



Examining Multilevel Correlates of Geographic Mobility in a Sample of US Young Adults Before and During the COVID-19 Pandemic

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Abstract

Before the COVID-19 pandemic, geographic mobility, previously viewed as an indicator of economic stability, was declining among young adults. Yet, these trends shifted during the COVID-19 pandemic; young adults were more likely to move during COVID-19 for reasons related to reducing disease transmission and fewer educational and job opportunities. Few studies have documented the individual and neighborhood characteristics of young adults who moved before and during the pandemic. We used data from a cohort of young adults aged 18–34 in six metropolitan areas to examine individual- and neighborhood-level predictors of mobility before and during the COVID-19 pandemic. The sample was majority female, white, and educated with a bachelor's degree or more. Residents in neighborhoods they lived in were mostly White, US-born, employed, and lived above the poverty level. Before the pandemic, identifying as a sexual minority was significantly related to mobility. During the pandemic, being younger, single, and non-Hispanic were significantly related to mobility. Higher neighborhood poverty was significantly related to mobility before and during the COVID-19 pandemic. Future studies that examine young adult populations who moved during the pandemic are needed to determine whether COVID-19 related moves increase economic instability and subsequent health-related outcomes.

Keywords COVID-19 pandemic · Mobility patterns · Migration · Human mobility

Introduction

Geographic mobility is an important indicator of a population's ability to move, obtain job opportunities, expand the labor market, and climb social strata. [1–3](#) It also provides important information on population mixing, which is particularly relevant during a global pandemic, when movement between populations is discouraged in order to

prevent disease transmission. [4](#) Throughout the 1980s until pre-COVID-19, geographic mobility declined in the US, [1,2](#) and in 2020–2021 (during COVID-19), such mobility was at an all-time low. [5](#)

Some of the steepest declines in geographic mobility in the US have been driven by young adults staying in place, [6](#) as this is the age group that typically shows the greatest mobility. [5](#) Low mobility during young adulthood is concerning, as this is a pivotal period where moving can provide opportunities that may reduce neighborhood poverty gaps and facilitate economic benefits related to upward mobility. Such mobility may in turn influence health behaviors [6](#) and outcomes (e.g., substance use, mental health), [7,8](#) and ultimately provide advantages across the life course. [9](#) Alternatively, not moving can reduce such opportunities, resulting in decreased likelihood of transitioning to socially-advantaged areas and future mobility, as well as less access to health-promoting resources within their current and future communities, thus impacting their health behaviors and outcomes. [8](#) Understanding characteristics of young adults who are mobile is therefore important to understand socioeconomic inequities in general and those that relate to health.

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Despite mobility being at record lows during COVID-19 across age groups in the US, young adults (ages 20–29) were the most likely age group to move (18% vs. 8% of the overall population), consistent with trends preceding the pandemic. ⁵ Notably, however, 9% of young adults reported moving specifically due to COVID-19, which was more common among racial/ethnic minority versus White young adults. ¹⁰ Among those who moved due to the pandemic, prominent reasons for moving included: to reduce their risk of contracting COVID-19 (28%), because their college campus closed (23%), to be with family (20%), and financial (18%, including job loss [8%] or another money-related reason [10%]).¹⁰ These findings align with the literature indicating that young adults were particularly impacted by job instability leading to layoffs and changes in educational plans (e.g., switching to virtual instruction). ^{11–13} Moreover, this adds to the extensive discourse regarding the differential economic impact of the COVID-19 pandemic on individuals from disadvantaged neighborhoods, namely those with high levels of poverty, higher racial minority composition, and lower educational attainment. ^{14–16} For example, financial hardships resulted in disproportionate evictions among people from disadvantaged neighborhoods during COVID-19. ¹⁴ Such circumstances have important implications for one's ability to afford housing, move to new neighborhoods, or even desire existing housing arrangements. ¹⁷ Moreover, compared to before the pandemic, US adults are now less likely to want to live in cities (19% in 2021 vs. 23% in 2018). ¹⁸

While these data speak to general population trends over time, there has been little specific examination of cohorts of young adults and their mobility during COVID-19, particularly research that has accounted for individual- and neighborhood-level predictors of mobility (i.e., moving) both during and before the pandemic. Thus, the purpose of this manuscript is to describe mobility among a young adult sample in six metropolitan statistical areas (MSAs) in the US and examine individual- and neighborhood-level correlates of mobility before and during the COVID-19 pandemic.

