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Immigrant Status, Health, and Mortality in Later Life

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Immigrant Status, Health, and Mortality in Later Life

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Dedication

This dissertation is dedicated to my mother and my late father.

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Immigrant Status, Health, and Mortality in Later Life

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Given the growing importance of the immigrant population in the United States, identifying the determinants of immigrant health following migration is critical to understanding the impact of international migration on the health of the nation. Using the Health and Retirement Study (HRS), this study examined nativity differences in mortality and physical functioning in later life, with special attention to (1) the determinants of nativity differences in mortality and physical functioning and (2) the association between mortality and disability in terms of the compression of morbidity paradigm.

This study found that immigrant men had lower mortality compared to their U.S.-born counterparts of similar racial/ethnic backgrounds. However, immigrant women were indistinguishable from U.S.-born women of similar racial/ethnic backgrounds. With respect to physical functioning, immigrants showed lower levels of functional limitations but were indistinguishable from U.S.-born residents of similar racial/ethnic backgrounds

in terms of disability. The data also showed that the effect of immigrant status somewhat differs across mortality and physical functioning. While all foreign-born racial/ethnic minorities showed lower or comparable mortality risks compared to native-born whites, foreign-born Hispanics showed poorer functional health than native-born whites.

This study also found that socioeconomic status, social integration, and health behaviors play important roles in explaining the observed nativity differences in mortality and physical functioning. In particular, compared to prior research, the results indicate that socioeconomic factors better explain the observed nativity differences in mortality and physical functioning compared to social integration and health behaviors.

This study also illustrated that integrating mortality and disability is a valuable way to investigate immigrant health. Compared to U.S.-born residents, the analysis of active life expectancy revealed that mortality is loosely coupled with disability for immigrants and that, except for foreign-born whites, immigrants' lengthy lives are expected to be a prolonged period of disability.

Overall, the results indicate that immigrant's socioeconomic adaptation into U.S. society has a great impact on immigrant health in later life. This study also suggests that social policies aimed at promoting immigrant health need to be accompanied by a more general effort to integrate immigrants into U.S. society.

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Chapter 1: Introduction

1. Introduction

The racial/ethnic composition of immigrant streams into the United States has substantially changed since 1965. The origin of immigrant streams has shifted from Europe and toward Latin America and Asia. High levels of immigration from developing countries have renewed the debate over the social and economic consequences of immigration in the United States. In addition, there has been considerable debate concerning the well-being of immigrants. Some scholars (e.g., Portes and Zhou 1993; Zhou 1997) have argued that the adaptation processes of new immigrants are grounded in fundamentally different structural circumstances that set them apart from earlier immigrants from European countries, while other scholars (e.g., Alba and Nee 2003) have been more optimistic about new immigrants' successful assimilation into U.S. society.

Despite the controversial debate over the future of new immigrants, a substantial body of literature has documented that often immigrants show lower infant/adult mortality risks and better health than U.S.-born residents of similar racial/ethnic backgrounds or the U.S.-born population in general (Dey and Lucas 2006; Fuentes-Afflick, Hessol, and Pérez-Stable 1999; Hummer, Rogers, Nam, and LeClere 1999; Hummer, Biegler, Turk, Forbes, Frisbie, Hong, and Pullum 1999; Muennig and Fahs 2002; Singh and Siahpush 2002, 2001; Singh and Yu 1996). A similar pattern has also been documented in other major immigrant-receiving countries, such as Canada (Hyman

2001), Australia (Australian Institute of Health and Welfare 2000), and other European countries such as France and Germany (Darmon and Khlat 2001; Razum, Zeeb, Akgun, and Yilmaz 1998).

Given the growing importance of the immigrant population in the United States, identifying the determinants of immigrant health following migration is critical to understanding the impact of international migration on the health of the nation. Using the Health and Retirement Study (HRS), this study examines nativity differences in mortality and physical functioning in later life, with special attention to (1) the determinants of nativity differences in mortality and physical functioning and (2) the association between mortality and disability in terms of the compression of morbidity paradigm.

2. Background of the Study

Racial/ethnic differentials in health and mortality have been well documented in the United States. Previous studies found that disadvantaged racial and ethnic minority groups continue to have lower life expectancies and poorer health outcomes than do non-Hispanic whites (Feinstein 1993; Hayward, Miles, Crimmis, and Yang 2000; Williams and Collins 1995). Standard explanations for this pattern emphasized racial/ethnic disparities in socioeconomic status. However, the association between socioeconomic status and racial/ethnic differences in health and mortality is a complex phenomenon with many intervening processes. Recent studies indicate that socioeconomic explanations do not provide a complete picture of racial/ethnic differentials in health and mortality in the United States.

In contrast to blacks, for example, despite their socioeconomic disadvantages, national mortality data indicate that the life expectancy of Mexican Americans in the United States is comparable to non-Hispanic whites. Social scientists have used the term *epidemiologic paradox* to describe this unexpected result in mortality. Furthermore, a growing body of literature suggests that other Hispanic populations, such as Puerto Ricans, also have favorable mortality outcomes (e.g., Hummer et al. 1999; Landale, Oropesa, and Gorman 2000). Evidence also indicates that Hispanics in the United States have a relatively short period of disability than do blacks (Hayward and Heron 1999).

Standard explanations for this paradoxical phenomenon are (1) data artifacts; (2) protective Hispanic cultures; and (3) migration selectivity. The first explanation suggests that the epidemiologic paradox is a result of data errors, such as ethnic identification, misreporting of ages, and mismatches of records (Elo et al. 2004; Palloni and Arias 2004). The second explanation focuses on the role of protective cultures retained by Hispanic populations. This perspective suggests that Hispanic populations tend to retain protective cultural forces of the country of origin, such as extended family structure, supportive social networks, and healthy lifestyles, and these protective cultural factors compensate for their socioeconomic disadvantages (Abraido-Lanza, Dohrenwend, Ng-Mak, and Turner 1999; Hao and Johnson 2000; Vega and Amaro 1994).

Compared to the aforementioned two explanations, the third one applies only to immigrants. This argument is based on the fact that immigrants constitute a considerable portion of Hispanic populations in the United States. More specifically, research on immigrant health suggests that immigrants are positively selected in terms of health outcomes (the healthy migrant effect) and immigrants with poor health are more likely to return to the country of origin (the return-migration effect) (Landale, Oropesa, and Gorman 2000; Palloni and Arias 2004). Thus, remaining immigrants in the host country are much healthier than non-migrants in the country of origin.

Although substantial evidence indicates that immigrants have lower mortality risks and better health than U.S.-born residents, however, a growing body of literature also suggests that the immigrant health advantage diminishes dramatically over time in the United States. Evidence suggests that the length of time that immigrants spend in the United States is correlated with increases in adverse birth outcomes, health risk behaviors, and chronic conditions (e.g., Cobas, Balcazar, Benin, Keith, and Chong 1996; Johnson, Vangeest, and Cho 2002; Singh and Siahpush 2002). Given the association between socioeconomic status (SES) and health, immigrants' health deterioration over time is considered puzzling in the literature because immigrants' standards of living tend to improve as they adapt to U.S. society, even though immigrants have higher rates of poverty than U.S.-born residents when they first enter the United States. To explain immigrant's health deterioration following migration, the majority of previous studies focused on the impact of behavioral/cultural assimilation of immigrants. Overall, the literature suggests that acculturation into U.S. society has negative effects on health outcomes (in particular, birth outcomes and health risk behaviors) (Lara, Gamboa, Kahramanian, Morales, and Hayes Bautista 2005; Rogler, Cortes, and Malgady 1991; Rumbaut 1997; Salant and Lauderdale 2003).

While previous studies well documented the impact of nativity on racial/ethnic differences in health and mortality and described the health of immigrants in terms of their initial positive selection and subsequent deterioration, our current understanding of immigrant health remains incomplete. First, except for a few recent studies on immigrant health (e.g., Jasso et al. 2004; Singh and Siahpush 2002, 2001), the majority of previous studies are cross-sectional or based on at most two time points to clarify causality. In particular, this problem becomes more troublesome when many previous studies describe immigrant health change with cross-sectional data. Research based on cross-sectional data (or two time points) does not adequately measure health change over time. Further, the dynamics of socioeconomic and behavioral/cultural forces were not adequately captured. If socioeconomic and behavioral/cultural factors vary sufficiently over time, measuring these factors at baseline may miss important changes.

Second, prior research on the epidemiologic paradox emphasized the protective roles of health behaviors, family structure, and social networks to explain the favorable health and mortality outcomes of Hispanic populations. However, rather than identifying the specific roles of protective behavioral/cultural components, using acculturation scales, prior research mainly focused on the association between behavioral/cultural assimilation and immigrant health. Despite their increasing popularity, to date, acculturation scales have heavily relied on language-based items and thus have limited capabilities to incorporate immigrants' behavioral/cultural changes. Furthermore, a number of previous studies have also used proxy measures of acculturation due to data limitations.[1] Thus,

[1] Duration of residence, age at immigration, and proportion of life spent in the host society are frequently used measures of behavioral/cultural changes of immigrants. Although these proxy measures have some advantages in terms of parsimony and generalizability across broad racial/ethnic groups, research findings

much less is known about the specific processes by which protective behavioral/cultural factors are associated with health and mortality among Hispanic populations.

Third, except for a few studies (e.g., Jasso et al. 2004), previous findings suggest that SES measures, such as education and income, contribute little to the observed differences in health and mortality between immigrants and U.S.-born residents (e.g., Hummer et al. 1999; Lucas, Barr-Anderson, and Kington 2003; Singh and Siahpush 2002, 2001). These findings are puzzling since SES is one of the most consistent determinants of variations in health and mortality (Feinstein 1993; Williams 1990; Williams and Collins 1995). Although it may be argued that the comparative economic achievements of immigrants in the host country are overwhelmed by the negative impact of behavioral/cultural assimilation, it is not clear whether the lack of association between SES and the nativity differences in health and mortality may result from inadequate SES measures. For example, previous studies considered only limited socioeconomic factors, such as education and family income. Further, based on cross-sectional data, most prior research on immigrant health has measured SES at only one time. Thus, it is not clear whether previous studies captured the true socioeconomic profiles of the immigrant population.[2]

Finally, to date, systematic research has not been conducted to integrate mortality

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based on proxy measures often fail to provide a unified picture of the processes of acculturation (Cabassa 2003; Lara, Gamboa, Kahramanian, Morales, and Hayes Bautista 2005; Rogler, Cortes, and Malgady 1991; Salant and Lauderdale 2003). Thus, it is not surprising that prior research based on proxy measures found inconsistent results regarding the effect of acculturation.

[2] Evidence suggests that the use of standard income measures does not capture the true change in well-being over the life course. In particular, this problem becomes more troublesome in later life since socioeconomic well-being among old persons is more dependent upon wealth rather than income (Burkhauser and Wilkinson 1983; Henretta and Campbell 1978).

and health in the study of immigrant health. Although a number of previous studies have reported favorable mortality outcomes of immigrants, little is known about the quality of their prolonged lives. Whether or not immigrants' longer lives are associated with a prolonged period of healthy life remains unclear in the literature. Maintaining healthy life during a prolonged life is as important in defining quality of life as is the avoidance of death (Manton and Land 2000). If immigrants' longer lives are not accompanied by more years of healthy life, a simple comparison of mortality between immigrants and U.S.-born residents is far from complete and may present misleading information. Research on active life expectancy (ALE) reflects the importance of examining the quality of life resulting from the epidemiological transition in developed countries (Crimmins, Hayward, and Saito 1994; Katz, Branch, Branson, Papsidero, Beck, and Greer 1983).

Using the HRS panel data, this study examines nativity differences in physical functioning and mortality in later life. First, although several explanations have been proposed to explain the observed nativity differences in mortality and health following migration, to date, systematic research has not been conducted to assess the relative importance of each explanation. Based on rich information from the HRS, special attention will be paid to comparing the relative importance of socioeconomic status, social integration, and health behaviors in explaining nativity differences in mortality and physical functioning in later life.

Second, this study integrates mortality and disability and compares immigrants to U.S.-born residents in terms of the compression of disability. Although the literature on immigrant health indicates that immigrants have lower mortality than U.S.-born residents, little is known about the quality of immigrants' lengthy lives. This study addresses the gap in the literature by examining how mortality is associated with disability for immigrants and U.S.-born residents and illustrates the importance of integrating mortality and disability in the study of immigrant health.

3. Organization of the Study

This study consists of six following chapters. Chapter 2 reviews prior research on immigrant health. Chapter 3 discusses data and measures along with methods for analyzing mortality, physical functioning, and multi-state life table generation. Methods for handling incomplete data are also discussed. Chapter 4 provides discrete-time hazard model results for differential mortality. Chapter 5 provides latent growth model results for the trajectories of functional limitations and disability. Chapter 6 provides multistate life table model results. Finally, chapter 7 summarizes findings and discusses their implications.

Chapter 2: Review of the Literature

1. Introduction

In the following sections, this study reviews five major health-related domains: (1) infant/adult mortality and birth outcomes, (2) physical health, (3) mental health, (4) health behaviors, and (5) health insurance/health care access/utilization. Each section consists of two parts. First, previous findings on nativity differences in health-related domains are presented. Second, this study reviews previous findings with regard to immigrant health change. Because most prior research addressed immigrant health change in the context of acculturation, the following literature review on immigrant health change is also closely connected to acculturation. Acculturation or behavioral/cultural assimilation can be broadly defined as “those psychological and social changes that groups and individuals experience when they enter a new and different cultural context” (Cabassa 2003: 128). In the following review, acculturation was measured by either acculturation scales[3] or proxy measures such as duration of residence.

2. Infant/Adult Mortality and Birth Outcomes

Overall, prior research has consistently shown that immigrants in the United States experience lower infant/adult mortality risks and better birth outcomes than do

[3] Two popular acculturation scales developed for Hispanic populations are Bidimensional Acculturation Scale for Hispanics (BAS) and Acculturation Rating Scale for Mexican Americans-II (ARSMA-II). SL-ASIA was developed for Asian populations but this scale was closely modeled after acculturation scales developed for Hispanics (see Cabassa 2003; Suinn, Ahuna, and Khoo 1992)

U.S.-born residents of similar racial/ethnic backgrounds (Cabral, Fried, Levenson, Amaro, and Zuckerman 1990; Hummer, Biegler, De Turk, Forbes, Frisbie, Hong, and Pullum 1999; Hummer, Rogers, Nam, and LeClere 1999; King and Locke 1987; Landale, Oropesa, and Gorman 2000; Landale, Oropesa, Llanes, and Gorman 1999; Muennig and Fahs 2002; Peak and Weeks 2002; Singh and Siahpush 2002, 2001; Singh and Yu 1996; Weeks and Rumbaut 1991). For example, Singh and Siahpush (2001, 2002) used data from the National Longitudinal Mortality Study (1979-1989) and found that immigrant men and women 25 years or older had significantly lower risks of mortality than their U.S.-born counterparts. Singh and Yu (1996) also found that foreign-born status was associated with a substantially reduced risk of infant mortality and low birth-weight. However, several studies also suggest that the mortality gap between immigrants and U.S.-born residents is smaller or reversed in old age (Kitagawa and Hauser 1973; Muennig and Fahs 2002; Singh and Siahpush 2002, 2001). For example, Kitagawa and Hauser (1973) found that the mortality of foreign-born whites in the age group 35-64 was below that of native-born whites but the reverse was true above age 65.

Despite the initial mortality advantage, an extensive literature suggests that the mortality advantage diminishes as immigrants are acculturated into U.S. society. Prior research has documented that acculturation into U.S. society is associated with worse birth outcomes (i.e., pre-maturity, low birth-weight, teenage pregnancy, neonatal mortality) as well as with undesirable prenatal and postnatal behaviors (i.e., smoking and drug use during pregnancy) (Lara et al. 2005). For example, Cobas et al. (1996) found that acculturation has a negative effect on low birth-weight status directly and indirectly through smoking and dietary intake. Landale, Oropesa, and Gorman (2000) found that infant mortality risks rise with years of exposure to U.S. society among Puerto Rican migrant women. Landale et al. (1999) also found that early (childhood) migrant women were more likely to engage in health risk behaviors during pregnancy compared to recent migrant women.

However, some literature suggests mixed or no effects of acculturation on mortality and birth outcomes (Hummer et al. 1999; Reynoso, Felice, and Shragg 1993; Zambrana, Scrimshaw, Collins, and Dunkel-Schetter 1997). For example, Zambrana et al. (1997) found that there were no direct effects of acculturation on infant gestational age or birth-weight, even though higher acculturation was significantly associated with more undesirable health risk behaviors among Mexican origin women. Reynoso, Felice, and Shragg (1993) found that more acculturated pregnant Mexican-origin young women were not at higher risk of adverse birth outcomes, such as preterm delivery and low-birth weight, compared to their less acculturated counterparts. Hummer et al. (1999) also found that there were virtually no adult mortality differences by length of stay in the United States.

3. Physical Health

The literature suggests that overall immigrants also exhibit better physical health compared to U.S.-born residents (Cho, Frisbie, and Rogers 2004; Huang, Rodriguez, Burchfiel, Chyou, Curb, and Yano 1996; Jasso et al. 2004; Muennig and Fahs 2002; Singh and Siahpush 2002). For example, Frisbie, Cho, and Hummer (2001) found that

Asian-Pacific Islander (API) immigrants showed better health in terms of self-rated health, activity limitations, and bed days due to illness. Cho, Frisbie, and Rogers (2004) also reported similar findings among Hispanic populations. Lucas, Barr-Anderson, and Kington (2003) found that foreign-born black men reported better self-rated health compared to U.S.-born blacks. Foreign-born blacks were also less likely than U.S.-born black/white men to have functional limitations.

With respect to the impact of acculturation, prior research has documented that acculturation has a negative impact on physical health in general (Cho, Frisbie, and Rogers 2004; Finch and Vega 2003; Frisbie, Cho, and Hummer 2001; Fujimoto, Bergstrom, Boyko, Chen, Kahn, Leonetti, McNeely, Newell, Shofer, and Wahl 2000; Lucas, Barr-Anderson, and Kington 2003; Marmot and Syme 1976; Singh and Siahpush 2002). For example, Cho, Frisbie, and Rogers (2004) and Frisbie, Cho, and Hummer (2001) found that duration of residence in the United States is negatively associated with immigrant health among APIs and Hispanic populations, respectively. Lucas, Barr-Anderson, and Kington (2003) found that time in the United States is negatively associated with self-rated health among foreign-born black men. Huang et al. (1996) found that total years lived in Japan was inversely associated with the prevalence of diabetes among Japanese American men.

However, several previous studies found positive, mixed, or no effects of acculturation. For example, using the New Immigrant Survey-Pilot, Jasso, Massey, Rosenzweig, and Smith (2004) found that on average immigrant's self-rated health actually improved during the first year following migration among legal immigrants. Le

Marchand, Wilkens, Kolonel, Hankin, and Lyu (1997) found that duration of residence in the United States was unrelated to colorectal cancer which occurs predominantly in developed countries. Reed, McGee, Cohen, Yano, Syme, and Feinleib (1982) found that acculturation was positively associated with the prevalence of coronary heart disease, which is consistent with Marmot and Syme (1976), but not with the incidence.

4. Mental Health

Several previous studies found that overall immigrants had lower rates of mental health problems than U.S.-born residents (Burnam, Hough, Karno, Escobar, and Telles 1987; Takeuchi, Chung, Lin, Shen, Kurasaki, Chun, and Sue 1998). For example, Landale et al. (1999) found that island-born Puerto Rican women were less likely to experience stressful life events and showed lower levels of stress compared to U.S.-born Puerto Rican women. Burnam et al. (1987) also found that immigrant Mexican Americans were less likely to have a lifetime diagnosis of psychiatric disorders, such as major depression and obsessive-compulsive disorder, than non-Hispanic whites and native-born Mexican Americans.

However, a few studies reported different findings. For example, Wilmoth and Chen (2003) found that immigrants at midlife showed higher depressive symptoms compared to their native-born counterparts. Angel, Buckley, and Sakamoto (2001) also found that, among immigrants approaching retirement, foreign-born status was a proximate risk factor for emotional distress, even after socioeconomic characteristics were controlled for. Further, refugees generally are considered to be at high-risk of mental disorders because many refugees were exposed to significant trauma prior to immigration (Dick 1984; Steel, Silove, Phan, and Bauman 2002), even though there is some evidence that refugees also have remarkable resilience despite traumatic experiences and ongoing poverty and violence (e.g., Mollica, Cui, Mcinnes, and Massagli 2002 for Cambodian refugees).

