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TECHNICAL REPORT

Exploring the Association Between Military Base Neighborhood Characteristics and Soldiers' and Airmen's Outcomes

Sarah O. Meadows • Laura L. Miller • Jeremy N. V. Miles • Gabriella C. Gonzalez • Brandon T. Dues

RAND CORPORATION

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Preface

This report explores the applicability of neighborhood studies theory and social indicators research to our understanding of the quality of life in and around military bases. Preliminary research suggests that a neighborhood studies assessment of military installations and their environs could contribute to military decisionmaking in such areas as programming and distribution of resources across base support services. This exploratory analysis also highlights gaps in neighborhood studies methodology that need to be addressed in future research. Finally, we outline how a more in-depth neighborhood studies analysis of military installations could be conducted.

This report results from the RAND Corporation's continuing program of self-initiated independent research. Support for this program is provided, in part, by donors and by the independent research and development provisions of RAND's contracts for the operation of its U.S. Department of Defense federally funded research and development centers.

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Contents

Figures

Tables

Summary

Current extended military engagements in foreign nations have taken their toll on U.S. service members and their families. As a result, the services have made renewed commitments to support the needs of the families of military personnel. Quality of life and family programs across the services continue to grow, including recent efforts designed both to support service members and their families across the deployment cycle and to instill resiliency even before they face a deployment. For example, both the Army and the Air Force have adopted community covenants (Donley, 2009; U.S. Army OneSource, undated). Community covenants are designed to develop and foster partnerships between states, communities, and bases in order to improve the quality of life of service members and their families. These covenants reaffirm the services' commitment to family and community well-being and recognize that the success of an all-volunteer force depends on the satisfaction, health, and well-being of service members *and* their families. The services generally rely on surveys, focus groups, service utilization reports, and analysis of recruitment and retention reports to assess service member and family satisfaction with programs and services and, ultimately, family well-being. To our knowledge, none has applied neighborhood studies theory and methods to better understand these military issues.

Neighborhood studies, a well-established field within sociology, assess the association between social and economic characteristics of neighborhoods, demographic characteristics of residents, and indicators of health and well-being. Generally, neighborhoods characterized by high socioeconomic status, that are safe and free of crime, and that offer recreational activities are associated with better mental and physical health among residents. Empirical studies of the neighborhood–health link have demonstrated that the impact of neighborhood characteristics exists regardless of an individual's own characteristics, such as age, race, ethnicity, or gender. Theoretically, neighborhoods are linked to well-being because higher-quality neighborhoods offer more resources and better infrastructure, facilitate social relationships, and contribute little in the way of additional exposure to stress for residents.

Despite the growing body of evidence supporting a link between neighborhood and health and well-being, none of the existing research has examined this association specifically for a military population. Studies of military satisfaction and retention and spouse satisfaction with military service have considered the role of particular characteristics, such as the recreational facilities, the local labor market, and the quality and availability of child care. But the relative quality of military installations and their

surrounding neighborhoods may also be of importance for service member and family health and well-being. Installations, and the communities where they are located, vary in terms of the quality of life they provide inhabitants (e.g., spouse employment opportunities, family programs, child care, recreational facilities). Similarly, the families who live in these communities and who are assigned to these installations also vary in terms of their needs. Given that neighborhood context and family needs vary, a one-size-fits-all approach to base resource allocation and the provision of services, without acknowledging that certain challenges and resources may be geographically dependent, may not be the most effective in fostering health and well-being among service members and their families. Thus, the services may want to use this approach as part of their efforts to identify gaps in support to service members and families so that they can make the necessary adjustments and better compensate where communities are lacking.

This report provides results from a preliminary, proof-of-concept study aimed to provide information the military can use to tailor its efforts to locally support service members and their families based on characteristics of installations and their surrounding neighborhoods. To achieve this goal, we address three broad research questions. First, how do military installations and their surrounding neighborhoods compare with one another in sociodemographic and economic indicators? Second, how are individual health and well-being outcomes associated with military neighborhood profiles? And third, how can the military improve service member and family health and well-being via installation-level resources or support strategies?

This report focuses on two case studies, one utilizing U.S. Army bases and one using U.S. Air Force installations. Using sociodemographic and economic data from the U.S. Census Bureau, we rank geographic areas including and surrounding selected Army and Air Force installations within the continental United States (CONUS), bounded by ZIP Codes. We do so by employing a commonly used methodology that evaluates social indicators of these geographic areas against one another. The result is the military neighborhood ranking index, or MNRI. We then link MNRI scores to personnel outcomes (such as retention and reenlistment), as well as Soldier and Airman health and well-being, using the same neighborhood modeling framework found in the academic literature.

The ranking of military base neighborhoods among both Army and Air Force installations showed that no geographic area, installation size, or installation type was consistently rated higher than others. However, we note that the U.S. Military Academy at West Point and the U.S. Air Force Academy in Colorado Springs, Colorado, were both ranked first in their service's ranking index.

None of the associations between the MNRI and the outcomes in the Army analysis remained significant after controlling for individual, Soldier-level characteristics;

however, body mass index was the only health and well-being measure available to us, and we could not determine from the personnel records whether that score was recent. The other two Army outcomes were attrition and separation from military service.

In the Air Force analysis, however, some of the associations we observed appeared to corroborate the MNRI. Specifically, the results for the rating of the civilian area as a place to live, neighborhood cohesion, and ratings of safety of the Airman's residence and neighborhood and the civilian area around the base were all positively associated with the MNRI. These positive associations reinforce the utility of objective measures of neighborhoods (i.e., Census data) by validating them against Airmen's subjective ratings of the characteristic and qualities of neighborhoods.

The Air Force case study yielded more-significant substantive results than the Army case study primarily because of differences in the nature of the data. We relied on the Total Army Personnel Database (TAPDB), a database of all Army personnel, their demographic characteristics, and their assignment locations, and the Air Force's Community Assessment Survey, a subjective survey of Airman and family well-being and community satisfaction. Survey data may be more fruitful in neighborhood studies given that individual *perceptions* of neighborhood quality may be more influential for self-reported health and well-being than more-objective measures are. Other data limitations may have also affected our ability to detect significant associations between the MNRI and health and well-being outcomes: Our use of ZIP Codes to define installation neighborhoods may have resulted in "neighborhoods" that were too large to influence outcomes; our outcome data may not have been sensitive enough to capture neighborhood effects on health and well-being; and our inability to control for exposure, or duration spent in an installation neighborhood, may have masked any significant associations between the MNRI and outcomes.

Nonetheless, we believe that, with further refinement, the use of neighborhood studies theory and methodology among the military can be useful for installation management charged with allocating resources related to service member and family well-being. The Army and the Air Force cannot control such factors as unemployment or family poverty rates in the neighborhoods surrounding their installations. They can, however, recognize that community resources in the poorest neighborhoods are likely already taxed and less able to support Soldiers and Airmen living in or near those neighborhoods. In those cases, the importance of the availability of installation resources, such as counseling and spouse employment services, may be magnified and even necessary to ensure a comparable quality of life for service members and their families across the various base locations.

One possible policy-relevant example relates to housing. Despite the fact that the basic allowance for housing (BAH) does take the median cost of rentals into account, it does not take the quality of that median rental into account. If a particular installation is

located in an area where a large portion of community members spend more than they can afford on housing (e.g., 35 or more percent of income), it may suggest that affordable, *quality* housing is sparse. In these select areas, the military could consider additional housing subsidies that ensure that families, especially those who may be living at or near the poverty line, can find affordable but also high-quality housing. With more fine-grained data, we expect that additional associations will emerge with more policy implications for how the services address the needs of their families.

Neighborhood factors can inform, but do not determine, base assignment preferences and the design and allocation of installation resources. Service member and family assignment preferences may be completely detached from, or only partially consider, neighborhood quality. Assignment preferences may instead take into account such factors as proximity to friends and family, career opportunities available (such as command or joint assignments), and preferred climate or regional culture. Similarly, the distribution of installation resources ultimately must take into account a range of factors, such as overall budget, operating costs, and usage rates. Thus, neighborhood characteristics are not the only factors that are relevant to consider, but they do complement existing measures and perhaps illuminate gaps not otherwise apparent.

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Other RAND personnel also contributed to this effort. Stephanie L. Taylor helped conceive of the original idea for this project. Laurie L. McDonald provided advice and research programming for the Army data sets. Nancy Campbell assisted in preparing the Air Force survey data for analysis. Gary Massey extracted data from Air Force personnel files to illustrate, by ZIP Code, where Air Force personnel are clustered. Lisa Miyashiro employed mapping software to display these results. And Donna White provided assistance with formatting this report.

The opportunity to brief Army and Air Force personnel also helped us gather feedback that shaped our presentation and our recommendations. Thus we would like to thank the Army's Dennis Dingle in the Headquarters, Department of the Army (HQDA) Deputy Chief of Staff for Personnel (DCS G-1); Timothy Holt in the U.S. Army Medical Command (USA MEDCOM) Office of the Surgeon General; and Dee Geise and her staff in the Soldier and Family Readiness Division of the Assistant Chief of Staff for Installation Management. We also thank the Air Force headquarters' office of Airman and Family Services, specifically that office's H. L. Larry, Eliza Nesmith, and Curt Cornelssen, for their feedback on this research.

Abbreviations

AAFES	Army and Air Force Exchange Service
ACC	Air Combat Command
AETC	Air Education and Training Command
AFB	Air Force base
AFMC	Air Force Materiel Command
AFQT	Armed Forces Qualification Test
AFSOC	Air Force Special Operations Command
AFSPC	Air Force Space Command
AMC	Air Mobility Command
AOC	area of concentration
AVF	all-volunteer force
B	coefficient
BAH	basic allowance for housing
BMI	body mass index
BRAC	base realignment and closure
CES-D	Center for Epidemiological Studies–Depression Scale
CONUS	continental United States
CWI	Child and Youth Well-Being Index
DoD	U.S. Department of Defense
DRU	direct reporting unit
FCD	Foundation for Child Development
FY	fiscal year
GIS	geographic information system
HQDA	Headquarters, Department of the Army
ISH	Index of Social Health
MAJCOM	major command
MNRI	military neighborhood ranking index
MNRI-D	equally weighted military neighborhood ranking index
MOS	military occupational specialty
MTO	Moving to Opportunity
OCONUS	outside the continental United States
OR	odds ratio
p	probability
PACAF	Pacific Air Forces

PAF	RAND Project AIR FORCE
PCS	permanent change of station
PSM	propensity score matching
PUMA	public-use microdata area
QOL	quality of life
SD	standard deviation
SE	standard error
TAPDB	Total Army Personnel Database
USA MEDCOM	U.S. Army Medical Command
USPS	U.S. Postal Service
ZCTA	ZIP Code Tabulation Area

Chapter One. Introduction

Background

Since September 11, 2001, the all-volunteer force (AVF) has experienced the strains of extended warfare. Combat deployments to Iraq and Afghanistan have taken their toll on service members and their families (Burrell et al., 2006; Chandra et al., 2010; Hosek, Kavanagh, and Miller, 2006; Lipari et al., 2010; Spera, 2009; Tanielian and Jaycox, 2008). Quality-of-life (QOL) and family programs across the services continue to grow, including recent efforts designed to support service members and their families across the deployment cycle and to instill resiliency even before they face a deployment (Decision Engineering Associates, 2002; Jowers, 2007; MacDermid, Samper, et al., 2008; Schwerin et al., 2002; Sprenkle, Ko, and MacDermid, 2006). The Army and Air Force in particular have made renewed commitments to support the needs of their families through the Army Family Covenant begun in 2007 and the Year of the Air Force Family 2009–2010. Both services have also established community covenants (Donley, 2009; U.S. Army OneSource, undated). Community covenants are designed to promote relationships between states, local communities, and bases in order to develop programs and offer resources that service members and their families can use. These covenants reaffirm the services' commitment to family and community well-being and recognize that the success of an AVF depends on the satisfaction, health, and well-being of service members *and* their families.

The services typically attempt to measure service member and family well-being through surveys, focus groups, and utilization reports for installation services. To our knowledge, however, they have not yet applied neighborhood studies theory and its associated methods to understand these military issues better.

Neighborhood theory, a well-established field within sociology, assesses the association among social and economic characteristics of neighborhoods, demographic characteristics of residents, and indicators of health and well-being. This body of research indicates that individual-level well-being is, at least in part, associated with the characteristics of an individual's environment, over and above the individual's own characteristics (Jencks and Mayer, 1990; Mayer and Jencks, 1989; Sampson, Morenoff, and Gannon-Rowley, 2002). That is, where people live can have a significant impact on their health and well-being.

A main contribution of our study is the application of this theory and methodology to the military context. Despite the growing body of evidence supporting a neighborhood–

health link, none of the existing research has examined this association for a military population. The sociodemographic and economic characteristics of areas surrounding a military installation may also have an effect on service member and military family health and well-being.

Even though military members typically move frequently, the relative quality of installations and their surrounding neighborhoods may be of great importance for service member and family job and life satisfaction, health and well-being, and service member retention. Installations, and the communities where they are located, vary in terms of living conditions and the resources available to support the quality of life for inhabitants. Similarly, the families who live in these communities and who are assigned to these installations also vary in terms of their needs. Given that neighborhood context and family needs vary, a one-size-fits-all approach to base resource allocation and the provision of services may not be the most effective. A study of the neighborhood–health link among military personnel could provide the services with a sense of the challenges and resources available within and immediately surrounding installations to help them better tailor their efforts and compensate where communities are lacking. In this way, the services can promote a more comparable quality of life for personnel and their families across military bases.

Objective

Thus, this project aims to provide information that the military can use to tailor its efforts to locally support service members and their families based on characteristics of installations and their surrounding neighborhoods. To achieve this goal, we address three broad research questions. First, how do military installations and their surrounding neighborhoods compare with one another in sociodemographic and economic indicators? Second, how are individual health and well-being outcomes associated with military neighborhood profiles? Third, how can the military improve service member and family health and well-being via installation-level resources or support strategies?

Using sociodemographic and economic data from the U.S. Census Bureau, we rank the geographic areas including and surrounding selected U.S. military installations, bounded by ZIP Codes. We do so by employing a commonly used methodology that evaluates social indicators of these geographic areas against one another. Data presented in this report come from two case studies: one using U.S. Army bases and one using U.S. Air Force installations within the continental United States (CONUS). We then link the social indicators of Army and Air Force installations to personnel outcomes (such as retention and reenlistment, which previous quality-of-life studies have used as outcomes), as well as Soldier and Airman health and well-being, using the same neighborhood

modeling framework found in the academic literature. This study is intended to be a *preliminary* application of neighborhood studies methodology to the military context—a proof-of-concept study. Because this methodology is flexible in its design, we encourage readers to think about how an analysis similar to this one may be adapted to be most useful to their setting or goals.

Organization

Chapter Two examines some of the existing neighborhood studies described in the academic literature in order to lay the framework for the current study of military personnel. Chapter Three provides details about our data and methods, while Chapters Four and Five provide results from the case studies of the Army and Air Force, respectively. In Chapter Six, we discuss these results with respect to policies that the armed forces may use to improve the lives of service members and their families. This final chapter also points to directions for future research on the military using a social indicators and neighborhood studies methodology strategy. Readers wishing to review details of the study's results beyond what is presented in Chapters Four and Five will find additional results presented in Appendixes A and B.

Chapter Two. Neighborhood Studies and Social Indicators Research

This chapter provides an overview of the growing field of neighborhood studies, as well as the related field of social indicators research. Thus, it serves as background material for our study and as an introduction to these literatures for those who are unfamiliar with them. This chapter presents the basic theories behind the methodologies, previous approaches to this work, measures that have been developed, and relationships between neighborhoods and health that have been demonstrated thus far. We also highlight gaps in the neighborhood studies literature that are relevant for the mobile military population; these gaps also apply to nonmilitary populations. Military personnel research has largely neglected to consider neighborhood characteristics. Thus we also recognize some of the research that has considered how community factors may influence the satisfaction and retention of military personnel, as well as spouse satisfaction with military life. For those who wish to skip ahead to a description of the data and methods used in this study, that discussion begins in Chapter Three.

The Field of Neighborhood Studies

The past 30 years of research in the fields of epidemiology, sociology, and demography have found an association between a neighborhood's social, economic, and ecological characteristics and certain health risks, behaviors, and outcomes of individual residents. These health outcomes include coronary risk factors and heart disease mortality, low birth weight, smoking, morbidity, all-cause mortality, and self-reported health (Sampson, 2003). Although the evidence is mixed, effect sizes often small, and causality difficult to pinpoint, the association between where someone lives and his or her health outcomes persists, even when individuals' characteristics and behaviors are taken into account.[1]

There are two hypothesized mechanisms by which neighborhoods, beyond the status and attributes of the individuals who live there, might lead to various health outcomes. One is that measured neighborhood characteristics reflect the strength of *social interactions*, including a community's social networks, extent of social organization, social closure (defining who "belongs"), or sense that a group can work together to

[1] See Robert (1998) and Robert (1999) for reviews of the field.

achieve a goal (known as *collective efficacy*). Those social interactions can have an effect on health and well-being. The second relates to the quality of the *physical infrastructure and resources*, such as a neighborhood's proximity to and existence of damaged buildings or graffiti and trash, access to resources that enable physical or healthy activities, and the toxicity of the air and land. These, too, can have an influence on the physical and mental health of residents.

The fields of sociology and psychology tend to focus on the role of social interactions, whereas the fields of epidemiology, demography, and medical geography tend to focus on features of the physical environment (e.g., Gardner, 1973; Fox, Jones, and Goldblatt, 1984; Britton, 1990). The following two subsections provide an overview of past research on these two mechanisms.

Social Interactions

Research on social interactions has examined how individuals are connected to each other—the patterns and networks of contacts or interactions—to understand differences in residents' health outcomes (Koopman et al., 1991; Koopman and Longini, 1994; Koopman and Lynch, 1999). For example, friendship ties and family social support networks that can be found in the workplace, religious institutions, families, and peer groups have been found to promote individual health by generating their own collective properties (Berkman and Syme, 1979). Social patterns and networks can provide information about and support for beneficial health behaviors, such as exercising or healthy eating (Kaplan et al., 1994). On the other hand, social networks can also encourage unhealthy behaviors, such as drinking, smoking, or poor eating habits (Raudenbush, 2003).

Much of this literature draws from social capital theory's explanation about how and why social networks can work to an individual's advantage or disadvantage. *Social capital* refers to the value of social relationships for an individual participant. It can take many forms, such as reciprocal obligations (drawing on favors when in need), information exchanges, or parents interacting with parents of their children's friends (known as *intergeneration closure*), which can improve their ability to monitor their children's behavior. Voluntary associations, such as clubs or neighborhood associations, can produce social capital by generating community action around a specific purpose or by creating new ties among people that may then facilitate other types of action (Sampson, 2003).[2] Neighborhood theory considers how the presence or absence and

[2] Also see Coleman (1988) and Putnam (1996) for further discussion of social capital theory.

quality of social capital in the form of neighborhood social interactions are associated with health behaviors and outcomes.

Social capital can also provide psychological support. One example is the role of social cohesion, which is defined as the absence of social conflict coupled with the presence of strong social bonds and mutual trust. Individuals who experience more social cohesion in their social interactions have been found to be less stressed and have stronger mental health (Kawachi, Kennedy, Lochner, and Prothrow-Stith, 1997; Kawachi, Kennedy, and Glass, 1999). Another way social capital can provide psychological support is through collective efficacy, a combination of social cohesion and informal social control. Collective efficacy occurs when there is a shared belief that one's individual actions will result in benefiting the common good and when there is a strong sense of mutual trust among residents. Residents of a neighborhood with more collective efficacy actively engage in community activities (such as councils or neighborhood watches) and have more trust in their neighbors (reporting that, in general, people in the neighborhood get along with each other) and in a shared expectation about informal social control (such as taking action if a fight broke out in front of their house or they caught neighborhood children skipping school).

In turn, individuals benefit from a neighborhood's collective efficacy in two ways: Individuals' engagement in community activities reinforces their trust and linkages to fellow residents, thus providing them with beneficial social supports; and the sense that others in a community are actively engaged to support the area where they live heightens their sense of purpose and trust (Sampson, 2003). Sampson, Raudenbush, and Earls (1997) and Sampson and Raudenbush (1999) found that a neighborhood's collective efficacy can be undermined by neighborhood characteristics, such as "the concentration of disadvantage, racial segregation, family disruption, and residential instability" (Sampson, 2003, p. 138).

Boardman (2004) and Matthews and Yang (2010) found that a significant portion of individuals' health disparities across neighborhoods could be attributed to different stress levels. These studies also found that the health of people in communities with a more stable or wealthier population is less affected by life stressors than that of residents in communities with a more transient and poorer population. Social interactions have been shown to shape an individual's exposure to stressors; they can reduce exposure to known life stressors and can moderate or even eliminate the deleterious effects associated with stress in general (Schulz et al., 2000). Interactions with neighbors provide a sense of consistency, therefore minimizing feelings of stress, and neighbors may provide direct or indirect access to resources that can be utilized when a stressful event occurs. This is called the *stress-buffering hypothesis* (Lin and Ensel, 1989).

Infrastructure

One's physical environment can also have an effect on one's health outcomes (Kawachi and Berkman, 2003a). The influential aspects of the environment include

- access to goods and amenities (e.g., proximity of health care facilities and fully stocked grocery stores, walkability of streets, availability of public transportation)
- proximity or exposure to toxic or unhealthy inputs (e.g., trash dumps; lead in water, paint, and air; industrial pollutants; emissions from trucks, buses, and cars)
- proximity or exposure to elements of social disorder (e.g., abandoned cars and buildings, defaced property, broken glass, garbage, litter, presence of drug paraphernalia, condoms on the street, public displays of prostitution) (Raudenbush, 2003).

