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Parallel Ethnic Identity Development of Mexican-Origin Adolescents and Mothers Under the Influence of Neighborhood Latinx Concentration and Ethnic-Racial Diversity

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ABSTRACT

Co-ethnic or ethnically-racially diverse neighborhoods can serve as safe and supportive places for U.S. immigrant families to explore and develop clarity about their ethnic identity. Although parents undergo concurrent changes in the adaptation process with their children, existing research has predominantly focused on adolescents, with fewer examination on adult parents' continued ethnic identity development; additionally, researchers also overlook the impact of neighborhood context on ethnic identity in parents. To fill this gap, this registered study used a three-wave longitudinal dataset of 595 Mexican-origin adolescents and their mothers in central Texas. Latent growth models were used to estimate how ethnic identity (i.e. *exploration, centrality*, and *resolution*) changed across time in mother – adolescent dyads. Our findings indicated some level of connectedness in the development of family members' ethnic identities, particularly in terms of *exploration*. We also found that mothers' ethnic identity development was shaped by their neighborhood contexts, with those residing in more diverse neighborhoods being less likely to explore their ethnic identities. Results inform prevention and intervention efforts to promote family collaboration and help immigrant family members develop a positive sense of ethnic identity in the adaptation process.

Introduction

Co-ethnic or ethnically-racially diverse neighborhoods can be a potential resource for Mexican-origin immigrant families to explore and gain clarity about their ethnic identity, which may promote positive immigrant adaptation in the host country (Suárez-Orozco et al., 2018). Sampson et al.'s (1997) collective efficacy theory posits that high ethnic homogeneity in neighborhoods promotes positive social processes due to shared cultural similarities, which could be salient for ethnic identity development among adolescents (Pasco et al., 2021). Prior work found that adolescents living in neighborhoods with high Latinx concentrations had higher initial levels of Mexican identity, which stayed stable or increased over time (White et al., 2017). Simultaneously, neighborhoods with high ethnic-racial diversity (i.e., larger proportions of Latinx, Blacks, or Asians) may protect Latinx adolescents

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from exposure to predominantly white neighborhoods where there may be fewer resources to support their ethnic identity development (White et al., 2018). This may suggest that highly concentrated Latinx or ethnically-racially diverse neighborhoods can serve as safe and supportive places for adolescents to socialize with their co-ethnic peers and to explore and develop clarity about their ethnic identity.

Informed by Minuchin's (1985) family socialization theory, which highlights behavioral interdependence within families, it is critical to examine the understudied phenomenon of parallel ethnic identity development among Mexican-origin adolescents and their parents, who are concurrently impacted by their neighborhood. Past research has shown that adolescents' ethnic identity can predict their Latina mothers' ethnic identity (Meca et al., 2021). However, this body of work has not examined the influence of neighborhood context on mothers' ethnic identity development. This registered report aims to examine how neighborhoods influence dyadic ethnic identity development among Mexican-origin adolescents and their mothers.

Ethnic identity development

For ethnic minorities, development or change of ethnic identity could be manifested in the process of adapting to the larger host society. They may strive to preserve their culture of origin and declare it as part of their sense of self, while feeling the pressure of becoming Americanized. Latinx have become the largest racial or ethnic group in the U.S. in the past decade, and those of Mexican origin constitute 60% (or ~ 37.2 million people) of the nation's overall Latinx population as of 2021 (Krogstad et al., 2023). In their new social or cultural context, Mexican-origin families may encounter challenges as they engage in activities to 1) learn more about the meaning of their ethnic background (i.e., *exploration*; Umaña-Taylor et al., 2004); 2) gain an understanding of what Mexican identity means to them and how it connects to their sense of self (i.e., *resolution*; Umaña-Taylor et al., 2004); and 3) evaluate how closely their self-concept is tied to being a person of Mexican origin (i.e., *centrality*; Sellers et al., 1997).

Previous research has found that the process of exploring, forming, and retaining ethnic identity is critical for successful adaptation of the immigrant-origin population (Suárez-Orozco et al., 2018). For instance, individuals with higher ethnic identity centrality have reported a higher sense of purpose and belonging. An achieved ethnic identity is also associated with positive outcomes, such as having a greater sense of life meaning (Williams et al., 2020). Therefore, understanding how ethnic identity develops or changes in immigrant-origin families may provide insights into how to support these families in developing a positive ethnic identity, which can be vital to their adaptation in new contexts, such as migrating to a new country.

Ethnic identity development among adolescent-mother dyads

Upon migrating to a new country as a family unit, both adolescents and their parents could experience challenges in the host cultural context (Suárez-Orozco et al., 2018), where the adolescent and parents together undergo ethnic identity changes and influence one another. For ethnic minority adolescents, ethnic identity is a critical and normative developmental task (Umana-Taylor & Guimond, 2010). It involves learning, understanding, and evaluating their history, traditions, and customs through various sociocultural experiences. Parent-child relationships within the family system are the earliest sociocultural context for identity development among adolescents (Crocetti et al., 2014). For Mexican-origin immigrant families in the U.S., mothers often serve as principal sources of information about ethnicity, as they tend to be highly involved in their children's day-to-day activities and take on the task of teaching them about their heritage traditions and history (Umaña-Taylor et al., 2013).

Extant longitudinal studies have focused on the associations between parental ethnic socialization and adolescents' ethnic identity (Else-Quest & Morse, 2015; Umana-Taylor & Guimond, 2010). They argue that these socialization experiences, where parents aim to pass down their cultural heritage to

the next generation, will foster ethnic identity development in adolescents. However, parents' socialization practices are shaped by their own evolving sense of ethnic identity in terms of how much they understand and value their cultures, traditions, and customs across time (Hughes et al., 2006). In other words, parents' own sense of ethnic identity is not necessarily static, a consideration that has not been given sufficient attention in the literature. It is critical to examine the relationship between changes in parents' ethnic identity and their children's corresponding changes in ethnic identity during adolescence. It is likely that initial levels and changes in *exploration*, *resolution*, and/or *centrality* in Mexican-origin mothers are positively associated with adolescents' ethnic identity development across time.

