



Research Paper: Social Determinants of Delayed Gratification Among American Children



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Running Title Ethnicity, Socioeconomic Status, and Delay Discounting

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ABSTRACT

Background: A wide array of Socioeconomic Status (SES) indicators show differential effects for the members of diverse social groups. Researchers know a little about the ethnic variation and the effects of family income on delay discounting which is the predictor of risk behaviors.

Objectives: This study examined the effect of family income and its differences on delayed gratification between Latino and non-Latino children.

Materials & Methods: In this cross-sectional analytical study, data came from wave one of the Adolescent Brain Cognitive Development (ABCD) study which included 3903 non-Latino or Latino Black or White American children who are between 9 and 10 years old. The predictor was family income. Data were collected from 21 sites in the US, in 2018. The outcome was the children's delay discounting. We measured delay discounting, which reflected individuals' tendency to assign less value to remote outcomes and rewards (inversely correlated with delayed gratification). Data analysis was done by linear regression in SPSS V. 22.

Results: According to our pooled sample regression, higher family income was associated with lower children delay discounting (Beta=-0.05, P=0.021). We found a significant interaction between family income and ethnicity, suggesting that the association between family income and delay discounting is stronger for Latino compared with non-Latino children (Beta=-0.09, P=0.043).

Conclusion: Not all ethnic disparities are due to socioeconomic status gaps. Across diverse social groups, differential returns of socioeconomic status indicators, such as family income, also contribute to ethnic disparities in health.

Keywords: Impulsivity behavior; Income; Population groups

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Highlights

- Although family income has positive effects on children's health, this effect may differ for Latino and non-Latino individuals.

Introduction

A wide range of socioeconomic status (SES) indicators such as family income are protective against high-risk behaviors [1]. Children from high-income families show lower high-risk behaviors [1]. The inverse association between family income and aggression, tobacco use, sex, alcohol, and drug use, suggests that family income is one of the most robust and salient protective factors against many risk behaviors [1]. Family income may be one of the mediators and explanatory factors for low-risk behaviors of children from highly educated families [2].

How an SES indicator alters the living conditions and outcomes of populations and individuals may, however, vary across demographic groups [3]. That is, the real-world effects of SES indicators such as education depend on ethnicity, race, and place, suggesting that ethnicity, resources, and place interact with one another in how they alter health and behaviors [4]. For example, the effects of income may depend on what people can purchase and what services people can receive in the exchange of such income [5]. In other words, if due to poor density of resources in the area, access to services and goods are limited, in part due to residential segregation, high-income people would still not report high self-reported health [6].

As shown recently by a growing body of research [7, 8], SES indicators such as family income generate less health and poorly promote positive health behaviors for Black and Latino families than White and non-Latino ones [9]. For example, SES indicators such as family income increase the time of childbearing [10], place of living [11], exercise frequency [12], stress [13], living conditions [14], economic well-being [15], and health [16] more among non-Latino White people than Latino and Black individuals. All these studies suggest that high SES Latino and Black children and adults may remain at risk in part because the protective effects of SES decrease in contexts in which resources are limited [17]. The privileged group can leverage available resources to secure measurable and tangible health outcomes, while

the disadvantaged and marginalized group fails to successfully navigate the system [10].

Research has recently proposed Marginalization-Related Diminished Returns (MDRs) defined as weaker health effects of SES indicators for Black and Latino than White and non-Latino families [7, 8] as a neglected cause of ethnic health inequalities in high SES families [7, 8]. As a result of these MDRs, SES generates fewer positive health outcomes for children who are Black or Latino versus White or non-Latino ones [7, 8]. Thus, we observe worse than expected economic, behavioral, and health outcomes for children from highly educated Latino and Black families—a pattern not seen for White families [18]. These MDRs not only hold for Latinos or Blacks [19] but also other marginalizing identities such as sexual orientation or nativity [20].