Methods

Study Design

This study utilized data from survey responses collected among individuals ages 18–34 years participating in a two-year, five-wave longitudinal cohort study entitled the Vape shop Advertising, Place characteristics and Effects Surveillance (VAPES) study. ¹⁹ The VAPES study assesses the vape retail environment and its effects on e-cigarette and

tobacco use among young adults. Participants were recruited from six MSAs with diverse tobacco and marijuana legislative settings: Atlanta, GA; Boston, MA; Minneapolis, MN; Oklahoma City, OK; San Diego, CA; Seattle, WA. ²⁰ These cities/states also represent various experiences with COVID-19 related state orders. ²¹ Bi-annual surveys were initiated in Fall 2018. This study was approved by the Emory University Institutional Review Board.

Participants and Recruitment

Study participants were recruited through social media platforms (i.e., Facebook, Reddit; see details provided elsewhere ¹⁹), via advertisements that: (1) targeted individuals of the eligible age range (18–34 years old) and geographical location (home residence \leq 15 miles of a previously mentioned MSA); and (2) used groups/interests (e.g., entertainment, technology) and images (i.e., young adults of diverse racial/ethnic backgrounds) of interest/appeal to the target population. Quota and purposive sampling were used to recruit sufficient proportions of e-cigarette and cigarette users, roughly equivalent numbers of men and women, and \geq 40% racial/ethnic minorities to explore use within subgroups.

After clicking an advertisement, individuals were directed to study webpage with a consent form. After consenting, they completed an eligibility screener (which included questions on gender, race, ethnicity, and past 30-day use of e-cigarettes and cigarettes to facilitate reaching recruitment targets in each MSA). Eligible individuals were directed to the baseline (Wave 1) survey hosted on Alchemer. After completing the baseline survey, individuals confirmed their participation in a follow-up email, after which individuals were officially enrolled and emailed their initial incentive (\$10 Amazon electronic gift card).

Recruitment lasted 87–104 days across MSAs. Of 10,433 Facebook/Reddit users who clicked ads, 9,847 consented. Of these, 2,751 (27.9%) were either ineligible ($n=1,472$) or excluded to reach subgroup targets ($n=1,279$). Of the 7,096 included, 49% ($n=3,460$) completed the survey. Of the 3,636 who partially completed surveys (and were deemed ineligible), most (68%; $n=2,469$) only provided the initial sociodemographic data. ¹⁹ In order to be officially enrolled in the study, 87% ($n=3,006$) then confirmed participation via a follow-up email 7 days later.

This study utilized baseline survey data (Fall 2018, $n=3,006$), as well as location information updated among all participants in January 2020 and Fall 2020 survey data ($n=2,476$). The January 2020 data collection included assessments of current home/primary residence address at that time and at the time of the baseline survey; Fall 2020 data collection included assessment of current home address.

There were 2,153 individuals with data at all three timepoints (excluding 19 who resided outside the US at any timepoint), with 1,382 participants (46.0% of the sample) included in this analysis who provided home address data at all timepoints.

Measures

Mobility pre-pandemic (Fall 2018 to Jan 2020) and during pandemic (Jan-Fall 2020) were our primary outcomes. Mobility was determined using home addresses provided at these timepoints. Addresses provided were geocoded to latitude and longitude coordinates using the geocode function in R package ‘ggmap’, which uses Google as a reference source for geocoding using a Google API. [22,23](#) Latitude and longitude coordinates were then converted to census block codes using an FCC API. [24](#) Census block codes were compared among individuals pre-pandemic and during pandemic, and were categorized as ‘Did not move’ (remained in the same census block) or ‘Moved’ (resided in different census blocks).