Immigrant mothers, as the most important socializing agents for Mexican-origin adolescents, are also influenced by their children in reconstructing their ethnic identity. However, little is known about how adolescents affect their parents' ethnic identity development. One recent study revealed the bidirectional relationships between adolescents' and their parents' ethnic identity (Meca et al., 2021). What has not been examined, however, is how adolescents' ethnic identity development informs changes in parents' ethnic identity, or if this process is parallel. For example, immigrant mothers, who already formed a refined sense of ethnic identity in their country of origin, are unlikely to shed their history, traditions, and customs while adapting to the host country (Williams et al., 2020). However, adolescents who actively explore and resolve their identity in adolescence but hold negative views of their heritage cultural practices and customs, may trigger changes in their parents' understanding of and feelings about their ethnic group in this reciprocal, social process. As such, this registered study aims to examine how ethnic identity changes across time in mother-adolescent dyads using a sample of Mexican-origin immigrant families. This may inform prevention and intervention efforts to promote family collaboration and help immigrant family members develop a positive sense of ethnic identity in the adaptation process.

Mother-adolescent parallel ethnic identity development in neighborhood contexts

The neighborhood environment, a proximal current context where immigrants constantly interact with both their co-ethnic peers and peers of other ethnicities on a day-to-day basis, profoundly influences the development of their ethnic identity. Mexican-origin families reside in different neighborhood settings, from ethnically homogeneous neighborhoods (where there is a high concentration of Latinx co-ethnics to ethnically diverse neighborhoods (where there is a variation of Latinx, black, Asian, white, and other populations; Pasco et al., 2021). Previous research has shown that high Latinx concentrations in neighborhoods predicted stability or growth in ethnic-racial identity over time in Mexican-origin adolescents (White et al., 2017). This may suggest that living among a high concentration of co-ethnics helps Mexican-origin adolescents to obtain culturally supportive institutional, social, and behavioral resources in the community (Yoshikawa, 2011). With these resources, Mexican-origin adolescents may have more opportunities to explore cultural knowledge, beliefs, and behaviors (i.e., *exploration*); to develop clarity associated with their ethnic or heritage cultures (i.e., *resolution*); and to evaluate how important ethnic identity is to their self-concept (i.e., *centrality*; Pasco et al., 2021). It has also been suggested that ethnically and racially diverse neighborhoods, with higher percentages of ethnic and racial minority groups (e.g., blacks, Asians, or Latinx) and lower percentages of whites, may promote ethnic identity development (White et al., 2018). As such, it is possible that ethnically homogeneous neighborhoods or ethnically/racially diverse neighborhoods will predict higher initial levels and growth of ethnic identity in Mexican-origin adolescents. Conversely, predominantly white neighborhoods with less ethnic and racial diversity will predict lower initial levels and declines or non-significant slopes in ethnic identity due to limited cultural resources.

Existing research on neighborhood ethnic-racial concentration and ethnic identity has predominantly focused on adolescence, overlooking development in adulthood. It is important to recognize that adult immigrants' experiences are continuously shaped by critical life events – for example, moving to a new country and adapting to the host culture (Williams et al., 2020). These experiences may also offer opportunities for adult immigrants to continue exploring and reconstructing ethnic

identity through interactions with individuals from the same or diverse ethnic-racial backgrounds. Meanwhile, immigrant parents and their children are concurrently impacted by the neighborhood where they live. For instance, Mexican-origin mothers who are raising their children in neighborhoods with a high percentage of white neighbors may be concerned about practicing Mexican customs, such as traditional holidays and celebrations, which are critical for feeling connected to their culture of origin. While past research has shown that Latinx adolescents' ethnic identity can predict their mothers' ethnic identity (Meca et al., 2021), it remains unknown how neighborhood context exerts its influence on mothers' ethnic identity development. It is likely that a lower initial level of Mexican identity among Mexican-origin adolescents who live in neighborhoods with fewer Latinx co-ethnics may predict a decline in mothers' growth in ethnic identity due to isolation from other co-ethnics and therefore lack motivation in engaging in practices related to Mexican culture. Recognizing the importance of examining the neighborhood context as well as the interdependence of family members in their ethnic identity development is critical in informing more tailored intervention efforts. This knowledge can also be used to inform local and national immigrant policies that aim to promote family collaboration to help immigrant families develop an achieved sense of ethnic identity from ethnically homogeneous to diverse neighborhoods.

The current study

Taken together, the first aim of this registered study is to understand the associations between initial levels and growth of ethnic identity development in adolescent-mother dyads. Based on prior research which suggest that caregivers (primarily mothers) are often the primary source of information about the heritage culture for Latino adolescents, and that caregivers' ethnic identity significantly predicted adolescents' ethnic identity over time (Meca et al., 2021), it was hypothesized that Mexican-origin mothers' high initial levels and positive slopes in ethnic identity over time would be associated with adolescents' high initial levels and positive changes in ethnic identity. Due to limited studies on exploring the parallel processes of ethnic identity between adolescents and their mothers, no additional hypotheses were proposed regarding how adolescents' ethnic identity development may inform changes in parents' ethnic identity.

The second aim of this registered study is to test how ethnic identity among Mexican-origin adolescents and their mothers varies by Latinx concentration and ethnic-racial diversity in their neighborhood. Given that ethnically homogeneous neighborhoods or ethnically-racially diverse neighborhoods would promote more positive racial or ethnic socialization (White et al., 2018), it was hypothesized that both Mexican-origin adolescents and their mothers would experience growth in ethnic identity in neighborhoods with high concentrations of Latinx co-ethnics or diverse neighborhoods with a large proportion of ethnic and racial minorities. Conversely, they would experience non-significant slope or decreasing slope of ethnic identity development in neighborhoods with fewer Latinx or lower ethnic diversity.