Compared to other dimensions of health, it is difficult to find a consistent pattern on the relationship between acculturation and mental health (Lara et al. 2005; Rogler, Cortes, and Malgady 1991; Salant and Lauderdale 2003). Some studies found negative effects of acculturation among Asian (Nguyen and Peterson 1993; Shen and Takeuchi 2001) and Hispanic populations (Hovey 2000; Ortega, Rosenheck, Alegria, and Desai 2000), while others showed positive or mixed effects of acculturation (Burnam et al. 1987; Kaplan and Marks 1990; Mehta 1998; Takeuchi et al. 1998). For example, Nguyen and Peterson (1993) found that acculturation into U.S. society was positively associated with increased depressive symptoms among Vietnamese college students. In contrast, Mehta (1998) found that acculturation was negatively associated with mental health problems among Asian Indian immigrants. Kaplan and Marks (1990) found that acculturation was positively associated with psychological distress for young Mexican American adults, but negatively related for older Mexican American adults.

5. Health Behaviors

Health behaviors include substance use, such as alcohol, cigarettes, and illegal drugs, and dietary practices in this review. First, the literature on substance use suggests that on average immigrants are less likely than U.S.-born residents of similar racial/ethnic backgrounds or the U.S.-born population in general to use alcohol (Blake, Ledsky, Goodenow, and O'Donnell 2001; Cabral et al. 1990; Johnson, Vangeest, and Cho 2002; Landale et al. 1999; Lucas, Barr-Anderson, and Kington 2003; Singh and Yu 1996), smoking (Cabral et al. 1990; Landale et al. 1999; Lucas, Barr-Anderson, and Kington 2003; Perez-Stable, Ramirez, Villareal, Talavera, Trapido, Suarez, Marti, McAlister 2001; Singh and Siahpush 2002; Taylor, Kerner, Gold, and Mandelblatt 1997), and illegal drugs such as marijuana and cocaine (Blake et al. 2001; Cabral et al. 1990; Johnson, Vangeest, and Cho 2002; Singh and Yu 1996). For example, using the National Health Interview Survey, Johnson, Vangeest, and Cho (2002) found that immigrants had lower rates of past year and lifetime use of alcohol, hallucinogens, marijuana, cocaine, stimulants, sedatives, and tranquilizers.

The negative impact of acculturation stands out in substance use. Prior research has documented the negative impact of acculturation on alcohol drinking (Blake et al. 2001; Cobas et al. 1996; Landale et al. 1999; Marks, Garcia, and Solis 1990), smoking (Chen, Unger, and Johnson 1999; Landale et al. 1999; Perez-Stable et al. 2001; Singh and Siahpush 2002; Unger, Cruz, Rohrbach, Ribisl, Baezconde-Garbanati, Chen, Trinidad, and Johnson 2000), and illegal drug usage (Amaro, Whitaker, Coffman, and Heeren 1990; Blake et al. 2001; Gfroerer and Tan 2003; Johnson, Vangeest, and Cho 2002; Velez and Ungemack 1989). For example, Lucas, Barr-Anderson, and Kington (2003) found that for foreign-born blacks, the risk of smoking rose with increased length of time in the United States, even though it remained significantly lower than that for U.S.-born white men. Amaro et al. (1990) also found that acculturation into U.S. society was accompanied by a higher prevalence of marijuana and cocaine use among Mexican and Puerto Rican Americans, which holds true even when socioeconomic characteristics were taken into account.

Further, several studies (e.g., Marks, Garcia, and Solis 1990) found that the negative effect of acculturation on health risk behaviors is stronger among Hispanic women, but it appears that research on gender differences does not present a consistent pattern (see Markides, Krause, and Mendes de Leon 1988; Markides, Ray, Stroup-Benham, and Trevino 1990). In addition, a few previous studies found that acculturation was not related to alcohol consumption or smoking among Hispanic populations (e.g., Markides, Coreil, and Ray 1987; Markides, Krause, and Mendes De Leon 1988; Markides, Ray, Stroup-Benham, and Trevino 1990). For example, Markides, Coreil, and Ray (1987) found that acculturation was not related to greater likelihood of smoking among either Mexican American men or women.

With respect to dietary practices, the literature suggests that immigrants tend to have healthier dietary intake practices compared to the native-born (Guendelman and Abrams 1995; Neuhouser, Thompson, Coronado, and Solomon 2004). For example, Dixon, Sundquist, and Winkleby (2000) found that despite poverty and lower levels of education, overall, foreign-born Mexican Americans had the healthier nutrition profile, compared to their U.S.-born counterparts. However, several studies also found that acculturation is negatively related to healthy diets (Cobas et al. 1996; Dixon, Sundquist, and Winkleby 2000; Guendelman and Abrams 1995; Fujimoto, Bergstrom, Boyko, Chen, Kahn, Leonetti, McNeely, Newell, Shofer, and Wahl 2000; Huang et al. 1996; Neuhouser et al. 2004). For example, using the data from the Massachusetts Hispanic Elderly Study (MAHES), Bermudez, Falcon, and Tucker (2000) found that the more acculturated Hispanic elders had a macronutrient profile closer to that of the non-Hispanic whites than the less acculturated Hispanics, even though Hispanic elders consumed significantly less saturated fat and simple sugars and more complex carbohydrates than did non-Hispanic whites.

6. Health Insurance/Health Care Access/Utilization

The literature suggests that immigrants are less likely to gain access and utilize health insurance and health care (including preventive) services (Borrayo and Guarnaccia 2000; Carrasquillo, Carrasquillo, and Shea 2000; Dey and Lucas 2006; Frisbie, Cho, and Hummer 2001; Granados, Puvvula, Berman, and Dowling 2001; LeClere, Jensen, and Biddlecom 1994; Lucas, Barr-Anderson, and Kington 2003; Thamer, Richard, Casebeer, and Ray 1997). Prior research also suggests that immigrants tend to underutilize mental health services (Vega, Kolody, Aguilar-Gaxiola, and Catalano 1999). In addition to the lack of health insurance, immigrants face other barriers, such as linguistic and cultural barriers, which can negatively affect access to care, preventive care, adherence to therapy, use of health services, and patient satisfaction (Flores, Rabke-Verani, Pine, and Sabharwal 2002; Lu 2002; Ngo-Metzger, Massagli, Clarridge, Manocchia, Davis, Iezzoni, and Phillips 2003).

With respect to health insurance, Carrasquillo, Carrasquillo, and Shea (2000) found that 43.6 percent of all non-citizen immigrants in the United States lacked health insurance, compared with only 14.2 percent of the native-born in 1997. In particular, Hispanic immigrants have the highest rate of uninsured in the United States due to higher rates of poverty, low levels of educational attainment, higher rates of employment in industries that traditionally do not offer health insurance, and higher rates of undocumented immigrants (Dey and Lucas 2006; Thamer et al. 1997). Furthermore, welfare reform regarding immigrants' eligibility for federally funded Medicaid in 1996 has negative implications (Ellwood and Ku 1998).

Compared to health risk behaviors, research on health care access/utilization found that acculturation has positive impacts (Lucas, Barr-Anderson, and Kington 2003; Hu and Covell 1986; Thamer et al. 1997; Wells, Golding, Hough, Burdam, and Karno 1989). For example, Thamer et al. (1997) found that immigrants residing in the United States for less than 15 years were 1.5 to 4.7 times more likely to be uninsured than were non-Hispanic whites. However, the gap was substantially reduced for immigrants residing in the United States for 15 years or more. LeClere, Jensen, and Biddlecom (1994) found that duration of residence in the United States has strong and relatively robust effects on the access and volume of care for immigrants. Wells et al. (1989) also found that the more acculturated have less barriers to mental health care. The literature suggests that acculturation is also associated with higher use of some preventive services, such as breast cancer screening practices, among Hispanic women (Marks, Garcia, and Solis 1990; O'Malley, Kerner, Johnson, and Mandelblatt 1999; Peragallo, Fox, and Alba 1998).

7. Overview of Research Questions

Chapter 4 and 5 address mortality and physical functioning, respectively. Each chapter consists of two parts. First, the association between immigrant status and mortality/functioning is investigated. Progressive adjustment is then used to identify the determinants of the observed nativity differences in mortality and physical functioning. Second, the effect of immigrant status on mortality/functioning is investigated in the context of race/ethnicity. The main goad of this part is to compare foreign-born racial/ethnic minorities to native-born whites in mortality and physical functioning. Progressive adjustment is also used to identify the determinants of the observed mortality/functioning differences between native-born whites and foreign-born racial/ethnic minorities.

Chapter 6 integrates mortality and physical functioning in the analysis of active life expectancy. First, this chapter describes health transitions between three health states (active, disabled, and death) and then examines how immigrant status and race/ethnicity are associated with health transitions. Second, this chapter calculates life table indexes (total life expectancy, active life expectancy, and disabled life expectancy) and compares immigrants to U.S.-born residents in terms of the quality of life across racial/ethnic groups. The goal of this chapter is to identify patterns of the association between mortality and disability across immigrant status and race/ethnicity in terms of the compression of disability.

Chapter 3: Data and Methods

1. Data

The data for this study were obtained from the Health and Retirement Study (HRS). The original HRS survey was designed to follow individuals (and their spouses or partners) who made the transition from active worker into retirement (aged 51 - 61). Compared to the HRS, the Asset and Health Dynamics among the Oldest Old (AHEAD) survey was designed to investigate the dynamic interactions between health, family, and economic variables in the post-retirement period (aged 70 or over). In the original HRS and AHEAD cohorts, blacks, Hispanics, and Florida residents were oversampled. The HRS collected data in 1992, 1994, and 1996 and the AHEAD collected data in 1993 and 1995.

These two related surveys were merged into a single data collection effort in 1998. Since 1998, the entire survey is referred to as the HRS and has been conducted every two years. Furthermore, baseline information was added for two new sub-samples: Children of the Depression (CODA) (born in 1924 through 1930) and War Baby (WB) (born in 1942 through 1947). Thus, now the HRS panel study represents all persons over 50 years of age in the United States. The overall response rates range from a low of 86.8 percent (2000) to a high of 87.8 percent (2004) since 1998. This study obtains baseline information from the 1998 HRS survey to ensure that results are representative of individuals over 50 in the United States.

The HRS conducted 23,241 interviews during the 1998 period and these include interviews of 11,302 respondents in the fourth wave of HRS, 6,337 respondents in the third wave of AHEAD, 2,128 baseline interviews of persons in the CODA cohort and their spouses, and 3,474 respondents in the War Baby cohort and their spouses. The analytic sample in this study consists of 20,568 respondents over 50 years of age at baseline.[4] This study used the person-level analysis weight to adjust for stratification, clustering, and differential selection probabilities in the HRS sample design.

Regarding the analysis of mortality, survival information was obtained from the National Death Index 2002, which contains records of HRS sample respondents identified by the National Center for Health Statistics probabilistic matching procedure as being deceased as of 2002. Supplementary information was also obtained from HRS Exit interviews. The HRS has conducted Exit interviews for deceased respondents in every wave since the 1995 wave of AHEAD. The Exit interview was administered to someone knowledgeable about a respondent who died since the last wave (e.g., surviving spouse or close family member). The data indicate that, out of 20,568 respondents over age 50 at baseline, 15,002 respondents (72.94 percent) survived by the 2004 interview and 3,881 respondents (18.87 percent) died. The data also indicate that the number of losses to follow-up is 1,685 cases (8.19 percent).

2. Measures

Health Outcomes. Physical functioning (along with mortality) is the outcome variable and is also used as a predictor of mortality in this study. Physical functioning is assessed

[4] However, if individuals met the age eligibility requirement (over 50) during the observation period, their corresponding person-period records were included in the analysis.

from physical and daily task limitations. The number of functional limitations was enumerated from six NAGI physical performance items (Nagi 1976). Those NAGI items include walking several blocks, climbing several flights of stairs, stooping, kneeling, and crouching, lifting/carrying weights over 10 pounds, picking up a dime from a table, and reaching/extending arms above shoulder level. Disability was measured in terms of basic activities of daily living (ADL) and instrumental activities of daily living (IADL) tasks. Five ADL tasks include walking, dressing, bathing, eating, and getting in/out of bed. Five IADL tasks include using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. All NAGI, ADL, and IADL items are dichotomous measures, indicating whether the respondent has difficulty performing each item of NAGI, ADL, and IADL (yes = 1). Three composite NAGI (range 0-6), IADL (range 0-5), and ADL (range 0-5) scales were constructed by summing up the corresponding items.

This study also considers self-rated health, chronic conditions, and depressive symptoms as covariates. Self-rated health is considered a valid and reliable overall health measure and is a strong predictor of mortality (Idler and Benyamini 1997; Mossey and Shapiro 1982; Ross and Wu 1995). Although self-rated health is frequently considered an outcome variable, it is also predictive of change in morbidity and disability (Ferraro, Farmer, and Wybraniec 1997; Idler and Kasl 1995). Self-rated health was measured by an ordinal scale of health status, ranging from 1 (excellent) to 5 (poor).

Chronic conditions affect physical functioning along with mortality. With respect to chronic conditions, this study created 8 chronic condition dummies based on an affirmative response to a physician report of chronic conditions in the analysis of mortality: cancer, heart disease (heart attack, coronary artery disease, congestive heart failure, angina, and other), lung disease, stroke, arthritis, diabetes, hypertension, and emotional/psychiatric problems. However, in the analysis of physical functioning, this study measured morbidity as the sum of 8 chronic chronics (range 0-8) due to computational issues. Evidence suggests that these two approaches (using the sum of chronic conditions vs. using dummy variables for each chronic condition) produce almost identical results (Liang, Lawrence, Bennett, and Whitelaw 1990).

The Center for Epidemiologic Studies Depression (CES-D) scale was used to measure depressive symptoms in this study. Depression, in particular late-life depression, is costly because of associated mortality, disability, and other health problems (Penninx, Leveille, Ferrucci, van Eijk, and Guralnik 1999; Turvey, Conwell, Jones, Phillips, Simonsick, Pearson, and Wallace 2002). Respondents were asked to report whether they have experienced the following feelings much of the time during the past week (0 = no; 1 = yes): (1) you felt depressed, (2) you felt that everything you did was an effort, (3) your sleep was restless, (4) you were happy (reversed), (5) you felt lonely, (6) you enjoyed life (reversed), (7) you felt sad, and (8) you could not get going. A composite depressive symptoms scale was created, ranging from 0 to 8.

Socio-demographics. First, demographic characteristics include immigrant status, race/ethnicity, gender, and region of residence. Immigrant status is a dummy variable which is based on a self-report of place of birth (foreign-born = 1). Respondents were classified into five mutually exclusive racial/ethnic groups: non-Hispanic whites (reference), non-Hispanic blacks, non-Hispanic Asian/Native Americans (including Alaskan Natives), Mexicans, and non-Mexican Hispanics. Although prior research on race/ethnicity and health suggests that Asian Americans and Native Americans show substantially different patterns, unfortunately, it is not possible to separate two racial/ethnic groups due to data limitations of the HRS. Geographical region was categorized into four groups: Northeast (reference), Midwest, South, and West.

Second, this study considers individual-level, familial-level, and neighborhood or community-level SES indicators. Substantial evidence indicates that socioeconomic status is one of the most consistent determinants of variations in health (see Mirowsky and Ross 2003). Education as individual-level SES was measured in terms of the completed years of schooling. Occupations for the job with the longest reported tenure were categorized into nine categories: professional (reference), managerial, sales, clerical/administrative support, service, farming, precision production/craft/maintenance, transportation/machine operators, and occupation not reported.

This study also considers household income and wealth as familial-level SES indicators. Household income represents income received by the respondent and spouse/partner during the preceding year from all sources. Household wealth represents the household net worth (assets minus liabilities) in terms of housing and non-housing equity. Log-transformed household income and wealth variables are used in this study. This study also considers parental education which is a dichotomous variable, indicating whether parental education is seven years or less. To control for earlier life experiences, this study also includes parental mortality status, indicating whether respondent's father or mother is alive (alive = 1).

Further, two housing characteristics are considered: housing types and persons per room. Housing types were categorized into three groups: one-family/two-family house (reference), apartment/townhouse, and mobile home. Overcrowded housing was defined in terms of persons per room (PPR) in the household. This study also includes two neighborhood-level SES indicators: living in a central metropolitan area and self-rated neighborhood safety. Living in a central metropolitan area is a dichotomous variable and self-rated neighborhood safety was measured by an ordinal scale, ranging from 1 (excellent) to 5 (poor).

Social Integration. This study addresses the roles of family structure and social networks in terms of social integration. A key component of social integration concerns "the degree to which an individual is embedded in a broader network of social relations" (Booth, Edwards, and Johnson 1991: 209). Although evidence suggests that social integration influences patterns of health and mortality (e.g., Moen, Dempster-McClain, and Williams 1989), the specific mechanisms by which social integration is associated with health and mortality are not clearly understood. Wethington, Moen, Glasgow, and Pillemer (2000: 58) presents four mechanisms by which social integration influences health: (1) access to social support; (2) stable alliance with others in like-minded groups; (3) social control and socialization; (4) identity maintenance processes; and (5) information exchange relevant to health behavior and maintenance.

The indicators of social integration include marital status/living arrangements, employment status, children living within ten miles, number of children in contact, number of siblings in contact, relatives in neighborhood, good friends in neighborhood, religious affiliation, salience of religion, primary language spoken at home, and geographic mobility. This study combined marital status and living arrangements. Marital status and living arrangements were classified into four mutually exclusive categories: couple only (reference), couple with children/others, single with children/others, and living alone.[5] Employment status was categorized as currently working for pay versus not working. Three other social integration indicators capture the proximity of social networks. Respondents were asked whether there are relatives and good friends in the neighborhood or children living within ten miles (yes = 1). Religious affiliation was categorized into four groups: Protestants (reference), Catholics, other religions, and no religion. In addition, this study also considers the salience of religion, even though this measure does not capture an objective condition. The salience of religion measures the importance of religion to the respondent: very important (reference), somewhat important, and not too important. The primary language spoken at home is a dummy variable, indicating non-English language use in the household. Geographic mobility was measured in terms of change in the main residence, indicating whether the respondent changed his/her main residence between the observation period.[6]

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[5] Living with only non-family members are minimal in the analytic sample and thus the distinction between family and non-family members is not made in this study.
[6] Residential relocation is considered one of stressful life events, especially in later life (Choi 1996), but it is not possible to identify whether residential relocation is voluntary or forced in this study.

Health Behaviors, Health Insurance, and Medical Care Utilization. Health behaviors were measured in terms of smoking, alcohol consumption, regular exercise, and body mass index. Smoking substantially increases the risk of death from cancer, heart/respiratory diseases and has great potential to diminish life expectancy. Overweight/obesity also increases the risk of high blood pressure, heart disease, diabetes, disability, and mortality.[7] In contrast, vigorous physical activity reduces mortality and predicts healthy life. Regarding drinking, research indicates an inverted U-shaped relationship between alcohol consumption and health. Compared to both abstainers and heavy drinkers, moderate drinkers have lower mortality and morbidity (Ferrucci, Izmirlian, Leveille, Phillips, Corti, and Brock 1999; Mirowsky and Ross 2003; Rogers, Hummer, Krueger, and Pampel 2005).

Smoking status (current smoking) and regular exercise (3 times or more per week) are dichotomous measures.[8] Alcohol consumption was categorized into three groups: none (reference), moderate drinking (less than 3 drinks/day), and heavy drinking (3 or more drinks/day). In addition, body mass index (BMI) was calculated from self-reported height and weight. BMI was classified into four categories: underweight (BMI < 18.5), normal weight (reference) ($18.5 \leq$ BMI ≤ 24.9), overweight ($25 \leq$ BMI ≤ 29.9), and obesity (BMI ≥ 30).

This study also considers health insurance and medical care utilization measures.

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[7] However, Reynolds, Saito, and Crimmins (2005) found that obesity has little effect on life expectancy in adults aged 70 years and older, even though obese adults are more likely to be disabled.

[8] From the 2004 HRS survey, the single question about exercise or vigorous physical activity was replaced with three questions about physical activity covering vigorous, moderate, and light physical activity and the possible responses also changed. This study filled in missing values of regular exercise in 2004 by carrying forward the values from the 2002 HRS. If 2002 HRS information is not available, missing values were imputed by multiple imputation.