Therefore, residents in poorer neighborhoods experience "double jeopardy" (Macintyre and Ellaway, 2003, p. 34). They are personally poor, *and* they are likely to live in the sorts of neighborhoods that lack the infrastructure to promote a healthy life.

The physical infrastructure of a neighborhood can offset or exacerbate residents' stress levels. For example, although determining a causal relationship is difficult, research has linked the quality and accessibility of parks, recreational areas, and other green spaces to their greater usage and therefore to users' and local residents' physical and mental health and well-being (Lee and Maheswaran, 2010). Similarly, Matthews and Yang (2010) found that the presence of hazardous waste facilities increased neighborhood residents' stress.[3]

Neighborhood Studies Methodology

Both qualitative and quantitative methodologies have been used to describe and analyze neighborhood effects. Qualitative studies ground neighborhood processes within a historical context and can provide insights that cannot be captured with statistical analyses of large-scale data sets. However, quantitative methods may be more practical to use in large-scale studies than qualitative methods (Kawachi and Berkman, 2003b).

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[3] Physiologically, stress affects one's physical health and well-being through the overabundance of hormones, which the body prepares in response to an emergency situation. Known as the *fight-or-flight response*, the release of hormones, such as adrenaline, noradrenaline, epinephrine, cortisol, and other glucocorticoid hormones, is a vital component of human beings' response to a stressful situation. However, if one faces continual stress over a prolonged period of time, as residents in neighborhoods with poor infrastructure or pernicious social interactions may experience, the release of these hormones may have the unintended effect of breaking down important physiological processes that help to maintain internal stability (known as *allostasis* or *allostatic load*). The inability to maintain internal physiological stability, in turn, can have deleterious effects on cardiovascular, metabolic, and immune systems and brain activity or central nervous system functioning (McEwen, 1998).

Qualitative methods, such as interviews with residents, observational studies in communities, or ethnographies, have been the primary method of choice over the course of the past century, becoming most popular in the 1940s through 1960s, known as the *Chicago School* (e.g., Park, McKenzie, and Burgess, 1925; Whyte, 1943). These studies helped develop theories about the role of the neighborhood for individual well-being. For example, Whyte (1943) touted the role of social organization in maintaining social order in urban neighborhoods. And in fact, more-recent studies on social cohesion, norms of social support, perceptions of community violence and fear, and residents' active engagement in local institutions utilize many of the same qualitative methods (e.g., interviews, observations, and ethnographies; Raudenbush, 2003, p. 113).

The vast majority of research in the past 30 years has explored these theories through large-scale, quantitative, cross-sectional approaches. The quantitative analyses typically examine the effects of certain neighborhood characteristics on an individual's health outcome of interest while controlling for the individual's health-related behaviors and sociodemographic characteristics at a single point in time. Three common methodologies employed are contextual regression, propensity scores, and multilevel models.

Contextual regression studies investigate the contextual effects of neighborhood environments by including the characteristics of individuals and the neighborhoods in which they live in a regression framework and examining the associations between the neighborhood characteristics and the health outcome of interest before and after taking an individual resident's characteristics into consideration. Subgroup populations (such as minority groups, elderly people, or women) can be examined more closely in the regressions. However, contextual regression analyses do not account for variations across subgroup populations or across individuals, nor are they able to account for selection bias—whether individuals choose to live in particular neighborhoods (Diez-Roux, 2007). For this reason, many researchers have turned to alternative methodologies.

Propensity score matching (PSM) approaches allow researchers to compare subgroup populations' outcomes (Rubin, 1997; Harding, 2003). This methodology will "match" survey respondents based on the individual's characteristics (e.g., males over the age of 64) and then explore whether there are any differences in all males over the age of 64 who received a certain "treatment" compared with those who did not. In PSM, a control group of respondents is statistically weighted so that the group's characteristics are comparable to the treatment group's characteristics. The outcome measures of interest are then estimated for both groups. A notable limitation of PSM is that estimates of the associations that are being studied are obtained using a selected subgroup and may not be generalizable to the full population. In addition, if the two groups do not have substantial overlap, then errors may be introduced. For example, if only the worst cases from the untreated "comparison" group are compared with only the best cases from the treatment

group, the result may be regression toward the mean, which may make the comparison group look better or worse than it is in reality (see Heckman et al., 1998).

Multilevel models examine whether differences in the health and well-being of individuals living in different neighborhoods are due to neighborhood differences or to individual differences (Diez-Roux, 2003). These are called *multilevel models* because the individual and the neighborhood are analyzed in different "levels." Researchers can therefore separate the effects of individual characteristics (e.g., race, gender, income earned) from neighborhood characteristics (e.g., the proportion in the neighborhood that is of a certain race or gender or under an income threshold).

There are some disadvantages to using multilevel models. They do not take into consideration the possibility that individual-level characteristics may influence group characteristics (W. Mason, 1991; DiPrete and Forristal, 1994) or that group characteristics may shape individual-level characteristics. This is pertinent because, as mentioned earlier, some neighborhood and individual characteristics are likely to be interrelated (Entwisle, 1991; W. Mason, 1991). For example, neighborhood context may influence the socioeconomic trajectories of individuals, and living in disadvantaged neighborhoods may be one of the mechanisms leading to adverse health outcomes in persons of low socioeconomic position (Duncan, Jones, and Moon, 1998).

Defining a Neighborhood

Much of the research on neighborhood effects defines a person's neighborhood as a geographic space surrounding the person's residence. There are three common ways in which researchers have defined the geographic space of a neighborhood: through the use of administrative data, geographic information system (GIS) mapping, and personal reflections.

Most large-scale quantitative studies define a neighborhood through the use of available administrative data collected by government agencies (such as the U.S. decennial Census, vital health statistics, police records, or UK electoral wards). There are some drawbacks to using predetermined boundaries of a neighborhood (Diez-Roux, 2001; Macintyre, Ellaway, and Cummins, 2002). One problem is that government-defined geographic spaces may not coincide with residents' conceptions of their neighborhood (Diez-Roux, 2007; Macintyre and Ellaway, 2003). However, it may be both infeasible and impractical to collect data on residents' perceptions of their neighborhood because of budgetary constraints that preclude the administration of large-scale surveys or to conduct interviews of residents across multiple neighborhoods. Second, the researcher is limited by whatever data were collected by the government

agency for its purposes, so the data may not include measures of an important neighborhood characteristic (Macintyre and Ellaway, 2003).

However, the use of aggregated administrative data has some benefits: It provides standardized data for a wide range of areas, and it is cost-effective to collect and use. Furthermore, in the case of Census tracts, the boundaries were originally developed to be relatively homogeneous in socioeconomic characteristics and may capture differences in social and physical characteristics that are relevant to health (Diez-Roux, 2007).[4]

GIS mapping is used in tandem with large-scale databases that have been geo-referenced to construct measures of the density and accessibility of resources, features of the built environment related to urban form (such as buildings, road networks, land use, and density) (Handy et al., 2002), and accessibility of recreational resources. Studies have used GIS to characterize how buildings and roads are related to recreational activity, such as measures of mixed (commercial and residential) land use, street connectivity, and housing density (Handy et al., 2002). Although GIS is objective, in that there is no observation bias (e.g., a building or park exits or it does not), it can be expensive to use, and, if it is used alone, there is no way to confirm whether individuals actually use the resources to which they have access.

Personal reflections can also be used to define a neighborhood. For example, this method would ask individuals to define what they consider to be their neighborhood. It may or may not correspond to standard geographic boundaries, such as city blocks, cities, or counties. One advantage of using personal reflections to define neighborhoods is that it ensures that the neighborhood has some meaning to the individual, whereas a neighborhood defined by administrative data or GIS mapping may not. One notable disadvantage is that each individual will have a different definition of the neighborhood, making it difficult to collect standardized data.

Because researchers define neighborhoods in so many different ways, it can be difficult to compare results across studies. Regardless of how researchers have defined neighborhoods, however, their studies have shown an association between those neighborhoods and individual outcomes. Next, we review the types of measures that scholars have used to characterize neighborhood "quality" and the measures used to compare the health and well-being of residents of different neighborhoods.

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[4] Census tracts are small, relatively permanent statistical subdivisions of a county. They usually have between 1,500 and 8,000 persons and, when first delineated, are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Census tracts do not cross county boundaries. The spatial size of Census tracts varies widely depending on the density of settlement (U.S. Census Bureau, 2000).

Measures Used in Quantitative Studies of Neighborhood Effects

Regardless of the way in which neighborhood effects are measured, there has been some consistency in the indicators used to measure economic and social advantage or disadvantage of a neighborhood that might influence one's health. The range of indicators is listed in Table 2.1.

Table 2.1
Examples of Commonly Used Measures of Neighborhood Social and Physical Characteristics

Construct	Measure (Sample Items)	Source
Social environment		
Social cohesion and closure	This is a close-knit neighborhood. People in this neighborhood do not get along. People in this neighborhood do not share the same values. People in this neighborhood can be trusted. People around here are willing to help their neighbors. How often respondent and people in the neighborhood do favors for each other Respondent can count on adults in this neighborhood to watch out that children are safe and do not get in trouble. If children were skipping school, how likely that neighbors would do something about it If children were spray painting graffiti on a local building, how likely is it that your neighbors would do something about it? If child were showing disrespect to an adult, how likely is it that people in your neighborhood would scold that child? When a neighbor is not at home, how often do you and other neighbors watch over their property? How often respondent and other people in the neighborhood ask each other advice about personal things, such as child rearing or job openings Parents in the neighborhood know kids' friends. Adults in the neighborhood know local kids. Parents in the neighborhood know each other. There are adults kids can look up to. People are willing to help neighbors.	Elliott et al., 1996; Rountree and Land, 1996; Sampson, Raudenbush, and Earls, 1997; Ross and Mirowski, 1999; Kawachi and Berkman, 2000; Steptoe and Feldman, 2001; Markowitz et al., 2001; Sampson, Morenoff, and Gannon-Rowley, 2002; Browing and Cagney, 2002; Carpiano, 2007

Construct	Measure (Sample Items)	Source
	How many relatives live in the neighborhood? How many friends live in the neighborhood? How many adults do you recognize or know by sight in this neighborhood? In past 30 days, how many of your neighbors have you talked with for 10 minutes or more?	
Social networks and intergenerational closure	Number of children's friends you know Number of children's friends' parents you know Nature and extent of friendship networks	Coleman, 1988
SES	Percentage of residents with college degree or greater Percentage of residents with a professional occupation Percentage of residents in same residence for past five years Percentage of residents who own or rent Median income of residents or log of age-adjusted average income among residents or families Percentage of households with a single parent	Sharkey 2008; Carpiano, 2007
Physical environment		
Social and physical disorder	Prevalence of graffiti, litter, vandalism, and needles or syringes on streets Prevalence of adults loitering, people drinking alcohol or intoxicated, adults fighting or hostile arguing, and prostitution on streets	Kelling and Wilson, 1982; Perkins and Taylor, 1996; Rountree and Land; 1996; Sampson and Raudenbush, 1999; Ross, 2000; Cohen et al., 2000; Markowitz et al., 2001; Raudenbush, 2003
Access to and quality of physical resources	Transportation Housing stock Retail provision (grocery stores, post office, restaurants, clothing stores) Recreation facilities	LaGrange, 1999; Sampson and Raudenbush, 1999; Smith, Frazee, and Davison, 2000; Peterson, Krivo, and Harris, 2000
Environmental hazards	Air pollution Noise Hazardous waste Industrial effluents	Barker and Osmond, 1987

Construct	Measure (Sample Items)	Source
Geography	Geology Climate	Macintyre, 1999
Safety	Prevalence of drug dealing Crime rates Arrest rates Domestic abuse rates Prevalence of policing	Foster and Giles-Corti, 2008; Hipp, 2010; Gay, Evenson, and Smith, 2010; Sampson, Raudenbush, and Earls, 1997; Sampson and Groves, 1989
Community opportunities and institutional resources	Employment opportunities Quality and accessibility of education Access to health services and medical facilities Organized social and recreational activities Family support centers	Coulton, Korbin, and Su, 1999; Elliott et al., 1996; Peterson, Krivo, and Harris, 2000; Veysey and Messner, 1999; Morenoff, Sampson, and Raudenbush, 2001

NOTE: SES = socioeconomic status.

A variety of measures have also been developed to serve as indicators of individual health and well-being. Prevalent examples are provided in Table 2.2.

Table 2.2
Examples of Commonly Used Measures of Health-Related Outcomes

Outcome Measure	Study
Infectious diseases, such as tuberculosis or sexually transmitted diseases or infections	Greenberg and Schneider, 1994; Acevedo-Garcia, 2000; Fullilove, 2003; Diez-Roux and Aiello, 2005
Chronic diseases (e.g., cardiovascular disease, diabetes, asthma)	Pickett and Pearl, 2001; Wright and Fischer, 2003; Auchincloss et al., 2009; Diez-Roux, 2007; Chaix, 2009
Infant mortality and low birth weight	Kleinman and Kessel, 1987; Kleinman et al., 1988; Collins and David, 1990; Rawlings, Rawlings, and Read, 1995; Collins and Schulte, 2003; O'Campo et al., 1995; Lane et al., 2008
Infant health and birth outcomes	Pickett and Pearl, 2001; Collins and Schulte, 2003
Health risk behaviors (e.g., smoking, alcohol and drug abuses)	Kleinschmidt, Hills, and Elliott, 1995; Diez-Roux, Nieto, Muntaner, et al., 1997; Duncan, Jones, and Moon, 1999; Upchurch et al., 1999; South and Baumer, 2000; Lanctôt and Smith, 2001; Stockdale et al., 2007; Cerdá et al., 2010; M. Mason and Mennis, 2010
Obesity, BMI	Ellaway, Anderson, and Macintyre, 1997
Diagnosis of depression, depressive symptoms	Aneshensel and Sucoff, 1996; Yen and Kaplan, 1999; Ross, 2000; Cutrona et al., 2000; Mujahid et al., 2008
Lower-quality diet	Diez-Roux, Nieto, Caulfield, et al., 1999
Poor self-rated health	Humphreys and Carr-Hill, 1991; Robert, 1998
Intimate-partner violence	O'Campo et al., 1995
Mortality rate	Kawachi and Berkman, 2003a

NOTE: BMI = body mass index.

Although studies vary in the individual-level demographic characteristics that are taken into consideration, some are standard. In general, most quantitative analyses control for demographic, social, and economic factors, such as race and ethnicity, gender, occupation or employment status, income or poverty status, education level, length of residence in neighborhood and mobility patterns, whether the family is headed by one or two adults, marital status, number of dependents in the household, and baseline indicators of health.

Key Relationships Between Neighborhoods and Health

Given these assorted methodologies and measures, it has been difficult for the literature to conclusively establish a causal relationship between neighborhood characteristics and an individual's health and well-being and to agree on the magnitude of

these effects. However, researchers have consistently found the following general relationships (from Diez-Roux, 2007, and Sampson, 2003):

- Neighborhood inequality is a persistent and growing problem in the United States: Geographic areas differ from each other along multiple socioeconomic characteristics.
- Particular health problems tend to cluster together in geographically defined areas.
- Concentrated poverty (or affluence), racial segregation, family disruption, residential instability, and poor-quality housing are commonly associated with many health-related outcomes.
- The relationship between community context (particularly neighborhood deprivation or poverty) and increased risk for mortality, depression, cardiovascular issues, and violence remain even when taking into consideration individual-level risk factors and socioeconomic position.
- The primary influence of neighborhoods is the residential clustering of people by SES and race and ethnicity, which are correlated with one another and with health and well-being outcomes. The additional measured effect attributed to a neighborhood—independent of the individual's social, behavioral, and socioeconomic characteristics—is salient but low.

Currently Recognized Limitations of Neighborhood Studies

This is a vibrant and burgeoning field that has demonstrated clear associations between where a person resides and his or her health outcomes, even when individual characteristics are taken into consideration. However, gaps in this literature remain. Studies linking neighborhood characteristics and health outcomes need to have clear theories about the mechanisms by which neighborhood characteristics affect specific health outcomes so that direct and indirect relationships can be considered.

Few, if any, direct causal relationships can be pinpointed.[5] Neighborhoods may affect individual health outcomes directly or indirectly. Therefore, these studies consider a variety of chains of causation, which variables are acting on each other, and in which directions. For example, some studies potentially suffer from endogeneity bias (Sampson,

[5] The Moving to Opportunity (MTO) experiment is one notable exception. MTO was randomized experiment in which roughly 4,600 low-income families with children living in low-income, public housing neighborhoods were moved to private-market housing in less economically deprived areas through the use of vouchers (U.S. Department of Housing and Urban Development, undated). The final evaluation of MTO is ongoing, but interim results have been mixed (Ludwig et al., 2008). For example, MTO had no significant effects on math and reading achievement among children or economic self-sufficiency among adults. However, adults have reported improved mental and physical health outcomes and feeling safer and more satisfied with their housing.

2003) when they include health risks and health behavior as independent variables, if those health risks could themselves be predictors or intervening variables between a neighborhood and an individual's health. Personal health behaviors may actually be on the causal pathway between neighborhood exposures and health outcomes. A low-quality diet is one example of a health behavior ostensibly based on individual choice that is also often the consequence of limited healthy food choices available in poor neighborhoods (Macintyre and Ellaway, 2000). Any study on neighborhoods should therefore consider the complex interdependencies of place, space, and individuals. Few personal characteristics are truly exogenous to the social environment. That is, people create the space they are in, and the space, in turn, can affect an individual's health in different ways (Macintyre and Ellaway, 2003).

Perhaps a larger source of endogeneity is the fact that individuals make choices about where they live. Because of this selection issue, interpreting the result of neighborhood studies as causal is difficult. Neighborhoods may have an association with health and well-being not because living there causes a particular outcome but because certain types of individuals (e.g., healthy, wealthy) may be more likely to live there. Certainly, parceling out some of the individual-level factors associated with well-being outcomes can help to alleviate any possible selection or endogeneity problems; however, unobservable factors may still be responsible for both neighborhood selection and health.

Neighborhood studies also find it difficult to estimate health outcomes independently of individual socioeconomic position. This position is often found to be a key confounder of any neighborhood health effects because of the known relationship between socioeconomic position and health and because of the strong residential segregation by socioeconomic position that exists in most of today's societies (Diez-Roux, 2007). Neighborhood processes affect individual health via individual SES; therefore, controlling for individual SES in multilevel models may reduce the very variation that a model is trying to explain.

Neighborhood studies have not yet documented how neighborhood factors may differentially affect certain types of subpopulations. Neighborhood influences on health may not be the same for all population groups and for all health outcomes. For example, children, women, and the elderly may be more vulnerable to different kinds of diseases or to mortality in a given area than other groups (Macintyre and Ellaway, 2003).

Another challenge is that a person's community is now generally defined as a geographically bounded neighborhood in which a person resides. This ignores the possibly pertinent effects of social affiliations that extend beyond geographic proximity, such as electronic (Internet) communities. There is ample room to question or expand conceptions of one's geographically defined neighborhood as an influence on health.

The Complementary Field of Social Indicators Research

Because of the many different measures of the social and physical characteristics of a neighborhood (see Table 2.1), scholars have found it fruitful to condense the wide array of information into meaningful categories. One method that is frequently used to rank order geographic units (e.g., cities, states, nations) is called social indicators methodology. The method produces a summary index that condenses several neighborhood indicators into a single metric that can be applied to multiple units for ranking purposes.

Primarily the domain of sociologists, social indicators research has a long history in the United States and been used to shape public policy (Cobb and Rixford, 1998).[6] In 1929, President Herbert Hoover established an ad hoc committee to examine social change in America, and the resultant Research Committee on Social Trends produced a 1,500-page report (Mitchell, 1933). Social indicators research picked up additional momentum during the social movements research of the 1960s and 1970s and focused primarily on economic indicators to gauge the health and well-being of the country at large (Cobb and Rixford, 1998).

Today, most of the work using social indicators methodology has focused on constructing quality-of-life (QOL) indexes. QOL indexes compare geographic units with respect to social, economic, or other QOL domains. Not surprisingly, the growth in the use of social indicators methodology in the late 1990s and early 2000s occurred at the same time that political leaders and policymakers became more interested in improving the QOL of Americans (Land, 2000). Hagerty and Land (2007) report that the term *quality of life* was used on the floor of Congress an average of 20 times per week during this growth period (see also U.S. Government Printing Office, 1999).

From a policy standpoint, indexes based on social indicators methodology can be very useful (Hagerty et al., 2001).[7] An index can serve as an overall assessment and can be disaggregated into its constituent elements. By focusing on specific indicators, researchers and policymakers are able to see which aspects of social life are the most influential for overall QOL. This allows policymakers to focus their attention and

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[6] In fact, social indicators research can be traced back to the beginnings of the social measurement movement of the late 19th century. The Massachusetts Bureau of Statistics and Labor was created in 1869 (Leiby, 1960), followed shortly by the establishment of the U.S. Bureau of Labor, established in 1884.

[7] However, it should be also be acknowledged that the translation from social index to public policy is not always a smooth or direct one (see Cobb and Rixford, 1998). For example, some indexes rely on indicators of neighborhood conditions that are not easily addressed by policy change (e.g., social cohesion, mortality rates).

resources on the most-influential aspects of the index (Cobb and Rixford, 1998).[8] In addition, high-quality social indicators and indexes make it relatively easy to track progress in well-being and QOL when compared longitudinally (Land, 2000). In this sense, QOL indexes can be viewed as barometers of health and well-being. Two examples of indexes that have been used to influence public policy are the Index of Social Health and the Child and Youth Well-Being Index (CWI).

The ISH was developed by Miringoff and Miringoff (1999) and examines 16 social indicators of health and well-being in the United States. These indicators measure

- average weekly household earnings
- average life expectancy at age 65
- gap between rich and poor
- violent-crime rate
- infant mortality rate
- child abuse rate
- percentage of children in poverty
- teenage suicide rate
- drug abuse prevalence
- high school dropout rate
- teenage birth rate
- unemployment rate
- level of health insurance coverage
- poverty rate among those older than 65
- number of alcohol-related traffic fatalities
- an affordable housing index.

