

Association between skin tone and mental health status in the National Longitudinal Survey of

Youth 1997 cohort

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Abstract

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Background: While the relationship between race and mental health has been studied extensively, skin tone also contributes to social stratification and experiences of colorism can result in poor mental health. This study evaluated the association between skin tone, a proxy for colorism, and mental health status, and whether race and ethnicity modified the association.

Methods: This study used data from the National Longitudinal Survey of Youth 1997 cohort (N=2,177). Mental health was measured in 2010 with the Mental Health Inventory (MHI-5) which asks about mental health factors in the past month. Scores ranged from 0-15 with higher scores indicating worse mental health status. Mental health was evaluated continuously and dichotomously, using a cut point at 46. Interviewers identified skin tone in 2010 ranging from 1-10, with 1 as the lightest skin tone and 10 as the darkest. Skin tone was evaluated continuously and categorically (light skin tone (1); medium skin tone (2-4); and dark skin tone (5-10)).

Poisson and binomial regression analyses were used to compute prevalence ratios and relative

risks. Effect modification was assessed using a Wald test. Stratified models were used to compute stratum-specific PRs for racial and ethnic groups.

Results: For the continuous MHI-5 score, the prevalence of poor mental health was null among participants with medium skin tone and slightly lower among participants with dark skin tone compared to participants with light skin tone (PR=0.92, 95% CI=0.85,1.00). For the dichotomous MHI-5 score, the risk of poor mental health was lower for both medium and dark skin tones compared to light skin tone (medium vs. light: RR=0.83, 95% CI=0.68,1.02; dark vs. light: RR=0.88, 95% CI=0.68,1.14). The association was null after examining skin tone continuously for both continuous and dichotomous MHI-5 score. Race and ethnicity did not appear to modify the association (medium vs. light $p=0.98$; dark vs. light $p=0.99$). Post-hoc analyses of MHI-5 indicators and categorical skin tone produced mixed results for participants with dark skin tone.

Conclusion: The association between continuous MHI-5 score and skin tone was close to null or null. The association between dichotomous MHI-5 score and skin tone showed a protective effect for individuals with darker skin tones. Hypothesized protective factors for Black or African American individuals may also serve as protective factors for individuals with darker skin tones. Alternatively, in settings where individuals are around others with similar skin tones, perceived skin tone may not impact mental health to the same degree as other factors.

Introduction

In 2020, the Kaiser Family Foundation found that Black and Hispanic individuals reported experiencing mild, moderate, or severe mental illness as categorized by NSDUH (DSM-V) less often than White individuals (17%, 19%, and 26% respectively).¹ Similarly, the National Survey on Drug Use and Health found that in 2021, a higher percentage of White individuals reported experiencing any mental illness than Black, Hispanic, Native Hawaiian or other Pacific Islander, and Asian individuals. However, the percentage of multiracial individuals who reported experiencing any mental illness was significantly higher than White individuals (35% versus 24% respectively).²

Although the prevalence of mental illness has been lower in the past among Black and Hispanic individuals compared to White individuals,^{1,2} current evidence is inconclusive on whether Black and Hispanic individuals truly experience a lower risk of poor mental health outcomes. While some studies have not found differences in depression and mental illness between Black and White individuals,^{3,4} others found that Black and Hispanic individuals are at a higher risk of experiencing depressive symptoms.^{5,6} Some explanations for Black individuals experiencing a lower prevalence of mental illness and depression include certain protective factors, such as high self-esteem and religiosity, that may reduce their likelihood of depression.⁴ However, others hypothesize that racial and ethnic minorities are likely underdiagnosed due to flawed screening processes and structural barriers.^{1,5,6} Furthermore, racial and ethnic minorities may be reluctant to report poor mental health status to avoid disclosing an additional stigmatizing identity.⁷

Race has been explored extensively as a factor in social stratification in previous studies; however, skin tone can also contribute to social stratification and experiences of colorism have been linked to poor mental health outcomes.⁸ Colorism refers to the preferential treatment of individuals with lighter skin tones and more Eurocentric features over darker skin tones and less Eurocentric features.⁸ More generally, previous studies have shown that White individuals with darker skin have worse social outcomes, including incarceration, education, and mental health.⁸⁻

¹⁰ Examining mental health by race and ethnicity alone could mask the heterogeneity that exists within these groups. Previous studies have shown that Black individuals with darker skin tones experienced worse mental health outcomes, particularly depressive symptoms, when compared to Black individuals with lighter skin tones.^{11,12} This points to the Black-White paradox potentially being due in part to the aggregation of Black individuals with varying skin tones.⁸

This study aims to add to the current literature by evaluating the association between interviewer-identified skin tone and participant-reported mental health status among the 1997 National Longitudinal Survey of Youth (NLSY) cohort. While previous studies examining perceived colorism and mental health have generally focused on one racial or ethnic group, this study builds upon previous work by examining the association between skin tone and mental health status across multiple racial and ethnic groups. Additionally, skin tone was identified by interviewers in NLSY, which could mitigate social desirability bias that may be present with participant-reported skin tone. Using interviewer-identified skin tone can also provide valuable insight into the connection between others' perceptions of skin tone and self-reported mental health status. Perception of phenotypical characteristics impacts social interactions with others, potentially affecting mental health positively or negatively. Although race and ethnicity are different from skin tone, individuals with darker skin tones often experience higher levels of racial discrimination than their lighter skin tone counterparts, which may result in worse mental health for these individuals.

Mental health and skin tone have not yet been examined in the NLSY cohort, and this study will provide insight into the association between skin tone and mental health in a large, representative sample in the US. This work can inform future studies focused on mental health and call attention to the importance of examining colorism as a contributing factor to poor mental health status among racial and ethnic minorities. Additionally, this study examines how mental health differs between racial and ethnic groups as well as how individuals of varying skin tones differ within these groups, potentially capturing heterogeneity between individuals.

Methods

NLSY is a nationally representative prospective cohort study in the US that conducts annual interviews, either in person or via telephone, to collect information about participants' work, education, and health.¹³ Cross-sectional analyses were conducted for data collected in 2010 and demographic information collected at baseline in 1997.