Research indicates that medical care utilization and health insurance do not improve health. Compared to health behaviors, the role of medical care utilization (including check-ups and screening) is not to prevent the onset of disease. Further, the role of health insurance is to reduce economic hardship that erodes health, rather than improving health directly (see Mirowsky and Ross 2003). With respect to health insurance, five health insurance dummy variables were created: Medicare, Medicaid, employer-sponsored health insurance (including spouse's employment), long-term care (LTC) health insurance, and other health insurance (any insurance other than government, employer-sponsored, or long-term care insurance). This study also considers three medical care utilization measures: hospital, nursing home, and doctor visit. These dummy variables indicate whether the respondent reported any overnight hospital/nursing home stay, or doctor visit since the last interview or the last two years.

Table 3.1. Weighted Percentage Distributions of Selected Variables at Baseline

	Native-Born					Foreign-Born				
	White	Black	Asian/NA	Mexican	Other HP	White	Black	Asian/NA	Mexican	Other HP
Age (mean)	65.76	64.78	63.28	62.61	64.53	68.23	62.28	63.49	63.27	64.22
Female	54.69	59.72	52.91	52.34	55.24	56.62	57.64	56.31	53.04	62.56
Education (mean)	12.68	10.81	11.57	9.19	11.08	12.20	11.15	13.49	4.99	9.21
Occupation										
Professional	12.98	8.75	15.54	6.29	10.32	14.42	10.51	18.25	.24	4.75
Managerial	12.00	5.26	8.84	5.74	7.21	10.56	7.47	14.04	2.72	3.73
Sales	8.05	3.03	4.34	4.16	5.86	8.02	2.67	6.54	5.68	3.68
Clerical	12.73	8.77	8.80	9.63	8.79	10.97	11.57	11.19	2.60	6.79
Service	7.49	21.71	10.95	15.84	10.53	8.09	37.54	12.82	12.45	21.35
Farming	2.21	2.06	4.73	5.91	4.14	.91	.83	2.63	10.85	1.49
Mechanics	9.00	7.16	9.51	10.05	12.29	8.71	5.27	6.81	9.98	5.77
Operators	9.00	17.51	14.01	19.61	15.92	8.39	5.50	9.07	26.51	20.57
Not Reported	26.56	25.74	23.27	22.75	24.94	29.93	18.64	18.65	28.97	31.87
HH Income (median, in $1,000s)	34.50	17.70	21.20	18.52	24.20	32.38	18.80	34.60	12.05	14.89
HH Wealth (median, in $1,000s)	159.50	34.04	60.00	45.30	60.52	177.00	43.00	114.50	27.30	7.00
Housing Type										
Single/Duplex	82.30	77.37	76.32	87.53	72.03	77.17	71.70	78.37	82.44	51.07
Apartment	10.70	19.91	15.37	6.50	16.47	18.99	28.03	20.50	11.38	47.18
Mobile Home	7.01	2.72	8.30	5.97	11.49	3.84	.27	1.14	6.17	1.75
Mother's Education (7 or less)	21.61	43.20	41.08	72.56	54.98	31.61	43.40	54.15	88.97	67.09
Father's Education (7 or less)	27.89	52.21	46.69	74.51	55.96	28.43	38.39	32.87	86.42	58.95
Mother Alive	24.60	23.09	25.51	28.44	23.21	21.34	25.42	25.58	26.69	25.12
Father Alive	10.05	8.81	9.95	12.23	10.48	7.26	23.86	9.71	12.63	10.93
Central Metropolitan Residence	39.42	48.69	32.98	35.57	39.41	67.35	91.36	69.56	37.13	87.88
Region of Residence										
Northeast	18.45	15.09	9.93	.71	16.35	34.27	71.72	25.61	.36	35.91
Midwest	28.93	20.82	17.87	6.19	7.14	19.61	2.49	13.78	4.86	3.46
South	34.69	56.81	46.22	48.98	26.89	18.66	23.50	22.12	5.51	43.48
West	17.92	7.28	25.98	44.12	49.61	27.46	2.29	38.49	39.68	17.15
Neighborhood Safety (mean)	1.95	2.82	2.44	2.59	2.20	1.88	2.59	2.04	2.77	2.64

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Table 3.1. (*Continued*)

	Native-Born					Foreign-Born				
	White	Black	Asian/NA	Mexican	Other HP	White	Black	Asian/NA	Mexican	Other HP
Living Arrangements										
Couple Only	48.41	21.25	29.20	26.91	32.06	46.61	13.52	24.52	19.83	24.33
Living Alone	22.69	28.33	24.03	16.13	24.38	21.25	17.97	14.01	11.21	17.91
Single/Children	11.27	29.97	20.73	20.83	20.72	11.69	31.98	19.35	17.19	32.04
Couple/Children	17.63	20.45	26.04	36.12	22.85	20.46	36.53	42.12	51.76	25.72
Children in Contact (Mean)	3.03	3.59	3.37	4.14	3.50	2.71	4.13	2.88	5.03	3.14
Children within 10 Miles	54.97	59.89	56.03	63.73	50.21	49.21	51.80	34.54	72.03	54.83
Sibling in Contact (Mean)	2.30	3.36	3.27	4.46	3.47	2.27	4.66	3.86	4.21	3.73
Relative in Neighborhood	29.56	32.73	33.86	36.87	32.56	24.01	32.99	25.42	30.22	19.11
Friend in Neighborhood	68.41	64.40	61.56	63.68	69.06	71.25	69.41	63.50	64.90	59.89
Religion										
Protestant	64.36	89.55	63.77	20.89	29.61	41.09	59.30	22.78	14.31	14.67
Catholic	25.88	4.49	16.98	71.57	64.41	39.71	28.61	34.57	83.29	78.68
Other	3.61	1.76	9.83	.77	.78	10.87	3.13	36.85	.59	1.24
No Religion	6.15	4.19	9.42	6.77	5.20	8.33	8.96	5.80	1.81	5.40
Salience of Religion										
Not Too Important	12.87	3.89	16.42	5.55	11.69	20.62	4.86	15.41	6.35	8.17
Somewhat Important	28.50	10.72	23.47	23.99	26.75	30.09	14.02	18.42	20.10	20.30
Very Important	58.63	85.39	60.11	70.46	61.56	49.29	81.13	66.17	73.55	71.53
Paid Work	43.87	38.83	43.20	44.24	39.79	38.40	56.26	51.71	38.60	40.73
Regular Exercise	45.54	36.04	40.06	42.83	47.31	42.43	38.47	40.49	41.90	37.32
Smoking	17.18	23.21	25.43	18.10	10.91	12.91	5.37	10.17	17.65	13.48
Drinking										
None	66.51	81.39	81.24	73.91	68.26	56.67	83.58	80.26	80.40	80.80
Moderate Drinking	26.14	12.29	10.72	14.04	22.79	37.30	13.98	17.16	10.43	11.51
Heavy Drinking	7.35	6.33	8.04	12.04	8.95	6.04	2.44	2.58	9.17	7.69
Body Mass Index										
Underweight	2.12	2.34	2.40	1.65	1.40	2.07	1.16	2.58	2.14	2.30
Normal	37.01	25.00	24.79	22.41	38.57	44.43	33.73	53.09	22.21	36.74
Overweight	39.19	37.91	41.33	43.94	38.46	37.79	44.71	31.78	43.77	40.97
Obesity	21.67	34.75	31.48	31.99	21.58	15.71	20.40	21.55	31.88	19.99
NAGI (mean, range 0-6)	1.45	1.92	1.74	1.68	1.49	1.31	1.44	1.23	1.71	1.60
ADL (mean, range 0-5)	.26	.48	.44	.41	.41	.32	.29	.17	.52	.51
IADL (mean, range 0-5)	.21	.43	.38	.39	.32	.31	.22	.21	.42	.40
Number of Deaths	2,793	601	51	100	21	170	19	10	51	65
Sample Size	15,025	2,720	251	547	182	728	141	141	376	457

Note: Asian/NA = Asian/Native American; Other HP = Other Hispanic.

3. Methods

1) Differential Mortality

To examine the mortality difference between immigrants and U.S.-born residents, this study estimated a series of discrete-time hazard models (separately for males and females). In this study, the time metric was calculated between the age at the baseline survey and death (or the age at the last interview for censored cases). The HRS interviewed age-heterogeneous groups of old people at baseline. Thus, this study adjusted late entrants in statistical modeling. More specifically, individuals must have entered the measurement window but they must not have already died in order to be in the corresponding risk set. This study used a complementary log-log link instead of a logit link for the discrete-time hazard model. In general, fitted hazard models from logit and clog-log link functions are indistinguishable unless hazard is high. However, the underlying time metric (age) is truly continuous in this study and the only reason we observe discretized time values is due to measurement difficulties. In addition to the identification of the shape of the hazard function, the primary advantage of fitting the discrete-time hazard model with a clog-log link is that it invokes a proportional hazard assumption which is directly analogous to the continuous time hazard model (e.g., the Cox regression model) (Singer and Willett 2003).

With respect to the representation of the main effect of time, this study used a functional form of the baseline hazard. Although we can use a nonparametric specification for time by including time indicators, this approach to the baseline hazard

(1) lacks parsimony since it requires the inclusion of many unknown parameters in the model; and (2) results in fitted hazard functions that fluctuate erratically across consecutive ages, in particular, advanced ages, due to sampling variation resulting from small data points (Beck, Katz, and Tucker 1998; Singer and Willett 2003). This study examined several polynomial specifications for the main effect of time in the clog-log hazard function and found that the linear specification for time works as well as the completely general one. This study also subtracts a centering constant 65 from age to facilitate interpretation. Thus, the full model equation takes the form of

$$\log[-\log(1-h(t_{ij}))] = \alpha_0 + \alpha_1(AGE_{ij} - 65) + \sum_k \boldsymbol{\alpha}_k \mathbf{X}_{i \cdot k} + \sum_p \boldsymbol{\alpha}_p \mathbf{Z}_{ijp}, \quad (1)$$

where $\mathbf{X}$ is a vector of time-invariant covariates and $\mathbf{Z}$ is a vector of time-varying covariates.[9] After examining the association between immigrant status, race/ethnicity, and mortality, progressive adjustment is then used to investigate the determinants of the observed difference in mortality (see Mirowsky 1999 for details on progressive adjustment). Progressive adjustment can account for the observed association between immigrant status, race/ethnicity, and mortality by examining how the association changes after adjustment for a set of covariates.

[9] In this study, except for race/ethnicity, gender, immigrant status, education, longest-held occupation, parental education, religion, and language spoken at home, all other variables are time-varying covariates.

2) Trajectories of Functional Limitations and Disability

To examine functional health trajectories, this study estimated a series of latent growth models (or random coefficients models). Given that the developmental trajectories of functional limitations and disability are closely associated, this study estimated a series of associative growth models to simultaneously investigate differences and similarities between functional limitations and disability over the observation period. It is possible to consider three parallel growth processes of ADLs, IADLs, and NAGIs. However, the data indicate that the trajectories of ADLs and IADLs are highly correlated.[10] Although there is little consensus as to how functional health measures should be treated, this study combines ten ADL/IADL items in terms of disability (α = .82, .83, .83, and .82). Conceptually, ADLs and IADLs refer to individual capability to perform expected social role activities (Verbrugge and Jette 1994). In contrast, NAGI items, which are aspects of functional limitations, are relatively situational-free and refer to individual capability without reference to his/her environment (α = .78, .78, .77, and .76). Log transformed functional limitation (NAGIs) and disability (ADLs/IADLs) scales are used in order to reduce skewness.

This study assumes that each respondent's change in functional health over the observation period can be adequately represented by a straight line.[11] Let *i* and *j* denote individuals and repeated observations, respectively. Further, denote a vector of time-

[10] The data indicate that the estimated correlations between two slopes as well as two intercepts of ADL and IADL trajectories exceed .90. Introducing higher order factors could be an alternative method to handle the multicollinearity problem. However, this study does not consider this approach since the data indicate that the effect of immigrant status is different across functional limitations and disability.

[11] Empirical growth plots also indicate that the linear representation of time is appropriate. The inclusion of quadratic terms in the unconditional associative growth model slightly improves model fit. However, compared to the added complexity in the model, the improvement remains minimal.

invariant and time-varying covariates by $\mathbf{X}$ and $\mathbf{Z}$, respectively. In terms of a multi-level or hierarchical structure, the latent growth model can be partitioned into the within-individuals model

$$Y_{ij} = \pi_{0i} + \pi_{1i}T_{ij} + \sum_{p} \boldsymbol{\pi}_{pi}\mathbf{Z}_{pi(j-1)} + \varepsilon_{ij}, \tag{2}$$

and between-individuals model

$$\begin{aligned} \pi_{0i} &= \gamma_{00} + \sum_{k} \boldsymbol{\gamma}_{0k}\mathbf{X}_{ki} + \zeta_{0i} \\ \pi_{1i} &= \gamma_{10} + \sum_{k} \boldsymbol{\gamma}_{1k}\mathbf{X}_{ki} + \zeta_{1i} \\ \boldsymbol{\pi}_{pi} &= \boldsymbol{\gamma}_{p0}, \end{aligned} \tag{3}$$

with

$$\varepsilon_{ij} \sim N(0, \sigma_{\varepsilon}^{2}) \quad \text{and} \quad \begin{bmatrix} \zeta_{0i} \\ \zeta_{1i} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_{0}^{2} & \sigma_{01} \\ \sigma_{10} & \sigma_{1}^{2} \end{bmatrix} \right), \tag{4}$$

where Y_{ij} is the value of functional health for individual *i* at time *j*, π_{0i} is the intercept of the functional health trajectory for individual *i* when all time-varying covariates are zero ($\mathbf{Z} = 0$) in 1998 ($T = 0$), π_{1i} is the conditional rate of change in functional health for individual *i*, γ_{00} represents the population average of the intercept for the baseline group ($\mathbf{X} = 0$ and $\mathbf{Z} = 0$) in 1998, γ_{10} is the population average rate of change in functional health for the baseline group, $\boldsymbol{\gamma}_{0k}$ and $\boldsymbol{\gamma}_{1k}$ are the conditional effects of time-invariant covariates on the intercept and slope respectively, and $\boldsymbol{\gamma}_{p0}$ is the conditional effects of time-varying covariates.[12] Consistent with the analysis of mortality, progressive adjustment is used to examine the determinants of the observed difference in physical function across immigrant status and race/ethnicity.

This study restricts attention to the main effects of time-varying covariates and, like time-invariant covariates, the effects of time-varying covariates are constrained to be constant across population members. Further, this study coded time-varying covariates so that the values in time period *j* refer to measures at previous time periods in order to link prior status on time-varying covariates with current status on functional health. Although we cannot exclude the possibility of reverse causality such as anticipating effects, this approach is less prone to inferential problems and helps us to better understand the roles of covariates in explaining nativity differences in functional health. One drawback of this approach is information loss for the first time period. However, this problem is not substantial in this study because over 75 percent of the 1998 HRS respondents were interviewed in 1995 (AHEAD) or in 1996 (HRS). This study fitted the latent growth models in a person-level data format and used a reduced set of covariates because of computational issues (e.g., numerical integration of incomplete data).[13]

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[12] Compared to the analysis of mortality, the time metric in the latent growth models is the year of data collection. The HRS is a collection of age-heterogeneous individuals and thus an accelerated cohort design is preferable (e.g., individually-varying times of observations). However, this study does consider this approach due to identification (variance components) and convergence problems.

[13] Total 21,103 cases who met age eligibility during the observation period were used in the latent growth models. In the growth models, a composite chronic condition measure was created by summing up eight chronic conditions and, with respect to marital status/living arrangements, the reference group is couple only or with children/others. Further, age is treated as a time-invariant covariate (age at baseline) and the effects of age on the intercepts and slopes of functional limitations and disability are estimated.

3) Active and Disabled Life Expectancy

Prior research has operationalized the concept of active life expectancy (ALE) in many different ways. This study defines active life in terms of life free of severe disability. More specifically, following Katz et al. (1983), active life expectancy is defined as the period of life free of disability in activities of daily living (ADL). Given that ADL tasks are key components of maintaining independent living, individuals were considered disabled or inactive if they reported any difficulty performing at least one of 5 ADL tasks in this study (see also Land, Guralnik, and Blazer 1994). Further, evidence also suggests that changing the ADL cutoff for defining individuals as disabled has relatively little effect on ALE estimates (Lynch, Brown, and Harmsen 2003).

The objective of analyzing active or disabled life expectancy is to estimate the expected time in an active or disabled state rather than identifying the determinants of mortality and functional health. To estimate the expected time in an active or disabled state, thus this study seeks a parsimonious model. In addition to age, this study considers race/ethnicity and immigrant status as covariates. Further, in estimating total, active, and disabled life expectancy, race/ethnicity was categorized into four mutually exclusive groups: non-Hispanic whites, non-Hispanic blacks, Hispanics, and Asian/Native Americans.

Active life expectancy was calculated by Markov-based multi-state life table models in this study. Following Laditka and Wolf (1998) and Lievre, Brouard, and Heathcote (2003), this study used a maximum-likelihood method to model a process of discrete time transitions between functional status states. The primary advantage of this approach is that this method produces standard errors of the parameter estimates from which life expectancy indexes are calculated. Further, this approach also allows us to analyze unbalanced (varying numbers of measurement occasions across individuals) and time-unstructured (variably spaced measurement occasions across individuals) panel data. In addition to an absorbing state (dead: state 3), this study also defined two non-absorbing functional status states: active (state 1) and disabled or inactive (state 2). Bidirectional transitions between active and inactive states were also allowed. Figure 3.1 shows health states and transitions across states in this study. Let P_x^{ij} denote a 1 month transition probability of occupying status *j* conditional on the initial status *i* at age *x*. First, the following multinomial logit regression model is fitted to model the log odds of the transition to and from disability and to death with age.

$$\log \frac{P_x^{ij}}{P_x^{ii}} = \beta_{ij0} + \beta_{ij1} AGE + \beta_{ij2} BLACK + \beta_{ij3} HISPANIC$$

$$+ \beta_{ij4} ASIAN / NATIVE\ \ AMERICAN \ + \ \beta_{ij4} IMMIGRANT, \qquad (5)$$

where $i = 1, 2$; $j = 1, 2, 3$; and $i \neq j$.

Second, the one-step transition probabilities are then used to construct a multi-state life table to calculate total, active, and disabled life expectancy. The total life expectancy at age *x* is the sum of life expectancy spent in active and disabled states irrespective of the initial state ($e_x^{\cdot\cdot} = e_x^{\cdot 1} + e_x^{\cdot 2}$). Further, life expectancies in each disability state irrespective of the initial state ($e_x^{\cdot j}$) are the weighted mean of e_x^{1j} and e_x^{2j}. The weights are the proportions of individuals in each disability state at any age, which are calculated from the incidences of disability, recovery, and mortality (stable or period prevalence of disability) at earlier ages to get period indexes. Separate models were estimated for males and females using person-level sampling weights.[14]

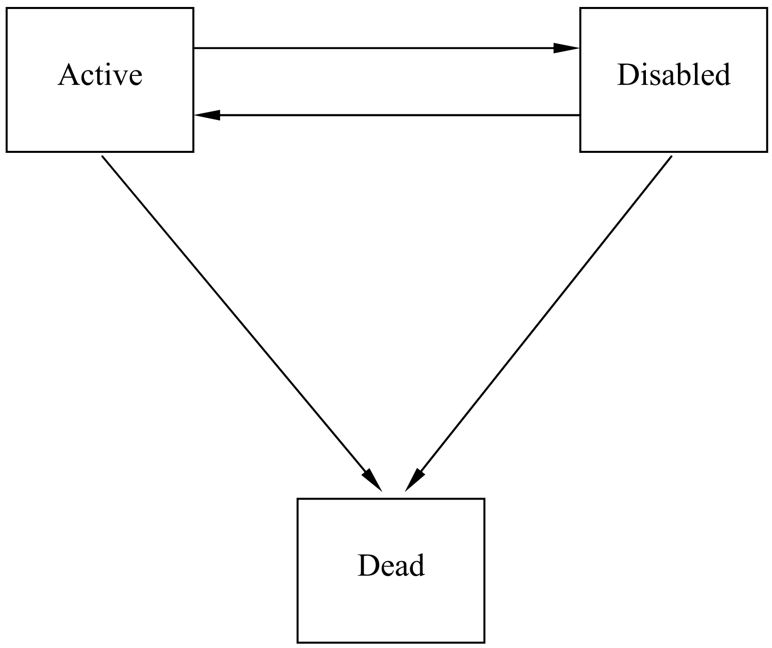

Figure 3.1. Health States and Transitions across States

[14] Total 21,075 cases (8,895 males and 12,180 females), who met age eligibility during the observation period, were used in calculating life table indexes. Respondents with missing information on race/ethnicity and immigrant status were excluded in the analysis (n = 28).