Methods

Participants and procedure

A three-wave longitudinal study on Mexican-origin families including mothers and adolescents was utilized in this registered report (W1: 2012–2015; W2: 2013–2016; W3: 2017 – 2020). Participants at Wave 1 consisted of 604 middle school adolescents (grades 6 through 8, Age_{range} = 11.00–15.00, M_{age} = 12.41, SD = 0.97, 54% female) and 595 mothers (Age_{range} = 27.28–61.56, M_{age} = 38.89, SD = 5.74). At Wave 2, 483 adolescents and 480 mothers continued participating in the study. At Wave 3, 334 adolescents and 328 mothers remained in the project. The majority of adolescents were born in the United States (75%), while almost all the mothers were born in Mexico (99.1%). The mean and median

household income for participating Mexican-origin families ranged from \$20,001 to \$30,000. The median highest education level for mothers was middle/junior high school.

Through public records, school presentations, and community-wide outreach, target participants were recruited in central Texas between 2012 and 2015. Parents in the families needed to be of Mexican descent and have at least one middle-school language brokering child who translated for their English-limited parents to qualify for participation. Parents and adolescents were asked for consent (for parents) and assent (for adolescents) before the first family visit. In the family visit, parents and adolescents completed questionnaires, with the questions read aloud by a bilingual interviewer in English or Spanish. Parents' and adolescents' responses were then recorded on a laptop computer by the interviewers. Participating families were compensated \$60 in Waves 1 and 2, and \$90 in Waves 2 and 3.

Measures

Ethnic identity

On a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), mothers' and adolescents' self-reports of ethnic identity were separately measured in three dimensions: *centrality*, *exploration*, and *resolution* at Wave 1, Wave 2, and Wave 3.

Mexican identity: exploration. Exploration was measured for mothers and adolescents with three items from the Ethnic Identity Scale (Umaña-Taylor et al., 2004). Sample item is, *"I have often done things that will help me understand my Mexican background better."* Higher average scores indicate a greater sense of Mexican identity exploration (mother: $\alpha_{wave1} = .85$, $\alpha_{wave2} = .89$, $\alpha_{wave3} = .87$; adolescent: $\alpha_{wave1} = .81$, $\alpha_{wave2} = .82$, $\alpha_{wave3} = .85$).

Mexican identity: centrality. Centrality was measured for mothers and adolescents with three items adapted from the centrality subscale of the Multidimensional Inventory of Black Identity Scale (Sellers et al., 1997). Sample item is, *"I have a sense of belonging with other Mexican people."* Higher composite scores indicate a greater sense of centrality (mother: $\alpha_{wave1} = .60$, $\alpha_{wave2} = .65$, $\alpha_{wave3} = .63$; adolescent: $\alpha_{wave1} = .66$, $\alpha_{wave2} = 64$, $\alpha_{wave3} = .61$).

Mexican identity: resolution. Resolution was measured for mothers and adolescents with three items from the Ethnic Identity Scale (Umaña-Taylor et al., 2004). Sample item is, *"I have a clear sense of what being Mexican means to me."* Higher average scores indicate a greater sense of Mexican identity resolution (mother: $\alpha_{wave1} = .88$, $\alpha_{wave2} = .88$, $\alpha_{wave3} = .86$; adolescent: $\alpha_{wave}1 = .85$, $\alpha_{wave2} = .88$, $\alpha_{wave3} = .87$).

Neighborhood Latinx concentration and ethnic-racial diversity

To explore the role of neighborhood ethnic-racial concentration and diversity in ethnic identity changes, U.S. Census tract-level estimates of neighborhood characteristics from the American Community Survey (ACS) were linked to adolescent and mother data. Specific characteristics considered include the share of residents identifying as Latinx, white, non-Latinx black, or non-Latinx Asian (with a range of 0–100%) in the five-year survey of 2011–2015, which closely aligns with our project's data collection years at Wave 1. Neighborhood Latinx concentration was calculated by the share of residents identifying as Latinx in each neighborhood. The neighborhood diversity index indicated the likelihood that two individuals who were randomly selected from a neighborhood would come from different ethnic groups (e.g., Latinx, non-Latinx black, and non-Latinx Asian; Simpson, 1949). Values can range from 0 to approximately 1, with higher values indicating greater diversity.

Covariates

Demographic variables, including mothers' and adolescents' age, and mothers' income and education level at Wave 1, were included as covariates, given that past literature has demonstrated the potential

association between age, family socioeconomic status and ethnic identity development (Phinney & Ong, 2007; Phinney et al., 2001). To partial out the potential effects of transitioning from school into emerging adulthood, a covariate indicating four categories to indicate adolescents' life transition in the school context by Wave 3 were included in the analyses: (1) present high school students, (2) high school dropouts, (3) high school graduates, and (4) high school to higher education.

Analysis plan

Descriptive statistics and correlation analysis were conducted in SPSS 28.0 (see Table 1; SPSS 28.0: SPSS; IBM Corp 2021), while latent growth curve models (LGCMs) were estimated in Mplus 8.6 (Muthén & Muthén, 2018). The full information maximum likelihood estimator with robust standard errors was used to handle missing data (Enders, 2022).

To address the first aim of this registered report (see Figure S1), six sets of unconditional LGCM models were examined to identify the growth of ethnic identity in mothers and adolescents, respectively. Each LGCM model was composed of two latent factors: intercept and slope. The intercept factor represents the initial value of the growth trajectories of ethnic identity at Wave 1, while the slope factor indicates the rate of change in growth of ethnic identity over the three waves. Second, to achieve the second aim, neighborhood Latinx concentration and ethnic-racial diversity were introduced separately to each set of multivariate models to explore if these neighborhood characteristics are associated with the initial values and slopes in mothers' and adolescents' sense of Mexican identity. In addition, three sets of multivariate parallel latent growth models were tested while controlling for covariates to examine the robustness of the results. A Structural Equation Framework was used to develop the models, where the comparative fix index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) were selected as goodness-of-fit indicators (Hu & Bentler, 1999). When the CFI value is greater than .90 and the RMSEA and SRMR values are below .06, the model fit is considered acceptable (Hooper et al., 2008).

