SOCIAL RELATIONSHIPS AND IMMIGRANT HEALTH: STRUCTURAL AND TEMPORAL PERSPECTIVES

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ABSTRACT

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Decades of research have paid extensive attention to the health outcomes of immigrants and the implications of their social relationships. Scholars have yet to fully appreciate, however, how immigrants' personal relationships are fundamentally shaped by the structural conditions that encompass their lived experiences, and by the temporal dynamics that unfold these experiences over time. This dissertation investigates how structural and temporal conditions contribute to the consequences of immigrants' social relationships for their physical and mental health. The first chapter summarizes the empirical evidence on immigrants' social relationships and health outcomes, outlining a theoretical framework on the roles of structural and longitudinal factors in underlying these patterns. The second chapter leverages data from the Mexican Migration Project to examine how gender inequalities in the sending context contribute to heterogeneity in immigrant health selection among Mexican immigrants. Analyses find that less empowered female immigrants – especially those without documentation -- saw significantly lower degrees of health selection. By contrast, male immigrants were positively selected on health even when they were relatively disadvantaged. The third chapter investigates the mental health implications of instability in immigrant adolescents' same-sex best friends, and how it explains the association between acculturation and depressive symptoms. Using data from the National Longitudinal Study of Adolescent to Adult Health, analyses find that friendship instability was associated with

higher depressive symptoms only among immigrant adolescents with a low level of acculturation. The fourth chapter examines the mental health disparities between undocumented Mexican immigrants and individuals of other race-nativity backgrounds, and how the experiences of social isolation and inadequate emotional support explain these disparities. Leveraging data from the National Health and Nutrition Examination Survey, analyses find that undocumented Mexican immigrants saw lower levels of depression than other race-nativity groups. Meanwhile, they reported both a lower risk of social isolation and a higher risk of inadequate emotional support than non-Hispanic Whites, which explained their mental health advantages in different directions. The fifth chapter discusses the substantive implications of the three research chapters for immigrants' well-being, identifies the challenges and limitations encountered in these studies, and explores the directions of further research.

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CHAPTER 1

Introduction

INTRODUCTION

As of 2022, the immigrant population in the United States has reached 46.2 million, accounting for 13.9% of the total population (Azari et al. 2024). In understanding their well-being in the host society, the existing bulk of immigration studies have paid extensive attention to health outcomes (Feliciano 2020; Ornelas, Yamanis, and Ruiz 2020). Notably, scholars have found that immigrants tend to report better health than their native-born counterparts – a pattern at odds with their greater exposure to socioeconomic disadvantages, but their health advantages tend to wane over time (Antecol and Bedard 2006; Feliciano 2020; Lu et al. 2017). Numerous studies have since examined the potential mechanisms that may explain these patterns, including the implications of immigrants' social relationships.

Decades of literature have demonstrated that personal networks are crucial for individual well-being. Not only so, but also the mechanisms by which personal networks shape health are multifaceted -- from the earlier studies that focused on social integration, to the later scholarship that analyzed social support, network diffusion, network homophily, and so on (Berkman et al. 2000; House, Umberson, and Landis 1988; Smith and Christakis 2008; Zhang and Centola 2019). Much research is also dedicated to analyzing how social relationships shape immigrants' health. In this vein, scholars have found that the dynamics in social relationships may both promote and harm immigrants' well-being, offering crucial insights into both the health variations among immigrants and health disparities by immigrant generation status (Diaz and Niño 2019; McMillan 2019; Niño et al. 2017).

Yet the formation of immigrants' personal networks is not random, nor is that solely guided by personal preferences. If anything, the bulk of social network scholarship has illuminated that social networks – especially those among the marginalized population – are fundamentally shaped by the structural conditions that encompass their lived experiences in the host society, and by the temporal dynamics that unfold these experiences (DiMaggio and Garip 2012; Erikson and Occhiuto 2017). Such is also the case for the immigrant population. Their social relationships are structurally determined: from the migrant networks in the sending community, to immigrants' social relationships in the host society, the existing scholarship has well demonstrated – or implied – that they are products of systems of inequality, migration policies, and anti-immigrant sentiments from the native-born population (Garcini et al. 2021; Massey 1990; Massey and Espinosa 1997). Their social relationships are also inherently dynamic: while the international movement may substantially disrupt the stability of personal ties, the assimilation process *per se* entails profound changes in immigrants' values, behaviors, and social interactions (Alba and Nee 2003; Portes and Zhou 1993).

These implications may be crucial for understanding how, exactly, the systemic challenges against the immigrant population "get under the skin" to influence individuals' physical and psychological well-being. As an "interstitial mechanism," social networks may contribute to understanding various forms of populational inequalities, including those by health (Erikson and Occhiuto 2017; Zhang and Centola 2019). The temporal dynamics of social relationships may also offer crucial insights into immigrants' declining health advantages over time, to the extent that network-related stressors constitute crucial dimensions of acculturative stress (Berry et al. 1987; Rudmin 2009).

The present dissertation aims to investigate the health implications of immigrants' social relationships, adopting structural and temporal perspectives. I begin by offering an overview of the past literature, including empirical evidence on health among the immigrant population, the role of social relationships, and how structural conditions and longitudinal dynamics may shed light on these patterns. Then, I outline the main objectives of the three research chapters, which answer the dissertation's overarching question through different theoretical angles.

LITERATURE REVIEW

The Immigrant Health Paradox

The existing research on immigrants' health outcomes has generally found that immigrants report better health than the native-born population, despite their socioeconomic disadvantages in the host society (see, for example, Feliciano 2020, for a systematic review). The apparent "immigrant health paradox" has informed a sizable number of studies to investigate the underlying mechanisms. To date, scholars have offered two major explanations: immigrant health selection and the positive health effects of immigrants' post-migration experiences.

Immigrant health selection refers to the pattern that immigrants are positively selected from their home countries, based on their health and health behaviors (Jasso et al. 2004). Numerous studies have found that immigrants on average saw lower rates of mortality, hypertension, obesity, smoking status, etc., than those who stayed in the sending communities (Guillot et al. 2018; Riosmena, Wong, and Palloni 2013; Riosmena, Kuhn, and Jochem 2017; Ro, Fleischer, and Blebu 2016), though a notable study (Rubalcava et al. 2008) found counterevidence from the prospective health and migration data from the Mexican Family Life Survey.

Indeed, immigrants' advantages over their non-migrant compatriots may extend to other measures of personal well-being, e.g., socio-economic status and psychological characteristics (Cebolla-Boado and Soysal 2018; Engzell 2018; Feliciano 2006); these general patterns of immigrant selectivity have been theorized as an important part of the migration process (Jasso et al. 2004; Massey et al. 1993). Insofar as the challenges associated with international migration factor into individuals' cost-benefit analyses in migration decision-making, they may contribute to the systematic differences between who leaves and who stays – in ways that profoundly shape migration inflows over time (Massey et al. 1993).

Later research has shifted its focus from *whether* immigrants are positively selected on health to *how* they are selected. To this end, studies have investigated the heterogeneity in the health selection effects, showing that immigrants' health advantages over non-migrants may vary by factors such as gender, country of origin, documentation status, immigration policy, etc. (Donato, Hamilton, and Bernard-Sasges 2019; Lu and Li 2020; Morey et al. 2020; Ro, Fleischer, and Blebu 2016). These findings call for more systematic incorporations of migration theories into immigrant health research. What, exactly, explains the apparent variations in immigrant health selections? Though studies hinted at the potential roles played by pre- and peri-migration factors, scholars have yet to fully understand how the context of exit (i.e., factors related to the sending communities) shapes the presence and magnitude of immigrants' health advantages.

The second line of research focuses on the health implications of immigrants' experiences and behaviors after migration. Drawing on theories in immigrant incorporation, scholarship in this vein has paid extensive attention to the role of assimilation processes, i.e., the process by which immigrants adapt to the host sociocultural norms, gain access to the major social

institutions in the host country, and blur their ethno-racial boundaries with the native-born population (Alba and Nee 2003; Portes and Zhou 1993), in individuals' health outcomes.

Scholars have found that participation in immigrant communities and social networks, suggesting a lack of assimilation, is associated with better health and health behaviors, as indicated by lower rates of smoke initiation, drinking, drug use, and depression (McMillan 2019; Walton 2012). These patterns may indeed stem from immigration selectivity effects: to the extent that immigrants exhibit better health behaviors and personal characteristics, such as optimism and aspiration, they may also have a positive social influence on other immigrants in the same communities and social cliques, in ways that promote community and network members' health (Zhang and Centola 2019). It should be noted, though, that a close affiliation with ethnic enclaves may also prevent immigrants from assimilating into positive norms in the receiving society (Tong 2010). Meanwhile, some forms of assimilation into the host society may promote health. English proficiency, for example, is consistently found to predict better mental health (Harker 2001; Kimbro, Gorman, and Schachter 2014; Takeuchi et al. 2007).

Perhaps the biggest challenge to immigrants' well-being is the stressful experiences in the host society. Empirical evidence suggests that immigrants' health outcomes tend to exhibit a downward trend over time, thereby converging with those of the native-born population (Antecol and Bedard 2006; Cho et al. 2004; Guillot et al. 2018). These findings imply that post-migration experiences could be detrimental to individuals' well-being, though a few studies have pointed out that the negative health implications of years in the host society could be confounded by immigrant arrival cohorts (Hamilton and Hummer 2011; Lu et al. 2017). Scholars have since documented a wide array of factors related to the host society that negatively affect immigrants' health, including material hardship stemming from socioeconomic disadvantages (Altman et al.

2021), barriers to healthcare access (Hacker et al. 2015; Lauderdale et al. 2006), experiences of discrimination due to anti-immigrant sentiments among the native-born population (Kim et al. 2011; Yoo, Gee, and Takeuchi 2009), restrictive immigration policies that contribute to socio-legal exclusions (Amuedo-Dorantes and Arenas-Arroyo 2021; Chiswick, Lee, and Miller 2008; Ornelas, Yamanis, and Ruiz 2020), psychosocial stress accompanying the cultural adaptation process (Berry et al. 1987; Rudmin 2009), assimilation into the host culture that normalizes negative health behaviors (Lu et al. 2017; McMillan 2019), and so on. These challenges may collectively contribute to immigrants' experiences of acculturative stress, i.e., psychosocial stress that arises from the acculturation process (Berry et al. 1987).

Taken together, previous studies have demonstrated that the "immigrant health paradox" may result from a complex set of mechanisms. Whereas the migration selection process and the protective effects of immigrant communities may contribute to better health among immigrants, the systems of exclusion, marginalization, and violence against immigrants in the host society have harmful health effects. All these mechanisms are closely related to individuals' social relationships, a robust predictor of physical and mental health (Berkman and Syme 1979; Berkman et al. 2000; Smith and Christakis 2008; Zhang and Centola 2019). First, scholars have long observed that migrant networks play an integral role in the immigration process and, in turn, immigrant health selectivity; social ties with household and community members that have already emigrated may substantially reduce migration costs and affect migration decisions and, thus, influence the importance of health in migration decision-making (Jasso et al. 2004; Massey 1990; Massey, Goldring, and Durand 1994). Second, immigrants' social networks in the host community, including their relationships with both other immigrants and people native to the

host society, may influence immigrants' health trajectories in profound ways (Viruell-Fuentes and Schulz 2009).

Social Relationships and Immigrant Health

Decades of research have demonstrated that individuals' personal networks have a profound influence on health outcomes (Smith and Christakis 2008; Zhang and Centola 2019). For example, a sizable number of studies suggest the number of social connections may promote an individual's social integration and, thus, predict better health (Berkman et al. 2000; Seeman 1996), though there was evidence suggesting that too many social connections may have a detrimental health effect (Falci and McNeely 2009). Later scholarship expanded the inquiry by examining the multidimensional nature of social relationships, finding that a wide range of personal network characteristics, such as receipt of social support (House, Umberson, and Landis 1988), network homophily (i.e., similarity between individuals and their network members; McMillan 2019; McPherson, Smith-Lovin, and Cook 2001), network density (i.e., the degree to which members of an individual's personal network are connected with each other; Walker 2015), diffusion of diseases and health behaviors (i.e., the spread of health conditions and practices from network alters to the ego; Smith and Christakis 2008; Zhang and Centola 2019), network instability (Chan and Poulin 2009; Schwartz and Litwin 2017; Schwartz and Litwin 2019), and so on may all have a significant influence on physical and mental health.

Social relationships also have important implications for understanding immigrants' health. Some studies have found that migrant networks in sending communities may diminish the magnitude of immigrant health selection effects (Lu and Li 2020). Through resource and information provisions that alleviate the cost of migrations, migrant networks may reduce

immigrant selectivity over time, including health selectivity (Jasso et al. 2004; Massey 1990). Furthermore, transnational networks, i.e., social ties between immigrants and non-migrants in the country of origin, may also play a substantial role in promoting immigrants' well-being through provisions of social support and facilitating healthcare access (Torres et al. 2016). Relatedly, family separation is conceptualized as an important component of acculturative stress, i.e., the psychological strain resulting from the sociocultural adaptation process, which significantly predicts worse mental health (Berry et al. 1987; Rudmin 2009).

Much more attention, however, is paid to how immigrants' personal ties formed in the host community shape their health outcomes and health behaviors. The segmented assimilation theory suggests that the context of reception, including the presence of ethnic enclaves and receptions from the host community, plays a crucial role in incorporation outcomes (Portes and Zhou 1993, Zhou 1997). By extension, scholars have argued that social ties with both other immigrants and the native-born population may influence immigrants' well-being in unique ways (Takeuchi et al. 2007; Walton 2012). Empirical evidence has generally suggested that maintaining ties with immigrant communities is beneficial to immigrants' health. For example, living in an immigrant-concentrated neighborhood enables immigrants to engage in mutual provisions of social support, which may buffer stress and improve mental health (Walton 2012). Having a larger share of foreign-born friends in school is associated with lower rates of drinking, smoking, and depression among immigrant adolescents (McMillan 2019; Niño et al. 2017). These findings imply that a low degree of assimilation is not necessarily undesirable for personal well-being, as the co-ethnic solidarity among immigrants may reinforce their health advantages over the native-born.

Meanwhile, other studies have demonstrated that social relationships with people native to the host country may also predict better health among immigrants, though with more caveats. A line of research recognizes that language barriers in the host society constitute a form of acculturative stress that precludes the formation of high-quality ties with native-born people could be precluded by language barriers, in ways that harm mental health (Berry et al. 1987). As such, network effects help to partially explain the positive health benefits of language proficiency, as it is found to reduce the risks of experiencing discrimination – a form of interpersonal violence – and promote personal network diversity (Tegegne 2018; Xu and Chi 2013). Additionally, adaptation to the host society may also bolster the quality of immigrants' personal networks. A few studies have found that more years in the U.S. were associated with higher levels of perceived social support (Harker 2001; Morey et al. 2021).

Overall, the existing research has demonstrated that social relationships have important and complex implications for immigrants' health outcomes. However, scholars have yet to fully account for the complexity of immigrants' social relationships *per se*: the social network scholarship has long suggested that personal networks are far from purely based on individual choices, nor are they static over time. Structural conditions and temporal dynamics constitute two factors that fundamentally define network characteristics. An appreciation of the structural and temporal foundations of social relationships, as illustrated below, may substantially advance our understanding of immigrants' well-being.

The Structural Foundation of Immigrants' Social Relationships

Scholars have long recognized that social relationships are not randomly formed, but are fundamentally conditioned by the structural contexts (Coleman 1988; Granovetter 1973). Various

forms of "social, psychological, or physical entities" (i.e., foci), such as organizations, communities, and social gatherings, undergird individuals' day-to-day interactions and social tie formations (Feld 1981:1025). Indeed, the putative individual preferences in social relationships, such as the preference for homophilous ties, may be explained in a large proportion by network structural factors, such as propinquity, availability, and balancing mechanisms (Kossinets and Watts 2009; McPherson, Smith-Lovin, and Cook 2001; Wimmer and Lewis 2010). Structural contexts may also constrain personal network choices, by both preventing individuals from forming ties with those they prefer, and forcing them to maintain relationships with those they would otherwise avoid (Feld 1981; Offer 2021). For example, studies have shown that negative ties may ensue when individuals are bounded by structural constraints and social norms, which may result in harmful effects on mental health (Offer and Fischer 2018; Offer 2020).

Later scholarship paid growing attention to how systems of inequalities shape social networks. Axes of stratification such as race, socioeconomic status, and gender not only dictate resource distribution, but also constitute network boundaries that segregate interactions and relationships (DiMaggio and Garip 2012; McPherson, Smith-Lovin, and Cook 2001). These boundaries enable more privileged individuals to reserve their resources and information from the less privileged, as well as to adopt beneficial practices at higher rates, which contribute to their cumulative advantages (DiMaggio and Garip 2012). Relatedly, evidence suggests that marginalized populations, such as racial minorities and lower-SES individuals, report lower amounts of support receipt and higher risks of relationship instability (Cornwell 2015; Schafer and Vargas 2016). Their greater exposure to network disadvantages is partially explained by the experiences of adverse life events that disrupt personal networks, such as unemployment, eviction, and incarceration (Dawkins, Shen, and Sanchez 2005; Desmond and Shollenberger

2015; Pettit and Western 2004). Consequently, social networks may exacerbate inequalities in multiple outcomes concerning individuals' well-being, including health.

The structural foundation of social networks has important implications for immigrants' social relationships and well-being implications. For example, scholars have found that migrant networks in sending communities are shaped by social norms and material conditions in the origin countries (Bashi 2007; He and Gerber 2019). While these networks facilitate the cumulative causations of migration, they may also perpetuate inequalities in resource distribution and power dynamics among immigrants. In particular, gender constitutes a salient factor that contributes to both migrant network boundaries and migration decision-making (Curran and Rivero-Fuentes 2003; Hondagneu-Sotelo 1994; Massey, Fischer, and Capoferro 2006). Women typically migrate at lower rates than men, because men enjoy more freedom in migration decision-making, have more access to financial resources to facilitate migration, and see high economic returns to migration (Massey 1990; Massey, Fischer, and Capoferro 2006). As a result, the unequal gender representation in migrant networks may contribute to gender inequality in migration social capital, in ways that have far-reaching consequences for female immigrants' well-being in the host society (Donato, Hamilton, and Bernard-Sasges 2019; He and Gerber 2019).

Another structural condition that factors into migrant networks in the sending context is inequality based on socioeconomic status. Individuals' educational and financial backgrounds may not only determine their overall likelihood of migration, but also stratify their access to resources provided by fellow migrants. In the context of Mexico-U.S. migration, for example, scholars found that individuals from indigenous places, who faced systematic economic and social disadvantages, were more likely to migrate without documentation (Asad and Hwang

2019). The material deprivation of those aspiring migrants resulted in their disproportional reliance on networks of undocumented immigrants. Consequently, their migration experiences were characterized by exposure to violence and danger during the border-crossing process, as well as continued hardship in the destination country (Jasso 2011; Pickering 2011).

It should be noted, however, that the social stratification behind migrant networks may depend on the policy context upon emigration. For instance, evidence suggests that Chinese emigrants to the U.S. have exhibited a high degree of immigrant selectivity based on political, human, and social capital, due to the tightening exit and entry policies, as compared to those who moved to Europe, for whom the policies were more lenient (Lu, Liang, and Chunyu 2013). These patterns imply that China-U.S. emigrant networks might well be characterized by a rich amount of resource and information provisions. It might partially explain patterns of "hyper-selectivity" among Chinese immigrants in the United States, who have reported better health and higher educational attainments than the native-born population (Lee and Zhou 2015; Lee and Kye 2016).

After resettlement in the host society, the structural conditions in the context of reception may play an integral role in immigrants' personal network formations. An important factor could be local immigration policies, which preclude immigrants from accessing major host institutions, deterring them from interacting with the native-born population, and thereby contributing to the social and legal exclusions of immigrant communities of specific racial/ethnic origins (Gonzales 2016; Ornelas, Yamanis, and Ruiz 2020). The economic opportunities in the host community may also influence immigrants' social relationships, by stratifying incorporation outcomes and providing immigrants with entry into the host society's middle-class echelon (Portes and Zhou 1993; Villarreal and Tamborini 2018). Moreover, anti-immigrant sentiments among the native-

born population elevate immigrants' risks of encountering discrimination when they navigate the host community and, as a result, may lead immigrants to withdraw from socializing with people native to the host society (Morey 2018; Rodriguez et al. 2023).

While the systemic disadvantages in the context of reception may preclude immigrants from assimilating into native-born people's personal networks, they may also constrain immigrants' everyday social lives within immigrant communities and facilitate co-ethnic bonds. Indeed, segmented assimilation theory contends that co-ethnic solidarity is a defining characteristic of many migrant communities, by facilitating economic integration without cultural assimilation (Portes and Zhou 1993). Co-ethnic support is also crucial for promoting immigrants' mental health (Diaz and Niño 2019).

However, the extent to which migrant communities may facilitate high-quality ties among immigrants also depends on community material conditions. The structural conditions of ethnic enclaves, including the number of immigrants in the community and the amount of community financial capital, are crucial for shaping immigrants' incorporation trajectories (Portes and Zhou 1993). In those communities that are materially deprived, individuals are indeed exposed to more financial hardship and violence, which leads to downward assimilation. The negative consequences may extend to immigrants' social relationship formations. Hagan (1998) found that ethnic enclaves might encapsulate immigrants' personal networks in the long run, in ways that hamper their upward economic mobility and, presumably, personal well-being. Other scholars have also suggested the risks of exploitative relationships in ethnic enclaves, whereby immigrants engage in financial exploitations of their co-ethnic newcomers and negatively affect the latter's well-being (Liu and Olivos 2019; Sanders and Nee 1987).

Though the structural foundation of immigrants' personal networks has been explored in the prior literature, its health implications remain curious. Existing studies have primarily focused on how personal network measures – as individual-level characteristics – may help to explain health disparities among immigrants or across immigrant generation status. However, they have underappreciated the structural foundation of immigrants' personal networks. The systematic disadvantages faced by immigrants – including inequalities embedded in migrant networks, anti-immigrant sentiments, and the challenges associated with legal status – may exacerbate health challenges, while personal networks as "interstitial mechanisms" may help us understand how these disadvantages manifest in immigrants' lived experiences and affect their well-being. Thus, the multi-faceted structural foundation in immigrants' social relationships deserves much greater attention in scholarship on immigrants' health.

The Temporal Foundation of Immigrants' Social Relationships

Social networks are inherently dynamic, which constitutes one of the most important topics in network science (Erikson and Occhiuto 2017). A large bulk of literature has documented that macro-level historical and societal processes play integral roles in shaping the evolutions of social networks, which may in turn contribute to patterns of inequality (Erikson and Occhiuto 2017; White 2008).

The longitudinal dynamics of personal networks also have important health consequences. Using sociocentric network methods, numerous studies have investigated the co-evolution of social networks and health measures within a network structure (Smith and Christakis 2008). Evidence has generally suggested that social ties and health are mutually influential on each other: individuals' health and health behaviors tend to be significantly

influenced by those of their network members, also known as network diffusion (DiMaggio and Garip 2012; Zhang and Centola 2019). Meanwhile, the formation and dissolution of social ties are fundamentally guided by selections; individuals with similar health status and health practices tend to form and maintain ties over time (Zhang and Centola 2019). These mechanisms may illuminate a wide range of health-related outcomes, including depression, suicidal ideation, physical exercise, smoking, infectious diseases, etc. (adams et al. 2022; Klovdahl et al. 1994; Mueller and Abrutyn 2015; Schaefer, Kornienko, and Fox 2011). Importantly, network dynamics may also help to explain how health disparities are compounded over time. When network clusters – often defined by racial, gender, and class boundaries – see uneven rates of disease and health behavior contagion, the populational health inequities may be drastically exacerbated in the long run (DiMaggio and Garip 2012; Laumann and Youm 1999).

Another line of research has examined personal network characteristics on the individual level, often leveraging egocentric network and health data. Studies in this vein have shown, for example, that experiences of social isolation may steadily increase over the life course, and old adults are at particularly high risks of experiencing a lack of social connections and loneliness (Donovan and Blazer 2020; Umberson, Lin, and Cha 2022). Other studies have focused on shorter-term instability in personal networks, which are characterized by the formation of new ties, the dissolution of old ties, and changing patterns of interactions within a short timeframe (Cornwell 2015; Schafer and Vargas 2016). They have generally found a negative association between personal network instability and mental health, as frequent turnover in network members may induce negative emotions in response to relationship loss, diminish individuals' social integration, and disrupt the receipt of social support (Chan and Poulin 2009; Lessard and

Juvonen 2018; Schwartz and Litwin 2019). An exception is that the dissolution of negative ties may alleviate an individual's stress burden, which improves mental health (Offer 2021).

Not surprisingly, these patterns of personal network changes are also dictated by systems of inequality. As mentioned above, individuals of marginalized backgrounds (by their race and SES) were significantly more likely to experience network instability, including bereavement, disruptions in family of origin, spousal separation, and turnover in supportive ties, etc. (Fomby and Cherlin 2007; Kposowa 1998; Schafer and Vargas 2016; Umberson et al. 2017). These forms of adverse network changes are found to significantly predict worse mental health and poorer developmental outcomes among adolescents (Chan and Poulin 2009; Fomby and Cherlin 2007; Lessard and Juvonen 2018). Individuals of low-SES backgrounds are also more likely to find themselves in a disadvantageous kinship network over their life course, such as single parenthood during young adulthood and orphanage during adulthood (Sohn 2023). These patterns may contribute to diminished receipt of social support and substantial challenges against personal well-being over time.

These temporal dynamics of personal networks may well be relevant to immigrants' lived experiences and, in turn, play an important role in their health outcomes. International migration *per se* constitutes a form of relocation, which may substantially disrupt personal networks. Separation from family and community members in the country of origin is well known as an important stressor (Gutierrez-Vazquez, Flippen, and Parrado 2018; Rudmin 2009). The disruption in personal networks formed in the sending context may contribute to feelings of loneliness among immigrants in the long run, especially considering that support from family members can't be easily replaced by that provided by other network members (Cornwell and Qu 2024; Negi et al. 2021).

The personal networks immigrants formed in the receiving community may also exhibit considerable evolution and instability over time. Theories of incorporation posit that the process of assimilation involves substantial changes in personal beliefs, values, *and* social relationships (Alba and Nee 2003; Gordon 1964; Portes and Zhou 1993). Over time, immigrants may expand their personal networks outside of their ethnic enclaves to establish close contact with the native-born population (Brown 2006). These network changes may contribute to immigrants' economic mobility, but the gradual loss of connections with co-ethnic immigrants might imply diminished immigrant health advantages (McMillan 2019). Additionally, immigrants may encounter substantial challenges in maintaining their interethnic ties, due to language barriers and cultural differences (Brown 2006; Emerson, Kimbro, and Yancey 2002). The resultant instability in personal networks might also help to explain the downward health trajectories among the immigrant population over time.

Despite these implications, how temporal dynamics in social relationships shape immigrants' health remains a significantly underexamined topic (Lubbers et al. 2010). This is in large part because of the lack of longitudinal data on immigrants' social networks and health outcomes. Yet as illustrated above, not only do the dynamics in personal networks constitute an important part of the assimilation process, but it may also have important implications on patterns of declining immigrants' health advantages over time. Adopting a longitudinal approach to analyzing social network and health may advance our understanding of how social relationships may both buffer and compound experiences of stress for immigrants.

THE PRESENT DISSERTATION

Through three studies, the present dissertation aims to investigate 1) how structural conditions and temporal dynamics factor into immigrants' social relationships, and 2) how these implications shed light on both health variations among immigrants, and health disparities by immigrant generation status.

The second chapter analyzes how gender inequalities in sending households and communities contribute to heterogeneity in immigrant health selection (i.e., the positive role of early-life health in migration) among Mexican immigrants, and how the patterns vary by individuals' gender and documentation status. Recent studies found that female immigrants in the U.S., especially those without documentation, face systematic health disadvantages, thereby challenging the notion of an "immigrant health paradox." In explaining these patterns, little research has considered the role of the sending context. Leveraging event history data from the Mexican Migration Project, analyses find that less empowered female immigrants saw significantly lower degrees of health selectivity. This pattern was particularly pronounced among undocumented women. By contrast, male immigrants were positively selected on health even when they were relatively disadvantaged. Indeed, having a more educated spouse promoted health selectivity in men's undocumented immigration. These findings suggest that gender inequalities in the sending context may contribute to intersectional health disparities by gender and documentation status among Mexican immigrants.

The third chapter investigates the mental health implications of instability in immigrant adolescents' same-sex best friends, and how it explains the association between acculturation and depressive symptoms. Recent scholarship suggests that personal tie instability, i.e., the dissolution of old ties and the formation of new ties, may lead to psychological distress. However, this association remains understudied among the immigrant population, for whom

acculturation may present unique challenges to both personal tie stability and psychological well-being. Using data from the National Longitudinal Study of Adolescent to Adult Health, analyses find that friendship instability was associated with higher depressive symptoms only among immigrant adolescents with a low level of acculturation. For more acculturated adolescents, replacing their original friendship with an interracial friend predicted lower depressive symptoms. These findings imply that friendship instability constitutes a dimension of acculturative stress, with detrimental effects unique to immigrant adolescents in the early stages of acculturation.

The fourth chapter examines the mental health disparities by documentation status and race-ethnicity, i.e., the differences in mental health between undocumented Mexican immigrants, documented Mexican immigrants, native-born Mexican Americans, and native-born non-Hispanic Whites, and the explanatory roles played by two dimensions of social relationship characteristics: social isolation and inadequate emotional support. Scholars have paid extensive attention to undocumented Mexican immigrants' mental health, as their legal status may subject them to a wide array of psychosocial stressors. However, few studies have examined the mental health implications of undocumented immigrants' social relationships. Leveraging data from the 2005-2008 National Health and Nutrition Examination Survey, analysis results suggest that undocumented Mexican immigrants saw lower levels of depression than the other three groups. However, they reported both a lower risk of social isolation and a higher risk of inadequate emotional support than non-Hispanic Whites, which explained undocumented Mexican immigrants' mental health advantages in different directions. The chapter concludes by discussing how the structural challenges faced by undocumented immigrants may contribute to the apparent "social relationship paradox," and how an appreciation of the complexity of social

relationships may advance the understanding of undocumented immigrants' psychological well-being.

The fifth chapter offers a conclusion of this dissertation, by synthesizing findings from chapters 2-4 and discussing their substantive implications for immigrants' well-being. The chapter will also identify the common challenges and limitations encountered in these studies, and how they may inform the directions of further research.