The sampling of study subjects was completed in two phases. The first phase included the main cross-sectional sample with 6,748 participants at baseline. The second phase was a supplemental sample of Black and Hispanic or Latino individuals created by oversampling these groups and resulted in an additional 2,236 participants completing the baseline interview in 1997. In total, 8,984 individuals were initially enrolled in the study. Participants were aged between 13 and 17 years in 1997. Sample attrition from 1997 to 2010 was 16.8%. In 2010, 82.1% of the cross-sectional sample and 86.5% of the supplemental sample responded for an overall response rate of 83.2% (7,479 participants). Participants were aged between 25 and 31 years.

Primary Exposure

Skin tone was assessed by the interviewer using a 10-point color card ranging from 1 for the lightest skin tone to 10 for the darkest skin tone using a color card. Some individuals were assigned a value of 0 for skin tone. Per NLSY's recommendation, these individuals were treated the same as individuals assigned a 1. Skin tone was measured once for each participant and was collected in 2008, 2009, or 2010 depending on when participants were interviewed. If interviews were conducted via telephone, skin tone was not captured (n=78). Skin tone values across all three years were combined to maximize data availability. A new variable was created categorizing skin tone into three groups: light (1), medium (2-4), and dark (5-10). Skin tone was evaluated as both a continuous variable (1-10) and a categorical variable.

Primary Outcome

The five-item Mental Health Inventory (MHI-5) is a brief version of the 38-item MHI that assesses psychological well-being and distress. Previous studies have shown that the MHI-5 is a reliable instrument to assess mental health status and is comparable to the 38-item MHI instrument and other similar instruments, such as the General Health Questionnaire (GHQ-12) and Mental Health Component Summary Score (MCS).^{14,15}

Participants were asked five questions about their mental health in the past month, specifically “How much of the time during the last month have you: been a very nervous person?; felt calm and peaceful?; felt downhearted and blue?; been a happy person?; and felt so down in the dumps that nothing could cheer you up?” Participants selected one of the following response options for each indicator: 1) All of the time; 2) Most of the time; 3) Some of the time; 4) None of the time.

Responses were recoded to range from 0-3 instead of 1-4. Responses were also recoded for questions 1, 3, and 5 to reflect a higher score for worse mental health factors. All responses were added together into one overall MHI-5 score ranging from 0-15, with a higher score indicating worse mental health status. MHI-5 was also evaluated as a dichotomous variable using a cut-point of ≥ 46 to indicate worse mental health status after standardizing the overall score to 0-100. Standardization was performed using the following formula: $MHI-5 \text{ score} = 100 \times ((Q1 \text{ score} + Q2 \text{ score} + Q3 \text{ score} + Q4 \text{ score} + Q5 \text{ score}) - 0) / 15$. While there is no validated cut-point for the four-point Likert scale used in this study, previous studies using this dataset have implemented 46 as a cut-point to detect moderate depressive symptoms.¹⁶⁻¹⁸

Effect Modifier

Race and ethnicity were captured at baseline and again in 2006. In both rounds, participants were asked to choose one of the following response options: White; Black or African American; American Indian, Eskimo, or Aleut (referred to as American Indian or Alaskan Native

(AI/AN)); Asian or Pacific Islander; Something else (referred to as Another Race). Fewer participants were interviewed in 2006 (7,889), so baseline race and ethnicity were used instead. The five race categories were combined with another dichotomous variable that asked if participants were Hispanic or Latino (e.g., White Hispanic, White non-Hispanic). Due to sample size limitations, only four categories were used: White Hispanic; White non-Hispanic; Another Race non-Hispanic; and Another Race Hispanic. Another Race included American Indian or Alaskan Native, Asian or Pacific Islander, Another Race, and Black or African American individuals. Race and ethnicity were included as an effect modifier because the association between skin tone and mental health was thought to vary by racial and ethnic identity.

Covariates

Age, sex, participant immigration status, parent immigration status, parent acculturation percentage, household income status, interview season, interview region, and interviewer race and ethnicity were included as covariates in the models. All covariates were included as confounders as they were believed to affect skin tone and mental health status.

Age was measured in years at the time of the interview in 2010 when participants were aged 25-31 years. Sex was measured in 1997 and participants were asked to choose either female or male.

Parent and participant immigration status were measured in 1997 and are dichotomous variables that asked if the parent or participant was born in the US. These variables were included because there is evidence that children of immigrants, who are either immigrants themselves or born in the US, may be more likely to experience poor mental health outcomes.^{19,20}

Parent acculturation percentage was calculated by dividing the number of years in the US by the responding parent's age in 2010 to obtain a percentage of their life spent in the US by 2010. Similar to immigration status, an acculturation gap has been shown to increase the

likelihood of poor mental health among US second-born generations.²¹ Parents born in the US were given a value of 100%.

Household income status was measured in 1997 and is a ratio comparing the gross household income to the federal poverty level for the previous year, accounting for household size. This variable was dichotomized to represent households below and above the poverty level. Living in a low-income household through childhood has been shown to contribute to poor mental health status.^{22,23}

The season the interview was conducted was captured in 2010 and included three seasons: winter, spring and summer, and fall. The region of the interview was measured in 2010 and included four Census regions: Northeast, North Central, South, and West.

Interviewer race and ethnicity were measured in 2010 and interviewers selected one of the following response options: White; Black or African-American; American Indian, Eskimo, or Aleut (referred to as AI/AN); Asian or Pacific Islander; Other race (referred to as Another Race); or Multiracial. This was combined with a separate dichotomous variable that asked if the interviewer was Hispanic or Latino. However, all Hispanic individuals identified as White and after excluding incomplete cases, there were four categories: White Hispanic; White non-Hispanic; Another Race non-Hispanic; and Another Race non-Hispanic

Other variables, such as participant income in 2010 and education, were not included as covariates due to their potential status as a mediator between skin tone and mental health status.