The indicators are tracked annually for the entire United States since 1970 (see Opdycke and Miringoff, 2008). Each year, each indicator is evaluated against its best previous value. Thus, each indicator is compared with a gold standard rather than against an ideal and likely unrealistic value in which no social ills would be present. Values for each of the 16 indicators are then averaged to obtain the value of the ISH for a specific year.

The ISH is an example of a social index to track the health and well-being of the U.S. population over time. Not only can it tell us how the country is doing as a whole; it can also reveal what specific areas of social life are lagging behind and may deserve more scrutiny by policymakers. Notice that the ISH also spans a range of topics: It does not

[8] The field of social indicators typically assesses influence in several ways. One way involves validating the index against other objective measures of QOL (e.g., morbidity or mortality). A second way is by examining subjective QOL. And a third way is by longitudinally examining which components of an index drive change in the index over time.

focus exclusively on economic indicators. Many leading government agencies, such as the Centers for Disease Control and Prevention and the National Center for Health Statistics, the Federal Reserve, and the Bureau of Labor Statistics, independently report monthly or annual statistics that provide insight into the well-being of the country. However, to truly capture the overall health of the nation, all those pieces of data must fit together. Thus, indexes like the ISH provide a more well-rounded depiction of the social health of the nation than the specific indexes of more-specialized organizations (see Dolan and White, 2007).

Some indexes, such as the CWI, focus on the health and well-being of a specific subset of the population (Land, Lamb, and Mustillo, 2001; Meadows, Land, and Lamb, 2005). Social indicators focusing exclusively on children are a relatively recent area of research compared with the larger field of social indicators; it has grown tremendously since the 1970s (Lippman, 2007). The CWI tracks roughly 25 indicators from federal data sources (e.g., the Census Bureau, the National Center for Education Statistics) to track child well-being across seven domains.[9] These indicators are tracked over time and reproduced each year so that child well-being can be compared with that in a base year, 1975. This allows the CWI to directly assess progress in child well-being over time. In addition, it can also assess the impact of individual indicators, as well as individual domains, on that progress.

Neighborhood Characteristics in Military Personnel Research

Although the military has not taken the same approach to assessing the association between neighborhoods and health, research has considered the characteristics of military neighborhoods relative to recruitment, readiness, satisfaction with military service, and military personnel retention outcomes. Analyses of military and family member satisfaction and retention have considered the role of on-base resources and services intended to supplement or offer military families exclusive access alternatives to community resources. Examples of these types of benefits and compensation that are part of manpower research models and analytic frameworks include on-base housing, counseling, child care centers, and fitness and recreation centers (August, 1996; Buddin, 1998; Caliber Associates, 2003; Hansen and Wenger, 2002a, 2002b; Harrison, Brennan, and Levine, 2000). Here we discuss some examples of specific types of community

[9] The seven domains are based on studies of subjective well-being and include children's material well-being, social relationships, health, safety and behavioral concerns, productive activity, place in community, and emotional and spiritual well-being.

characteristics that have been considered, although we do not provide a comprehensive review of this literature.

Scholars have used Census data to pursue questions about the quality and availability of military spouse employment. One such study demonstrated a decline in employment and number of hours worked per week among civilians who relocated with their spouses serving in the military (Cooke and Speirs, 2005). Another study found that the lower wages of civilian spouses of military personnel are not only the result of frequent relocations: Overall, wages are lower in labor markets surrounding military installations than in labor markets elsewhere (Booth, 2003). Still other research uses Census data to control for labor market variation and confirm the relative disadvantage of civilian spouses married to military personnel compared with those married to other civilians (Lim, Golinelli, and Cho, 2007). Analyses of surveys of spouses complement these studies, revealing that spouses also perceive that labor market characteristics around military bases affect spouse employment opportunities (Harrell et al., 2004). An examination of whether military wives' wages vary by location found little difference between those in urban, suburban, and rural areas—a result the authors hypothesize could reflect a tendency for military wives to work on or near base (Hosek et al., 2002).

Availability, cost, quality, and utilization of various on-base programs, sometimes in contrast to off-base programs, have also been assessed relative to spouse and service member outcomes. Lack of appropriate child care has been linked to spouse satisfaction with military life, retention, and the ability of service members to effectively perform their duties (MacDermid, Strauss, et al., 2004; Zellman et al., 2009). Studies of morale, welfare, and recreational facilities and programs more broadly, such as libraries, child and youth programs, child care programs, fitness centers, and campgrounds, have shown that utilization of and satisfaction with these services are associated with satisfaction with military life (Booth, Segal, and Bell, 2007; Nord, Perry, and Maxfield, 1997; Westhuis and Fafara, 2007).

Through survey research, scholars have recently explored the possibilities of measuring military community cohesion and its link to satisfaction with military life and retention intentions. One exploratory study tested measures of community cohesion at a single base and called for greater research on the larger military community in which service members and their families are embedded (Mcclure and Broughton, 2000). The research with the greatest affinity to the type of research we conducted here is the body of work being developed by Gary Bowen and his colleagues, who have developed a survey to identify military members' social capital via formal and informal social networks and its association with not only satisfaction but also well-being (Bowen et al., 2000; Heubner et al., 2009; Mancini, Bowen, and Martin, 2005). The community capacity-building model these researchers propose argues for both military-sponsored support of

service members and their families and partnership and collaboration with community organizations (Heubner et al., 2009). Of note is an observation of this field:

> Perhaps the most significant recognition in studying and working with military families during the past decade has been that these families are embedded in a larger community context. Although this is an obvious recognition to scholars familiar with the study of military families or the broader literature in work and family, military researchers and practitioners have only recently started to see the community and the power of both formal and informal networks that are endemic to a community perspective as a partner in support of military families. (Heubner et al., 2009, pp. 225–226)

Although this literature does examine how aspects of neighborhoods influence service members and their families, very little focuses on the association between aggregate neighborhood characteristics and health and well-being outcomes. Methodologically, it does not use aggregate measures of neighborhood quality and relative ranking, as a social indicators approach would, to identify variation across installation neighborhoods. Survey research about utilization and evaluation of community resources and the link to satisfaction and retention are more typical. Social indicators scores can be incorporated into this type of research in order to consider how aggregate relative ranking of installation neighborhoods, rather than individual measures, might be associated with attrition, retention, satisfaction, or service utilization rates. Such an approach could also indicate the degree to which community partners with sufficient resources might be available for military–community partnerships. Resources in poor communities may already be taxed by the demand of nonmilitary families in need. The approach used is intended to develop a line of research that will enrich our understanding of the community context in which service members and their families live and work. By doing so, we hope to make policymakers more aware of variation not only in personnel outcomes among service members and their families but also in health and well-being outcomes. Ultimately, a better understanding of the variance in outcomes will highlight the need for specific support services.

The Current Study

Although prior research has considered the role of community resources, such as child care, spouse employment opportunities, and school quality, in military satisfaction, to our knowledge, no study has combined aspects of social indicators and QOL research and neighborhood studies methodology in order to assess whether and how the neighborhoods where service members live, work, and socialize affect their health and well-being and those of their families. It is not likely that all service members and their

families need the same types of support and services. Some of their needs may be determined by individual-level family attributes, such as family structure, family size, and parents' education level and employment status. However, the communities in which families spend their time may influence other needs. For military families, community takes on an important meaning because they are tied to specific locations for definite periods of time. The needs of families who look very similar on paper may differ widely depending on whether they are located in a rural area versus an urban one, an area where the civilian labor market is strong versus weak, or an area with low crime rates versus high crime rates. Therefore, a service member and his or her family's well-being may depend on where they live, commute, work, and socialize because different geography can result in different exposure to stress, as well as to resources that can combat that stress.

Why is it important to understand how communities affect military personnel and their families? The military cannot directly change many of the sociodemographic and economic characteristics of surrounding communities in order to promote a healthier environment for its population. Yet an understanding of links between neighborhood characteristics and military health and well-being could provide the armed forces with a sense of the challenges and resources available within and immediately surrounding installations to help them better tailor their resources and efforts to support service members and their families, particularly those living in or near the poorest communities. In other words, this approach can point to QOL disparities across installations so that the services can actively work to counterbalance potentially negative influences.

Given that military members and their families move, on average, every three years, the relative quality of installations and their surrounding neighborhood may be of great importance for such things as job and life satisfaction, retention, and health and well-being.[10] Installations, and their surrounding communities, vary in terms of the QOL they can provide inhabitants. As noted above, the families who live in these communities and who are assigned to these installations vary in terms of their needs. A one-size-fits-all approach to resource allocation and the provision of services may not be the most effective. A study of the neighborhood–health link among military personnel could provide the services with a sense of the challenges and resources that military families face, thereby allowing the installation services to target the community-related stressors and service gaps.

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[10] Although the opposite could also be argued: Precisely because military families are so mobile, the quality of any single installation is less important for health and well-being. Compared with their civilian counterparts, who may never relocate over the course of a lifetime, neighborhood exposure may matter even less. We thank a reviewer for raising this issue.

Finally, we offer an important caveat for interpreting the results of this, and other neighborhood studies, analyses. Even though service members are assigned to a base or installation, they do have some ability to select the exact neighborhood in which they reside. Both observable and unobservable factors influence where people live, and these factors, rather than neighborhoods themselves, may influence health and well-being. Thus perhaps the best way to truly assess the causal impact of neighborhoods on health is to randomly assign service members to both bases and installations *and* neighborhoods. Of course, such a scenario is highly unlikely. As a result, the conclusions of this study must be understood as evidence of an *association* between neighborhoods and health, rather than a causal relationship. Nonetheless, the results can provide useful data for attempting to tailor services to military members and their families.

Chapter Three. Data and Methods

This chapter describes the data and methods used to select Army and Air Force installations for this study and to define their neighborhoods geographically. This chapter also details the data and methods applied in the creation of the military neighborhood ranking index (MNRI). Finally, we provide a brief description of the Army and Air Force data sets used in the subsequent two chapters to analyze the association between MNRI scores and Soldier and Airman health and well-being outcomes.

Installation and Neighborhood Data

In this study, we focus on Army and Air Force installations located within the 50 United States. We limited the sample to U.S. locations because of the availability, standardization, and value to our study of U.S. Census Bureau and U.S. ZIP Code data. In order to ensure that the sample of individual Soldiers and Airmen was large enough to support our analysis, we focused on installations with at least 1,000 full-time military personnel assigned to them. This excluded trainees, students who did not move (e.g., permanent change of station, or PCS), and patients because they are generally temporary visitors to military installations and not residents.

Using the criterion outlined above, we selected our sample using information on installation location and population size drawn from the 2009 *Army Stationing and Installation Plan* (U.S. Army, 2009) and the 2010 *USAF Almanac* (U.S. Air Force, 2010), which limited our analysis to 36 Army and 62 Air Force installations.[11] The Army installations include approximately 97 percent of all full-time Army personnel stationed in the United States in fiscal year (FY) 2003. The Air Force installations include approximately 99 percent of all full-time Air Force personnel in FY 2000. This is important because the individual-level data we used for Soldiers were collected in the period between FY 2000 and FY 2003 and individual-level data for Airmen were collected in FY 2003.

As noted in Chapter Two, existing neighborhood studies use a variety of measures to define neighborhoods. Our challenge was to define neighborhoods in a way that would capture the geographically specific area central to the daily lives of military personnel

[11] As a rule of thumb, the multilevel modeling technique we utilized requires that a minimum of 30 aggregated units or, in this case, installations be included to accurately estimate model parameters and have sufficient power to detect significant effects. Our sample sizes met this criterion.

(i.e., the installation) but that would also be compatible with existing data on the characteristics of that same geographic area. If we limited the neighborhood definition strictly to the installation, we would not be able to capture sufficiently the characteristics of the places where Soldiers, Airmen, and their families typically work, live, attend school, and use services. If we defined the neighborhood too broadly (e.g., by state or county), then we could lose the variability of different types of subneighborhoods within the larger neighborhood that are relevant to service members and their families and might explain differences in their QOL.

Another constraint is the availability of corresponding data. For example, although data at the city or county level may, theoretically, be the most informative, the types of neighborhood indicators that can be obtained at that level, across the entire United States, are limited. However, social indicator data at the ZIP Code, Census tract, or state level are far more prevalent.

For the purposes of this study, we define a military neighborhood as the ZIP Codes that include the installation itself, as well as those ZIP Codes that are contiguous with the respective installation ZIP Codes. The geographic size of a ZIP Code can vary dramatically, as can the size of a military installation. Military neighborhoods ranged in size from two to 27 ZIP Codes for the Army and two to 19 ZIP Codes for the Air Force. We eliminated other options for aggregated neighborhood units (e.g., city, county, or congressional districts) in part because these data are not centralized or standardized, and data collection from agencies at these levels across the United States was beyond the scope of this project in terms of both funding and time. In some cases, data are simply not available at these levels. In order to maximize the number of military neighborhood characteristics that we could analyze, Census data, which are available at the ZIP Code level, provided the best option.

Census Data

The 2000 decennial Census provides ZIP Code–level information about a variety of sociodemographic characteristics of neighborhoods.[12] The Census Bureau converts U.S. Postal Service (USPS) ZIP Codes into ZIP Code Tabulation Areas, or ZCTAs (see Krieger et al., 2002). In most cases, the ZCTA code equals the ZIP Code for a specific geographic area. However, ZIP Codes that represent very few addresses are folded into an adjacent ZCTA, and thus their ZCTAs do not precisely match their ZIP Code.

[12] Census data for 2010 were not yet available at the time of this study, and most of the sociodemographic characteristic questions we used were not included in that year's questionnaire.

We use ZIP/ZCTA-level data for several reasons. First, service members report where they live using physical addresses. Second, we had no a priori theoretical reason to use a unit of analysis other than ZIP Codes. Third, because this was an exploratory study, we opted to use a simple calculation of neighborhood to see whether the method could provide useful results. And fourth, ZIP Codes are generally smaller than any other unit of analysis provided by the Census, with the possible exception of Census blocks and block groups. Future analyses should consider using other units of analysis (e.g., Census tracts, public-use microdata areas [PUMAs]).

We utilized a web-based tool maintained by the Census Bureau called American FactFinder to extract data for all of the ZIP/ZCTA codes that comprised each military neighborhood.[13] We selected 22 characteristics, or indicators, to be included in our ranking index (see Table 3.1). Although this list is not exhaustive, it does represent key sociodemographic characteristics of neighborhoods that have been linked to health and well-being (e.g., SES). In general, our selection of indicators and domains were guided by three principles. First, we looked at domains and indicators found in other examples of social indexes (e.g., the Foundation for Child Development [FCD] CWI, the ISH). Second, we looked at the existing literature on adult and child health and well-being to see what social and economic factors at the individual level are associated with well-being. For example, personal income and wealth are positively associated with health and well-being (Deaton, 2003; Marmot, 2002; Subramanian and Kawachi, 2004). When these characteristics are aggregated to the population level, they can also affect population health. Third, we focused on indicators that could be put into a rank-order structure. For example, any characteristic that cannot be put into a rank-order structure is inappropriate for an index. The percentage of the population who self-identify as a minority is one such indicator. There is no clear or universal way to rank the percentage: Is a higher percentage better, or is a lower percentage better? Thus, we limit ourselves to indicators that can clearly be ranked from best to worst for all individuals within a particular military neighborhood.

The 22 indicators were then grouped into six larger domains: household composition, employment, transportation, social, income and poverty, and housing. As much as possible, we followed the domains used by the Census Bureau. These domains are also

[13] American FactFinder uses both the Census 2000 Summary File 1 and the Census 2000 Summary File 3. Summary File 1 contains data for the United States, the 50 states, and the District of Columbia in a hierarchical sequence down to the block level for many tabulations, but only to the Census-tract level for others. Summary File 3 contains data from the population and housing long form and is also known as the Sample Data because they are obtained from questions asked of a sample (generally one in six) of persons and housing units.

very similar to those used in other national indexes of well-being (e.g., the FCD CWI). These domains, along with the corresponding individual indicators, are shown in Table 3.1.

Table 3.1
Twenty-Two Sociodemographic Census Indicators Used in the Military Neighborhood Ranking Index, by Domain

Domain	Indicator
Household composition	Percentage of households headed by a female[a]
	Average household size (number of people)[a]
Employment	Percentage in the labor force
	Percentage unemployed[a]
Transportation	Mean travel time to work (in minutes)[a]
	Percentage using public transportation
	Percentage with access to one or more automobiles
Social	Percentage with less than a high school degree[a]
	Percentage with a bachelor's degree or higher
	Percentage currently married
	Percentage ages 16–64 with a disability[a]
	Percentage age 65+ with a disability[a]
	Percentage living in the same house since 1995
Income and poverty	Median household income (in dollars)
	Mean public assistance (in dollars)[a]
	Median family income (with children under age 18) (in dollars)
	Percentage of families in poverty[a]
	Percentage of female-headed households in poverty[a]
Housing	Percentage paying 35 percent or more of income for rent[a]
	Percentage paying 35 percent or more for owner costs[a]
	Vacant housing units (number of units)[a]
	Percentage of occupied units that are rentals[a]

[a] Lower is better.

Some of the specific characteristics in Table 3.1 are clearly associated with SES (e.g., median household income, poverty rates, expenditures on housing), which is, in turn, related to health and well-being. However, other nonsocioeconomic characteristics have also been linked to well-being in previous research. For example, we included data on average household size because there is a literature that shows that family members, especially children, fare better when family resources are distributed among fewer people (Bradbury, 1989; Downey, 1995). So for our ranking process in this case, the "best" military neighborhood will be that with the smallest average household size.[14] Similarly,

[14] Unfortunately, Census data cannot reveal whether the individuals in a household are adults or children.

female-headed households are typically characterized as lower in SES (i.e., income) (DeNavas-Walt, Proctor, and Smith, 2011), and children from these household do worse on several well-being outcomes (McLanahan and Sandefur, 1996). Married households tend to have higher SES (i.e., income) (DeNavas-Walt, Proctor, and Smith, 2011). Thus, *lower* percentages on the household size and female-headed household indicators and a *higher* percentage on the married household indicator, are "better."

The transportation domain includes the mean travel time to work, the percentage using public transportation, and the percentage with access to one or more personal vehicles. High rates of utilization of public transportation could reflect lack of personal transportation; however, this disadvantage would be captured by the data assessing percentages of people with access to cars. On the positive end, utilization of public transportation could serve as a proxy for neighborhood infrastructure or services. Additionally, recent research suggests that the introduction of public transportation may be associated with increased physical activity and reduction in BMI among residents (MacDonald et al., 2010).

The housing domain is a combination of economic indicators and potential indicators of neighborhood cohesion. High rates of vacancies and renter-occupied units may signal neighborhoods with high rates of turnover, which have been linked to low cohesion among residents (Coleman, 1990). Lower neighborhood cohesion, and collective efficacy, has then been linked to higher levels of criminal activity (Sampson, Raudenbush, and Earls, 1997). Vacant housing units can also mean reduced tax revenues for neighborhoods, which could potentially translate into reduced government spending on services and the criminal justice system.

One caveat about the Census characteristics is worth noting. We are limited to the variables that are available in existing Census data. So although we do not have a direct measure of criminal activity within a military neighborhood, such as the violent-crime rate, or a direct measure of school quality, such as the student-to-teacher ratio, we do have indicators that tap into SES. SES has previously been correlated with crime and school quality (Fernandez and Rogerson, 1996; Hipp, 2007), so such indicators as median household income, use of public assistance and poverty are important for multiple dimensions of life.[15]

Each of the military neighborhoods in our study is defined by an amalgamation of anywhere from two to 27 ZIP Codes. Thus, it was necessary to combine data from all the

[15] Because this project was intended to be a proof-of-concept study, we limited the avenues of data collection. However, other indicators, such as crime and school quality, might be available through local agencies.

ZIP Codes that comprised a single military neighborhood into a single value for each of the 22 Census sociodemographic indicators. To do this, data from each military neighborhood ZIP Code were weighted by population size and then averaged into a single data point for each individual military neighborhood. By doing so, we allowed ZIP Codes with larger populations to carry a larger share of the overall military neighborhood value than ZIP Codes with smaller populations because more people are exposed to those more densely populated geographic areas.

Methods for Ranking the Military Neighborhoods

We used social indicators methodology to combine the military neighborhood data into meaningful categories, or domains, in order to create installation profiles. For every military neighborhood characteristic, or indicator, shown in Table 3.1, we ranked neighborhoods by comparing each military neighborhood with the best-performing military neighborhood on that specific indicator. For example, if the neighborhood surrounding neighborhood A has a 10-percent family poverty rate, the lowest, most desirable rate among all locations, but neighborhood B has a 15-percent poverty rate, then neighborhood A will receive a score of 100 (the best, highest score possible for an indicator) on the family poverty indicator and neighborhood B will receive a score of 50 on the family poverty indicator. That is, neighborhood B's family poverty rate is 50 percent as good as the "best" (in this case defined as the lowest) family poverty rate among all neighborhoods. Indicator scores range from 100, which is set by the neighborhoods with the most-desirable social conditions, and can reach into the negative range if a comparison neighborhood's performance is more than twice as poor as that of the best neighborhood.

The general indicator formula is presented below:[16]

$$INDEXSCORE = 100 \pm \left(\frac{BESTSCORE - CURRENTSCORE}{BESTSCORE} \times 100 \right).$$

The best score is the military neighborhood with the most desirable (highest or lowest) score on the indicator in question, and the current score is the military neighborhood that is being compared. The indicator score is then added (if a higher value on the indicator is better) or subtracted (if a lower score on the indicator is better) from 100. Thus, the result is one value for each indicator for each military neighborhood.

[16] In our multilevel modeling analysis, the index score was then scaled down by a factor of 100 (i.e., the index score was divided by 100) to aid interpretation of model coefficients.