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CHAPTER 2

Moving/Staying with the Tide: Gender Inequalities in the Sending Context, Documentation Status, and Heterogeneity in Immigrant Health Selectivity

ABSTRACT

Recent studies found that female immigrants in the U.S., especially those without documentation, face systematic health disadvantages, thereby challenging the notion of an "immigrant health paradox." In explaining these patterns, little research has considered the role of the sending context. To address this gap, this study analyzes how gender inequalities in sending households and communities contribute to heterogeneity in immigrant health selectivity (i.e., the positive role of early-life health in migration), an important process shaping immigrants' health. Leveraging data from the Mexican Migration Project (n = 7,953), analyses find that less empowered female immigrants saw significantly lower degrees of health selectivity. This pattern was particularly pronounced among undocumented women. By contrast, male immigrants were positively selected on health even when they were relatively disadvantaged. Indeed, having a more educated spouse promoted health selectivity in men's undocumented immigration. These findings suggest that gender inequalities in the sending context may contribute to intersectional health disparities by gender and documentation status among Mexican immigrants.

INTRODUCTION

As of 2021, more than 45 million of the U.S. population were foreign-born, and women constituted more than half of the immigrant population (Migration Policy Institute 2022a; Migration Policy Institute 2022b). The growing diversity among immigrants, as well as the systematic disadvantages they face due to restrictive immigration policies, has attracted growing attention from public health scholars (Ornelas, Yamanis and Ruiz 2020; Perreira and Pedroza 2019). Notably, female immigrants report worse health than male immigrants (Gorman, Read and Krueger 2010; Read and Reynolds 2012). Undocumented women are particularly vulnerable, facing more health issues and greater barriers to healthcare access (de Leon Siantz et al. 2013; Marshall et al. 2005; Munro et al. 2013). These patterns have informed recent scholarship to examine potential explanations of (undocumented) women's health disadvantage, yet the role of the sending context remains little understood.

An important process shaping immigrants' health is immigrant health selectivity, i.e., better health selects individuals into migration from their origin countries (Akresh and Frank 2008; Feliciano 2020). Numerous studies revealed that early-life health predicts a higher likelihood of U.S. migration (Cheong and Massey 2019; Lu and Li 2020; Ullmann, Goldman and Massey 2011). However, in observing growing disparities in health among immigrants, recent scholarship seeks to understand potential variations in immigrant health selectivity (Morey et al. 2020; Ro, Fleischer and Blebu 2016). Though a few of them examined gender variations in health selection and found mixed evidence (Akresh and Frank 2008; Donato, Hamilton and Bernard-Sasges 2019; Lu and Li 2020), scholars have yet to articulate *how* gender dynamics in the context of origin contribute to heterogeneity in health selectivity, in ways that might heighten immigrant women's health disadvantages (Ornelas, Yamanis and Ruiz 2020).

To address this gap, the present study analyzes how gender inequalities in households and communities of origin contribute to variations in immigrant health selectivity. The focus on how gender dynamics in the context of origin is crucial for understanding immigrants' health, as migration is a fundamentally gendered process (Cerrutti and Massey 2001). Women are often "tied-movers" who follow their male relatives to the host country, holding limited bargaining power in migration decision-making (Donato 1993; Massey 1990). Power and resource inequalities along the gender line have important implications for migration patterns (Cerrutti and Massey 2001; Curran and Rivero-Fuentes 2003; Hondagneu-Sotelo 1994); thus, it is plausible that they also factor into immigrant health selectivity.

Leveraging life history data from the Mexican Migration Project, analyses reveal that less empowered female immigrants saw significantly lower degrees of health selection; the patterns were more pronounced for those without documentation. By contrast, male migrants were positively selected on health even when they were relatively disempowered. These findings suggest that gender inequalities in the context of origin may contribute to intersectional health disparities by gender and documentation status among Mexican immigrants.

BACKGROUND

The Immigrant Health Paradox and the Role of Health Selectivity

A large bulk of scholarship found that immigrants reported better health, despite lower socioeconomic status, than their native-born counterparts (see Feliciano 2020). For example, immigrants in the United States have seen lower rates of mortality, obesity, and chronic conditions than the U.S.-born population (Antecol and Bedard 2006; Hamilton and Hagos 2020;

Singh and Siahpush 2001). These patterns lead to an "immigrant health paradox" that informed scholars to examine its potential explanations.

An important mechanism underlying immigrants' health advantage is the health selection process in immigration (Akresh and Frank 2008; Feliciano 2020; Ullmann, Goldman and Massey 2011). Insofar as migration decisions are driven by individuals' cost-benefit analyses (Sjaastad 1962; Todaro 1969), poor health could prevent migration by heightening migration costs and limiting employment opportunities in the host country (Jasso et al. 2004; Massey 1990). Empirical evidence shows that immigrants report better health than their non-migrant compatriots (Riosmena, Kuhn and Jochem 2017; Ro, Fleischer and Blebu 2016). Other studies leveraging life history data found that better early-life health is associated with higher likelihoods of emigration from sending communities (Donato, Hamilton and Bernard-Sasges 2019; Ullmann, Goldman and Massey 2011).

Later studies have advanced this line of research by investigating potential variations in immigrant health selectivity, which is necessary for understanding health disparities *among* immigrants (Cheong and Massey 2019; Lu and Li 2020; Morey et al. 2020; Ro, Fleischer and Blebu 2016). For example, having family ties with previous migrants weakens the role of early-life health in U.S. migration, potentially because support from initial household migrants may mitigate migration costs (Lu and Li 2020). Other studies have revealed substantial heterogeneity in health selectivity by factors including country of origin, reasons for migration, etc. (Jasso et al. 2004; Morey et al. 2020; Ro, Fleischer and Blebu 2016).

In the present study, I investigate how the degree of immigrant health selection could vary by gender inequalities in the sending context. The bulk of existing scholarship has established gender as both a fundamental dimension of the migration process (Cerrutti and

Massey 2001; Côté et al. 2015) and an important axis of health stratification among immigrants (de Leon Siantz et al. 2013; Gorman, Read and Krueger 2010). Previous studies have produced inconsistent results on gender variations in the extent of health selectivity. Akresh and Frank (2008) found that female immigrants were less selected than men based on self-perceived health, while later research found that immigrant women reported better health and health behaviors than non-migrant women (Donato, Hamilton and Bernard-Sasges 2019; Riosmena, Kuhn and Jochem 2017).

Despite these findings, little is known about the mechanisms driving these patterns. It has been long noted that gender dynamics in origin households and communities – especially power and resource inequalities – play crucial roles in migration decision-making (Hondagneu-Sotelo 1994; Massey 1990; Massey, Fischer and Capoferro 2006). Furthering this line of research, this study examines how gender inequalities translate into heterogeneity in health selectivity, in ways that might underlie health disadvantages for (undocumented) female immigrants.

Gender and Health among Mexican Immigrants

The notion of "immigrant health paradox" should not obscure substantial variations in health among immigrants. Importantly, numerous studies have found significant gender disparities in immigrants' health. For example, female immigrants from Mexico reported worse health than their male counterparts (Gorman, Read and Krueger 2010; Read and Reynolds 2012). Their health upon initial arrival in the U.S. was worse than Mexican men, including higher BMI, poorer self-rated health, and higher risks of hypertension (Antecol and Bedard 2006; Gorman, Read and Krueger 2010). Female Mexican immigrants' health trajectories also converged faster

with their native-born counterparts over time, whereas male immigrants retained their health advantages in the long run (Antecol and Bedard 2006).

These patterns lead studies to investigate how experiences in the host society may factor into immigrant women's health disadvantages. Evidence suggests that more acculturation, as indicated by the length of U.S. residence and citizenship status, was associated with high risks of smoking and alcohol consumption for immigrant women, but much less so for men (Lopez-Gonzalez, Aravena and Hummer 2005). Immigrant men's higher socioeconomic status in part factored into their better health, including better self-rated health and fewer chronic conditions (Read and Reynolds 2012). Additionally, access to the U.S. healthcare system also served as an important mechanism for understanding gender disparities in immigrant health. Immigrant women reported more utilization of healthcare resources and, thus, were more aware of their health issues (Gorman, Read and Krueger 2010; Read and Reynolds 2012). Nonetheless, healthcare access did not fully explain higher hypertension rates among female immigrants from Mexico (Gorman, Read and Krueger 2010).

The negative health implications of post-migration experiences are especially pronounced among undocumented immigrant women. Undocumented immigrants face systematic barriers to healthcare access in the host country (de Leon Siantz et al. 2013; Hilfinger Messias, McEwen and Clark 2015; Marshall et al. 2005). The U.S. border patrol's surveillance of public clinics also deterred undocumented immigrants, especially women, from seeking health services in medical facilities (Hilfinger Messias, McEwen and Clark 2015). Moreover, undocumented women are subject to high risks of physical violence and sexual abuse, both of which constitute important domains of psychosocial stress (Garcini et al. 2021). These factors collectively undermine

undocumented women's well-being. Studies have found that undocumented Latinas reported worse self-rated health and birth outcomes (Marshall et al. 2005; Munro et al. 2013).

By comparison, how pre-migration factors contribute to gender disparities in immigrants' health has received insufficient attention (Ornelas, Yamanis and Ruiz 2020). Scholars have speculated that reasons for immigration might be an important mechanism for understanding gender variations in health selectivity (Riosmena, Kuhn and Jochem 2017). Men typically immigrate to the U.S. for employment, which requires good physical health. Women, on the other hand, tend to migrate for family reunions; support from family ties may lower the extent of migrant selectivity (Cerrutti and Massey 2001; Hondagneu-Sotelo 1994). However, the speculation is not well supported by empirical evidence. Recent studies revealed that immigrants with a spouse visa reported equally good, if not better, health than those with an employment visa (Jasso et al. 2004; Morey et al. 2020). These findings call for further examinations of how the context of exit could factor into immigrant health selectivity. This study answers this call by investigating a specific aspect of the sending context that is especially relevant to female immigrants' lived experiences, i.e., gender inequalities.

Gender Inequalities in the Sending Context

International migration is a fundamentally gendered process, typically initiated and dominated by men (Cerrutti and Massey 2001; Donato, Hamilton and Bernard-Sasges 2019; Feliciano 2020; Hondagneu-Sotelo 1994). Extensive scholarship has investigated how migration patterns are influenced by gender dynamics in households and communities of origin.

Gender inequalities at the household level

Perhaps not surprisingly, a sizable number of female migration studies have focused on gender inequalities in sending households (Curran and Rivero-Fuentes 2003; Parrado and Flippen 2005), as families exemplify a social institution where people "do gender" (Connell 1987; Homan 2019). One of the most crucial indicators of this is the sequence of migration among male and female household members – especially among couples. Scholars of gender and migration have long found that gender conflicts and power dynamics in households are ingrained in migration decision-making, often compromising a rational-choice assumption of migration outcomes (Hondagneu-Sotelo 1994). In Mexico – a country dominated by patriarchal norms, men are typically in charge of migration decisions for the entire household, whereas women are often excluded from such process (Hondagneu-Sotelo 1994; Massey, Fischer and Capoferro 2006).

The outcome of male-centered household migration decisions is substantial gender inequalities in the migration sequence. Women not only face limited migration opportunities but also have even less freedom to migrate before their husbands. Long noted as "follower migrants" preceded by their husbands (He and Gerber 2019; Mincer 1978), women whose husbands are already migrants could be pressured to take care of their families in their home country, or forced to move to the destination country (Hondagneu-Sotelo 1994). Resultantly, those who followed their husbands tended to show more compliance with gender norms in the sending country (He and Gerber 2019). By contrast, women who migrated before marriage or before their husbands can be stigmatized by female-caregiver norms, which expect them to stay in households (Hoang and Yeoh 2011). Such an act is often viewed as female empowerment and trespass on traditional gender roles (Donato 2010; He and Gerber 2019). Men, however, are almost always in charge of

their own migration – and often migrations of their wives and children, either before or after marriage (Hondagneu-Sotelo 1994).

Concurrently, gender inequalities in households also arise from differences in socioeconomic backgrounds among spouses, which dictate resource distribution across gender (Parrado, Flippen and McQuiston 2005). Women's empowerment in a relationship depends heavily on their own socioeconomic status, which is integral to their financial independence and social prestige (Thomas 1990; Xu and Lai 2002). Spousal differences in human capital endowments (e.g., years of education) indicate relative commands over household resources and decisions, including migration (Nobles and McKelvey 2015). However, men who occupy a more disadvantaged position vis-à-vis their wives could be socially stigmatized by male breadwinner norms (Hondagneu-Sotelo 1994). The pressure to provide for their families might motivate migrations for employment opportunities.

Gender inequalities at the community level

International migration patterns can also be influenced by community-level gender dynamics. Notably, community migrant networks have been long theorized as a key driver for individual migrations (Massey, Goldring and Durand 1994). Yet these networks are highly gendered. Resources and information that facilitate migration typically do not flow across gender boundaries in these networks (Curran and Rivero-Fuentes 2003; Hondagneu-Sotelo 1994). Men often utilize material support from distant family kin and friends, whereas women resort to weaker ties with female community members mostly when their migrations are opposed by male relatives (Hondagneu-Sotelo 1994; Lindstrom and Saucedo 2002). As a result, an individual's likelihood of migration is only promoted by same-gender migrant networks in the community

(Côté et al. 2015; Curran and Rivero-Fuentes 2003). Differences in the size of male and female migrant networks not only imply gender inequalities in social capital that facilitate migration, but also reflect gender norms around migration in the sending community (Massey, Goldring and Durand 1994).

Moreover, gender differences in labor force participation also have important implications for migration. Labor market opportunities in the host community constitute an important factor in the migration cost-benefit analysis (Massey et al. 1993b; Todaro 1969). Differences in labor force participation rates by gender might further influence migration intentions, especially for those facing a systematic disadvantage. Earlier research noted that women's employment rates in the sending country constitute an important indicator of origin gender norms (Flippen and Parrado 2015; Polavieja 2015). Large differentials in labor force participation rates between men and women could be a result of prevailing female caregiver norms, which hampers women's migration by their own will (He and Gerber 2019). More opportunities for women's employment also contribute to their human capital acquisitions, which may bolster their bargaining power in migration decision-making (Xu and Lai 2002).

Implications for Immigrant Health Selection

Leveraging life history data from the Mexican Migration Project (MMP), this study examines immigration health selection through the association between individuals' early-life health and ever migration to the U.S. Previous research using MMP has found positive immigrant health selectivity, wherein better health at early ages strongly predicts U.S. migration (Cheong and Massey 2019; Donato, Hamilton and Bernard-Sasges 2019; Lu and Li 2020;

Ullmann, Goldman and Massey 2011). This study advances these findings by considering the moderating roles of gender inequalities in Mexican communities.

If healthy people are selected into migration, the extent of this selection can be influenced by other factors in the sending context, including those related to gender inequalities (Jasso et al. 2004). As migration decisions are highly subject to household and community conditions (Massey 1990; Massey, Goldring and Durand 1994), individuals who are disadvantaged vis-à-vis household/community members of the opposite gender may have less bargaining power in migrations. By extension, their health – a concern more perceptible to themselves – may hold less weight in migration decisions. Additionally, women's empowerment over men constitutes a trespass of gender traditionalism expecting their compliance (He and Gerber 2019). Migrations under such conditions might require excellent health conditions because pressure from conventional gender norms could heighten migration costs.

- H_1: The association between an individual's early-life health and ever U.S. migration is lessened by gender inequalities (that subject the individual to disadvantage) in the sending context.

Furthermore, the role of pre-migration gender inequalities in immigrant health selection could be more pronounced among women. This is not simply because women face systematic disadvantages vis-à-vis men; rather, the implications of gender inequalities for migration could be inherently different across gender. Women could be forced to migrate by male relatives and community members, often as a result of conservative gender norms or abusive relationships (Clerge et al. 2017; Hondagneu-Sotelo 1994). In these scenarios, migration under poor health could take place as a result of women's low decision-making power. By contrast, seldom have scholars found that men migrated against their wills because of more empowered women in their

households/communities. A more gender-egalitarian context often implies women's empowerment in making their *own* migration decisions; it does not necessarily impose migration upon unwilling men. Therefore, gender inequalities in the sending context might mitigate immigrant health selectivity mainly for women.

- H_2: The lessening effect of sending-context gender inequalities on the association between early-life health and U.S. migration is more pronounced among women.

The Role of Documentation Status

The importance of gender dynamics in understanding the healthy migrant effect could also vary by documentation status. Undocumented immigrants might see lower levels of health selection when they are in a less empowered status vis-à-vis the opposite gender, for two main reasons. First, the U.S. visa system mandates physical examinations for its visa applicants. Those carrying certain illnesses (e.g., communicable diseases, mental disorders) and not showing proof of proper treatments could be denied entry into the U.S. (United States Department of State 2023). It implies that the extent of health selection in documented migration may be less susceptible to gender inequalities in the sending context.

Moreover, patterns of stratification behind documentation status could also factor into health selection patterns. Studies of Mexico-U.S. migration have found that undocumented migration was disproportionately linked to socioeconomic disadvantage in sending communities (Asad and Hwang 2019). This is in large part a result of the differential costs of crossing the Mexico-U.S. border, wherein obtaining a legal status requires much more financial resources and longer wait time than undocumented migration (Jasso and Rosenzweig 1990; Massey and Espinosa 1997). Mexicans who lack financial and human capital thus tended to migrate to the

U.S. without legal status. Among them, women might be under compounded resource disadvantages and disempowerment when they face gender inequalities in origin communities. They might well have to rely on financial and social capital from men in the same household/community. The reliance might heighten male dominance in migration decision-making, in ways that deprioritize her health concerns.

- H_3: The lessening effect of sending-context gender inequalities on the association between early-life health and U.S. migration is more pronounced in the context of undocumented migration.

DATA AND METHODS

Data

The present study draws on data from the Mexican Migration Project (MMP 2021), a collaborative research project based at Princeton University and the University of Guadalajara. MMP is a repeated cross-sectional survey that employs a two-stage sampling design, where households are sampled in Mexican communities. It collects respondents' life history data, including important life events such as migration, employment, and household finance. Starting in 2008, survey questions on the health of sampled household heads and their spouses are included, making possible examinations of immigrant health selectivity. This study draws on respondents' life history data from the 2008-2019 waves of MMP.

This study focuses on migration to the U.S. and gender dynamics during adulthood. The analytic sample consists of respondents aged between 18-55 at the time of survey, who were either head of the household or spouse of the head (n = 13,003). I further excluded respondents who were ever divorced (n = 1,869), for their marriage dynamics with previous spouse(s) were

not collected in the survey. I also excluded respondents who migrated before 18 (n = 364); respondents who had migrated to Canada (n = 11) or had internal migrations in Mexico (n = 1,626); respondents who were born in the U.S. or whose spouse was born in the U.S. (n = 27); respondents who married before 18 (n = 876) or lived in a same-sex household (n = 22). Finally, cases with missing values – representing 3.1% of the total sample (n = 255), were excluded. The final sample consists of n = 7,953 respondents, whose life history comprises 160,276 person-years.

Measures

Dependent variables

The analysis draws on two dependent variables. First, I employed a binary variable indicating whether the respondent *migrated to the U.S.* during the person year (1 = migrated). Second, I accounted for the *documentation status of respondents' first trip to the U.S.*, which consists of three categories: no migration (reference group), documented migration (i.e., the respondent presented valid documents upon entry into the U.S.), and undocumented migration (the respondent did not present valid documents).

Independent variable

The independent variable is respondents' *self-rated health at age 14*, a time-constant measure capturing individuals' early-life health. The measure involves a four-point scale (poor, regular, good, and excellent health), with higher values indicating better health; it is employed as a continuous variable throughout the analyses. Self-rated health at age 14 reflects respondents'

subjective perceptions of their early-life health conditions and thus likely affects an individual's migration decision (Lu and Li 2020).

Measures of gender inequalities in the sending context

The present study employs a range of variables to capture gender inequalities in the sending context. At the household level, I focus on the gender dynamics in marriages, e.g., the power and resource inequalities between wives and husbands. *Migration sequence* indicates the timing of the respondent's migration in the household, relative to their marriage and spouse's migration. It consists of three categories, indicating whether the respondent was single, married with a non-migrant spouse, or married with a migrant spouse during the person-year (He and Gerber 2019). Among male respondents, only 31 individuals reported having a wife who had migrated before them. The small number of individuals in this category precluded reliable statistical inferences, especially on interaction terms[1]. I thus collapsed this category with married to a non-migrant spouse for male respondents; the resultant measure is a dummy variable whether the respondent was single or married during the person-year.[2]

Concurrently, the analyses also account for differences in socioeconomic resources among couples, with *differences in years of education between respondent and their spouse* (Nobles and McKelvey 2015; Parrado, Flippen and McQuiston 2005)[3]. The variable applies only to person-years in which respondents were married.

At the community level, *gender difference in community migration prevalence* captures the relative strengths of gendered migrant networks in sending communities. According to Massey and colleagues (1994), the ratio of migrants to the total population of a community (i.e., migration prevalence ratio) indicates the strength of community migrant networks. The variable

is constructed as the difference between male and female migration prevalence ratios in the sending community[4]. Additionally, *gender difference in community labor force participation rates* is measured as the difference in labor force participation rates between men and women in the sending community.

Covariates

The analysis controls for individual- and community-level factors. Basic socio-demographic controls include *gender* (1 = Female), *age, age squared, marital status* (1 = Married), *years of education,* and *number of children under 18*, all of which were found to play significant roles in migration decisions (Curran and Rivero-Fuentes 2003). *Number of migrant relatives* measures the number of respondents' relatives with U.S. migration experiences (Cerrutti and Massey 2001; Côté et al. 2015). As respondents' self-rated health was subjective, I included two controls on individuals' early-life nutrition status and health behaviors. They are respondents' *height*, a time-constant continuous measure, and *smoking history*, a dummy variable indicating whether the respondent has ever smoked as of the person-year (Lu and Li 2020). Additionally, a binary variable is employed to indicate whether responses to the questionnaire were *respondent's self-report* (vis-à-vis filled by other household members).

At the household level, two binary indicators of whether a respondent's *household owns business* and *household owns lands*, as well as a continuous variable on the *number of rooms owned by the household*, measure property ownership of the sending households, which have important implications for migration decisions (Lu and Li 2020; Wassink and Massey 2022).

The analyses also account for community-level characteristics. *Rural* is a binary measure of whether the community was located in a rural area, indicating the level of community

economic development. *Total migration prevalence ratio* is calculated as the proportion of people who had ever migrated to the U.S. in the community in a given year.

All independent variables and covariates are measured one year prior to the failure event (i.e., U.S. migration), so as to account for lagged effects.

Methods

The analysis consists of three parts. First, I examined descriptive statistics of the sample, disaggregated by respondents' gender. T-tests were performed to examine differences in mean/percentages between female and male respondents, to get a sense of gender inequalities in origin communities/households.

Second, I employed discrete-time logistic regressions to examine the associations between early-life health and U.S. migration, overall and by documentation status of the first U.S. trip, controlling for covariates. The first two models are binary logistic regressions that investigate whether health at age 14 predicts ever migration to the U.S., stratified by gender. The next two models are multinomial logistic regressions predicting documentation status, with non-migrants as the reference group (Wassink and Massey 2022).

Third, I examined how measures of sending-context gender inequalities moderated the associations between early-life health and international migration. I employed discrete-time logistic models that included the interactions between early-life health and measures of gender dynamics, adjusting for covariates. The first part of this analysis used ever migration to the U.S. as the outcome, employing binary logistic regressions; the second part disaggregated U.S. migrants by their documentation status, thereby employing multinomial logistic regressions.[5]

In all survival analyses, respondents become at risk at the age of 18. For models analyzing married individuals, respondents become at risk the year of their marriage (individuals who never married or migrated before marriage were excluded from these models).

I employed Mize's (2019) method to interpret interaction effects in logistic models. In this study's context, the method helped to illustrate how the average marginal effect *(AME)* of health at age 14 on U.S. migration varies by different measures of gender inequalities. The results section will present graphs of predicted probabilities of U.S. migration by early-life health and gender dynamics measures[6]. To save space, coefficients models examining the interactions between gender inequalities and health are reported in Tables 2.1S-2.4S; tests of AME differences are reported in Tables 2.5S-2.12S (see supplemental materials). Discussions in the Results section focus on statistically significant results reported in these tables.

RESULTS

Table 2.1 reports descriptive statistics, observed on respondents' last year of their life history. On average, Mexican women were much less likely to migrate to the U.S. than Mexican men ($p < .001$). Among U.S. immigrants, women were more likely to hold a documented status during their first U.S. trip than men. Women and men did not differ significantly in their health at age 14. Meanwhile, Mexican women were subject to more disadvantaged positions vis-à-vis men in sending communities. They were more likely to have a husband who already had U.S. migration experiences, and more likely to report fewer years of education than their husbands ($p < .001$). In terms of the community context, women also saw lower migration prevalence, suggesting weaker female migrant networks, and lower labor force participation rates ($p < .001$).

Table 2.2 presents the association between health at age 14 and U.S. migration, controlling for covariates. Models 1.1 and 1.2 reveal that both Mexican female and male migrants were positively selected on health, adjusting for covariates. Taking exponents of the coefficients, a one-unit increase in early-life health significantly promotes the odds of U.S. migration by 87.0 percent for women, and 63.4 percent for men ($p < .001$).

Models 1.3 and 1.4 employ discrete-time multinomial logit regressions to examine the separated roles of early-life health in documented and undocumented U.S. migrations. Results reveal that both documented and undocumented immigrants reported better early-life health than non-migrants, and the patterns were consistent for both women and men. Documented female migrants were particularly selected on their early-life health, as a one-unit increase in health at age 14 multiplies the odds of documented migration by 4.68 ($p < .001$).

Moderating Effects of Household-Level Gender Dynamics

Figure 2.1 presents predicted probabilities of U.S. migration during the person-year for men and women, by their early-life health and migration sequence. Corresponding AMEs of early-life health are reported in Table 2.5S. Results suggest that the association between women's early-life health and U.S. migration substantially varies by their migration sequence. Single women saw the highest immigrant health selectivity effect; the AME of health on U.S. migration during person-year at age 14 is .0014 ($p < .001$). It is more than three times higher than that for women married to a non-migrant husband (AME = .0004; $p > .05$); the test of AME differences between these two groups yields significant results at the .05 level.

Moreover, early-life health turns out to negatively predict, though insignificantly, the likelihoods of U.S. migration for women with already-migrant husbands (AME = -.0008;

$p > .05$). However, the difference in AME of health at age 14 between single women and women with an already-migrant husband is not significant at the .05 level, mostly due to the larger standard errors in estimates for the latter group. These findings provide partial evidence in support of H_1.

By contrast, early-life health always significantly predicts ever U.S. migration for men, regardless of their sequence of migration and marriage. As shown in Figure 2.1, the likelihoods of U.S. migration during person-year increases with health at age 14 for both single and married men, with no significant difference in AMEs. The fact that immigrant men's health selectivity is not moderated by migration sequence (which was not the same for immigrant women) supports H_2.

Figure 2.2 presents predicted probabilities of U.S. migration by health and spousal differences in years of education. A significant moderating effect is observed among men: early-life health is associated with U.S. migration only for those who were less educated than their wives. For example, the AME of health at age 14 on U.S. migration is .0038 higher for men with three more years of education as their spouses, as compared to those with three fewer years of education ($p < .05$; see Table 2.6S). This finding in part contradicts the presupposition in H_1. On the contrary, spousal educational differences do not significantly interact with early-life health to predict U.S. migration among Mexican women.

Moderating Effects of Community-Level Gender Dynamics

Figure 2.3 shows predicted probabilities of U.S. migration by differences in community migrant networks across gender. Results suggest that it significantly factors into women's health selection: having a much higher male migration prevalence in the community (vis-à-vis female)

significantly diminishes the association between health at age 14 and U.S. migration (see Table 2.7S). For men, gender differences in community migration prevalence weakly moderate the health-migration association. Men living in a community with a more balanced migration prevalence between men and women saw a slightly lower association between early-life health and U.S. migration, though it is still sizable and significant at the .001 level. Together, these patterns lend support to H_1 and H_2.

Figure 2.4 reveals that differences in labor force participation by gender do not moderate the association between U.S. migration and early-life health. For women, health at age 14 seemed to play a more important role in U.S. migration when there was a stark difference in labor force participation rates by gender, though the AME differences (reported in Table 2.8S) are not significant. For men, gender differences in community labor force participation are not related to the overall immigrant health selection pattern. Together, findings regarding differences in labor force participation do not support H_1 or H_2.

Differences by Documentation Status

The analyses then examine how gender inequalities in sending households/communities could play distinct roles in patterns of health selectivity by documentation status. Due to space limits, only significant patterns (per tests of AME differences) are included in discussions here. (For a complete gallery of predicted probabilities of U.S. migration by documentation status, health at age 14, and measures of gender inequalities, see Supplemental Figures 2.1S-2.4S).

Figure 2.5 shows selected analysis results on Mexican women. These results suggest that gender inequalities in the sending context – particularly those related to social capital – significantly lessen health selectivity for undocumented female immigrants, but not for those

with documentation. Panel A of the figure, displaying results regarding migration sequence, shows that early-life health positively predicted documented U.S. trips for women regardless of their sequence of migration vis-à-vis marriage and husband's migration. AME tests further suggested no moderating effects from migration sequence (shown in Table 2.9S).

By contrast, undocumented female migrants saw positive health selection only when they were single (AME = .0007; $p < .01$). Those with a non-migrant husband were virtually prohibited from migration without documentation, therefore seeing no health selection effect. As for those with an already-migrant husband, health at age 14 is negatively associated with undocumented U.S. migration (AME = -.0031), though the association was not significant. The AME of early-life health on undocumented U.S. migration is significantly smaller for women in the latter two groups than for single women at the .05 level.

Panel B of Figure 2.5 reveals that gender differences in community migrant networks only factored into undocumented female immigrants' health selection. The AME of health at age 14 on undocumented U.S. migration is .0017 ($p < .05$; see Table 2.13S), when male migration prevalence is three percentage points higher than female migration prevalence – suggesting relative equality in migration social capital. It is significantly larger than the AME of health at age 14 when the community migration prevalence was 24 percentage points higher for men than for women (.0003; $p > .05$). The difference in the health-migration association between these two conditions was sizable (difference in AME = .0015; $p < .05$). For documented female migrants, the association between early-life health and migration did not vary by gender differences in community social capital, as shown in Part B1 of Figure 2.5. In summary, findings regarding undocumented female immigrants support prepositions in H_3.

Figure 2.6 presents results regarding male immigrants. In Panel A, results show that the moderating role of spousal differences in years of education was only manifest in undocumented immigration. The interaction between early-life health and spousal differences in education did not predict documented trips to the U.S. (Part A1 of Figure 2.6). On the contrary, undocumented male migrants with higher educational attainments than their spouses saw a lower level of health. For those with three fewer years of education than their spouse, the AME of early-life health on undocumented U.S. trips was .0046 ($p < .001$; see Table 2.11S); for those with four more years of education, early-life health no longer predicted undocumented U.S. migration (AME = .0007; $p > .05$). The difference in AME between these two groups was significant at .05 level. These patterns are also consistent with H_3.