Family income and other SES indicators better protect non-Latino White than Latino and Black individuals against risk behaviors [21]. In several studies on adults, SES indicators such as family income and education showed weaker effects on aggression [16], tobacco use [16], and alcohol use [22] among Black and Latino people than non-Latino White individuals. Similarly, SES has enhanced exercise [12] and a better diet [23] for non-Latino White children and adults than Latino and Black ones. However, none of these studies have focused on delayed gratification. Delayed gratification, is inversely correlated to delay discounting, and is defined as the tendency to postpone rewards for a later outcome [24, 25]. Thus, additional studies on MDRs of family income on delay discounting of children would be a unique contribution to the literature.

One of the mechanisms by which high SES Latino and Black children remain vulnerable to high-risk behaviors such as aggression [16], tobacco use [16], and alcohol use [22, 26] is the low economic stability of high SES Latino and Black families compared to their White counterparts. Other mechanisms can be residential segregation, the density of Whites and Blacks, density of poverty, and the differential distribution of resources [19]. Another alternative can be high levels of stress in the life of Latino and Black families with high SES [14]. There is, however, another explanation for higher than the ex-

pected behavioral risk of high SES Latino and Black children, which is poor emotion regulation and inhibitory control, high impulsivity, high delay discounting, and weak delayed gratification [27, 28].

One of the tendencies that contribute to high impulsivity, fun seeking, and low inhibitory control of children is poor delayed gratification due to delay discounting [29]. As a result of poor delayed gratification, behaviors with immediate consequences are more likely to occur than behaviors with the delayed consequences [30, 31]. Poor delayed gratification (high delay discounting) has implications for a wide range of outcomes such as obesity, sex, tobacco usage, alcohol usage, drug abuse, and gambling [29]. In literature, poor delayed gratification can be measured as a high delay discounting [32].

With MDRs being historically neglected, the research community has only recently acknowledged that SES indicators such as family income may also operate as a source of health disparities [7, 8]. To expand the past work on MDRs among Latino and Black families [12], this study had two aims: first, to test the effect of family income on children's delayed gratification and second, to compare this effect between Latino and non-Latino children.

Materials and Methods

Design and settings

This was an analysis of the existing data from the Adolescent Brain Cognitive Development (ABCD) study [33-35]. The ABCD is a national, state-of-the-art brain imaging study of children brain development [33, 36]. Data were collected in 2018 from 21 sites in the US.

Participants and sampling

In the ABCD, participants were selected across multiple cities across various states in the US. This sample was predominantly from the US school system. The recruitment catchment area of ABCD, which was composed of 21 participating sites, encompasses over 20% of the entire United States population of 9- to 10-year-old children. ABCD applied a closely monitored sampling and recruitment process, which is described here [33, 36], to ensure that the sample is random and representative. Such efforts of local randomization yielded a final overall ABCD sample that is a close approximation of the US national sociodemographic factors.

These sociodemographic factors include ethnicity, race, age, sex, SES, and urbanicity. The SES target in the

ABCD has two sources: 1. The American Community Survey (ACS); and 2. Annual third- and fourth-grade school enrollment. The ABCD sample and sampling are well described here [37]. The first is a large-scale survey of about 3.5 million families conducted annually by the US Census. The second data are maintained by the National Center for Education Statistics (NCES), affiliated with the US Department of Education.

Analytical sample

The analysis included 3903 non-twin non-Latino or Latino 9-10 years old children who had data on delay discounting (as an inverse proxy of delayed gratification), family income, and ethnicity. The participants could be from any race.

Variables

The study variables included ethnicity, demographic factors (race, age, and sex), family income (as a proxy of SES), family marital status, and parental employment, as well as delayed discounting (measured via task).