Once relative ranking scores have been calculated for the 22 sociodemographic indicators for each military neighborhood, they can then be used to calculate a ranking score for each neighborhood along each of the six domains of neighborhood indicators shown in Table 3.1: household composition, employment, transportation, social, income and poverty, and housing. The same methodology outlined above is used. For example, neighborhood A's scores on (1) gross rent as percentage of income, (2) owner costs as a percentage of income, (3) vacant housing units, and (4) percentage of housing units that are renter-occupied are averaged into a single domain score for the housing characteristics domain. All the indicators within a domain are weighted equally.[17] This process allows us to condense multiple military neighborhood characteristics into one meaningful score for each domain of indicators.

Domain scores can range from 100 to an unconstrained negative number. A score of 100 on a domain would reflect that a military neighborhood had the best score on all the indicators within that domain. At no point in our analyses did a single neighborhood score best on every item within a domain, so a 100 domain score is a hypothetical score rather than an actual achieved score. Domain scores can generally be interpreted as how well a given military neighborhood is doing compared with a hypothetical neighborhood that scored the highest on all the indicators within a domain. Positive values can be interpreted as a percentage of the hypothetical neighborhood that receives an indicator score of 100; negative scores indicate that a base is doing more than twice as poorly.[18]

Finally, we create the MNRI. Scores across the six domains are averaged into a single, equally weighted index score. That is, each of the six domains listed in Table 3.1 carries the same weight as the other domains in determining a military neighborhood's ranking. In turn, those six domains contain all the 22 Census-derived sociodemographic indicators, as shown in Figure 3.1. Thus, the MNRI indexes, or ranks, each neighborhood against all other neighborhoods and allows us to condense military neighborhood characteristics into a single meaningful score.

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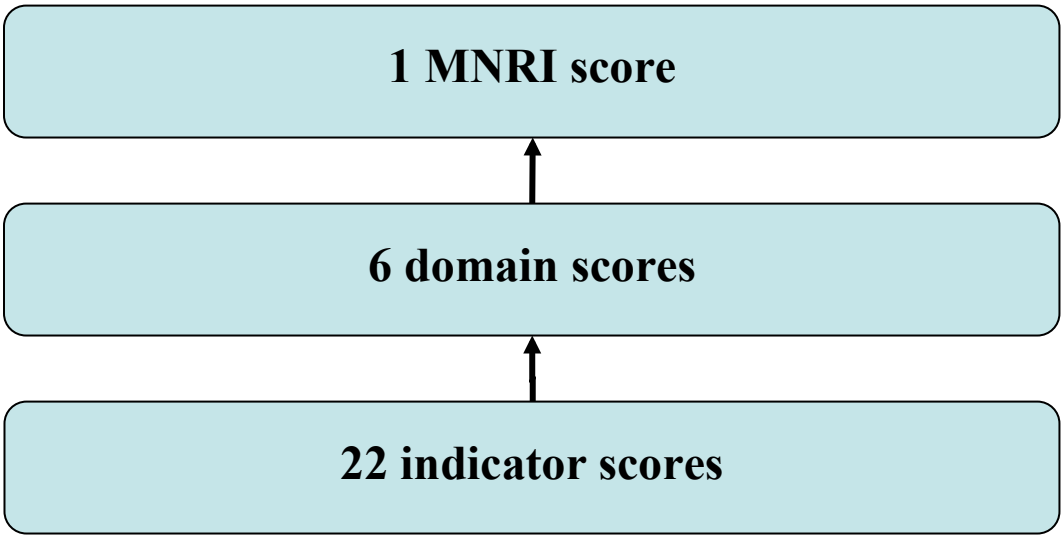
[17] An alternative approach weights each of the 22 indicators equally, without calculating any domain scores. We refer to the ranking strategy as the MNRI(I), with the (I) denoting the direct use of the indicators. Results from this version of the MNRI for the Army appear in Appendix A and for the Air Force in Appendix B. Results using both versions of the MNRI are substantively similar. Evidence from prior research suggests that, in the absence of a clear rationale for a preferred weighting scheme, an equally weighted domain index, rather than an equally weighted indicator index, is preferable (Hagerty and Land, 2007).

[18] Technically, a negative score can occur for an indicator only where a lower number is better.

Figure 3.1
Flow Chart for Derivation of the Military Neighborhood Ranking Index



We refer to a score of 100 on the MNRI as a hypothetical gold standard toward which neighborhoods might strive but that they will never achieve. Similar to the interpretation of a domain score, the MNRI score tells us how well a particular military neighborhood is doing compared with a hypothetical neighborhood that scores the highest on all six domains and, thus, all 22 indicators. Because all scores are based on 100, the final MNRI score can be interpreted as a percentage of the hypothetical neighborhood (i.e., a score of 50 would mean that a neighborhood is doing 50 percent as well as the hypothetical base). For comparison purposes, Table 3.2 reviews the similarities and differences among the three different measures that can be used to rank military neighborhoods.

Table 3.2
Description of Ranking Measures by Which Military Neighborhoods Can Be Assessed

Measure	Indicator Score	Domain Score	MNRI Score
Description	Population-weighted average of a single Census sociodemographic characteristic, indexed against other military neighborhoods	Equally weighted average of multiple indicator scores that fall within a particular substantive domain	Equally weighted average of all domain scores
Number of values that can be calculated for each military neighborhood	22	6	1
Highest possible score	100	100	100
Lowest possible score	Unconstrained negative value identifying how far below the best actual indicator score a neighborhood falls	Unconstrained negative value identifying how far below the highest possible domain score a neighborhood falls	Unconstrained negative value identifying how far below the highest possible MNRI score a neighborhood falls
Interpretation of the score	Percentage of best score on indicator	Percentage of hypothetical military neighborhood that scores highest on all indicators within a domain	Percentage of hypothetical military neighborhood that scores highest on all domains

It is important to keep in mind that, because this is an exploratory study, we are not suggesting that these indicators and domains, or our decisions about how to combine them into one index score, are the "right" ones. Rather, we are trying to highlight the utility and flexibility of social indicators methodology in describing the areas around military installations. So although we have chosen to use Census data at the ZIP Code level and chosen an equally weighted index methodology, this is not the only way to create an index reflecting neighborhood quality and characteristics. We selected these data and methods for multiple reasons, as discussed above, but one of the primary ones is the ease of data collection, analysis, and interpretation. In this sense, the analysis can be thought of as an instruction manual for applying social indicators and neighborhood studies methodology to the military context.

As a reminder, this ranking exercise is not intended to create a proxy for service member and family base assignment preference. Individual preferences may include climate, proximity to cities or certain types of recreation (e.g., skiing, fishing, hunting), distance from friends and family members, opportunities for career-enhancing assignments, or specific local career or education options for spouses. The purpose of this index is to identify where neighborhood-related stressors may be greater or local

resources may be lacking so that military installations can compensate through programs and services to support military personnel and their families.

Multilevel Modeling

The Census data provide aggregated information collected from a sample of individuals living within a geographically defined space. We explore associations between individual Soldier and Airman outcome data with those aggregated neighborhood scores. Therefore, we use a multilevel model: individuals at one level and the military neighborhood at the second level. Multilevel modeling is used for two reasons. First, it allows us to estimate the correct standard error of the relationship between neighborhood characteristics and outcomes. This standard error can be thought of as the amount of error around our estimates. If the multilevel nature of the data is not taken into account, the size of this error will be underestimated, thereby making it more likely that we will find results that are statistically significant (i.e., false positives). Second, the covariates we introduce into the models may also vary across installations. If they do, then the associations we observe between any given domain or the overall MNRI and the outcomes may simply be due to installation differences in the covariates.

In this next stage of analyses, we incorporate the MNRI results into available service-specific data to look for any associations between the MNRI scores and available health or retention outcomes. We briefly describe those service data here.

Army Data

We use the Total Army Personnel Database (TAPDB) as our source of individual-level career information about active-duty Soldiers. The database contains information about Soldiers' demographics, as well as career elements, including assignment locations. We use Soldiers' gender, race, ethnicity, age, marital status, civilian education level, pay grade (rank), amount of time spent in current pay grade (an indication of how quickly they rise through the ranks), years of service, number of dependent children in the household, Armed Forces Qualification Test (AFQT) percentile (which applies to enlisted service members only), and whether the Soldier's spouse is also in the Army. The data also indicate whether or not the Soldier was previously stationed in a CONUS location prior to his or her assignment location as of the end of FY 2003. Most variables, especially sociodemographic characteristics, such as gender, race, ethnicity, and education level, are similar to those that are used in neighborhood studies using civilian data.

We are limited in our ability to access Army data on individual-level outcomes for this study because of its exploratory nature and, more importantly, because the research did not have an official Army sponsor who could provide access to health and well-being

measures. The only individual-level health variable available in the TAPDB was BMI. Our primary concern with this is that there was no indication of when BMI was entered into the personnel files: whether it was an entry-level measurement, was updated after the last physical examination, or whether it was entered at inconsistent intervals across the population.

In the traditional of military personnel research, we also consider two retention variables, even though the civilian neighborhood studies literature has not explored the link between neighborhood and organizational commitment. QOL and family support services have grown since the advent of the AVF, in part because of the belief that these resources can bolster the attractiveness of military service, offset some of its negative aspects, and increase job satisfaction and organizational commitment. Indeed, as noted above, previous research has explored the association between some community-based indicators and these types of personnel outcomes. Health and well-being may be indirectly or directly related. If neighborhoods improve health and well-being and that improvement, in turn, increases or maintains a taste for military service, primarily via job satisfaction, there could be an association between overall neighborhood quality and retention, although other factors play a role in service commitment as well. Poor health even more directly affects retention because those whose health renders them unable to continue to serve effectively can be medically discharged or medically retired.

The Army personnel files provide information about separation from active duty. This includes attrition, when a Soldier leaves the Army prior to the completion of his or her contractually obliged term, and separation from active duty, when a Soldier who has completed his or her contractually required term does not reenlist or remain on active duty afterward.

Air Force Data

We use the 2003 Air Force Community Assessment Survey for individual-level information about attitudes, self-reported behaviors, and demographic characteristics of Airmen, including their assignment location.[19] The survey was designed to help senior Air Force leadership determine the strengths and needs of Air Force communities and to help service providers effectively utilize installation-specific resources. It has been

[19] Note that the Army does not have a corresponding community-level survey in which respondents can be linked to the bases to which they are assigned. Although there are U.S. Department of Defense (DoD)–wide surveys intended to measure community attitudes and beliefs (e.g., housing satisfaction, neighborhood satisfaction) the sample size of Soldiers in these surveys would not have been large enough to support our analysis. Further, not all these surveys link respondents to the bases and installations where they are assigned.

conducted, Air Force–wide, every two to 2.5 years since 1991. The 2003 version was sent to 66,515 randomly selected active-duty Airmen, stratified by rank (enlisted versus officer) and gender within each of 85 Air Force bases (AFBs). This stratified random sampling design meant that large enough samples were drawn within each base to allow results to be valid at the base level, making these data ideal for our analysis. The final response rate was 61 percent (Spera, 2009).

We use several demographic variables: whether the service member lived on or off the base, whether he or she was married—and, if so, whether the spouse was employed (including employed by the military)—his or her pay grade, whether he or she had children living at home, and the amount of time he or she had spent away from home.

The Air Force data provide a range of outcomes related to health and satisfaction with other aspects of the environment that are not available in the Army data. In our models, we used a variety of health and well-being outcomes: depressive symptoms, satisfaction with life, and self-rated health. We also assessed community attitudes and beliefs: satisfaction with current housing; satisfaction with housing stock; perceived safety of one's residence, neighborhood, and the civilian area around the installation; and rating of whether civilians in the area were friendly to service members. The one financial outcome that was assessed was the number of financial difficulties experienced by the Airman. Measures assessing attitudes toward the Air Force included overall satisfaction with current base assignment and intention to reenlist (for enlisted service members only).

Chapter Four. Case Study 1: U.S. Army Installations

This chapter presents results from our case study using data from the Army. First, we present data on the 36 Army installations used for the Army military neighborhoods. Second, we use Census data to rank those military base neighborhoods across six domains, as well as the overall MNRI. Third, we provide an overview of a select group of military neighborhoods that ranked highest and lowest on the overall MNRI. Fourth, we use multilevel modeling to link the six domains, as well as the overall MNRI, to three Soldier outcomes: attrition (i.e., leaving before the end of a Soldier's term of service), separation from active duty (referred to as separation), and BMI. Although we execute the same series of models for each of the outcomes, in the interest of brevity, we focus only on those associations that are statistically significant.

Army Base Neighborhoods

Table 4.1 provides a list of the 36 Army installations we used, the state in which they are located, primary mission type as defined by the 1995 Base Realignment and Closure (BRAC) Commission (Hix, 2001, p. 31), and their full-time Army populations as of 2003.[20] Population size information helped us to ensure that the sample of individual Soldiers was large enough to support the requirements of multilevel modeling. Later in this section, we also consider whether the top- and bottom-ranked neighborhoods tend to reflect any particular patterns with regard to state, primary mission of the installation, and full-time population size.

Table 4.1
List of Army Installations Included in the Analysis, with Installation Type and Full-Time Army Personnel Population Size as of Fiscal Year 2003

Installation	Installation Type	Full-Time Army Population Size
Fort Hood, TX	Maneuver	40,040
Fort Bragg, NC	Maneuver	38,979
Fort Campbell, KY	Maneuver	23,122
Fort Lewis, WA	Maneuver	18,662

[20] Recall that individual-level Soldier data were collected in the period between FY 2000 and FY 2003.

Installation	Installation Type	Full-Time Army Population Size
Fort Stewart, GA	Maneuver	14,395
Fort Carson, CO	Maneuver	13,396
Schofield Barracks, HI	Maneuver	12,526
Fort Benning, GA	Training school	10,868
Fort Drum, NY	Maneuver	10,769
Fort Swill, OK	Training school	10,303
Fort Riley, KS	Maneuver	9,674
Fort Bliss, TX	Training school	9,551
Fort Polk, LA	Major training area	8,179
Fort Knox, KY	Training school	6,144
Fort Gordon, GA	Training school	5,656
Fort Sam Houston, TX	Training school	5,094
Fort Leonard Wood, MO	Training school	5,040
Fort Irwin, CA	Major training area	4,936
Fort Eustis, VA	Training school	4,352
Fort Wainwright, AK	Maneuver	4,127
Fort Jackson, SC	Training school	4,057
Hunter Army Airfield, GA	Maneuver	4,043
Fort Huachuca, AZ	Training school	3,956
Fort Rucker, AL	Training school	3,044
Fort Meade, MD	Command and control	3,006
Fort Lee, VA	Training school	2,857
Walter Reed Army Medical Center, MD	Medical facility	2,567
Fort Richardson, AK	Maneuver	2,557
Fort Shafter, HI	Command and control	2,329
Fort Belvoir, VA	Command and control	2,302
Fort Leavenworth, KS	Professional school	2,004
Fort McPherson, GA	Command and control	1,938
Fort Myer, VA	Command and control	1,769
Aberdeen Proving Ground, MD	Proving ground	1,532
West Point, NY	Professional school	1,420
Fort Story, VA	Maneuver	1,031

SOURCE: U.S. Army, 2009.

Results from the Army Military Neighborhood Ranking Index

Domain Scores

The first set of results that we discuss is the domain-specific scores. Rather than present the rankings for all 36 Army neighborhoods in our analysis for each domain, we present only the five highest- and five lowest-scoring military neighborhoods. Domain scores can range from 100 to negative values. In general, the same group of Army neighborhoods appears consistently in the top five scores across the domains, as are several neighborhoods consistently in the bottom five. Tables 4.2 through 4.7 present the results by domain.

These results for the household composition domain are presented in Table 4.2. Fort Myer, a command-and-control post, with its surrounding military neighborhood located near Arlington, Virginia, was ranked the highest among Army neighborhoods, with a domain score of 98.2. That the value on the indicator score is less than 100 means that Fort Myer was not ranked the highest on both of the indicators that comprise the household composition domain (percentage of households headed by a female and average household size). According to the indicator score, Fort Myer is doing 98.2 percent as well as a hypothetical neighborhood that scored the best (i.e., 100) on all the indicators in the household composition domain. In contrast, Fort McPherson, a command-and-control post located on the southwest edge of Atlanta, Georgia, was ranked the lowest, with an index score of –48.2, which was well below the neighborhood that ranked next to last, with a score of 12.4. The Fort McPherson military neighborhood is doing more than twice as poorly as that hypothetical comparison neighborhood (which, in this case, was not too far off from the highest-ranked neighborhood). Four of the five lowest-ranking Army neighborhoods are located in Georgia, meaning that these neighborhoods had the greatest percentage of female-headed households or the largest average household sizes.

Table 4.2
Domain-Specific Results: Household Composition Domain, Army

Top Five Army Neighborhoods		Bottom Five Army Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Fort Myer, VA	98.2	32. Hunter Army Airfield, GA	23.1
2. Fort Story, VA	89.1	33. Fort Gordon, GA	19.1
3. Fort Riley, KS	88.6	34. Fort Benning, GA	18.0
4. Fort Huachuca, AZ	82.5	35. Fort Lee, VA	12.4
5. Fort Leonard Wood, MO	81.6	36. Fort McPherson, GA	–48.2

NOTE: The household composition domain contains two indicators: the percentage of households headed by a female and the average household size.

Table 4.3 presents the results for the employment domain. West Point's neighborhood, home to the U.S. Military Academy and located along the Hudson River in southern New York state, ranks the highest, with an indicator score of 98.5. The other four highest-scoring Army neighborhoods are all in the vicinity of Washington, D.C., and the Pentagon, and all but Fort Story are command-and-control installations. As in the household domain, Fort McPherson's neighborhood is the lowest-ranked neighborhood, with an index score of –159.1, which was far worse than even the next-to-lowest-ranked Army neighborhood. Further investigation of the results showed that the unemployment rate in the Fort McPherson neighborhood in 2000 was more than five times as high as in the best neighborhood on that indicator (11.7 percent versus 2.0 percent in the West Point neighborhood). This large difference in unemployment rates can account for the Fort McPherson neighborhood's poor performance in the broader employment domain.

Table 4.3
Domain-Specific Results: Employment Domain, Army

Top Five Army Neighborhoods		Bottom Five Army Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. West Point, NY	98.5	32. Fort Gordon, GA	21.7
2. Fort Story, VA	92.8	33. Fort Bliss, TX	18.2
3. Fort Meade, MD	91.8	34. Fort Irwin, CA	6.7
4. Fort Belvoir, VA	88.3	35. Fort Wainwright, AK	4.4
5. Fort Myer, VA	81.5	36. Fort McPherson, GA	–159.1

NOTE: The employment domain contains two indicators: percentage in the labor force (over age 16) and percentage in the labor force who are unemployed (over age 16).

Table 4.4 presents the results for the transportation domain. Fort Myer's neighborhood, with a domain score of 78.7, is the highest-ranked Army neighborhood, while Schofield Barracks in Hawaii and Fort Meade in Maryland scored the lowest at 36.9 and 37.0, respectively. Lower scores mean higher commute times, less use of public transportation, and fewer people with access to vehicles. This is the only domain in which the Fort McPherson neighborhood did not appear among the bottom five Army neighborhoods.

Table 4.4
Domain-Specific Results: Transportation Domain, Army

Top Five Army Neighborhoods		Bottom Five Army Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Fort Myer, VA	78.7	32. Fort Polk, LA	41.9
2. Fort Riley, KS	68.2	33. Aberdeen Proving Ground, MD	41.5
3. Walter Reed, DC	68.2	34. Fort Belvoir, VA	39.8
4. Fort Drum, NY	65.0	35. Fort Meade, MD	37.0
5. Fort Wainwright, AK	64.4	36. Schofield Barracks, HI	36.9

NOTE: The transportation domain contains three indicators: mean travel time to work (in minutes), percentage who take public transportation to work, and percentage with access to one or more vehicles.

Table 4.5 presents the results for the social domain, which combines items on population education, marital status, disability status, and residential stability. As with the employment domain, the U.S. Military Academy neighborhood at West Point receives the highest domain score of all Army neighborhoods. Relative to the score that would reflect having the highest score on every one of the six indicators in the social domain, the West Point neighborhood is doing roughly 84 percent as well. The Fort Riley neighborhood in Kansas appears in the top five again, as it did under the household composition and transportation domains. Again, the Fort McPherson neighborhood is the worst-performing military neighborhood, with a score of –15.0, meaning that its performance on the social domain indicators is more than twice as poor as the best score a neighborhood could achieve on this domain.

Table 4.5
Domain-Specific Results: Social Domain, Army

Top Five Army Neighborhoods		Bottom Five Army Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. West Point, NY	83.7	32. Fort Benning, GA	21.8
2. Fort Riley, KS	79.9	33. Fort Bliss, TX	19.8
3. Fort Meade, MD	79.3	34. Fort Rucker, AL	17.8
4. Fort Story, VA	79.0	35. Fort Lee, VA	9.6
5. Fort Wainwright, AK	73.5	36. Fort McPherson, GA	–15.0

NOTE: The social domain contains six indicators: percentage with less than a high school degree or equivalency, percentage with a bachelor's degree or higher, percentage currently married, percentage with a disability (ages 16 to 64), percentage with a disability (age 65 and over), and percentage residing in the same house since 1995.

Table 4.6 presents the results for the income and poverty domain. Fort Meade, located in Maryland, had the highest-ranked military neighborhood, with a domain score of 57.2. Notice here that even the best neighborhood performed only 57 percent as well as a hypothetical gold-standard neighborhood, which is well below the best military neighborhood scores on the other domains. Fort McPherson was by far the lowest-ranked military neighborhood with a score of –190.6, well below the next-to-last-ranked Fort Rucker neighborhood in Alabama, with its score of –91.0. In fact, all the bottom five neighborhoods on the income and poverty domain have scores below 0. The poor performance on this domain relative to the other domains, even among the highest-ranked military neighborhoods, suggests that economic status of neighborhoods including and surrounding military installations may be problematic for military personnel and their families in general but especially problematic for families assigned to posts where the surrounding neighborhoods are particularly disadvantaged. As with the household composition domain, more than one military neighborhood located in Georgia appears in the bottom five.