Panel B of Figure 2.6 shows that gender differences in community migration prevalence also moderated the association between early-life health and undocumented U.S. migration for men to a limited extent. Communities with larger differences in men vs. women migration prevalence significantly promoted health selectivity, though the magnitude of this moderating effect was small (as suggested in Part B2 of Figure 2.6). Even men from communities with small gender differences in migration prevalence (at a gap of two percentage points) saw a significant AME of health at age 14 on undocumented U.S. migrations, which is .0042 ($p < .001$; reported in Table 2.11S). For documented male migrants, the association between migration and early-life health waned as gender inequalities in community migration increased (Part B1 of Figure 2.9), but tests of AME differences did not yield significant results.[7]

DISCUSSIONS

Though immigrants report better health than native-born people in the host country, recent studies have uncovered substantial variations in immigrants' health outcomes. In particular, female immigrants – especially those without legal status –face more health disadvantages, bringing up the question of whether (undocumented) female immigrants are less selected on health from their sending communities (Donato, Hamilton and Bernard-Sasges 2019). The present study contributes to this discussion by analyzing how gender inequalities in the sending context factor into immigrant health selectivity.

Leveraging data from the Mexican Migration Project, analyses reveal distinct patterns between Mexican women and men. For women, gender inequalities in the sending context – specifically those related to migration social capital – significantly lessened the association between early-life health and U.S. migrations. Better early-life health did not predict U.S. migration for women with an already-migrated husband, or for women in communities with much weaker female (vis-à-vis male) migrant networks. These patterns were especially pronounced for undocumented female immigrants. These findings are in part consistent with the cumulative causation theory, which posits that ties with initial migrants may lower the degree of selectivity for later immigrants (Massey 1990; Massey et al. 1993a). Usually as follower migrants, women admittedly benefited from ties with male migrants in lowering their migration costs and, thus, might not need to be in good health to migrate (Jasso et al. 2004; Mincer 1978).

However, the fact that gender *inequalities* in migration social capital contributed to lower degrees of immigrant health selectivity for women (but not for men) suggests the role of systematic disadvantages women face in the context of origin. Numerous studies have shown that women's intentions of leaving/staying in the home community may be opposed by male family members (Hoang and Yeoh 2011; Hondagneu-Sotelo 1994). The issue could be especially

heightened for women who followed their husband's migration, as they tend to show high compliance to traditional gender norms (He and Gerber 2019). Similarly, in communities with substantial gender gaps in migration prevalence, gender traditionalism may prevail in these communities that expect women to stay. A weak female migrant network may also imply low provision of emotional and social support from fellow women, which is crucial for dealing with disapproval from male relatives (Curran and Rivero-Fuentes 2003; He and Gerber 2019; Hondagneu-Sotelo 1994). In these conditions, women's own health concerns may be deprioritized in migration decisions, such that female immigrants may carry health conditions over the national border. Gender inequalities in the sending context might thus explain worse health upon arrival among immigrant women relative to men, as suggested in prior studies (Antecol and Bedard 2006; Gorman, Read and Krueger 2010).

The finding that undocumented female immigrants were particularly affected further corroborates the necessity of examining the health implications of gender inequalities in the context of exit. Previous studies suggest that undocumented female immigrants face systematic disadvantages in access to U.S. healthcare, due to policy barriers and deportation threats from the U.S. immigration system (de Leon Siantz et al. 2013; Hilfinger Messias, McEwen and Clark 2015). Insofar as information about healthcare barriers in the host country may be shared with the sending community through transnational migrant networks, worries about not being able to get proper treatments may preclude less healthy women from migrating without documentation. Yet this study finds that when women are in a disempowered position, those with poor early-life health may be just as likely (or even more) to have an undocumented U.S. trip as those with excellent health. It suggests that undocumented women's health disadvantages may be traced

back to dynamics of power and resource distributions along the gender line in their sending communities.

Moreover, these results also contribute to the discussions on how reasons for migration factor into immigrant health selectivity. Scholars have proposed that migrants for family reunification might see lower degrees of health selection, but this is not fully supported by analyses comparing the health of immigrants across visa categories (Jasso et al. 2004; Morey et al. 2020). The study advances this discussion by suggesting that rationales behind this proposition may mainly apply to the case of undocumented female immigrants, a likely result of differential selection mechanisms by documentation status. The costs of crossing the Mexico-U.S. border may substantially vary by documentation status, as documented Mexico-U.S. migrations incur far more financial costs, longer wait time, and health screenings that may require documentation for proper prior treatments (Asad and Hwang 2019; Jasso and Rosenzweig 1990; United States Department of State 2023). The role of health in migration is less rigid for undocumented immigrants and, thus, more susceptible to gender inequalities in the sending context. It is therefore important to recognize that reasons for migration *per se* may be influenced by gender inequalities in sending communities, and that its role in immigrant health advantages is shaped by the context of exit.

On the other hand, men seldom migrated with poor early-life health, even when they were less empowered in the sending context. If any, those who reported fewer years of education saw a stronger association between early-life health and U.S. migration. One potential explanation is that male breadwinner norms in sending communities pressured these men to seek employment opportunities in another country (Hondagneu-Sotelo 1994). Men with more human

capital than their wives might also leverage more household resources to facilitate their migration, thereby lowering health selectivity.

Nonetheless, it is important to note that gender disempowerment never lessened the association between health and U.S. migration for men, which likely results from the core rationales behind gendered migration processes. Studies have extensively documented how female empowerment contributed to the improvement of women's own conditions, including migration freedom and economic integration in the host country (Flippen and Parrado 2015; He and Gerber 2019; Hondagneu-Sotelo 1994). These processes, however, rarely involve forcing men to leave their home countries. Poor health always factored in men's migration decisions, thereby contributing to overall better health among recent male immigrants.

This study is not without limitations. First, the Mexican Migration Project collected life history data mostly from return migrants, so this study could examine immigrant health selectivity only by comparing non-migrant Mexicans and Mexicans who returned from the U.S. Previous studies have found mixed support on the health selection in return migration, with those who returned to Mexico reporting more health limitations and stress, but not worse self-rated health, than those who stayed in the United States (Cheong and Massey 2019; Diaz, Koning and Martinez-Donate 2016). It implies that the estimates of immigrant health selection among return migrants may largely reflect, or underestimate, the overall health selection among Mexican immigrants in the United States. Concurrently, recent evidence also suggests that gender plays a salient role in return migration; women in return migrant households tended to show more compliance with traditional gender norms (Samari 2021). To the extent that their traditional gender values were consistent with their beliefs when emigrating from the sending community, one might expect that gender inequality plays a more important role in migration decision-

making for return migrants. By extension, gender inequality might also attenuate the association between early-life health and migration to larger degrees in the MMP sample.

Due to data limitations, the present study is not able to capture health selectivity through comparing health outcomes of non-migrants and immigrants in the U.S. Future studies may advance this topic by leveraging bi-national data collected in both sending and receiving communities.

Second, this study employs a subjective and retrospective measure to capture respondents' early-life health. Previous research using MMP has demonstrated that analyses using health at age 14 are robust to the length of the recalling period and respondents' informant status (Cheong and Massey 2019; Lu and Li 2020). Third, though this study focuses on gender inequalities in resources and power in the sending context, it does not involve any direct measures of gender dynamics in the migration decision-making process (e.g., gender attitudinal measures). These variables are not available in the retrospective data, but it is worth examining how immigrant health selectivity can be affected by gender ideologies behind migration decision-making.

Future research should continue to investigate how the migration processes and factors related to the context of exit shape immigrant health. Particularly, it is important to investigate the interplay between pre- and post-migration gender inequalities jointly shape immigrants' health, and the disparities in health by gender and legal status. In recent years, a growing body of literature has been dedicated to examining the role of immigration policies in immigrants' well-being (see Ornelas, Yamanis and Ruiz 2020). It should thus be noted that these policies have a fundamental role in determining who becomes (un/documented) immigrants, which is inherently

a selection process. Therefore, connecting research and data on immigrants' origin communities may constitute an important step forward.

In summary, findings from the present study suggest that gender inequalities in the sending context may contribute to the intersectional health disparities by immigrants' gender and documentation status. In examining why female immigrants – especially those who were undocumented – reported worse health than their male counterparts, previous research has focused mostly on their post-migration experiences, i.e., acculturation (Gorman, Read and Krueger 2010; Read and Reynolds 2012). Complementing their findings, this study suggests that undocumented female immigrants' health disadvantages may stretch back to gender inequalities in the sending context. Women's experiences of gender disempowerment in their origin communities may not only result in their undocumented migrations under poor health conditions, but also contribute to continued trauma and gender violence they face after migration (Garcini et al. 2021). It is crucial to incorporate a life-course perspective to investigate immigrants' health patterns over time, where pre- and post-migration factors should be jointly examined as determinants of health among the foreign-born population.

NOTES

[1] Alternative analyses dropping male respondents with an already-migrant wife yielded substantively similar results.

[2] The frequency of having an already-migrant wife among male respondents is reported in descriptive statistics, so as to facilitate comparisons with female respondents.

[3] Alternatively, I utilized spousal differences in age as a measure of power dynamics among couples (Parrado, Flippen and McQuiston 2005). Analyses (available upon request) yielded results that were similar to, though less significant than, those based on differences in years of education, suggesting the more important role played by inequalities in human capital endowment in immigrant health selection process.

[4] An alternative coding strategy that calculates the ratio of female vs. male migration prevalence ratios (and the ratio of female vs. male LF participation rates) did not yield significant results, though the directions of estimated coefficients are similar. This is potentially because ratios could obscure important variations in community-level gender dynamics. For example, if 1% of women and 4% of men in a community have migrated to the U.S., it primarily indicates a lack of community migrant networks (as opposed to substantial gender inequalities in migrant networks). The overall low levels of migration prevalence might have yet to have a considerable influence on the migration behaviors in the entire community. This could be substantially different from another community where 10% of women and 40% of men have migrated.

[5] Additional analyses including Mexican state and survey year fixed effects yielded substantially similar results (results available upon request). However, including them resulted in questionable estimates of the standard errors when predicting probabilities of documented migration. I therefore did not include these fixed effects in the main results.

[6] To simplify visualization, for models with interactions of health at age 14 and a continuous measure of gender inequalities, I present predicted probabilities at two representative values of health at age 14: 2, indicating regular health, and 4, indicating excellent health.

[7] Additionally, analyses also found that gender differences in community labor force (LF) participation rates had a marginally significant moderating effect on the health-migration association for documented male immigrants. As shown in Supplemental Figure 2.4S, the health selectivity effect wanes when men have much higher LF participation rates than women, as men – regardless of their early-life health -- reported low probabilities of U.S. migration. Thus, men with poor health were still unlikely to migrate. AME difference tests (Table 2.12S) yielded significant results at .1 level, but not at .05.

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TABLES AND FIGURES

Table 2.1 Descriptive Statistics, observed in the last year of respondents' life history †

	Mean (SD) / Proportion		
	Women (n = 4,150)	Men (n = 3,803)	*p*
Ever Migrated to the U.S.	.04	.24	<.001
Documentation Status of First U.S. Trip ††			
Documented Migration	.26	.12	<.001
Undocumented Migration	.74	.88	<.001
Health at Age 14	3.30 (.54)	3.28 (.52)	0.22
Migration Sequence			
Single	.26	.32	<.001
Married, Spouse Not Yet Migrated	.55	.67	<.001
Married, Spouse Already Migrated	.19	.01	<.001
Spousal Difference in Years of Education (R – Spouse) †††	-.11 (3.41)	.30 (3.32)	0.001
Gender Difference in Community Migration Prevalence (Men – Women)	13.99 (8.91)	13.25 (9.04)	<.001
Gender Difference in Community LF Participation Rates (Men – Women)	47.76 (6.91)	48.42 (7.93)	<.001
Age	36.89 (9.45)	35.34 (1.50)	<.001
Years of Education	8.10 (3.66)	8.21 (3.76)	0.18
Married	.74	.68	<.001
Number of Children under 18	1.81 (1.30)	1.67 (1.38)	<.001
Number of Migrant Relatives	.09 (.42)	.05 (.27)	<.001
Household Owns Business	.30	.25	<.001
Household Owns Lands	.83	.86	<.001
Number of Rooms Owned by Household	3.39 (1.90)	2.96 (2.06)	<.001
Height	1.57 (.08)	1.67 (.08)	<.001
Ever Smoked	.04	.25	<.001
Rural	.83	.84	0.10

Community Migration Prevalence	1.99 (8.50)	1.39 (8.67)	0.002
Respondent Was Informant	.57	.36	<.001

† Last year of life history refers to the year of migration for respondents who had ever migrated to the U.S., and the year of survey for non-migrants.
†† Restricted to U.S. migrants (n = 171 for women; n = 903 for men).
††† Restricted to married individuals (n = 3,076 for women; n = 2,590 for men).

Table 2.2 Discrete-Time Regressions Predicting U.S. Migration

	1.1	1.2	1.3		1.4	
	Women	**Men**	**Women**		**Men**	
Model Type	Logit	Logit	Multinomial Logit		Multinomial Logit	
Outcome Category	Ever Migration	Ever Migration	Documented Migration	Undocumented Migration	Documented Migration	Undocumented Migration
Health at Age 14	0.626***	0.491***	1.544***	0.356*	0.396*	0.502***
	(0.15)	(0.06)	(0.35)	(0.17)	(0.19)	(0.07)
# Person-Years	86,709	73,567	86,709		73,567	
# Respondents	4,150	3,853	4,150		3,853	

*p < .05, **p < .01, ***p < .001 (two-tailed test).
All models control for the set of covariates specified in the Data and Methods section (full regression results are available upon request).

Figure 2.1 Predicted Probabilities of U.S. Migration, by Health at Age 14 and Migration Sequence

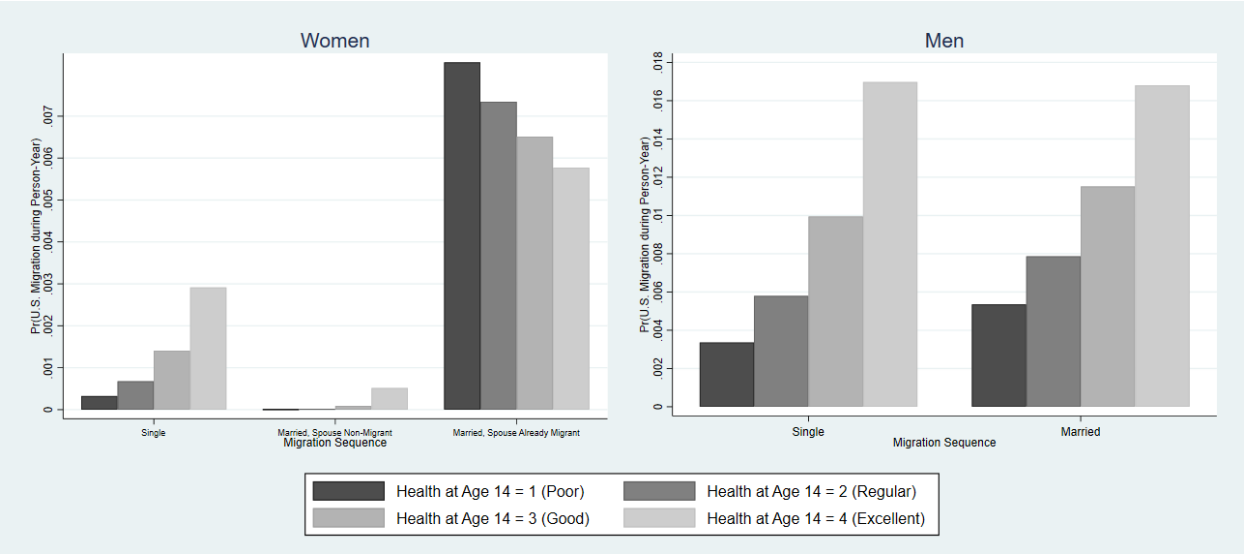


Figure 2.2 Predicted Probabilities of U.S. Migration, by Health at Age 14 and Differences in Years of Education between R and Spouse

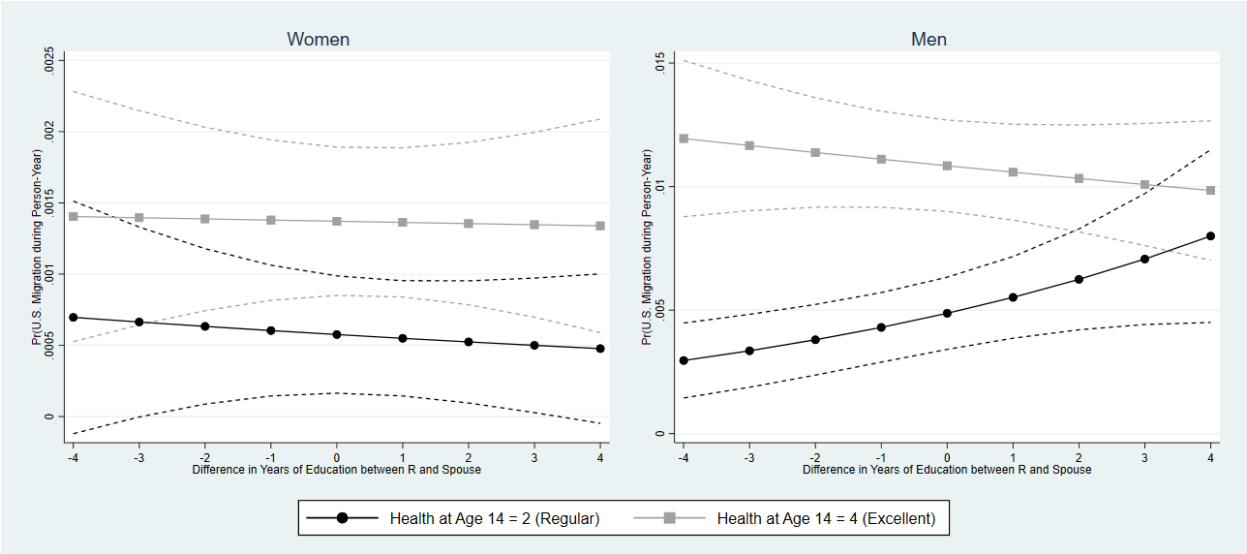


Figure 2.3 Predicted Probabilities of U.S. Migration, by Health at Age 14 and Difference in Community Migration Prevalence between Men and Women

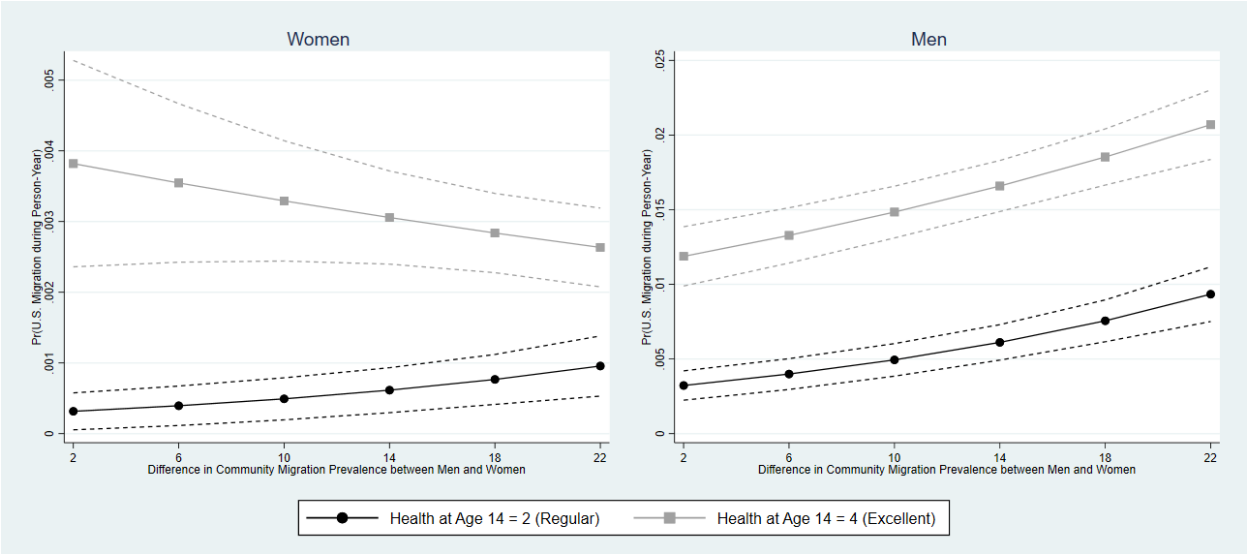


Figure 2.4 Predicted Probabilities of U.S. Migration, by Health at Age 14 and Difference in Community LF Participation Rate between Men and Women

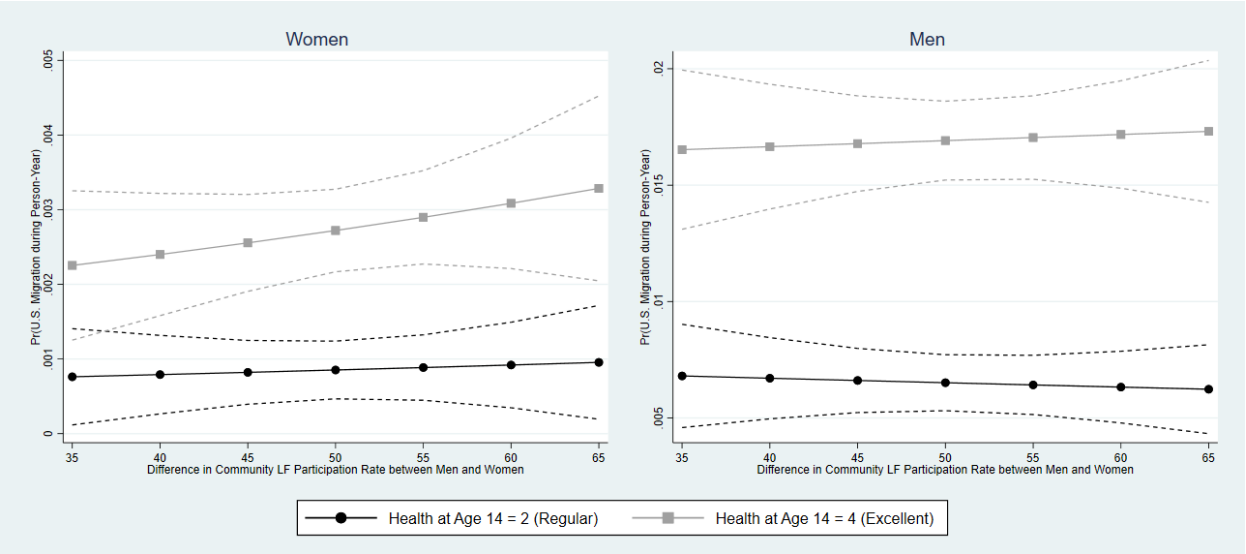


Figure 2.5 Predicted Probabilities of Documentation Status of First U.S. Migration among Women, by Health at Age 14 and Select Measures of Gender Inequality

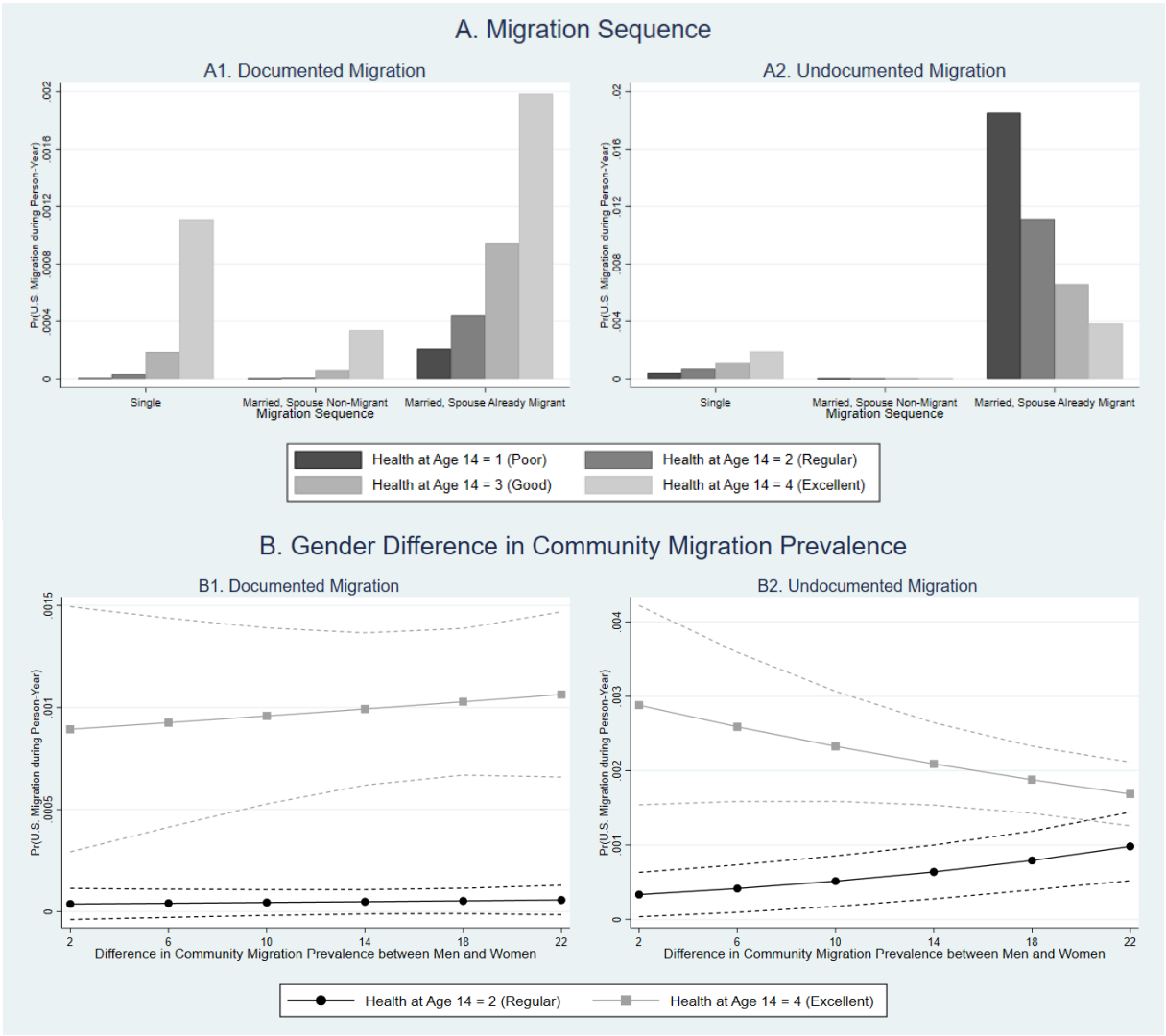
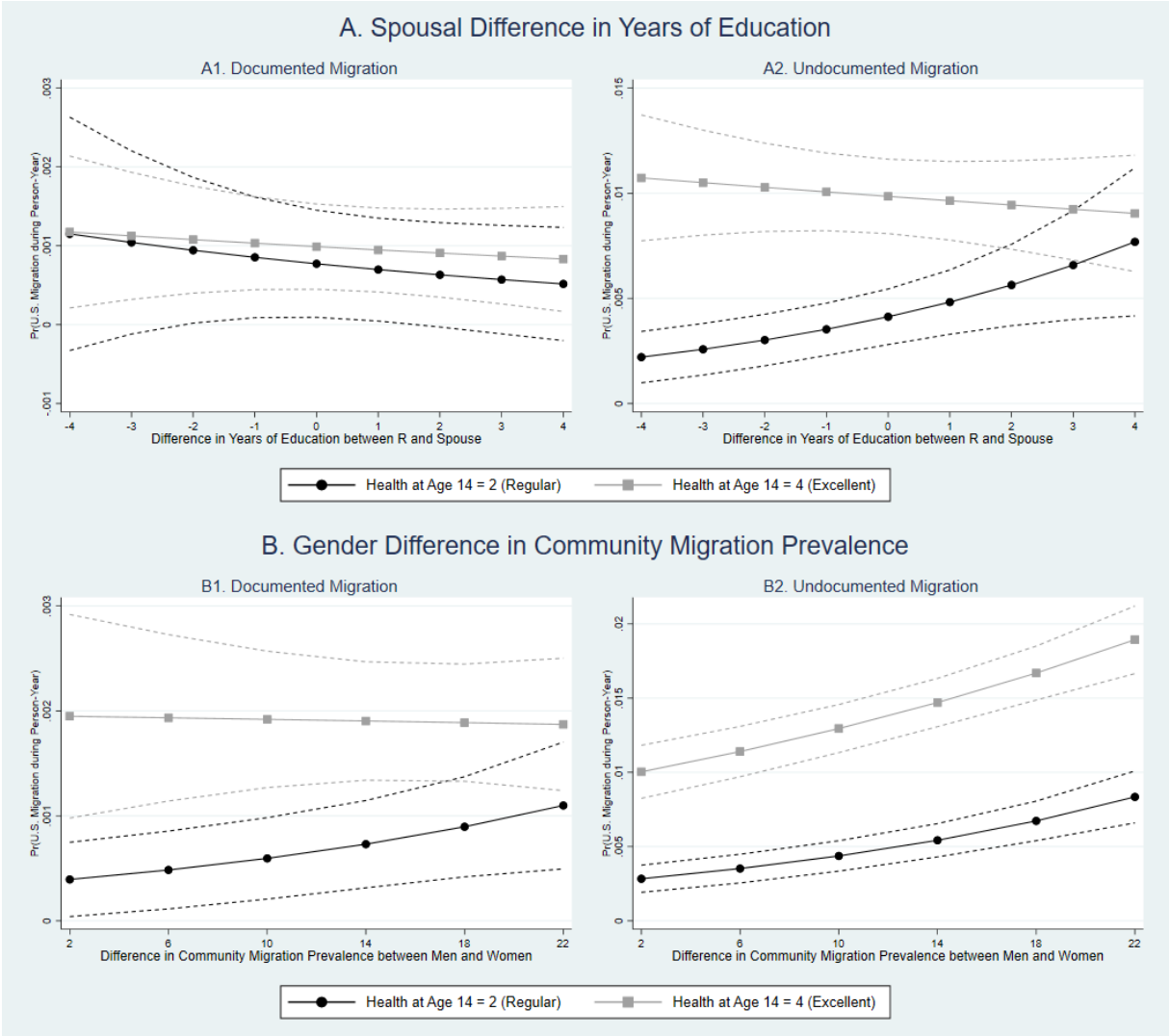


Figure 2.6 Predicted Probabilities of Documentation Status of First U.S. Migration among Men, by Health at Age 14 and Select Measures of Gender Inequality



SUPPLEMENTAL TABLES AND FIGURES

Table 2.1S Discrete-Time Logistic Regressions Predicting Ever Migration to the U.S., by Health at Age 14 and Household-Level Gender Inequalities

	S1.1	S1.2	S1.3	S1.4
	Women	**Men**	**Women**	**Men**
Health at Age 14 **(H)**	0.754***	0.551***	0.432	0.466***
	(0.18)	(0.08)	(0.32)	(0.12)
Migration Sequence (ref. = Single)				
Married, Spouse Not Yet Migrated	-6.030	0.631		
	(4.36)	(0.45)		
Married, Spouse Not Yet Migrated * H	1.061	-0.160		
	(1.16)	(0.13)		
Married, Spouse Already Migrated[1]	4.238***	-		
	(1.14)	-		
Married, Spouse Already Migrated * H	-0.881**	-		
	(0.32)	-		
Difference in Years of Education between R and Spouse			-0.157	0.264*
			(0.31)	(0.11)
Difference in Years of Education between R and Spouse * H			0.046	-0.077*
			(0.09)	(0.03)
# Person-Years	86,709	73,567	53,285	41,184
# Respondents	4,150	3,853	3,076	2,590

*p < .05, **p < .01, ***p < .001 (two-tailed test).
All models control for gender, age, age squared, years of education, number of children under 18, number of migrant relatives, household access to business, household access to lands, number of rooms owned by household, height, smoking history, rural community, total migration prevalence, and respondents' informant status.
[1] Collapsed with the "married, spouse not yet migrated" category for male respondents (the new category indicates that R is married).