4) Incomplete Data

This study deals with incomplete data using multiple imputation instead of deleting cases with missing values. Specifically, this study used the multivariate imputation by chained equations (MICE) (Van Buuren, Boshuizen, and Knook 1999; Van Buuren and Oudshoorn 2000). Multiple imputation with the MICE method fits regression models (e.g., normal linear regression, binary logistic regression, multinomial logistic regression, and ordered logistic regression) for each different type of variable with missing data instead of fitting a single comprehensive model under the assumption of multivariate normality (e.g., SAS PROC MI). In particular, the MICE method is useful for handling large complex data with many different types of variables in the imputation process. In the imputation process, this study also included 1995 AHEAD and 1996 HRS data to create lagged covariates in latent growth models. Although it is desirable to carry out multiple imputation in a person-level data set, multiple imputation was implemented in a person-period format due to multicollinearity and computational issues.

Let $Y = (Y_1, Y_2, \ldots, Y_k)$ be a set of k random variables. Under the assumption of Missing at Random (MAR),[15] the MICE method draws imputations from the posterior density of missing values of a variable conditional on other variables. In the first round, it

[15] Missing data are missing at random (MAR) if the distribution of missingness does not depend on missing data. Further, missing data are missing completely at random (MCAR) if the distribution of missingness does not depend on observed or missing data. Under the MCAR assumption, the missingness is completely independent of all other variables, whereas the missingness may depend on other variables under the assumption of MAR (but only through observed quantities of other variables). In both MCAR and MAR, thus it is assumed that the failure to observe a certain data point is independent of the missing data. If these conditions are violated, missing data are non-ignorable or missing not at random (MNAR). One important consequence of the MAR assumption is that maximum likelihood estimation of the parameters of the model for the complete data (not for the observed data) can be made without regard for missing-data mechanisms (Schafer 1997).

repeats the following sequence of Gibbs sampling iterations until all incomplete variables have been imputed.

$$
\begin{aligned}
&Y_1^{(t+1)} \sim P(Y_1 \mid Y_2^{(t)}, Y_3^{(t)}, \ldots, Y_k^{(t)}) \\
&Y_2^{(t+1)} \sim P(Y_2 \mid Y_1^{(t+1)}, Y_3^{(t)}, \ldots, Y_k^{(t)}) \\
&\qquad \cdots \\
&Y_k^{(t+1)} \sim P(Y_k \mid Y_1^{(t+1)}, Y_2^{(t+1)}, \ldots, Y_{k-1}^{(t+1)})
\end{aligned}
\tag{6}
$$

In the second and subsequent rounds, each variable with missing values is regressed on all other variables using all imputed values created during previous steps (along with nonmissing data) and this process continues until stable imputed values are generated. This study created 5 imputed data sets and then subsequent analyses were performed using these multiply imputed data. Estimates for complete-data model parameters are averaged across the 5 imputed data sets and standard errors are computed according to Rubin's rule (Rubin 1987).

Compared to the statistical modeling of mortality, there is some concern about mortality selection in the analysis of functional limitations and disability, even though this study follows a relatively short period of time and contains those individuals who die during the observation period. Mortality as a form of missing data may diminish health differences between immigrants and U.S.-born residents. Prior research suggests that U.S.-born residents are more likely than immigrants to die, which may leave behind a more robust group of U.S.-born residents. Although mortality is an important source of missing data in longitudinal studies, missing data from mortality are a bit different from other missing data in that there are no real future data for decedents because they are dead. In this study, decedents' missing data before death were imputed in the multiple imputation process, but their missing data after death were not imputed.

This study combines multiple imputation and full information maximum likelihood (FIML) estimation in latent growth models to deal with incomplete data. Multiple imputation and FIML are two recommended classes of modern incomplete-data procedures. Rather than imputing missing data, FIML directly estimates parameters and standard errors by maximizing the casewise likelihood of the observed data. These two procedures are known to yield similar results when the input data (e.g., variables and observational units) and models are comparable (Collins, Schafer, and Kam 2001; Schafer 2003).

It is not feasible to test whether missingness from mortality meets the assumption of MAR because missing data from mortality are inherently unobserved and thus it is impossible to know whether the probability of missingness depends on unobserved data. If the assumption of MAR is violated, FIML as a method of handling mortality selection may yield biased results. Although missing data patterns are complex in social science applications, however, typically individuals participate in a survey for some time and then die after showing deterioration in their health status in repeated measures studies. If decedents' missing data from mortality closely depend on their health scores prior to death, the assumption of MAR is not unrealistic. Further, although the assumption of MAR is suspect, in general, we can reduce bias after conditioning on decedents' (observed) health scores prior to death along with other covariates. In a simulation study, Collins, Schafer, and Kam (2001) also show that an erroneous assumption of MAR may have only a minor effect on estimates and standard errors unless the relationships between the omitted cause of missingness and the outcomes are unusually strong.

Chapter 4: Differential Mortality

1. Introduction

This chapter examines differential mortality by immigrant status. Using the discrete-time hazard models, the roles of SES, social integration, health behaviors, health insurance/medical care utilization, and health status in explaining the nativity difference in mortality are examined. To better understand the effect of immigrant status on mortality in the context of race/ethnicity, this study also examines whether the effect of immigrant status differs across racial/ethnic groups.

2. Results

The discrete-time hazard model estimates for males and females are shown in Table 4.1 and 4.2, respectively. Model 1 only included race/ethnicity in addition to the baseline hazard. Non-Hispanic black men show a significantly higher risk of mortality (approximately 32 percent) compared to non-Hispanic white men. However, the mortality risks of Mexican, other Hispanic, and Asian/Native American men are not statistically different from that of white men. The overall pattern is similar among women but one exception is that non-Mexican Hispanic women display a significantly lower risk of mortality compared to white women.

Model 2 shows that immigrant men have a significantly lower risk of mortality compared to their native-born counterparts (approximately 20 percent). Immigrant women also show a lower risk of mortality compared to native-born women (approximately 14 percent) but the effect of immigrant status is only marginally significant (p=.098). Model 3 considered race/ethnicity and immigrant status simultaneously. Among men, except for blacks, the mortality risks of other racial/ethnic minority groups slightly increased, while the mortality risk of immigrant men somewhat decreased with the inclusion of race/ethnicity. The pattern in the effect of race/ethnicity is similar among women. However, the effect of immigrant status is slightly reduced compared to men and is not statistically significant.

In Model 4, the excess mortality of black men was eliminated with the inclusion of SES indicators. We can also observe the same pattern among black women. These findings suggest that the black-white mortality gap can be largely explained by socioeconomic factors.[16] Model 4 also shows that socioeconomic disadvantages increase the mortality risks of other racial/ethnic minorities and immigrants. However, there are some differences between men and women. While the effect of immigrant status remains strong among men, Table 4.2 shows that non-Mexican Hispanic women exhibit an approximately 73 percent lower risk of mortality compared to white women.

In Model 5, social integration indicators were included. Compared to Model 3, the mortality risk of immigrant men slightly increased with the inclusion of social integration indicators. However, the mortality risk of black men decreased approximately 15 percent. The overall pattern is similar among women but the impact of social integration is relatively smaller among black women. Further, note that the mortality risk

[16] Some ambiguity remains whether parental mortality status is a measure of SES. However, additional analyses (not shown) show that the results above remain unchanged after these variables are dropped from the model.

of other Hispanic women is not statistically different from white women, indicating that social integration indicators explain the lower mortality risk of other Hispanic women. Overall, the inclusion of social integration indicators has a greater impact on race/ethnicity compared to immigrant status. Although social integration indicators reduce the mortality risks of both immigrant men and women, however, the specific roles of social integration indicators are less clearly understood. The data also indicate that social integration indicators are not uniformly beneficial to immigrants.[17]

With the introduction of health behaviors in Model 6, the nativity difference in mortality is only marginally significant among men (p=.065). The excess mortality of black men was also eliminated with the inclusion of health behaviors. However, like social integration, health behaviors do not eliminate the excess mortality risk of black women, even though the mortality risk of black women was somewhat reduced. The data also suggest that the roles of social integration and health behaviors differ across immigrant status and race/ethnicity. While immigrants benefit from both social integration and healthy lifestyles, overall the mortality risks of racial/ethnic minorities decreased with the inclusion of health risk behaviors, indicating that racial/ethnic minorities tend to retain unhealthy lifestyles.

Compared to social integration indicators, the data indicate that overall immigrants consistently benefit from their healthy lifestyles. Further analyses of the

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[17] Additional analyses of the baseline survey reveal that (1) immigrant women are less likely to live alone and both immigrant men and women are more likely to live with their spouse and children; (2) immigrant women are less likely to have children living within ten miles; (3) both immigrant men and women are less likely to have relatives in neighborhood; (4) both immigrant men and women are more likely to be Catholics, other religions, or no religion; (5) immigrant women are more likely to report that religion is not too important or somewhat important; and (6) immigrant men are more likely to be in paid work, controlling for age and race/ethnicity ($\alpha = .05$).

baseline survey reveal (not shown) that, except for regular exercise, both immigrant men and women are less likely to smoke, are more likely to be moderate drinkers, and are less likely to be obese, controlling for age and race/ethnicity ($\alpha = .05$).

In Model 7, health insurance/medical care utilization measures were included. The roles of health insurance and medical care utilization are similar to that of socioeconomic factors. The inclusion of these factors reduced the mortality risks of both immigrants and racial/ethnic minorities. With the inclusion of health status measures in Model 8, overall, the mortality risks of racial/ethnic minority groups decreased. However, the impact of health status on immigrant status remains relatively small.[18]

This study also fitted a series of discrete-time hazard models using the combinations of race/ethnicity and immigrant status to better understand the effect of immigrant status in the context of race/ethnicity (Table 4.3 and 4.4). Model 1 only included combined race/ethnicity and immigrant status dummies in addition to the baseline hazard. Both native-born black men and women show higher mortality risks compared to their native-born white counterparts (approximately 33 percent and 44 percent, respectively). Although the sample size is relatively small, however, foreign-born black men and women are not different from native-born white men and women, respectively.

Model 1 also shows that foreign- and native-born Mexican men exhibit considerably different mortality risk patterns compared to native-born white men. While

[18] Some caution should be exercised in interpreting the effect of health status. First, this study used a self-report of chronic conditions diagnosed by a physician. Immigrants may be less likely to be exposed to physician-diagnosed chronic conditions due to their limited access to health care. Second, this study also included subjective health measures. Immigrants from different countries may use different response thresholds when assessing their health within scales (Albert and Cattell 1994; Jasso et al. 2004).

foreign-born Mexican men display an approximately 39 percent lower risk of mortality, the mortality risk of native-born Mexican men is about 50 percent higher. Model 1 also shows that foreign-born Asian/Native American men exhibit a considerably lower risk of mortality compared to native-born white men. Although we could not distinguish between Asian Americans and Native Americans due to data limitations, given the recent immigrant streams into the United States, it is reasonable to believe that the majority of foreign-born Asian/Native Americans are Asian Americans. It is also worthwhile to mention that both native- and foreign-born non-Mexican Hispanic women showed lower mortality risks than native-born white women. In particular, the mortality risk pattern of native-born other Hispanic women is unique in that this is the only native-born racial/ethnic group showing lower mortality compared to the foreign-born of similar racial/ethnic backgrounds.

In Model 2, socioeconomic factors were introduced and the overall patterns are similar to those in Table 4.1 and 4.2. For example, the excess mortality of native-born black men and women disappeared with the inclusion of socioeconomic factors. Further, the mortality risks of immigrants and other racial/ethnic minorities decreased. In particular, Table 4.3 and 4.4 indicate that the role of SES has greater salience among foreign-born Hispanics (Mexicans and other Hispanics). The data also indicate that the effects of health insurance/medical care utilization (Model 5) and health status (Model 6) are similar to that of socioeconomic factors. Both native- and foreign-born racial/ethnic minority men and women experienced reduced mortality risks with the introduction of these factors compared to their native-born white counterparts.

However, regarding the role of social integration, Table 4.3 and 4.4 show a bit different picture. Among women, overall the inclusion of social integration indicators increased the mortality risks of foreign-born minority women in Model 3. However, except for foreign-born white men, the inclusion of social integration indicators decreased the mortality risks of foreign-born racial/ethnic minority men. This indicates that, although immigrant men benefit from family structure and social networks compared to their native-born counterparts of similar racial/ethnic backgrounds, this is not true when foreign-born racial/ethnic minority men are compared to native-born white men.

A similar pattern also emerges with respect to the effect of health behaviors. Among men, except for foreign-born whites, all foreign-born racial/ethnic minority men experienced reduced mortality risks with the introduction of health behaviors in Model 4, indicating that foreign-born racial/ethnic minority men are more likely to retain unhealthy lifestyles compared to native-born white men. Among women, the data show mixed findings. The inclusion of health risk behaviors increased the mortality risks of foreign-born white, black, and Asian/Native American women. However, foreign-born Mexican and other Hispanic women exhibited reduced mortality risks compared to native-born white women. This indicates that foreign-born Mexican and other Hispanic women (along with their native-born counterparts) are more likely to retain unhealthy lifestyles compared to native-born white women.

Table 4.1. Discrete-Time Hazard Model Estimates: Males

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	-3.578***	-3.538***	-3.538***	-1.480***	-3.075***	-2.839***	-3.644***	-5.057***	-2.061***
Age	.094***	.094***	.094***	.081***	.077***	.083***	.077***	.073***	.061***
Race/Ethnicity (White)	–		–	–	–	–	–	–	–
Black	.277***		.273***	-.064	.153†	.040	.120	.064	.015
Asian/Native American	-.209		-.130	-.316	-.232	-.330†	-.219	-.395†	-.468***
Mexican	.124		.216	-.174	.209	.057	-.007	-.072	.123
Other Hispanic	.003		.177	-.219	.178	-.001	.041	.086	.035
Immigrant		-.229*	-.268*	-.349**	-.244*	-.219†	-.295*	-.278*	-.216
Education				-.011					.014
Household Income				-.157***					-.064*
Household Wealth				-.248***					-.262***
Occupation (Professional)				–					–
Managerial				.155					.203
Sales				.326*					.406*
Clerical				.430*					.316†
Service				.338*					.345*
Farming				.130					.301
Mechanics				.143					.098
Operators				.280*					.225
Not Reported				.338**					.233†
Mother's Education				.011					-.056
Father's Education				-.003					-.044
Mother Alive				-.502***					-.428**
Father Alive				-.302					-.166
Metropolitan Residence				.035					.034
Region (Northeast)				–					–
Midwest				.057					-.006
South				.132					.030
West				.013					.023
Neighborhood Safety				.072*					-.032
Housing (Single/Duplex)				–					–
Apartment				.185*					.085
Mobile Home				.358*					.270**
Person Per Room				.115					.021

Continued on next page

Table 4.1. (*Continued*)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Living Arrangements (couple)					–				–
Living Alone					.298***				.091
Single/Children					.406***				.190†
Couple/Children					.177*				.024
Children in Contact					.004				-.011
Children within 10 Miles					.020				-.070
Sibling in Contact					-.021				-.035*
Relative in Neighborhood					-.106†				-.140*
Friend in Neighborhood					-.302***				-.148*
Change of Residence					.107				-.097
Religion (Protestant)					–				–
Catholic					-.123†				.006
Other					.085				.119
No Religion					-.116				-.148
Religion (Very Important)					–				–
Not Too Important					-.026				.014
Somewhat Important					.110†				.121†
Paid Work					-.905***				-.293**
Non-English at Home					-.057				-.227
Regular Exercise						-.842***			-.340***
Smoking						.534***			.398***
Drinking (None)						–			–
Moderate Drinking						-.649***			-.357***
Heavy Drinking						-.420***			-.278*
BMI (Normal)						–			–
Underweight						.693***			.407**
Overweight						-.369***			-.263***
Obesity						-.491***			-.490***
Medicare							.185†		-.016
Medicaid							.457***		.012
Employer-Sponsored Insurance							-.185***		.039
LTC Insurance							-.238*		.003
Other Health Insurance							-.112		.069
Hospital Use							.828***		.425***
Nursing Home Use							.422***		-.104
Doctor Visit							-.181		-.300*

Continued on next page

Table 4.1. (*Continued*)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Depression								.044**	.019
High Blood Pressure								-.099†	-.052
Diabetes								.205**	.230***
Cancer								.467***	.465***
Lung Disease								.430***	.320***
Heart Disease								.192***	.154*
Stroke								.093	.009
Arthritis								-.297***	-.246***
Psychiatric Problem								.076	.033
ADL								.070*	.071*
IADL								.112***	.076**
NAGI								.057*	.026
Self-Rated Health								.401***	.331***

Note: 29,855 person-period records; † p < .10 * p < .05 ** p < .01 *** p < .001.

Table 4.2. Discrete-Time Hazard Model Estimates: Females

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	-4.155***	-3.538***	-4.151***	-1.298***	-3.867***	-3.724***	-4.132***	-5.545***	-2.037***
Age	.104***	.103***	.104***	.095***	.090***	.092***	.089***	.080***	.076***
Race/Ethnicity (White)	–		–	–	–	–	–	–	–
Black	.361***		.359***	.075	.304***	.285***	.176*	.128†	.104
Asian/Native American	.218		.253	.047	.259	.207	.054	.089	.201
Mexican	.141		.173	-.233	.291	.090	-.058	-.125	.084
Other Hispanic	-.470**		-.403*	-.750***	-.304	-.499**	-.613**	-.724***	-.562**
Immigrant		-.156†	-.106	-.139	-.048	-.055	-.134	-.080	-.001
Education				-.021*					.003
Household Income				-.120***					-.037†
Household Wealth				-.339***					-.334***
Occupation (Professional)				–					–
Managerial				-.324					-.251
Sales				-.038					-.032
Clerical				-.180					-.157
Service				.065					-.002
Farming				-.656					-.792†
Mechanics				-.095					-.121
Operators				.207					.110
Not Reported				.066					-.095
Mother's Education				-.126					-.075
Father's Education				.098					.054
Mother Alive				.051					.150
Father Alive				-.368					-.278
Metropolitan Residence				.034					-.009
Region (Northeast)				–					–
Midwest				.109					.124
South				.153†					.055
West				.068					-.038
Neighborhood Safety				.054†					-.022
Housing (Single/Duplex)				–					–
Apartment				.079					.083
Mobile Home				.217*					.085
Person Per Room				.101					.024

Continued on next page

Table 4.2. (*Continued*)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Living Arrangements (couple)					–				–
Living Alone					.155*				-.111
Single/Children					.344***				-.115
Couple/Children					.240†				-.003
Children in Contact					-.022				-.027†
Children within 10 Miles					.132*				.044
Sibling in Contact					-.103				-.020
Relative in Neighborhood					-.060				-.127*
Friend in Neighborhood					-.204***				.020
Change of Residence					.010				-.242**
Religion (Protestant)					–				–
Catholic					-.138*				-.029
Other					-.341*				-.245†
No Religion					-.222				-.151
Religion (Very Important)					–				–
Not Too Important					.171				.168
Somewhat Important					.264***				.185**
Paid Work					-.994***				-.529***
Non-English at Home					-.205				-.324†
Regular Exercise						-.792***			-.247**
Smoking						.468***			.402**
Drinking (None)						–			–
Moderate Drinking						-.653***			-.219*
Heavy Drinking						-.333			-.005*
BMI (Normal)						–			–
Underweight						.690***			.460***
Overweight						-.279***			-.282***
Obesity						-.206**			-.390***
Medicare							.039		-.117
Medicaid							.468***		.071
Employer-Sponsored Insurance							-.095		.080
LTC Insurance							-.403***		-.240*
Other Health Insurance							-.139*		-.065
Hospital Use							.745***		.358***
Nursing Home Use							.420***		.016
Doctor Visit							-.165		-.315*

Continued on next page

Table 4.2. (*Continued*)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Depression								.018	.005
High Blood Pressure								.020	.064
Diabetes								.350***	.412***
Cancer								.465***	.447***
Lung Disease								.524***	.415***
Heart Disease								.203***	.172**
Stroke								-.055	-.096
Arthritis								-.398***	-.341***
Psychiatric Problem								-.139*	-.141*
ADL								.104***	.115***
IADL								.117***	.091***
NAGI								.064*	.041
Self-Rated Health								.382***	.310***

Note: 41,413 person-period records; † p < .10 * p < .05 ** p < .01 *** p < .001.