Table 4.6
Domain-Specific Results: Income and Poverty Domain, Army

Top Five Army Neighborhoods		Bottom Five Army Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Fort Meade, MD	57.2	32. Fort Stewart, GA	–72.9
2. Fort Belvoir, VA	46.9	33. Hunter Army Airfield, GA	–77.2
3. Fort Leavenworth, KS	42.4	34. Fort Bliss, TX	–79.1
4. Walter Reed, DC	32.1	35. Fort Rucker, AL	–91.0
5. West Point, NY	29.3	36. Fort McPherson, GA	–190.6

NOTE: The income and poverty domain contains five indicators: median household income (in dollars), mean public assistance (in dollars), median family income (in dollars), percentage of families with children under age 18 in poverty, and percentage of female-headed households with children under age 18 in poverty.

Table 4.7 presents the results for the housing domain, which includes measures of those spending more than 35 percent of their income on rent or homeowner expenses and measures of vacancies in rental and housing units. The only score above 0 on this domain was for the West Point neighborhood, which scored only 38 percent as well as that best possible domain score, based on the best scores on all four indicators in the housing domain. All the other military neighborhoods scored below 0, indicating that they were performing at least twice as poorly as the hypothetical gold standard. The lowest-ranked military neighborhood, Fort Story, has a domain score of –553.6.

Closer inspection of the indicators within the housing domain reveals a great degree of variation across the indicator values. For example, although 10.4 percent of individuals in the Fort Leonard Wood neighborhood spend 35 percent or more of their income on rent, 35.3 percent of individuals in the Fort McPherson neighborhood did so. This three-fold difference from lowest (i.e., "best") to highest (i.e., "worst") scores is one reason for the negative domain scores. A similar discrepancy between best and worst military neighborhoods exists for the percentage of individuals who spent 35 percent or more of their income on homeownership costs (7.6 percent at Fort Leonard Wood, Missouri, versus 25.6 percent at Schofield Barracks, Hawaii) and the percentage of units that were occupied by renters (25.5 percent at Fort Knox, Kentucky, versus 67.8 percent at Fort Myer, Virginia). By far, the largest discrepancy occurred on the indicator that captures the number of vacant housing units. West Point had the fewest vacant housing units, with roughly 110.[21] In contrast, 2,546 housing units were vacant in the Fort Story military

[21] Remember that the vacant housing unit indicator is a weighted average of all ZIP/ZCTAs in a military neighborhood.

neighborhood. This difference is more than twenty-fold and is the main reason that the housing domain scores are so low across all military neighborhoods.

Table 4.7
Domain-Specific Results: Housing Domain, Army

Top Five Army Neighborhoods		Bottom Five Army Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. West Point, NY	38.2	32. Hunter Army Airfield, GA	–252.3
2. Fort Belvoir, VA	–6.6	33. Fort Lee, VA	–262.3
3. Fort Leavenworth, KS	–6.9	34. Fort Irwin, CA	–292.9
4. Fort Mead, MD	-6.9	35. Fort McPherson, GA	–338.5
5. Fort Leonard Wood, MO	–15.6	36. Fort Story, VA	–553.6

NOTE: The housing domain contains four indicators: percentage spending 35 percent or more of income on rent, percentage spending 35 percent or more of income on owner costs, percentage of units that are renter-occupied, and number of vacant housing units.

Correlation Between Domains and the Overall Military Neighborhood Ranking Index

Now that we have discussed each of the six domains separately, we consider how the domains relate to one another, and then turn to the overall MNRI scores for each base. To do so, we present bivariate correlations between the six individual domains. These correlations range from –1 to 1. A correlation of 0 indicates no linear association between two domain scores, a positive correlation suggests that higher (or lower) values on one domain are associated with higher (or lower) values on another domain, and a negative correlation suggests that higher (or lower) values on one domain are associated with values in the opposite direction lower (or higher) domains on another domain. A perfect correlation of 1, either positive or negative, would indicate that there is a one-to-one correspondence between two domain scores.

A correlation matrix of the adjusted domain scores is shown in Table 4.8.[22] The housing domain is highly positively correlated with overall MNRI. Most domains are positively correlated to a lesser degree to each other and to the MNRI. The transportation domain is less correlated, and generally, when it is correlated, it is negatively correlated with other measures. The overall alpha excluding the equally weighted index is 0.67, suggesting that the measures are assessing similar but not completely overlapping

[22] Recall that outliers are adjusted by reassigning domain values to 10 less than the next-lowest domain score. Table A.1 in Appendix A presents the raw data used to create the correlation matrix.

constructs. That the measures are not completely overlapping suggests that the domains in and of themselves may be useful in explaining variation in Soldier outcomes across military neighborhoods, a point to which we return later in the chapter.

Table 4.8
Correlations Between Neighborhood Domains and the Overall Military Neighborhood Ranking Index, Army

Domain or Index	1	2	3	4	5	6
1. MNRI						
2. Household composition domain	0.59					
3. Social domain	0.70	0.71				
4. Employment domain	0.67	0.51	0.59			
5. Income and poverty domain	0.77	0.42	0.69	0.65		
6. Transportation domain	–0.14	0.21	0.01	–0.26	–0.09	
7. Housing domain	0.94	0.49	0.50	0.60	0.58	–0.28

Overall Military Neighborhood Ranking Index

We turn now to the results from the overall MNRI, which equally weights the six domains reviewed above. Table 4.9 shows the complete ranking of the 36 Army neighborhoods in our analysis, with the top half of the distribution shown in white and the bottom half shown in gray. Our discussion, however, focuses on the top five and bottom five Army neighborhoods as ranked by the MNRI. Domain scores for each installation are reported in Appendix A, Table A.1.

Given their appearances in the top and bottom five positions within the domain rankings, the Army neighborhoods ranking in the overall top and bottom five positions may not come as a surprise. West Point's neighborhood in New York garners the highest MNRI score, at 58.5, and is followed by Fort Meade's neighborhood in Maryland (52.3), Fort Leavenworth's in Kansas (45.8), Fort Belvoir's in Virginia (45.3), and Fort Leonard Wood's in Missouri (39.7). The lowest-ranked neighborhood is Fort McPherson, Georgia, with a very low MNRI score of –119.3. In ascending order, the rest of the bottom five military neighborhoods are Fort Story's in Virginia (–55.8), Hunter Army Airfield's in Georgia (–43.8), Fort Irwin in California (–43.1), and Fort Lee also in Virginia (–42.8).

Table 4.9
Overall Military Neighborhood Ranking Index Scores, Army

Rank	Neighborhood	Score	Rank	Installation	Score
1	West Point, NY	58.5	19	Fort Sam Houston, TX	–2.1
2	Fort Meade, MD	52.3	20	Fort Stewart, GA	–7.9
3	Fort Leavenworth, KS	45.8	21	Fort Shafter, HI	–12.2
4	Fort Belvoir, VA	45.4	22	Fort Drum, NY	–12.3
5	Fort Leonard Wood, MO	39.7	23	Fort Polk, LA	–13.8
6	Fort Jackson, SC	28.9	24	Fort Campbell, KY	–14.6
7	Fort Knox, KY	25.2	25	Fort Benning, GA	–20.8
8	Fort Myer, VA	24.8	26	Fort Bragg, NC	–22.4
9	Fort Richardson, AK	23.0	27	Fort Sill, OK	–22.8
10	Aberdeen Proving Ground, MD	21.0	28	Fort Rucker, AL	–24.3
11	Fort Wainwright, AK	20.6	29	Schofield Barracks, HI	–26.7
12	Fort Riley, KS	19.0	30	Fort Gordon, GA	–34.9
13	Fort Carson, CO	15.7	31	Fort Bliss, TX	–37.7
14	Walter Reed, MD	15.4	32	Fort Lee, VA	–42.8
15	Fort Hood, TX	13.2	33	Fort Irwin, CA	–43.1
16	Fort Eustis, VA	12.5	34	Hunter Army Airfield, GA	–43.8
17	Fort Lewis, WA	11.2	35	Fort Story, VA	–55.8
18	Fort Huachuca, AZ	8.5	36	Fort McPherson, GA	–119.3

Compared with the hypothetical gold-standard military neighborhood scoring the highest on all 22 indicators and all six domains, the West Point military neighborhood, at the top of the MNRI list, is ranked roughly only 58 percent as highly. This suggests that, even at the top, no neighborhood is ideal and there is room for improvement. In contrast, though, Fort McPherson's neighborhood is quite disadvantaged compared with that same gold-standard military neighborhood. Further, given the large gap between the 35th- and 36th-ranked military neighborhoods (–119.3 versus –55.8), Fort McPherson is also quite disadvantaged compared with all the other Army neighborhoods.[23]

No obvious geographic commonalities appear that would easily explain which Army neighborhoods rose to the top of the ranking index and which fell behind. Notice that neither the top five nor the bottom five military neighborhoods are clustered in any specific geographic region. In fact, one state, Virginia, is home to a top-five military neighborhood (Fort Belvoir) and two bottom-five military neighborhoods (Fort Lee and

[23] Fort McPherson was closed in September 2011 as recommended by the 2005 BRAC Commission.

Fort Story). Fort Belvoir, ranked fourth on the MNRI, is located in Fairfax, Virginia, not far from the Pentagon in Arlington, Virginia, or Washington, D.C. Some 100 miles south is the 32nd-ranked Fort Lee neighborhood, located just south of Virginia's capital of Richmond. Fort Story is farther southeast, located on the Atlantic coast in Virginia Beach, near Norfolk's naval facilities. In a corridor of roughly 200 miles, we find both the best and the worst in terms of Army neighborhoods. Hunter Army Airfield, ranked 34th, is less than an hour's drive from Fort Stewart, which ranked 20th. Nor does the distribution of Army neighborhoods appear to be associated with how remote or how close they are located to large U.S. cities.

Similarly, neither the top nor the bottom five Army neighborhoods reflect a single type of installation. The top five military neighborhoods contain two professional schools (West Point's U.S. Military Academy and Fort Leavenworth's Command and General Staff College), two command-and-control installations (Fort Meade and Fort Belvoir near the Pentagon and Washington, D.C.), and a major training school location (Fort Leonard Wood). The bottom five military neighborhoods contain two maneuver installations (Hunter Army Airfield and Fort Story), one major training area (Fort Irwin, California, home to the National Training Center), one training school location (Fort Lee), and one command-and-control installation (Fort McPherson).

Finally, the top and bottom five military neighborhoods are not clustered by the size of the installation, as measured by the number of full-time military assigned to each installation. The smallest of the 36 installations that met our inclusion criteria were West Point and Fort Story. West Point had approximately 1,400 full-time military personnel in FY 2003, and Fort Story had just over 1,000. However, West Point's neighborhood ranked as the top military neighborhood, and Fort Story was at the bottom of the list, ranked 35th. In general, the top and bottom five military neighborhoods included moderately sized installations falling in the 1,000- to 5,000-person range. The larger posts, such Fort Hood (15) and Fort Bragg (26), both with more than 35,000 full-time personnel (as of FY 2003), fell mostly in the middle of the MNRI.

Multilevel Modeling

In the multilevel modeling, two of the outcomes that we examine are dichotomous (attrition and separation). For these outcomes, we present the results in the form of an odds ratio (OR). Values greater than 1 indicate a higher probability of experiencing the outcome than either the comparison group (e.g., men versus women) or an individual with more of the variable in question (e.g., years of education), and values less than 1 indicate a lower probability of experiencing the outcome. BMI is a continuous variable,

and we present the linear association (i.e., a one-unit increase in the MNRI is associated with an increase of one coefficient unit for BMI).

There are seven total neighborhood predictors (or main independent variables) in our analysis: the overall MNRI and the six individual domains (household composition, social, employment, income and poverty, transportation, and housing). The analysis consisted of multilevel regression models for each predictor and each outcome pairing. Two models were run for each predictor/outcome pairing. The first model, referred to as the basic model, was estimated without incorporating any covariates. The second model was run incorporating a set of covariates (see Table 4.10), in order to control for additional factors that may be associated with outcomes and that may also differ in their levels across neighborhoods. This is referred to as the full model. All models were run separately for Army enlisted personnel and officers.

Table 4.10
Covariates for Full Models, Army

Variable	Enlisted	Officers
Married (%)	71	76
Spouse in Army (%)	7	NA
Male (%)	87	84
Age (years)	31.4 (SD = 6.6; range = 20 to 58)	35.5 (SD = 7.3; range = 19 to 64)
Black[a] (%)	31	13
Hispanic[a] (%)	9	5
Asian[a] (%)	3	4
Native American[a] (%)	<1	<1
Unknown[a] (%)	3	2
College degree or more (%)	22	97[b]
AFQT percentile	56.9 (SD = 19; range = 0 to 99)	NA
Number of dependent adults	0.63, (SD = 19; range = 0 to 6)[c]	0.74 (SD = 0.60; range = 0 to 6)[d]
Number of dependent children	1.1 (SD = 1.3; range = 0 to 17)[e]	1.2 (SD = 1.3; range 0 to 6)[f]
Previous OCONUS assignment (%)	50	76
Years of service[g]	10.9 (SD = 6; range = 4 to 30)	12.0 (SD = 6.8; range = 4 to 30)
Time in grade (years)	2.5 (SD = 2.4; range = 0 to 15)[h]	2.5 (SD = 2.3; range = 0 to 15)
MOS/AOC: combat support[i] (%)	19	17
MOS/AOC: combat service support (%)	44	44

Variable	Enlisted	Officers
MOS/AOC: other (%)	11	39
Second lieutenant[j] (%)	NA	4
First lieutenant[j] (%)	NA	9
Captain[j] (%)	NA	45
Lieutenant colonel[j] (%)	NA	24

NOTE: NA = not applicable. SD = standard deviation. OCONUS = outside CONUS. MOS = military occupational specialty. AOC = area of concentration.
[a] White is the reference group.
[b] It is not clear why not all officers in the sample have a college degree. Data-entry error may be one reason.
[c] The majority of the sample (54 percent) had one dependent adult living in their households; 42 percent had no dependent adults.
[d] Sixty-six percent of the sample had one dependent adult in the household; 30 percent had no dependent adults.
[e] Forty-five percent of the sample reported no children. Among those with children, slightly more (20.5 percent) had two dependents than had one (19.5 percent). Five percent of the entire sample had more than three dependent children. Only one of the 163,000 cases in the sample reported 17 children. The next-highest number of children was ten, reported by three individuals.
[f] Forty-three percent of the sample had no children. Among those with children, 18 percent had one child, and 23 percent had two children.
[g] We imposed a restriction of serving at least four years to be included in the analysis.
[h] We do not include a separate variable for pay grade. Years in grade and time in grade should provide a reasonable estimate of current pay grade, although it may underestimate individuals who are promoted above the zone. Inasmuch as these individuals may be more likely to leave service (or to be forced out because of up-and-out policies), the omission of pay grade from our models may result in upwardly biased estimates of the neighborhood–outcome association.
[i] Combat arms is the reference group.
[j] Colonel is the reference group. Flag and warrant officers are not included.

Enlisted Results

We now present the results from the analysis of the available enlisted Soldier BMI and retention outcomes. This analysis consisted of multilevel models linking attrition, completion of service, and BMI to a Soldier's Army base neighborhood quality using the six MNRI domains, as well as the overall MNRI. We should qualify here that, in this exploratory project, we matched Soldiers to the Army neighborhood that corresponded with the installation to which they were assigned, although they may have actually lived farther away from the post. At the conclusion of this report, in Chapter Six, we address our recommendations for a full-scale study with contemporary data.

When we examined the outcome measures by installation, we noticed two anomalous results (see Table A.2 in Appendix A). First, the attrition rate at Fort Story, 6.2 percent, was unusually high compared with those at the other installations. Second, the Fort Rucker separation rate, at 27.6 percent, is unusually high. For the purposes of the multilevel model analysis, Fort Rucker was excluded from all models of separation and Fort Story was removed from all models of attrition to avoid skewing the results.

Basic Model

Table 4.11 shows the results for the basic model (versus the full model) by outcome. For each outcome, we show the direction of the association with the MNRI (+ or –), whether the association was statistically significant at the $p < 0.05$ level (yes or no), and, if significant, the size of the OR or coefficient (depending on whether the outcome is dichotomous or not). Actual coefficients are presented in Table A.3 in Appendix A.

Table 4.11
Results from the Basic Model, Army Enlisted

Outcome	Direction	Significant	OR
Attrition	—	No	NA
Separation	+	Yes	1.33
BMI[a]	+	Yes	0.43

[a] BMI is a linear coefficient rather than an OR.

The parameter estimate for attrition is negative, although this is not statistically significant. The association between the MNRI and leaving the Army following term completion is positive and significant, with an OR of 1.33, indicating that the probability of enlisted Soldiers not reenlisting in the Army is higher at installations with higher MNRI scores. Because some of the indicators are economic, that result could reflect better job opportunities in those communities. Alternatively, Soldiers might prefer to remain in those higher-quality neighborhoods and thus choose not to reenlist to avoid a potential relocation. We should note that reenlistment is not always a Soldier's option (i.e., not all Soldiers are eligible to reenlist), depending on their health, job performance, general behavior, and other eligibility factors (see Hansen and Wenger, 2003). BMI has a positive and statistically significant parameter estimate, indicating that installations with higher neighborhood scores have Soldiers with higher BMIs.

Full Model

We added covariates to the models for separation and BMI to assess whether differences in those covariates across Army neighborhoods could account for the

significant associations we observed in the basic models.[24] Covariates used for this model are presented in Table 4.11.[25]

When the covariates were added to the model for separation, the coefficient for the MNRI was no longer statistically significant, although it remained positive. Similarly, for BMI, the introduction of the covariates caused the coefficient for the MNRI to become insignificant, although it, too, remained positive.[26] These results suggest that differences in the covariates by base neighborhood fully accounted for the significant associations we observed between separation and BMI and the overall MNRI in the basic models.

Predicting Outcomes Using Domains from the Military Neighborhood Ranking Index

We turn now to examine the independent associations between our outcomes of interest and each of the six domains that comprise the MNRI: household composition, social, employment, income and poverty, transportation, and housing. For each domain, we ran two models. The first, the basic model, examines the neighborhood association between the outcomes and each domain. The second, the full model, examines the neighborhood association between the outcomes and each domain but also includes the covariates described above.

Our results showed that only in one instance was the association between a domain and an outcome statistically significant, and this occurred for the housing domain and BMI (see Table A.4 in Appendix A for the parameter estimates). Enlisted Soldiers assigned to installations whose neighborhoods have higher, more desirable scores on the housing domain have higher BMIs than those assigned to installations whose neighborhoods have lower housing domain scores. It is not clear why this association is statistically significant. The housing domain may be capturing the SES of neighborhoods; however, if that were the case, then we would expect the opposite association: Higher-ranking neighborhoods on the housing domain (i.e., those higher in SES) should be associated with lower (and healthier), not higher, BMIs. We should also note that the magnitude of the coefficient is quite small, meaning that, for each shift of one point in the housing index score, BMI is increased by 0.08 units.

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[24] We also estimated the full model for attrition (see Table A.4 in Appendix A). The coefficient for the MNRI remained insignificant.

[25] The analytic sample varies across models because of the exclusion of certain installations and individuals for particular outcomes (e.g., separation at Fort Rucker is not estimated; attrition is not estimated for Fort Story).

[26] We do note that the coefficient is marginally significant at $p < 0.07$.

The housing domain is comprised of four indicators: percentage paying 35 percent or more of income for rent, percentage paying 35 percent or more of income for owner costs, the number of vacant housing units, and the percentage of renter-occupied versus homeowner-occupied units. If positive scores on these indicators are viewed as a measure of neighborhood affluence that is not being addressed by the income and poverty domain (i.e., few people spend large portions of their income on housing, there are few vacant homes, and more individuals have a mortgage or own their own homes), then these results suggest that affluence might be associated with higher BMI. The research literature typically demonstrates, however, that SES and BMI are *negatively* correlated (Wang and Beydoun, 2007). That is, wealthy, more educated individuals with higher incomes typically have lower weight and body fat levels. They are also more likely to live in safe neighborhoods where there is less risk to exercising outdoors and where there are more leisure and recreation activities, which also leads to lower BMI (Papas et al., 2007). Our finding is in opposition to this research. Unfortunately, our data do not include any measures of eating or exercise habits that might allow us to disentangle why we found a positive association between the housing domain and BMI. However, it is important to keep in mind that individuals in the Army must meet certain physical fitness and BMI standards and that the range of BMI scores in our data is very small (officers: mean = 25.3, SD = 2.6; enlisted: mean = 24.6, SD = 3.6). The mean BMI for American adults in the 1999–2002 time frame was 28 (Ogden et al., 2004, p. 2).

Officer Results

The procedure for the enlisted personnel multilevel modeling was also followed for the modeling for Army officers. Neighborhoods with extreme MNRI scores were adjusted, as noted previously. Fort Myer was removed from any analyses involving separation because it appeared to be anomalous on that dimension—65 percent of officers at Fort Myer separated from active duty at the end of their service requirement, which was unusually high (see Table A.8 in Appendix A).

Basic Model

As with the enlisted sample, we first estimated the basic model (without covariates) and then the full model, with covariates. Table 4.11 shows the results for the basic model by outcome (see also Table A.9 in Appendix A). For each outcome, we show the direction of the association with the MNRI (+ or –), whether the association was statistically significant at the $p < 0.05$ level (yes or no), and, if significant, the size of the OR or coefficient (depending on whether the outcome is dichotomous or not). As shown in Table 4.12, none of the parameter estimates was statistically significant. When we

explored the full models, with all covariates, the parameter estimates for the MNRI remained insignificant (see Tables A.10, A.11, and A.12 in Appendix A).