Table 2.2S Discrete-Time Logistic Regressions Predicting Ever Migration to the U.S., by Health at Age 14 and Community-Level Gender Inequalities

	S2.1	S2.2	S2.3	S2.4
	Women	**Men**	**Women**	**Men**
Health at Age 14 **(H)**	1.377***	0.684***	0.474	0.375
	(0.28)	(0.11)	(0.82)	(0.33)
Difference in Community Migration Prevalence between Men and Women	0.135***	0.079***		
	(0.04)	(0.02)		
Difference in Community Migration Prevalence between Men and Women * H	-0.039***	-0.013**		
	(0.01)	(0.00)		
Difference in Community LF Participation Rates between Men and Women			0.003	-0.008
			(0.06)	(0.02)
Difference in Community LF Participation Rates between Men and Women * H			0.003	0.002
			(0.02)	(0.01)
# Person-Years	86,709	73,567	86,709	73,567
# Respondents	4,150	3,853	4,150	3,853

*p < .05, **p < .01, ***p < .001 (two-tailed test).
All models control for gender, age, age squared, years of education, number of children under 18, number of migrant relatives, household access to business, household access to lands, number of rooms owned by household, height, smoking history, rural community, total migration prevalence, and respondents' informant status.

Table 2.3S Discrete-Time Multinomial Logistic Regressions Predicting Documentation Status of First U.S. Migration (Reference = Non-Migrants), by Health at Age 14 and Household-Level Gender Inequalities

	S3.1	S3.2	S3.3	S3.4
	Women	**Men**	**Women**	**Men**
Panel A: Outcome = Documented Migration				
Health at Age 14 **(H)**	1.821***	0.535*	1.529**	0.129
	(0.50)	(0.23)	(0.50)	(0.32)
Migration Sequence (ref. = Single)				
Married, Spouse Not Yet Migrated	-1.122	0.963		
	(4.72)	(1.31)		
Married, Spouse Not Yet Migrated * H	-0.032	-0.404		
	(1.25)	(0.38)		
Married, Spouse Already Migrated[1]	4.933	-		
	(2.69)	-		
Married, Spouse Already Migrated * H	-1.082	-		
	(0.72)	-		
Difference in Years of Education between R and Spouse			-0.131	-0.155
			(0.55)	(0.29)
Difference in Years of Education between R and Spouse * H			0.030	0.028
			(0.15)	(0.08)
Panel B: Outcome = Undocumented Migration				
Health at Age 14 **(H)**	0.542**	0.551***	-0.150	0.441***
	(0.20)	(0.09)	(0.36)	(0.11)
Migration Sequence (ref. = Single)				
Married, Spouse Not Yet Migrated	-14.368	0.605		
	(4.18e+3)	(0.48)		
Married, Spouse Not Yet Migrated * H	-0.498	-0.134		
	(1.25e+3)	(0.14)		
Married, Spouse Already Migrated[1]	5.165***	-		
	(1.26)	-		
Married, Spouse Already Migrated * H	-1.105**	-		
	(0.37)	-		
Difference in Years of Education between R and Spouse			-0.151	0.337**
			(0.35)	(0.11)
Difference in Years of Education between R and Spouse * H			0.039	-0.090**
			(0.10)	(0.03)
# Person-Years	86,709	73,567	53,285	41,184
# Respondents	4,150	3,853	3,076	2,590

*p < .05, **p < .01, ***p < .001 (two-tailed test).

All models control for gender, age, age squared, years of education, number of children under 18, number of migrant relatives, household access to business, household access to lands, number of rooms owned by household, height, smoking history, rural community, total migration prevalence, and respondents' informant status.

[1] Collapsed with the "married, spouse not yet migrated" category for male respondents (the new category indicates that R is married).

Table 2.4S Discrete-Time Multinomial Logistic Regressions Predicting Documentation Status of First U.S. Migration (Reference = Non-Migrants), by Health at Age 14 and Community-Level Gender Inequalities

	S4.1	S4.2	S4.3	S4.4
	Women	**Men**	**Women**	**Men**
Panel A: Outcome = Documented Migration				
Health at Age 14 **(H)**	1.661**	0.861**	1.553	1.522
	(0.63)	(0.32)	(1.76)	(0.87)
Difference in Community Migration Prevalence between Men and Women	0.038	0.105*		
	(0.11)	(0.05)		
Difference in Community Migration Prevalence between Men and Women * H	-0.007	-0.027		
	(0.03)	(0.01)		
Difference in Community LF Participation Rates between Men and Women			-0.010	0.055
			(0.13)	(0.06)
Difference in Community LF Participation Rates between Men and Women * H			0.000	-0.023
			(0.04)	(0.02)
Panel B: Outcome = Undocumented Migration				
Health at Age 14 **(H)**	1.221***	0.662***	-0.247	0.210
	(0.31)	(0.12)	(0.90)	(0.35)
Difference in Community Migration Prevalence between Men and Women	0.141***	0.077***		
	(0.04)	(0.02)		
Difference in Community Migration Prevalence between Men and Women * H	-0.042***	-0.011*		
	(0.01)	(0.01)		
Difference in Community LF Participation Rates between Men and Women			-0.022	-0.016
			(0.06)	(0.02)
Difference in Community LF Participation Rates between Men and Women * H			0.011	0.006
			(0.02)	(0.01)
# Person-Years	86,709	73,567	86,709	73,567
# Respondents	4,150	3,853	4,150	3,853

*p < .05, **p < .01, ***p < .001 (two-tailed test).
All models control for gender, age, age squared, years of education, number of children under 18, number of migrant relatives, household access to business, household access to lands, number of rooms owned by household, height, smoking history, rural community, total migration prevalence, and respondents' informant status.

Table 2.5S Average Marginal Effect of Health at Age 14 on Ever Migration to the U.S., by Migration Sequence

	AME of Health at Age 14	
	Women	Men
(a) Single	.0014***	.0063***
(b) Married, Spouse Not Yet Migrated	.0004	.0049***
(c) Married, Spouse Already Migrated[1]	-.0008	-
Test of Difference in AME		
a-b	.0009*	.0015
a-c	.0022	-
b-c	.0012	-

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S1.1 and S1.2.
[1] Collapsed with the "married, spouse not yet migrated" category for male respondents (the new category indicates that R is married).

Table 2.6S Average Marginal Effect of Health at Age 14 on Ever Migration to the U.S., by Spousal Difference in Years of Education

	AME of Health at Age 14	
	Women	Men
(a) Lower Spousal Difference in Years of Education (R – Spouse)[1]	.0004	.0048***
(b) Average Spousal Difference in Years of Education (R – Spouse)[2]	.0005	.0034***
(c) Higher Spousal Difference in Years of Education (R – Spouse)[3]	.0005	.0009
Test of Difference in AME		
a-b	-.0000	.0015
a-c	-.0001	.0038*
b-c	-.0000	.0023*

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S1.5 and S1.6.
1 Lower Difference = -3 for women and men.
2 Average Difference = 0 for women and men.
3 Higher Difference = 3 for women, 4 for men.
"Lower," "Average," and "Higher" differences are defined as mean – 1 standard deviation, mean, and men + 1 standard deviation within each gender group.

Table 2.7S Average Marginal Effect of Health at Age 14 on Ever Migration to the U.S., by Gender Difference in Community Migration Prevalence

	AME of Health at Age 14	
	Women	Men
(a) Lower Difference in Community Migration Prevalence (Men – Women)[1]	.0025**	.0050***
(b) Average Difference in Community Migration Prevalence (Men – Women)[2]	.0017***	.0057***
(c) Higher Difference in Community Migration Prevalence (Men – Women)[3]	.0008**	.0062***
Test of Difference in AME		
a-b	.0009*	-.0006*
a-c	.0017*	-.0012
b-c	.0008**	-.0005

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S2.1 and S2.2.
[1] Lower Difference = 3 for women, 2 for men.
[2] Average Difference = 13 for women, 11 for men.
[3] Higher Difference = 24 for women, 21 for men.
"Lower," "Average," and "Higher" differences are defined as mean – 1 standard deviation, mean, and men + 1 standard deviation within each gender group.

Table 2.8S Average Marginal Effect of Health at Age 14 on Ever Migration to the U.S., by Gender Difference in Community LF Participation Rate

	AME of Health at Age 14	
	Women	Men
(a) Lower Difference in Community LF Participation Rate (Men – Women)[1]	.0010*	.0055***
(b) Average Difference in Community LF Participation Rate (Men – Women)[2]	.0011***	.0058***
(c) Higher Difference in Community LF Participation Rate (Men – Women)[3]	.0013**	.0061***
Test of Difference in AME		
a-b	-.0002	-.0003
a-c	-.0004	-.0006
b-c	-.0002	-.0003

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S2.3 and S2.4.
[1] Lower Difference = 40 for women and men.
[2] Average Difference = 50 for women and men.
[3] Higher Difference = 60 for women and men.
"Lower," "Average," and "Higher" differences are defined as mean – 1 standard deviation, mean, and men + 1 standard deviation within each gender group.

Table 2.9S Average Marginal Effect of Health at Age 14 on Documentation Status of First U.S. Migration (Reference = Non-Migrants), by Migration Sequence

	AME of Health at Age 14			
	Women		Men	
Outcome Category	Documented Migration	Undocumented Migration	Documented Migration	Undocumented Migration
(a) Single	.0009*	.0007**	.0009*	.0055***
(b) Married, Spouse Not Yet Migrated	.0003	.0000	.0001	.0048***
(c) Married, Spouse Already Migrated[1]	.0010	-.0031	-	-
Test of Difference in AME				
a-b	.0007	.0007**	.0007	.0007
a-c	-.0000	.0038*	-	-
b-c	-.0007	.0031	-	-

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S3.1 and S3.2.
[1] Collapsed with the "married, spouse not yet migrated" category for male respondents (the new category indicates that R is married).

Table 2.10S Average Marginal Effect of Health at Age 14 on Documentation Status of First U.S. Migration (Reference = Non-Migrants), by Spousal Difference in Years of Education

	AME of Health at Age 14			
	Women		Men	
Outcome Category	Documented Migration	Undocumented Migration	Documented Migration	Undocumented Migration
(a) Lower Spousal Difference in Years of Education (R-Spouse)[1]	.0006	-.0002	.0000	.0046***
(b) Average Spousal Difference in Years of Education (R-Spouse)[2]	.0006*	-.0001	.0001	.0032***
(c) Higher Spousal Difference in Years of Education (R-Spouse)[3]	.0006*	-.0000	.0002	.0007
Test of Difference in AME				
a-b	.0000	-.0001	-.0001	.0015*
a-c	.0000	-.0001	-.0001	.0039*
b-c	.0000	-.0001	-.0001	.0025*

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S3.5 and S3.6.
[1] Lower Difference = -3 for women and men.
[2] Average Difference = 0 for women and men.
[3] Higher Difference = 3 for women, 4 for men.
"Lower," "Average," and "Higher" differences are defined as mean – 1 standard deviation, mean, and men + 1 standard deviation within each gender group.

Table 2.11S Average Marginal Effect of Health at Age 14 on Documentation Status of First U.S. Migration (Reference = Non-Migrants), by Gender Difference in Community Migration Prevalence

	AME of Health at Age 14			
	Women		Men	
Outcome Category	Documented Migration	Undocumented Migration	Documented Migration	Undocumented Migration
(a) Lower Difference in Community Migration Prevalence (Men-Women)[1]	.0007*	.0017*	.0010*	.0042***
(b) Average Difference in Community Migration Prevalence (Men-Women)[2]	.0007**	.0009*	.0007*	.0050***
(c) Higher Difference in Community Migration Prevalence (Men-Women)[3]	.0008*	.0003	.0004	.0058***
Test of Difference in AME				
a-b	-.0000	.0008*	.0002	-.0008**
a-c	-.0001	.0015*	.0005	-.0016
b-c	-.0001	.0007*	.0003	-.0001

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S4.1 and S4.2.
[1] Lower Difference = 3 for women, 2 for men.
[2] Average Difference = 13 for women, 11 for men.
[3] Higher Difference = 24 for women, 21 for men.
"Lower," "Average," and "Higher" differences are defined as mean – 1 standard deviation, mean, and men + 1 standard deviation within each gender group.

Table 2.12S Average Marginal Effect of Health at Age 14 on Documentation Status of First U.S. Migration (Reference = Non-Migrants), by Gender Difference in Community LF Participation Rate

	AME of Health at Age 14			
	Women		Men	
Outcome Category	Documented Migration	Undocumented Migration	Documented Migration	Undocumented Migration
(a) Lower Difference in Community LF Participation Rate (Men-Women)[1]	.0009*	.0002	.0011*	.0044***
(b) Average Difference in Community LF Participation Rate (Men-Women)[2]	.0008***	.0004	.0005*	.0051***
(c) Higher Difference in Community LF Participation Rate (Men-Women)[3]	.0007*	.0006	.0002	.0059***
Test of Difference in AME				
a-b	.0001	-.0002	.0005	-.0007
a-c	.0001	-.0004	.0009	-.0015
b-c	.0001	-.0003	.0004	-.0008

*p < .05, **p < .01, ***p < .001 (two-tailed test).
Estimates are based on Models S4.3 and S4.4.
[1] Lower Difference = 40 for women and men.
[2] Average Difference = 50 for women and men.
[3] Higher Difference = 60 for women and men.
"Lower," "Average," and "Higher" differences are defined as mean – 1 standard deviation, mean, and men + 1 standard deviation within each gender group.

Figure 2.1S Predicted Probabilities of Documentation Status of First U.S. Migration, by Gender, Health at Age 14, and Migration Sequence

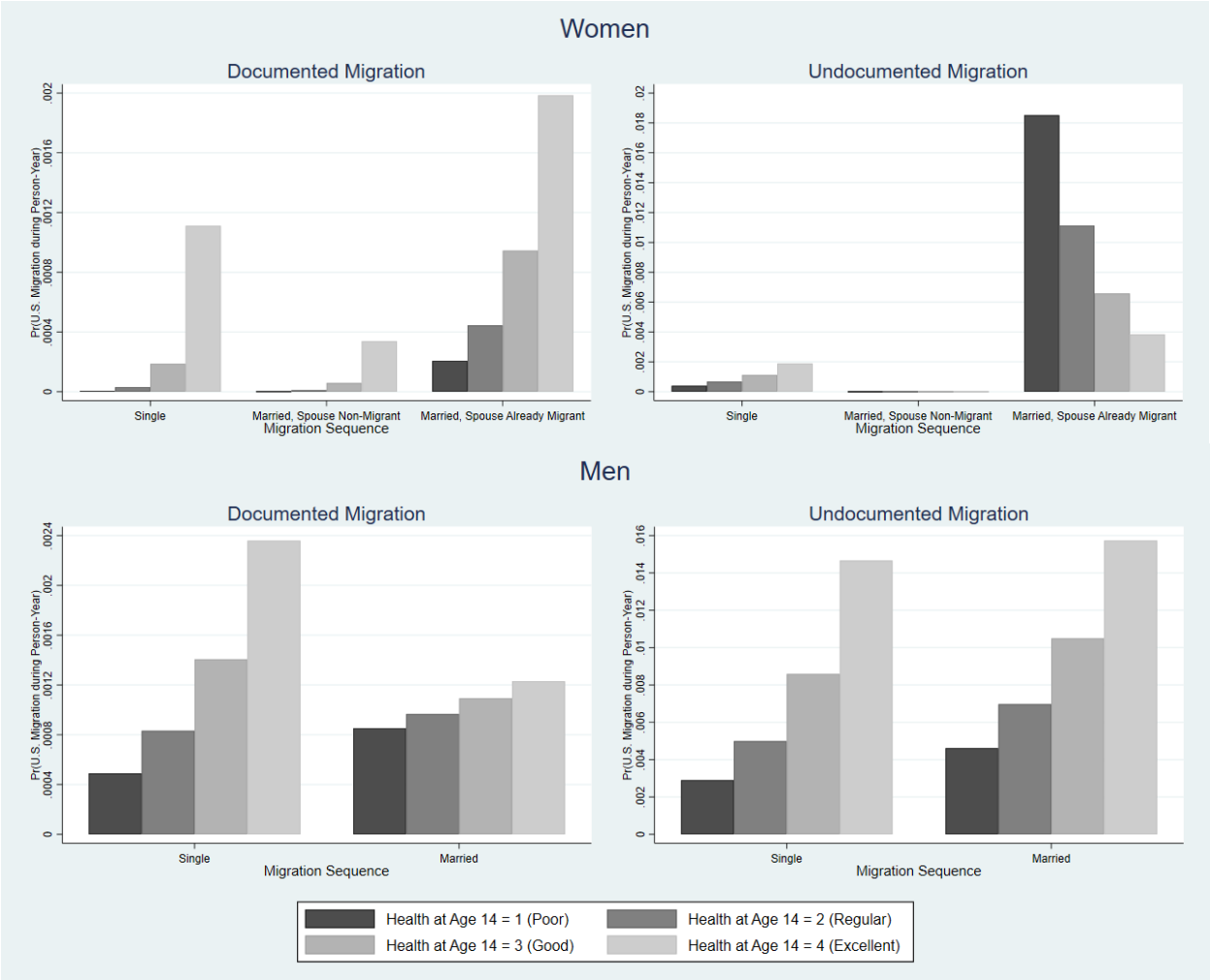


Figure 2.2S Predicted Probabilities of Documentation Status of First U.S. Migration, by Gender, Health at Age 14, and Difference in Years of Education between R and Spouse

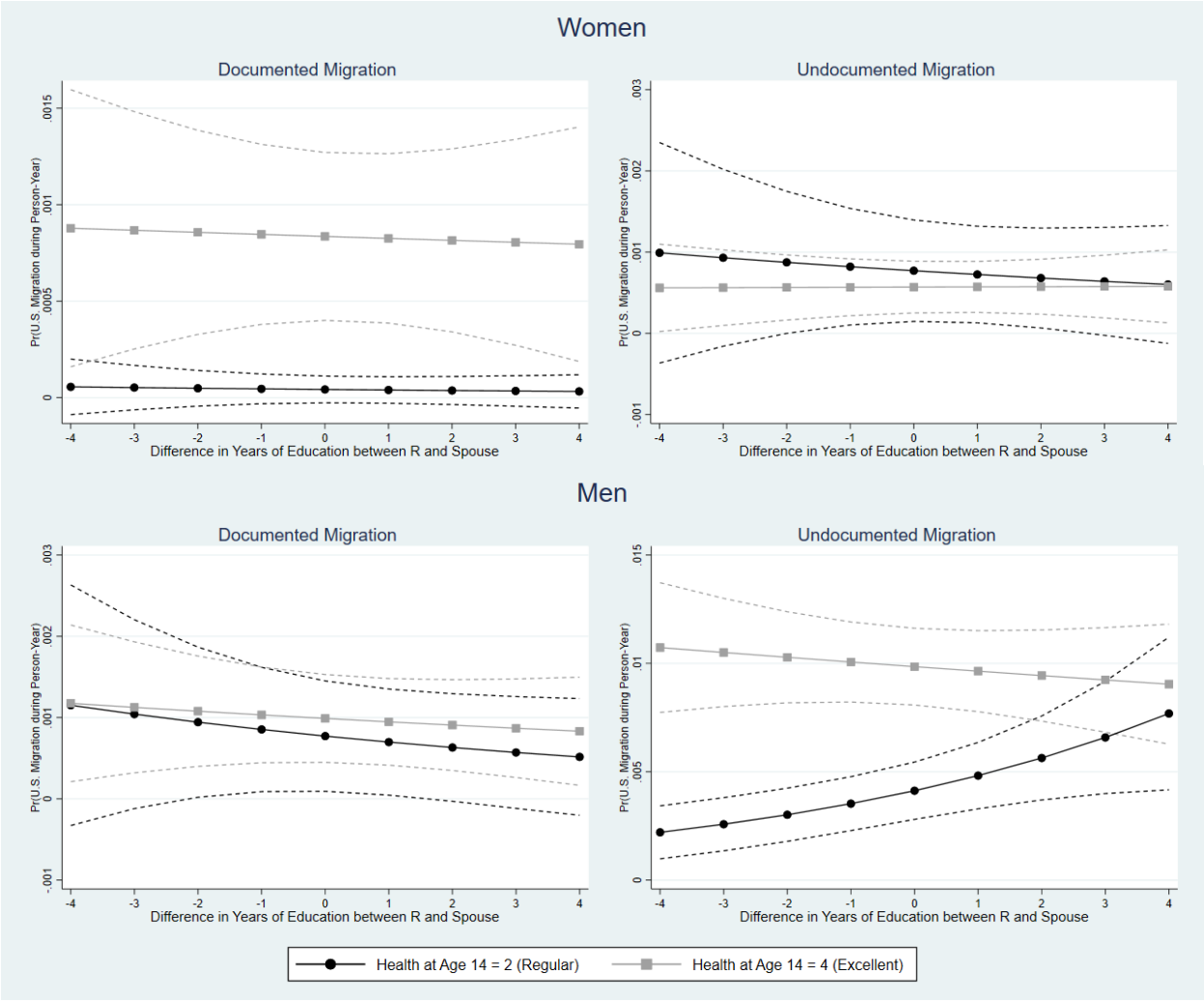


Figure 2.3S Predicted Probabilities of Documentation Status of First U.S. Migration, by Gender, Health at Age 14, and Difference in Community Migration Prevalence between Men and Women

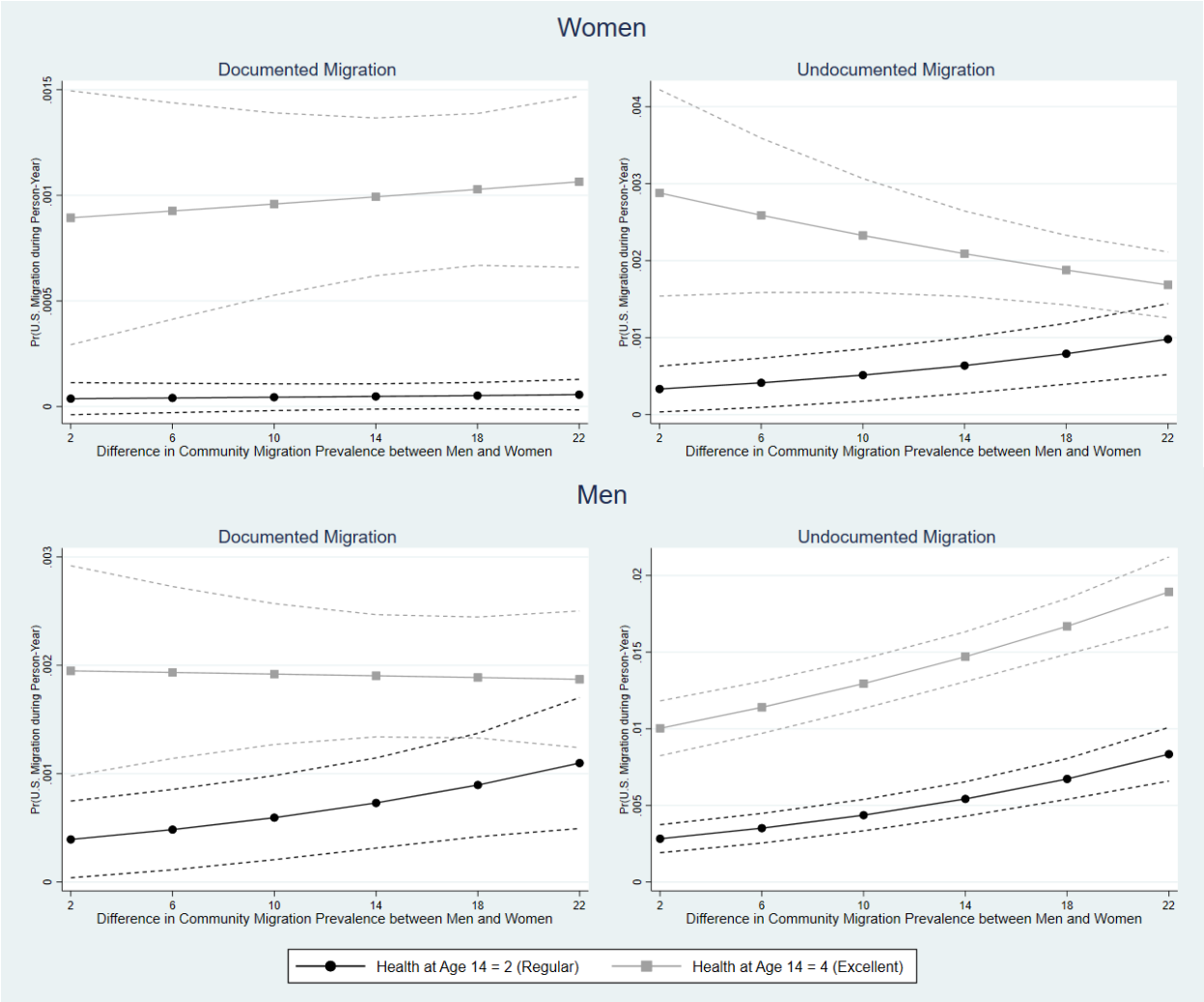
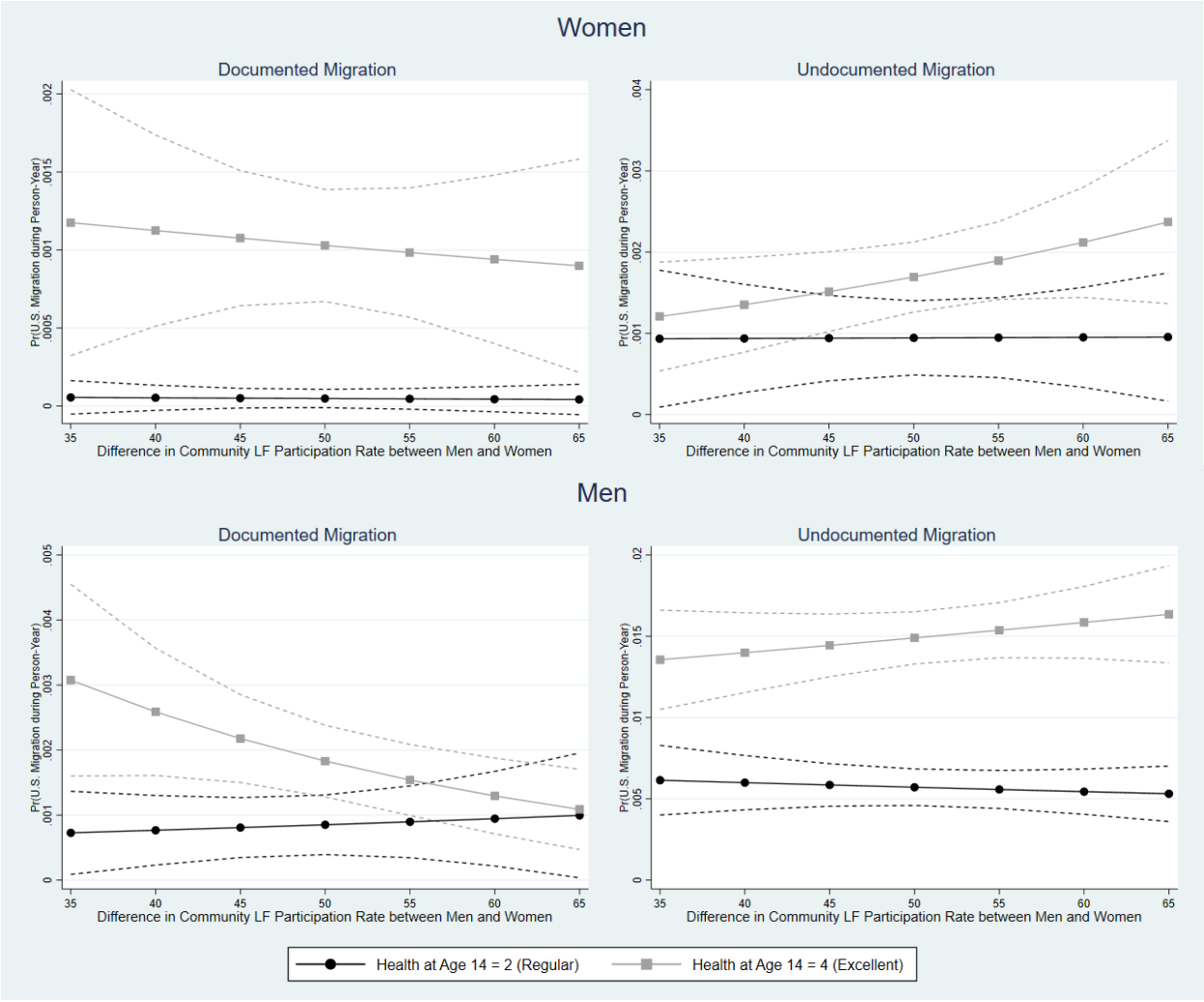


Figure 2.4S Predicted Probabilities of Documentation Status of First U.S. Migration, by Gender, Health at Age 14, and Difference in Community LF Participation Rate between Men and Women



CHAPTER 3

Acculturation, Depressive Symptoms, and Friendship Instability among Immigrant Adolescents

This chapter is in press as: Li, Yezhen, and Alyssa W. Goldman. 2024. "Acculturation, Depressive Symptoms, and Friendship Instability among Immigrant Adolescents." Society and Mental Health: 21568693231221513. As the first author, I was responsible for coming up with the research idea, designing research methods, performing data analysis, and writing the manuscript.

ABSTRACT

Recent scholarship suggests that personal tie instability, i.e., the dissolution of old ties and formation of new ties, may lead to psychological distress. However, this association remains understudied among the immigrant population, for whom acculturation may present unique challenges to both personal tie stability and psychological well-being. Using data from the National Longitudinal Study of Adolescent to Adult Health, we investigate the mental health implications of instability in immigrant adolescents' same-sex best friends, and how it explains the association between acculturation and depressive symptoms. We find that friendship instability was associated with higher depressive symptoms only among immigrant adolescents with a low level of acculturation. For more acculturated adolescents, replacing their original friendship with an interracial friend predicted lower depressive symptoms. These findings imply that friendship instability constitutes a dimension of acculturative stress, with detrimental effects unique to immigrant adolescents in the early stages of acculturation.

