obesity coded 1 if the body mass index (BMI) was equal or larger than 30.0 [66]. The NHANES has measured height and weight to calculate the BMI.

### Main independent variables

The main independent variables of interest were education level, employment, and marital status. Educational attainment was a categorical variable with the following categories: 1) less than high school graduate, 2) high school graduate, or general equivalency diploma (GED), 3) some college, and 4) college degree. Employment was a dummy variable (=1, If individual working at a job or business or with a job or business but not at work and =0, if looking for a job or not working at a job or business). Household income was a three level variable: \$0-\$34,999, 35,000-\$74,999 and  $\geq 75,000$ .

### Covariates

For demographic variables, we included age (years), sex, and marital status (1 = married, 0 = otherwise). We did not control for health behaviors such as smoking (never smoked, a former smoker and current smoker), drinking (never drink, former drinker and current drinker), and physical activity (vigorous activity) because they may explain racial variation in the link between SES and obesity.

### Race

Moderator was race/ethnicity group. This was a dichotomous variable (non-Hispanic White = 0 and non-Hispanic Black =1).

### Analytic strategy

We used descriptive analysis to compare the mean and proportional differences between non-Hispanic White and non-Hispanic Black people for all four conditions. The prevalence of obesity was greater than 10%: used weighted modified GLM (sub pop) [67-69] to produce prevalence ratios (PR) and the corresponding 95% confidence intervals (CI) [67,68]. We ran nested models with various

combination of SES Indicators such as education, employment, and income. All models controlled for our interaction effects. Our models were performed without and with interaction terms between race and education, income, and employment. Finally, we stratified the analyses by race. All analyses were weighted using the NHANES individual-level sampling weights for 1999-2016 (8 waves of data) that makes the effect sizes and estimates representative of the national level for the US non-institutionalized population [70]. A P-value <0.05 was statistically significant (two-sided). We used STATA statistical software version 15 to perform all analyses.

## Results

Table 1 shows the descriptive data of our participants. As this table shows, 5237 participants entered our analysis. From this number, 2023 were obese and 3214 were not obese. Average age of our participants was 32 years and 60% of them were married. From all our participants, 18% WERE Black and 82% were White, however, between 13 to 27% of White and Black women were obese.

Table 2 shows the distribution of obesity by race, education, and income. Figure 1 to 3 shows the pattern of the association between educational attainment, income, and employment with obesity overall and by race. Social patterning of obesity, as a result of SES indicators, was more robust in White women than in Black women.

As Table 3 shows, while race (Black) was associated with higher odds of obesity, high educational attainment and high income was associated with lower odds of obesity in the pooled sample. However, an interaction showed that employment is associated with larger protection for Non-Hispanic White than non-Hispanic Black women.

As Table 4 shows, higher educational attainment was associated with lower odds of obesity for Non-Hispanic White but not non-Hispanic Black women. High income was associated with odds

**Table 1:** Descriptive Analysis.

	Obese (n=2,023)		Non-Obese (n=3,214)		Overall (5,237)	
	Mean	SD	Mean	SD	Mean	SD
Obese					0.34	(0.34)
Age (Year)	33.4	(5.57)	31.97	(5.17)	32.45	(5.33)
Married %	0.56	(0.38)	0.61	(0.34)	0.6	(0.35)
<b>Education %</b>						
>High School	0.14	(0.27)	0.09	(0.2)	0.11	(0.22)
High School/GED	0.23	(0.32)	0.19	(0.27)	0.2	(0.29)
Some Col.	0.41	(0.38)	0.36	(0.33)	0.38	(0.35)
Col. Above	0.22	(0.32)	0.36	(0.33)	0.31	(0.33)
<b>Race (%)</b>						
White NH	0.73	(0.34)	0.87	(0.24)	0.82	(0.28)
Black NH	0.27	(0.34)	0.13	(0.24)	0.18	(0.28)
<b>Income %</b>						
\$0-#34,999	0.37	(0.37)	0.27	(0.31)	0.3	(0.33)
\$35,000-\$74,999	0.37	(0.37)	0.34	(0.33)	0.35	(0.34)
>75,000	0.25	(0.33)	0.38	(0.34)	0.34	(0.34)
Missing	0.01	(0.07)	0.01	(0.06)	0.01	(0.06)
Worked last week	0.71	(0.35)	0.73	(0.31)	0.72	(0.32)