Table 4.3. Discrete-Time Hazard Model Estimates: Males

Predictor	Model 1	Model 2[a]	Model 3[b]	Model 4[c]	Model 5[d]	Model 6[e]	Model 7[f]
NB White	–	–	–	–	–	–	–
FB White	-.059	-.076	-.046	.039	-.044	-.047	.035
NB Black	.287***	-.055	.162†	.054	.132	.075	.026
FB Black	-.150	-.468	-.154	-.304	-.271	-.207	-.295
NB Asian/NA	.106	-.099	-.003	-.063	.029	-.204	-.249
FB Asian/NA	-1.202*	-1.437*	-1.325*	-1.416*	-1.346*	-1.366*	-1.501**
NB Mexican	.407*	.073	.364†	.293†	.219	.145	.283
FB Mexican	-.487*	-1.090***	-.593*	-.669**	-.805***	-.823***	-.705*
NB Other HP	.267	.062	.265	.168	.253	.351	.382
FB Other HP	-.124	-.694**	-.197	-.288	-.348	-.298	-.426†

Note: 29,855 person-period records; † p < .10 * p < .05 ** p < .01 *** p < .001.
NB = native-born; FB = foreign-born; Asian/NA = Asian/Native American; Other HP = Other Hispanic.
[a] Socioeconomic Status; [b] Social Integration; [c] Health Behaviors; [d] Health Insurance and Medical Care Utilization;
[e] Health Status; [f] All Covariates are included.

Table 4.4. Discrete-Time Hazard Model Estimates: Females

Predictor	Model 1	Model 2[a]	Model 3[b]	Model 4[c]	Model 5[d]	Model 6[e]	Model 7[f]
NB White	–	–	–	–	–	–	–
FB White	-.075	-.084	-.036	-.024	-.107	-.065	.004
NB Black	.367***	.083	.314***	.292***	.184*	.133†	.105
FB Black	.074	-.197	.011	.094	-.123	-.076	.100
NB Asian/NA	.436†	.145	.364	.362	.148	.211	.241
FB Asian/NA	-.279	-.347	-.060	-.219	-.323	-.300	.086
NB Mexican	.201	-.122	.324	.129	.005	-.058	.173
FB Mexican	.015	-.572*	.198	-.038	-.304	-.329	-.082
NB Other HP	-1.000**	-1.211**	-.932*	-1.032**	-1.131**	-1.414***	-1.126**
FB Other HP	-.312†	-.748***	-.133	-.387*	-.584**	-.561	-.374

Note: 41,413 person-period records; † p < .10 * p < .05 ** p < .01 *** p < .001.
NB = native-born; FB = foreign-born; Asian/NA = Asian/Native American; Other HP = Other Hispanic.
[a] Socioeconomic Status; [b] Social Integration; [c] Health Behaviors; [d] Health Insurance and Medical Care Utilization;
[e] Health Status; [f] All Covariates are included.

3. Discussion

This chapter investigated the association between immigrant status, race/ethnicity, and mortality. Consistent with prior research, the data showed that both black men and women suffered higher mortality risks compared to other racial/ethnic groups. However, other racial/ethnic minorities showed comparable levels of mortality compared to non-Hispanic whites. One exception was that non-Mexican Hispanic women showed a significantly lower risk of mortality than white women.

With respect to the effect of immigrant status, the data showed that its impact differs across gender. While immigrant men displayed significantly lower mortality than their native-born counterparts, immigrant women did not show this pattern, controlling for race/ethnicity. Thus, the results presented in this study are somewhat different from previous studies (e.g., Singh and Siahpush 2001, 2002).[19] A growing body of literature documents the importance of gender relations in understanding the causes, processes, and consequences of international migration (Hondagneu-Sotelo 1994; Pessar 1999; Kanaiaupuni 2000). Although prior research on immigrant health simply argues that immigrants tend to be positively selected in terms of measured or unmeasured health outcomes, health selectivity may differ across gender because of the gender-selective nature of international migration governed by national policies, in particular labor migration. Further, gender may be one of important risk factors in the adaptation processes of immigrants in the host country (see Arcia et al. 2001). Darmon and Khlat (2001) also found that immigrant women from North Africa did not share the same health advantage as men in France. They present several possible explanations in terms of migration selectivity and gendered adaptation. First, most of immigrant women did not arrive in France as workers and thus many immigrant women were not subject to health selection linked to labor migration. Second, immigrant women are often non-working than are native-born women of similar socioeconomic status.

This chapter also investigated the impact of socioeconomic factors on mortality across race/ethnicity and immigrant status. Previous studies (e.g., Hummer et al. 1999;

[19] Using the National Longitudinal Mortality Study (NLMS), Singh and Siahpush (2001, 2002) found that both foreign-born men and women had lower risks of mortality compared to their native-born counterparts.

Singh and Siahpush 2002) found that the black-white mortality gap remains significant, controlling for social and demographic factors. The results in this chapter indicate that the black-white mortality gap can be largely explained by socioeconomic factors. It is not possible to compare the results in this study to previous findings directly since the target population of this study is different from the previous studies. If mortality differs across SES and race/ethnicity at younger ages, research restricted to the old population does not capture the underlying processes leading to the observed mortality differences at old ages. However, it also should be noted that this study considered comprehensive socioeconomic indicators and their dynamics over time.

Further, prior research suggests that socioeconomic factors contribute little to the observed nativity difference in mortality. However, this study found some evidence that socioeconomic disadvantages increase the mortality risk of immigrants along with racial/ethnic minority groups. In particular, the evidence presented in this chapter indicates that the impact of SES is substantial among foreign-born Hispanics. With the introduction of SES indicators, this study found that both foreign-born Hispanic men and women showed significantly lower mortality risks compared to their native-born white counterparts.

This study also found that social integration plays a positive role in explaining better mortality outcomes of immigrants and Hispanic women. Prior research did not clarify the association between race/ethnicity, immigrant status, and social integration. That is, although prior research emphasized the protective roles of Hispanic cultures, the nativity distinction was not explicitly made. Thus, it was not clear whether native- and foreign-Hispanic populations equally share their protective cultures in the literature. This study found some evidence that Hispanic women benefit from family structure and social networks, even after controlling for nativity.

Prior research suggests that social integration, measured by multiple role involvements, plays an important role in explaining low mortality and better health outcomes (e.g., Moen, Dempster-McClain, and Williams 1989, 1992). However, this study found that the impact of social integration remains relatively small compared to SES. Further, as pointed out earlier, compared to SES indicators and health behaviors, the specific roles of social integration indicators are less clearly understood. It is not surprising because social integration only measures structural conditions rather than the quality of social relationships. This study did not consider the quality of social relationships due to data limitations and thus there is some possibility that the importance of social relationships among immigrants was underestimated in this study.

This study also found some evidence that the lower mortality risk of immigrants can be explained in part by their healthy lifestyles. Therefore, while socioeconomic disadvantages increase the mortality risk of immigrants, social integration and healthy lifestyles tend to reduce the risk. However, immigrants are not uniformly advantaged in terms of social integration and health behaviors. In particular, the data indicate that foreign-born racial/ethnic minority men are not advantaged in terms of social integration and health risk behaviors compared to native-born white men.

Chapter 5: Trajectories of Functional Limitations and Disability

1. Introduction

This chapter examines the trajectories of functional limitations and disability over the observation period. First, this chapter examines the linear trajectories of functional limitations and disability without predictors. Second, using the correlations between intercepts and slopes, this chapter describes the inter-relationships between functional limitation and disability trajectories. Third, the roles of SES, social integration, health behaviors, and health status in explaining nativity differences in functional health are investigated. Finally, this chapter also examines whether the effect of immigrant status differs across racial/ethnic groups.

2. Results

Table 5.1 presents unconditional associative growth model parameter estimates. These growth parameter estimates provide information about population average functional limitation and disability trajectories along with the population variations in true individual intercepts and slopes around these averages. The intercepts represent the average levels of functional limitations and disability in 1998. Parameter estimates indicate significant mean initial levels in both functional limitations and disability. In addition, all slope means are also statistically significant, showing evidence of meaningful development in functional limitations and disability over four time points.

For example, the data indicate that, on average, individuals' true disability increases by .051 per two-year period, having a value of -1.714 at baseline (in natural logarithmic forms). Table 5.1 also shows the estimated variances of the unconditional associative growth model. The significant intercept variances indicate that substantial variation exists in individual differences in the initial statuses of functional limitations and disability. There is also significant variability in individual differences in the slopes of functional limitations and disability over time.

Table 5.1. Unconditional Latent Growth Model Estimates

	Functional Limitations	Disability
Fixed Effects		
Intercept	-3.249***	-1.714***
Slope	.191***	.051***
Variance Components		
Level-2 (Intercept)	14.591***	1.043***
Level-2 (Slope)	.122***	.018***
Level-1 Error	9.500***	.567***

Note: *** p < .001.

Table 5.2 presents the relationships between the intercepts and slopes of functional limitations and disability. The data indicate that the intercepts (initial statuses) of functional limitations and disability are highly correlated (r = .609), indicating that those who have higher levels of functional limitations are also more likely to show higher levels of disability at baseline. The rates of change of functional limitations and disability are also highly correlated (r = .598). Table 5.2 shows that the rate of change in functional limitations is negatively associated with its initial level (r = -.313), indicating that individuals with higher initial levels of functional limitations at baseline show a slower increase over four time points. In contrast, the correlation between the intercept and slope of disability is positive but is not statistically significant.[20] The data also indicate that higher initial levels of functional limitations are associated with a steeper increase in disability over time (r = .072), while higher initial levels of disability are associated with a slower increase in functional limitations (r = -.289).

Table 5.2. Correlations between the Intercepts and Slopes of Functional Limitations and Disability

	Functional Limitations		Disability	
	Intercept	Slope	Intercept	Slope
Functional Limitations				
Intercept	1.000			
Slope	-.313***	1.000		
Disability				
Intercept	.609***	-.289***	1.000	
Slope	.072***	.598***	.015	1.000

Note: *** p < .001.

Table 5.3 shows the latent growth model parameter estimates of functional limitations and disability. There is no sufficient evidence that immigrant status and race/ethnicity are significantly associated with the rates of change in functional limitations and disability in Table 5.3, indicating parallel growth trajectories between groups over four time points. Immigrant status and race/ethnicity along with age in 1998 and gender were included in Model 1. Although the effect of race/ethnicity is similar across functional limitations and disability, the data indicate that the effect of immigrant status differs across functional health dimensions. While immigrants show lower levels of functional limitations, they are not statistically different from their native-born counterparts in terms of disability. With respect to race/ethnicity, all racial/ethnic minorities show higher levels of functional limitations and disability.

[20] It should be noted, however, that the estimated covariance between the intercept and slope depends on the choice of the scale of how time is calculated. A recentering of time could affect the sign of the estimated covariance as well as its magnitude.

However, the results are considerably different with the introduction of SES indicators in Model 2. Except for blacks in functional limitations and blacks and Asian/Native Americans in disability, the racial/ethnic differences in functional health largely disappeared. Further, the effect of immigrant status became stronger with the inclusion of SES indicators. In addition to functional limitations, note that immigrants also show lower levels of disability (α = .05). These results suggest that immigrants' socioeconomic disadvantages reduce the nativity differences in functional health.

In Model 3, with the inclusion of social integration indicators, the coefficient of immigrant status a bit decreased in absolute value, indicating that social integration plays a positive role in promoting the functional health of immigrants. Further, overall the inclusion of social integration indicators resulted in a reduction in the gaps between whites and racial/ethnic minorities. The roles of health behaviors are similar to those of social integration indicators in Model 4. That is, while racial/ethnic minorities tend to retain unhealthier lifestyles than whites, immigrants show healthier lifestyles than U.S.-born residents. Therefore, although social integration and health behaviors partially explain the observed nativity differences in functional limitations and disability, the data indicate that the roles of social integration and health behaviors are contrasted with that of socioeconomic factors.

In Table 5.4, this study estimated additional six models by combining immigrant status and race/ethnicity and then introducing each component of predictors shown in Table 5.3. Overall, consistent with the pattern in Table 5.3, Table 5.4 reveals that the impacts of SES, social integration, and health behaviors are more noticeable in functional limitations compared to disability. In Model 1, immigrant status and race/ethnicity combination dummies were included in addition to age and gender. The results indicate that only foreign-born whites show significantly lower initial levels of functional limitations compared to native-born whites. Foreign-born blacks, foreign-born Asian/Native Americans, and foreign-born other Hispanics are not statistically different from native-born whites in functional limitations. However, foreign-born Mexicans along with their native-born counterparts showed significantly higher levels of functional limitations than native-born whites. We can also find a similar pattern in disability. However, compared to functional limitations, foreign-born whites are not statistically different from their native-born counterparts. Further, like foreign-born Mexicans, foreign-born other Hispanics also showed higher levels of disability than native-born whites.

However, with the inclusion of SES indicators in Model 2, a considerably different picture emerges. Except for native-born blacks, other racial/ethnic minority groups regardless of nativity show comparable or lower levels of functional limitations compared to native-born whites. Note that now foreign-born Mexicans and other Hispanics show lower levels of functional limitations with the inclusion of SES indicators. Therefore, these findings suggest that SES plays an important role in explaining higher functional limitations and disability among foreign-born Hispanic populations.

The inclusion of social integration indicators in Model 3 had a relatively great impact on native-born Asian/Native Americans in functional limitations. Although the coefficients of native- and foreign-born Mexicans were a bit reduced, the gaps between native-born whites and (foreign- and native-born) Mexicans in functional limitations and disability remain statistically significant. Model 4 shows that health behaviors also play an important role in explaining higher levels of functional limitations among native- and foreign-born Mexicans, even though their impact on disability is relatively small. Finally, the inclusion of health status measures also reduced the gaps between native-born whites and (native- and foreign-born) racial/ethnic minorities.

Table 5.3. Latent Growth Model Estimates of Functional Limitations and Disability

	Model 1				Model 2				Model 3			
	Limitations		Disability		Limitations		Disability		Limitations		Disability	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
Fixed Effects												
Constant	-4.155***	.200***	-1.846***	.054***	-.383†	.173***	-.856***	.070***	-3.899***	.183***	-1.767***	.050***
Age in 1998	.112***	.005***	.029***	.005***	.087***	.006***	.023***	.005***	.091***	.005***	.023***	.005***
Female	1.357***	.004	.099***	.000	1.252***	.004	.074***	.000	1.203***	.005	.050**	.000
Black	.892***	-.019	.395***	.006	.220*	-.014	.233***	.004	.593***	-.022	.317***	.005
Asian/NA	.467†	-.009	.196**	-.004	.273	-.010	.153*	-.004	.365	.002	.159*	-.003
Mexican	1.098***	.018	.404***	-.002	-.291	.036	.042	-.006	.986***	.017	.388***	.001
Other Hispanic	.680**	.014	.288***	.011	-.102	.015	.091	.007	.650**	.006	.262***	.014
Immigrant	-.697***	-.021	-.033	.001	-.891***	-.016	-.085*	.001	-.583***	-.018	-.016	.003
Education					-.219***	.002	-.061***	-.001†				
HH Income					-.153***		-.037***					
HH Wealth					-.092***		-.014***					
NH Safety					.134***		.015*					
Single/Alone									.170*		.111***	
Single/Children									.370***		.221***	
Children									.064***		.006	
Sibling									.030*		.001	
Relative									.130**		.016	
Friend									-.026		-.026*	
Catholic									-.412***	.001	-.066**	-.007†
Other Religions									-.375†	-.061	-.016	-.006
No Religion									-.094	-.065†	.061	-.004
Paid Work									-.786***		-.174***	
Variance Components												
Level 2	12.546***	.118***	.931***	.015***	11.747***	.117***	.877***	.015***	12.008***	.117***	.894***	.015***
Level 1	9.499***		.565***		9.514***		.567***		9.529***		.568***	

Continued on next page

Table 5.3. (*Continued*)

	Model 4				Model 5				Model 6			
	Limitations		Disability		Limitations		Disability		Limitations		Disability	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
Fixed Effects												
Constant	-4.382***	.185***	-1.735***	.051***	-6.843***	.076***	-2.441***	.027***	-4.305***	.022	-1.472***	.035***
Age in 1998	.120***	.005***	.028***	.005***	.073***	.002**	.021***	.004***	.062***	.004***	.013***	.004***
Female	1.306***	.009	.057**	.000	1.250***	.004	.077***	.001	1.149***	.010	-.001	.001
Black	.482***	-.015	.349***	.006	.285**	-.022	.261***	.006	-.340***	-.013	.126***	.003
Asian/NA	.261	-.008	.155*	-.002	.311	-.034	.161*	-.010	.043	-.020	.087	-.007
Mexican	.698***	.027	.362***	-.001	.660***	.036	.301***	-.005	-.127	.029	.097†	-.005
Other Hispanic	.517*	.018	.261***	.011	.217	.013	.183**	.011	-.112	.019	.055	.012
Immigrant	-.541***	-.025	-.021	.001	-.491***	-.022	.008	.001	-.442***	-.017	-.022	.003
Education									-.091***	.004†	-.037***	-.001
HH Income									-.084***		-.021***	
HH Wealth									-.106***		-.020***	
NH Safety									.061**		.001	
Single/Alone									-.070		.064***	
Single/Children									.065		.162***	
Children									.008		-.005	
Sibling									-.002		-.009**	
Relative									.073†		.001	
Friend									.005		-.019†	
Catholic									-.298***	.005	-.032	-.006
Other Religions									.041	-.057	.080†	-.004
No Religion									.103	-.063†	.098**	-.005
Paid Work									-.403***		-.100***	
Exercise	-.627***		-.133***						-.511***		-.113***	
Smoking	.692***		.102***						.520***		.051**	
Moderate Drinking	-.628***		-.142***						-.361***		-.089***	
Heavy Drinking	-.273**		-.105***						-.040		-.065***	
Underweight	.008		.284***						-.077		.258***	
Overweight	.675***		-.024†						.505***		-.055***	
Obesity	1.708***		.061**						1.307***		-.012	
Chronic Conditions					.827***		.163***		.710***		.147***	
Self-Rated Health					.659***		.156***		.568***		.138***	
Variance Components												
Level 2	10.780***	.110***	.878***	.015***	8.249***	.096***	.716***	.013***	7.280***	.091***	.665***	.013***
Level 1	9.660***		.570***		9.868***		.585***		9.903***		.587***	

Note: n = 21,103; † p < .10 * p < .05 ** p < .01 *** p < .001.

Table 5.4. Latent Growth Model Estimates of Functional Limitations and Disability

	Model 1[a]				Model 2[b]				Model 3[c]			
	Limitations		Disability		Limitations		Disability		Limitations		Disability	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
NB White	–	–	–	–	–	–	–	–	–	–	–	–
FB White	-.942***	-.007	-.008	.001	-.998***	-.003	-.024	.001	-.821***	-.002	.006	.003
NB Black	.884***	-.017	.406***	.006	.205†	-.011	.243***	.004	.587***	-.020	.328***	.005
FB Black	.134	-.066	.157	.004	-.465	-.065	.011	.001	-.065	-.064	.102	.006
NB Asian/NA	.641***	.042	.313***	-.008	.209	.038	.207*	-.011	.454	.053	.256**	-.006
FB Asian/NA	-.577	-.114	-.044	.005	-.513	-.107	-.020	.007	-.439	-.100	-.039	.007
NB Mexican	.826***	.002	.377***	.000	-.233	.018	.104	-.003	.767***	.001	.364***	.003
FB Mexican	.844***	.024	.419***	-.004	-1.294***	.058	-.146†	-.011	.757***	.024	.412***	.001
NB Other HP	-.066	.031	.155	.008	-.565	.036	.024	.006	-.076	.035	.138	.012
FB Other HP	.270	-.015	.311***	.013	-.812**	-.007	.036	.008	.344	-.023	.298***	.017

	Model 4[d]				Model 5[e]				Model 6[f]			
	Limitations		Disability		Limitations		Disability		Limitations		Disability	
	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope
NB White	–	–	–	–	–	–	–	–	–	–	–	–
FB White	-.766***	-.007	.013	.001	-.726***	.000	.036	.002	-.605***	.005	.029	.005
NB Black	.469***	-.013	.361***	.006	.259**	-.019	.269***	.006	-.377***	-.009	.132***	.003
FB Black	.010	-.058	.135	.005	.100	-.074	.144	.002	-.251	-.063	.037	.003
NB Asian/NA	.325	.039	.274**	-.007	.338	.010	.247**	-.015	-.115	.020	.139	-.014
FB Asian/NA	-.412	-.112	-.072	.008	-.252	-.128	.020	.001	-.112	-.110	-.020	.007
NB Mexican	.497*	.017	.343***	.002	.486*	-.003	.296***	-.001	-.100	.024	.142*	.001
FB Mexican	.485†	.018	.378***	-.005	.443†	-.013	.319***	-.012	-.641*	.027	-.005	-.012
NB Other HP	-.037	.038	.160	.008	-.276	.032	.106	.008	-.374	.045	.037	.011
FB Other HP	.190	-.014	.283***	.013	-.087	-.015	.224**	.014	-.456*	-.006	.042	.014

Note: NB = native-born; FB = foreign-born; Asian/NA = Asian/Native American; Other HP = Other Hispanic.
N = 21,103; † p < .10 * p < .05 ** p < .01 *** p < .001.
Control variables are as follows: [a] age and gender; [b] age, gender, education, household income, household wealth, and neighborhood safety; [c] age, gender, marital status/living arrangements, number of children, number of siblings, relative in neighborhood, friend in neighborhood, religion, and paid work; [d] age, gender, regular exercise, smoking, drinking, and body mass index; [e] age, gender, number of chronic conditions, and self-rated health; [f] all covariates are included.