INTRODUCTION

Following the Immigration and Nationality Act of 1965, the United States has witnessed a drastic inflow of new immigrants (Portes and Rumbaut 2014). As of 2019, immigrants account for 15.3% of the U.S. population, a substantial increase from 5.4% in 1960 (U.S. Census Bureau 2020). In understanding the well-being of the immigrant population, the existing literature has paid extensive attention to the mental health of immigrant adolescents (Takeuchi et al. 2007; Zhou 1997). In particular, scholars have found that immigrant youths' social relationships play an important role in shaping their psychological well-being (Harker 2001; McMillan 2019).

The process of acculturation may cause substantial challenges to the formation of personal social networks, which typically function as key sources of social support. Indeed, the notion of "acculturative stress," i.e., psychosocial stress directly induced by acculturation, explicitly accounts for network-related stressors (Berry et al. 1987; Vega et al. 1998). Feelings of social isolation and interpersonal conflicts with native-born people are common network-related risk factors that lead to psychological distress (Mora et al. 2014; Xu and Chi 2013). However, most prior studies have relied on cross-sectional data to investigate the role of social relationships in immigrants' mental health. Examining temporal changes in immigrants' social ties may shed unique light on their psychological well-being on a dynamic account.

Evidence suggests that personal network instability, i.e., the dissolution of old ties and formation of new ties, is associated with more psychological distress (Chan and Poulin 2009; Schwartz and Litwin 2017). Experiences of friendship instability could be especially relevant to immigrant adolescents, as their social relationships are subject to considerable cultural and educational challenges in host educational institutions (Cherng 2015; Kao 2004; McMillan 2019; Zhou 1997). Scholars have found that immigrant youths face high risks of social isolation in

secondary schools, due to cultural differences and discrimination from native-born peers (Cherng 2015). To the extent that these factors may hamper immigrant adolescents' formation of in-school friendships – in ways that translate into psychosocial stress, it would be also important to examine the mental health implications of their friendship dynamics over time.

Drawing on two waves of data from the National Longitudinal Study of Adolescent to Adult Health, the present study investigates how friendship instability predicts depressive symptoms among first- and second-generation immigrant adolescents, and how it explains the association between measures of acculturation (e.g., time in the U.S., English use in-home) and depressive symptoms. We focus on instability in adolescents' same-sex best friends in school, who symbolize their strongest ties in the educational institutions and may have substantial mental health consequences (Chan and Poulin 2009; Rude and Herda 2010).

BACKGROUND

Acculturation and Mental Health among Immigrant Adolescents

Acculturation refers to the process by which immigrants adapt to the dominant socio-cultural norms in the receiving society, through changes in their language use, values, behaviors, etc. (Zhou 1997). For immigrant children (i.e., first generation) and native-born children with immigrant parents (i.e., second generation), acculturation has important implications for their educational outcomes and mental health. Compared to adult immigrants, first- and second-generation immigrant adolescents are less likely to perceive their ethnic origins as a point of reference; instead, they are more inclined to align their values and behaviors with those held by native-born peers (Gans 1992; Rumbaut 2004). These inclinations expose immigrant adolescents

to more substantial contacts with people native to the host society, such that acculturation plays crucial roles in shaping their psychological well-being (Zhou 1997; Zhou and Gonzales 2019).

Prior literature has used numerous measures of acculturation to understand its mental health consequences. Immigrant generation status and, among first-generation immigrants, years in the U.S., have been commonly utilized as proxies of acculturation (Greenman and Xie 2008; Harker 2001; Kimbro, Gorman, and Schachter 2014). Empirical evidence suggests that these measures tend to negatively predict mental health: first-generation immigrant adolescents experienced a decline in mental well-being with more years in the host country, and second-generation adolescents report worse mental health than those who are foreign-born (Harker 2001; Tam and Lam 2005). Other studies have focused on behavioral indicators of acculturation. For instance, English language proficiency, capturing the language aspect of acculturation, is associated with better mental health (Harker 2001; Kim et al. 2011).

An important mechanism explaining the linkage between acculturation and mental health is the stress entailed in this process (Kimbro, Gorman, and Schachter 2014; Morey et al. 2021). Acculturation may engender a unique set of stressors, i.e., acculturative stress, as individuals undergo dramatic changes in their values, behaviors, and lived experiences (Berry et al. 1987). Immigrant adolescents might experience heightened acculturative stress, as growing up in the host country entails additional challenges in their psychosocial and educational developments (Cherng 2015; Montazer and Wheaton 2011; Zhou 1997). Existing research has examined how the risk of acculturative stress could vary by the degree of acculturation. For instance, adolescents with low English proficiency reported higher rates of encountering discrimination (Berry et al. 1987; Kim et al. 2011). Other studies have investigated how the negative mental health consequences of acculturative stress vary by acculturation (Berry 2006). Alamilla and

associates (2010) found that retaining Latino values, suggesting a lack of acculturation, promoted the association between perceived discrimination and anxiety among Latino college students.

To date, what constitutes acculturative stress – as well as how it might explain the mental health consequences of acculturation – remains an important topic in immigration studies. However, less is understood about whether and how personal tie instability over time factors into immigrants' mental health, largely because longitudinal data on immigrant networks remain scarce (c.f. Lubbers et al. 2010). Existing research on acculturative stress alludes to the potential that immigrants may encounter considerable difficulties in maintaining stable personal ties (Berry 2006). Understanding friendship instability as a risk factor for depression may shed new light on how the acculturation process shapes immigrants' mental health.

Friendship Instability as a Psychosocial Stressor

A large bulk of literature has demonstrated the profound influence of friendship on adolescents' mental health (Bearman and Moody 2004; Falci and McNeely 2009; Ueno 2005). Studies have also investigated how friendships shape the mental well-being of immigrant adolescents, who are at a high risk of experiencing friendship isolation and marginalization in schools (Cherng 2015; Kao 2004; McMillan 2019). In particular, scholars found that having a larger proportion of foreign-born friends was associated with lower rates of depression and less alcohol misuse for first-generation youths, but it failed to predict better mental health in the long run (McMillan 2019; Niño et al. 2017). These patterns have led scholars to speculate on the potential role of friendship instability in immigrant youths' mental health decline over time.

Recent studies point to the mental health implications of personal network instability. The dissolution of egocentric ties, including those with friends, family members, and neighbors, may

lead to social isolation if it is not compensated through the formation of new relationships (Perry and Pescosolido 2012; Schwartz and Litwin 2017). The lack of enduring ties may reflect an individual's weak connection with the larger social environment (Chan and Poulin 2009). Instability in personal ties may also result in inconsistent access to social support, advice exchange, and coordinated oversight around health behaviors (Bearman and Moody 2004; Chan and Poulin 2009; Flashman 2012), thereby contributing to elevated risks of depressive symptoms (Chan and Poulin 2009; Schwartz and Litwin 2017). An important caveat is that social ties can also be sources of considerable stress, and curtailing these "negative ties" may improve an individual's mental well-being (Offer 2020).

For adolescents, friendship instability could be particularly detrimental to their mental health. Peer support and influence profoundly shape adolescents' skill acquisition, values, and sense of belonging (Faris and Felmlee 2018; Kao 2004; Poulin and Chan 2010). A high degree of friendship instability is associated with perceptions of low friendship quality and marginalization from peer groups (Brendgen et al. 2002; Chan and Poulin 2009). Notably, Chan and Poulin (2009) found that changes in adolescents' self-reported best friends predicted more depressive symptoms, whereas dynamics in secondary friendships were not associated with depression. This is in part because best friends constitute strong ties in youths' friendship networks, and these bonds are typically characterized by high-quality support (Brendgen et al. 2002; Chan and Poulin 2007; Rude and Herda 2010).

Furthermore, the mental health consequences of friendship instability may depend on the characteristics of any new ties that are added to the network following the loss of old ties (Schwartz and Litwin 2017). The characteristics of youths' new friends may determine whether their mental health could "recover" from prior friendship loss. For example, switching from in-

school peer friendships to out-of-school friends may marginalize youths from the educational environment (Cherng 2015). The resultant loss of peer support in schools could translate into more depressive symptoms (Chan and Poulin 2009; Cherng 2015).

The race/ethnicity of friendship ties may also matter for the mental health implications of friendship instability. Same-race friendships among adolescents are typically characterized by higher levels of quality than interracial friendships (Aboud and Sankar 2007; Rude and Herda 2010). Newly formed interracial friendships may provide inadequate social support, thus harming youths' mental health. Conversely, scholars argued that friends of different racial/ethnic origins may facilitate integration into the educational environment (Kao 2004; Reynolds and Crea 2017), which could positively contribute to immigrant youths' well-being.

The Current Study

The present study is guided by the overarching research question: How does friendship instability explain the association between acculturation and depressive symptoms? If relationship-related stress may emerge throughout the acculturation process (Berry et al. 1987; Harker 2001; Singh, McBride, and Kak 2015), instability in personal ties could also factor into immigrant youths' acculturation experiences. We focus on the instability in immigrant adolescents' same-sex best friendships (Chan and Poulin 2009), considering two potential mechanisms of how it explains the association between acculturation and depressive symptoms.

First, lower levels of acculturation might be associated with a higher risk of friendship instability, which leads to more psychological distress. In this way, friendship instability mediates the association between acculturation and health. Evidence suggests that English proficiency alleviates acculturative stress and facilitates bonding with native-born people (Brown

2006; Kim et al. 2011). Immigrant youths who reported greater language barriers are less likely to develop interethnic ties and more likely to experience social isolation in schools (Cherng 2015). Furthermore, previous studies suggest that immigrants with more years in the host society reported higher levels of social support, because longer migration experiences enhance immigrants' social skills and enable them to develop better-quality social relationships (Harker 2001; Morey et al. 2021).

- H_1: Friendship instability will mediate the association between acculturation and depressive symptoms among immigrant adolescents.

Second, friendship instability may be more psychologically detrimental to immigrant adolescents with lower levels of acculturation; it therefore moderates the association between acculturation and depressive symptoms. Secondary schools in the host society subject immigrant youths to a variety of challenges, including taking courses in another language, socializing with peers of different ethnic origins, and dealing with discrimination based on national and racial origins (Cherng 2015; Zhou 1997). In-school friendships play a crucial role in buffering those stressors that emerge from youths' educational experiences (Kao 2004). These challenges may be disproportionately experienced by immigrant students who have yet to acculturate into the host society, and they tend to rely more heavily on peer support (Cherng 2015; Kim et al. 2011). Friendship instability may predict more depression for those with low levels of acculturation.

- H_2: Friendship instability will moderate the association between acculturation and depressive symptoms among immigrant adolescents. Specifically, friendship instability will be more strongly associated with depressive symptoms for immigrant adolescents with lower levels of acculturation, than for those with higher levels of acculturation.

Among less acculturated immigrant adolescents who experienced friendship instability, higher risks of depressive symptoms might be further concentrated among those who replaced a friendship tie with an out-of-school friendship. As lowly acculturated adolescents tend to have inadequate social capital in schools, the replacement of an in-school best friend with one outside of their school context may pull them away from the in-school peer network, thereby having adverse consequences for integration into educational environments. This could diminish their receipt of social support from schoolmates and heighten their feelings of social exclusion (Chan and Poulin 2009; Cherng 2015).

For more acculturated immigrant adolescents, friendship instability may be less stressful. Friendship networks in secondary schools are highly dynamic (Chan and Poulin 2007; Flashman 2012); immigrant adolescents with higher levels of acculturation may be adjusted to friendship changes and, thus, are less likely to perceive friendship changes in a negative light. Instead, replacing their prior tie with an interracial friendship might improve their mental health. This is because more acculturation enables immigrant youths to form higher-quality friendships with their interracial peers (Rumbaut 2004). Interracial friendships might facilitate their integration into peer social groups in the host educational institutions, which lowers depressive symptoms (Kao 2004).

- H_3: The association between friendship instability and depressive symptoms will differ by social-contextual aspects of the replacement tie, including race and the school context.

DATA AND METHODS

Data

The present study draws on data from the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a longitudinal study of a nationally representative sample of 90,118 adolescents, who were in grades 7-12 during the 1994-95 school year. Descriptions of the study design are documented in Harris et al. (2019).

Add Health's Wave-I study consisted of two rounds of data collection. An in-school questionnaire was administered to all students from the 132 selected secondary schools (hereafter W1). In the same school year, an in-home interview followed a subsample of 20,745 respondents (W2). The mean timelapse between W1 and W2 was 7.64 months. We focus on immigrant adolescents' instability in their same-sex best friend and depressive symptoms during this period, as opposed to friendship changes in later waves of Add Health, for two reasons. First, friendship instability within a short timeframe is more psychologically detrimental for adolescents than longer-term changes (Chan and Poulin 2009). Second, a substantial proportion of students (29.2%) left their original schools in later waves. These students were ineligible for our analyses as their in-school friendships were disrupted by their departure from the initial school context (Meter and Card 2016). As a result, the sample size is substantially reduced and not large enough to produce reliable inferences.

Sample

The W1 and W2 surveys collected data on respondents' friendship networks. A name generator recorded respondents' nominations of up to 10 individuals whom they perceived as their closest friends (5 males and 5 females). Nominated friends could be either peers in their school or people outside of school. The first male and female friendship nominations recorded respondents' best male and female friends, respectively (Rude and Herda 2010). W1 interviewed

all students in sampled schools and, thus, made available global network data. W2 interviewed a subsample of students in each school, and many respondents (about 80%) were asked to nominate only one male friend and one female friend. This precludes analyses of longitudinal, sociocentric network analyses over the W1-W2 timeframe.[1]

Following Rude and Herda (2010), we investigate how adolescents' depressive symptoms are associated with the instability of their same-sex best friend. Our analysis is not able to account for adolescents' cross-sex best friendships, because Add Health's name generators placed respondents' romantic partner, if any, as their first different-sex friendship nomination, making these two types of relationships indistinguishable from each other (Quillian and Campbell 2003; Rude and Herda 2010). The mental health implications of adolescents' romantic experiences merit different theoretical discussions (Quillian and Campbell 2003).

Our analytic sample consists of adolescents with an immigrant background, i.e., first- and second-generation (Zhou 1997).[2] Respondents were eligible for analyses if they nominated an in-school same-sex best friend who was identifiable by student rosters in W1. Nominations of a same-sex best friend in W1 who was out of school, or who couldn't be matched in the school roster, were not traceable in subsequent waves of Add Health, and therefore their dynamics over time could not be captured.

Overall, a total of 1434 first- and second-generation adolescents met these criteria. Among them, only a small proportion (n = 44) did not nominate a same-sex best friend in W2. As such, we could not produce reliable estimates on how losing a best friend without replacement predicted depressive symptoms. These individuals were therefore not included in the sample. We further excluded 140 respondents who were missing on survey design factors, e.g., survey weight, strata, and cluster (Chen and Chantala 2014). Missingness within the rest of

the sample occurred only among covariates (parental education, two-parent house, GPA, delinquency, depression at W1, and network average depression) and was generally lower than 5 percent. The two exceptions are respondents' GPA (15.9%) and delinquency (9.2%). We employed listwise deletion and yielded a sample of n = 952 respondents.[3] Supplemental analyses using multiple imputations by chained equations (with 10 imputed datasets) yielded substantively similar results, as presented in Supplemental Table 3.1S.

Measures

Depressive Symptoms

The dependent variable for the present study is the Center for Epidemiologic Studies Depression Scale (CES-D), a well-validated measure of *depressive symptoms*. Perreira et al. (2005) recommended a five-item version of CES-D for producing valid assessments of mental health disparities across race/ethnicity and immigrant generation. The five CES-D items are *depressed, life, sad, happy,* and *blues.* Corresponding survey questions for these items are described in Supplemental Table 3.1S. Each item is measured through a four-point scale (with values ranging from 0-3). We recoded each item such that larger values indicate more depressive symptoms. The CES-D index sums the scores of the five items (Cronbach's Alpha = .77) and has a range of 0-15.

Friendship Instability

Friendship Instability consists of our categories, based on respondents' in-school same-sex best friend nominations in W1 and W2: W1 friendship maintained; W1 friendship replaced by an out-of-school friend; W1 friendship replaced by an in-school, different-race friend; and W1

friendship replaced by an in-school, same-race friend. Following previous studies, we consider Latino as a race and distinguish Latino youths from non-Hispanic white, non-Hispanic black, and Asian adolescents (Greenman 2011; McMillan 2019).

Acculturation Measures

We employ two variables as proxies of acculturation. First, *English Use In-Home* captures respondents' language assimilation. The variable is coded as 1 if respondents reported speaking English with close family members at home and as 0 otherwise.

Second, we constructed a three-category variable indicating respondents' *Time in the U.S.*, accounting for their immigrant generation status and, among the first-generation adolescents, their years in the host country (Bersani 2014; Greenman 2011). The variable consists of three categories: first generation with fewer than five years in the U.S., first generation with at least five years in the U.S., and second generation. Previous research shows that first-generation adolescents with fewer than five years of migration experience reported significantly lower rates of substance (Greenman 2011), which could have major influences on their mental health (Conway et al. 2018). In our sample, time in the U.S. has a low correlation with English use in-home ($r = .322$; $p < .05$).[4]

Covariates

All covariates are measured at W1 to account for lagged effects. We adjust for individual sociodemographic characteristics including *age* (in years)*, female,* and *race* (Black, Latino, Asian, Non-Hispanic White, and other). *Parental education* measures the highest level of education among respondents' parents (less than high school, high-school graduate, some

college, and BA degree). *Two-parent household* is a binary variable indicating whether respondents shared their residence with both parents. Additionally, the duration between W1 and W2 could affect the persistence of friendship ties (Meter and Card 2016). We account for the *time difference between W1 and W2 interviews*, measured in months.

Students' behavioral characteristics are found to be associated with their depressive symptoms (Kao 2004). Respondents' *GPA* is calculated by averaging their grades in English, math, science, and social studies courses (McMillan 2019). *Number of delinquent events* indicates the total number of the following events that respondents had engaged in the past year: lied to their parents, skipped school without an excuse, and got into physical fights (Sweeten 2012). *Depression at W1* measures respondents' depressive symptoms in the baseline wave. Because Add Health employed different survey items to measure depressive symptoms in the first wave, only one item in the questionnaire was pertinent to Perreira et al.'s (2005) recommendations for measuring depressive symptoms across immigrant generations: "In the last month, how often did you feel depressed or blue?" The survey item employed a five-point scale (values ranging from 0 to 4), with higher values indicating more depression.

We also control for other aspects of respondents' friendship networks at W1 that could affect their levels of depression. First, respondent's frequency of social interactions with their baseline best friend could be an important determinant of their friendship loss (Chan and Poulin 2009). *Frequency of interactions with best friend at W1* measures how often respondents interacted with their original best friend, which is a five-point scale summing binary items indicating whether respondents went to the friend's house, hung out with them, spent time with the friend, talked about a problem together, and talked on the telephone during the past seven days, with higher values indicating more frequent social interactions. *Number of in-school*

friends measures the number of respondent's total in-school friendship nominations (with a maximum of 10), accounting for the confounding effect of network size (Falci and McNeely 2009). Moreover, personal networks could affect an individual's mental health through the social contagion effect. Namely, an individual's mental health status may significantly predict the mental health of their friends over time (Bearman and Moody 2004; Eisenberg et al. 2013). We thus control for respondent's *network average depression,* a continuous variable measuring the levels of depressive symptoms among respondents' in-school friends at W1. It is calculated by averaging the depression scores of respondents' W1 in-school friends.

School-level control variables include schools' *urbanicity* (1 = school was located in an urban area; 0 = rural area), *school type* (public vs. private), and *school size* (logged number of students). Moreover, opportunities for intragroup contacts may be constrained by the availability of in-group peers (Rude and Herda 2010). Thus, we control for the *proportion of same-immigrant-generation students* and *proportion of same-race students in school*.

Methods

The analyses employed multilevel OLS models to predict respondents' depressive symptoms. All models are mixed-effect regressions with a random intercept, where individuals are nested within schools. Regression models also account for survey design factors including survey cluster, strata, and weights (Chen and Chantala 2014). All analyses were conducted in Stata 16.1.

The regressions are presented in the following order. The first two regressions examine immigrant adolescents' depressive symptoms by their acculturation levels (i.e., years in the U.S., immigrant generation, English use in-home), controlling for individual- and school-level covariates. Specifically, the first model examines respondent's depression at W1; the second model

examines depression at W2, controlling for depression at W1.

The third model adds to the second friendship instability to examine its mediating effect through changes in the coefficients for acculturation measures. We conducted additional mediation analyses, using structural equation models (Ullman and Bentler 2012), to investigate the indirect effect of friendship instability on the association between acculturation measures and depressive symptoms.

The fourth and fifth regressions include interaction terms between friendship instability and measures of acculturation to investigate potential moderation effects. Graphs of predicted probabilities are presented to aid interpretations.

RESULTS

Main Analysis

Table 3.1 presents weighted descriptive statistics. The average score of depressive symptoms among immigrant adolescents in the sample was 2.48. Meanwhile, less than half of the respondents (49.2%) maintained their W1 friendship through W2. Among those immigrant adolescents who lost their original friendship, 23.1% formed a new in-school friendship with a peer of the same race. 14.1% replaced their in-school best friendship with a friend outside of their schools. Additionally, 31.4% of respondents were born in a foreign country (6.9% had been in the U.S. for fewer than five years, and 24.5% had settled in the U.S. for five years or more). About two thirds (69.0%) of respondents reported that they spoke English at home.

[TABLE 3.1 ABOUT HERE]

Table 3.2 reports regression coefficients from models predicting depressive symptoms among immigrant adolescents. We begin with an investigation of the general patterns of depressive

symptoms by respondent's levels of acculturation, controlling for covariates. Model 2.1 examines the distribution of depression in the baseline wave (W1). First-generation adolescents with fewer than five years in the U.S. reported less depression compared to their second-generation counterparts (β = .469; $p < .05$). Speaking English at home is not significantly associated with depression. However, Model 2.2 shows that the first-generation advantage in depressive symptoms waned in W2, as recently arrived first-generation adolescents reported a relatively higher level of depressive symptoms at W2 than their second-generation counterparts (β =-1.406; $p < .05$). Together, these models suggest that first-generation adolescents with fewer than 5 years of migration indeed experienced a significant mental health decline over the W1-W2 period.

[TABLE 3.2 ABOUT HERE]

Models 2.3-2.5 investigate the potential explanatory role of friendship instability in the associations between depressive symptoms and acculturation. Model 2.3 includes the friendship instability variable, which does not significantly predict depressive symptoms. Coefficients for acculturation measures remain virtually unchanged. Additional mediation analyses suggest that friendship instability does not have a significant indirect effect on the associations between acculturation measures and depressive symptoms (results are presented in Supplemental Table 3.3S). These findings do not support hypothesis H_1.

The next two models examine the moderating effects of friendship instability on acculturation. Model 2.4 includes interaction terms between friendship instability and time in the U.S. Results indicate that foreign-born youths with fewer than 5 years in the U.S. experienced a significant increase in depressive symptoms after dissolving the tie with their W1 best friends. For first-generation adolescents with at least five years in the U.S. and second-generation adolescents, the associations between depression and these two types of friendship instability were significantly

lessened, supporting H_2. Specifically, when their in-school best friend was replaced by an out-of-school friend, the level of depression significantly increased ($\beta = 3.117$, $p < .001$). This finding supports H_3 by demonstrating that the association between friendship instability and depressive symptoms depends on the in-school context of the replacement tie. Replacing the W1 best friend with another in-school, different-race peer was also associated with more depressive symptoms ($\beta = 1.555$; $p < .05$).

Figure 3.1 shows predicted values of depressive symptoms by adolescents' friendship instability and time in the U.S., based on Model 2.4. Among immigrant adolescents with fewer than five years in the U.S., higher depression was observed for those who replaced their W1 best friend with an out-of-school friend (5.71) or a different-race friend in school (4.15), compared to those who maintained the friendship (2.59). By contrast, friendship instability did not result in higher depression among youths with more years in the U.S. Indeed, their depressive symptoms improved after replacing the W1 friendship with an in-school, different-race friend (1.52), compared to maintaining the original friendship (2.86) or replacing it with an in-school, same-race friend (3.09; $p < .05$). For second-generation adolescents, replacing their friendship with an in-school, same-race friend also predicted lower levels of depressive symptoms (1.71) vis-à-vis the replacement with an out-of-school friend (2.62; $p < .05$). These results support H_3 by showing that the mental health implications of friendship instability depend on the racial characteristics of the replacement friendship.

[FIGURE 3.1 ABOUT HERE]

Model 2.5 investigates the interaction between friendship instability and English use in-home. Replacing the W1 best friend with a friend outside school predicted more depression for adolescents who did not speak English at home ($\beta = 1.667$; $p < .01$). The effect was fully attenuated,

however, for immigrant adolescents who spoke English with their family members (β = -1.816; p < .01), supporting H_2.

Figure 3.2 presents predicted values of depressive symptoms by the interactions between friendship instability and English use in-home. Immigrant adolescents who spoke another language at home reported significantly higher levels of depressive symptoms when replacing their W1 friend with a friend outside of school (4.07), as compared to maintaining the W1 tie (2.40). For those who spoke English at home, however, the same pattern was not observed. Instead, having a new in-school, different-race friend improved depressive symptoms (1.88), compared to forming a new same-race tie (2.60; p < .05). This pattern also supports H_3.

[FIGURE 3.2 ABOUT HERE]

In supplemental analyses, we employed alternative coding strategies of friendship instability and investigated their role in immigrant adolescents' depressive symptoms. First, friends' immigrant generation may have a strong association with immigrant adolescents' mental health (McMillan 2019). The alternative friendship instability measure thus captured the immigration generation status of respondent's in-school best friend at W2 (i.e., whether the friendship at W1 was replaced by a different-generation or a same-generation friend). As shown in Supplemental Table 3.4S, replacing the W1 friend with either a different-generation or a same-generation friend did not predict any significant differences in depressive symptoms.

Second, it is possible that the race of adolescents' original best friends also factored into the mental health consequences of friendship instability. We coded friendship instability to account for the racial background of respondent's W1 best friend. The variable consists of four categories: 1) respondent reported a same-race best friend in W1 and maintained the tie through W2; 2) respondents dissolved the tie with their W1 same-race best friend; 3) respondents

reported a different-race best friend in W1 and maintained the tie through W2; 4) respondents dissolved tie with their different-race best friend. Presented in Supplemental Table 3.5S, regression analyses using this variable did not yield significant results, suggesting that the mental health consequences of friendship instability depend more on the characteristics of new ties that replaced the old ties.

DISCUSSION

Drawing on the Add Health data, the present study analyzed the implications of friendship instability for depressive symptoms among immigrant adolescents. Our results suggest that friendship instability moderates the association between levels of acculturation and depressive symptoms. Specifically, adolescents who recently arrived in the U.S. (i.e., fewer than five years) reported more depressive symptoms when they replaced their best friendship in school with an out-of-school friend, or another in-school friend who was of a different racial/ethnic origin. Replacing an in-school best friendship with an out-of-school friend also predicted more depressive symptoms among immigrant youths who did not speak English at home. By contrast, friendship instability was not associated with depressive symptoms for more acculturated immigrant adolescents, as indicated by more time in the U.S. and English use at home.

These results imply that friendship instability may constitute a form of acculturative stress for immigrant adolescents with low levels of acculturation, especially when it results in a loss of in-school peer connections. Scholars have proposed that experiences of strained relationships constitute an important dimension of acculturative stress (Berry et al. 1987). Adopting a temporal perspective, this study suggests that instability in personal ties may also produce stress that uniquely affects immigrant adolescents in the early stages of acculturation. These adolescents have

yet to adjust to the host social environment and may have found the dramatic changes in their social lives – including new experiences in education and interactions – to be psychologically taxing (Cherng 2015). Friendship instability might also disrupt social support from peers, which is crucial for immigrant adolescents to buffer stress from their educational experiences (Berry et al. 1987; Morey et al. 2021).

Friendship instability might also contribute to the waning mental health advantage among immigrant adolescents over time. Previous research found that foreign-born adolescents tend to report better mental health than their native-born peers, but this advantage deteriorates as they spend more years in the U.S. (Harker 2001). Indeed, our analyses found that recently arrived immigrant adolescents indeed reported lower depressive symptoms than their second-generation counterparts at the baseline, but they no longer saw a mental health advantage at the later timepoint. This pattern may arise in part from their higher vulnerability to the disruption of their best friendship ties. Whereas friendship instability could be common to adolescents (Flashman 2012), a lack of acculturation into the U.S. secondary schools might lead immigrant youths to perceive them in a negative light and, thus, see a higher risk of psychological distress.

Yet it should be noted that not all forms of friendship instability led to more psychological distress for immigrant adolescents. We find that switching to an out-of-school best friend was especially harmful to these adolescents' well-being, potentially reflecting marginalization from in-school peer networks. By contrast, the replacement of the original best friendship with another in-school, same-race friend did not predict more depressive symptoms, even for lowly acculturated immigrant adolescents. This pattern indicates that friendship instability translates into immigrant adolescents' psychological distress primarily through compounding their social disintegration from the school environment.

Indeed, individuals' loss of social connections over time is found as an important mechanism that underlies the harmful psychological consequences of personal network instability (Chan and Poulin 2009). Our findings contribute to this discussion by highlighting that context-specific social (dis)integration – in this case, the school context – may be crucial for understanding the mental health implication of friendship instability among immigrant adolescents. As secondary educational institutions constitute a crucial source of their socialization experiences in the host society (Kao 2004), experiences of friendship instability that gravitates immigrant youths out of the in-school peer network could be especially detrimental to their mental health. Social support provided by friends outside of school also could not replace those provided by in-school friends, in terms of their buffering effects of stress from the learning experience.

Conversely, more acculturated immigrant youths did not see worse mental health after experiencing friendship instability, potentially because they have adapted to the volatile friendship networks in U.S. secondary schools (Flashman 2012). Additionally, when their original friend was replaced with an in-school interracial friend, those youths reported fewer depressive symptoms. More acculturation enhances immigrant youths' ability to socialize with peers of different racial/ethnic backgrounds (Rumbaut 2004). It avails immigrant adolescents of a wider range of friendship choices and, thus, better provision of social capital. These factors may promote the quality of their interracial friendships and facilitate integration into the school environment, thus contributing to lower risks of depression (Kao 2004).