This registered report utilized data from a larger study that examined stress, academic outcomes, health outcomes, and adjustment outcomes of adolescents in Mexican immigrant families (NSF, BCS-0956123 and BCS-1651128; NIH, R21MD012706 and R03HD060045). Prior knowledge of these data is reported in supplementary materials at https://doi.org/10.17605/OSF.IO/V5D43. The stage 1 version of this registered report was accepted in principle on April 5, 2023. Following in-principle acceptance, it was pre-registered on the Open Science Framework at https://doi.org/10.17605/OSF.IO/2NCA7. This pre-registration was performed prior to data analysis.

Results

Following the pre-registered analysis plan, latent growth curve models (LGCMs) were estimated. There were no deviations from the pre-registered analysis plan.

Unconditional latent growth curve of ethnic identity

Ethnic identity for Mexican-origin adolescents
The results of univariate LGC models are presented in Table S1. For adolescents' *ethnic identity exploration*, the significant mean (3.337, $p < .001$) and variance (.360, $p < .001$) of the intercept suggest individual variations in the initial levels of exploration at Wave 1, while the significant variance (0.024, $p = .003$) of the slope suggests that there was variation in trajectories of exploration across the three waves. In addition, the nonsignificant mean of the slope shows that there was no increase in adolescent exploration across waves. For adolescents' *ethnic identity centrality*, the significant mean (3.736, $p < .001$) and variance (.121, $p < .001$) of the intercept indicate notable individual variations in the initial levels of centrality at Wave 1, whereas the significant mean of the slope (.019, $p = .007$) suggests an average linear increase in

Table 1. Descriptive statistics and correlations among study variables.

	1	2	3	4	5	6	7	8	9	10	11
1. W1 A cent	1.00										
2. W1 A expl	.45**	1.00									
3. W1 A reso	.61**	.55**	1.00								
4. W2 A cent	.40**	.23**	.34**	1.00							
5. W2 A expl	.23**	.51**	.30**	.44**	1.00						
6. W2 A reso	.28**	.29**	.37**	.53**	.50**	1.00					
7. W3 A cent	.29**	.11*	.24**	.26**	.15**	.19**	1.00				
8. W3 A expl	.09	.20**	.12*	.06	.32**	.14*	.38**	1.00			
9. W3 A reso	.16**	.07	.23**	.16**	.08	.18**	.49**	.29**	1.00		
10. W1 M cent	.04	.06	-0.01	0	.09*	.04	-0.01	-0.06	-0.05	1.00	
11. W1 M expl	.03	.09*	.05	.03	.17**	.05	.04	.03	.03	.44**	1.00
12. W1 M reso	.07	.07	.07	.04	.100*	.07	-0.02	0.01	-0.01	.51**	.52**
13. W2 M cent	.02	.06	-0.03	.01	.06	.04	.05	0	0	.45**	.32**
14. W2 M expl	.06	.11*	.07	.05	.09*	.03	.03	0	.02	.38**	.57**
15. W2 M reso	.02	.08	.02	.08	.13**	.08	.03	.1	.03	.27**	.35**
16. W3 M cent	.03	.06	.04	.01	.06	.02	.05	.02	-0.05	.42**	.29**
17.W3 M expl	-0.01	.12*	.04	-0.06	.15**	.05	-0.03	.03	-0.08	.36**	.49**
18. W3 M reso	.02	.09	.04	.07	.16**	.12*	.01	.04	-0.04	.30**	.37**
19. Concentration	.01	-0.01	.01	-0.01	.04	-0.05	-0.04	-0.03	-0.07	.02	.06
20. Diversity	0	.02	0	-0.05	-0.05	.02	.06	.01	.13*	-0.03	-.11**
21. W1 A age	-0.02	-.19**	-.11**	-.09*	-.18**	-0.07	.01	-0.03	-0.04	-0.01	-0.03
22. W1 M age	-0.08	.01	.06	-0.03	.01	.05	-0.03	.09	.06	-0.03	.01
23. W1 M income	-0.03	-.10*	-0.07	-0.02	-0.05	.08	-0.06	.03	-0.07	-0.06	-.09*
24. W1 M education	.03	-0.05	0	.02	.01	.08	.02	.02	.09	-0.02	-.09*
N	604	604	603	483	482	483	334	334	334	593	594
Mean	3.74	3.37	3.98	3.75	3.26	3.98	3.84	3.29	3.99	3.95	3.44
SD	0.66	0.79	0.69	0.62	0.78	0.65	0.57	0.77	0.61	0.64	0.92

	12	13	14	15	16	17	18	19	20	21	22	23	24
12. W1 M reso	1.00												
13. W2 M cent	.26**	1.00											
14. W2 M expl	.37**	.52**	1.00										
15. W2 M reso	.39**	.48**	.50**	1.00									
16. W3 M cent	.33**	.49**	.36**	.32**	1.00								
17.W3 M expl	.39**	.30**	.52**	.37**	.49**	1.00							
18. W3 M reso	.43**	.33**	.38**	.40**	.57**	.57**	1.00						
19. Concentration	.05	.04	.06	.05	.01	.10	.05	1.00					
20. Diversity	-0.06	-0.05	-.10*	.01	.05	-0.06	-0.02	-.58**	1.00				
21. W1 A age	-0.04	-0.01	.01	-0.02	-0.03	-0.01	-0.02	.03	.01	1.00			
22. W1 M age	.02	.05	.10*	.06	-0.02	.12*	.04	-0.04	.06	.04	1.00		
23. W1 M income	-0.06	-0.04	-0.08	-0.04	-0.09	-0.06	-0.07	-0.06	.04	.05	.05	1.00	
24. W1 M education	.07	-0.03	-0.06	.09	-0.05	-0.06	.07	-0.05	.04	-.09*	.00	.13**	1.00
N	591	479	480	479	328	327	328	604	604	604	594	494	593
Mean	4.15	3.91	3.50	4.11	3.94	3.56	4.16	0.56	0.52	12.41	38.40	2.23	4.81
SD	0.61	0.65	0.94	0.64	0.65	0.85	0.55	0.17	0.11	0.97	5.74	1.56	2.20

Note. Coefficients for correlations among study variables are listed. W1 = Wave 1. W2 =Wave 2. W3= Wave 3. *M*= mother. A = adolescent. Cent = centrality; expl = exploration; reso = resolution. Means and standard deviations are displayed at the bottom of table.