**Table 2:** Distribution of obesity by race, education, and income.

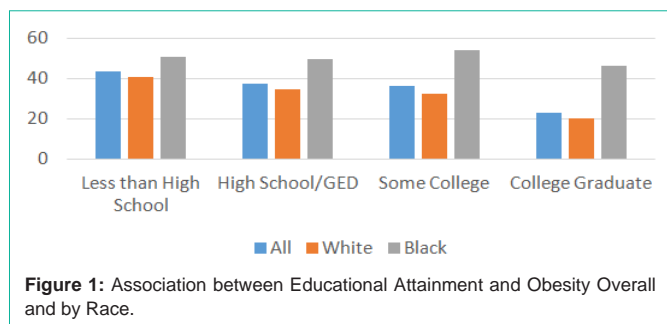
	Overall		White NH		Black NH	
	Mean	SD	Mean	SD	Mean	SD
Obese	33.4	41.7	29.5	45.6		
Not married	36.1	48	28.9	45.3	51.2	50
Married	31.6	46.5	30.6	46.1	53.2	50
<b>Education %</b>						
>High School	43.7	49.6	40.6	49.2	51	50
High School/GED	37.6	48.4	34.6	47.6	49.7	50
Some Col.	36.6	48.2	32.3	46.8	54.2	49.8
Col. Above	23.1	42.2	20.4	40.3	46.4	49.9
<b>Race (%)</b>						
<b>White NH</b>						
>High School	40.6	49.2	-	-	-	-
High School/GED	34.6	47.6	-	-	-	-
Some Col.	32.2	47.8	-	-	-	-
Col. Above	20.4	40.3	-	-	-	-
<b>Black NH</b>						
>High School	51	50	-	-	-	-
High School/GED	49.7	49.8	-	-	-	-
Some Col.	54.2	49.8	-	-	-	-
Col. above	46.4	49.9	-	-	-	-
<b>Income %</b>						
\$0-#34,999	41	49.2	35.7	47.9	53.4	49.9
\$35,000-\$74,999	34.9	47.7	32	46.6	49.9	50
>75,000	24.6	43.1	23.4	41.7	48	50
Worked last week	33.3	47.1	29.3	45.5	52.4	49.9
Have not worked last week	35.6	47.9	32.1	46.7	49.6	50

of lower obesity of Non-Hispanic White and non-Hispanic Black women.

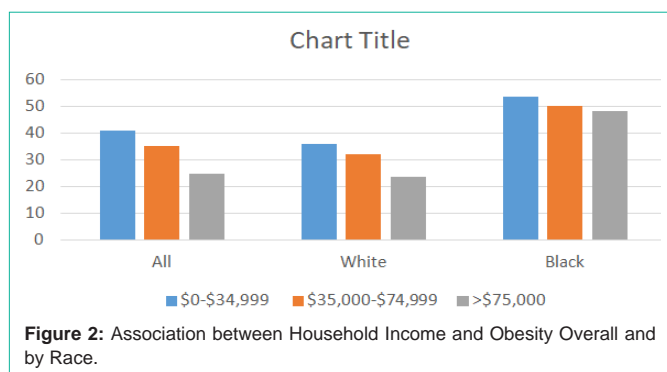
## Discussion

This study was conducted to test racial variation in the association between education, employment, and income with obesity in women at reproductive age. The study documented racial variation in the magnitude of the associations between all SES indicators and obesity in women at reproductive age. We found a lower risk of obesity in educated and high-income White women at reproductive age, while these effects were absent or weaker for Black women than White women. As a result, Black women at reproductive age remain at risk of obesity regardless of their education, income, and employment.