The present study has several limitations. First, the first two waves of Add Health were conducted in the 1990s. The age of the data may therefore limit the generalizability of our findings to the experiences of immigrant adolescents today. With the expansion and increasing diversity of the immigrant population in the U.S., along with efforts to promote inclusion in

secondary educational institutions throughout the past two decades, we speculate that immigrant adolescents today – including those with a low level of acculturation – might experience lower risks of frequent friendship instability, and therefore experience fewer depressive symptoms as a result of this network phenomenon. To the best of our knowledge, however, Add Health remains the most recent dataset that includes longitudinal friendship network data from a nationally representative sample of immigrant adolescents in the United States.

Second, due to data collection errors in Add Health (Rude and Herda 2010), we are not able to investigate instability in respondents' entire friendship networks. It should be noted, nonetheless, that adolescents' best friendship instability constitutes more robust predictors of depressive symptoms than dynamics in secondary friends, according to prior research (Chan and Poulin 2009). Third, reverse causality could be an issue in our analyses. Previous research suggests that depression *per se* may lead to personal network loss (Perry and Pescosolido 2012). Our analysis investigates the association between friendship instability between W1 and W2 and depression at W2, *controlling for depressive symptoms at W1.* Even so, it is possible that friendship instability resulted from respondents' depressive symptoms at the baseline. Future studies could advance this line of research by using data collected at more than two timepoints. Finally, our study examines friendship instability and depressive symptoms using two waves of data, which limits our analysis to investigate only between-individual variations. Examining the dynamics of adolescents' friendships over a longer period and over multiple time points will allow researchers to capture within-individual differences in friendship networks, which may have important mental health implications.

Overall, our study suggests that friendship instability may constitute a distinct form of acculturative stress, whose association with depressive symptoms is independent of other

friendship network characteristics. Specifically, it captures social relation stress through a longitudinal lens, thereby speaking to the temporal dynamics of immigrants' lived experiences in the host society. Through interrogating the roles of persistence, dissolution, and replacement of personal network ties, we provide unique insights into how social relationships shape immigrants' mental health *over time* as they are at different stages of the acculturation process.

We recommend that future research on immigrant health further examine the consequences of personal network instability. Longitudinal surveys on immigrants could benefit from collecting personal network data. Cross-sectional surveys could also develop items on respondents' self-reported instability in their personal ties. For example, survey items could ask respondents whether they "lost friends due to language barrier or cultural differences," or "found it hard to maintain relationships due to their immigrant background." These items may shed important light on the patterning of mental health among the immigrant population.

NOTES

[1] Though sociocentric network data at W2 was available in the 16 "saturated schools" in the Add Health sample, only a small proportion of respondents in these schools identified as immigrant adolescents. To obtain a sufficient sample of immigrant adolescents, we included respondents from non-saturated schools. Our analyses of friendship instability and depressive symptoms are thus egocentric in nature.

[2] Though third-generation adolescents could constitute a meaningful reference group, we found that a dummy variable indicating third-generation status was nearly perfectly collinear with English use at home -- around 99% of third-generation adolescents spoke English at home.

Considering the importance of the analytic results regarding English use at home, we limited our sample to first- and second-generation adolescents, for whom acculturative stress is relevant.

[3] The large amount of missingness of respondents' GPA and delinquency likely resulted from missing-not-at-random (MNAR) patterns, i.e., adolescents with lower GPA and higher delinquency scores had lower likelihoods of answering corresponding survey questions. The MNAR violates the core assumptions in existing multiple imputation techniques (i.e., missing at random), and as a result, multiple imputations would likely yield biased estimates (Allison 2001). By contrast, scholars found that listwise deletion may be a more *unbiased* technique for handling missing data when data are missing on predictor variables, under two conditions: the probabilities of missing predictors do not depend on the dependent variable, and the regression model is correctly specified (Allison 2001; 2014). In Supplemental Table 3.2S, we show that the dependent variable (depression at W2) does not significantly predict missingness on any predictors. For these reasons, we decided to present regression results using listwise deletion.

[4] In additional analyses (available upon request), we found that models including these two measures separately yield substantively similar results, in terms of their interactions with friendship instability.

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TABLES AND FIGURES

Table 3.1 Descriptive Statistics (n = 952)

	Mean (SD) / Percentage
Depression at Wave II	2.48 (.15)
Friendship Instability	
Maintained	49.2
Dissolved, Replaced by an out-of-School Friend	14.1
Dissolved, Replaced by an in-School, Different-Race Friend	13.6
Dissolved, Replaced by an in-School, Same-Race Friend	23.1
Time in the U.S.	
First Generation, Fewer than Five Years in the U.S.	6.9
First Generation, at Least Five Years in the U.S.	24.5
Second Generation	68.6
English Use In-Home	69.0
Age	14.91 (.18)
Female	.54 (.03)
Race	
White	35.5
Black	3.0
Latino	33.6
Asian	19.7
Other	8.3
Parent's Education	
Less than HS	15.6
HS Graduate	22.7
Some College	18.5
College Graduate	43.2
Two-Parent House	.87 (.02)
GPA	3.00 (.06)
Delinquency	1.41 (.05)
Depression at Wave I	1.16 (.08)
Interactions with Same-Sex Best Friend at Wave I	3.03 (.08)
No. of Friends at Wave I	6.70 (.18)
Network Average Depression at Wave I	1.21 (.05)
Urban School	.33 (.07)
Public School	.88 (.05)
Logged Number of Students in School	6.70 (.14)
% Same-Immigrant Generation Students in School	.16 (.02)
% Same-Race Students in School	.47 (.04)
Time Difference between Wave I and Wave II (in months)	7.53 (.16)

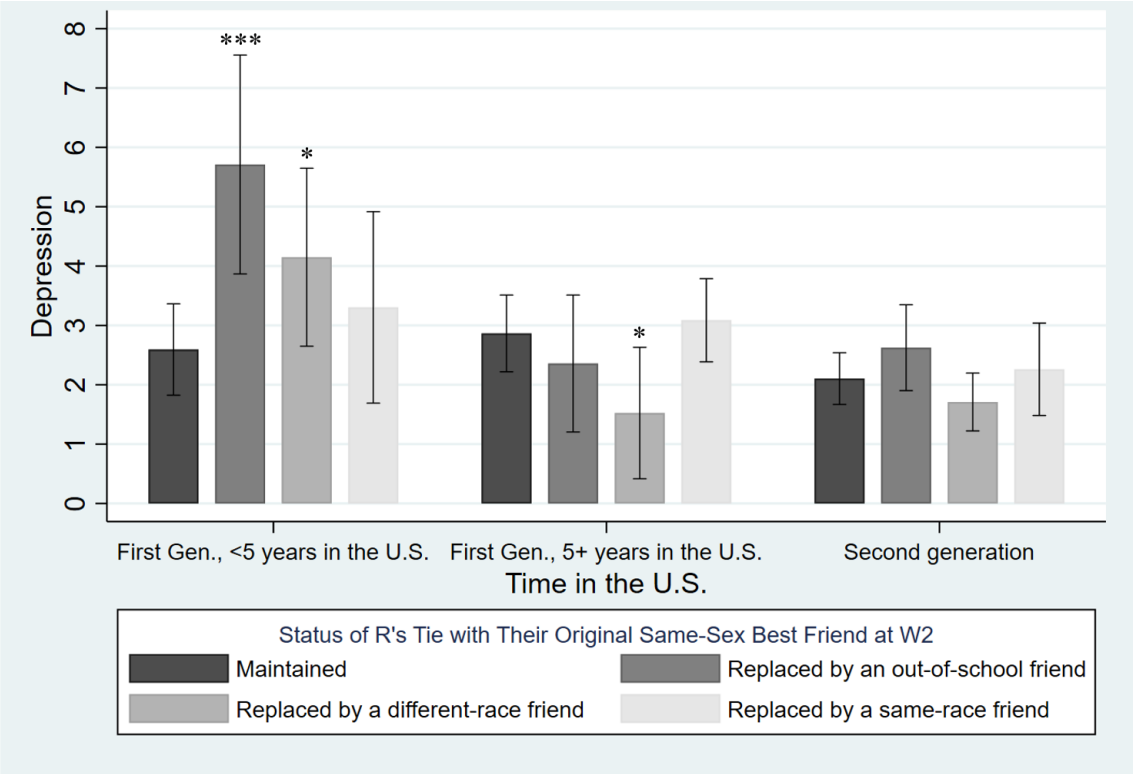
All means and percentages are adjusted for sample design effects (weights, cluster, and strata).

Table 3.2 Mixed-Effects OLS Regressions Predicting Depressive Symptoms at W2 (n = 952)

	Depression at W1	**Depression at W2**			
	2.1	**2.2**	**2.3**	**2.4**	**2.5**
Time in the U.S. (Ref. = First Generation, Fewer than Five Years in the U.S.)					
First Generation, at Least 5 Years in the U.S.	0.334	-0.798	-0.792	0.272	-0.668
	(0.19)	(0.58)	(0.57)	(0.35)	(0.51)
Second Generation	0.469*	-1.406*	-1.412*	-0.490	-1.321*
	(0.19)	(0.61)	(0.60)	(0.44)	(0.54)
English Use at Home	0.187	-0.274	-0.295	-0.161	-0.111
	(0.17)	(0.36)	(0.37)	(0.37)	(0.35)
Best Friendship Instability (Ref. = Maintained)					
Replaced by an Out-of-School Friend			0.491	3.117***	1.667**
			(0.32)	(0.81)	(0.56)
Replaced by an In-School, Different-Race Friend			-0.410	1.555*	-0.410
			(0.28)	(0.75)	(0.51)
Replaced by an In-School, Same-Race Friend			0.190	0.709	-0.019
			(0.28)	(0.67)	(0.54)
Interactions with First Generation, at Least 5 Years in the U.S.					
Replaced by an Out-of-School Friend				-3.624**	
				(1.18)	
Replaced by an In-School, Different-Race Friend				-2.897**	
				(0.96)	
Replaced by an In-School, Same-Race Friend				-0.487	
				(0.76)	
Interactions with Second Generation					
Replaced by an Out-of-School Friend				-2.596**	
				(0.87)	
Replaced by an In-School, Different-Race Friend				-1.950*	
				(0.78)	
Replaced by an In-School, Same-Race Friend				-0.553	
				(0.66)	
Interactions with English Use at Home					
Replaced by an Out-of-School Friend					-1.816**
					(0.63)
Replaced by an In-School, Different-Race Friend					0.005
					(0.53)
Replaced by an In-School, Same-Race Friend					0.333
					(0.59)
Constant	-2.701**	3.934	4.349	2.780	4.010
	(0.86)	(2.65)	(2.58)	(2.32)	(2.46)
Adjusted R^2	**.454**	**.446**	**.453**	**.466**	**.466**

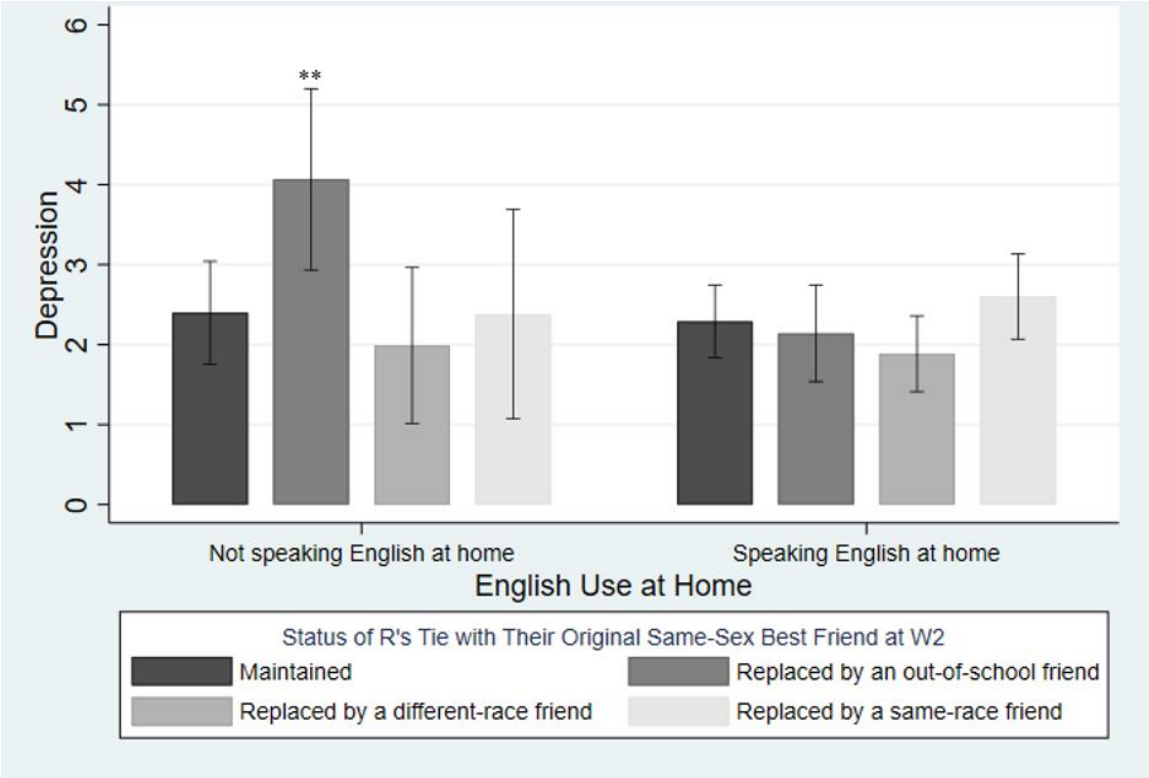
* p<0.05, ** p<0.01, *** p<0.001 (Two-Tailed Test)
All models controlled for the set of covariates specified in the Data and Methods section (Model 2.1 does not control for depression at W1, which is its dependent variable). Full regression results are reported in Supplemental Table S6. Standard errors are included in the parentheses for each estimate.

Figure 3.1 Predicted Values of Depressive Symptoms, by Friendship Instability and Time in the U.S.



* p <.05, ** p<.01, *** p<.001 (two-tailed test)
Reference group: friendship maintained, within each category of time in the U.S.

Figure 3.2 Predicted Values of Depressive Symptoms, by Friendship Instability and English Use In-Home



* p<.05, ** p<.01, *** p<.001 (two-tailed test)
Reference group: friendship maintained, within each category of English use at home

SUPPLEMENTAL TABLES

Table 3.1S Mixed-Effects OLS Regressions Predicting Depressive Symptoms at W2, Using Multiple Imputed Data (n = 1,249)

	S1.1	**S1.2**	**S1.3**	**S1.4**	**S1.5**
Time in the U.S. (Ref. = First Generation, Fewer than Five Years in the U.S.)					
First Generation, at Least 5 Years in the U.S.	0.279	-0.384	-0.358	0.197	-0.336
	(0.18)	(0.34)	(0.33)	(0.36)	(0.32)
Second Generation	0.378*	-1.104**	-1.082**	-0.798*	-1.040**
	(0.17)	(0.36)	(0.36)	(0.34)	(0.35)
English Use at Home	0.281*	-0.304	-0.332	-0.229	-0.038
	(0.13)	(0.34)	(0.34)	(0.34)	(0.31)
Friendship Instability (Ref. = Maintained)					
Dissolved, Replaced by an Out-of-School Friend			0.655*	1.781*	1.597**
			(0.33)	(0.75)	(0.53)
Dissolved, Replaced by a Different-Race Friend			-0.152	1.392*	-0.093
			(0.27)	(0.67)	(0.43)
Dissolved, Replaced by a Same-Race Friend			0.194	-0.013	0.120
			(0.25)	(0.40)	(0.46)
Interactions with First Generation, at Least 5 Years in the U.S.					
Dissolved, Replaced by an Out-of-School Friend				-2.044*	
				(1.02)	
Dissolved, Replaced by a Different-Race Friend				-1.857*	
				(0.74)	
Dissolved, Replaced by a Same-Race Friend				-0.177	
				(0.65)	
Interactions with Second Generation					
Dissolved, Replaced by an Out-of-School Friend				-1.004[a]	
				(0.87)	
Dissolved, Replaced by a Different-Race Friend				-1.649*	
				(0.68)	
Dissolved, Replaced by a Same-Race Friend				0.343	
				(0.47)	
Interactions with English Use at Home					
Dissolved, Replaced by an Out-of-School Friend					-1.628**
					(0.54)
Dissolved, Replaced by a Different-Race Friend					-0.161
					(0.47)
Dissolved, Replaced by a Same-Race Friend					0.115
					(0.53)
Age	0.134**	0.046	0.039	0.039	0.037
	(0.05)	(0.07)	(0.07)	(0.07)	(0.06)
Female	0.450***	0.336	0.366	0.391	0.337
	(0.12)	(0.22)	(0.22)	(0.22)	(0.21)
Race (Ref. = White)					
Black	-0.261	0.167	0.127	0.205	0.179

	(0.21)	(0.49)	(0.54)	(0.53)	(0.52)
Latino	-0.035	0.337	0.363	0.441	0.339
	(0.19)	(0.53)	(0.53)	(0.53)	(0.53)
Asian	0.099	0.087	0.104	0.078	0.100
	(0.23)	(0.55)	(0.57)	(0.56)	(0.56)
Other	0.044	-0.083	-0.163	-0.151	-0.098
	(0.25)	(0.65)	(0.67)	(0.66)	(0.66)
Parental Education (Ref. = Less Than High School)					
HS Graduate	0.184	0.013	0.038	0.015	0.164
	(0.16)	(0.47)	(0.48)	(0.47)	(0.48)
Some College	-0.083	-0.674	-0.641	-0.710	-0.612
	(0.16)	(0.44)	(0.43)	(0.45)	(0.44)
BA Degree	0.049	-0.323	-0.277	-0.361	-0.307
	(0.15)	(0.41)	(0.42)	(0.43)	(0.41)
Two-Parent House	-0.422**	0.071	0.082	0.082	0.154
	(0.15)	(0.35)	(0.34)	(0.34)	(0.32)
GPA	-0.038	-0.010	-0.013	0.003	-0.004
	(0.08)	(0.13)	(0.13)	(0.14)	(0.13)
Delinquency	0.223***	0.479***	0.452**	0.480***	0.441**
	(0.05)	(0.14)	(0.14)	(0.13)	(0.14)
Depression at Wave I	-	0.772***	0.765***	0.743***	0.768***
	-	(0.08)	(0.08)	(0.08)	(0.08)
Interactions with Same-Sex Best Friend at Wave I	0.074*	-0.037	-0.028	-0.009	-0.016
	(0.03)	(0.05)	(0.06)	(0.07)	(0.06)
No. of Friends at Wave I	-0.049*	0.036	0.040	0.037	0.043
	(0.02)	(0.04)	(0.04)	(0.04)	(0.04)
Network Average Depression at Wave I	0.296**	0.207	0.220	0.202	0.222
	(0.11)	(0.16)	(0.15)	(0.16)	(0.15)
Urban School	0.563**	0.028	-0.046	-0.111	0.013
	(0.21)	(0.26)	(0.26)	(0.25)	(0.27)
Public School	-0.058	-0.017	-0.081	-0.070	-0.095
	(0.23)	(0.40)	(0.37)	(0.33)	(0.37)
Logged Number of Students in School	0.092	-0.282	-0.272	-0.251	-0.259
	(0.07)	(0.16)	(0.14)	(0.13)	(0.14)
% Same Immigrant Generation Students in School	-0.337	-0.299	-0.416	0.047	-0.029
	(0.72)	(1.39)	(1.39)	(1.35)	(1.40)
% Same-Race Students in School	-0.259	-0.116	-0.178	-0.141	-0.328
	(0.32)	(0.62)	(0.66)	(0.68)	(0.64)
Time Difference Between Wave I and Wave II	-	-0.044	-0.065	-0.073	-0.066
	-	(0.07)	(0.07)	(0.07)	(0.07)
GPA Missing	-0.061	-0.176	-0.208	-0.143	-0.177
	(0.15)	(0.33)	(0.32)	(0.30)	(0.32)
Delinquency Missing	-0.182	-0.224	-0.213	-0.102	-0.232
	(0.18)	(0.36)	(0.36)	(0.37)	(0.36)
Constant	-2.352**	2.991	3.160	2.547	2.769
	(0.84)	(2.20)	(2.11)	(1.87)	(2.07)

* p<0.05, ** p<0.01, *** p<0.001 (Two-Tailed Test)

[a] Though the interaction effect is not significant at .05 level, the total effect of replacement with an out-of-school friend on depression is not significant for second-generation adolescents ($\beta = 0.777$; $p > .05$).

Table 3.2S Logistic Regressions Predicting Item Missingness on Depression at W2 (n = 1249)

Missing Item	Odds Ratio of Depression at W2	p-value
GPA	1.005	0.932
	(0.06)	
Delinquency	1.048	0.537
	(0.08)	
Parental Education	1.005	0.945
	(0.08)	
Two-Parent House	0.999	0.994
	(0.11)	
Depression at W1	1.082	0.465
	(0.12)	
Network Average Depression at W1	1.012	0.925
	(0.12)	

Standard errors in parentheses. All estimates account for survey design factors (weight, cluster, strata).

Table 3.3S Structural Equation Models Predicting Indirect Effects of Friendship Instability on the Associations between Acculturation Measures and Depressive Symptoms

Acculturation Measure	Indirect Effect of Friendship Instability	p-value
Time in the U.S. (Ref. = First Generation, Fewer than Five Years in the U.S.)		
First Generation, at Least 5 Years in the U.S.	-.006	0.919
	(0.06)	
Second Generation	.006	0.940
	(0.08)	
English Use at Home	.021	0.666
	(0.05)	

Standard errors in parentheses. All estimates account for survey design factors (weight, cluster, strata).

Table 3.4S Mixed-Effects OLS Regressions Predicting Depressive Symptoms at W2, Using Alternative Measure of Friendship Instability

	S4.1	S4.2	S4.3
Time in the U.S. (Ref. = First Generation, Fewer than Five Years in the U.S.)			
First Generation, at Least 5 Years in the U.S.	-0.831	0.209	-0.687
	(0.57)	(0.37)	(0.51)
Second Generation	-1.464*	-0.556	-1.360*
	(0.60)	(0.44)	(0.54)
English Use at Home	-0.290	-0.222	-0.017
	(0.36)	(0.38)	(0.33)
Friendship Instability (Ref. = Maintained)			
Dissolved, Replaced by an Out-of-School Friend	0.491	2.830**	1.635**
	(0.32)	(0.83)	(0.56)
Dissolved, Replaced by a Different-Generation Friend	0.153	1.300	0.377
	(0.24)	(0.78)	(0.50)
Dissolved, Replaced by a Same-Generation Friend	-0.437	0.781	-0.550
	(0.29)	(0.92)	(0.41)
Interactions with First Generation, at Least 5 Years in the U.S.			
Dissolved, Replaced by an Out-of-School Friend		-3.288**	
		(1.20)	
Dissolved, Replaced by a Different-Generation Friend		-1.507	
		(0.78)	
Dissolved, Replaced by a Same-Generation Friend		-1.250	
		(1.04)	
Interactions with Second Generation			
Dissolved, Replaced by an Out-of-School Friend		-2.328*	
		(0.91)	
Dissolved, Replaced by a Different-Generation Friend		-1.157	
		(0.76)	
Dissolved, Replaced by a Same-Generation Friend		-1.359	
		(1.01)	
Interactions with English Use at Home			
Dissolved, Replaced by an Out-of-School Friend			-1.741**
			(0.62)
Dissolved, Replaced by a Different-Generation Friend			-0.328
			(0.59)
Dissolved, Replaced by a Same-Generation Friend			0.260
			(0.54)
Age	0.033	0.041	0.015
	(0.06)	(0.06)	(0.06)
Female	0.678**	0.693**	0.657**
	(0.25)	(0.25)	(0.23)
Race (Ref. = White)			

Black	0.096	0.146	0.197
	(0.58)	(0.56)	(0.53)
Latino	0.521	0.526	0.506
	(0.57)	(0.58)	(0.57)
Asian	0.310	0.282	0.280
	(0.64)	(0.65)	(0.63)
Other	0.210	0.266	0.250
	(0.75)	(0.73)	(0.74)
Parental Education (Ref. = Less Than High School)			
HS Graduate	-0.292	-0.306	-0.237
	(0.47)	(0.48)	(0.45)
Some College	-0.763	-0.806	-0.748
	(0.43)	(0.44)	(0.41)
BA Degree	-0.578	-0.617	-0.604
	(0.43)	(0.44)	(0.40)
Two-Parent House	-0.028	-0.035	0.029
	(0.44)	(0.42)	(0.41)
GPA	0.007	-0.003	-0.019
	(0.12)	(0.12)	(0.12)
Delinquency	0.513**	0.472**	0.464**
	(0.14)	(0.14)	(0.13)
Depression at Wave I	0.770***	0.772***	0.777***
	(0.10)	(0.09)	(0.09)
Interactions with Same-Sex Best Friend at Wave I	-0.043	-0.024	-0.043
	(0.09)	(0.08)	(0.08)
No. of Friends at Wave I	0.054	0.054	0.063
	(0.05)	(0.05)	(0.05)
Network Average Depression at Wave I	0.274	0.244	0.256
	(0.19)	(0.20)	(0.18)
Urban School	-0.117	-0.104	-0.106
	(0.34)	(0.32)	(0.34)
Public School	-0.201	-0.138	-0.168
	(0.55)	(0.52)	(0.53)
Logged Number of Students in School	-0.335	-0.325	-0.314
	(0.16)	(0.16)	(0.16)
% Same Immigrant Generation Students in School	0.948	1.152	1.276
	(1.64)	(1.56)	(1.72)
% Same-Race Students in School	0.110	0.126	0.098
	(0.77)	(0.80)	(0.77)
Time Difference Between Wave I and Wave II	-0.120	-0.109	-0.110
	(0.09)	(0.09)	(0.09)
Constant	4.037	2.843	3.809
	(2.51)	(2.34)	(2.38)

* p<0.05, ** p<0.01, *** p<0.001 (Two-Tailed Test)

Table 3.5S OLS Regressions Predicting Depressive Symptoms at W2, Using Alternative Measure of Friendship Instability that Accounts for Racial Background of W1 Friend

	S5.1	**S5.2**	**S5.3**
Time in the U.S. (Ref. = First Generation, Fewer than Five Years in the U.S.)			
First Generation, at Least 5 Years in the U.S.	-0.821	-1.013	-0.734
	(0.58)	(0.73)	(0.56)
Second Generation	-1.422*	-1.108	-1.331*
	(0.61)	(0.67)	(0.6)
English Use at Home	-0.304	-0.294	-0.367
	(0.38)	(0.39)	(0.73)
Friendship Instability (Ref. = Dissolved Tie with a Different-Race Friend)			
Dissolved Tie with a Same-Race Friend	-0.605	0.492	-0.376
	(0.42)	(0.91)	(0.71)
Maintained Tie with a Different-Race Friend	-0.376	-0.874	-1.164
	(0.43)	(0.51)	(0.77)
Maintained Tie with a Same-Race Friend	-0.515	-1.098	-0.446
	(0.35)	(0.57)	(0.58)
Interactions with at Least 5 Years in the U.S.			
Dissolved Tie with a Same-Race Friend		-0.743	
		(0.89)	
Maintained Tie with a Different-Race Friend		0.661	
		(0.78)	
Maintained Tie with a Same-Race Friend		1.438	
		(0.79)	
Interactions with Second Generation			
Dissolved Tie with a Same-Race Friend		-1.289	
		(0.78)	
Maintained Tie with a Different-Race Friend		0.565	
		(0.68)	
Maintained Tie with a Same-Race Friend		0.424	
		(0.54)	
Interactions with English Use at Home			
Dissolved Tie with a Same-Race Friend			-0.339
			(0.67)
Maintained Tie with a Different-Race Friend			0.992
			(0.82)
Maintained Tie with a Same-Race Friend			-0.115
			(0.58)
Age	0.039	0.041	0.034
	(0.07)	(0.07)	(0.07)
Female	0.674**	0.668**	0.641**
	(0.24)	(0.23)	(0.24)
Race (Ref. = White)			

Black	0.176	0.109	0.183
	(0.57)	(0.53)	(0.57)
Latino	0.491	0.551	0.384
	(0.63)	(0.62)	(0.64)
Asian	0.301	0.335	0.277
	(0.68)	(0.68)	(0.66)
Other	0.166	0.255	0.093
	(0.76)	(0.73)	(0.74)
Parental Education (Ref. = Less Than High School)			
HS Graduate	-0.319	-0.328	-0.359
	(0.47)	(0.47)	(0.46)
Some College	-0.799	-0.770	-0.836
	(0.44)	(0.45)	(0.44)
BA Degree	-0.582	-0.573	-0.611
	(0.44)	(0.44)	(0.42)
Two-Parent House	-0.040	-0.035	-0.069
	(0.46)	(0.43)	(0.44)
GPA	0.042	0.021	0.055
	(0.12)	(0.12)	(0.13)
Delinquency	0.550**	0.525**	0.543***
	(0.15)	(0.15)	(0.15)
Depression at Wave I	0.76***	0.769***	0.778***
	(0.09)	(0.09)	(0.10)
Interactions with Same-Sex Best Friend at Wave I	-0.054	-0.046	-0.058
	(0.08)	(0.08)	(0.08)
No. of Friends at Wave I	0.052	0.047	0.057
	(0.05)	(0.05)	(0.05)
Network Average Depression at Wave I	0.280	0.262	0.260
	(0.20)	(0.20)	(0.20)
Urban School	-0.033	-0.031	-0.029
	(0.35)	(0.36)	(0.36)
Public School	-0.148	-0.119	-0.175
	(0.57)	(0.60)	(0.57)
Logged Number of Students in School	-0.357	-0.365	-0.359
	(0.18)	(0.19)	(0.18)
% Same Immigrant Generation Students in School	0.984	0.537	1.202
	(1.71)	(1.63)	(1.76)
% Same-Race Students in School	0.308	0.365	0.398
	(0.79)	(0.80)	(0.77)
Time Difference Between Wave I and Wave II	-0.092	-0.083	-0.095
	(0.09)	(0.09)	(0.09)
Constant	4.080	3.901	4.180
	(2.54)	(2.57)	(2.51)

* p<0.05, ** p<0.01, *** p<0.001 (Two-Tailed Test)

Table 3.6S Complete Results from Mixed-Effects OLS Regressions Predicting Depressive Symptoms at W2 (n = 952)