*p < .05,**p < .01.

centrality across the waves. Additionally, the variance of the slope was not significant, suggesting that there was a universal trajectory of centrality across the three waves. For adolescents' *ethnic identity resolution*, the significant mean (3.976, *p* < .001) and variance (0.118, *p* < .001) of the intercept suggest individual variations in the initial levels of resolution at Wave 1. The nonsignificant mean and variance indicate that there was no increase in adolescent resolution, and there was a universal trajectory of resolution across the three waves.

Ethnic identity for Mexican-origin mothers

For mothers' *ethnic identity exploration*, the mean of the intercept (3.451, *p* < .001) and slope (.019, *p* = .031) were statistically significant, suggesting a significant linear change in mothers' exploration across time. The significant variance (0.514, *p* < .001) of the intercept also indicates individual variations in the initial levels of exploration at Wave 1. For mothers' *ethnic identity centrality* and *resolution*, the significant mean (*centrality*: 3.936, *p* < .001; *resolution*: 4.136, *p* < .001) and variance (*centrality*: 0.189, *p* < .001; *resolution*: 0.145, *p* < .001) of the intercept indicates individual differences in the initial levels of centrality and resolution at Wave 1. The nonsignificant mean and variance of the slope indicate that there was no increase in mothers' centrality and resolution, and there was a universal trajectory of centrality and resolution across the three waves.

Unconditional parallel growth curve model of ethnic identity

Ethnic identity exploration

The results of the unconditional parallel growth curve model of exploration in mothers and adolescents showed that the intercept and slope for adolescent exploration were negatively associated (β = −.503, *SE* = .073, *p* < .001), suggesting that adolescents with higher initial levels of exploration at Wave 1 were more likely to have a faster decline in exploration over time. Additionally, the intercept of adolescent exploration at Wave 1 was positively associated with the intercept of mother exploration at Wave 1 (β = .191, *SE* = .061, *p* = .002), suggesting that adolescents with higher initial levels of exploration at Wave 1 were more also more likely to have mothers who also reported high initial levels of exploration at Wave 1. All significant results remained after controlling for covariates (see Tables S2 and S3).

Ethnic identity centrality

The results of the unconditional parallel growth curve model of centrality in mothers and adolescents revealed no associations between adolescents' initial levels of centrality and mothers' initial levels of centrality at Wave 1, nor between the intercept of adolescents' centrality and the slope of mothers' centrality.

Ethnic identity resolution

Similar to ethnic identity resolution, no association was found between adolescents' initial levels of exploration and mothers' initial levels of exploration.

Multivariate parallel growth curve model of ethnic identity

Exploration with Latinx concentration/neighborhood diversity

When accounting for demographic covariates, the results showed that neighborhood diversity was negatively associated with the intercept of mothers' exploration (β = −.126, *SE* = .040, *p* = .002), suggesting that mothers who lived in a more diverse neighborhood were more likely to have lower levels of ethnic exploration at Wave 1 (see Table 5). In addition, consistent with results from the unconditioned parallel growth curves, the results of the covariance association revealed that the intercept of adolescents' exploration was negatively associated with the slope of

Table 2. Parallel process latent growth curve model of exploration with Latinx concentration (standardized).

	Intercept of A expl	Slope of A expl	Intercept of M expl	Slope of M expl
Intercept of A expl	-	−0.474***	0.176**	0.069
Slope of A expl	-	-	−0.088	−0.072
Intercept of M expl	-	-	-	−0.389
Latinx concentration	0.014	−0.055	0.053	0.027
A age	−0.263***	0.146*	−0.037	0.011
M age	0.031	0.082	0.047	0.16
M income	−0.097	0.088	−0.102	−0.031
M education	−0.046	0.044	−0.086	0.046

Note. Model fit: χ2 (17) = 24.922, *p* = .097; CFI = .984; RMSEA = 0.028; SRMR = .020. A = adolescent; *M* = mother. Expl = exploration. The significance of the results remained the same after excluding the demographic covariates from the analysis. **p* < .05,**p < .01, ***p < .001.

Table 3. Parallel process latent growth curve model of exploration with neighborhood diversity (standardized).

	Intercept of A expl	Slope of A expl	Intercept of M expl	Slope of M expl
Intercept of A expl	-	−0.478***	0.179**	0.088
Slope of A expl	-	-	−0.093	−0.087
Intercept of M expl	-	-	-	−0.389
Neighborhood Diversity	0.018	0.016	−0.126**	0.157
A age	−0.263***	0.145*	−0.033	0.009
M age	0.03	0.082	0.051	0.162
M income	−0.1	0.09	−0.101	−0.035
M education	−0.048	0.048	−0.083	0.041

Note. Model fit: χ2 (17) = 23.808, *p* = .125; CFI = .986; RMSEA = .026; SRMR = .019. A = adolescent; *M* = mother. Expl = exploration. The significance of the results remained the same after excluding the demographic covariates from the analysis. **p* < .05,**p < .01, ***p < .001.

Table 4. Parallel process latent growth curve model of centrality with Latinx concentration (standardized).

	Intercept of A cent	Slope of A cent	Intercept of M cent	Slope of M cent
Intercept of A cent	-	-	0.034	0.042
Slope of A cent	-	-	-	-
Intercept of M cent	-	-	-	−0.101
Latinx concentration	−0.015		0.030	−0.056
A age	−0.066	-	−0.015	−0.015
M age	−0.079	-	0.001	−0.021
M income	−0.060	-	−0.064	−0.021
M education	0.042	-	−0.019	−0.036

Note. Model fit: χ2 (27) = 31.492, *p* = .251; CFI = .983; RMSEA = .017; SRMR = .064. A = adolescent; *M* = mother. Cent = centrality. The slope of adolescent centrality was not included in the model as a non-positive covariance matrix growth factor's variance was observed in unconditional Latent Growth Curve Models. The significance of the results remained the same after excluding the demographic covariates from the analysis.

adolescents' exploration, but positively related to the intercept of mothers' exploration (see Tables 2 and 3).