Data Analysis

Descriptive statistics are presented as weighted means and standard deviations for continuous variables and weighted percentages and sample size for categorical variables. Each variable was stratified by skin tone (light, medium, or dark). Per NLSY's recommendations, weighted percentages, means, and standard deviations were calculated using the baseline

cumulative case survey weights provided by NLSY that adjusted for the oversampling of Black and Hispanic individuals.²⁴

Poisson regression was used to evaluate the MHI-5 score as a continuous variable and skin tone both continuously and categorically. Per NLSY's recommendations, survey weights were not applied to any regression models.²⁴ Binomial regression was used to evaluate the MHI-5 score as a dichotomous variable and skin tone both continuously and categorically. Unadjusted and adjusted models were used for each version of the MHI-5 outcome and skin tone exposure. The adjusted model controlled for participant age, participant sex, participant immigration status, parent immigration status, parent acculturation percentage, household income status, interview season, interview region, and interviewer race and ethnicity.

The adjusted models were also evaluated for effect modification by race and ethnicity. Stratum-specific PRs were calculated by using stratified Poisson regression models, adjusting for all covariates, and using the continuous MHI-5 score and categorical skin tone.

Results

This study included 2,177 individuals. 6,807 (76%) individuals were excluded due to missing values for one or more of the variables (Figure 1). Descriptive statistics for the sample are provided in Table 1. The mean age of participants in 2010 was 28 years and participants were mostly White non-Hispanic (71%), born in the US (98%), had a responding parent who was born in the US (91%), and lived in a household with an income above the federal poverty level in 1997 (85%). Approximately 27% of participants had light skin tone (n=590), 53% had medium skin tone (n=1,161), and 20% had dark skin tone (n=426). Skin tone is presented continuously in Figure 2. Participants had an average continuous MHI-5 score of 4.2 on a scale of 0-15 and most participants had a dichotomous MHI-5 score below the cut point of 46 after standardizing MHI-5 scores to 0-100 (82%).

Results from the unadjusted and adjusted Poisson and binomial regression models are presented in Table 2 and Figure 3. When examining MHI-5 continuously, the prevalence of a participant reporting poor mental health status (higher MHI-5 score) was slightly lower among participants with darker skin tones compared to light skin tone (medium vs. light: PR=0.94, 95% CI=0.90, 1.00; dark vs. light: PR=0.93, 95% CI=0.86, 1.00). After adjusting for all covariates, the prevalence of poor mental health status (higher MHI-5 score) was also slightly lower among participants with dark skin tone compared to participants with light skin tone (PR=0.92, 95% CI=0.85, 1.00). The association was close to null when comparing participants with medium skin tone to those with light skin tone. The association was also null for the unadjusted and adjusted models using continuous skin tone.

After using a cut point of 46, the risk of a participant with medium skin tone reporting poor mental health status (MHI-5 score >46) was lower compared to participants with light skin tone (RR=0.81, 95% CI=0.66,1.00). The risk of a participant with dark skin tone reporting poor mental health status was also slightly lower compared to participants with light skin tone (RR=0.91, 95% CI=0.66, 1.25). The association was null when examining skin tone continuously. After adjusting for all covariates, the risk of a participant reporting poor mental health status was lower for both medium and dark skin tones (medium vs. light: RR=0.83, 95% CI=0.68, 1.02; dark vs. light: RR=0.88, 95% CI=0.68, 1.14). However, all models had confidence intervals that included or crossed 1. The association was null when examining skin tone continuously and adjusting for the same covariates.

None of the models found that a participant's self-reported race and ethnicity modified the association between skin tone and poor mental health status. Wald test p-values and stratum-specific PRs from the stratified models are presented in Table 3.

Post-hoc analyses were performed to examine the association between skin tone and each of the MHI-5 indicators using Poisson regression and the continuous version of skin tone. The decision to evaluate these additional outcomes was made after the initial analysis was

completed and was not part of the *a priori* analysis plan. Findings for the post-hoc analyses are presented in Table 4 and Figure 3. The prevalence of feeling calm and peaceful less often in the past month was slightly lower for individuals with medium skin tone (PR=0.96, 95% CI=0.92, 1.01) and lower for participants with dark skin tone (PR=0.87, 95% CI=0.82, 0.94) when compared to participants with light skin tone and holding all covariates constant. The association between feeling happy and skin tone was null for both medium and dark skin tones. Participants with medium skin tone reported a lower prevalence of feeling downhearted and blue and nervous in the past month (downhearted and blue: PR=0.91, 95% CI=0.75, 1.09; nervous: PR=0.91, 95% CI=0.92, 1.05) compared to participants with light skin tone. Participants with dark skin tone also reported a lower prevalence of feeling downhearted and blue and nervous (downhearted and blue: PR=0.96, 95% CI=0.85, 1.08; nervous: PR=0.79, 95% CI=0.69, 0.91). The prevalence of feeling down in the dumps more often in the past month was lower for participants with medium skin tone (PR=0.93, 95% CI=0.85, 1.02), but higher for participants with dark skin tone (PR=1.17, 95% CI=0.94, 1.46).

Discussion

When evaluating MHI-5 continuously, the association with skin tone was close to null or null. When evaluating MHI-5 dichotomously, the association with skin tone showed a protective effect for individuals with darker skin tones. This differs from other studies that found worse mental health outcomes among individuals with darker skin tones. While there is some evidence showing that individuals with medium skin tones may experience a protective effect against poor mental health outcomes⁸, individuals with the darkest skin tones consistently experienced poorer mental health outcomes in most studies.^{8,12,25} However, these studies examined only one racial or ethnic group. Perhaps when individuals from multiple racial and ethnic groups are included, the hypothesized protective factors for Black or African American individuals, such as high self-esteem, also serve as protective factors for individuals with darker skin tones. It is also possible

that skin tone may not affect mental health to the same degree as other factors in certain settings. For example, if individuals live in areas where those around them have similar skin tones, other factors, such as perceived discrimination,²⁵ may impact mental health more than skin tone. Furthermore, previous studies have shown that ingroup colorism is an important driver of health outcomes, sometimes even more so than outgroup colorism.^{8,11,26} Perceived skin tone may influence mental health to a greater degree in settings where individuals of the same race or ethnicity are being compared versus individuals of different racial or ethnic identities.