	Depression at W1	**Depression at W2**			
	2.1	**2.2**	**2.3**	**2.4**	**2.5**
Time in the U.S. (Ref. = First Generation, Fewer than Five Years in the U.S.)					
First Generation, at Least 5 Years in the U.S.	0.334	-0.798	-0.792	0.272	-0.668
	(0.19)	(0.58)	(0.57)	(0.35)	(0.51)
Second Generation	0.469*	-1.406*	-1.412*	-0.490	-1.321*
	(0.19)	(0.61)	(0.60)	(0.44)	(0.54)
English Use at Home	0.187	-0.274	-0.295	-0.161	-0.111
	(0.17)	(0.36)	(0.37)	(0.37)	(0.35)
Friendship Instability (Ref. = Maintained)					
Replaced by an Out-of-School Friend			0.491	3.117***	1.667**
			(0.32)	(0.81)	(0.56)
Replaced by an In-School, Different-Race Friend			-0.410	1.555*	-0.410
			(0.28)	(0.75)	(0.51)
Replaced by an In-School, Same-Race Friend			0.190	0.709	-0.019
			(0.28)	(0.67)	(0.54)
Interactions with First Generation, at Least 5 Years in the U.S.					
Replaced by an Out-of-School Friend				-3.624**	
				(1.18)	
Replaced by an In-School, Different-Race Friend				-2.897**	
				(0.96)	
Replaced by an In-School, Same-Race Friend				-0.487	
				(0.76)	
Interactions with Second Generation					
Replaced by an Out-of-School Friend				-2.596**	
				(0.87)	
Replaced by an In-School, Different-Race Friend				-1.950*	
				(0.78)	
Replaced by an In-School, Same-Race Friend				-0.553	
				(0.66)	
Interactions with English Use at Home					
Replaced by an Out-of-School Friend					-1.816**
					(0.63)
Replaced by an In-School, Different-Race Friend					0.005
					(0.53)
Replaced by an In-School, Same-Race Friend					0.333
					(0.59)
Age	0.142*	0.033	0.023	0.035	0.011
	(0.05)	(0.07)	(0.06)	(0.06)	(0.06)
Female	0.343*	0.666**	0.687**	0.719**	0.647**
	(0.14)	(0.24)	(0.23)	(0.23)	(0.21)

Race (Ref. = White)					
Black	-0.266	0.158	0.031	0.115	0.127
	(0.30)	(0.56)	(0.61)	(0.58)	(0.58)
Latino	-0.053	0.466	0.447	0.536	0.444
	(0.21)	(0.61)	(0.61)	(0.61)	(0.60)
Asian	0.413	0.273	0.190	0.206	0.169
	(0.24)	(0.66)	(0.67)	(0.68)	(0.67)
Other	0.239	0.242	0.130	0.199	0.163
	(0.22)	(0.75)	(0.77)	(0.77)	(0.76)
Parental Education (Ref. = Less Than High School)					
HS Graduate	0.348	-0.290	-0.279	-0.264	-0.200
	(0.23)	(0.48)	(0.49)	(0.48)	(0.47)
Some College	-0.220	-0.756	-0.712	-0.764	-0.689
	(0.19)	(0.46)	(0.44)	(0.44)	(0.42)
BA Degree	0.065	-0.584	-0.530	-0.584	-0.541
	(0.18)	(0.44)	(0.43)	(0.42)	(0.41)
Two-Parent House	-0.394*	-0.048	-0.017	-0.046	0.053
	(0.17)	(0.45)	(0.43)	(0.41)	(0.40)
GPA	-0.079	0.039	0.023	0.037	-0.002
	(0.08)	(0.13)	(0.13)	(0.13)	(0.12)
Delinquency	0.231***	0.541***	0.499***	0.457**	0.445**
	(0.06)	(0.15)	(0.14)	(0.14)	(0.13)
Depression at Wave I	-	0.773***	0.770***	0.775***	0.787***
	-	(0.10)	(0.09)	(0.09)	(0.09)
Interactions with Same-Sex Best Friend at Wave I	0.107**	-0.047	-0.041	-0.024	-0.036
	(0.03)	(0.08)	(0.08)	(0.08)	(0.08)
No. of Friends at Wave I	-0.042	0.049	0.055	0.058	0.063
	(0.03)	(0.05)	(0.05)	(0.05)	(0.05)
Network Average Depression at Wave I	0.467***	0.260	0.275	0.217	0.257
	(0.11)	(0.20)	(0.19)	(0.20)	(0.18)
Urban School	0.347	-0.019	-0.114	-0.125	-0.075
	(0.20)	(0.35)	(0.35)	(0.32)	(0.36)
Public School	-0.134	-0.239	-0.331	-0.215	-0.317
	(0.22)	(0.60)	(0.54)	(0.49)	(0.53)
Logged Number of Students in School	0.077	-0.349*	-0.341*	-0.305	-0.304*
	(0.08)	(0.17)	(0.16)	(0.16)	(0.15)
% Same-Immigrant Generation Students in School	-0.199	0.780	0.629	1.033	0.913
	(0.79)	(1.66)	(1.58)	(1.62)	(1.55)
% Same-Race Students in School	0.024	0.076	-0.138	-0.051	-0.213
	(0.29)	(0.80)	(0.86)	(0.89)	(0.84)
Time Difference Between Wave I and Wave II	-	-0.093	-0.108	-0.112	-0.101
	-	(0.09)	(0.10)	(0.09)	(0.09)
Constant	-2.701**	3.934	4.349	2.780	4.010
	(0.86)	(2.65)	(2.58)	(2.32)	(2.46)
Adjusted R^2	**.454**	**.446**	**.453**	**.466**	**.466**

* p<0.05, ** p<0.01, *** p<0.001 (Two-Tailed Test). Standard errors are included in the parentheses for each estimate.

CHAPTER 4

A "Social Relationship Paradox"? Social Isolation, Receipt of Emotional Support, and Mental Health among Undocumented Mexican Immigrants

ABSTRACT

Recent scholarship has paid extensive attention to undocumented Mexican immigrants' mental health, as their legal status may subject them to a wide array of psychosocial stressors. However, few studies have examined the mental health implications of undocumented immigrants' social relationships. Leveraging data from the 2005-2008 National Health and Nutrition Examination Survey (n = 1,397), the present study examines the disparities in levels of depression between undocumented Mexican immigrants, on the one hand, and documented Mexican immigrants, native-born Mexican Americans, and native-born non-Hispanic Whites, on the other hand. It then investigates how two dimensions of social relationship characteristics – social isolation and inadequate emotional support – explain those mental health disparities. Results suggest that undocumented Mexican immigrants saw lower levels of depression than the other three groups. However, they reported both a lower risk of social isolation and a higher risk of inadequate emotional support than non-Hispanic Whites, which explained undocumented Mexican immigrants' mental health advantages in different directions. The study concludes by discussing how the structural challenges faced by undocumented immigrants may contribute to the apparent "social relationship paradox," and how an appreciation of the complexity of personal networks may advance the understanding of undocumented immigrants' psychological well-being.

INTRODUCTION

As of 2022, nearly 11 million immigrants resided in the United States without documentation – accounting for approximately 23.8% of the total immigrant population, with Mexican immigrants constituting the largest ethnic group at 4.81 million (Baker and Warren 2024). Recent scholarship has paid extensive attention to undocumented Mexican immigrants' mental well-being, as restrictive immigration policies, immigration border surveillance, and anti-immigrant sentiments may subject them to considerable psychosocial stressors (Gonzales 2016; Ornelas, Yamanis, and Ruiz 2020). However, scholars have yet to fully understand the role of social relationships in undocumented Mexican immigrants' mental health outcomes. This is in part due to data scarcity, especially as large-scale datasets rarely collect information on respondents' documentation status (Ornelas, Yamanis, and Ruiz 2020; Sullivan and Rehm 2005).

Decades of mental health studies have demonstrated the crucial roles of social relationships in shaping individuals' psychological well-being (Smith and Christakis 2008; Umberson, Crosnoe, and Reczek 2010). For immigrants, their personal network formation constitutes an important part of their experiences in the host society, having far-reaching consequences for status attainment and mental health (Gordon 1964; Hagan 1998; McMillan 2019). Meanwhile, undocumented immigrants may well encounter systematic challenges in forming supportive personal relationships. Their opportunities for expanding personal networks may be considerably constrained by the systems of legal and social exclusions, as well as discrimination from native-born communities, which may have profound mental health consequences (Gonzales 2011).

The present study aims to investigate undocumented Mexican immigrants' mental health and the roles of their social relationships, leveraging data from the 2005-2008 National Health

and Nutrition Examination Survey (NHANES). Adopting the methodological strategies developed in recent studies to impute legal status among Mexican immigrants (Weitzman, Behrman, and Ascherio 2023), I examined disparities in levels of depression between undocumented Mexican immigrants, on the one hand, and documented Mexican immigrants, native-born Mexican Americans, and native-born non-Hispanic Whites, on the other hand. I then focused on the mediation roles played by two dimensions of social relationship characteristics: social isolation, indicated by a lack of social connections, and inadequate emotional support, which is linked to the quality of personal relationships. Analyses found that while undocumented Mexican immigrants saw lower levels of depression than the other three groups, they reported both a lower risk of social isolation and a higher risk of inadequate emotional support. The paradoxical patterns regarding these two social relationship characteristics, in turn, have partially explained and suppressed their mental health advantage over non-Hispanic Whites.

LITERATURE REVIEW

Mental Health among Undocumented Mexican Immigrants

A recent study found that undocumented immigrants reported better physical health than native-born Whites, as indicated by their better self-rated health and fewer chronic conditions (Ruhnke et al. 2022). It remains curious, however, whether this "healthy immigrant paradox" extends to patterns of mental health, as the existing scholarship has documented a wide array of psychosocial stressors faced by undocumented Mexican immigrants.

For example, perceived discrimination constitutes a major mental health risk for undocumented Mexican immigrants, whose ethnic backgrounds and legal status may both be targeted against by members of the native-born community (Mora et al. 2014; Negi 2013;

Quesada et al. 2014; Rodriguez et al. 2023). Fears of detention and deportation are also theorized as important dimensions of stress (Arreola et al. 2022; Vega et al. 1998). The presence of broader surveillance in undocumented immigrants' daily lives may deter them from accessing medical facilities and public institutions, resulting in greater barriers to acquiring health and social benefits (Tuohy 2019). Additionally, undocumented immigrants are subject to substantial material hardship, in part due to their lower wages and fewer opportunities for upward mobility (Hall, Greenman, and Yi 2018; Ornelas, Yamanis, and Ruiz 2020; Segarra and Prasad 2024). The socioeconomic disadvantages may compound their financial stress and barriers to healthcare utilization.

Under the circumstances, scholars have highlighted the importance of social connections in undocumented Mexican immigrants' mental health (Mora et al. 2014; Negi et al. 2021; Ornelas, Yamanis, and Ruiz 2020). Structural conditions have a profound influence on individuals' social relationships, including both the size of personal networks and relationship quality (Feld 1981). Insofar as legal status subjects undocumented immigrants to systematic disadvantages, it may also preclude the formation of a well-functioning personal network in the host society. Undocumented immigrants also face high risks of family separation, a robust predictor of anxiety and depressive symptoms (Galvan et al. 2022; Negi et al. 2021). Numerous studies found that feelings of isolation and loneliness are prevalent among undocumented immigrants (Hurtado-de-Mendoza et al. 2014; Mora et al. 2014; Negi 2013; Negi et al. 2021). These negative emotions may translate into risks of negative health behaviors, such as alcohol use (Organista, Arreola, and Neilands 2016).

Despite these findings, scholars have yet to consider different dimensions of social relationship characteristics in analyzing undocumented Mexican immigrants' mental health. Prior

studies have often discussed social isolation and lack of social support in tandem. However, these factors indeed speak to different dimensions of personal networks and, thus, merit independent discussions. As illustrated in the next section, the existing bulk of literature has demonstrated that social relationships may influence mental health through multiple mechanisms. Unpacking the complex nature of personal relationships helps to advance the understanding of undocumented Mexican immigrants' mental health.

Social Relationships and Mental Health among Undocumented Mexican Immigrants

Decades of literature have demonstrated the crucial role of personal networks in individuals' mental health (Smith and Christakis 2008). Earlier studies have generally focused on the number of personal ties, as a lack of social connections leads to social isolation, which constitutes a strong predictor of poor mental health (Berkman and Syme 1979; Seeman 1996; Umberson, Lin, and Cha 2022). Later scholarship has illustrated the multifaceted mental health implications of personal networks, including social support, network density, social contagion, relationship stability, etc., which may influence mental health independent of social isolation (Eisenberg et al. 2013; Giordano and Lindstrom 2010; Lessard and Juvonen 2018; Walker 2015).

In this vein, much attention has been paid to individuals' receipt of emotional support. As an important indicator of personal network quality, support from network members robustly predicts better mental health, through buffering stressors and promoting feelings of social integration (House, Umberson, and Landis 1988). Social support can occur in various forms, including provisions of emotional support, advice, materials, information, etc. In comparing different types of support, a sizable number of studies have found that emotional support has the

strongest influence on psychological well-being (House, Umberson, and Landis 1988; Morelli et al. 2015; Thoits 2011).

In the present study, I juxtapose examinations of social isolation and receipt of emotional support in terms of their mental health consequences for undocumented Mexican immigrants. Recognizing these two factors as independent – though related – dimensions of social relationships is especially crucial for understanding the role of structural barriers surrounding legal status in the formation of social relationships in the host society.

Social isolation among undocumented Mexican immigrants

As implied in numerous prior studies, undocumented Mexican immigrants may face a particularly high risk of experiencing social isolation. Policies that exclude undocumented immigrants from obtaining social benefits (e.g., a Social Security number) may disrupt individuals' daily lives and socialization patterns, thereby contributing to curtailing social ties with members of the host community (Gonzales 2016). Those policies that preclude undocumented immigrants from obtaining a driver's license may restrain individuals' mobility across neighborhoods and, as a result, limit opportunities for developing personal ties (Moinester and Stanhope 2024). Additionally, perceived discrimination and stigmatized identity of being an undocumented immigrant may also lead individuals to withdraw from native-born social networks (Gonzales 2011; Negi et al. 2021; Vega et al. 1998). The factors contribute to a hostile context of reception that precludes undocumented immigrants' participation in specific foci, especially those where native-born people constitute the majority, in ways that are particularly detrimental to the formation of weak ties, such as friendships (Feld 1981).

Family separation is also a particularly pronounced issue in undocumented immigrant communities. Studies of Mexican day laborers in the United States found that many left their home communities without the company of their spouses (Negi 2013; Organista, Arreola, and Neilands 2016). The immigrant deportation system may also force undocumented immigrants to sever ties with their close relatives (Galvan et al. 2022; Gulbas et al. 2016). These factors jointly create systematic challenges against both the development of new relationships and the stability of existing relationships, in ways that heighten social isolation of undocumented immigrants.

On the other hand, there are reasons to expect that undocumented immigrants may experience a lower level of social isolation, compared to the native-born population. Scholars have long found that migrant networks play a central role in facilitating both migration and post-migration experiences for undocumented immigrants (Massey 1990; Massey and Espinosa 1997; Wassink and Massey 2022). The migration process may be conducive to social capital acquisition after their resettlements in the host country. Indeed, familism and co-ethnic solidarity have been long argued as traits of migrant communities (Marsiglia, Parsai, and Kulis 2009; Portes and Zhou 1993). The compounded material hardship faced by undocumented immigrants may reinforce their reliance on immigrant networks, in ways that promote the formation and stability of co-ethnic ties (Segarra and Prasad 2024). Religious attendance could be another occasion where undocumented immigrants develop their social relationships. One study leveraged data from the National Latino and Asian American Study and found that foreign-born Mexican immigrants reported higher frequencies of religious attendance than their native-born counterparts, which in part explained their lower rates of substance use disorder (Moreno and Cardemil 2018).

Additionally, insofar as restrictive immigration laws and anti-immigrant sentiments deter undocumented immigrants from socializing with the native-born population, they might compress social interactions within migrant communities. Scholars have argued that social relationships are more likely to occur when individuals' interactions are constrained within a social context (i.e., foci; Feld 1981). The high structural pressure from the host community, while limiting the daily interactions of undocumented Mexican immigrants within their neighborhoods, may facilitate bonding among community and family members to reduce the risks of social isolation.

Receipt of emotional support among undocumented Mexican immigrants

Receipt of emotional support may also be patterned by the structural conditions stratified by legal status. It should be noted that the amount of emotional support an individual receives may depend on their personal network size (House, Umberson, and Landis 1988). To the extent that undocumented Mexican immigrants have more social connections, they might also receive a higher level of emotional support from their network members. Furthermore, their co-ethnic ties may be characterized by a high level of closeness, which is conducive to mutual provision of emotional support. Prior studies have demonstrated that the strength of racially homophilous ties is generally higher than heterophilous relationships (McDonald et al. 2013; McPherson, Smith-Lovin, and Cook 2001). Co-ethnic community solidarity and familism may further encourage mutual support provision among undocumented immigrants, in ways that promote their mental health (Diaz and Niño 2019; Kimbro, Gorman, and Schachter 2014).

Conversely, undocumented Mexican immigrants may be less likely to receive adequate emotional support. Studies have found that undocumented immigrants' family members may

collectively face deportation fears and the stress from discrimination (Gulbas et al. 2016; Rodriguez et al. 2023). The contagion of negative emotions may compromise family members' abilities to provide emotional support, especially when they lack the necessary means to cope with these systematic challenges. For undocumented Mexican immigrants who experienced family separation, co-ethnic relationships may not replace their family ties in terms of support provision. Negi and associates (2021) found that undocumented Latino day laborers often drew on community members as the primary source of social connections, but those ties were not characterized by the same level of emotional closeness as their family ties. Resultantly, they experienced more feelings of desperation and loneliness, which translated into worse mental health (Negi et al. 2021; Organista, Arreola, and Neilands 2016).

In addition, support provided by network members outside of immigrant communities may be also limited, due to their unfamiliarity with the unique challenges faced by undocumented immigrants (Gonzales 2016). Differences in social backgrounds may weaken undocumented immigrants' relationships with their native-born network members, in ways that hamper emotional support receipt.

Summary of Research Questions

The present study aims to investigate how two dimensions of individuals' social relationships, i.e., experiences of social isolation and receipt of social support, factor into the mental health of undocumented immigrants. Specifically, it asks:

1) Is there a difference in mental health between undocumented Mexican immigrants and other race-nativity groups (i.e., documented Mexican immigrants, native-born Mexican Americans, and native-born non-Hispanic Whites)?

2) Does social isolation explain mental health differences between undocumented Mexican immigrants and other race-nativity groups?
3) Does inadequate emotional support explain mental health differences between undocumented Mexican immigrants and other race-nativity groups?

DATA AND METHODS

Data

The present study draws on data from the 2005-2008 National Health and Nutrition Examination Survey (NHANES). NHANES is a nationally representative study conducted by the National Center for Health Statistics (NCHS) to examine the nutritional status and health outcomes among the children and adult population in the United States. Since 1999, NHANES has launched repeated cross-sectional studies on a biannual basis, with about 5,000 respondents participating in each wave. It collects data on respondents' demographic, socioeconomic, dietary, and health information. The 2005-2008 NHANES consists of two waves: 2005-06, and 2007-08, which were the last waves in which the survey collected information on respondents' personal relationships.

The analytic sample consists of respondents who self-identified as either of Mexican origin (foreign-born and U.S.-born), or a non-Hispanic White born in the United States. The age range of the sampled respondents is restricted to 40-65 (i.e., middle adulthood), because these respondents received the majority of survey questions on personal relationships in the NHANES' Social Support module. Though this restriction is due to limitations in the survey administration,

it may result in a substantial loss of undocumented immigrants in the sample, as most Mexican immigrants tend to cross the national border during young adulthood (Borjas 2017). Nonetheless, social relationships have important implications for middle-aged adults' mental health and mortality (Umberson, Lin, and Cha 2022). Due to the strategies for identifying Mexican respondents' legal status described below, the sample is further restricted to respondents who completed a high school degree or less. The final sample consists of n = 1,397 respondents.

Measures

Dependent variable

The dependent variable is a measure of depression, adopted from the Patient Health Questionnaire (PHQ-9) scale. The scale consists of 9 items, asking respondents how often they had been bothered by different mental health issues, e.g., little interest or pleasure in doing things, feeling tired or having little energy, etc., over the last 2 weeks. Each item employed a four-point scale, ranging from 0 (not at all) to 3 (nearly every day).

The sum of these nine items had a value range between 0-27 (Cronbach's alpha = .86). To account for positive skewness, I added 1 to the sum and then took its natural logarithm.

Independent variable

The independent variable is a measure of individuals' *race-nativity*, comprising four categories: 1) undocumented Mexican immigrants; 2) documented Mexican immigrants; 3) native-born Mexicans; and 4) native-born non-Hispanic Whites.

As NHANES did not provide measures of individuals' documentation status, this study combines strategies of imputing legal status among foreign-born Mexicans, developed by

multiple prior studies. First, among the foreign-born Mexicans, a respondent was identified as a likely undocumented immigrant if they were not a citizen, obtained a high school degree or less, and had been in the United States for at least five years (Amuedo-Dorantes and Arenas-Arroyo 2021). Empirical data suggests that undocumented immigrants are disproportionately less educated, and that long-term immigrants who were not naturalized are likely to reside in the U.S. without documentation (Amuedo-Dorantes and Arenas-Arroyo 2021). Second, I employed the residual strategy adopted by Borjas (2017) to reduce the false positive rate, by classifying respondents who received public benefits (e.g., Medicaid, food stamps, Supplemental Security Income) as likely documented immigrants. Due to the imputation strategy, all Mexican immigrants who received education beyond a high school degree would be classified as documented immigrants, making levels of education colinear with documentation status. Thus, the analyses focus only on respondents with a high school degree or less.

Both studies have shown that the estimated proportion of likely undocumented immigrants in their samples approximated those in official statistics (Amuedo-Dorantes and Arenas-Arroyo 2021; Borjas 2017). In the present study, 183 out of 379 foreign-born Mexican respondents (48.3%) were categorized as undocumented immigrants. This is smaller than the estimated average proportion of undocumented immigrants among the foreign-born Mexican population in the U.S. between 2005-2008, around 57.1% (see Supplemental Table 4.1S for calculations). Several factors may contribute to this difference. The analytical focus on less educated individuals may drive up the proportion of undocumented immigrants; by contrast, the sample restriction to middle-aged respondents, as well as the likely lower response rates of undocumented immigrants due to their stigmatized identities, may lower the representation of

undocumented immigrant respondents in the sample (Amuedo-Dorantes and Arenas-Arroyo 2021; Ruhnke et al. 2022).

Social relationship measures

The study employs two measures to capture different facets of individuals' social relationships. First, *social isolation* is measured using Berkman and Syme's (1979) social network index, a widely used measure of individual experiences of isolation. Following the recent practice of Umberson and colleagues (2022), I coded the index as a sum of four binary items: whether the respondent was single, lived alone, a friendship isolate (number of friends ≤ 1, representing the bottom quartile of friendship network size), or not a frequent church attendee (less than once per month in the past year). Specifically, respondents' marital status and living arrangements were accounted for as separate dimensions of social isolation, as undocumented immigrants are at high risk of separation from their spouses (Negi et al. 2021). The two items only have a moderate correlation with each other ($r = .51$; $p < .05$). The index of social isolation ranges from 0 to 4, with higher values indicating more isolation.

Second, *inadequate emotional support* was measured using a binary item indicating whether the respondent reported the emotional support they received was inadequate. The corresponding survey question is: "In the last 12 months, could you have used more emotional support than you received?" Respondents were coded 1 in this variable if they responded "yes" to this question, and 0 otherwise.

Covariates

The present study controls for respondents' age, gender (1 = female), health insurance status (1 = insured), level of education (less than 9th grade, 9th to 11th grade, and high school graduate), and interview wave (2005-06 vs. 2007-08). Importantly, I did not control respondents' current socioeconomic status (e.g., employment status, income, etc.). This is because undocumented immigrants' financial conditions are fundamentally determined by their legal status; controlling for post-migration SES might result in an underappreciation of undocumented immigrants' depressive symptoms.

Methods

The analytic strategy consists of three parts. The first set of regressions analyzes the patterning of individuals' social relationship characteristics by their race-nativity status. In doing so, I employed ordinary least squares (OLS) and logistic regressions to predict respondents' social isolation and inadequate emotional support, respectively, based on their race-nativity and other covariates. As the items comprised in the social isolation index speak to different dimensions of individuals' social connections, I additionally regressed each of the four items on the independent variables using logistic regressions. These results will help to achieve a more nuanced understanding of undocumented immigrants' social connections in the host society.

Second, I used OLS regressions to predict respondents' depression. The first model regresses depression on individuals' race-nativity and covariates. The second and third models add to the first model social isolation and inadequate emotional support, respectively. These two models aim to examine the explanatory role of individuals' social relationship characteristics in the mental health differences between undocumented Mexican immigrants and other social groups, through changes in the coefficients of race-nativity.

Third, to further investigate the mediation roles of social relationship measures, I employed structural equation models to decompose the total effect of race-nativity on depression (Ullman and Bentler 2012). The total effect is decomposed into a direct effect of race-nativity, and an indirect effect of race-nativity through the two social relationship measures. A significance test will offer insights into whether variations in individuals' social relationships factor into undocumented Mexican immigrants' mental health, vis-à-vis other race-nativity groups.

All models account for survey design factors, including strata and weights. Missing data was addressed with multiple imputations with chained equations, imputing 10 datasets.

RESULTS

Main Analysis

Table 4.1 presents weighted descriptive statistics, stratified by respondents' race-nativity. Undocumented Mexican immigrants reported significantly lower levels of depression (.81) at the .05 level, as compared to documented Mexican immigrants (1.07), U.S.-born Mexicans (1.06), and U.S.-born non-Hispanic Whites (1.10). In terms of social relationship characteristics, undocumented Mexican immigrants did not see significantly different levels of social isolation than other groups. Breaking down the index into individual dimensions of social connections, however, results suggest that undocumented Mexican immigrants reported significantly lower risks of living alone and inference church attendance, and a higher risk of being a friendship isolate, than did non-Hispanic Whites. Moreover, undocumented Mexican immigrants saw a significantly higher likelihood of experiencing inadequate emotional support (.47) than non-Hispanic Whites (.23) at the .05 level.

Table 4.2 reports results on the patterning of individuals' social relationship characteristics. Model 2.1 reveals that undocumented Mexican immigrants saw significantly lower levels of social isolation than U.S.-born Mexicans and Whites. Specifically, the average social isolation index was .347 higher for U.S.-born Mexicans ($p < .01$), and .437 higher for Whites ($p < .001$), vis-à-vis undocumented Mexican immigrants. Conversely, Model 2.2 suggests that non-Hispanic Whites saw a lower likelihood of inadequate emotional support than undocumented Mexican immigrants ($\beta = -.597$; $p < .01$), which is at odds with their lower levels of social isolation. It should be noted, though, that undocumented Mexican immigrants still reported a lower risk of lacking emotional support receipt than their documented counterparts ($\beta = .442$; $p < .05$).

Table 4.3 presents regressions results on the patterning of individual items in the social isolation index. It appears that undocumented immigrants' lower levels of social isolation primarily resulted from their household and church connections. Exponentiating the coefficients, results suggested that the odds of non-Hispanic Whites being single, living alone, and infrequently attending church services were 107.9%, 715.8%, and 304.7% larger than those for undocumented Mexican immigrants ($p < .05$, .01, and .001, respectively). Compared to native-born Mexicans, undocumented immigrants were also less likely to be single or have infrequent church attendance ($\beta = .899$ and .828; $p < .05$ and .01, respectively). By contrast, undocumented Mexican immigrants were significantly disadvantaged in terms of their friendship networks: their odds of being a friendship isolate were 60.7% larger than non-Hispanic Whites' ($p < .001$).

With these insights, Table 4.4 reports results from OLS regressions predicting levels of depression. Model 4.1 suggests that, controlling for covariates, undocumented Mexican immigrants' depression was .269, .361, and .513 lower than those for documented Mexican

immigrants, U.S.-born Mexicans, and U.S.-born non-Hispanic Whites, respectively ($p < .05$ for all coefficients). After accounting for individuals' experiences of social isolation, Model 4.2 reveals that undocumented Mexican immigrants' mental health advantages over native-born Mexicans and non-Hispanic Whites were slightly attenuated: the respective coefficients are now .317 and .458, respectively ($p < .05$ and .01). The mental health difference by documentation status among Mexican immigrants was virtually unchanged. Meanwhile, social isolation significantly predicts more depression ($\beta = .126$; $p < .01$).

Model 4.3 accounts for the explanatory role of inadequate emotional support. While inadequate emotional support was associated with more depressive symptoms ($\beta = .470$; $p < .001$), it explained the mental health differences by race-nativity in different ways. Specifically, the adjusted mental health difference between undocumented and documented Mexican immigrants is now .221 ($p < .05$). Moreover, non-Hispanic Whites now see a heightened disadvantage in mental health: their level of depression becomes .570 higher than undocumented Mexican immigrants, on average ($p < .001$).

To further investigate the mediation roles played by variations in social relationships, Table 4.5 summarizes results from structural equation models decomposing the associations between race-nativity and depression. It was revealed that experiences of social isolation partially explained undocumented Mexican immigrants' mental health advantages over native-born Mexicans and non-Hispanic Whites. The size of the mediation effects is moderate, however, accounting for 12.2% and 10.7% of the total effects on depression for the two respective groups. Meanwhile, undocumented Mexican immigrants' lower levels of inadequate emotional support relative to their documented counterparts explained the former's mental health advantage by 17.8%. By contrast, inadequate emotional support suppressed undocumented Mexican

immigrants' mental health advantage over non-Hispanic Whites, as the indirect effect was -.065 ($p < .01$), about -12.7% of the total effect.

Additionally, the role of social relationship characteristics in depression indeed varied among foreign-born Mexicans by their legal status. Using documented Mexican immigrants as the reference category, structural equation model results (shown in Table 4.6) suggest that social isolation does not significantly explain differences in depression from any other race-nativity groups. By contrast, inadequate emotional support appeared to play a larger explanatory role. Apart from explaining documented immigrants' higher levels of depression than undocumented immigrants (17.8%), inadequate emotional support also substantially suppressed their mental health advantage over non-Hispanic Whites by 46.3% (indirect effect = -.113; $p < .001$). Inadequate emotional support also had a negative indirect effect of -.062 on the association between being a U.S.-born Mexican (vis-à-vis a documented Mexican immigrant) and depression ($p < .05$). The proportion of total effect it mediated should be interpreted with caution, as documented Mexican immigrants saw little difference in depression from their U.S.-born counterparts ($\beta = .092$; $p > .05$).

Supplemental Analysis

Two groups of supplemental analyses were conducted as robustness checks. First, I examined the mediating effects of individual items in the social isolation index on the association between race-nativity and depression, given that these items speak to different domains of personal connections. Results from structural equation models, presented in Table 4.2S, reveal that living alone significantly mediated undocumented Mexican immigrants' mental health advantage over non-Hispanic Whites (indirect effect = .040; $p < .05$). By contrast, lack of

friendship ties suppressed the association of non-Hispanic Whites (vs. undocumented Mexican immigrants) and depression, by having a negative indirect effect of -.047 ($p < .05$). The implications of these results are addressed in the discussion section.

Second, the main analysis drew on earlier waves of NHANES data, it remains curious whether the observed mental health advantages among undocumented Mexican immigrants were persistent over time. To explore this question, I used more recent waves of NHANES data, drawing on the 2013-18 waves.[1] Table 4.3S in the supplementary file presents regression results predicting depression during this period. Model S3.1 analyzed the overall sample, and Models S3.2 and S3.3 analyzed stratified samples by the U.S. president terms (2013-16 and 2017-18), which had important implications for racially marginalized populations' well-being (Torche and Rauf 2021).