Centrality with Latinx concentration/neighborhood diversity
Controlling for the demographic covariates, the results showed that neither Latinx concentration nor neighborhood diversity was associated with either the intercept or slope of mothers' centrality, and neither related to the intercept of adolescents' centrality (see Tables 4 and 5).

Resolution with Latinx concentration/neighborhood diversity
Controlling for the demographic covariates, the results indicate that neither Latinx concentration nor neighborhood diversity had associations with the intercept or slope of mothers' resolution, or with the intercept of adolescents' resolution (see Tables 6 and 7).

Table 5. Parallel process latent growth curve model of centrality with neighborhood diversity (standardized).

	Intercept of A cent	Slope of A cent	Intercept of M cent	Slope of M cent
Intercept of A cent	-	-	0.034	0.038
Slope of A cent	-	-	-	-
Intercept of M cent	-	-	-	−0.104
Neighborhood Diversity	0.007	-	−0.061	0.132
A age	−0.066	-	−0.013	−0.015
M age	−0.079	-	0.003	−0.027
M income	−0.060	-	−0.062	−0.042
M education	0.042	-	−0.018	−0.034

Note. Model fit: χ2 (27) = 33.678, *p* = .176; CFI = .975; RMSEA = .020; SRMR = .064. A = adolescent; *M* = mother. Cent = centrality. The slope of adolescent centrality was not included in the model as a non-positive covariance matrix growth factor's variance was observed in unconditional Latent Growth Curve Models. The significance of the results remained the same after excluding the demographic covariates from the analysis. **p* < .05,**p < .01, ***p < .001.

Table 6. Parallel process latent growth curve model of resolution with Latinx concentration (standardized).

	Intercept of A reso	Slope of A reso	Intercept of M reso	Slope of M reso
Intercept of A reso	-	-	0.130	-
Slope of A reso	-	-	-	-
Intercept of M reso	-	-	-	-
Latinx concentration	−0.043		0.081	
A age	−0.151**	-	−0.026	-
M age	0.116	-	0.044	-
M income	−0.044	-	−0.093	-
M education	0.079	-	0.123*	-

Note. Model fit: χ2 (36) = 36.079, *p* = .465; CFI = 1.00; RMSEA = 0.002; SRMR = .050. A = adolescent; *M* = mother. Reso = resolution. The slope of adolescent resolution was not included in the model as a non-positive covariance matrix growth factor's variance was observed in unconditional Latent Growth Curve Models. **p* < .05, **p < .01, ***p < .001.

Table 7. Parallel process latent growth curve model of resolution with neighborhood diversity (standardized).

	Intercept of A reso	Slope of A reso	Intercept of M reso	Slope of M reso
Intercept of A reso	-	-	0.129	-
Slope of A reso	-	-	-	-
Intercept of M reso	-	-	-	-
Neighborhood Diversity	0.076	-	−0.05	-
A age	−0.153**	-	−0.023	-
M age	0.113	-	0.044	-
M income	−0.045	-	−0.095	-
M education	0.079	-	0.121*	-

Note. Model fit: χ2 (36) = 41.884, *p* = .231, CFI = .975; RMSEA = 0.016; SRMR = 0.048. A = adolescent; *M* = mother. Reso = resolution. The slope of adolescent resolution was not included in the model as a non-positive covariance matrix growth factor's variance was observed in univariate LGCMs. **p* < .05, **p < .01, ***p < .001.

Discussion

Across U.S. neighborhoods, patterns of co-ethnic concentration and ethnic-racial diversity likely implicate ethnic minority family members' ethnic identities. Borrowing from a family systems perspectives such as family socialization theory (Minuchin, 1985), and informed by collective efficacy theory (Sampson et al., 1997), we (1) examined dyadic interdependence between Mexican-origin mothers and their adolescent children's ethnic identity development, and (2) investigated whether neighborhood contexts can potentially inform this interdependence. Our results revealed only some level of connectedness between family members' ethnic identity development (particularly for *ethnic identity exploration*). Further, neighborhood contexts were linked to mothers' ethnic identity development, such that Mexican-origin mothers living in more diverse neighborhoods were less likely to engage in exploration of their ethnic identities. Our findings provide some information that may be

helpful for informing intervention efforts aimed at developing positive perceptions of ethnic identity for immigrant family members across ethnically homogeneous and diverse neighborhoods.

Our pattern of findings provides partial support for the hypothesized dyadic interdependence between family members' ethnic identity development, as we showed that adolescents who were more likely to engage in exploration of their ethnic identities were also more likely to have mothers who exhibited high levels of identity exploration at baseline. The parent-adolescent dynamic constitutes one of the earliest and most fundamental socialization experiences for learning about and engaging in tasks that facilitate adolescent ethnic identity development (Crocetti et al., 2014). Mexican-origin youth are therefore more likely to be receptive to early sociocultural socialization experiences, and can benefit (in terms of their ethnic identity exploration) from having a mother with high levels of exploration, as these mothers can provide a conducive environment for adolescents to develop an interest in their ethnic identities. That is, mothers with high ethnic identity exploration are also more likely to be motivated to pass on ethnic values and help children learn about their history (Umaña-Taylor et al., 2013) such as incorporating heritage traditions into their children's lives (e.g., attending cultural festivals together, sending children to heritage language classes, etc.). Mothers may originally engage in ethnic socialization with the intention of educating their children about their cultural roots, but ultimately, engaging in socialization practices and learning along with their children can also reaffirm mothers' own *ethnic identity exploration* as they engage in relevant activities and focus on experiences related to their ethnic culture (Umaña-Taylor et al., 2013).