Sociodemographic characteristics assessed at baseline included age, gender, sexual orientation, race, ethnicity, if they were born in the US, highest level of educational attainment, employment status, and relationship status.

Neighborhood characteristics of census tracts geocoded from home addresses were taken from the American Community Survey (ACS) 5-year estimates, specifically 2014–2018 ACS to characterize Fall 2018 neighborhoods and 2015–2019 ACS for 2020 neighborhoods. ACS data were collected using the ‘tidycensus’ package in R. [25](#) Estimates extracted included: race, ethnicity, proportion foreign-born, highest education attainment, proportion unemployed, and poverty level. Poverty levels were categorized into tertiles for analysis (0–33% = ‘Low’, 34–66% = ‘Medium’, and 67–100% = ‘High’).

Statistical Analysis

Descriptive statistics were used to characterize the sample and neighborhood characteristics of their home addresses. Bivariate analyses were performed to compare individual sociodemographic and neighborhood characteristics across mobility groups (i.e., those who did vs. did not move pre-pandemic and during pandemic, respectively). Groups were compared using the chi-square or Kruskal-Wallis test for categorical and continuous variables, respectively, with a two-sided p value < 0.05 used for statistical significance. We used multivariable logistic regression to examine correlates of mobility pre-pandemic and during pandemic. In our adjusted model, we included the following: (1) for individual characteristics significant in the bivariate analysis:

age, gender, sexual orientation, race, ethnicity, employment status, highest level of education achieved, and relationship status; and (2) for neighborhood characteristics significant in the bivariate analysis: proportion foreign-born and poverty level (as tertiles). Variables were tested for multicollinearity and those highly correlated (e.g., individual level foreign born) were removed from the final adjusted model. All analyses were performed using R version 4.0.4 (Vienna, Austria).

Results

Descriptive statistics of the analytic sample ($n = 1,382$) are shown in Table 1. The median age was 25 years (interquartile range [IQR] 21–29), most were female (57%) and White (73%), 78% had a bachelor’s degree or higher, 31% identified as a sexual minority (gay/lesbian or bisexual), and 39% were married or living with a partner in Fall 2018. Per ACS data characterizing the neighborhoods of participants in Fall 2018, the median proportion of White individuals was 72% (IQR 59–82%), foreign-born individuals 15% (IQR 9–26%), unemployed 4% (IQR 3–7%), and below the poverty level 11% (IQR 6–21%).²⁵

Slightly more participants moved pre-pandemic (36%) rather than during pandemic (32%). In bivariate analyses (Table 1), pre-pandemic movers (vs. non-movers) were more likely to be sexual minority and live in census tracts that were below the poverty level in Fall 2018 (p ’s < 0.05). In multivariable logistic regression (Table 2), predictors of moving pre-pandemic included being a sexual minority ($OR_a = 1.52$; $CI_{95\%} = 1.18, 1.94$) and living in a census tract falling into one of the top two tertiles (vs. the bottom) of percent below poverty in Fall 2018 (Medium: $OR_a = 1.56$, $CI_{95\%} = 1.17, 2.09$; High: $OR_a = 1.82$, $CI_{95\%} = 1.35, 2.45$).

In bivariate analyses (Table 1), movers during the pandemic (vs. non-movers) were younger and were more likely to be non-Hispanic and single (p -values < 0.05); however, there were no significant differences in Fall 2020 census tract characteristics between movers and non-movers during the pandemic. In multivariable logistic regression (Table 2), predictors of moving during the pandemic included younger age ($OR_a = 0.95$; $CI_{95\%} = 0.92, 0.98$), non-Hispanic ethnicity (vs. Hispanic; $OR_a = 0.59$; $CI_{95\%} = 0.38, 0.90$), being single (vs. married or living with a partner; $OR_a = 0.76$; $CI_{95\%} = 0.58, 0.99$), and greater (tertile) level of poverty in their census tract (Medium: $OR_a = 1.50$, $CI_{95\%} = 1.11, 2.03$; High: $OR_a = 1.86$, $CI_{95\%} = 1.37, 2.54$).