Outcome

Delay discounting was the outcome. Discounting is defined as individuals' tendency to assign less value to remote outcomes and rewards, and was measured using a neurocognitive task. The data were available in the "ABCD Youth Delay discounting Sum Scores," which was a part of the discounting and valuation of proximal and distal rewards. The delayed amount was \$100. The participants were evaluated for the tally of immediate choices for rewards to be received after "3 months," "1 year," and "5 years" delay. For example, children had the option to choose between "getting \$100 now" vs. "get \$100 in 5 years"). The proportion of the maximum (\$100) reward that, if presented immediately, was equal in subjective value to the maximum (\$100) reward if the subject had to wait some time to receive the maximum award. Delays were 6 hours, 1 day, 1 week, 1 month, 3 months, 1 year, and 5 years [24, 25, 29-31, 38-40].

Moderator

Ethnicity is a self-identified and a categorical variable: 1 for Latino and 0 for non-Latino (reference category).

Independent variables

Family income. Family income, a continuous measure, ranged from 1 to 10, where a higher score indicates higher level of family income. The item is read as

“What is your total combined family income for the past 12 months?” and should include income (before taxes and deductions) from all sources, wages, rent from properties, social security, disability and veteran’s benefits, unemployment benefits, workman. Responses included 1=less than \$5000; 2=\$5000; 3=\$12000; 4=\$16000; 5=\$25000; 6=\$35000; 7=\$50000; 8=\$75000; 9=\$100000; 10=\$200000. We used median response time for all choices (median latency [in minutes] of all choices) as our variable.

Confounders

Race, age, sex, and family structure were the covariates. Race is a categorical variable: 1 for Black and 0 for White (reference category). Parents reported children’s age. Sex was 1 for male and 0 for female. The family structure receives 1 for married and 0 for others.

Data analysis

The SPSS V. 23 was used for our data analysis. Mean±SD, frequency, and relative frequency (%) were reported at the first step. To perform multivariable analyses, four multiple linear regressions were performed. Our first two models were performed in the pooled sample. Model 1 was performed without our interaction term. Model 2 also included an interaction term between ethnicity and family income. Model 3 and Model 4 were performed on non-Latino people and Latino people, respectively.

In all models, delay discounting was the outcome. These models were controlled for race, age, sex, and parental employment, marital status. Regression coefficient (b), standard error, 95% CI, and P value were reported for each model. To test our moderation hypothesis, we applied a regression model with the pooled sample with an interaction term as suggested by Aiken, West, and Reno [41]. We also split the sample by ethnicity and ran regressions separately in both groups. Both these approaches were used to test if the b coefficients were significantly different between non-Latino and Latino children.

Results

Descriptive data

Table 1 presents the children’s characteristics both overall and ethnicity-specific. The current analysis included an overall sample of 3903 9-10 years old children who were either non-Latino (n=3160) or Latino (n=743).

Multivariate analysis

Table 2 presents the results of two linear regression models in the overall (pooled) sample. Model 1 (the main effect Model) showed a negative association between family income and delay discounting. Model 2 (the interaction Model) showed an interaction term between ethnicity with family income on delay discounting, sug-

Table 1. Overall and ethnicity-specific descriptive data (n=3903)

Variables		No. (%)		
		All	Non-Latino	Latino
Race (Black)	No	3342 (85.6)	2663 (84.3)	679 (91.4)
	Yes	561 (14.4)	497 (15.7)	64 (8.6)
Sex	Male	1859 (47.6)	1520 (48.1)	339 (45.6)
	Female	2043 (52.4)	1639 (51.9)	404 (54.4)
Age (y)	9	1931 (49.5)	1549 (49.0)	382 (51.4)
	10	1972 (50.5)	1611 (51.0)	361 (48.6)
Parents employed	No	1117 (28.6)	873 (27.6)	244 (32.8)
	Yes	2786 (71.4)	2287 (72.4)	499 (67.2)
Family marital status ^{a,b}	Other	1076 (27.6)	772 (24.4)	304 (40.9)
	Married	2827 (72.4)	2388 (75.6)	439 (59.1)

Variables	Mean±SD		
	All	Non-Latino	Latino
Family income (1-10) ^a	7.46±2.22	7.78±2.05	6.09±2.40
Delayed discounting ^a	8321.36±633.29	8299.28±643.62	8415.27±578.40

*P<0.05 for Black-White comparisons; ^a The independent samples t test; ^b The Chi-Square test.