However, the fact that we did not find longitudinal associations between mother-adolescents' ethnic identity exploration might ultimately suggest distinct pathways for the *development* of ethnic exploration between mothers and adolescents' exploration. Given the vast amount of literature that have linked maternal ethnic socialization with adolescents' own ethnic exploration (Else-Quest & Morse, 2015; García Coll et al., 1996; Umaña-Taylor et al., 2009), perhaps, adolescents' exploration is enhanced when their mother is adept at employing good strategies and efforts that transmit cultural information to their children, and this association occurs regardless of her own exploration levels. As there is less research that have linked maternal-adolescent ethnic exploration together, we suggest that more research is needed on this topic to corroborate our present findings. Nevertheless, the cross-sectional findings here may still be vital in providing supporting evidence that is in line with recent studies demonstrating bidirectionality in the links between adolescents' and their parents' cultural identities (Meca et al., 2021). Perhaps, mothers with high exploration may still be helpful for adolescents who are just exploring and learning about their own ethnic identities. Critically, more resources can be channeled to develop a greater reservoir of resources (e.g., cultural awareness workshops, cultural centers, cultural art and music, heritage trips, etc.) for ethnic minority mothers to promote greater exploration and reaffirm their own sense of identity.

Contrary to our expectations, we note that we did not find any significant cross-sectional and longitudinal associations between mother-adolescents' ethnic identity centrality and resolution. One reason why we did not find any mother-adolescent links for ethnic centrality and resolution may be explained by the fact that Mexican-origin mothers' who make the decision to immigrate to the U.S. may already hold strong beliefs about their own cultural beliefs and possess a clear sense of their ethnic identities (Cheung et al., 2011), thus their interactions with their adolescent children have little sway in impacting their own longstanding ethnic beliefs about who they are ethnically and what their Mexican identity means to them. Indeed, these non-significant cross-sectional and longitudinal findings were in line with one recent study by Desmarais et al. (2023) where Mexican-origin mothers' ethnic pride development was not associated with their children's pride (i.e., the positive feelings associated with their Mexican identity) from 5th grade to emerging adulthood. It was suggested that mothers may choose to retain their Latinx culture in reaction to the changes in their children's ethnic identity. Desmarais et al. (2023) also highlighted that the growing independence and autonomy during adolescence may contribute to adolescents developing an independent ethnic identity that is less closely tied to their parents. Taken together with these recent findings, it is also important to be mindful that external pressures, such as acculturation, may affect mothers and adolescents differently

as they respond to these pressures in heterogenous ways that can manifest in variations in their ethnic identity centrality and resolution that are not necessarily correlated (Phinney et al., 2022). For instance, while adolescents learn and adjust to the information of their heritage culture as they grow up in the U.S., mothers may become more steadfast in their ethnic cultures in response to their need to acclimatize to the new U.S. environment. We suggest more research is needed to more comprehensively understand how the development of the different components of mother-adolescent ethnic identity are linked with each other.

It is particularly important to note that this registered study shows that the neighborhood environment had a role to play in shaping ethnic minority families' ethnic identity development. Variability in neighborhood co-ethnic concentration and the proportion of neighborhood diversity produced variations in vital aspects of individuals' ecological niches, encompassing their institutional resources, social infrastructures and interpersonal processes, all of which convey implicit messages about race and ethnicity for Mexican-origin families (García Coll et al., 1996; Hill & Witherspoon, 2011; Yoshikawa, 2011). We found that mothers who lived in more diverse neighborhoods showed lower levels of ethnic exploration at baseline. Our findings are contrary to some studies and existing models (i.e., numerical minority and diversity hypotheses; French et al., 2006; Rumbaut, 2008; Umaña-Taylor, 2004) that have supported the notion that neighborhood ethnic diversity may promote ethnic identity development (White et al., 2018). That said, the findings here are at least consistent with other literature that has postulated inverse relations between neighborhood diversity and ethnic identity development. For instance, Mexican-origin mothers may be concerned about raising their children in neighborhoods with a high proportion of white neighbors, and in such cases they may reduce engagement in Mexican traditions, practices and customs (White et al., 2017). It is also possible that isolation from co-ethnics accentuates their ethnic uniqueness, leading to less motivation to explore their ethnic identities.

Regardless of the exact mechanisms at work in mothers' ethnic identity development, an important strength of this registered study is its focus on mothers as well as adolescents (in a field which is predominantly focused on adolescents' identity development). Our results highlight the dynamic nature of adults' ethnic identity and suggests that mothers' exploration of their heritage identity appears to be heavily rooted in their childrearing experiences, either through supporting their children in exploration or in learning about their history, traditions, and customs in day-to-day socialization experiences with their children. Along with identifying links between adolescents' ethnic exploration and mothers' ethnic exploration, the present study sheds light on the understudied domain of neighborhood contexts and mother-adolescent ethnic identity development. These findings can help inform policies, both at the local and national level, so that intervention efforts aimed at promoting family collaboration to help Mexican-origin families develop a positive and coherent sense of ethnic identity in the adaptation process can begin to consider the influence of neighborhood effects. For instance, encouraging community integration programs that promote interaction and understanding among residents across different ethnicities in diverse neighborhoods can help Mexican-origin mothers feel less isolated, more empowered, and comfortable practicing their traditions.

It was surprising that we did not find stronger evidence for a link between neighborhood Latinx concentration and mothers' ethnic identity development, considering the body of literature focused on the concentration hypothesis – which suggests that residing in neighborhoods with a higher concentration of co-ethnics can create a sense of community and belonging that increases cultural connection (Leventhal et al., 2009). A greater concentration of co-ethnics means increased opportunities for cultural connections with community members, which can empower Mexican-origin family members to explore and express their ethnic identities (Sampson et al., 1997). One possibility for our null findings is that mothers living in Latinx-concentrated neighborhoods have to navigate the complexities of educating their children what it means to be Latinx in a society where there is rampant discrimination (note that data collection for this registered study occurred during the Trump era, during which discrimination against Latinx minorities was a particularly salient issue and might have washed out any benefits of living in a Latinx-concentrated neighborhood; see Bellmore et al., 2012;

Stevenson & Arrington, 2009). To ensure healthy ethnic identity development, local agencies may step in to implement anti-discriminatory measures and transform public services so that they are more culturally sensitive in a post-Trump era (e.g., inclusion of language interpretation services and culturally tailored healthcare programs). Tangentially, and on a more conceptual level, this registered study may not have been able to find any neighborhood effects for Latinx concentration because the potential beneficial effects of neighborhood Latinx co-ethnic concentration may be experienced differently by immigrant Latinx individuals (foreign-born) versus native Latinx individuals (Mexican-American). Indeed, this possibility has been echoed by other researchers, and has been posed as a potential explanation for the inconsistencies in the concentration hypothesis (Leventhal et al., 2009; White et al., 2017).