Table 1 Individual and neighborhood characteristics of the sample and bivariate comparisons of movers versus non-movers pre-pandemic (Fall 2018 to Jan 2020) and during pandemic (Jan 2020 to Fall 2020), N = 1,382

	Baseline	Pre-Pandemic Move (Fall 2018 to Jan 2020)		p-value	During Pandemic Move (Jan 2020 to Fall 2020)		p-value
	Total N = 1,382 N (%)	Yes N = 494 (35.7) N (%)	No N = 888 (64.3) N (%)		Yes N = 437 (31.6) N (%)	No N = 945 (68.4) N (%)	
Individual characteristics							
Age, median (IQR)	25 (21, 29)	24 (21, 28)	25 (21, 29)	0.153	23 (20, 27)	25 (22, 29)	<0.001
Gender				0.901			0.784
Male	556 (40.2)	195 (39.5)	361 (40.7)		170 (38.9)	386 (40.8)	
Female	794 (57.4)	287 (58.1)	507 (57.1)		257 (58.8)	537 (56.8)	
Other	32 (2.3)	12 (2.4)	20 (2.3)		10 (2.3)	22 (2.3)	
Sexual minority	429 (31.0)	181 (36.6)	248 (27.9)	<0.001	287 (30.4)	142 (32.5)	0.427
Race				0.506			0.066
White	1011 (73.1)	369 (74.7)	642 (72.3)		691 (73.1)	320 (73.2)	
Black	72 (5.2)	25 (5.1)	47 (5.3)		54 (5.7)	18 (4.1)	
Asian	159 (11.4)	58 (11.7)	101 (11.4)		97 (10.3)	62 (14.2)	
Other	140 (10.3)	42 (8.5)	98 (11.0)		103 (10.9)	37 (8.5)	
Hispanic	137 (10.0)	48 (9.7)	89 (10.0)	0.855	32 (7.3)	105 (11.1)	0.028
Foreign-born	123 (8.9)	41 (8.3)	82 (9.2)	0.559	37 (8.5)	86 (9.1)	0.700
Education ≥ bachelor's degree	1082 (78.3)	389 (78.7)	694 (78.2)	0.798	351 (80.3)	732 (77.5)	0.230
Employment status				0.573			<0.001
Student	338 (24.5)	112 (22.7)	226 (25.5)		136 (31.1)	202 (21.4)	
Unemployed	123 (8.9)	41 (8.3)	82 (9.2)		30 (6.9)	93 (9.8)	
Employed part-time	348 (25.2)	130 (26.3)	218 (24.5)		118 (27.0)	230 (24.3)	
Employed full-time	573 (41.5)	211 (42.7)	362 (40.8)		153 (35.0)	420 (44.4)	
Relationship status				0.149			<0.001
Single/Other	849 (61.4)	316 (64.0)	533 (60.0)		301 (68.9)	548 (58.0)	
Married/Living with partner	533 (38.6)	178 (36.0)	355 (40.0)		136 (31.1)	397 (42.0)	
	%, median (IQR)	%, median (IQR)	%, median (IQR)		%, median (IQR)	%, median (IQR)	
Neighborhood characteristics¹							
Race							
Black or African American	6.7 (2.4, 14.5)	6.2 (2.5, 14.4)	6.5 (2.5, 14.4)	0.782	7.0 (2.2, 13.6)	7.1 (2.8, 15.8)	0.103
White	72.2 (57.8, 82.1)	73.0 (58.7, 82.9)	72.2 (58.0, 81.9)	0.289	73.0 (59.6, 82.4)	71.9 (57.9, 81.1)	0.254
Hispanic or Latino	7.3 (4.1, 13.4)	7.6 (4.7, 14.2)	7.3 (4.2, 13.5)	0.222	7.2 (4.4, 14.0)	8.2 (4.8, 15.4)	0.089
Foreign-born	15.3 (8.7, 25.9)	14.2 (8.2, 24.4)	15.0 (8.8, 24.8)	0.128	14.5 (8.3, 23.3)	15.1 (8.8, 25.6)	0.151
Educational attainment ²							
High school graduate	14.5 (8.5, 22.8)	14.5 (9.0, 22.6)	15.2 (8.8, 23.7)	0.824	14.3 (8.6, 22.7)	15.5 (9.2, 23.7)	0.062
≥ Bachelor's degree	27.7 (17.6, 35.8)	27.5 (19.4, 35.4)	28.2 (18.2, 35.5)	0.714	27.5 (19.0, 35.8)	27.9 (18.3, 35.5)	0.787
Unemployed ³	4.2 (2.7, 6.6)	4.0 (2.6, 6.0)	3.9 (2.4, 6.0)	0.284	4.1 (2.5, 6.0)	4.1 (2.6, 6.2)	0.927
Poverty rate							
Below poverty level ⁴	11.2 (6.0, 20.5)	10.7 (6.2, 19.3)	9.5 (5.5, 17.6)	0.009	11.6 (5.9, 20.6)	10.0 (6.0, 18.4)	0.101
Below poverty level tertiles							
Low	4.7 (3.2, 6.0)	4.8 (3.4, 5.9)	4.0 (2.8, 5.6)	0.022	4.5 (2.9, 5.7)	4.8 (3.2, 6.1)	0.081