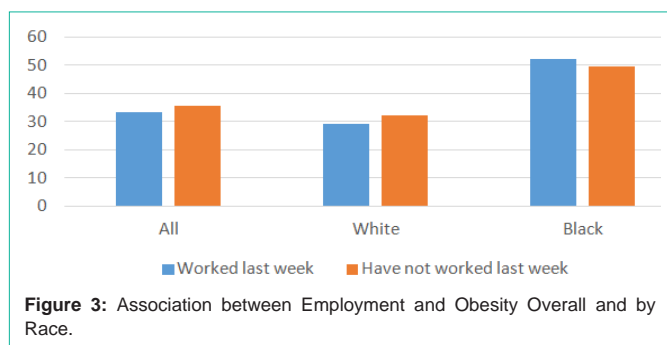
The observed MDRs may describe how social stratification and racism contribute to racial and health inequalities of Black women across class lines. MDRs describe how racism operates without requiring racist actors, so Black people, regardless of their education or employment; remain at risk of health problems, because the opportunities are not available for them. While the life experiences of people improves after education and employment, what employment and education can do for Black people is far more limited than White people.



**Figure 1:** Association between Educational Attainment and Obesity Overall and by Race.



**Figure 2:** Association between Household Income and Obesity Overall and by Race.



**Figure 3:** Association between Employment and Obesity Overall and by Race.

Due to diminished returns of education and employment on economic status and health in Black people, (MDRs), we observe widening, rather than narrowing of the racial/ethnic health gap as SES increases [5,6]. These findings and the MDRs framework provides an explanation for why Black-White economic and health gaps are not limited to poor, unemployed, and low educated individuals, but extend to educated and employed (middle-class) Black communities [17,18]. Similarly, these observations explain why we observe sustained racial health gap despite a narrowing of racial gap in SES.

Although best described as MDRs [5,6] similar findings are reported by Hudson [19-21], Kaufman [26], Shapiro [27,28], Williams [29,30], Ceci [31], Ferarro [32], Navarro [33-35], and Thorpe [36-38] for various SES indicators and health outcomes. Across SES indicators and health outcomes, these findings remain as robust. Studies also show similar MDRs for other racial and ethnic groups such as Native American [71,72], Asian American [73], and even sexual minority people [74,75], suggesting that these MDRs are related to marginalization, the common element and experience across all less privileged social groups. This commonality across various outcomes also suggests that these findings are not cultural or

biological. Extensive evidence shows how high SES Black people are discriminated against [18,76-83].

The MDRs framework attributes worse-than-expected health of middle-class people, not to poverty, but diminished effects of education and employment in the lives of Black middle-class. This phenomenon has recently attracted attention and provided a novel approach to health disparities research.

Our preliminary data suggest that different returns of employment [51,53,84] and segregation [85,86] may have a role. Thus; highly-educated and employed Black people work in jobs with lower occupational prestige and lower pay which are associated with higher stress and exposure to toxins [5,6]. Thus, policies that alter availability, quality, and benefits of jobs may be a step toward equalizing the health returns of education and employment for Black people and White people. However, there are no previous studies testing how occupational policies across U.S. states can mitigate these trends.

Extensive empirical support is found for MDRs. Previous work shows that due to MDRs, highly educated and employed Black people show worse mental [41], behavioral [42,43], and physical health [17], and unmet healthcare needs [44,45]. These patterns are non-specific and can be seen for mental health [46,47], chronic diseases [48-50], substance use [43,51,52], and mortality [53,54]. Recent studies have also shown that due to MDRs, diet [55], exercise [56], obesity [57,58] are also worse for Black middle-class.

Different returns of education on employment and income [51,53,84], due to job and residential segregation [85,86], may have a role. As a result of segregation and labor market discrimination, highly-educated and employed Black people work in jobs with lower occupational prestige and lower pay which are associated with higher stress and exposure to toxins [5,6]. High income Black people live in worse neighborhoods than high income White people [85].