Table 4.12
Results from the Basic Model, Army Officers

Outcome	Direction	Significant	OR
Attrition	–	No	NA
Separation	+	No	NA
BMI[a]	–	No	NA

[a] BMI is a linear coefficient rather than an OR.

Predicting Outcomes Using Domains from the Military Neighborhood Ranking Index

When we examined the domains, we found only one statistically significant relationship. The parameter estimate for separation suggests that, in military neighborhoods that fare better on the income and poverty domain, there is a higher probability of officers leaving the service at the end of their term of commitment (see Table A.13 in Appendix A). One might conclude that this is a result of greater temptation to leave where job opportunities are more plentiful and compensation is more competitive. However, when the covariates are added to the model, the parameter estimate shrinks dramatically and is no longer statistically significant, meaning that the measurable impact of the domain disappears when the demographic characteristics of the officers are taken into account.

Summary

The social indicator analysis of 36 active-duty Army bases revealed that one cannot infer neighborhood quality from an installation's population size, geographic location, or primary mission.[27] The six domains measured overlapping but distinct characteristics, and the housing domain was particularly highly correlated with the overall MNRI. The domain rankings may be especially useful in identifying some of the community challenges beyond the Army's control that Soldiers and their families face and in

[27] In fact, a regression using installation population size, region, and primary mission to predict MNRI scores did not yield significant results. That is, these three variables did not predict a base neighborhood's scores. However, given that there are only 36 bases in our sample, these results should be interpreted with caution.

tailoring programs to target the potential impact of those challenges or provide resources to compensate for the lack of local support.

The multilevel modeling analysis of the data from the Army revealed few statistically significant neighborhood effects on attrition, separation, or BMI as recorded in the personnel database. For enlisted Soldiers, we found a significant association between the MNRI and separation, such that military neighborhoods with higher MNRI scores were associated with higher likelihood of separation and higher BMI scores. Once we controlled for other covariates, these associations were no longer significant. When we looked at individual domains, one statistically significant relationship emerged. We found that higher scores on the housing domain in military neighborhoods were associated with a higher BMI among the enlisted, a finding that was upheld when we adjusted for covariates, such as marital status and age.

Among officers, none of the associations between the MNRI and the available outcome data was significant. In examining the individual domains, we found that higher scores in the income and poverty domain were associated with higher probability of separation for officers but that these results were not upheld when we adjusted for covariates.

In sum, we found little evidence that military neighborhoods had a significant impact on the BMI or retention of Soldiers. However, a few limitations of our analysis are worth nothing. First, the personnel database that we used contained only one health outcome, and we cannot be sure that it was, in fact, a recent measure of BMI. Second, we did not include in our models controls for neighborhood exposure. That is, we were unable to account for how long an individual had lived on or near a particular base. Third, we were unable to assess why an individual left active-duty service. It is possible that, if we had information that would allow us to distinguish choice from medical discharges or termination of service due to disciplinary reasons, more significant associations may have emerged. Finally, we had very broadly defined neighborhoods using ZIP Codes. Although this allowed us to use Census data to describe and rank military neighborhoods, we did not assess where individual Soldiers actually live or how they might define their own installation neighborhood. Nor were we able to assess some neighborhood characteristics that might also be relevant to the outcomes in the analysis (e.g., crime rates, school quality, availability of hospitals or physicians). We discuss these data limitations, as well as what the "ideal" type of data for this type of analysis might be, in Chapter Six. First, though, we present our analysis of AFB neighborhoods, for which we had some more-extensive data available for the multilevel modeling.

Chapter Five. Case Study 2: U.S. Air Force Bases

This chapter presents results from our case study using data from the Air Force.

We had access to a different type of data for the Air Force case study than we did for the Army. Although we used personnel data files for the Army, with the Air Force, we used self-reported demographics, attitudes, and assessments from a survey of Air Force personnel. These data provide information, at the individual level, that more closely aligns with the neighborhood studies research literature because they include more health-related outcomes.

The survey data also allow us to address the issue of exposure that we discussed in Chapter Two. Specifically, the Air Force Community Assessment Survey asks Airmen whether they live on or off base. At best, this is a proxy for the amount of time an Airman (and his or her family) may spend in the communities outside the base itself. That is, we assume that Airmen who live *and* work on base are less exposed to external base neighborhood characteristics than Airmen who work on base but live elsewhere. Thus, we expect that the association between the MNRI (and its domains) and our outcomes will be stronger for Airmen who live off, rather than on, base because of that broader level of exposure. We acknowledge that the on-base/off-base distinction is a rather weak measure of exposure. However, in this exploratory study, in the absence of any other measure of exposure in the existing data (i.e., how far the Airman lives from the base, how much time he or she spends off base in leisure activities, or how many services he or she utilizes that are located off base), we used the best available measure.

The analysis of Air Force data proceeds in several steps. First, we present data on the 62 AFBs used to create the Air Force military neighborhoods. Second, we use Census data to rank those Air Force neighborhoods across the six domains, as well as on the overall MNRI. Third, we discuss a select group of military neighborhoods in order to highlight how the MNRI works. Fourth, we use multilevel modeling to explore associations among the six domains and the overall MNRI to nine Airman outcomes: satisfaction with housing, community satisfaction, neighborhood cohesion, perceived safety of the community, financial difficulties, depressive symptoms, self-rated health, satisfaction with life, and intentions to remain in the Air Force (among enlisted only).

Air Force Base Neighborhoods

Table 5.1 provides a list of Air Force installations, the state in which each is located, the Air Force major command (MAJCOM) under which each is organized or its status as

a direct reporting unit (DRU), and each base's full-time Air Force military population size as of 2003.[28] This list is organized from largest to smallest in terms of base population. Population size information helped us to ensure that the sample of individual Airmen was large enough to support the requirements of multilevel modeling. Later in this section, we also consider whether the top- and bottom-ranked neighborhoods tend to reflect any particular patterns with regard to state, primary mission of the installation, and full-time population size.

Table 5.1
List of Air Force Installations, with Major Command, Direct Reporting Unit Classification, and Full-Time Air Force Personnel Population Size, as of Fiscal Year 2003

Installation	MAJCOM/DRU	Full-Time Air Force Population Size
Keesler AFB, MS	AETC	10,205
Lackland AFB, TX	AETC	8,532
Langley AFB, VA	ACC	8,275
Offutt AFB, NE	ACC	8,241
Davis-Monthan AFB, AZ	ACC	8,235
Scott AFB, IL	AMC	7,500
Eglin AFB, FL	AFMC	7,445
Tinker AFB, OK	AFMC	7,300
Hurlburt Field, FL	AFSOC	7,191
Barksdale AFB, LA	ACC	6,895
Travis AFB, CA	AMC	6,807
Elmendorf AFB, AK	PACAF	6,752
Nellis AFB, NV	ACC	6,500
Wright-Patterson AFB, OH	AFMC	6,000
Andrews AFB, MD	AMC	5,855
MacDill AFB, FL	AMC	5,810
Shaw AFB, SC	ACC	5,800
Dover AFB, DE	AMC	5,671
Hill AFB, UT	AFMC	5,634
Luke AFB, AZ	AETC	5,600
Kirtland AFB, NM	AFMC	5,468

[28] The Air Force base classification system does not use the same designations as the Army. Also note that, although one MAJCOM may have primary responsibility for a base, other MAJCOMs may have tenant units on the same base. Also note that we rely on individual Airman data from 2003 because the most-recent Census data available to us were collected in 2000.

Installation	MAJCOM/DRU	Full-Time Air Force Population Size
Robins AFB, GA	AFMC	5,272
Randolph AFB, TX	AETC	5,010
Pope AFB, NC	AMC	4,844
McGuire AFB, NJ	AMC	4,750
Fairchild AFB, WA	AMC	4,675
Little Rock AFB, AR	AETC	4,670
Moody AFB, GA	ACC	4,648
Dyess AFB, TX	ACC	4,622
Hickam AFB, HI	PACAF	4,592
Charleston AFB, SC	AMC	4,500
Minot AFB, ND	ACC	4,482
Seymour Johnson AFB, NC	ACC	4,400
Maxwell AFB, AL	AETC	4,247
Mountain Home AFB, ID	ACC	4,200
Tyndall AFB, FL	AETC	4,191
Sheppard AFB, TX	AETC	3,864
Buckley AFB, CO	AFSPC	3,800
Holloman AFB, NM	ACC	3,781
Vandenberg AFB, CA	AFSPC	3,631
Malmstrom AFB, MT	AFSPC	3,577
McChord AFB, WA	AMC	3,507
F. E. Warren AFB, WY	AFSPC	3,500
Edwards AFB, CA	AFMC	3,450
Cannon AFB, NM	ACC	3,205
Peterson AFB, CO	AFSPC	3,175
Whiteman AFB, MO	ACC	3,149
Beale AFB, CA	ACC	3,047
Ellsworth AFB, SD	ACC	2,995
Grand Forks AFB, ND	AMC	2,737
Eielson AFB, AR	PACAF	2,713
McConnell AFB, KS	AMC	2,615
Patrick AFB, FL	AFSPC	2,500
U.S. Air Force Academy, CO	DRU	2,369
Schriever AFB, CO	AFSPC	2,075
Altus AFB, OK	AETC	2,030
Brooks AFB, TX	AFMC	1,943
Los Angeles AFB, CA	AFMC	1,535

Installation	MAJCOM/DRU	Full-Time Air Force Population Size
Bolling AFB, DC	DRU	1,480
Goodfellow AFB, TX	AETC	1,432
Hanscom AFB, MA	AFMC	1,413
Laughlin AFB, TX	AETC	1,367

SOURCE: U.S. Air Force, 2010.
NOTE: AETC = Air Education and Training Command. ACC = Air Combat Command. AFMC = Air Force Materiel Command. AFSOC = Air Force Special Operations Command. AMC = Air Mobility Command. PACAF = Pacific Air Forces. AFSPC = Air Force Space Command.

Results from Air Force Military Neighborhood Ranking Index

Domain Scores

We first present highlights from the domain-specific scores for the 62 AFBs included in our study, then discuss the overall MNRI rankings. As with the Army, we present only the top and bottom five military neighborhoods for each domain. Domain scores can range from 100 for the base scoring highest on all indicators to negative values. In general, the same Air Force neighborhoods appear consistently in the top five across domains, as are several neighborhoods consistently in the bottom five. Tables 5.2 through 5.7 present the results by domain.

The results for the household composition domain are presented in Table 5.2. The Patrick AFB neighborhood in Florida was ranked the highest, with a domain score of 80.4. Because the value on the indicator score is less than 100, Patrick AFB is not ranked the highest on both of the two indicators that comprise the household composition domain (percentage of households headed by females and average household size). According to the indicator score, Patrick AFB is doing 80.4 percent as well as the ideal best score on both of the indicators in the household composition domain. As with the Army, the neighborhood that is home to the Air Force's military academy ranks highly on several domains, including this one. In contrast, Bolling AFB, located in Washington, D.C., is ranked lowest, with a household composition domain score of –198.2.

Table 5.2
Domain-Specific Results: Household Composition Domain, Air Force

Top Five Air Force Neighborhoods		Bottom Five Air Force Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Patrick AFB, FL	80.4	58. Brooks AFB, TX	–21.3
2. U.S. Air Force Academy, CO	79.4	59. Lackland AFB, TX	–49.6
3. Schriever AFB, CO	78.0	60. Maxwell AFB, AL	–53.1
4. Hanscom AFB, MA	76.0	61. Andrews AFB, MD	–55.8
5. Fairchild AFB, WA	75.7	62. Bolling AFB, DC	–198.2

NOTE: The household composition domain contains two indicators: percentage of households headed by females and average household size.

Table 5.3 presents the results for the employment domain. Whiteman AFB in Missouri ranks the highest, with an indicator score of 97.4. As with the previous domain, the neighborhoods of Hanscom AFB in Massachusetts and the U.S. Air Force Academy in Colorado are included in the top five. Once again, Bolling AFB is by far the lowest-ranked military neighborhood, with an index score of –186.3. Further investigation of the results showed that the unemployment rate within the Bolling AFB military neighborhood was more than five times as high as in the best neighborhood on that indicator (10.3 percent versus 1.6 percent in the Whiteman neighborhood). Bolling's neighborhood appears at the bottom of other domains as well. Unlike the Army's worst-performing neighborhood, the 2005 BRAC did not require the closure of this base; instead, it required a merger with a nearby Navy installation to form Joint Base Anacostia-Bolling. Whether and how the consolidation of bases affects the military neighborhood is a question for future research.

Table 5.3
Domain-Specific Results: Employment Domain, Air Force

Top Five Air Force Neighborhoods		Bottom Five Air Force Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Whiteman AFB, MO	97.4	58. Elmendorf AFB, AK	–23.4
2. Hanscom AFB, MA	87.5	59. Laughlin AFB, TX	–45.8
3. McGuire AFB, NJ	84.3	60. Nellis AFB, NV	–46.8
4. U.S. Air Force Academy, CO	76.3	61. Edwards AFB, CA	–71.8
5. Langley AFB, VA	73.7	62. Bolling AFB, DC	–186.3

NOTE: The employment domain contains two indicators: percentage in the labor force (over age 16) and percentage in the labor force who are unemployed (over age 16).

Table 5.4 presents the results for the transportation domain. Minot's neighborhood in North Dakota, with a domain score of 68.3, is the highest-ranked neighborhood, while Schriever's neighborhood, located in Colorado, scored the lowest at 3.7. Individuals in Minot's rural neighborhood have the lowest average travel time to work of all the 62 military neighborhoods (the average for Minot is 12 minutes). Further, 94 percent of individuals in the Minot neighborhood said they had access to one or more vehicles, which is close to the highest-ranking neighborhood on this indicator. Taken together, these two indicators account for Minot's high ranking on this domain and overshadow the indicator on using public transportation to get to work. In contrast, the mean drive time to work for Schriever's neighborhood is more than three times as high as Minot's, at 38 minutes. Despite the fact that 97 percent of individuals report having access to an automobile, the mean driving time to work pulls Schriever's overall transportation domain score down. The highest-ranking Air Force neighborhoods in the transportation domain appear to be in low-population areas: North Dakota, Montana, South Dakota, and Missouri. On this domain, none of the lowest-ranking neighborhoods sinks to a negative score.

Table 5.4
Domain-Specific Results: Transportation Domain, Air Force

Top Five Air Force Neighborhoods		Bottom Five Air Force Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Minot AFB, ND	68.3	58. Luke AFB, AZ	25.9
2. Malmstrom AFB, MT	63.6	59. Travis AFB, CA	21.6
3. Grand Forks AFB, ND	62.3	60. Edwards AFB, CA	17.3
4. Ellsworth AFB, SD	61.9	61. Andrews AFB, MD	8.6
5. Whiteman AFB, MO	61.7	62. Schriever AFB, CO	3.7

NOTE: The transportation domain contains three indicators: mean travel time to work (in minutes), percentage who take public transportation to work, and percentage with access to one or more vehicles.

Table 5.5 presents the results for the social domain. The Air Force Academy receives the highest domain score. Compared with a hypothetical neighborhood that scored the highest on all six indicators in the social domain, the Air Force Academy military neighborhood is doing 84 percent as well. Nellis AFB is the worst-performing military neighborhood, with a score of –245.6, meaning that its performance on the social domain indicators is more than twice as poor as the hypothetical best neighborhood on this domain. In fact, all the bottom five neighborhoods have large negative scores on the social domain. In general, disability rates are higher and neighborhood turnover is greater in these areas, accounting for some of the low scores. However, the indicator that drives

most of the large negative values is the percentage of inhabitants of the Air Force neighborhood with less than a high school degree or equivalency. For example, among individuals in the Air Force Academy military neighborhood, roughly 2 percent have less than a high school degree or equivalency, whereas, in the Nellis neighborhood near Las Vegas, 40 percent of the population does. Three of the other four lowest-ranking Air Force neighborhoods are located in Texas, and the fifth belongs to Bolling AFB.

Table 5.5
Domain-Specific Results: Social Domain, Air Force

Top Five Air Force Neighborhoods		Bottom Five Air Force Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. U.S. Air Force Academy, CO	84.0	58. Bolling AFB, DC	–174.8
2. Hanscom AFB, MA	59.1	59. Brooks AFB, TX	–175.9
3. Patrick AFB, FL	40.8	60. Lackland AFB, TX	–207.5
4. Grand Forks AFB, ND	39.9	61. Laughlin AFB, TX	–228.1
5. Eielson AFB, AK	28.8	62. Nellis AFB, NV	–245.6

NOTE: The social domain contains six indicators: percentage with less than a high school degree or equivalency, percentage with a bachelor's degree or higher, percentage currently married, percentage with a disability (ages 16 to 64), percentage with a disability (age 65 and over), and percentage residing in the same house since 1995.

Table 5.6 presents the results for the income and poverty domain. Langley AFB, located in Virginia, had the highest-ranked military neighborhood, with a domain score of 32.6. Notice that, in this domain, even the best neighborhood performed only 33 percent as well as a hypothetical gold-standard neighborhood, which is well below the best Air Force neighborhood scores on the other domains. Bolling AFB had the lowest-ranked neighborhood, with a score of –278.2. In fact, all the bottom five neighborhoods on the income and poverty domain have scores well below 0. The poor performance on this domain, even among the highest-ranked military neighborhoods, suggests that financial issues may be problematic for all military personnel and their families, but especially problematic for families assigned to installations where the surrounding neighborhoods are also disadvantaged. High rates of family poverty (i.e., the percentage of families with children under age 18 in poverty and the percentage of female-headed households with children under age 18 in poverty) is the main driver of trends in the income and poverty domain.

Table 5.6
Domain-Specific Results: Income and Poverty Domain, Air Force

Top Five Air Force Neighborhoods		Bottom Five Air Force Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Langley AFB, VA	32.6	58. Cannon AFB, NM	–178.3
2. U.S. Air Force Academy, CO	32.1	59. Edwards AFB, CA	–199.5
3. McGuire AFB, NJ	23.9	60. Maxwell AFB, AL	–200.8
4. Patrick AFB, FL	18.9	61. Laughlin AFB, TX	–212.5
5. Andrews AFB, MD	11.6	62. Bolling AFB, DC	–278.2

NOTE: The income and poverty domain contains five indicators: median household income (in dollars), mean public assistance (in dollars), median family income (in dollars), percentage of families with children under age 18 in poverty, and percentage of female-headed households with children under age 18 in poverty.

Table 5.7 presents the results for the housing domain. No Air Force neighborhood received a positive score in this domain. Whiteman AFB scored the highest, with a –10.3. Even the best military neighborhood in this domain performed at least twice as poorly as the hypothetical gold standard. The lowest-ranked military neighborhood, Bolling AFB, has a domain score of –522.4. The wide distribution of only negative values suggests that a different military neighborhood was the "best" on each of the four indicators in the housing domain. Indeed, this turned out to be the case: The Grand Forks neighborhood had the lowest percentage of people spending more than 35 percent of their income on rent (6.8 percent), the Whiteman neighborhood had the lowest percentage of people spending more than 35 percent of their income on homeownership costs (5.2 percent), the Schriever neighborhood had the lowest percentage of renter-occupied rather than owner-occupied housing units (13.1 percent), and the Hanscom neighborhood had the fewest vacant housing units (164 units).[29]

Closer inspection of the indicators in the housing domain revealed a wide spread across the range of indicator values. For example, although 6.8 percent of individuals in the Grand Forks neighborhood in North Dakota spend 35 percent or more of their income on rent, 37.3 percent of individuals in the Edwards military neighborhood did so. This five-fold difference from lowest (i.e., "best") to highest (i.e., "worst") scores is one reason for the negative domain scores. We found a similar discrepancy between best and worst military neighborhoods for the percentage of individuals who spent 35 percent or more of their income on homeownership costs (5.2 percent at Whiteman versus

[29] Remember that the vacant-housing-unit indicator is a weighted average of all ZIP/ZCTAs in a military neighborhood.

75.5 percent at Grand Forks[30]) and the percentage of housing occupied by renters (13.1 percent at Schriever versus 81.2 percent at Grand Forks). By far, the largest discrepancy occurred on the indicator that captures the number of vacant housing units. The Hanscom military neighborhood had the fewest vacant housing units, with roughly 164. In contrast, 2,465 housing units were vacant in the Bolling military neighborhood. This difference is fifteen-fold and is the main reason that the housing domain scores are so low across all military neighborhoods.

Table 5.7
Domain-Specific Results: Housing Domain, Air Force

Top Five Air Force Neighborhoods		Bottom Five Air Force Neighborhoods	
Neighborhood	**Score**	**Neighborhood**	**Score**
1. Whiteman AFB, CO	–10.3	58. Davis-Monthan AFB, AZ	–341.5
2. McGuire AFB, NJ	–44.8	59. Nellis AFB, NV	–341.7
3. Eielson AFB, AK	–45.8	60. Grand Forks AFB, ND	–370.6
4. Shaw AFB, SC	–48.9	61. Holloman AFB, NM	–372.4
5. Randolph AFB, TX	–51.8	62. Bolling AFB, DC	–522.4

NOTE: The housing domain contains four indicators: percentage spending 35 percent or more of income on rent, percentage spending 35 percent or more of income on owner costs, percentage of units that are renter-occupied, and number of vacant housing units.

Overall, the Air Force neighborhood rankings show a wide range of diversity across bases, with certain bases appearing in the top five or bottom five on more than one domain. AFB neighborhoods scored worst on the housing domain, suggesting that housing costs may play a role in the economic challenges that Air Force families face. Relative to other domains, Air Force neighborhoods scored best on the transportation domains, which is one QOL aspect that may be a positive benefit of the remoteness of many AFBs that are homes to flying units.