Table 1 (continued)

	Baseline	Pre-Pandemic Move (Fall 2018 to Jan 2020)			During Pandemic Move (Jan 2020 to Fall 2020)		
Medium	11.2 (9.0, 14.2)	10.0 (8.4, 12.2)	9.8 (8.3, 11.9)	0.351	10.8 (8.8, 13.1)	10.7 (8.7, 13.2)	0.796
High	26.9 (20.6, 40.1)	25.8 (18.8, 38.6)	23.3 (18.1, 34.3)	0.073	23.4 (18.5, 36.4)	24.5 (18.8, 32.4)	0.866

¹Data from the American Community Survey 5-Year Data 2014–2018 from census tract levels was used for Baseline characteristics, and the American Community Survey 5-Year Data 2015–2019 from census tract levels was used for all other estimates.

²For individuals ≥ 18 years.

³For individuals ≥ 16 years.

⁴Total income in past 12 months.

Discussion

This study examined the individual- and neighborhood-level correlates of mobility before and during the COVID-19 pandemic among a young adult sample. More young adults moved pre-pandemic versus during the pandemic (36% vs. 32%, respectively), aligning with other estimates indicating less mobility during the pandemic albeit higher estimates of young adult mobility during this time nationally (18%).⁵ This could be a result of our sample being drawn from cities, which netted greater moves out than in during the pandemic. 5.

Individual-level predictors of moving pre-pandemic were identifying as a sexual minority. Few studies have assessed whether being a sexual minority is related to mobility. However, the health impacts of changing neighborhoods during this critical period is dependent on age, gender, and intimate partnerships. 29 Therefore, future studies should explore whether individuals who identify as sexual minorities have different partnering patterns and whether this influences their mobility and neighborhood exposures.

Younger age, being single, and non-Hispanic ethnicity predicted moving during the pandemic. Previous studies that have examined associations between individual characteristics and mobility among young adults have shown that those with less education and those who identified as Black male had lower upward mobility, 9 which was related to higher mortality over the life course. Our study examined mobility overall, rather than upward or downward mobility, and therefore the characteristics related to mobility in general may be different.

Higher neighborhood poverty was also correlated with mobility both before and during the pandemic indicating that living in a higher poverty neighborhood, regardless of whether there is a pandemic or not, may be related to moving. Previous studies that have examined neighborhood level predictors of residential mobility have shown that living in a poor neighborhood in childhood predicts disproportionate exposure to poverty over the life course.