A few reasons may explain the null or close-to-null findings, particularly when evaluating skin tone continuously. There was limited variability in skin tone among study participants. Over half of the participants were assigned one of the lightest skin tone values (0-3), which resulted in fewer participants being categorized as having dark skin tones. The dark skin tone group represents respondents with both medium to dark skin tones and this heterogeneity may make it difficult to detect effects clearly. Additionally, when MHI-5 indicators were evaluated individually in the post-hoc analyses, the associations were null for some indicators while others showed either a detrimental or protective effect for individuals with darker skin tones. For example, the prevalence of feeling nervous more frequently and calm less often in the past month was lower for participants with dark skin tone compared to participants with light skin tone but the prevalence of feeling down in the dumps more frequently was higher for the same group. Since the total MHI-5 index averages these individual indicators, a null result is not surprising.

Race and ethnicity did not appear to modify the association between skin tone and mental health status. However, the study sample consisted of mainly White non-Hispanic individuals, even after NLSY oversampled Hispanic and Black individuals. There were very few American Indian or Alaskan Native (n=61) and Asian or Pacific Islander individuals (n=160). As a result, some racial and ethnic groups were combined due to small sample sizes. This limited the study's ability to evaluate race and ethnicity as an effect modifier because fewer groups were included, which may have missed some of the differences that exist between racial and ethnic groups.

This study was limited by the amount of missingness that was present, which potentially contributed to null findings by eliminating the ability to evaluate potential heterogeneity across skin tones and racial and ethnic groups. Skin tone was only measured once for each participant, which did not capture potential variations throughout the year. Additionally, skin tone was only reported by the interviewer, which did not allow for an inter-rater reliability calculation. Previous studies found discrepancies between interviewer-assessed skin tone, particularly when examining differences in skin tone classification by interviewer race and ethnicity.^{27,28} For example, Hannon and DeFina found that Black or African American respondents were three to four times more likely to be classified as having darker skin by a White non-Hispanic interviewer compared to those with a Black or African interviewer.²⁸ In the NLSY 2010 round, 77% of interviewers identified as White non-Hispanic, which could have impacted skin tone classifications of darker skin tones. Furthermore, participant-reported skin tone was not collected. As the sociologist Ellis Monk points out, participant-reported skin tone is also important since perception of one's skin tone can influence health outcomes, including mental health.⁸ It is also imperative to measure perceived colorism and discrimination in addition to skin tone as measuring skin tone alone may not fully capture its impact on health.^{8,29} Although covariates were carefully considered, there is potential unmeasured confounding, such as perceived discrimination and residential segregation. Finally, social desirability bias could have been present since interviewers asked participants sensitive questions about mental health that could be influenced by social, cultural, and/or religious norms.

Despite these limitations, this study also had some strengths. Data from NLSY offered a nationally representative sample. Although conducting a complete case analysis resulted in missingness for the covariates included, the sample was still relatively large with over 2,000 participants. The covariates adjusted for are not on the causal pathway, meaning that no mediators were included in the analyses. This study also examined mental health at a critical age. In 2015, 20.9% of adults aged 26 to 49 years experienced a mental illness, which increased to

33.7% in 2021.^{2,30} This same age group also consistently reported higher percentages of mental illness compared to other age groups.^{2,30} This study assessed mental health when participants were aged between 25 and 31 years. Given the consistently rising trend in mental illness and worse outcomes among this age group, this study offers valuable information about mental health status during a key life phase.

Research that evaluates mental health at multiple time points may help us better understand how skin tone can impact mental health over the life course. Recruiting more participants of various racial and ethnic identities would strengthen the ability to determine if the association between skin tone and mental health is modified by race and ethnicity. Furthermore, skin tone should be reported by both the participant and interviewer given that the interviewer's race and ethnicity can impact the classification of participants' skin tone. Future studies should focus on evaluating the impact of skin tone and perceived discrimination, both ingroup and outgroup, to provide more context about factors that could impact mental health.

Tables and Figures

Figure 1. Sample size flowchart, depicting missing observations after each variable was added to the models.