Table 2. Linear regressions on social determinants of delayed discounting in the overall sample (n =3903)

Variables	Model 1						
	Beta	b	SE	95% CI		t	p
Ethnicity (Latino)	0.06	98.94	27.38	45.27	152.61	3.61	0.000
Race (black)	0.06	100.72	31.01	39.92	161.53	3.25	0.001
Sex (Male)	0.04	51.77	20.18	12.20	91.34	2.56	0.010
Age (10 y)	-0.03	-41.76	20.20	-81.36	-2.16	-2.07	0.039
Parents employed	0.01	7.57	23.14	-37.80	52.94	0.33	0.744
Married family	0.00	0.89	26.64	-51.35	53.13	0.03	0.973
Family income	-0.05	-13.39	5.79	-24.75	-2.04	-2.31	0.021
Family income x ethnicity (Latino)	-	-	-	-	-	-	-

Variables	Model 2						
	Beta	b	SE	95% CI		t	p
Ethnicity (Latino)	0.15	248.80	79.08	93.75	403.85	3.15	0.002
Race (black)	0.06	111.63	31.47	49.94	173.33	3.55	0.000
Sex (Male)	0.04	51.95	20.18	12.40	91.51	2.58	0.010
Age (10 y)	-0.03	-42.29	20.19	-81.88	-2.70	-2.09	0.036
Parents employed	0.01	9.27	23.15	-36.12	54.65	0.40	0.689
Married family	0.00	-0.90	26.65	-53.14	51.34	-0.03	0.973
Family income	-0.03	-7.14	6.57	-20.02	5.73	-1.09	0.277
Family income x ethnicity (Latino)	-0.09	-22.78	11.28	-44.89	-0.67	-2.02	0.043

^b: Unstandardized regression Coefficient; CI: Confidence Interval; SE: Standard Error



gesting a strong association between family income and delayed discounting for Latino than non-Latino children.

children's delayed gratification for non-Latino and Latino children.

Multivariate analysis

Table 3 summarizes the results of two linear regression models with respect to ethnicity. Model 3 showed no association between family income and delayed discounting in non-Latino children. Model 4 showed an association between family income and children delayed discounting in Latino families.

This is the first paper that documents the differential effects of family income on delayed gratification/delayed discounting of Latino and non-Latino children in the US. Racial and ethnic differences in the effects of family SES are reported for other psychological factors such as inhibitory control [42], fun seeking [27], and impulsivity [28]. The unique contribution of this paper is to enrich the literature on differential effects of family income on delay gratification and delayed discounting which are correlated with a wide range of high-risk behaviors [24, 29, 30, 32, 39].

Discussion

We showed that (a) in general, high family income increases children's delayed gratification at ages 9-10 years, and (b) high family income differently impacts

Most of the previous studies have been conducted to compare Black and White children. This study, however, extends this literature to the comparison of Latino

Table 3. Linear regressions on social determinants of delayed discounting across groups defined by race (n=3903)

Variables	Model 3 Non-Latino						
	Beta	b	SE	95% CI		t	P
				Lower	Upper		
Race (black)	0.08	137.53	34.67	69.56	205.50	3.97	0.000
Sex (Male)	0.05	67.37	22.82	22.62	112.12	2.95	0.003
Age (10 y)	-0.03	-37.07	22.86	-81.89	7.76	-1.62	0.105
Parents employed	0.01	8.75	26.21	-42.63	60.13	0.33	0.738
Married family	0.00	4.54	31.57	-57.36	66.44	0.14	0.886
Family income	-0.02	-5.94	6.97	-19.60	7.72	-0.85	0.394