The results also have some implications for researchers and statisticians. Race and SES have more than main effects and their effects are not limited to their independent effects. Thus, race and SES should not be reduced to control variables, and their effects may be tested across groups. MDRs test non-linear and non-additive effects of race/ethnicity and SES which are more realistic than universal average effects. Nothing fits all, and no effect is universal. The relevance of SES depends on race, and the relevance of race depends on SES. As Navarro has mentioned, it is not race or SES, but race and SES that cause health disparities. These nuances can be only understood theory intersectional lens and requires large diverse sample size that allows us to explore heterogeneity of the effects of SES and race across groups. One statistical approach to address these nuances is moderated-mediation models rather than a simple mediation model.

There is a need for societal and structural changes that can help middle-class Black people secure health. Policy solutions are needed to equalize the health returns of education, income, and employment for both highly educated and employed Black and White people. Such occupational policies are hoped to reduce health disparities that are due to diminished health returns of education and employment for Black people. This is important, because solutions to health



**Table 3:** Poisson regression estimates overall.

	M1	M2	M3	M4	M5	M6	M7
	PR/ci95	PR/ci95	PR/ci95	PR/ci95	PR/ci95	PR/ci95	PR/ci95
Obese							
Age (Year)	1.02*** [1.02-1.03]	1.02*** [1.02-1.03]	1.02*** [1.02-1.03]	1.02*** [1.02-1.03]	1.02*** [1.02-1.03]	1.02*** [1.02-1.03]	1.02*** [1.02-1.03]
Married	0.93 [0.85-1.01]	0.92 [0.85-1.01]	0.98 [0.89-1.07]	0.97 [0.89-1.07]	0.98 [0.89-1.08]	0.92 [0.84-1.01]	0.97 [0.88-1.07]
<b>Education %</b>							
Ref. >High School							
High School/GED	0.92 [0.81-1.05]	0.86 [0.73-1.02]	0.94 [0.82-1.07]	0.94 [0.82-1.07]	0.91 [0.79-1.05]	0.9 [0.78-1.03]	0.91 [0.79-1.05]
Some Col.	0.9 [0.80-1.01]	0.81** [0.69-0.94]	0.94 [0.84-1.06]	0.94 [0.84-1.05]	0.92 [0.81-1.04]	0.88* [0.78-0.99]	0.92 [0.81-1.03]
Col. Above	0.58*** [0.50-0.67]	0.49*** [0.41-0.60]	0.65*** [0.56-0.76]	0.66*** [0.56-0.76]	0.64*** [0.55-0.75]	0.57*** [0.49-0.66]	0.64*** [0.54-0.75]
<b>Black NH with High School/GED</b>		1.15 [0.92-1.43]					
<b>Black NH with Some Col.</b>		1.34** [1.10-1.64]					
<b>Black NH with Col. Above</b>		1.82*** [1.43-2.31]					
<b>Race (%)</b>							
Black NH (Ref. White NH)	1.59*** [1.47-1.72]	1.23* [1.03-1.46]	1.54*** [1.42-1.67]	1.43*** [1.28-1.59]	1.52*** [1.40-1.65]	1.41*** [1.23-1.61]	
<b>Income %</b>							
\$0-#34,999							
\$35,000-\$74,999			0.92 [0.84-1.01]	0.9 [0.80-1.02]	0.92 [0.83-1.02]		0.92 [0.83-1.02]
>75,000			0.73*** [0.64-0.83]	0.68*** [0.58-0.80]	0.72*** [0.62-0.83]		0.72*** [0.62-0.83]
Missing			0.79 [0.47-1.32]	0.92 [0.44-1.95]	0.71 [0.41-1.24]		0.71 [0.41-1.24]
Black NH with income \$35,000-\$74,999				1.06 [0.89-1.26]			
Black NH with income >75,000				1.42** [1.15-1.75]			
Worked last week					1.04 [0.95-1.13]	0.96 [0.86-1.07]	1 [0.89-1.12]
Black NH worked last week						1.17* [1.01-1.36]	1.15 [1.00-1.33]

disparities due to low returns of racism and (reduced returns of education and employment for Black people) are different from those due to poverty, low education, or unemployment, which have been a historic focus of policymakers. Unless we see the role of systemic racism and develop policies that can undo their harm, and unless we go beyond elimination of poverty and unemployment, education and employment may continue to operate both as ‘a solution’ and ‘a source’ of health disparities.