In this registered report, we also found that adolescents with high initial levels of exploration at study baseline showed greater declines in exploration over time. This finding might suggest greater identity consolidation. Adolescents who start off with high levels of ethnic identity exploration may be in the middle of active self-discovery and exploration of their ethnic roots; as they accumulate more experiences and knowledge by interacting with their social environments, they may achieve greater clarity and stability in their sense of identity, reducing the need for further exploration (Pahl & Way, 2006). This may signal high levels of satisfaction and coherence in their ethnic identities. As adolescents grow older, they may also find fewer new opportunities for identity exploration, resulting in depleted efforts in that direction. More studies are necessary to identify how Mexican-origin adolescents come to terms with different domains of their ethnic identity, and to explore how initial levels of ethnic identity may impact long-term identity development.

Relatedly, immigrant status might explain some of the inconsistent or null findings in the current work. In particular, one possible reason why we did not obtain significant links between neighborhood effects and adolescents' identity development may be related to the sensitive developmental period of cultural identification. That is, perhaps the neighborhood effect operates differently in immigrant families. Immigrants who migrated at a young age, or adolescents with Mexican-origin parents, may possess a greater capacity (as compared to native, or Mexican American, adolescents) for sociocultural learning and ethnic socialization. It is also important to be mindful of the possibility that significant findings documented in prior research could be associated with publication bias. Given that research on neighborhood contexts has gained greater traction recently (White et al., 2017), we suggest that more work is necessary to better understand how immigrant status may moderate the neighborhood effects (including neighborhood ethnic concentration and diversity) to implicate adolescents' ethnic identity development.

There are important limitations in this registered study that should be noted. We only examined mother-adolescent dyads in our study because there is general consensus in the literature that mothers play a more important role than fathers in transmitting cultural heritage and tradition (Umaña-Taylor et al., 2013). We were also not able to conduct additional analyses with father-adolescent dyads because of the limited sample of fathers who participated in our study, which would have compromised statistical power. However, considering the more recent evidence regarding the associations between fathers' and adolescents' ethnic pride development (Desmarais et al., 2023), it may be important for future work to purposefully recruit for fathers in their samples to provide a fuller account of how fathers and their adolescent children influence each other's ethnic identity development. The sample was part of a larger study that examined family dynamics in low-income, Mexican-origin immigrant families and how they navigate the adaptation process. As such, the study specifically recruited a sample of adolescents who engaged in language brokering – translating and interpreting between English and Spanish – for their parents. This unique experience might influence the results of the study because adaptation experiences can implicate the parent-child relationship (e.g., parent-child gaps in acculturation, perceptions of parental warmth, and the sense of familial obligation) as well as the identity development patterns of family members (Kim et al., 2017). More research is needed with more diverse populations (e.g., immigrant, non-immigrant; other ethnic minorities) to ascertain the

external validity of the current work. Methodologically, there is also the possibility that families self-select into the neighborhoods in which they live, because although we found some neighborhood effects for neighborhood diversity levels, it is difficult to determine whether neighborhood diversity directly explains the associations found in this registered study or whether there are potential confounding factors. Relatedly, we used census tract-level estimates of neighborhood characteristics as proxies for neighborhood variables; however, we are unable to account for the lived experiences of Mexican-origin mother-adolescent dyads who reside in these neighborhoods, particularly the degree of exposure and the socialization processes that occur within these spaces (Noah, 2015). Relatedly, we were not able to separate immigrant status (due to issues with reduced power), which might have offered a better glimpse into the lived experiences of our participants (especially in terms of understanding their struggles as "outgroup" members, despite living in a predominantly Latinx space; Kiang & Fuligni, 2010; White et al., 2017). It may be important for future work to recruit larger samples (of native and immigrant-born participants), or to incorporate qualitative assessments, in order to capture the lived experiences of Mexican-origin mother-adolescents.

All in all, this registered report underscores the importance of situating Mexican-origin family members' ethnic identity development within the family system. Specifically, we provide some evidence that mothers and their adolescent children's ethnic identity exploration are dyadically connected. These parallel processes can also be contextualized in the neighborhood setting, as we showed that mothers living in more diverse neighborhoods were less likely to engage in exploration of their identities. Future work may incorporate larger samples – particularly samples that include immigrant, non-immigrant, and mother-adolescent dyads from other ethnic minority groups – to reach a more comprehensive understanding of their ethnic identity development. Investigating how the identity process develops in Mexican-origin mothers and their adolescents, and incorporating findings from the relatively under-studied domain of neighborhood effects in this process, can shed new light and provide new avenues for prevention and intervention efforts to aid immigrant families in their adaptation process.

Authors' contributions

HWT and JJY contributed equally as first author. HWT conceptualized and designed the study, drafted a portion of the manuscript, provided critical reviews for revision of the manuscript, and provided administrative support. JJY drafted a portion of the manuscript, conducted statistical analyses, and provided critical reviews and revision of the manuscript. LS drafted a portion of the manuscript and provided critical reviews of the manuscript. MYZ participated in conducting statistical analyses and provided critical reviews for revision of the manuscript. WW participated in conducting statistical analysis, including acquisition or interpretation of data. JXS conceptualized and designed the initial study and provided critical reviews for abstract of registered report. SYK created the design of the larger project and was responsible for data collection and curation, project management, and supervision of the current research. She also provided critical reviews of the manuscript important intellectual content. All authors contributed to the review of the manuscript and approved the final manuscript.

Data sharing declaration

This manuscript's data will not be deposited.

Disclosure statement

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Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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