Variables	Model 4 Latino						
	Beta	b	SE	95% CI		t	P
				Lower	Upper		
Race (black)	-0.02	-45.93	76.42	-195.96	104.09	-0.60	0.548
Sex (Male)	-0.01	-14.94	42.51	-98.40	68.52	-0.35	0.725
Age (10 y)	-0.06	-64.59	42.39	-147.82	18.63	-1.52	0.128
Parents employed	0.00	-3.92	48.91	-99.94	92.09	-0.08	0.936
Married family	-0.02	-21.04	48.15	-115.57	73.50	-0.44	0.662
Family income	-0.12	-27.94	10.39	-48.35	-7.54	-2.69	0.007

^b: Unstandardized regression coefficient; CI: Confidence interval; SE: Standard Error.

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and non-Latino children. The results suggest that ethnic differences in the effects of family income on delayed gratification/discounting may be a mechanism of high-risk inequalities by ethnicity and SES in the US.

We found that while children who live in high-income families have high delayed gratification, this effect is not the same for Latino compared with non-Latino families. Some research studies have shown the differential effects of family income, household income, parental education, and marital status on impulse control [28], inhibitory control [42], and fun seeking [27] by race and ethnicity. As a result, high SES Latino and Black children have high aggression [16], poor school function [21], school bonding [43], and tobacco use [18]. Ultimately, Latino and Black children from high SES families remain at high risk of diseases [5] such as attention deficit hyperactivity disorder [44], asthma [45], obesity [46], anxiety [47], suicide [48], and depression [49]. This literature, however, is more established for Blacks than Latinos.

Differential effects of SES are rules rather than exceptions [7, 8]. Differential health effects of SES hold for many visible and non-visible marginalizing factors such as ethnicity [22, 50], race [16], sexual orientation [20], immigration [51], and even place [17]. That is, all forms of marginalization of populations result in a reduction of the health gain that typically follows SES. This study was limited to children. Racial and ethnic differences in the health effects of SS are observed for children [45], adolescents [28, 46], adults [52], and older adults [53]; they are seen over the life course. Similarly, these differential effects are not specific to any specific health outcomes [7, 8].

The results reported here can be seen in the context of findings by others scholars such as Navarro [54-56], Farmer and Ferraro [57], Hamilton and Darity [58], Hudson et al. [59], Shapiro and Oliver [60, 61], and other scholars [62]. Farmer and Ferraro documented MDRs of education on self-rated health. They showed that Whites gained more than ethnic minorities from an increase in

their educational attainment [57]. Shapiro and Oliver have documented the extensive and pervasive inequalities in wealth distribution between Latino and non-Latino families [60, 61]. Hamilton and Darity have described the same type of wealth gap in other studies and reports [58]. Other investigators have also published on MDRs [62]. Navarro has argued that health is not a function of ethnicity or SES, but ethnicity and SES [54]. Others have shown that income reduces discrimination more for non-Latino Whites than ethnic minorities [63].

Differential effects of SES for racial and ethnic groups are shown for cigarettes [18], drinking [22], anxiety [47], suicide [48], depression [49], aggression [16], obesity [46], and chronic disease [45] in high SES ethnic minority children. Besides, physical activity [23] and school performance are differently affected by high SES in ethnically diverse groups of children.

The study has a few limitations. First, most surveys do not have a balanced sample size of Latino and non-Latino participants. The sample was also not random. In the US. In addition, in this study, SES was not matched between Latino and non-Latino participants. Non-Latino families have higher levels of education and family income and are more likely to be married than Latino families. This study only used 9-10 years old children and missed other developmental groups of White and Black children who may show different patterns.

5. Conclusions

In a national sample in the US, Latino and non-Latino families show differences in the effect of family income on children's delayed gratification. This new insight may help researchers, clinicians, policymakers, and others to tackle ethnic inequalities in risk behaviors in American children.

Ethical Considerations

Compliance with ethical guidelines

Although the ABCD study protocol was approved by the Institutional Review Board (IRB) of the University of California, San Diego (UCSD), and many other institutions [36], and while children and parents gave their assent and consent, our study was exempt from a full review.

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