Correlation Between Domains and the Overall Military Neighborhood Ranking Index

Before turning to the overall MNRI, it is important to get a sense of how the individual domains relate to each other. To do so, we present bivariate correlations between the six individual domains. These correlations range from –1 to 1. A correlation

[30] Apparently, renters and homeowners in the Grand Forks AFB neighborhood are very different. According to the Census data, only 6.8 percent of renters spend 35 percent or more of their income on rent, compared with 75.5 percent of homeowners spending that much of their income on owner costs.

of 0 indicates no linear association between two variables, a positive correlation suggests that higher (or lower) values on one domain are associated with higher (or lower) values on another domain, and a negative correlation suggests that values on one domain are associated with values in the opposite direction on another domain. A perfect correlation of 1, either positive or negative, would indicate that there is a one-to-one correspondence on domain scores.

Table 5.8 shows these relationships in tabular form.[31] The majority of these relationships are positive, with a mean correlation coefficient of 0.42. Although some are highly correlated (e.g., the social domain and the income and poverty domain), the majority of correlations are moderate. The transportation domain stands out as being less correlated with the other measures, which parallels the low level of correlation found in the Army data.

The overall alpha excluding the MNRI itself is 0.80, suggesting that the measures are assessing similar constructs, with some degree of overlap. However, because the alpha is not a 1.0 (indicating perfect overlap), there is some degree of differentiation in what the six domains measure. That is, although the MNRI is tapping into some underlying latent construct that could be called *neighborhood quality*, it is measuring different aspects of that quality.

Table 5.8
Correlations Between Neighborhood Domains and the Overall Military Neighborhood Ranking Index, Air Force

Domain or Index	1	2	3	4	5	6
1. MNRI						
2. Household composition domain	0.70					
3. Social domain	0.87	0.71				
4. Employment domain	0.80	0.56	0.66			
5. Income and poverty domain	0.89	0.56	0.79	0.73		
6. Transportation domain	0.02	0.23	0.05	0.10	–0.18	
7. Housing domain	0.80	0.39	0.51	0.57	0.61	–0.01

[31] Table B.1 in Appendix B presents the raw data used to create the correlation matrix. Several of the domains have an obvious outlier, which, in every case, was Bolling AFB located in Washington, D.C. As with the Army data, outliers are adjusted by reassigning domain values to 10 less than the next-lowest domain score, to avoid skewing the data downward.

Overall Military Neighborhood Ranking Index

We turn now to the Air Force results from the overall MNRI, which equally weights the six domains reviewed above. Table 5.9 shows the full ranking for the 62 Air Force neighborhoods included in our analysis, with the top half shown in white and the bottom in gray. Our discussion of the results, however, is limited to the top five and bottom five Air Force military neighborhoods as ranked by the MNRI. Domain scores for each base are reported in Table B.1 in Appendix B.

The U.S. Air Force Academy has the highest MNRI score, at 42.3, and is followed by Whiteman AFB in Missouri (36.6), Hanscom AFB in Massachusetts (33.5), McGuire AFB in New Jersey (22.6), and Eielson AFB in Alaska (18.3). The lowest-ranked neighborhood belongs to Bolling AFB, with a MNRI score of –219.3. In ascending order, the rest of the bottom five neighborhoods are Nellis AFB in Nevada (–125.2), Edwards AFB in California (–116.5), Laughlin AFB in Texas (–114.7), and Maxwell AFB in Alabama (–95.9).

Table 5.9
Overall Military Neighborhood Ranking Index Scores, Air Force

Rank	Neighborhood	Score	Rank	Neighborhood	Score
1	U.S. Air Force Academy, CO	42.3	32	Tinker AFB, OK	–26.9
2	Whiteman AFB, MO	36.6	33	Buckley AFB, CO	–27.8
3	Hanscom AFB, MA	33.5	34	Ellsworth AFB, SD	–30.6
4	McGuire AFB, NJ	22.6	35	Malmstrom AFB, MT	–30.6
5	Eielson AFB, AK	18.3	36	Little Rock AFB, AR	–30.7
6	Scott AFB, IL	17.6	37	Vandenberg AFB, CA	–31.8
7	Langley AFB, VA	13.3	38	Andrews AFB, MD	–32.7
8	Randolph AFB, TX	13.0	39	Pope AFB, NC	–37.7
9	Minot AFB, ND	12.1	40	Elmendorf AFB, AK	–38.7
10	Hill AFB, UT	4.8	41	Altus AFB, OK	–41.5
11	Offutt AFB, NE	4.5	42	McChord AFB, WA	–42.9
12	Schriever AFB, CO	3.9	43	Hickam AFB, HI	–45.9
13	Wright-Patterson AFB, OH	–0.2	44	Seymour Johnson AFB, NC	–46.9
14	Barksdale AFB, LA	–1.1	45	Tyndall AFB, FL	–50.7
15	Shaw AFB, SC	–6.4	46	Goodfellow AFB, TX	–50.8
16	F. E. Warren AFB, WY	-6.8	47	Moody AFB, GA	–53.3
17	Dyess AFB, TX	–7.0	48	Beale AFB, CA	–60.3
18	Patrick AFB, FL	–7.8	49	Keesler AFB, MS	–60.7
19	Fairchild AFB, WA	–10.5	50	Charleston AFB, SC	–65.0
20	Sheppard AFB, TX	–11.8	51	Los Angeles AFB, CA	–77.5
21	Robins AFB, GA	–12.6	52	Brooks AFB, TX	–78.3
22	Luke AFB, AZ	–15.6	53	Holloman AFB, NM	–78.4
23	MacDill AFB, FL	–17.6	54	Cannon AFB, NM	–82.0
24	McConnell AFB, KS	–18.1	55	Davis-Monthan AFB, AZ	–86.2
25	Peterson AFB, CO	–20.7	56	Kirtland AFB, NM	–89.2
26	Grand Forks AFB, ND	–22.2	57	Lackland AFB, TX	–90.0
27	Eglin AFB, FL	–22.5	58	Maxwell AFB, FL	–95.9
28	Dover AFB, DE	–24.3	59	Laughlin AFB, TX	–114.7
29	Mountain Home AFB, ID	–25.4	60	Edwards AFB, CA	–116.5
30	Hurlburt Field, FL	–25.5	61	Nellis AFB, NV	–125.2
31	Travis AFB, CA	–25.5	62	Bolling AFB, DC	–219.3

In terms of interpreting the MNRI scores of the top and bottom neighborhoods, we can say that, compared with the hypothetical gold-standard military neighborhood, the Air Force Academy military neighborhood is ranked roughly 42 percent as highly. This suggests that, even at the top, there is room for improvement. In contrast, the military

neighborhood surrounding Bolling AFB is quite disadvantaged compared with that same gold-standard military neighborhood. Further, given the large gap between the 62nd- and 61st-ranked military neighborhoods (–219.3 versus –125.2), Bolling is also quite disadvantaged compared compared with other Air Force military neighborhoods.

Also notice that the top five and bottom five military neighborhoods are not clustered in any specific geographic region. The top five neighborhoods are located in the west (Air Force Academy), the midwest (Whiteman AFB), and the northeast (Hanscom AFB and McGuire AFB), and one is OCONUS (Eielson AFB). The bottom five military neighborhoods are distributed across the country as well: Two are in the west (Edwards AFB and Nellis AFB), one is in the southwest (Laughlin AFB), one is in the south (Maxwell AFB), and one is on the coast in the mid-Atlantic region (Bolling AFB).

Similarly, the top and bottom five military neighborhoods are not concentrated among one type of installation based on its MAJCOM designation. The top five military neighborhoods contain one ACC installation (Whiteman AFB), one AFMC installation (Hanscom AFB), one AMC installation (McGuire AFB), one PACAF installation (Eielson AFB), and one DRU that belongs to no MAJCOM (Air Force Academy). The bottom five military neighborhoods contain two AETC installations (Maxwell AFB and Laughlin AFB), one AFMC installation (Edwards AFB), an ACC installation (Nellis AFB), and one DRU (Bolling AFB).

Finally, the top and bottom five military neighborhoods are not clustered by the size of the installation, as measured by the number of full-time military assigned to a particular installation. In terms of size, the smallest of the 62 installations that met our inclusion criteria were Hanscom AFB and Laughlin AFB. Both had approximately 1,400 full-time military personnel in FY 2000. However, Hanscom ranked in the top five military neighborhoods, at 3, and Laughlin was at the bottom of the list, ranked 59th. In general, the top and bottom five military neighborhoods were moderately sized bases falling in the 1,500- to 7,000-person range. The larger bases, such as Lackland AFB (57) and Langley (7), both with more than 8,000 full-time personnel (as of FY 2000), were also represented among the best and among the worst.

Thus, as with the Army case study, one cannot predict where an Air Force neighborhood might fall on this social indicator ranking index using assumptions based on geographic location, base population size, mission type (e.g., education, operations, depot), or MAJCOM responsible for the base or DRU status.[32] We now turn to the Air Force data available to use to analyze in conjunction with the MNRI data.

[32] We also ran a regression model using installation population size, region, and mission type to predict MNRI scores. None of these three base characteristics was statistically significant.

Air Force Community Survey Sample Description

The survey sample is made up of all active-duty Airmen who completed the 2003 Air Force Community Assessment Survey and who were assigned to one of the 62 installations included in our analysis. Because we were interested in the impact of a neighborhood, and given the lack of a standard in the literature for how long someone should be a resident before we might be able to detect an association between neighborhood characteristics and outcomes, we excluded individuals who had not been assigned to their current locations for at least one year (n = 3,067; 10.8 percent). The mean number of Airmen responding per base who met that eligibility criterion was 361.7, with a range of 244 to 583. Table 5.10 shows the housing status of the included respondents, approximately two-thirds of whom lived off base. Of those who lived on base, the majority lived in base housing (26.1 percent) rather than dorms (8.1 percent). Of those who lived off base, approximately equal numbers lived in rented or leased housing versus owned their own home.

Table 5.10
Housing Status of Airmen in the Analytic Sample

Housing Status	Type	n	Percentage	n	Percentage
On base	Government housing	5,639	26.1	7,396	37.1
	Dorms	1,757	8.1		
Off base	Government housing	423	2.0	13,996	62.0
	Government-leased housing	176	0.8		
	Own a house, townhouse, or condo	6,460	29.9		
	Rent or lease	6,892	31.9		
	Hotel or motel	15	0.1		
Other	Other	213	1.0	213	1.0

SOURCE: 2003 Air Force Community Assessment Survey.

Covariates

Table 5.11 lists means and standard deviations (when appropriate) for the covariates used in full models.[33]

[33] Race and ethnicity and age were not self-reported in the Air Force Community Assessment Survey.

Table 5.11
Model Covariates for Full Models, Air Force

	Enlisted		Officers	
Variable	**On Base**	**Off Base**	**On Base**	**Off Base**
Married or cohabiting (%)	68	65	95	73
Spouse in military (%)	7	18	4	14
Spouse employed (%)	28	26	29	25
Male (%)	76	73	90	77
Child living at home (%)	59	48	78	50
1 to 3 years of service[a] (%)	38	23	11	18
4 to 6 years of service (%)	15	16	13	14
7 to 10 years of service (%)	11	12	19	17
11 to 20 years of service (%)	31	40	44	41
21+ years of service (%)	6	9	13	10
Time away from home[b]	3.0 (SD = 1.3)	3.1 (SD = 1.3)	2.9 (SD = 1.3)	3.0 (SD = 1.3)
E1 to E4 (%)	45	29	NA	NA
E5 to E6 (%)	42	50	NA	NA
E7 to E9 (%)	13	20	NA	NA
O1 to O3 (%)	NA	NA	57	60
O4+[c] (%)	NA	NA	43	40

[a] We excluded Airmen who reported serving less than one year.
[b] Refers to time spent on temporary duty assignments, training, or deployments in the past year. Response categories ranged from two weeks or less to all 12 months, on a six-point scale (higher scores indicate longer periods). The mean of 3.0 is equivalent to one to three months away.
[c] Flag officers are not included.

Outcomes

We examine nine outcomes that cover Airmen's attitudes toward their communities, Airman health and well-being, and enlisted retention: (1) satisfaction with housing, (2) community satisfaction, (3) neighborhood cohesion, (4) perceived safety of the community, (5) financial difficulties, (6) depressive symptoms, (7) self-rated health, (8) satisfaction with life, and (9) career intentions. In this section, we briefly describe these measures.

Satisfaction with housing is made up of two separate measures. The first is *satisfaction with current housing*. Airmen were asked about their levels of satisfaction with their current housing, on a six-point scale from very dissatisfied to very satisfied, with higher scores indicating higher satisfaction. The second is *satisfaction with housing stock*. This measure combines three separate survey items that address the availability,

affordability, and quality of housing, which are factors that can influence satisfaction with housing stock. These items were highly correlated (alpha = 0.80), so the mean of these variables was calculated to give overall satisfaction with housing.

Community satisfaction is made up of three separate measures: satisfaction with the local civilian area as a place to live, ratings of civilian friendliness, and overall satisfaction with the current installation assignment. These variables were moderately, but not highly, correlated (correlations ranged from 0.44 to 0.54; alpha = 0.73), so the measures were not combined. All measures were rated on a six-point scale, with higher scores indicating higher levels of satisfaction or friendliness.

Neighborhood cohesion was assessed by a scale of six items: People in my neighborhood "know the names of their neighbors," "sponsor events and celebration where residents come together," "reach out to welcome new residents and families," "can be trusted," "look out for one another," and "offer help or assistance to one another in times of need." Responses were made on a six-point scale, from strongly agree to strongly disagree, with 6 representing strongly agree. The alpha for these items is very high, at 0.93, indicating that they are tapping into the same underlying construct of neighborhood cohesion.

Perception of neighborhood safety was a combination of two separate questions asking Airmen how safe they felt in their residences and their neighborhoods on a six-point scale, from very unsafe to very safe, with 6 representing very safe. The residence and neighborhood scores were highly correlated ($r = 0.89$) and were combined into a single score. Airmen were also asked to rate the *safety of the civilian area surrounding the installation* to which they were assigned on a six-point scale, from very unsafe to very safe, with 6 representing very safe.

Financial difficulties were assessed using 13 items asking whether respondents had experienced certain events during the past 12 months, including "bounced two or more checks" (endorsed by 8 percent of respondents), "fell behind in paying credit card" (13 percent), "borrowed money from friends or relatives" (12.5 percent), "had your utilities shut off" (4.2 percent), and "declared personal bankruptcy" (0.08 percent).[34] The distribution was highly skewed, with 73 percent of respondents reporting none of those

[34] The 13 economic well-being items were "bounced two or more checks"; "received a letter of indebtedness"; "had your wages garnished"; "fell behind in paying your rent or mortgage"; "fell behind in paying your credit card, AAFES [Army and Air Force Exchange Service], or club account"; "had a bill collector contact your unit leader"; "pawned or sold valuables to make ends meet"; "borrowed money from friends or relatives to help with a financial difficulty"; "borrowed money through an emergency loan assistance program or a Service Aid Society"; "had your utilities shut off"; "had a car, household appliances, or furniture repossessed"; "was unable to afford medical care"; and "went bankrupt."

financial difficulties, 12 percent reported one difficulty, 6 percent reporting two difficulties, and one respondent reporting all 13 difficulties.

Depressive symptoms were measured using a short version of the Center for Epidemiological Studies–Depression Scale (CES-D; Radloff, 1977). A shortened, seven-item version of the CES-D, asking about number of days on which symptoms of depression were experienced during the past seven days, was included in the community survey.[35] Scores on the seven items were summed and averaged to create a single mean score for each Airman (alpha = 0.85).

Self-rated health was assessed with a single item that asked respondents to rate their health on a six-point scale, from extremely poor to excellent, with 6 representing excellent.

Satisfaction with life was assessed using four items asking about physical health, emotional well-being, spiritual well-being, and life as a whole. Each item was scored on a six-point scale, from very dissatisfied to very satisfied, with higher scores indicating higher satisfaction. Scores were summed across the three measures to create one life satisfaction score (alpha = 0.79).

Finally, Airmen were asked their *military career intentions*. Specifically, we focused on those Airmen who indicated that they intended to stay in the military until retirement versus those who said they intended to stay beyond their current obligation but not necessarily to retirement,[36] those who intended to complete their present obligation, those who intended to leave before the end of their current obligation, and those who said they were unsure of their career intentions.

Table 5.12 shows descriptive statistics for all the outcome variables.

[35] The seven CES-D items were how many days during the past seven days the respondent "felt that you just couldn't get going," "felt sad," "had trouble getting to sleep or staying asleep," "felt that everything was an effort," "felt lonely," "felt that you couldn't shake the blues," and "had trouble keeping your mind on what you were doing."

[36] Retirement generally occurs after 20 years of service. At that point, a service member is eligible for full retirement benefits.

Table 5.12
Outcome Variables, Air Force

	Enlisted		Officer	
Variable	**On Base**	**Off Base**	**On Base**	**Off Base**
Satisfaction with housing	4.21 (SD = 1.35)	4.88 (SD = 1.09)	4.49 (SD = 1.3)	5.10 (SD = 1.01)
Satisfaction with housing stock	4.23 (SD = 1.29)	4.22 (SD = 1.3)	4.10 (SD = 1.38)	4.20 (SD = 1.40)
Rating of civilian area	3.48 (SD = 1.32)	3.85 (SD = 1.27)	3.79 (SD = 1.33)	4.08 (SD = 1.36)
Civilian friendliness	4.65 (SD = 1.01)	4.86 (SD = 0.93)	4.93 (SD = 0.91)	5.10 (SD = 0.85)
Satisfaction with installation assignment	4.12 (SD = 1.45)	4.42 (SD = 1.35)	4.69 (SD = 1.17)	4.77 (SD = 1.19)
Neighborhood cohesion	3.74 (SD = 1.11)	3.77 (SD = 1.18)	4.56 (SD = 0.92)	4.01 (SD = 1.09)
Safety of residence and neighborhood	5.35 (SD = 0.79)	4.89 (SD = 0.91)	5.65 (SD = 0.65)	5.17 (SD = 0.81)
Safety of civilian area around installation	4.35 (SD = 1.13)	4.55 (SD = 1.01)	4.58 (SD = 1.12)	4.77 (SD = 0.97)
Financial difficulties	0.83 (SD = 1.52)	0.64 (SD = 1.37)	0.20 (SD = 0.66)	0.19 (SD = 0.67)
Depressive symptoms	0.47 (SD = 0.57)	0.45 (SD = 0.55)	0.26 (SD = 0.41)	0.33 (SD = 0.45)
Self-rated health	4.65 (SD = 1.02)	4.63 (SD = 1.03)	4.77 (SD = 1.03)	4.80 (SD = 1.03)
Life satisfaction	4.94 (SD = 0.91)	4.97 (SD = 0.89)	5.18 (SD = 0.79)	5.07 (SD = 0.86)
Career intentions (%)	53	62	76	64

NOTE: Possible range of all measures is 1 to 6, with the exception of depressive symptoms (range: 0–4), financial difficulties (possible range 0–13, actual range 0–9), and career intentions (yes/no).

Analysis Plan

For each outcome and predictor pair (i.e., the overall MNRI and the six domains), we estimated multilevel regression models in which individual Airmen were at one level and Airmen nested within installation populations (the Air Force neighborhoods) were at the second level.[37] Similar to our analysis using the Army data, we estimate basic (no

[37] For the majority of models, we used a continuous outcome estimator; for three outcomes, we used a binary outcome (reenlistment intention, spouse employment, and spouse seeking work) and employed a logistic model; and, for one count outcome (financial difficulties), we employed a negative binomial model (a Poisson model did not fit the data because of zero inflation). Ordered logistic or ordered probit models are difficult to estimate within a multilevel framework and tend to lead to problems in estimating the

covariates) and full models. However, because we are also able to capture "exposure" to base neighborhoods via the on-base/off-base status of Airmen, both the basic and covariate models include a dummy variable indicating whether Airmen live on base (versus off), as well as an interaction between living on base and the overall MNRI or the individual domains (i.e., on base × MNRI). This allows us to see whether the association between neighborhood quality and the outcomes is stronger among Airman who live on base versus off base.

The first set of models we estimated focused on the association between the MNRI and the outcomes. The second set of models focused on the association between the six domains and the outcomes. Separate models were estimated for officers and enlisted, although they are presented together. Thus, for each outcome–predictor pair, there are four models: officer basic, officer full, enlisted basic, and enlisted full. The discussion that follows presents the results for each outcome individually and, in the interest of parsimony, focuses only on statistically significant results from the full model.[38]

Multilevel Modeling Results

Table 5.13 summarizes the results of the multilevel models. Each of the outcomes we examined is listed along the left side of the table. For each outcome, we indicate whether the overall MNRI and the domains have a statistically significant positive or negative association with the outcome and whether the associations support our exposure hypothesis (i.e., that the off-base association is stronger than the on-base association as indicated by a significant interaction effect between living on base and the MNRI or domain).

As can be seen in the table, the MNRI and its constituents were not always significantly associated with the outcomes. In fact, for financial difficulties, depressive symptoms, self-rated health, and life satisfaction, neither the MNRI nor the individual domains were significant predictors. Thus, in the sections that follow, we discuss only the significant results.

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random effects, leading to such problems as model nonconvergence. In addition, when the distributions of the outcome variables are not highly skewed or bimodal, a substantively different result is rare (Miles and Shevlin, 2000).

[38] Results for all models can be obtained from the authors.