3. Discussion

Using latent growth models, this chapter examined nativity differences in functional limitations and disability. Although relatively few studies have investigated nativity differences in functional health compared to infant/adult mortality, several cross-sectional studies found that on average immigrants showed better functional health in terms of activity limitations (Cho, Frisbie, and Rogers 2004; Frisbie, Cho, and Hummer 2001; Lucas, Barr-Anderson, and Kington 2003). This study followed a relatively short period of time and there was no sufficient evidence that immigrant status is associated with the rates of change in functional limitations and disability, indicating that the functional health trajectories of immigrants and U.S.-born residents were parallel over the observation period. The data also indicate that immigrants have lower levels of functional limitations but are indistinguishable from U.S.-born residents in disability.

This study also found that the effect of immigrant status differs across racial/ethnic groups. Although immigrants showed lower levels of functional limitations than their native-born counterparts of similar racial/ethnic backgrounds, only foreign-born whites had lower levels of functional limitations than native-born whites. In particular, both native- and foreign-born Mexican Americans showed significantly higher levels of functional limitations than native-born whites.

This study also found some indications that family structure/social networks and health behaviors play positive roles in explaining the observed nativity differences in functional health. The data indicate that immigrants benefit from social integration and health behaviors compared to U.S.-born residents of similar racial/ethnic backgrounds.

However, the evidence presented in this chapter also suggests that immigrants do not uniformly benefit from social integration and health behaviors when they are compared to native-born whites.

In contrast to prior research, this study found that SES also plays a crucial role in mediating the observed nativity differences in functional health. The data indicate that functional health differences across immigrant status and race/ethnicity can be better explained by socioeconomic factors compared to social integration indicators or health behaviors. Although this chapter considered a reduced set of SES indicators, the inclusion of SES indicators largely removed the gaps between native-born whites and foreign-born racial/ethnic minorities. In particular, the data indicated that the impact of SES was substantial among foreign-born Hispanic populations.

Finally, like the analysis of mortality, some caution should be exercised in generalizing the results. The HRS is age-limited panel data, representing individuals over 50 years of age in the United States. Prior research found that the mortality risk of U.S.-born residents is higher than immigrants, in particular at younger ages. Although the HRS is a valuable source for the study of immigrant health, the HRS sample members have already been subject to selective mortality. If mortality selection at younger ages leaves beyond robust U.S.-born residents in terms of functional health, this study does not capture the underlying processes leading to the observed functional health differences at old ages. However, it is also equally important to note that return migration may underestimate health problems of immigrants. Although the literature suggests that the impact of return migration is greater at older ages (Palloni and Arias 2004), returning migrants who were less successful at younger ages, including disabled or injured migrant workers, may also underestimate health problems of immigrants.

Chapter 6: Active and Disabled Life Expectancy

1. Introduction

In chapter 4 and 5, this study examined differential mortality and the trajectories of functional limitations and disability, respectively. The data indicated that foreign-born racial/ethnic minorities have comparable or lower mortality risks compared to native-born whites. However, the functional health of foreign-born racial/ethnic minorities showed a different picture. This chapter combines mortality and functional health in terms of the compression of morbidity paradigm. First, descriptive health transition data are presented. Second, this chapter examines the multinomial logit parameter estimates of health transitions. Finally, this chapter examines total, active, and disabled life expectancy across race/ethnicity and immigrant status.

2. Results

Table 6.1 shows descriptive health transition patterns of the entire sample and combinations of race/ethnicity and immigrant status between the 1998 and 2004 HRS waves. It should be noted that Table 6.1 only describes health transitions between the first (1998) and last (2004) HRS waves. Thus, this descriptive table does not show any intermediate functional status transitions occurred in the 2000 and 2002 waves. Approximately 56 percent of the respondents remained active and 5.26 percent remained disabled by 2004. Further, 8.11 percent of the respondents, who were active in 1998, became disabled in 2004 and 3.52 percent became active.

Compared to native-born whites, Table 6.1 shows that foreign-born whites were less likely to remain active and were slightly more likely to remain disabled. Foreign-born whites were also more likely to become disabled and were less likely to recover from disability. As we can expect, native-born whites and native-born blacks show markedly different patterns in health transitions. The only exception is that native-born blacks were more likely to recover from disability in 2004. Although the sample size is relatively small, in contrast to native-born blacks, the descriptive data indicate that the health transitions of foreign-born blacks are not markedly different from native-born whites.

The descriptive data also indicate that the health transitions of native-born Asian/Native Americans are somewhat similar to those of native-born blacks. However, native-born Asian/Native Americans were less likely to become disabled and were more likely to recover from disability compared to native-born blacks. In contrast to native-born Asian/Native Americans, foreign-born Asian/Native Americans were more likely to remain active and were less likely to become disabled compared to native-born whites. Further, foreign-born Asian/Native Americans were substantially less likely to die by 2004. However, foreign-born Asian/Native Americans were more likely to remain disabled and were less likely to recover from disability. The health transition patterns of Hispanics are a bit mixed. Although the transition to death of Hispanics are lower (in particular, foreign-born Hispanics) and Hispanics are also more likely to recover from disability compared to native-born whites, both native- and foreign-born Hispanics were less likely to remain active, were more likely to remain disabled, and were more likely to become disabled in 2004. Thus, although Hispanics may have a longer or comparable life expectancy compared to native-born whites, the descriptive data suggest that they may suffer from a prolonged period of disability.

Table 6.1. Number/Percentage of Health Transitions between 1998 and 2004

Nativity	Race/Ethnicity	Remained Active	Remained Disabled	Became Active	Became Disabled	Died	Unknown
Native-Born	White	9,021 (58.65)	661 (4.30)	465 (3.02)	1,204 (7.83)	2,792 (18.15)	1,237 (8.05)
	Black	1,317 (47.22)	246 (8.82)	139 (4.98)	263 (9.43)	602 (21.58)	222 (7.96)
	Asian/NA	128 (48.85)	22 (8.40)	14 (5.34)	18 (6.87)	51 (19.47)	29 (11.07)
	Hispanic	398 (53.49)	51 (6.85)	43 (5.78)	67 (9.01)	121 (16.26)	64 (8.60)
Foreign-Born	White	395 (53.31)	35 (4.72)	19 (2.56)	60 (8.10)	170 (22.94)	62 (8.37)
	Black	82 (56.55)	6 (4.44)	7 (4.83)	8 (5.52)	19 (13.10)	23 (15.86)
	Asian/NA	98 (65.33)	8 (5.33)	2 (1.33)	8 (5.33)	10 (6.67)	24 (16.00)
	Hispanic	462 (53.47)	80 (9.26)	52 (6.02)	81 (9.38)	116 (13.43)	73 (8.45)
Total Sample		11,901 (56.47)	1,109 (5.26)	741 (3.52)	1,709 (8.11)	3,881 (18.42)	1,734 (8.22)

Note: Percentages in parentheses; Asian/NA = Asian/Native American.

Table 6.2 and 6.3 show multinomial logit parameter estimates for health transitions of men and women, respectively. For both men and women, age is significantly associated with transitions to disability and death. Age is also associated with lower recovery from disability. Table 6.2 and 6.3 also indicate that blacks and Hispanics are more likely than whites to be disabled. The results also indicate that both black men and women are more likely to die from the active state. Black men and women are also less likely to recover from disability compared to their white counterparts. However, Hispanics and Asian/Native Americans are not statistically different from whites in the transition to death and in recovering from disability. Therefore, the data suggest that, except for blacks, racial/ethnic differentials are mainly concentrated on disability rather than life expectancy in later life.

Regarding the effect of immigrant status, Table 6.2 and 6.3 indicate that immigrant status has somewhat differential effects on functional status transitions by gender. While immigrant men are significantly less likely to become disabled, immigrant women do not show this transition pattern. However, although statistically not significant, the data also indicate that both immigrant men and women are less likely to die once they are in the disabled state. Further, both immigrant men and women are also less likely to die from the active state compared to their native-born counterparts. These health transition patterns suggest that immigrants may experience lengthy inactive life once they are disabled.

Table 6.2. Parameter Estimates of Health Transitions: Males

Transition	Constant	Age	Black	Asian/NA	Hispanic	Immigrant
Active (1) to Disabled (2)	-9.149***	.054***	.441***	.304	.519***	-.313*
Active (1) to Death (3)	-11.865***	.078***	.394*	.134	-.096	-.239
Disabled (2) to Active (1)	-2.857***	-.015***	-.185†	.136	.179	-.184
Disabled (2) to Death (3)	-9.009***	.061***	-.173	-.785	.166	-.204

Note: Percentages in parentheses; NB = native-born; FB = foreign-born; Asian/NA = Asian/Native American.
† p < .10 * p < .05 ** p < .01 *** p < .001.

Table 6.3. Parameter Estimates of Health Transitions: Females

Transition	Constant	Age	Black	Asian/NA	Hispanic	Immigrant
Active (1) to Disabled (2)	-8.950***	.052***	.516***	.290†	.472***	.072
Active (1) to Death (3)	-14.306***	.101***	.584**	.290	-.658	-.130
Disabled (2) to Active (1)	-2.186***	-.026***	-.162*	.024	-.130	.024
Disabled (2) to Death (3)	-9.018***	.055***	-.072	.057	-.134	-.143

Note: Percentages in parentheses; NB = native-born; FB = foreign-born; Asian/NA = Asian/Native American.
† p < .10 * p < .05 ** p < .01 *** p < .001.

Table 6.4 and 6.5 show the distributions of total life expectancy (TLE), active life expectancy (ALE), and disabled life expectancy (DLE) by nativity at selected ages. The last column shows the percentage of disabled life expectancy out of total life expectancy at selected ages. Each of these life expectancy indexes are also shown separately by race/ethnicity. Overall, the gender gap in total life expectancy is notable but the gap decreases with age. However, the data indicate that the gender gap in the proportion of disabled life expectancy tends to increase with age. Further, regarding the gender gap in the context of nativity, the gender gap in total life expectancy is larger among U.S.-born residents compared to immigrants but decreases with age.

Table 6.4 and 6.5 also indicate that both immigrant men and women are expected to live more years at all selected ages. However, the nativity gap in total life expectancy decreases with age. Further, the data also indicate that the nativity difference in total life expectancy is more noticeable among men. Immigrant men tend to live more years in the active state than their U.S.-born counterparts. However, note that immigrant women show the opposite pattern, even though they are expected to live more years. Table 6.4 also shows that immigrant men are expected to live slightly more years with disability. Overall, the proportion of disabled life expectancy for immigrant men is comparable to that of U.S.-born men at each age.

However, the nativity gap in the proportion of disabled life expectancy is notable among women. At age 55, while U.S.-born women are expected to live less than 6 years in the disabled state, immigrant women are expected to live more than 7 years in the disabled state. Further, the nativity gap in the proportion of disabled life expectancy tends to increase with age. Thus, the overall pattern indicates that immigrant women's lengthy lives do not mean more years free of disability.

Table 6.4 and 6.5 also show racial/ethnic differences in TLE, ALE, and DLE. Among men, not surprisingly, native-born blacks are most disadvantaged in terms of total life expectancy. They are also expected to live fewer years in the active state. The proportion of disabled life expectancy is also highest. Native-born Hispanics are somewhere between native-born whites and blacks. Native-born Asian/Native Americans are expected to live more years (TLE) than native-born whites but they are expected to live fewer years in the active state and more years in the disabled state. Thus, the proportion of disabled life expectancy of native-born Asian/Native Americans is much higher than that of native-born whites at each age.

Table 6.4 also indicates that foreign-born men, except for foreign-born blacks, are expected to live more years than any native-born racial/ethnic groups. Compared to native-born whites, foreign-born whites are expected to live more years in both active and disabled states. The proportion of disabled life expectancy of foreign-born whites at each age is also a bit lower than that of their native-born counterparts. However, racial/ethnic minority groups do not show this pattern. Although the total life expectancies of all foreign-born racial/ethnic minority groups are comparable to that of native-born whites, they are expected to live more years in the disabled state. Further, for foreign-born racial/ethnic minorities, the proportions of disabled life expectancy exceed that of native-born whites.

As mentioned above, the nativity difference in total life expectancy is smaller among women. Table 6.5 shows that only foreign-born white and Hispanic women are expected to live more years compared to native-born white women. In contrast to foreign-born Asian/Native American men, the data indicate that foreign-born Asian/Native American women are expected to live fewer years at all selected ages. Regarding active life expectancy, all foreign-born racial/ethnic minority women are expected to live fewer years in the active state and more years in the disabled state compared to native-born white women. All foreign-born racial/ethnic minority women also exhibit much higher proportions of disabled life expectancy than native-born whites. Foreign-born white women also display a bit higher proportion of disabled life expectancy compared to their native-born counterparts.

It should be noted that, although foreign-born racial/ethnic minority men showed higher proportions of disabled life expectancy compared to native-born white men, they are clearly advantaged compared to their native-born counterparts of similar racial/ethnic backgrounds in terms of TLE, ALE, and the proportion of DLE. Among women, however, foreign-born racial/ethnic minority women show higher proportions of disabled life expectancy than their native-born counterparts of similar racial/ethnic backgrounds.

Table 6.4. Total, Active, and Disabled Life Expectancy: Males

Nativity	Race/Ethnicity	Age	TLE		ALE		DLE		DLE (%)
Native-Born		55	23.35	(.26)	19.83	(.24)	3.52	(.11)	15.07
		65	15.95	(.21)	12.88	(.19)	3.08	(.10)	19.28
		75	10.04	(.19)	7.54	(.18)	2.50	(.10)	24.89
		85	5.82	(.18)	3.96	(.16)	1.86	(.10)	31.96
	White	55	23.64	(.28)	20.29	(.26)	3.36	(.11)	14.19
		65	16.18	(.23)	13.24	(.21)	2.95	(.10)	18.21
		75	10.19	(.20)	7.78	(.19)	2.40	(.10)	23.59
		85	5.90	(.18)	4.11	(.16)	1.80	(.10)	30.41
	Black	55	20.83	(.77)	16.16	(.66)	4.67	(.42)	22.43
		65	13.95	(.62)	9.90	(.51)	4.06	(.37)	29.08
		75	8.63	(.48)	5.35	(.36)	3.27	(.33)	37.96
		85	4.96	(.35)	2.52	(.23)	2.44	(.29)	49.14
	Asian/NA	55	25.23	(2.16)	20.04	(1.65)	5.18	(1.12)	20.54
		65	17.78	(1.88)	13.04	(1.35)	4.74	(1.06)	26.64
		75	11.68	(1.57)	7.57	(1.00)	4.11	(1.00)	35.19
		85	7.16	(1.27)	3.82	(.65)	3.34	(.95)	46.59
	Hispanic	55	22.06	(1.10)	18.01	(.98)	4.05	(.47)	18.35
		65	14.74	(.91)	11.27	(.78)	3.46	(.42)	23.50
		75	9.01	(.69)	6.28	(.55)	2.73	(.36)	30.25
		85	5.07	(.46)	3.12	(.35)	1.95	(.30)	38.51
Foreign-Born		55	25.56	(.95)	21.62	(.89)	3.94	(.41)	15.42
		65	17.80	(.80)	14.33	(.73)	3.47	(.36)	19.51
		75	11.43	(.63)	8.59	(.56)	2.85	(.31)	24.90
		85	6.76	(.44)	4.63	(.39)	2.14	(.26)	31.61
	White	55	26.21	(1.11)	22.74	(1.02)	3.47	(.43)	13.25
		65	18.39	(.93)	15.30	(.85)	3.10	(.38)	16.83
		75	11.92	(.72)	9.35	(.65)	2.58	(.33)	21.60
		85	7.11	(.51)	5.15	(.46)	1.97	(.28)	27.65
	Black	55	23.23	(1.32)	18.35	(1.15)	4.89	(.72)	21.03
		65	15.94	(1.09)	11.64	(.92)	4.31	(.64)	27.03
		75	10.12	(.83)	6.57	(.66)	3.55	(.55)	35.11
		85	5.96	(.59)	3.25	(.42)	2.71	(.47)	45.48
	Asian/NA	55	27.73	(2.38)	22.31	(1.84)	5.41	(1.27)	19.52
		65	19.94	(2.09)	14.93	(1.55)	5.00	(1.20)	25.10
		75	13.40	(1.76)	8.99	(1.18)	4.41	(1.13)	32.93
		85	8.40	(1.43)	4.74	(.79)	3.66	(1.07)	43.59
	Hispanic	55	24.60	(1.18)	20.36	(1.08)	4.24	(.51)	17.22
		65	16.89	(.99)	13.20	(.89)	3.69	(.46)	21.84
		75	10.65	(.76)	7.68	(.65)	2.97	(.39)	27.89
		85	6.18	(.53)	4.00	(.43)	2.18	(.33)	35.35

Note: TLE = Total life expectancy; ALE = Active life expectancy; DLE = Disabled life expectancy.
Asian/NA = Asian/Native American; Standard errors are in parentheses.

Table 6.5. Total, Active, and Disabled Life Expectancy: Females

Nativity	Race/Ethnicity	Age	TLE		ALE		DLE		DLE (%)
Native-Born		55	27.90	(.25)	22.17	(.22)	5.73	(.13)	20.54
		65	19.49	(.22)	14.39	(.18)	5.10	(.13)	26.16
		75	12.49	(.20)	8.26	(.16)	4.23	(.12)	33.89
		85	7.32	(.18)	4.08	(.14)	3.24	(.13)	44.25
	White	55	28.35	(.27)	22.89	(.24)	5.46	(.14)	19.26
		65	19.87	(.24)	14.97	(.20)	4.90	(.13)	24.66
		75	12.75	(.21)	8.65	(.17)	4.10	(.13)	32.16
		85	7.47	(.19)	4.31	(.15)	3.17	(.13)	42.40
	Black	55	24.58	(.69)	17.46	(.54)	7.12	(.45)	28.96
		65	16.72	(.59)	10.49	(.42)	6.23	(.41)	37.27
		75	10.49	(.47)	5.41	(.29)	5.08	(.36)	48.46
		85	6.16	(.36)	2.31	(.18)	3.86	(.32)	62.58
	Asian/NA	55	26.06	(1.72)	20.21	(1.38)	5.85	(.94)	22.45
		65	17.88	(1.49)	12.71	(1.13)	5.18	(.86)	28.95
		75	11.23	(1.18)	6.97	(.81)	4.26	(.76)	37.95
		85	6.49	(.83)	3.24	(.51)	3.24	(.65)	49.98
	Hispanic	55	28.38	(1.26)	20.00	(.94)	8.38	(.80)	29.54
		65	19.93	(1.13)	12.53	(.77)	7.40	(.75)	37.13
		75	12.90	(.93)	6.84	(.55)	6.06	(.67)	46.95
		85	7.74	(.70)	3.19	(.34)	4.55	(.57)	58.77
Foreign-Born		55	28.85	(.88)	21.37	(.70)	7.48	(.54)	25.93
		65	20.36	(.78)	13.71	(.58)	6.66	(.50)	32.69
		75	13.24	(.64)	7.73	(.43)	5.52	(.47)	41.66
		85	7.95	(.49)	3.73	(.28)	4.22	(.39)	53.08
	White	55	29.35	(.98)	23.09	(.81)	6.25	(.55)	21.31
		65	20.76	(.87)	15.12	(.69)	5.65	(.51)	27.19
		75	13.50	(.71)	8.73	(.52)	4.77	(.45)	35.34
		85	8.04	(.53)	4.32	(.35)	3.72	(.39)	46.30
	Black	55	25.70	(1.21)	17.60	(.91)	8.10	(.83)	31.51
		65	17.72	(1.05)	10.59	(.71)	7.13	(.75)	40.25
		75	11.31	(.84)	5.45	(.48)	5.86	(.66)	51.78
		85	6.79	(.64)	2.32	(.28)	4.46	(.56)	65.77
	Asian/NA	55	27.09	(1.85)	20.42	(1.46)	6.67	(1.10)	24.61
		65	18.80	(1.63)	12.87	(1.20)	5.93	(1.01)	31.56
		75	11.98	(1.31)	7.06	(.86)	4.93	(.90)	41.11
		85	7.04	(.955)	3.27	(.52)	3.77	(.77)	53.58
	Hispanic	55	29.39	(1.26)	19.99	(.90)	9.40	(.84)	31.99
		65	20.83	(1.14)	12.50	(.74)	8.33	(.79)	40.00
		75	13.65	(.95)	6.79	(.53)	6.86	(.71)	50.22
		85	8.30	(.73)	3.13	(.32)	5.17	(.61)	62.25

Note: TLE = Total life expectancy; ALE = Active life expectancy; DLE = Disabled life expectancy.
Asian/NA = Asian/Native American; Standard errors are in parentheses.