26 Therefore, if an individual lives in a poor neighborhood, they are more likely to continue that trend. Although moves from high to low poverty neighborhoods can be good for behavioral functioning, 30 data also show that when young people move into neighborhoods with less poverty and more racial integration, inequality gains are often lost. 31 Thus, the cycles of inequality may persist; and those who live in poor neighborhoods may be vulnerable and have difficulty escaping the negative impacts that living in a poor neighborhood have on their health.

This study has several limitations. First, generalizability to all young adults is limited to those in the 6 metropolitan cities sampled in this study. Next, our estimates of mobility may be underestimated as we assessed mobility by comparing the addresses of participants in January 2020 and in Fall 2020 with the addresses provided in Fall 2018. Thus, any moves experienced by participants before between Fall 2018 and January 2020 were not captured. Finally, this analysis focused on individual- and neighborhood-level correlates of mobility rather than whether individuals who moved relocated to better or worse neighborhoods. Future studies, however, should assess whether young adults' mobility is upward, stable, or downward.

Conclusion

The findings of this study highlight individual- and neighborhood-level correlates of mobility before and during the COVID-19 pandemic in a young adult sample – namely Hispanic ethnicity, sexual minority status, and neighborhood poverty. Further studies are needed to better understand mobility patterns among racial/ethnic and sexual minority populations. However, neighborhood poverty was related to mobility, regardless of COVID-19, highlighting the pervasive impact of neighborhood poverty. Given that young adulthood is a critical period where mobility opportunities can exacerbate existing inequality, policies should

Table 2 Multivariable regression models identifying predictors of young adults moving pre-pandemic (Fall 2018 to Jan 2020) and during pandemic (Jan 2020 to Fall 2020), adjusted for individual and neighborhood characteristics, N = 1,382

	Pre-Pandemic Move (Fall 2018 to Jan 2020)		During Pandemic Move (Jan 2020 to Fall 2020)	
	OR	95% CI	OR	95% CI
Individual characteristics				
Age	0.97	0.94, 1.00	0.95	0.92, 0.98
Gender (ref: Male)				
Female	1.00	0.79, 1.27	1.09	0.86, 1.40
Other	0.78	0.35, 1.67	0.96	0.41, 2.14
Sexual minority (ref: Heterosexual)	1.52	1.18, 1.94	1.09	0.84, 1.41
Race (ref: White)				
African American or Black	0.86	0.50, 1.43	0.63	0.34, 1.10
Asian	1.06	0.73, 1.53	1.11	0.77, 1.60
Other	0.70	0.47, 1.04	0.80	0.52, 1.21
Hispanic (ref: non-Hispanic)	1.01	0.68, 1.48	0.59	0.38, 0.90
Education ≥ bachelor's degree (ref: <bachelor's degree)	1.05	0.79, 1.40	1.29	0.96, 1.75
Employment status (ref: Student)				
Unemployed	1.41	0.85, 2.31	0.82	0.48, 1.38
Employed part-time	1.35	0.97, 1.88	0.88	0.63, 1.22
Employed full-time	1.54	1.09, 2.17	0.79	0.56, 1.12
Relationship status (ref: Single/Other)				
Married/Living with partner	0.81	0.63, 1.05	0.76	0.58, 0.99
Neighborhood characteristics				
Foreign-born	0.99	0.98, 1.00	1.00	0.98, 1.01
Below poverty level tertiles (ref: Low)				
Medium	1.56	1.17, 2.09	1.50	1.11, 2.03
High	1.82	1.35, 2.45	1.86	1.37, 2.54

be considered to promote upward mobility among vulnerable young adult populations.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10900-022-01146-9>.

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Declarations

Compliance with ethical standards This study was approved by the Emory University Institutional Review Board.

Conflict of interest The authors have no conflicts of interest to disclose.

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