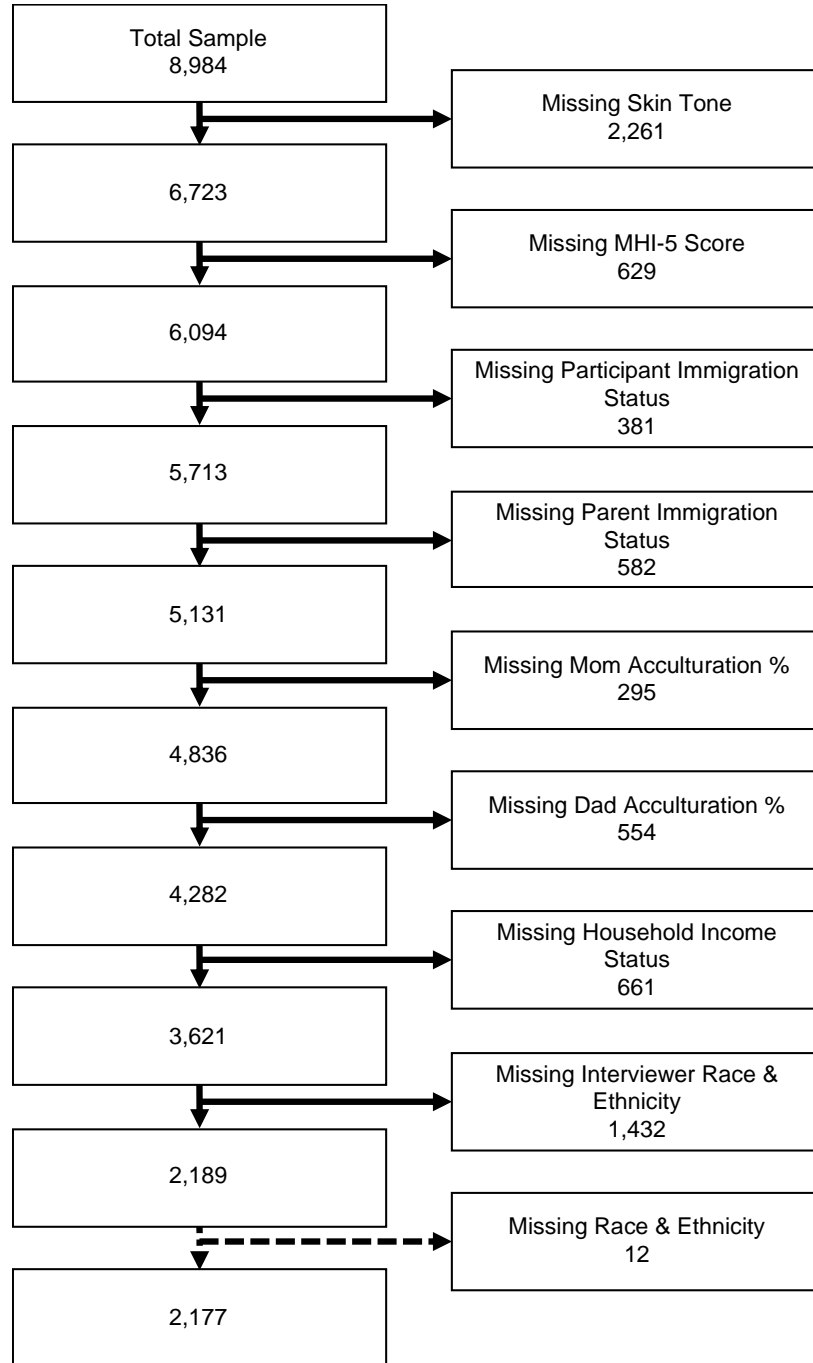


Figure 2. Histogram of continuous skin tone with 1 as the lightest skin tone and 10 as the darkest skin tone.

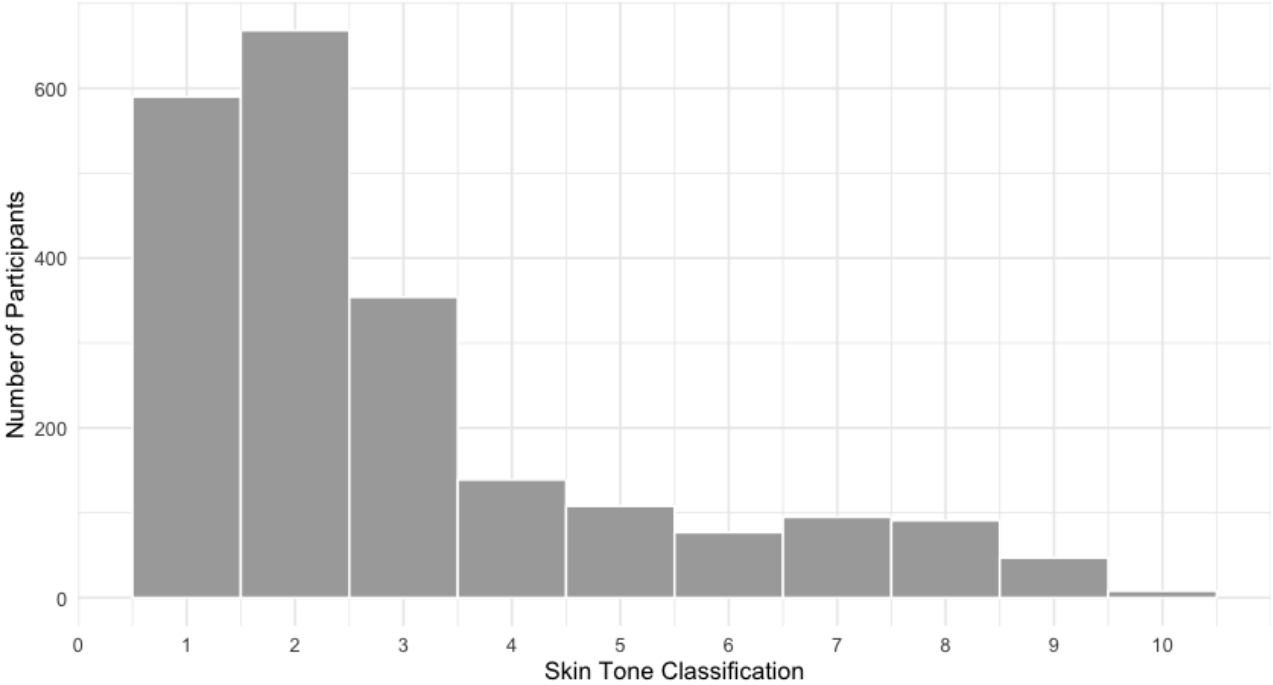


Table 1. Descriptive statistics of the National Longitudinal Survey of Youth 1997 cohort.