3. Discussion

Consistent with prior research on mortality, the results in this chapter also indicate that immigrant men and women, in particular men, are expected to live more years than their native-born counterparts. Among women, this chapter found that the nativity gap is much smaller and only foreign-born white and Hispanic women are expected to live more years than native-born white women.

The data also indicate that, although immigrants are expected to live more years, overall immigrants' lengthy lives do not simply mean more years in healthy life. This study found that the proportions of disabled life expectancy of foreign-born racial/ethnic minority groups are much higher compared to native-born whites, even though overall they are expected to live more years. Thus, the data indicate that foreign-born racial/ethnic minority men's prolonged lives are more likely to be associated with more years of inactive life.

This study also found that overall the total life expectancy of immigrant women is comparable to that of their native-born counterparts but the problem of disabled life expectancy is more striking among immigrant women. Although foreign-born racial/ethnic minority men exhibit higher proportions of disabled life expectancy than native-born white men, they are clearly advantaged in terms of total life expectancy, active life expectancy, and the proportion of disabled life expectancy compared to their native-born counterparts of similar racial/ethnic backgrounds. In contrast, foreign-born racial/ethnic minority women showed much higher proportions of disabled life expectancy than their native-born counterparts of similar racial/ethnic backgrounds, even though they are expected to live more years.

We do not have sufficient evidence to explain immigrant's prolonged period of disability. Prior research emphasized behavioral/cultural assimilation in order to explain health deterioration of immigrants. However, to date, little is known about the specific mechanisms by which behavioral/cultural assimilation is associated with a prolonged period of disability among immigrants. Further, the overall evidence presented in this study suggests that we need to take a closer look at immigrants' socioeconomic adaptation into U.S. society. Immigrants may be positively selected from the origin population, which may explain their longer life expectancy. However, they are also more likely to live with incomes below the federal poverty line in the United States, even though they are equally likely to participate in the labor force (Martin and Midgley 2003). In 2002, 16 percent of the foreign-born and 11 percent of native-born residents were living below the poverty line in the United States. However, the growing bifurcation of immigrants is apparent in the poverty rates of various national origin groups. In particular, the problem of poverty tends to become the problem of racial/ethnic minority immigrants. For example, while immigrants from Germany have a poverty rate of only 7.1 percent, immigrants from Mexico and the Dominican Republic suffered poverty rates of 24.4 percent and 25.8 percent, respectively (Camarota 2002; see also Borjas 1990).

Further, prior research has shown that immigrants are frequently disadvantaged in terms of employment, earnings, occupational prestige, and other types of employment hardship compared to the native-born (e.g., De Jong and Madamba 2001; Hirschman and Wong 1984; McDermott and Lee 1990; Nee and Sanders 1985; Peek-Asa, Erickson, and

Krause 1999; Zeng and Xie 2004). In particular, the fact that immigrants tend to be in greater proportion in hazardous occupations, such as construction, heavy industry, and farming, has an important implication for occupational accidents and disability (Bollini and Siem 1995; Mobed, Gold, and Schenker 1992; Robinson 1989). Many immigrant workers also do not get sufficient safety training or protection and do not obtain appropriate treatment if injured on the job (Pransky, Moshenberg, Benjamin, Portillo, Thackrey, and Hill-Fotouhi 2002). Health authorities also often have limited access to immigrant workers (in particular, seasonal or undocumented immigrant workers). This issue becomes more important in later life since life experiences are cumulated over time. Therefore, despite the healthy migrant effect at younger ages, many immigrants may end up with a substantial burden of disability in later life (Bollini and Siem 1995).

Chapter 7: Conclusion

Consistent with the pervasive assumption of the international migrant as a young and economically motivated male, relatively little is known about immigrant health in later life. Using the HRS panel data, this study examined nativity differences in mortality and physical functioning. In particular, this study focused on the roles of SES, social integration, and health behaviors in explaining nativity differences in physical functioning and mortality. This study also combined mortality and disability to investigate the quality of immigrants' prolonged lives.

Consistent with prior research, this study found that immigrant men had lower mortality compared to their U.S.-born counterparts. However, immigrant women were not different from U.S.-born women. With respect to physical functioning, immigrants showed lower levels of functional limitations but were not different from U.S.-born residents in terms of disability. The data also showed that the effect of immigrant status a bit differs across mortality and functional health. While all foreign-born racial/ethnic minority groups showed lower or comparable mortality risks compared to native-born whites, foreign-born Hispanics did not show comparable functional health compared to native-born whites.

This study also found that SES, social integration, and health behaviors play important roles in explaining the observed nativity differences in functional health and mortality. The evidence presented in this study suggests that socioeconomic factors better explain the observed nativity differences in mortality and functional health compared to social integration and health behaviors. In particular, this study found the role of SES was substantial among foreign-born Hispanics in both mortality and functional health.

The analysis of active life expectancy also revealed that, except for foreign-born whites, immigrants' lengthy lives are expected to be a prolonged period of disability. The data indicate that the proportions of disabled life expectancy are higher among foreign-born racial/ethnic minority men compared to native-born white men. The expected life in the disabled state was more notable among foreign-born women. While foreign-born racial/ethnic minority men were advantaged compared to their native-born counterparts of similar racial/ethnic backgrounds, foreign-born minority women did not show this pattern.

Overall, the results suggest that the current indications of immigrant health in later life are not optimistic. Health selectivity may have a greater impact on immigrant health at younger ages but this study indicates that immigrant's socioeconomic adaptation into U.S. society may have greater salience in later life. Positive health selection does not mean that social policies aimed at promoting immigrant health are unnecessary. This study suggests that social policies aimed at promoting immigrant health need to be accompanied by a more general effort to integrate immigrants into the mainstream of U.S. society. Given the growing number of the immigrant population in the United States, identifying the health status and needs of immigrants is critical to understanding the impact of international migration on the health of the nation. If the health status and needs of immigrants are poorly understood, this study suggests that the resulting burden on the nation as well as immigrants could be substantial.

This study also showed that integrating several health outcomes is a valuable way to investigate the health status of immigrants relative to U.S.-born residents. Although prior research emphasizes that immigrants are advantaged in terms of mortality, this study indicates that merely comparing life expectancy may present misleading information about immigrant health. Compared U.S.-born residents, the data indicate that mortality and disability are loosely coupled for immigrants and integrating mortality and physical functioning presents a more accurate description of immigrant health in later life.

Finally, several limitations of this study should be acknowledged. First, as pointed out, the HRS is age-limited panel data. It is important to note that the HRS sample members have already been subject to selective mortality. Thus, this study may not capture the underlying true processes leading to the observed nativity differences in mortality and physical functioning due to selective mortality at younger ages. Second, except for Hispanics, the HRS does not have sufficient data points for foreign-born populations, resulting in estimates that are subject to large errors. Third, this study only considered mortality and physical functioning because the literature remains unclear whether morbidity (chronic conditions) and self-rated health measures are valid and reliable in the study of immigrant health. Finally, the HRS does not provide information about the quality social relationships and thus this study may underestimate the role of social integration among immigrants.

References

Abraido-Lanza, Ana F., Bruce P. Dohrenwend, Daisy S. Ng-Mak, and J. Blake Turner. 1999. "The Latino Mortality Paradox: A Test of the "Salmon Bias" and Healthy Migrant Hypotheses." *American Journal of Public Health* 89(10): 1543-1548.

Alba, Richard and Victor Nee. 2003. *Remaking the American Mainstream: Assimilation and Contemporary Immigration*. Cambridge, MA: Harvard University Press.

Albert, Steven M. and Maria G. Cattell. 1994. *Old Age in Global Perspective: Cross-Cultural and Cross-National Views*. New York: G. K. Hall.

Amaro, Hortensia, Rupert Whitaker, Gerald Coffman, and Timothy Heeren. 1990. "Acculturation and Marijuana and Cocaine Use: Findings from HHANES 1982-84." *American Journal of Public Health* 80(suppl.): 54-60.

Angel, Jacqueline L., Cynthia J. Buckley and Arthur Sakamoto. 2001. "Duration or Disadvantage? Exploring Nativity, Ethnicity, and Health in Midlife." *Journal of Gerontology* 56B: S275-S284.

Arcia, Emily, Martie Skinner, Donald B. Bailey, and Vivian Correa. 2001. "Models of Acculturation and Health Behaviors among Latino Immigrants to the US." *Social Science and Medicine* 53(1): 41-53.

Australian Institute of Health and Welfare. 2000. "Australia's Health 2000: The Seventh Biennial Health Report of the Australian Institute of Health and Welfare." Canberra: AIHW.

Beck, Nathaniel, Jonathan N. Katz, and Richard Tucker. 1998. "Taking Time Seriously: Time-Series-Cross-Section Analysis with a Binary Dependent Variable." *American Journal of Political Science* 42(4): 1260-1288.

Bermudez, Odilia I., Luis M. Falcon, and Katherine L. Tucker. 2000. "Intake and Food Sources of Macronutrients among Older Hispanic Adults: Association with Ethnicity, Acculturation, and Length of Residence in the United States." *Journal of American Dietetic Association* 100(6): 665-673.

Blake, Susan M., Rebecca Ledsky, Carol Goodenow, and Lydia O'Donnell. 2001. "Recency of Immigration, Substance Use, and Sexual Behavior among Massachusetts Adolescents." *American Journal of Public Health* 91(5): 794-798.

Borjas, George J. 1990. *Friends or Strangers: The Impact of Immigrants on the U.S. Economy*. New York: Basic Books.

Borrayo, Evelinn A. and Charles A. Guarnaccia. 2000. "Differences in Mexican-Born and U.S.-Born Women of Mexican Descent Regarding Factors Related to Breast Cancer Screening Behaviors." *Health Care for Women International* 21(7): 599-613.

Burnam, M. Audrey, Richard L. Hough, Marvin Karno, Javier I. Escobar, and Cynthia A.

Telles. 1987. “Acculturation and Lifetime Prevalence of Psychiatric Disorders among Mexican Americans in Los Angeles.” *Journal of Health and Social Behavior* 28(1): 89-102.

Cabassa, Leopoldo J. 2003. “Measuring Acculturation: Where We Are and Where We Need To Go.” *Hispanic Journal of Behavioral Sciences* 25(2): 127-146.

Cabral, Howard, Lise E. Fried, Suzette Levenson, Hortensia Amaro, and Barry Zuckerman. 1990. “Foreign-Born and US-Born Black Women: Differences in Health Behaviors and Birth Outcomes.” *American Journal of Public Health* 80(1): 70-72.

Camarota, Steven A. 2002. “Immigrants in the United States – 2002: A Snapshot of America’s Foreign-Born Population.” *Backgrounder*. Washington, DC: Center for Immigration Studies.

Carrasquillo, Olveen, Angeles I. Carrasquillo, and Steven Shea. 2000. “Health Insurance Coverage of Immigrants Living in the United States: Differences by Citizenship Status and Country of Origin.” *American Journal of Public Health* 90(6): 917-923.

Chen, Xinguang, Jennifer B. Unger, and C. Anderson Johnson. 1999. “Is Acculturation a Risk Factor for Early Smoking Initiation among Chinese American Minors?: A Comparative Perspective.” *Tobacco Control* 8(4): 402-410.

Choi, Namkee G. 1996. “Older Persons Who Move: Reasons and Health Consequences.” *Journal of Applied Gerontology* 15(3): 325-344.

Cho, Youngtae, W. Parker Frisbie, Robert A. Hummer and Richard G. Rogers. 2004. “Nativity, Duration of Residence, and the Health of Hispanic Adults in the United States.” *International Migration Review* 38(1): 184-211.

Cobas, Jose A., Hector Balcazar, Mary B. Benin, Verna M. Keith, and Yinong Chong. 1996. “Acculturation and Low-Birthweight Infants among Latino Women: A Reanalysis of HHANES Data with Structural Equation Models.” *American Journal of Public Health* 86(3): 394-396.

Collins, Linda M., Joseph L. Schafer, and Chi-Ming Kam. 2001. “A Comparison of Inclusive and Restrictive Strategies in Modern Missing Data Procedures.” *Psychological Methods* 6(4): 330-351.

Crimmins, Eileen M., Mark D. Hayward, and Yasuhiko Saito. 1994. “Changing Mortality and Morbidity Rates and the Health Status and Life Expectancy of the Older Populations.” *Demography* 31(1): 159-175.

Darmon, Nicole and Myriam Khlat. 2001. “An Overview of the Health Status of Migrants in France, in Relation to Their Dietary Practices.” *Public Health Nutrition* 4(2): 163-172.

De Jong, Gordon F. and Anna B. Madamba. 2001 “A Double Disadvantage? Minority Group, Immigrant Status, and Underemployment in the United States.” *Social*

Science Quarterly 82(1): 117-130.

Dey, Achintya N. and Jacqueline W. Lucas. 2006. "Physical and Mental Health Characteristics of U.S.- and Foreign-Born Adults: United States 1998-2003." *Advance Data from Vital and Health Statistics* 369.

Dick, Bruce. 1984. "Diseases of Refugees: Causes, Effects and Control." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 78(6): 734-741.

Dixon, Lori B., Jan Sundquist, and Marilyn Winkleby. 2000. "Differences in Energy, Nutrient, and Food Intakes in a US Sample of Mexican American Women and Men: Findings from the Third National Health and Nutrition Examination Survey, 1988-1994." *American Journal of Epidemiology* 152(6): 548-557.

Ellwood, Marilyn R. and Leighton Ku. 1998. "Welfare and Immigration Reforms: Unintended Side Effects for Medicaid." *Health Affairs* 17(3): 137-151.

Elo, Irma T., Cassio M. Turra, Bert Kestenbaum, and B. Renee Ferguson. 2004. "Mortality among Elderly Hispanics in the United States: Past Evidence and New Results." Demography 41(1): 109-128.

Feinstein, Jonathan S. 1993. "The Relationship between Socioeconomic Status and Health: A Review of the Literature." *Milbank Quarterly* 71(2): 279-322.

Ferraro, Kenneth F., Melissa M. Farmer, and John A. Wybraniec. 1997. "Health Trajectories: Long-Term Dynamics among Black and White Adults." *Journal of Health and Social Behavior* 38(1): 38-54.

Ferrucci, Luigi, Grant Izmirlian, Suzanne Leveille, Caroline L. Phillips, Maria-Chiara Corti, and Dwight B. Brock. 1999. "Smoking, Physical Activity, and Active Life Expectancy." *American Journal of Epidemiology* 149(7): 645-653.

Finch, Brian K. and William A. Vega. 2003. "Acculturation Stress, Social Support, and Self-Rated Health among Latinos in California." *Journal of Immigrant Health* 5(3): 109-117.

Flores, Glenn, Jennifer Rabke-Verani, Whitney Pine, and Ashu Sabharwal. 2002. "The Importance of Cultural and Linguistic Issues in the Emergency Care of Children." *Pediatric Emergency Care* 18(4): 271-284.

Frisbie, W. Parker, Youngtae Cho, and Robert A. Hummer. 2001. "Immigration and the Health of Asian and Pacific Islander Adults in the United States." *American Journal of Epidemiology* 153(4): 372-380.

Fuentes-Afflick, Elena, Nancy A. Hessol, Eliseo J. Pérez-Stable. 1999. "Testing the Epidemiologic Paradox of Low Birth Weight in Latinos." *Archives of Pediatrics and Adolescent Medicine* 153(2): 147-153.

Fujimoto, Wilfred Y., Richard W. Bergstrom, Edward J. Boyko, Kwang-Wen Chen, Steven E. Kahn, Donna L. Leonetti, Marguerite J. McNeely, Laura L. Newell, Jane B. Shofer, and Patricia W. Wahl. 2000. "Type 2 Diabetes and the Metabolic

Syndrome in Japanese Americans." *Diabetes Research and Clinical Practice* 50(suppl.): S73-S76.

Gfroerer, Joseph C. and Lucilla L. Tan. 2003. "Substance Use among Foreign-Born Youths in the United States: Does the Length of Residence Matter?" *American Journal of Public Health* 93(11): 1892-1895.

Granados, Gilberto, Jyoti Puvvula, Nancy Berman, Patrick T. Dowling. 2001. "Health Care for Latino Children: Impact of Child and Parental Birth-Place on Insurance Status and Access to Health Services." *American Journal of Public Health* 91(11): 1806-1807.

Guendelman, Sylvia and Barbara Abrams. 1995. "Dietary Intake among Mexican-American Women: Generational Differences and a Comparison with White Non-Hispanic Women." *American Journal of Public Health* 85(1): 20-25.

Hao, Lingxin and Richard W. Johnson. 2000. "Economic, Cultural, and Social Origins of Emotional Well-Being: Comparisons of Immigrants and Natives at Midlife." *Research on Aging* 22(6): 599-629.

Hayward, Mark D. and Melonie Heron. 1999. "Racial Inequality in Active Life among Adult Americans." *Demography* 36(1): 77-91.

Hayward, Mark D., Toni P. Miles, Eileen M. Crimmins, and Yu Yang. 2000. "The Significance of Socioeconomic Status in Explaining the Racial Gap in Chronic Health Conditions." *American Sociological Review* 65(6): 910-930.

Henretta, John C. and Richard T. Campbell. 1978. "Net Worth as an Aspect of Status." *American Journal of Sociology* 83(5): 1204-1223.

Hirschman, Charles and Morrison G. Wong. 1984. "Socioeconomic Gains of Asian Americans, Blacks, and Hispanics: 1960-1976." *American Journal of Sociology* 90(3): 584-607.

Hovey, Joseph D. 2000. "Acculturation Stress, Depression and Suicidal Ideation in Mexican Immigrants." *Cultural Diversity and Ethnic Minority Psychology* 6(2): 134-151.

Hu, Dale J. and Ruth M. Covell. 1986. "Health Care Usage by Hispanic Outpatients as Function of Primary Language." *Western Journal of Medicine* 144(4): 490-493.

Huang, Boji, Beatriz L. Rodriguez, Cecil M. Burchfiel, Po-Huang Chyou, J. David Curb, and Katsuhiko Yano. 1996. "Acculturation and Prevalence of Diabetes among Japanese-American Men in Hawaii." *American Journal of Epidemiology* 144(7): 674-681.

Hummer, Robert A., Monique Biegler, Peter B. De Turk, Douglas Forbes, W. Parker Frisbie, Ying Hong, and Starling G. Pullum. 1999. "Race/Ethnicity, Nativity, and Infant Mortality in the United States." *Social Forces* 77(3): 1083-1117.

Hummer, Robert A., Richard G. Rogers, Charles B. Nam, and Felicia B. LeClere. 1999.

"Race/Ethnicity, Nativity, and U.S. Adult Mortality." *Social Science Quarterly* 80(1): 136-153.

Hyman, Ilene. 2001. "Immigration and Health." Working Paper 01-05. Health Policy Working Paper Series. Ottawa: Health Canada.

Idler, Ellen L. and Yael Benyamini. 1997. "Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies." *Journal of Health and Social Behavior* 38(1): 21-37.

Idler, Ellen L. and Stanislav Kasl. 1995. "Self-Ratings of Health: Do They Also Predict Change in Functional Ability?" *Journal of Gerontology* 50B(6): S344-353.

Jasso, Guillermina, Douglas S. Massey, Mark R. Rosenzweig, and James P. Smith. 2004. "Immigrant Health: Selectivity and Acculturation." Paper prepared for National Academy of Science Conference on Racial and Ethnic Disparities in Health. Working Paper WP04/23. Institute for Fiscal Studies.