Results suggest that undocumented Mexican immigrants no longer showed a mental health advantage over documented Mexican immigrants and U.S.-born Mexicans. Meanwhile, undocumented Mexican immigrants reported significantly lower levels of depression than non-Hispanic Whites ($\beta = .288$; $p < .05$) in the overall sample, but not in either of the stratified samples. As suggested by the estimation results, this was likely because of the larger standard errors in stratified samples arising from the reduced sample size, as opposed to secular changes in mental health patterns.

[1] Due to the COVID pandemic, the 2019-20 wave of NHANES did not finish its data collection, and, thus, was not a nationally representative sample. The 2019-20 NHANES also did not collect data on respondents' citizenship status, which makes the identification of respondents' legal status much more difficult and less accurate. The present study thus did not draw on the 2019-20 NHANES in the supplemental analysis.

By contrast, documented Mexican immigrants stood out as the group with much more pronounced mental health advantages than the native-born population. In the overall sample, documented Mexican immigrants reported significantly lower levels of depression than U.S.-born Mexicans (β = -.055-.177 = -.232; $p < .05$) and non-Hispanic Whites (β = -.055-.288 = -.343; $p < .001$); these patterns were mostly consistent in the stratified samples.

Unfortunately, data on individuals' social relationship characteristics were not available in these waves of NHANES, making it impossible to examine how social relationships factored into the mental health of undocumented immigrants during this period. But the shifting patterns of depression by individuals' race-nativity may offer some implications, which will be addressed in the discussion section.

DISCUSSION

Though studies have paid attention to social relationships among undocumented immigrants and the implications for mental health, few have leveraged nationally representative data to analyze mental health disparities by documentation status, and how multiple dimensions of social relationship characteristics may explain these disparities. To address this gap, the present study leveraged 2005-08 NHANES data to analyze how two facets of social relationships – social isolation and inadequate emotional support – explain the mental health disparities between undocumented Mexican immigrants and three other race-nativity groups.

Results suggest that undocumented Mexican immigrants reported significantly lower levels of depression than documented Mexican immigrants, U.S.-born Mexicans, and non-Hispanic Whites. The results are in line with recent evidence suggesting a "healthy immigrant paradox" among undocumented immigrants (Ruhnke et al. 2022). Furthermore, undocumented

Mexican immigrants also saw significantly lower levels of social isolation than U.S.-born Mexicans and U.S.-born non-Hispanic Whites. In turn, social isolation partially explained the former's mental health advantage.

Additional analyses suggested that the larger numbers of undocumented Mexican immigrants' social connections primarily resulted from their household and religious connections. Compared to non-Hispanic Whites, undocumented Mexican immigrants had significantly lower risks of being single, living alone, and having infrequent church attendance. These social relationships may be primarily accrued from the migration process. Recent scholarship found that household and community networks have played an integral role in facilitating undocumented Mexico-U.S. immigration (Asad and Hwang 2019; Wassink and Massey 2022). These networks may also constitute the primary source of undocumented immigrants' social relationships in the host society, in ways that buffer stress in the acculturation process and contribute to lower levels of depression. Additionally, supplemental analyses found that undocumented immigrants' lower risks of living alone served as the primary factor explaining their mental health advantage over non-Hispanic Whites. The finding is consistent with previous studies' contention that family separation constitutes a major stressor that harms undocumented immigrants' psychological well-being, speaking to the importance of family members present in buffering feelings of loneliness (Negi et al. 2021; Organista, Arreola, and Neilands 2016).

Yet undocumented Mexican immigrants also faced significantly higher risks of having inadequate friendships than non-Hispanic Whites, which in turn suppressed their mental health advantage. This might result from the socio-legal exclusion of undocumented immigrants in the United States (Gonzales 2011). For example, border patrols in the host community may deter

immigrants from accessing health facilities and social institutions (Ornelas, Yamanis, and Ruiz 2020; Tuohy 2019). Discrimination based on legal status and ethnic background may also discourage undocumented Mexican immigrants from interacting with the native-born population (Joseph 2011; Rodriguez et al. 2023). These factors may constrain the opportunities for undocumented immigrants to form friendship ties in the host community, which may have negative mental health consequences.

Concurrently, undocumented immigrants faced a significantly higher risk of inadequate emotional support than non-Hispanic Whites, which suppressed their mental health advantage. The paradoxical patterns of more social connections *and* less emotional support illuminate the primary form of relationship stress faced by undocumented Mexican immigrants: lack of supportive ties. Indeed, inadequate emotional support might be the crucial reason behind undocumented immigrants' *feelings* of isolation, as found in numerous studies (Mora et al. 2014; Negi et al. 2021). As undocumented immigrants' perceptions of isolation and desperation significantly predict their mental health and health behaviors, more research should be dedicated to examining the determinants of high-quality, emotionally supportive ties, beyond the size of personal networks.

The specific factors contributing to the lack of emotional support may include immigration border surveillance and perceived discrimination, which give rise to collective fear, anger, and despair in undocumented immigrant communities (Garcini et al. 2021; Ornelas, Yamanis, and Ruiz 2020). Personal ties – especially those with other undocumented immigrants – likely do not serve effective roles in buffering the structurally induced stressors; they may also lead to the contagion of negative emotions, which compromise their mutual provision of social support. Even so, undocumented Mexican immigrants still reported lower risks of inadequate

emotional receipt than their documented counterparts; it was potentially because the compounded structural challenges faced by undocumented immigrants have motivated them to engage in co-ethnic mutual support at higher rates.

It should be noted, however, that social isolation and emotional support receipt only mediated a small amount of mental health differences between undocumented immigrants and those of other race-nativity groups. After all, the process of immigrant health selection (i.e., the pattern that immigrants are positively selected on health from their home countries) is likely the primary mechanism behind the mental health advantage among undocumented immigrants (Feliciano 2020; Jasso et al. 2004). The costs of migration, psychological and physical demands in crossing the national border, and the anticipated stress from the immigration policies in the host community, may all require great mental health and coping resources for individuals to immigrate into the U.S. without documentation, in ways that contribute to undocumented Mexican immigrants' overall lower levels of depression (Asad and Hwang 2019; Segarra and Prasad 2024).

Nonetheless, the social relationships of undocumented immigrants deserve attention in terms of their mental health implications. First, social relationships *per se* constitute an important facet of immigrants' lived experiences in the host society, often recognized as crucial indicators of incorporation into the host society (Alba and Nee 2003; Gordon 1964). Second, scholars have found that immigrants' mental health outcomes tend to deteriorate over time (Harker 2001; Tam and Lam 2005); the cumulative effects of social relationships on undocumented immigrants' mental health could be sizable and, thus, merit examination in longitudinal studies.

The present study is not without limitations. First, the study used an imputed measure of respondents' documentation status, which inevitably results in misclassification of individuals'

race-nativity. Notably, the imputation strategy may incorrectly classify short-term undocumented Mexican immigrants as documented immigrants. Previous studies suggest that recently-arrived immigrants tend to report better mental health, yet lower levels of social support, than those who spent more years in the host community (Harker 2001; Morey et al. 2021). To the extent that these patterns also apply to undocumented immigrants, the findings regarding undocumented immigrants' mental health advantage, as well as their higher risks of inadequate emotional support, are likely conservative estimates. The focus on less educated undocumented immigrants also limited the findings from generalizing to those with more educational attainments. Studies have pointed out that college-educated undocumented immigrants may face dramatic challenges from their educational experiences, employment opportunities, and deportation threats (Gonzales 2016; Rodriguez et al. 2023). The sample restriction on age range, due to data limitation, also prevents the study from investigating the social relationships and mental health among younger-aged undocumented immigrants, who constitute a large proportion of the population (Borjas 2017). Future studies could overcome these limitations by collecting large-scale data among undocumented immigrants across socioeconomic and age spectrums.

Second, the study drew from data collected around two decades ago, which limits its generalizability to undocumented immigrants in recent years. Supplemental analyses found that undocumented Mexican immigrants in later periods no longer reported substantial mental health advantages over other race-nativity groups, likely because of growing anti-immigrant sentiments and restrictive immigration policies (Butz and Kehrberg 2019; de Haas, Natter, and Vezzoli 2018). Under the circumstances, the patterns regarding social relationships observed in the main analyses might be more pronounced over time. On the one hand, the restrictive immigration policies may further compress undocumented immigrants' social interactions within their

households and communities, in ways that promote their overall social connections and lower the level of isolation. On the other hand, the compounded structural challenges may further preclude undocumented immigrants from forming supportive ties. Perceptions of inadequate emotional support could be more prevalent in undocumented immigrant communities when they face more legal barriers and structural hardships.

Third, due to data limitations, the index of social isolation was not based on a comprehensive set of items considered in Berkman and Syme's (1979) original work. Specifically, measures are lacking regarding respondents' community ties. This might be partially captured through respondents' religious participation, which is a strong predictor of community cohesion (Andrews 2011). Moreover, co-ethnic ties are defining characteristics of immigrant communities (Bashi 2007; Portes and Zhou 1993). Thus, undocumented Mexican immigrants might see even lower levels of social isolation after accounting for community ties.

Fourth, as the present study analyzed cross-sectional data, it would be hard to ascertain the causal relationships between social relationships and mental health. It is possible, for instance, that undocumented immigrants' better mental health may contribute to larger personal networks (Schaefer, Kornienko, and Fox 2011). Addressing this issue requires examinations of longitudinal data on social networks and mental health among undocumented immigrants, which remains scarce to date. Future research should invest in longitudinal data collection among the undocumented immigrant population.

In conclusion, the present study found that undocumented Mexican immigrants exhibited a mental health advantage over those of different race-nativity backgrounds. The role of their social relationships in mental health, however, appeared to be complex. Specifically, I found that undocumented Mexican immigrants experienced a "social relationship paradox," as they had a

lower risk of social isolation and a higher risk of inadequate emotional support than non-Hispanic Whites. These puzzling patterns call for a more nuanced examination of the multidimensional characteristics of undocumented immigrants' social relationships, as well as their structural causes and mental health consequences. Achieving this requires an advancement of theories in immigrant incorporation, as they have mainly focused on personal network size and diversity as primary indicators of assimilation (Alba and Nee 2003; Gordon 1964). To this end, it is important to account for social relationship quality – in terms of social support provision – as an indicator of immigrants' structural incorporation (Gordon 1964), which may have far-reaching consequences for undocumented immigrants as they navigate the structural challenges in the host society.

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TABLES

Table 4.1 Descriptive Statistics (n = 1,230)

	Mean (S.D.) / Percentage			
	Undocumented Mexican Immigrant (n = 183)	Documented Mexican Immigrant (n = 196)	U.S.-Born Mexican (n = 135)	U.S.-Born Non-Hispanic White (n = 716)
Depression	.81 (.08)	1.07 (.08) *	1.06 (.10) *	1.10 (.04) *
Social Isolation Index	.96 (.08)	1.02 (.07)	1.03 (.08)	1.09 (.05)
Single	.18 (.04)	.25 (.03)	.29 (.05)	.26 (.02)
Living Alone	.02 (.01)	.03 (.01)	.05 (.02)	.13 (.01) *
Friendship Isolate	.30 (.03)	.35 (.04)	.18 (.05)	.08 (.01) *
Infrequent Church Attendance	.46 (.04)	.41 (.04)	.51 (.06)	.63 (.03) *
Inadequate Emotional Support	.47 (.05)	.57 (.03)	.36 (.05)	.23 (.02) *
Age	48.08 (.54)	49.77 (.55) *	51.09 (.65) *	51.50 (.34) *
Female	.39 (.03)	.50 (.03) *	.61 (.05) *	.50 (.02) *
Has Health Insurance	.31 (.03)	.45 (.05) *	.70 (.06) *	.81 (.02) *
Level of Education				
Less than 9th Grade	71.1	53.6*	14.8*	6.4*
9th-11th Grade	18.0	29.3	30.5*	22.0
High School Graduate	10.9	17.1*	54.6*	71.6*
Interview Cycle				
2005-06	63.0	43.0*	34.2*	48.2
2007-08	37.0	57.0*	65.8*	51.8

All means/percentages are adjusted for survey design factors (strata and weights).

*The mean/percentage is significantly different between the corresponding race-nativity group and undocumented Mexican immigrants at the .05 level.

Table 4.2 Regressions Predicting Respondents' Social Relationship Characteristics (n = 1,397)

	Social Isolation Index	Inadequate Emotional Support
	OLS	Logit
	2.1	**2.2**
Race-Nativity (ref. = Undocumented Mexican Immigrant)		
Documented Mexican Immigrant	0.119	0.442*
	(0.08)	(0.17)
U.S.-Born Mexican	0.347**	-0.073
	(0.11)	(0.31)
U.S.-Born Non-Hispanic White	0.437***	-0.597**
	(0.12)	(0.21)
Age	0.006	-0.001
	(0.00)	(0.01)
Female	-0.092	0.332*
	(0.05)	(0.15)
Has Health Insurance	-0.280**	-0.356*
	(0.08)	(0.15)
Level of Education (ref. = Less than 9th Grade)		
9th-11th Grade	0.015	-0.447
	(0.08)	(0.25)
High School Graduate	-0.209*	-0.549*
	(0.09)	(0.20)
Interview Cycle (ref. = 2005-06)		
2007-08	0.020	-0.090
	(0.07)	(0.18)
Constant	0.776**	0.122
	(0.22)	(0.49)

*p <.05, **p <.01, ***p <.001 (two-tailed test).

Table 4.3 Logistic Regressions Predicting Items of the Social Isolation Index (n = 1,397)

	Single	Living Alone	Friendship Isolate	Infrequent Church Attendance
	3.1	**3.2**	**3.3**	**3.4**
Race-Nativity (ref. = Undocumented Mexican Immigrant)				
Documented Mexican Immigrant	0.345	0.309	0.254	0.037
	(0.32)	(0.60)	(0.18)	(0.25)
U.S.-Born Mexican	0.899*	1.389	-0.268	0.828**
	(0.35)	(0.79)	(0.39)	(0.27)
U.S.-Born Non-Hispanic White	0.732*	2.099**	-0.933***	1.398***
	(0.35)	(0.58)	(0.25)	(0.28)
Age	0.023	0.067***	-0.024	-0.011
	(0.01)	(0.02)	(0.01)	(0.01)
Female	-0.033	-0.266	0.185	-0.366***
	(0.16)	(0.21)	(0.21)	(0.09)
Has Health Insurance	-0.337*	-0.044	-0.563*	-0.583*
	(0.16)	(0.28)	(0.22)	(0.21)
Level of Education (ref. = Less than 9th Grade)				
9th-11th Grade	0.125	-0.361	-0.147	0.251
	(0.23)	(0.27)	(0.23)	(0.17)
High School Graduate	-0.344	-0.503	-0.338	-0.228
	(0.22)	(0.33)	(0.22)	(0.18)
Interview Cycle (ref. = 2005-06)				
2007-08	0.266	0.074	0.274	-0.293
	(0.16)	(0.22)	(0.20)	(0.20)
Constant	-2.551***	-7.012***	0.315	0.668
	(0.67)	(1.01)	(0.64)	(0.52)

*p <.05, **p <.01, ***p <.001 (two-tailed test).

Table 4.4 OLS Regressions Predicting Depression (n = 1,397)

	4.1	**4.2**	**4.3**
Race-Nativity (ref. = Undocumented Mexican Immigrant)			
Documented Mexican Immigrant	0.269**	0.254**	0.221*
	(0.09)	(0.09)	(0.09)
U.S.-Born Mexican	0.361*	0.317*	0.375**
	(0.14)	(0.14)	(0.13)
U.S.-Born Non-Hispanic White	0.513***	0.458**	0.578***
	(0.13)	(0.13)	(0.13)
Social Isolation Index		0.126**	
		(0.04)	
Inadequate Emotional Support			0.470***
			(0.07)
Age	-0.006	-0.007	-0.006
	(0.00)	(0.00)	(0.00)
Female	0.237**	0.249***	0.208**
	(0.07)	(0.07)	(0.06)
Has Health Insurance	-0.238*	-0.203	-0.205*
	(0.10)	(0.10)	(0.09)
Level of Education (ref. = Less than 9th Grade)			
9th-11th Grade	-0.128	-0.130	-0.082
	(0.09)	(0.09)	(0.09)
High School Graduate	-0.196*	-0.170	-0.142
	(0.09)	(0.09)	(0.09)
Interview Cycle (ref. = 2005-06)			
2007-08	0.184**	0.182**	0.192**
	(0.06)	(0.06)	(0.06)
Constant	1.074***	0.976***	0.828***
	(0.19)	(0.20)	(0.19)

*p <.05, **p <.01, ***p <.001 (two-tailed test).

Table 4.5 Structural Equation Models Analyzing Mediation Effects of Social Relationship Measures on the Association between Race-Nativity and Depressive Symptoms (n = 1,397)

	Total Effect on Depressive Symptoms	Indirect Effect through Social Isolation Index		Indirect Effect through Inadequate Emotional Support	
	Effect Size	Effect Size	% Mediated	Effect Size	% Mediated
Race-Nativity (ref. = Undocumented Mexican Immigrant)					
Documented Mexican Immigrant	0.269**	0.015	-	0.048*	17.8%
	(0.09)	(0.01)		(0.02)	
U.S.-Born Mexican	0.361*	0.044*	12.2%	-0.014	-
	(0.14)	(0.02)		(0.03)	
U.S.-Born Non-Hispanic White	0.513***	0.055*	10.7%	-0.065**	-12.7%
	(0.13)	(0.03)		(0.02)	

*p <.05, **p <.01, ***p <.001 (two-tailed test).
% mediated is only reported for significant mediation effects.

Table 4.6 Structural Equation Models Analyzing Mediation Effects of Social Relationship Measures on the Association between Race-Nativity and Depressive Symptoms, with Documented Mexican Immigrants as the Reference Category (n = 1,397)

	Total Effect on Depressive Symptoms	Indirect Effect through Social Isolation Index		Indirect Effect through Inadequate Emotional Support	
	Effect Size	Effect Size	% Mediated	Effect Size	% Mediated
Race-Nativity (ref. = Documented Mexican Immigrant)					
Undocumented Mexican Immigrant	-0.269**	-0.015	-	-0.048*	17.8%
	(0.09)	(0.01)		(0.02)	
U.S.-Born Mexican	0.092	0.029	-	-0.062*	-67.4%
	(0.13)	(0.02)		(0.03)	
U.S.-Born Non-Hispanic White	0.244*	0.040	-	-0.113***	-46.3%
	(0.10)	(0.02)		(0.02)	

*p <.05, **p <.01, ***p <.001 (two-tailed test).
% mediated is only reported for significant mediation effects.

SUPPLEMENTAL TABLES

Table 4.1S Estimated Percentage of Undocumented Immigrants among the Mexican Immigrant Population, 2005-2008

Year	Estimated Undocumented Mexican Immigrant Population[1]	Total Mexican Immigrant Population[2]	% Undocumented
2005	5,970,000	11,200,000	53.3
2006	6,570,000	11,900,000	55.2
2007	6,980,000	11,700,000	59.7
2008	7,030,000	11,700,000	60.1
Four-Year Average	**6,637,500**	**11,625,000**	**57.1**

[1] Source: Hoefer, Rytina, and Campbell (2006 and 2007); Hoefer, Rytina, and Baker (2008 and 2009).
[2] Source: Galindo (2011); calculations were based on ACS estimates.

Table 4.2S Structural Equation Models Analyzing Mediation Effects of Individual Items from the Social Isolation Index on the Association between Race-Nativity and Depressive Symptoms (n = 1,397)

	Total Effect	Indirect Effect through Being Single		Indirect Effect through Living Alone		Indirect Effect through Friendship Isolate		Indirect Effect through Infrequent Church Attendance	
	Effect Size[1]	Effect Size	% Mediated	Effect Size	% Mediated	Effect Size	% Mediated	Effect Size	% Mediated
Race-Nativity[2]									
Documented Mexican Immigrant	.283**	.007	-	.003	-	.016	-	.001	-
	(.08)	(.01)		(.01)		(.01)		(.01)	
U.S.-Born Mexican	.375**	.020	-	.020	-	-.022	-	.029	-
	(.13)	(.02)		(.01)		(.02)		(.16)	
U.S.-Born Non-Hispanic White	.512***	.016	-	.040*	7.8%	-.047*	-9.2%	.049	-
	(.12)	(.01)		(.02)		(.02)		(.03)	

*p <.05, **p <.01, ***p <.001 (two-tailed test).
% mediated is only reported for significant mediation effects.
[1] The total effects of race-nativity on depression are slightly different from those in the main analyses, because of a different specification of the multiple imputation model.
[2] Reference category is Undocumented Mexican Immigrant.

Table 4.1S OLS Regressions Predicting Depression, Using 2013-2018 NHANES Data

	2013-18	2013-16	2017-18
	S3.1	**S3.2**	**S3.3**
Race-Nativity (ref. = Undocumented Mexican Immigrant)			
Documented Mexican Immigrant	-0.055[a]	-0.008[b]	-0.125[c]
	(0.09)	(0.13)	(0.13)
U.S.-Born Mexican	0.177	0.154	0.326
	(0.11)	(0.14)	(0.23)
U.S.-Born Non-Hispanic White	0.288*	0.294	0.316
	(0.11)	(0.15)	(0.15)
Age	0.001	-0.001	0.003
	(0.00)	(0.00)	(0.01)
Female	0.380***	0.293**	0.511***
	(0.07)	(0.08)	(0.10)
Has Health Insurance	0.016	0.127	-0.225
	(0.07)	(0.08)	(0.12)
Level of Education (ref. = Less than 9th Grade)			
9th-11th Grade	0.133	0.185*	-0.054
	(0.09)	(0.09)	(0.16)
High School Graduate	-0.104	-0.077	-0.223
	(0.10)	(0.11)	(0.16)
Interview Cycle (ref. = 2013-14)			
2015-16	0.073	0.081	-
	(0.07)	(0.07)	-
2017-18	0.041	-	-
	(0.08)	-	-
Constant	0.671**	0.717**	0.866*
	(0.21)	(0.24)	(0.38)
N	**1709**	**1172**	**537**

*p <.05, **p <.01, ***p <.001 (two-tailed test).

[a] Significantly different from U.S.-Born Mexican and U.S.-Born non-Hispanic White at the .05 level.

[b] Significantly different from U.S.-Born non-Hispanic White at the .05 level.

[c] Significantly different from U.S.-Born Mexican and U.S.-Born non-Hispanic White at the .05 level.

CHAPTER 5

Conclusion

Through three chapters, the present dissertation analyzed how structural conditions and temporal dynamics shaped immigrants' social relationships, in ways that influenced the health outcomes among this population. Chapters 1 and 3 focused on the structural aspect of immigrants' personal networks and their health implications, with specific attention paid to how systems of inequality – based on gender and legal status – shape personal networks and well-being. Their findings have demonstrated the complex mechanisms through which social relationships served as interstitial linkages between the structural disadvantages against (certain groups) of immigrants and patterns of health, in terms of both variations among immigrants and health disparities between immigrants and the native-born population.

The first chapter found that gender inequalities embedded in sending household and community migrant networks have significantly diminished the magnitude of immigrant health selection among female immigrants from Mexico. By contrast, gender disadvantages experienced by some Mexican men did not affect immigrant health selectivity among them. These findings may arise from a complex set of gender-based structural conditions, including gender inequality in resource distribution, gender norms regarding migration, and power dynamics in migration decision-making between female and male household members -- all of which have been found to shape migrant networks to unfold the "cumulative causation of migration" over time (Curran and Rivero-Fuentes 2003; Hondagneu-Sotelo 1994; Massey 1990; Massey, Fischer, and Capoferro 2006).

The specific mechanisms through which these structural factors perpetuate gender disparities in health, as contended in the chapter, are the processes of migration decision-making. Scholars have noted that health may factor into migration aspiration insofar as it factors into cost-benefit analyses (Jasso et al. 2004; Massey et al. 1993), while others have contended that the assumption of a rational migration decision-making may be challenged when individuals' bargaining powers were compromised (Nobles and McKelvey 2015; Parrado, Flippen, and McQuiston 2005). Women tend to occupy less empowered positions in households and communities, and additional forms of gender inequalities may only compound their lack of decision-making freedom (Curran and Rivero-Fuentes 2003). As a result, their migration decisions may be no longer informed by calculations of costs and benefits on the individual levels, in ways that diminish the immigrant selection based on their personal characteristics, such as socioeconomic status and health.

Chapter 1 also found that the role of gender inequalities in immigrant health selection was particularly pronounced among undocumented immigrants. In turn, undocumented Mexican women saw the weakest level of health selection when subject to gender disadvantages. These patterns speak to how intersectional structural inequities may compound the health disadvantages faced by multidimensionally marginalized groups. Recent scholarships have demonstrated that intersectional inequalities play important roles in both defining personal network boundaries and shaping individuals' health (Homan, Brown, and King 2021; Zhao 2023). Extending these implications, the first chapter called for attention to undocumented Mexican women's lived experiences before their migration, during which they were subject to high risks of violence, marginalization, and compounded material hardship (Asad and Hwang 2019). A lot of these disadvantages are deeply entrenched in migrant networks; as a result, they may contribute to the

cumulative disadvantages faced by undocumented immigrant women, in terms of both socioeconomic well-being and health outcomes.

Indeed, examining the health implications of individual experiences prior to migration is crucial for a life-course approach to health among the immigrant population. Due to data limitations, studies of immigrant health have seldomly accounted for pre-migration factors (other than individuals' reasons for migration; Gong et al. 2011; Morey et al. 2020). The first chapter thus calls for a more nuanced theoretical framework that outlines the social determinants of immigrants' health. How do the structural conditions faced by immigrants before and after migration jointly influence their health trajectories? And to what extent can the dynamics of personal networks explain the structural determinants of health among immigrants? Accounting for the systematic challenges faced by immigrants – especially those of marginalized backgrounds – at different stages of migration may advance our understanding of immigrants' incorporation trajectories, in terms of personal network characteristics, socioeconomic well-being, and health.

Chapter 3 found that legal status may have complex implications for immigrants' social relationships and mental health among Mexican immigrants. Surprisingly, undocumented Mexican immigrants reported a lower level of social isolation (i.e., more social connections) than the native-born population, which partially explained their lower levels of depression. These findings were at odds with numerous prior studies that highlighted isolation and loneliness as major health risks for individuals without documentation (Negi et al. 2021). It was further found that undocumented immigrants' advantage in social connections primarily resulted from their household and marriage ties. These results are consistent with prior studies' findings on the protective effects of immigrant communities on mental well-being (Bashi 2007; Takeuchi et al.

2007; Walton 2012). Scholars have long found that migrant networks are especially crucial for migrations without documentation (Asad and Hwang 2019; Wassink and Massey 2022); the present study finds that they are also important sources of personal connections in the host community. These ties may promote undocumented immigrants' social integration and buffer feelings of loneliness, which may improve mental health.

Concurrently, the hostile context of reception against undocumented immigrants – in terms of restrictive immigration policies, rising anti-immigrant sentiments, and the stratification in economic mobility by documentation status – might have also compressed immigrants' relationships within their ethnic enclaves, to the extent that they precluded immigrants from socializing in native-born communities (Gonzales 2011; Morey 2018). This potential may have contributed to the significant mediation effects of social isolation in undocumented Mexican immigrants' mental health advantages over non-Hispanic Whites, a pattern not observed for documented Mexican immigrants.

Yet not surprisingly, undocumented immigrants also reported higher risks of inadequate emotional support, which suppressed their mental health advantages. This finding calls for an appreciation of the complex processes by which structural conditions shape immigrants' personal networks, beyond the mere formation/dissolution of ties. Though studies have observed that structural disadvantages may solidify network boundaries, much less attention is paid to how structural hardships may compromise support provisions. For undocumented immigrants, the specific forms of systemic challenges that preclude receipt of efficient emotional support may be manifold, including the contagion of negative emotions within co-ethnic migration networks, lack of emotional resonance from their network members native in the host society, and the absence of family members in the host community – whose support is unlikely to be replaceable,

etc. (Gonzales 2011; Negi et al. 2021; Rodriguez et al. 2023). Hence, the study calls for examining how the size *and* quality of personal relationships may be a function of the structural conditions that encapsulate individuals. Both factors may be equally important for understanding undocumented immigrants' feelings of loneliness and desperation (Negi et al. 2021).

An important limitation of this chapter is that it didn't examine specific forms of structural disadvantages against undocumented Mexican immigrants, e.g., immigration policies. Theoretically, it is possible that undocumented immigrants in regions where there are more legal and policy barriers may experience an even higher risk of lacking emotional support, in ways that result in worse mental health (Ornelas, Yamanis, and Ruiz 2020). However, more nationally representative datasets – including NHANES, which was employed in the third chapter – did not publicize respondents' geographic locations, making it difficult to assess how the macro-level contexts determined undocumented immigrants' personal network characteristics. Further scholarship should investigate how specific policy contexts may influence the social relationship formations and quality among undocumented immigrants, which may have substantial implications for their physical and mental health.

Another objective of the present dissertation is to investigate how the temporal dynamics in immigrants' social relationships predict their health outcomes. Specifically, the second chapter examined how friendship instability explained the association between acculturation and depressive symptoms. The chapter found that friendship instability may predict a higher level of depression, but only among those with a low level of acculturation. The finding calls for understanding friendship network instability as a form of acculturative stress for immigrant adolescents, whose detrimental effects on mental health may wane as adolescents are integrated into the host society.

Indeed, it is probably important to realize that a comprehensive inventory for measuring acculturative stress should fully account for the dynamic aspect of immigrants' everyday experiences. Past research has mainly focused on the more static dimensions, e.g., language barriers and perceived discrimination (Berry et al. 1987; Rudmin 2009); the precariousness in immigrants' lived experiences, such as relationship and economic instability, remains underappreciated. To the extent that the acculturation process *per se* entails fundamental changes in an individual's values and behaviors (Alba and Nee 2003; Portes and Zhou 1993), a dynamic approach is crucial for both fully capturing acculturative stress and investigating the mental health implications of immigrants' social relationships.

Overall, the dissertation finds that both structural conditions and temporal dynamics are crucial for understanding the health implications of immigrants' social relationships. Often times, they have resulted in compounded health disadvantages faced by certain groups of immigrants. A common challenge faced by the three chapters, however, is the lack of fine-grained data. As such, the empirical analyses could not employ direct measures on structural conditions, nor could they fully appreciate the longitudinal characteristics of immigrants' personal networks. Future research should engage in innovations in data collection to examine the longitudinal changes in immigrants' social relationships and health, involving detailed measures of structural factors, multidimensional characteristics of personal networks, and personal well-being. Only then can scholars fully understand how interpersonal connections shed light on immigrants' lived experiences and illuminate their health patterns in the host society.

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