	Skin Tone Group							
	Light ¹ n = 590		Medium ² n = 1,161		Dark ³ n = 426		Total N = 2,177	
	n/mean	SD/% ⁴	n/mean	SD/% ⁴	n/mean	SD/% ⁴	n/mean	SD/% ⁴
Mean age (years) ±SD	27.9	±1.4	27.9	±1.4	28.0	±1.4	27.9	±1.4
Sex								
Female	311	54.0%	584	49.1%	222	50.9%	1117	50.9%
Male	279	46.0%	577	50.9%	204	49.1%	1060	49.1%
Participant race								
American Indian or Alaskan Native	5	0.8%	13	1.0%	2	0.9%	20	0.9%
Another race	31	3.5%	195	10.3%	28	8.0%	254	7.8%
Asian or Pacific Islander	2	0.4%	25	2.7%	1	0.5%	28	1.7%
Black or African American	0	0.0%	83	3.9%	361	77.6%	444	11.6%
White	552	95.3%	845	82.0%	34	13.0%	1431	78.0%
Participant ethnicity								
Hispanic	73	6.6%	360	17.3%	46	10.3%	479	12.9%
Not Hispanic	517	93.4%	801	82.7%	380	89.7%	1698	87.1%
Participant race & ethnicity								
Another race, Hispanic ⁵	23	1.8%	190	8.8%	29	6.3%	242	6.2%
Another race, non-Hispanic ⁵	15	2.9%	126	9.2%	363	80.8%	504	15.8%
White, non-Hispanic	502	90.5%	675	73.5%	17	8.9%	1194	71.3%
White, Hispanic	50	4.8%	170	8.5%	17	4.1%	237	6.8%
Participant immigration status								
Born in US	574	97.8%	1073	95.4%	416	97.5%	2063	96.4%
Born outside US	16	2.2%	88	4.6%	10	2.5%	114	3.6%
Mean parent acculturation % ±SD⁶								
Father	98.4%	±9.2%	94.8%	±15.1%	96.8%	±11.8%	96.2%	±13.1%
Mother	98.6%	±8.6%	95.2%	±14.2%	96.9%	±11.4%	96.5%	±12.3%
Parent immigration status								
Born in US	554	96.2%	931	87.5%	389	92.0%	1874	90.9%
Born outside US	36	3.8%	230	12.5%	37	8.0%	303	9.1%
Interviewer race								
Another Race	12	1.9%	30	1.6%	5	0.9%	47	1.6%
Black or African American	67	11.0%	94	7.3%	106	27.4%	267	11.0%
White	511	87.1%	1037	91.0%	315	71.7%	1863	87.4%
Interviewer ethnicity								
Hispanic	94	15.5%	151	9.1%	23	4.7%	268	10.7%
Not Hispanic	496	84.5%	1010	90.9%	403	95.3%	1909	89.3%
Interviewer race & ethnicity								
Another race, non-Hispanic	12	1.9%	30	1.6%	5	0.9%	47	1.6%
Black, non-Hispanic	67	11.0%	94	7.3%	106	27.4%	267	11.0%
White, Hispanic	94	15.5%	151	9.1%	23	4.7%	268	10.7%
White, non-Hispanic	417	71.6%	886	81.9%	292	66.9%	1595	76.7%
Household income status								
Below poverty threshold	60	8.6%	243	14.8%	156	32.2%	459	14.9%
Not below poverty threshold	530	91.4%	918	85.2%	270	67.8%	1718	85.1%
Season								
Winter	173	30.0%	339	29.8%	130	31.2%	642	30.0%
Spring & Summer	21	3.5%	43	4.0%	16	4.2%	80	3.9%
Autumn	396	66.5%	779	66.2%	280	64.6%	1455	66.1%
Region								
Northeast	179	31.4%	130	10.9%	64	12.5%	373	17.9%
North Central	116	20.8%	369	38.0%	51	12.0%	536	29.1%
South	137	22.7%	289	23.8%	272	65.4%	698	28.5%
West	158	25.1%	373	27.3%	39	10.1%	570	24.5%
Dichotomous MHI-5 score⁷								
≤46	473	79.9%	974	84.2%	348	81.2%	1795	82.4%
>46	117	20.1%	187	15.8%	78	18.8%	382	17.6%
Mean MHI-5 score ±SD	4.4	±2.4	4.2	±2.2	4.1	±2.6	4.2	±2.3

¹Light skin tone includes individuals assigned a skin tone value of 1²Medium skin tone includes individuals assigned a skin tone value of 2-4³Dark skin tone includes individuals assigned a skin tone value of 5-10⁴Weighted percentage⁵Includes American Indian or Alaskan Native, Asian or Pacific Islander, Another Race, and Black or African American individuals⁶Calculated using the following formula: years in the US / parent age⁷Calculated using the following formula after recoding indicator scores to 0-3: 100 x ((total MHI-5 score) – 0)/15

Table 2. Poisson and binomial regression models examining association between skin tone and MHI-5 score.

	Categorical Skin Tone ¹						Continuous Skin Tone		
	Medium vs Light			Dark vs Light			PR	95% CI	P
	PR	95% CI	P	PR	95% CI	P	PR	95% CI	P
MHI-5 Continuous²									
Unadjusted	0.94	0.90, 1.00	0.04	0.93	0.86, 1.00	<0.05	0.99	0.98, 1.00	0.19
Adjusted ³	0.96	0.91, 1.01	0.11	0.92	0.85, 1.00	0.04	0.99	0.98, 1.00	0.17
	RR	95% CI	P	RR	95% CI	P	RR	95% CI	P
MHI-5 Dichotomous²									
Unadjusted	0.81	0.66, 1.00	0.05	0.91	0.66, 1.25	0.54	1.01	0.96, 1.05	0.76
Adjusted ³	0.83	0.68, 1.02	0.09	0.88	0.68, 1.14	0.34	1.00	0.96, 1.04	0.89

¹Light skin tone used as referent group

²Sample size = 2,177

³Adjusted for age, sex, region, season, immigration status, parent immigration status, parent acculturation percentage, household income status, participant race and ethnicity, and interviewer race and ethnicity

Table 3. Stratified Poisson regression models evaluating the association between skin tone and continuous MHI-5 score across racial and ethnic groups and Wald test p-values for effect modification models.

	n	Skin Tone ¹					
		PR	Medium vs. Light 95% CI	P	PR	Dark vs. Light 95% CI	P
Another Race, Hispanic	242						
Unadjusted		0.94	0.71, 1.25	0.67	0.86	0.59, 1.24	0.42
Adjusted ²		0.94	0.72, 1.23	0.65	0.88	0.61, 1.27	0.49
Another Race, non-Hispanic	504						
Unadjusted		1.01	0.73, 1.39	0.96	0.92	0.67, 1.27	0.62
Adjusted ²		1.04	0.74, 1.46	0.92	0.95	0.68, 1.32	0.75
White, Hispanic	237						
Unadjusted		0.95	0.81, 1.11	0.52	0.82	0.62, 1.09	0.18
Adjusted ²		0.96	0.82, 1.12	0.62	0.84	0.63, 1.11	0.22
White, non-Hispanic	1,194						
Unadjusted		0.94	0.88, 1.00	<0.05	1.02	0.74, 1.42	0.89
Adjusted ²		0.95	0.89, 1.01	0.11	1.02	0.74, 1.39	0.92
Adjusted Model² x Race & Ethnicity Wald Test	2,177	-	-	0.98	-	-	0.99

¹Light skin tone used as referent group

²Adjusted for age, sex, region, season, immigration status, parent immigration status, parent acculturation percentage, household income status, and interviewer race and ethnicity

Table 4. Post-hoc analysis using Poisson regression to examine the association between skin tone and individual MHI-5 indicators.