There is a need for future research on multiple mechanistic questions. There is a need to discover the role of Jim Crow and redlining as an explanation for lower economic and health returns of education and employment for Black employees than the returns for White employees. We expect larger MDRs and worse health of middle-class Black people who reside in states and counties with a higher history of Jim Crow and redlining. There is also a need to test the role of county-level job segregation as an explanation for lower health returns of education and employment for Black employees than the returns for White employee. We expect worse-than-expected health of middle-class Black people to be in part due to job segregation that in turn reduces the effects of education and employment on income. There is also a need to study the contribution of healthy food options

and parks and green areas that help people maintain health and wellness. In this regard, there is a need to assess the role of geography in altering the MDRs related to inequalities in obesity. There is also a need to test how policies such as minimum wage policies help equalize the health returns of education and employment for Black and White people. We expect smaller racial health disparities in middle-class in the presence of equitable policies, such as higher minimum-wage.

### Conclusion

In line with MDRs, obesity remains higher than expected in highly educated, employed, and high-income Black women than for White women who are at their reproductive age. Given the risk of medical conditions and risk to pregnancy, secondary to obesity, Black middle-class women at reproductive age remains at risk obesity, which imposes a health risk to their health and health of their babies. While these findings are probably due to structural racism and social stratification, multi-level research is needed on structural factors that reduce the health returns of SES for Black people. It is also unknown which policy can undo these inequalities.

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**Table 4:** Poisson regression estimates stratified by race.

	White NH (n=3656)			Black NH (n=2047)		
	M1	M2	M3	M1	M2	M3
	PR/ci95	PR/ci95	PR/ci95	PR/ci95	PR/ci95	PR/ci95
Age (Year)	1.03*** [1.02-1.03]	1.03*** [1.02-1.03]	1.03*** [1.02-1.03]	1.01*** [1.01-1.02]	1.01*** [1.01-1.02]	1.01*** [1.01-1.02]
Married	0.88* [0.79-0.99]	0.94 [0.84-1.06]	0.93 [0.83-1.06]	1.02 [0.93-1.13]	1.05 [0.95-1.17]	1.07 [0.96-1.19]
<b>Education %</b>						
Ref. >High School						
High School/GED	0.87 [0.73-1.03]	0.89 [0.75-1.06]	0.87 [0.73-1.06]	0.98 [0.85-1.13]	0.99 [0.87-1.14]	0.96 [0.83-1.10]
Some Col.	0.81** [0.69-0.94]	0.86 [0.74-1.00]	0.84* [0.71-1.00]	1.07 [0.95-1.21]	1.1 [0.98-1.24]	1.06 [0.94-1.19]
Col. Above	0.49*** [0.41-0.60]	0.57*** [0.47-0.70]	0.56*** [0.46-0.69]	0.9 [0.77-1.03]	0.95 [0.81-1.11]	0.92 [0.79-1.08]
<b>Income %</b>						
\$0-#34,999						
\$35,000-\$74,999		0.91 [0.81-1.03]	0.92 [0.80-1.05]		0.9 [0.82-1.00]	0.88* [0.79-0.98]
>75,000		0.70*** [0.60-0.83]	0.70*** [0.59-0.83]		0.86 [0.73-1.01]	0.83* [0.70-0.99]
Missing		0.92 [0.44-1.94]	0.79 [0.34-1.85]		0.62* [0.39-0.99]	0.61* [0.38-0.98]
Worked last week			1.01 [0.90-1.14]			1.08 [0.99-1.19]

U54 TR001627; CA201415-02, 5S21MD000103, R25 MD007610, 4P60MD006923, and 54MD008149.

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