Johnson, Timothy P., Jonathan B. Vangeest, and Young I. Cho. 2002. "Migration and Substance Use: Evidence from the U.S. National Health Interview Survey." *Substance Use and Misuse* 37(8-10): 941-972.

Kandula, Namratha R., Margaret Kersey, and Nicole Lurie. 2004. "Assuring the Health of Immigrants: What the Leading Health Indicators Tell Us." *Annual Review of Public Health* 25: 357-376.

Kaplan, Mark S. and Gary Marks. 1990. "Adverse Effects of Acculturation Psychological Distress among Mexican American Young Adults." *Social Science and Medicine* 31(12): 1313-1319.

Katz, Sidney, Laurence G. Branch, Michael H. Branson, Joseph A. Papsidero, John C. Beck, and David S. Greer. 1983. "Active Life Expectancy." *New England Journal of Medicine* 309(20): 1218-1224.

King, Haitung and Frances B. Locke. 1987. "Health Effects of Migration: U.S. Chinese In and Outside the Chinatown." *International Migration Review* 21(3): 555-576.

Kitagawa, Evelyn M. and Philip M. Hauser. 1973. *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*. Cambridge, Massachusetts: Harvard University Press.

Laditka, Sarah B. and Douglas A. Wolf. 1998. "New Methods for Analyzing Active Life Expectancy." *Journal of Aging and Health* 10(2): 214-241.

Land, Kenneth C., Jack M. Guralnik, and Dan G. Blazer. 1994. "Estimating Increment-Decrement Life Tables with Multiple Covariates from Panel Data: The Case of Active Life Expectancy." *Demography* 31(2): 297-319.

Landale, Nancy S., R. S. Oropesa and Bridget K. Gorman. 2000. "Migration and Infant Death: Assimilation or Selective Migration among Puerto Ricans?" *American Sociological Review* 65(6): 888-909.

Landale, Nancy S., R. S. Oropesa, D. Llanes, and Bridget K. Gorman. 1999. "Does Americanization have Adverse Effects on Health?: Stress, Health Habits, and Infant Health Outcomes among Puerto Ricans." *Social Forces* 78(2): 613-641.

Lara, Marielena, Cristina Gamboa, M. Iya Kahramanian, Leo S. Morales, and David E. Hayes Bautista. 2005. "Acculturation and Latino Health in the United States: A Review of the Literature and Its Sociopolitical Context." *Annual Review of Public Health* 26: 367-397.

LeClere, Felicia B., Leif Jensen, and Ann E. Biddlecom. 1994. "Health Care Utilization, Family Context, and Adaptation among Immigrants to the United States." *Journal of Health and Social Behavior* 35(4): 370-384.

Le Marchand, Loic, Lynne R. Wilkens, Laurence N. Kolonel, Jean H. Hankin, and Li-Ching Lyu. 1997. "Associations of Sedentary Lifestyle, Obesity, Smoking, Alcohol Use, and Diabetes with the Risk of Colorectal Cancer." *Cancer Research* 57(21): 4787-4794.

Liang, Jersey, Renee H. Lawrence, Joan M. Bennett, and Nancy A. Whitelaw. 1990. "Appropriateness of Composites in Structural Equation Models." *Journal of Gerontology* 45(2): S52-59.

Lievre, Agnes, Nicolas Brouard, and Christopher Heathcote. 2003. "The Estimation of Health Experiences from Cross-Longitudinal Surveys." *Mathematical Population Studies* 10(4): 211-248.

Lu, Francis G. 2002. "The Poor Mental Health Care of Asian Americans: Two Recent Reports Found Striking Disparities in Care for Different Ethnic Groups." *Western Journal of Medicine* 176(4): 224.

Lucas, Jacqueline W., Daheia J. Barr-Anderson, and Raynard S. Kington. 2003. "Health Status, Health Insurance, and Health Care Utilization Patterns of Immigrant Black Men." *American Journal of Public Health* 93(10): 1740-1747.

Lynch, Scott M., J. Scott Brown, and Katherine G. Harmsen. 2003. "The Effect of Altering ADL Thresholds on Active Life Expectancy Estimates for Older Persons." *Journal of Gerontology* 58(3): S171-178.

Manton, Kenneth G. and Kenneth C. Land. 2000. "Active Life Expectancy Estimates for the U.S. Elderly Population: A Multidimensional Continuous-Mixture Model of Functional Change Applied to Completed Cohorts, 1982-1996." *Demography* 37(3): 253-265.

Markides, Kyriakos S., Jeannine Coreil, and Laura A. Ray. 1987. "Smoking among Mexican Americans: A Three-Generational Study." *American Journal of Public Health* 77(6): 708-711.

Markides, Kiryakos S., Neal Krause, and Carlos F. Mendes De Leon. 1988. "Acculturation and Alcohol Consumption among Mexican Americans: A Three-Generation Study." *American Journal of Public Health* 78(9): 1178-1181.

Markides, Kiryakos S., Laura A. Ray, Christine A. Stroup-Benham, and Fernando Trevino. 1990. "Acculturation and Alcohol Consumption in the Mexican American Population of the South-Western United States: Findings from HHANES 1982-84." *American Journal of Public Health* 80(Suppl.): 42-46.

Marks, Gary, Melinda Garcia, and Julia M. Solis. 1990. "Health Risk Behaviors of Hispanics in the Untied States: Findings from HHANES 1982-84." *American Journal of Public Health* 80(suppl.): 20-26.

Marmot, Michael G. and S. Leonard Syme. 1976. "Acculturation and Coronary Heart Disease in Japanese-Americans." *American Journal of Epidemiology* 104(3): 225-246.

Martin, Philip and Elizabeth Midgley. 2003. "Immigration: Shaping and Reshaping America." *Population Bulletin* 58(2).

McDermott, Suzanne and C. Virginia Lee. 1990. "Injury among Male Migrant Farm Workers in South Carolina." *Journal of Community Health* 15(5): 297-305.

Mehta, Sheila. 1998. "Relationship between Acculturation and Mental health for Asian Indian immigrants in the United." *Genetic, Social, and General Psychology Monographs* 124(1): 61-78.

Mirowsky, John. 1999. "Analyzing the Association between Mental Health and Social Circumstances." Pp. 105-123 in *Handbook of the Sociology of Mental Health*, edited by Carol S. Aneshensel and Jo C. Phelan. New York: Kluwer Academic/Plenum Publishers.

Mirowsky, John and Catherine E. Ross. 2003. *Education, Social Status, and Health*. New York: ALDINE DE GRUYTER.

Mobed, Ketty, Ellen B. Gold, and Marc B. Schenker. 1992. "Occupational Health Problems among Migrants and Seasonal Farm Workers." *Western Journal of Medicine* 157(3): 367-373.

Moen, Phyllis, Vivian Fields, Heather E. Quick, and Heather Hofmeister. 2000. "A Life-Course Approach to Retirement and Social Integration." Pp. 75-107 in *Social Integration in the Second Half of Life*, edited by Karl Pillemer, Phyllis Moen, Elaine Wethington, and Nina Glasgow. Baltimore: The Johns Hopkins University Press.

Moen, Phyllis, Donna Dempster-McClain, and Robin M. Williams, Jr. 1989. "Social Integration and Longevity: An Event History Analysis of Women's Roles and Resilience." *American Sociological Review* 54(4): 635-647.

Moen, Phyllis, Donna Dempster-McClain, and Robin M. Williams, Jr. 1992. "Successful Aging: A Life Course Perspective on Women's Roles and Health." *American Journal of Sociology* 97(6): 1612-1638.

Mollica, Richard F., Xingjia Cui, Keith Mcinnes, and Michael P. Massagli. 2002. "Science-Based Policy for Psychosocial Interventions in Refugee Camps: A

Cambodian Example." *Journal of Nervous and Mental Disease* 190(3): 158-166.

Mossey, Jana M. and Evelyn Shapiro. 1982. "Self-Rated Health: A Predictor of Mortality among the Elderly." *American Journal of Public Health* 72(8): 800-808.

Muennig, Peter and Marianne C. Fahs. 2002. "Health Status and Hospital Utilization of Recent Immigrants to New York City." *Preventive Medicine* 35(3): 225-231.

Myers, Dowell, William C. Baer, and Seong-Youn Choi. 1996. "The Changing Problem of Overcrowded Housing." *Journal of the American Planning Association* 62(1): 66-84.

Nagi, Saad Z. 1976. "An Epidemiology of Disability among Adults in the United States." *Milbank Memorial Fund Quarterly Health and Society* 54(4): 439-467.

Nee, Victor and Jimy Sanders. 1985. "The Road to Parity: Determinants of the Socioeconomic Achievements of Asian Americans." *Ethnic and Racial Studies* 8(1): 75-94.

Neuhouser, Marian L., Beti Thompson, Gloria D. Coronado, and Cam C. Solomon. 2004. "Higher Fat Intake and Lower Fruit and Vegetables Intakes Are Associated with Greater Acculturation among Mexicans Living in Washington State." *Journal of American Dietetic Association* 104(1): 51-57.

Ngo-Metzger, Quyen, Michael P. Massagli, Brian R. Clarridge, Michael Manocchia, Roger B. Davis, Lisa I. Iezzoni, and Russell S. Phillips. "Linguistic and Cultural Barriers to Care: Perspectives of Chinese and Vietnamese Immigrants." *Journal of General Internal Medicine* 18(1): 44-52.

Nguyen, Ly and Christopher Peterson. 1993. "Depressive Symptoms among Vietnamese-American College Students." *Journal of Social Psychology* 133(1): 65-71.

O'Malley, Ann S., Jon Kerner, Ayah E. Johnson, and Jeanne Mandelblatt. 1999. "Acculturation and Breast Cancer Screening among Hispanic Women in New York City." *American Journal of Public Health* 89(2): 219-227.

Ortega, Alexander N., Robert Rosenheck, Margarita Alegria, and Rani A. Desai. 2000. "Acculturation and the Life-Time Risk of Psychiatric and Substance Use Disorders among Hispanics." *Journal of Nervous and Mental Disease* 188(11): 728-735.

Palloni, Alberto and Elizabeth Arias. 2004. "Paradox Lost: Explaining the Hispanic Adult Mortality Advantage." *Demography* 41(3): 385-415.

Peak, Christopher and John R. Weeks. 2002. "Does Community Context Influence Reproductive Outcomes of Mexican Origin Women in San Diego, California?" *Journal of Immigrant Health* 4(3): 125-136.

Peek-Asa, Corinne, Rosemary Erickson, and Jess F. Kraus. 1999. "Traumatic Occupational Fatalities in the Retail Industry, United States 1992-1996." *American Journal of Industrial Medicine* 35(2): 186-191.

Penninx, Brenda W. J. H., Suzanne Leveille, Luigi Ferrucci, Jacques Th. M. van Eijk, and Jack M. Guralnik. 1999. "Exploring the Effect of Depression on Physical Disability: Longitudinal Evidence from the Established Populations for Epidemiologic Studies of the Elderly." *American Journal of Public Health* 89(9): 1346-1352.

Peragallo, Nilda P., Patricia G. Fox, and Melinda L. Alba. 1998. "Breast Cancer among Latino Immigrant Women in the U.S." *Health Care for Women International* 19(2): 165-172.

Perez-Stable, Eliseo J., Amelie Ramirez, Roberto Villareal, Gregory A. Talavera, Edward Trapido, Lucina Suarez, Jose Marti, and Alfred McAlister. 2001. "Cigarette Smoking Behavior among US Latina Men and Women from Different Countries of Origin." *American Journal of Public Health* 91(9): 1424-1430.

Portes, Alejandro and Min Zhou. 1993. "The New Second Generation: Segmented Assimilation and Its Variants." *Annals of the American Academy of Political and Social Science* 530: 74-96.

Pransky, Glenn, Daniel Moshenberg, Katy Benjamin, Silvia Portillo, Jeffrey L. Thackrey, and Carolyn Hill-Fotouhi. 2002. "Occupational Risks and Injuries in Non-Agricultural Immigrant Latino Workers." *American Journal of Industrial Medicine* 42(2): 117-123.

Razum, Oliver, Jajo Zeeb, H. Seval Akgun, and Selma Yilmaz. 1998. "Low Overall Mortality of Turkish Residents in Germany Persists and Extends into a Second Generation: Merely a Healthy Migrant Effect?" *Tropical Medicine and International Health* 3(4): 297-303.

Reynolds, Sandra, Yasuhiko Saito, and Eileen M. Crimmins. 2005. "The Impact of Obesity on Active Life Expectancy in Older American Men and Women." *Gerontologist* 45(4): 438-444.

Reynoso, Teresa C., Marianne E. Felice, and G. Paul Shragg. 1993. "Does American Acculturation Affect Outcome of Mexican-American Teenage Pregnancy?" *Journal of Adolescent Health* 14(4): 257-261.

Robinson, James C. 1989. "Exposure to Occupational Hazards among Hispanics, Blacks, and non-Hispanic Whites in California." *American Journal of Public Health* 79(5): 629-630.

Rogers, Richard G., Robert A. Hummer, Patrick M. Krueger, and Fred C. Pampel. 2005. "Mortality Attributable to Cigarette Smoking in the United States." *Population and Development Review* 31(2): 259-292.

Rogler, Lloyd H., Dharma E. Cortes, and Robert G. Malgady. 1991. "Acculturation and Mental Health Status among Hispanics." *American Psychologist* 46(6): 585-597.

Ross, Catherine E. and Chia-ling Wu. 1995. "The Links between Education and Health." *American Sociological Review* 60(5): 719-745.

Rubin, Donald B. 1987. *Multiple Imputation for Nonresponse in Surveys*. New York: John Wiley and Sons.

Rumbaut, Ruben G. 1997. "Paradoxes (and Orthodoxies) of Assimilation." *Sociological Perspectives* 40(3): 483-511.

Salant, Talya and Diane S. Lauderdale. 2003. "Measuring Culture: A Critical Review of Acculturation and Health in Asian Immigrant Populations." *Social Science and Medicine* 57(1): 71-90.

Schafer, Joseph L. 1997. *Analysis of Incomplete Multivariate Data*. London: Chapman & Hall.

Schafer, Joseph L. 2003. "Multiple Imputation in Multivariate Problems When the Imputation and Analysis Models Differ." *Statistica Neerlandica* 57(1): 19-35.

Shen, Biing-Jiun and David T. Takeuchi. 2001. "A Structural Model of Acculturation and Mental Health Status among Chinese Americans." *American Journal of Community Psychology* 29(3): 387-418.

Singh, Gopal K. and Mohammed Siahpush. 2002. "Ethnic-Immigrant Differentials in Health Behaviors, Morbidity, and Cause-Specific Mortality in the United States: An Analysis of Two National Data Bases." *Human Biology* 74(1): 83-109.

Singh, Gopal K. and Mohammed Siahpush. 2001. "All-Cause and Cause-Specific Mortality of Immigrants and Native Born in the United States." *American Journal of Public Health* 91(3): 392-399.

Singh, Gopal K. and Stella M. Yu. 1996. "Adverse Pregnancy Outcomes: Differences between US- and Foreign-Born Women in Major US Racial and Ethnic Groups." *American Journal of Public Health* 86(6): 837-843.

Suinn, Richard M., Carol Ahunna, and Gillian Khoo. 1992. "The Suinn-Lew Asian Self-Identity Acculturation Scale: Concurrent and Factorial Validation." *Educational and Psychological Measurement* 52(4): 1041-1046.

Steel, Zachary, Derrick Silove, Tuong Phan, and Adrian Bauman. 2002. "Long-Term Effect of Psychological Trauma on the Mental Health of Vietnamese Refugees Resettled in Australia: A Population-Based Study." *Lancet* 360(9339): 1056-1062.

Takeuchi, David T., Rita C. Chung, Keh-Ming Lin, Haikang Shen, Karen Kurasaki, Chi-Ah Chun, and Stanley Sue. 1998. "Lifetime and Twelve-Month Prevalence Rates of Major Depressive Episodes and Dysthymia among Chinese Americans in Los Angeles." *American Journal of Psychiatry* 155(10): 1407-1414.

Taylor, Kathryn L., John F. Kerner, Karen F. Gold, and Jeanne S. Mandelblatt. 1997. "Ever vs Never Smoking among an Urban, Multiethnic Sample of Haitian-, Caribbean-, and U.S.-born Blacks." *Preventive Medicine* 26(6): 855-865.

Thamer, Mae, Christian Richard, Adrianne W. Casebeer, and Nancy F. Ray. 1997. "Health Insurance Coverage among Foreign-born US Residents: The Impact of

Race, Ethnicity, and Length of Residence." *American Journal of Public Health* 87(1): 96-102.

Turvey, Carolyn L., Yeates Conwell, Michael P. Jones, Caroline Phillips, Eleanor Simonsick, Jane L. Pearson, and Robert Wallace. 2002. "Risk Factors for Late-Life Suicide: A Prospective, Community-Based Study." *American Journal of Geriatric Psychiatry* 10(4): 398-406.

Unger, Jennifer B., Tess Boley Cruz, Louise A. Rohrbach, Kurt M. Ribisl, Lourdes Baezconde-Garbanati, Xinguang Chen, Dennis R. Trinidad, and C. Anderson Johnson. 2000. "English Language Use as a Risk Factor for Smoking Initiation among Hispanic and Asian American Adolescents: Evidence for Mediation by Tobacco-Related Beliefs and Social Norms." *Health Psychology* 19(5): 403-410.

Van Buuren, S., H. C. Boshuizen, and D. L. Knook. 1999. "Multiple Imputation of Missing Blood Pressure Covariates in Survival Analysis." *Statistics in Medicine* 18(6): 681-694.

Van Buuren, S. and C. G. M. Oudshoorn. 2000. "Multiple Imputation by Chained Equations." Leiden: TNO Prevention and Health. Report PG/VGZ/00.038.

Vega, William A. and Hortensia Amaro. 1994. "Latino Outlook: Good Health, Uncertain Prognosis." *Annual Review of Public Health* 15: 39-67.

Vega, William A., Bohdan Kolody, Sergio Aguilar-Gaxiola, and Ralph Catalano. 1999. "Gaps in Service Utilization by Mexican Americans with Mental Health Problems." *American Journal of Psychiatry* 156(6): 928-934.

Velez, Carmen N. and Jane A. Ungemack. 1989. "Drug Use among Puerto Rican Youth: An Exploration of Generational Status Differences." *Social Science and Medicine* 29(6): 779-789.

Verbrugge, Lois M. and Alan M. Jette. 1994. "The Disablement Process." *Social Science and Medicine* 38(1): 1-14.

Weeks, John R. and Ruben G. Rumbaut. 1991. "Infant Mortality among Ethnic Migrant Groups." *Social Science and Medicine* 33(3): 327-334.

Wells, Kenneth B., Jacqueline M. Golding, Richard L. Hough, M Audrey Burdam, and Marvin Karno. 1989. "Acculturation and the Probability of Use of Health Services by Mexican Americans." *Health Services Research* 24(2): 237-257.

Wethington, Elaine, Phyllis Moen, Nina Glasgow, and Karl Pillemer. 2000. "Multiple Roles, Social Integration, and Health." Pp. 48-71 in *Social Integration in the Second Half of Life*, edited by Karl Pillemer, Phyllis Moen, Elaine Wethington, and Nina Glasgow. Baltimore: The Johns Hopkins University Press.

Williams, David R. 1990. "Socioeconomic Differentials in Health: A Review and Redirection." *Social Psychology Quarterly* 53(2): 81-99.

Williams, David R. and Chiquita Collins. 1995. "U.S. Socioeconomic and Racial

Differences in Health: Patterns and Explanations." *Annual Review of Sociology* 21: 349-386.

Wilmoth, Janet M. and Pei-Chun Chen. 2003. "Immigrant Status, Living Arrangements, and Depressive Symptoms among Middle-Aged and Older Adults." *Journal of Gerontology* 58B(5): S305-S313.

Zambrana, Ruth E., Susan C. M. Scrimshaw, Nancy Collins, and Christine Dunkel-Schetter. 1997. "Prenatal Health Behaviors and Psychosocial Risk Factors in Pregnant Women of Mexican Origin: The Role of Acculturation." *American Journal of Public Health* 87(6): 1022-1026.

Zeng, Zhen and Yu Xie. 2004. "Asian Americans' Earnings Disadvantage Reexamined: The Role of Place of Education." *American Journal of Sociology* 109(5): 1075-1108.

Zhou, Min. 1997. "Segmented Assimilation: Issues, Controversies, and Recent Research on the New Second Generation." *International Migration Review* 31(4): 975-1008.

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