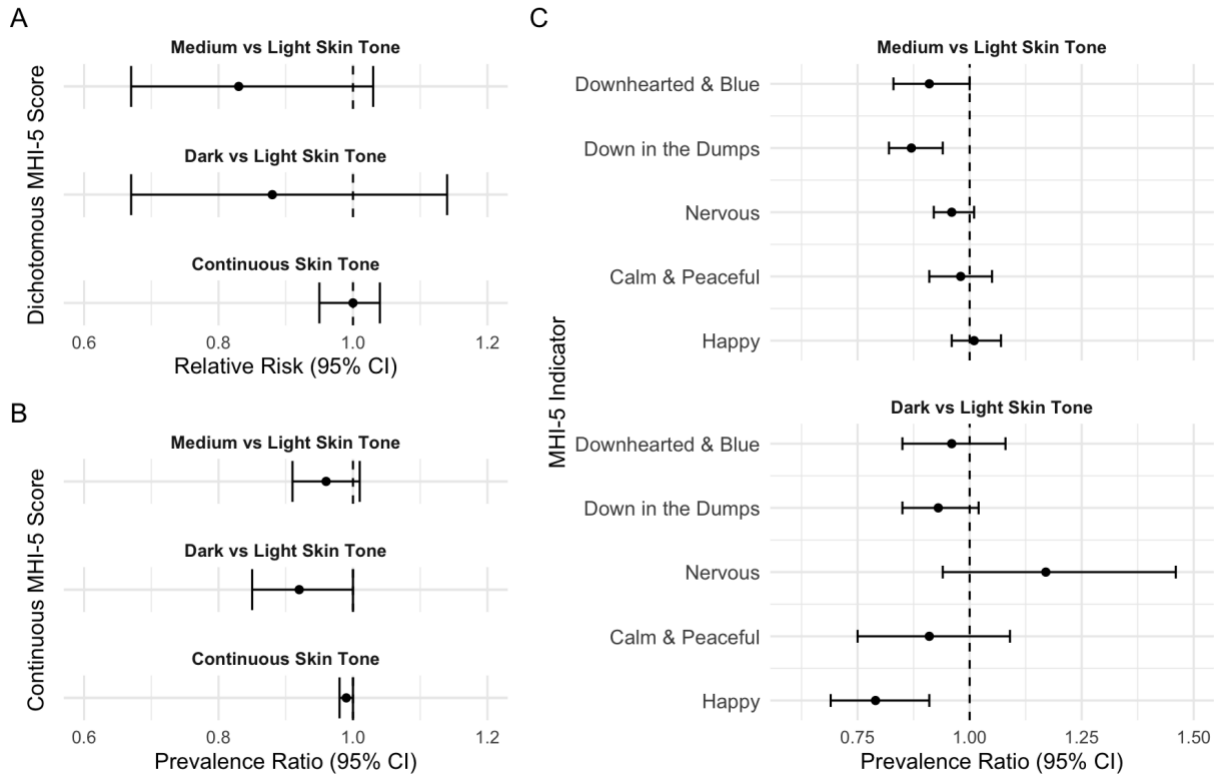
MHI-5 Indicator	Skin Tone ¹					
	Medium vs. Light			Dark vs. Light		
	PR	95% CI	P	PR	95% CI	P
Nervous²						
Unadjusted	0.90	0.82, 0.99	0.02	0.80	0.70, 0.91	<0.001
Adjusted ³	0.91	0.83, 1.00	0.05	0.79	0.69, 0.91	<0.001
Calm and peaceful²						
Unadjusted	0.95	0.91, 0.99	0.02	0.87	0.81, 0.93	<0.001
Adjusted ³	0.96	0.92, 1.01	0.12	0.87	0.82, 0.94	<0.001
Downhearted and blue²						
Unadjusted	0.91	0.76, 1.09	0.32	1.27	1.03, 1.57	0.03
Adjusted ³	0.91	0.75, 1.09	0.3	1.17	0.94, 1.46	0.17
Happy²						
Unadjusted	1.00	0.95, 1.05	0.94	0.97	0.91, 1.04	0.43
Adjusted ³	1.01	0.91, 1.05	0.66	0.98	0.91, 1.05	0.53
Down in the dumps²						
Unadjusted	0.91	0.83, 0.99	0.03	0.97	0.86, 1.09	0.59
Adjusted ³	0.93	0.85, 1.02	0.11	0.96	0.85, 1.08	0.49

¹Light skin tone used as referent group

²Sample size = 2,177

³Adjusted for age, sex, region, season, immigration status, parent immigration status, parent acculturation percentage, household income status, and interviewer race and ethnicity

Figure 4. Forest plots of A) relative risks and 95% confidence intervals (CI) for log binomial regression models with dichotomous MHI-5 score and categorical and continuous skin tone, B) prevalence ratios and 95% CI for Poisson regression models with continuous MHI-5 score and categorical and continuous skin tone, and C) prevalence ratios and 95% CI for Poisson regression models of continuous MHI-5 indicators and categorical skin tone. All models adjusted for age, sex, region, season, immigration status, parent immigration status, parent acculturation percentage, household income status, and interviewer race and ethnicity.



References

1. Panchal N, Saunders H, Published NN. Five Key Findings on Mental Health and Substance Use Disorders by Race/Ethnicity. KFF. Published September 22, 2022. Accessed December 4, 2023. <https://www.kff.org/mental-health/issue-brief/five-key-findings-on-mental-health-and-substance-use-disorders-by-race-ethnicity/>
2. Key Substance Use and Mental Health Indicators in the United States: Results from the 2021 National Survey on Drug Use and Health. Published online 2021.
3. LaMotte ME, Elliott M, Mouzon DM. Revisiting the Black-White Mental Health Paradox During the Coronavirus Pandemic. *J Racial Ethn Health Disparities*. Published online November 28, 2022:1-14. doi:10.1007/s40615-022-01457-6
4. Pamplin JR, Bates LM. Evaluating hypothesized explanations for the Black-white depression paradox: A critical review of the extant evidence. *Soc Sci Med*. 2021;281:114085. doi:10.1016/j.socscimed.2021.114085
5. Mossakowski KN. Dissecting the Influence of Race, Ethnicity, and Socioeconomic Status on Mental Health in Young Adulthood. *Res Aging*. 2008;30(6):649-671. doi:10.1177/0164027508322693
6. López N, Vargas E, Juarez M, Cacari-Stone L, Bettez S. What's Your "Street Race"? Leveraging Multidimensional Measures of Race and Intersectionality for Examining Physical and Mental Health Status among Latinxs. *Sociol Race Ethn*. 2018;4(1):49-66. doi:10.1177/2332649217708798

7. Krill Williston S, Martinez JH, Abdullah T. Mental health stigma among people of color: An examination of the impact of racial discrimination. *Int J Soc Psychiatry*. 2019;65(6):458-467. doi:10.1177/0020764019858651
8. Monk EP. The Cost of Color: Skin Color, Discrimination, and Health among African-Americans. *Am J Sociol*. 2015;121(2):396-444. doi:10.1086/682162
9. Branigan AR, Wildeman C, Freese J, Kiefe CI. Complicating Colorism: Race, Skin Color, and the Likelihood of Arrest. *Socius Sociol Res Dyn World*. 2017;3:237802311772561. doi:10.1177/2378023117725611
10. King RD, Johnson BD. A Punishing Look: Skin Tone and Afrocentric Features in the Halls of Justice. *Am J Sociol*. 2016;122(1):90-124. doi:10.1086/686941
11. Oh H, Lincoln K, Waldman K. Perceived colorism and lifetime psychiatric disorders among Black American adults: findings from the National Survey of American Life. *Soc Psychiatry Psychiatr Epidemiol*. 2021;56(8):1509-1512. doi:10.1007/s00127-021-02102-z
12. Louie P. Revisiting the Cost of Skin Color: Discrimination, Mastery, and Mental Health among Black Adolescents. *Soc Ment Health*. 2020;10(1):1-19. doi:10.1177/2156869318820092
13. NLSY97 Data Overview : U.S. Bureau of Labor Statistics. Accessed September 25, 2023. <https://www.bls.gov/nls/nlsy97.htm>
14. Kelly MJ, Dunstan FD, Lloyd K, Fone DL. Evaluating cutpoints for the MHI-5 and MCS using the GHQ-12: a comparison of five different methods. *BMC Psychiatry*. 2008;8:10. doi:10.1186/1471-244X-8-10

15. Rivera-Riquelme M, Piqueras JA, Cuijpers P. The Revised Mental Health Inventory-5 (MHI-5) as an ultra-brief screening measure of bidimensional mental health in children and adolescents. *Psychiatry Res.* 2019;274:247-253. doi:10.1016/j.psychres.2019.02.045
16. LeMasters K, Ross RK, Edwards JK, et al. Mass Probation: Effects of Sentencing Severity on Mental Health for Black and White Individuals. *Epidemiology.* 2024;35(1):74. doi:10.1097/EDE.0000000000001678
17. Thorsen SV, Rugulies R, Hjarsbech PU, Bjorner JB. The predictive value of mental health for long-term sickness absence: the Major Depression Inventory (MDI) and the Mental Health Inventory (MHI-5) compared. *BMC Med Res Methodol.* 2013;13(1):115. doi:10.1186/1471-2288-13-115
18. Theunissen marie José, Jansen M, Gestel A. Are mental health and binge drinking associated in Dutch adolescents? Cross-sectional public health study. *BMC Res Notes.* 2011;4:100. doi:10.1186/1756-0500-4-100
19. Mossakowski KN. Are Immigrants Healthier? The Case of Depression among Filipino Americans. *Soc Psychol Q.* 2007;70(3):290-304.
20. Vargas ED, Winston NC, Garcia JA, Sanchez GR. Latina/o or Mexicana/o?: The Relationship between Socially Assigned Race and Experiences with Discrimination. *Sociol Race Ethn Thousand Oaks Calif.* 2016;2(4):498-515. doi:10.1177/2332649215623789
21. Kim SY, Schwartz SJ, Perreira KM, Juang LP. Culture's Influence on Stressors, Parental Socialization, and Developmental Processes in the Mental Health of Children of Immigrants. *Annu Rev Clin Psychol.* 2018;14(1):343-370. doi:10.1146/annurev-clinpsy-050817-084925

22. Sorhagen NS, Wurster TJ. Income within context: relative income matters for adolescent social satisfaction and mental health. *J Child Psychol Psychiatry*. 2017;58(6):736-743. doi:10.1111/jcpp.12695
23. Fryers T, Melzer D, Jenkins R, Brugha T. The distribution of the common mental disorders: social inequalities in Europe. *Clin Pract Epidemiol Ment Health CP EMH*. 2005;1:14. doi:10.1186/1745-0179-1-14
24. Sample Weights & Design Effects | National Longitudinal Surveys. Accessed May 12, 2024. <https://www.nlsinfo.org/content/cohorts/nlsy97/using-and-understanding-the-data/sample-weights-design-effects>
25. Fattore GL, Amorim LD, dos Santos LM, dos Santos DN, Barreto ML. Personal-Level and Group-Level Discrimination and Mental Health: the Role of Skin Color. *J Racial Ethn Health Disparities*. 2018;5(5):1033-1041.
26. Monk EP. Colorism and Physical Health: Evidence from a National Survey. *J Health Soc Behav*. 2021;62(1):37-52. doi:10.1177/0022146520979645
27. Hill M. Race of the Interviewer and Perception of Skin Color: Evidence from the Multi-City Study of Urban Inequality. *Am Sociol Rev*. 2002;67(1):99-108.
28. Hannon L, DeFina R. Just Skin Deep? The Impact of Interviewer Race on the Assessment of African American Respondent Skin Tone. *Race Soc Probl*. 2014;6(4):356-364. doi:10.1007/s12552-014-9128-z
29. Harvey RD, Tennial RE, Hudson Banks K. The Development and Validation of a Colorism Scale. *J Black Psychol*. 2017;43(7):740-764. doi:10.1177/0095798417690054

30. Hedden SL, Kennet J, Lipari R, et al. Key Substance Use and Mental Health Indicators in the United States: Results from the 2015 National Survey on Drug Use and Health.

Published online 2015.

Appendix

Figure 4. The color card used by National Longitudinal Survey of Youth interviewers to assign skin tone values to participants.