Table 5.13
Summary of Results from the Air Force Case Study

	Positive Association		Negative Association		Evidence of Exposure	
Outcome	**Officers**	**Enlisted**	**Officers**	**Enlisted**	**Officers**	**Enlisted**
Satisfaction with housing	HC, H		T		T, H	
Satisfaction with housing stock	H		T		T, H	
Rating of civilian area	MNRI, HC, S, E, IP, H	MNRI, HC, S, E, IP, H			MNRI, HC, S, E, H	MNRI
Civilian friendliness	MNRI, HC, E	MNRI, HC, S, E, IP			MNRI, HC	MNRI, HC, S
Satisfaction with installation assignment	MNRI, IP	MNRI, IP	T			
Neighborhood cohesion	MNRI, S, E, IP	MNRI, S, E, IP, H			MNRI, S, E, IP	
Safety of residence and neighborhood	MNRI, HC, S, E, IP	MNRI, HC, S, E, IP, H			IP	IP
Safety of civilian area around installation	MNRI, HC, S, E, IP, T, H	MNRI, HC, S, E, IP, T, H			MNRI, HC, S, E, IP, H	MNRI, HC, S, E, IP, T, H
Financial difficulties						
Depressive symptoms						
Self-rated health						
Life satisfaction						
Career intentions	S	IP			S, IP	

NOTE: HC = household composition domain. H = housing domain. T = transportation domain. MNRI = MNRI. S = social domain. E = employment domain. IP = income and poverty domain.

Satisfaction with Current Housing

According to the results from the covariate models, the association between the overall MNRI and satisfaction with housing was not significant for officers or enlisted Airmen. We therefore move directly to the models that use the six individual domains.

Of the six domains, three yielded significant results in the full models. First, for officers who live off base, the higher the household composition domain score (meaning the smaller the household and the fewer female-headed households), the higher their level of satisfaction with current housing (see panel A in Table B.2 in Appendix B).

Second, officers who live on base are less satisfied with their housing in areas where the transportation domain has higher scores, meaning where many people have access to cars and commute times are low. This is not true of officers who live off base: In those

cases, higher transportation domain scores are associated with greater satisfaction (although this association is not statistically significant). The difference between the estimates for officers who live on and off base is statistically significant (see panel B in Table B.2 in Appendix B).

Third, in the covariate model, among officers who live off base, higher scores on the housing domain (less income spent on housing, fewer vacancies, fewer renters, and more homeowners) are associated with higher levels of satisfaction with current housing. This is not true for officers who live on base. The difference between officers who live on base versus off base is also statistically significant (see panel C in Table B.2 in Appendix B).

Satisfaction with Housing Stock

For both officers and enlisted, the MNRI is not statistically significant in the full model. When we examined the associations between the six domains and satisfaction with housing stock, we found only two significant results. First, among officers who live on base, those who live in neighborhoods with higher scores on the transportation domain report lower levels of satisfaction with the current housing stock (see panel A of Table B.3 in Appendix B). The association is positive, but not significant, among officers who live on base. However, the difference in the associations between officers who live on and off base is significant. Thus, officers who live off base in areas where public transportation is available and who have access to personal transportation rate their satisfaction with housing stock significantly higher than their counterparts who live on base.

Second, officers who live off base in neighborhoods with higher scores on the housing domain rate their satisfaction with current housing stock higher than officers who live in neighborhoods with lower housing domain scores (see panel B of Table B.3 in Appendix B). This is identical to our finding for current housing satisfaction.

Community Satisfaction: Civilian Area as a Place to Live

The MNRI, as well as five of the six domains, had a significant association with Airman ratings of the civilian area as a place to live. Regardless of whether an Airman is an officer or enlisted, or lives on or off base, higher MNRI scores are associated with higher ratings of the civilian area (see panel A of Table B.4 in Appendix B). However, the positive association between the MNRI and ratings of the civilian area are stronger for Airmen who live off base than for those who live on base. These results provide evidence that is consistent with our hypothesis that individuals who live off base are more exposed to the entire base neighborhood.

For the *household composition domain* (see panel B of Table B.4 in Appendix B), the *social domain* (see panel C of Table B.4 in Appendix B), and the *employment domain*

(see panel D of Table B.4 in Appendix B), results are similar to those of the overall MNRI, with associations between the domain score and the rating of the civilian area in the positive direction, and stronger relationships for those living off base, although this was true only for officers. For the *income and poverty domain*, the relationship holds that higher domain scores are associated with higher ratings of the civilian area, but the strength of the relationship does not vary between those who live on base and those who live off (see panel E of Table B.4 in Appendix B). Finally, for the *housing domain*, higher domain scores are associated with higher ratings of the civilian area for all groups except officers who live on base. Enlisted Airmen living both on and off base show the same positive association between domain scores and ratings of the civilian area, but the strength of the association does not differ by whether they live on or off base.

Community Satisfaction: Civilian Friendliness

The association between the overall MNRI and ratings of civilian friendliness is statistically significant only for Airmen who live off base (see panel A of Table B.5 in Appendix B). Among both officers and enlisted Airmen who live off base, higher MNRI scores are associated with higher ratings of civilian friendliness. The positive association observed among Airmen living off base is significantly stronger than that for Airmen living on base, again supporting our exposure hypothesis.

This general pattern of results is also true for the *household composition domain* (see panel B of Table B.5 in Appendix B) and the *social domain* (see panel C of Table B.5 in Appendix B; although, in the full, officer model, living off base is not statistically significant). The *employment domain* (see panel D of Table B.5 in Appendix B) also shows a similar pattern of results, although the strength of the association does not differ for Airmen living on or off base. The income and poverty domain shows a significant association with ratings of civilian friendliness only among enlisted Airmen living off base. The difference in the strength of the association between those Airmen and Airmen living on base is not significant (see panel E of Table B.5 in Appendix B).

Community Satisfaction: Satisfaction with Base Assignment

The association between the MNRI and Airmen's ratings of satisfaction with their current installation assignment was significant for officers living on base and enlisted living off base (see panel A of Table B.6 in Appendix B). For both, higher MNRI scores were associated with higher levels of satisfaction.

Only two of the domains yielded significant results for community satisfaction—the income and poverty domain and the transportation domain. For the *income and poverty domain*, higher domain scores are associated with higher satisfaction levels for officers who live on base, enlisted who live on base, and enlisted who live off base, but not

officers who live off base (see panel B of Table B.6 in Appendix B). The magnitude of the associations does differ for those living on versus off base. Higher scores on the *transportation domain* are associated with lower satisfaction only among officers who live on base (see panel C of Table B.6 in Appendix B).

Neighborhood Cohesion

The association between the overall MNRI and ratings of neighborhood cohesion were positive and statistically significant for officers and enlisted Airmen who lived on base (see panel A of Table B.7 in Appendix B). The association was stronger for officers living on base than off but did not differ for enlisted personnel living on or off base. Those who live on base may form stronger bonds with fellow Air Force personnel living on base than those living off base do with the mixed military and civilian community. That may be because of a greater likelihood that they work together; participate in base or unit organized activities together; see each other in base recreational facilities, child care centers, stores, and restaurants; and benefit from base welcoming norms. Also, there are fewer Airmen concentrated in a smaller area, and this could lead to a stronger sense of community as well. Results for the *social domain* and the *income and poverty domain* mirror those of the overall MNRI (see panels B and E of Table B.7 in Appendix B).

For the *employment domain*, higher domain scores are associated with higher perceived neighborhood cohesion among officers who live on base, as we saw for the overall MNRI and the social and income and poverty domains (see panel C of Table B.7 in Appendix B). However, for enlisted Airmen, this is true of those who live on or off base, and the strength of the association does not vary by housing status. The *housing domain* (panel E of Table B.7 in Appendix B) is significantly associated with perceived neighborhood cohesion only for those who are enlisted and live on base (see panel E of Table B.7 in Appendix B).

Perceptions of Safety of Area: Residence and Neighborhood

Higher scores on the overall MNRI are associated with higher safety scores for the Airman's residence and neighborhood among officers and enlisted, regardless of whether they live on or off base. The associations do not differ by on- versus off-base status.

With the exception of the transportation domain, all the domains have a positive and statistically significant association with safety ratings of the Airman's residence and neighborhood. The results for the *household composition* and *social domains* are similar to those of the overall MNRI (see panels B and C of Table B.8 in Appendix B). There are two exceptions, however. First, for the household composition domain, the strength of the association is stronger for enlisted Airmen who live off base. Second, for the social

domain, the association for officers who live off base is not statistically significant (although it is positive).

For both officers and enlisted, *employment domain* scores are significantly associated with safety scores only among those who live on base (see panel D of Table B.8 in Appendix B). This is also true for the *income and poverty domain*, but here the association is stronger for Airmen who live on base than for those off (see panel E of Table B.8 in Appendix B). Like the results for neighborhood cohesion, this suggests that there may be a greater sense of community among those living on base.

Finally, for the *housing domain*, domain scores are significant predictors of safety only for enlisted Airmen, and the effect does not depend on whether they live on or off base (see panel F of Table B.8 in Appendix B).

Perceptions of Safety of Area: Civilian Areas Around the Installation

Both the MNRI and all six of the domains showed a consistent pattern with these safety ratings: Higher index and domain scores are associated with higher ratings of safety, regardless of officer or enlisted status, but the association is stronger among those who live off than those on base (see Table B.9 in Appendix B; the one exception is for officers and the transportation domain). If the findings of prior research linking greater safety to higher-ranking social indicators hold true here, then this finding provides more evidence for our hypothesis that individuals who live off base are more exposed to the characteristics and qualities of the base neighborhood.

Career Intentions

Among both officers and enlisted Airmen, the MNRI is not a statistically significant predictor of intentions to stay in the Air Force until retirement in the full model.[39] Turning to the domain models, the social domain was positively and significantly associated with positive career intentions (see panel A of Table B.10 in Appendix B). Officers who lived in areas with higher scores on the social domain were more likely to endorse career intentions. This association was significantly strong among officers who lived off base than on base, as predicted by the exposure hypothesis. Presumably, these officers spend more time in the community than do their on-base peers. These

[39] Retention intentions have been shown to be a strong predictor of actual retention behavior in military samples (see Guthrie, 1992; Marsh, 1989; Janega and Olmsted, 2003). In fact, Jaros (1997) suggests that retention intentions are the "strongest, most direct" predictor of turnover behavior (p. 321). There is some evidence that survey data tend to overestimate actual behavior; however, in the civilian literature, individuals who express a desire to leave an organization are more likely to actually leave than counterparts who do not express that desire (Jans and Frazer-Jans, 2006).

neighborhoods were characterized as having a higher percentage of residents with a college degree (as well as a lower percentage who have less than a high school degree), who are married, who do not have a disability, and who have lived in the neighborhood for at least five years.

Among the domains, only one full model yielded a significant association with career intentions among enlisted Airmen. Higher scores on the neighborhood income and poverty domain are associated with higher odds of intention to stay for a career among enlisted Airmen who live on base (see panel B of Table B.10 in Appendix B). This indicates that, when economic conditions around the base are good, Airmen are more likely to consider the military as a career. This may seem counterintuitive because civilian jobs are likely to be plentiful when economies are good. However, this unexpected result can be explained by the exposure hypothesis: Enlisted Airmen who live and work on base may be less exposed to the civilian labor market and thus may be unaware that other job opportunities are available. Also note that the difference between the estimates for enlisted Airmen who live on and off base is not statistically significant.

Among officers, higher scores for the income and poverty domain are also associated with higher odds of intending to remain in the Air Force for a career. Unlike the results for enlisted Airmen, however, we do see evidence of an exposure effect. That is, officers who live on base are significantly more likely than officers who live off base to endorse career intentions. It is possible that this is a selection effect—officers who live on base do so because they are more committed to the Air Force—that may have little to do with the income and poverty characteristics of the neighborhood. This may also be the case for enlisted Airmen.

Summary

This chapter has presented the results for our case study of the Air Force. Similar to the results for the Army, the social indicator analysis of 62 active-duty AFBs revealed that one cannot infer neighborhood quality from an installation's population size, geographic location, or MAJCOM. The quality gap between the highest- and lowest-ranking Air Force neighborhoods was quite wide. As a reminder, factors included in our index, such as unemployment and use of public assistance among the general population, are not factors under Air Force control. The six domains measured overlapping but distinct characteristics, and the social domain and the income and poverty domain were highly correlated with the overall MNRI. The domain rankings may be especially useful in understanding the wide variability in the overall social indicators ranking of the bases and for developing Air Force strategies for addressing problems, particularly at the

lowest-scoring base neighborhoods, to promote a more comparable QOL across these bases.

We examined associations between the MNRI and its six constituent domains using multilevel regression models. The 2003 Air Force Community Survey allowed us to investigate whether the associations we found differed between officers and enlisted Airmen and whether the associations were stronger for those who live on or off base. The latter distinction was especially informative because it was the only way in which we could measure exposure to the characteristics and qualities of the broader base neighborhoods, outside the installation boundaries. Our assumption was that Airmen who lived *and* worked on base would have less contact with areas surrounding the base than would Airmen who worked on base but lived elsewhere. Thus, we predicted that associations between the MNRI and the domains and the outcomes we examined would be stronger for Airmen living off base.

Based on the results of the multilevel analysis, several conclusions can be made (see Table 5.13). First, the overall MNRI and the individual domains did not have significant associations with the health and well-being outcomes (i.e., financial difficulties, depressive symptoms, self-rated health, and life satisfaction). There are several possible explanations for this. First, it is possible that these measures of health and well-being are not as influenced by neighborhood characteristics as other measures may have been. For example, we did not have subjective or objective (e.g., cortisol levels) measures of stress, which may be directly influenced by neighborhood characteristics and which may ultimately, indirectly affect health and well-being. Second, in the absence of other measures of exposure, most notably how long the Airmen had been assigned to their current bases, we may not have been able to detect significant associations between neighborhoods and health and well-being. Similarly, because we were not able to track an individual Airman's career, we do not know what the qualities and characteristics of the Airman's prior military neighborhood were like. Moving from a base that scores high on the MNRI to one that scores much lower, or vice versa, may have an additional positive (or negative) impact on health and well-being. Third, neighborhoods may have a stronger effect on spouses and children of Airmen. Unfortunately, we did not have any information about the health and well-being of families. And fourth, based on the survey responses, it appears that active-duty Airmen are generally very healthy. Given this young, healthy sample, there was little variation in health and well-being at all, let alone to be explained by neighborhood profiles.

Second, reenlistment intentions were not predicted by neighborhood characteristics as measured by the MNRI or the domains, with the exception of the income and poverty domain. Theoretically, we linked neighborhoods to retention indirectly via health and well-being, as well as job satisfaction. Because we did not find significant associations

between the MNRI or the domains and the health and well-being outcomes, it should not be surprising that we did not find a significant association with reenlistment intentions. Nor did we have a direct measure of job satisfaction.

Third, some of the associations we observe appear to corroborate the MNRI and the domains. Specifically, the results for the rating of the civilian area as a place to live, neighborhood cohesion, and ratings of safety of the Airman's residence and neighborhood and the civilian area around the base are all positively associated with the MNRI, as well as with some of the domains. These positive associations indicate two things. First, they reinforce objective measures of neighborhoods (i.e., Census data) by using subjective Airman ratings of the characteristic and qualities of neighborhoods. Second, they validate our selection of indicators and suggest that they do, in fact, measure important qualities of neighborhoods.

Fourth, the transportation domain did not appear to add much explanatory power to the overall MNRI. The domain consists of three indicators: the mean travel time to work, percentage using public transportation, and percentage with access to one or more autos. In the few instances in which it did have a significant association with an outcome, the association was negative and mattered only for officers, who are much more likely to live off base and have longer commutes than enlisted Airmen. It could be that the domain is measuring three distinctly different aspects of a neighborhood. Travel time to work may measure neighborhood density or urbanicity, and many AFBs are located in rural areas. Use of public transportation may be an indicator of neighborhood infrastructure, but it could also be an indicator of poverty, with few individuals having access to personal transportation. Similarly, access to an automobile is likely an indicator of neighborhood SES. In conjunction, for some base neighborhoods, the three indicators may be working against each other, resulting in a domain that may not actually capture what it was intended to measure.

Finally, Airman ratings of the safety of the civilian area around the neighborhood were the only outcome that was consistently, and positively, associated with the overall MNRI and each of the six domains. The findings held for officers and enlisted, regardless of whether they lived on or off base. However, we also consistently found that the association was stronger among those who lived off base, confirming our hypothesis that living off base was signal of greater neighborhood exposure. In general, we found more support for the exposure hypothesis among officers than enlisted. That could be because officers are more likely to live off base than enlisted Airmen.

For at least two outcomes, perceived neighborhood cohesion and ratings of residence and neighborhood safety, we found that the association between the MNRI and domains was stronger for those who lived on base than for those who lived off base. This is likely the result of the fact that living on base fosters a sense of community that Airmen who

live off base may not be able to achieve in a civilian neighborhood. The association, particularly for neighborhood cohesion, was found only among officers, who are more likely to live off base. When they do live on base, however, they are more likely to associate, both socially and professionally, with other Air Force personnel, again possibly fostering a heightened sense of community that is more difficult to cultivate among officers living among larger numbers of civilians and military personnel outside the boundaries of the base.

Overall, we found some evidence that the quality and characteristics of the neighborhoods surrounding AFBs have an association with Airman outcomes. Stronger evidence may have been found had we used other measures of health and well-being or had access to neighborhood data defined by a different unit of analysis, such as a set distance around a base. The next chapter uses the results from the Army and Air Force case studies to make recommendations for neighborhood studies in general, as well as for future research on military neighborhoods.

Chapter Six. Recommendations for Neighborhood Studies in General and for Future Research on Military Neighborhoods

Our intent with this exploratory study was to provide a research framework that scholars could use to inform military leaders, policymakers, and service providers about how sociodemographic and economic characteristics of installations and their surrounding neighborhoods may be associated with military members' health, well-being, and satisfaction with military life. The purpose is to identify those locations where service members may be particularly dependent on installation services because of neighborhood-based stressors or because of the lack of neighborhood resources. This information can help the military adapt its programs and services to address location-specific need (such as greater employment support for spouses in areas of higher unemployment) and to preserve critical resources in particularly vulnerable regions during periods of greater budget constraints.

Thus far, we have addressed our first two research questions: (1) how do military installations and their surrounding neighborhoods compare with one another in sociodemographic and economic indicators, and (2) how are individual health and well-being outcomes associated with military neighborhood profiles? The Air Force case also allowed us to explore whether subjective assessments of a military neighborhood were associated with our social and economic indicators collected by the Census Bureau.

In this chapter, we assess how the military can use neighborhood indicators to improve service member and family health and well-being via installation-level resources. In addressing the question, we (1) explore the challenges we found in the existing neighborhood studies literature, noting how we suggest dealing with them; (2) address how the military can continue to pursue future work in the neighborhood studies realm by outlining an "ideal" study design; and (3) offer specific suggestions for how the findings from this study can be used to inform policy and improve the QOL for service members and their families.

Challenges in the Neighborhood Studies Literature

Individuals within a shared neighborhood may be differentially affected by the same neighborhood stimulus (or characteristic). For example, some individuals may have lived in a neighborhood for several years, while others may have lived there only a few months. If a particular type of toxin is in the soil or water of that neighborhood, the level of exposure to that substance would vary depending on how long a person has lived in

that neighborhood. Similarly, most working adults split time between a workplace and home. Some individuals may spend ten or more hours a day in their place of business, including commuting. Others may have more-flexible schedules and work from their homes more than from an office, while others may work part time or not at all. Frequent travel, temporary relocations, and school attendance may also influence the amount of time one spends in the neighborhood he or she may call "home."

In general, the exposure problem can lead to many theoretical and methodological challenges in conducting studies on neighborhood effects. In this chapter, we organize these challenges into three categories: issues pertaining to defining and conceptualizing relevant spatial scale, temporal scale, and chains of causality.

Spatial Scale

The geographic space that people inhabit on a regular basis can vary dramatically: Some live entirely within a few blocks, while others routinely travel great distances. Those habits can influence what people consider their "neighborhood." In our study, we had to consider that some service members live *and* work on an installation, while others may work on base but live nearby, and others may live some distance away and commute on a regular basis. While considering these individual characteristics in the military population, we turned to the literature to discover what was known about how spatial scale relates to neighborhood effects on specific health outcomes. The answer was surprisingly little.

Spatial scales vary with administrative or Census-defined geographies (e.g., some ZIP Codes are tiny; some are quite large) and with what local residents consider as their neighborhoods. Little theory has been generated about whether areas of different sizes could be relevant for different social processes and different health outcomes. Recognizing this problem, Diez-Roux (2007) suggests that, in the absence of strong theory on the spatial scale relevant to a particular health-related process, researchers incorporate exploratory analyses in their studies. And, at a minimum, researchers should test the sensitivity of results to different spatial scales.

Another spatial scale issue that is not adequately addressed in the literature is the disconnect between a geographic space and one's true "health environment." The vast majority of existing work has assumed that only the local area or immediate area around a person's residence is relevant to health. This ignores the possible impact of features or resources of more-distant areas or of workplaces, where people might spend a significant or even greater proportion of their waking hours. It is unlikely that only features of the local areas immediately around one's home are relevant to a person's health. For example, poor areas spatially isolated from a resource-rich area may be substantially worse for health than poor areas near resource-rich areas (Diez-Roux, 2007).

Some service members live and work in the same place. Yet they may, by necessity or desire, travel to the surrounding community for support or services and amenities, decreasing their exposure to the "home" neighborhood and increasing their exposure to an outside neighborhood. If studies do not consider spatial scale in their hypotheses, they may overestimate (or underestimate) the impact of neighborhood on individual-level outcomes.

All the issues regarding spatial scale can really be addressed by asking one simple question: How should we define a neighborhood? Although this question has received much attention in the literature, there is no clear consensus. In the existing literature, a neighborhood has been defined as everything from a Census block to a subjective area defined by a respondent as his or her neighborhood. It is likely that the definition of neighborhood depends on two things: the outcome under investigation and the population. For example, in studies that use self-rated health and well-being outcomes, such as the depressive symptoms measure we used in the Air Force case study, an individual's own definition of his or her neighborhood may be more meaningful than third-party definitions. However, if the outcome of interest is related to economic well-being, neighborhood measures taken from a Census tract, a ZIP Code, or even the state level may be more appropriate. More research needs to explore this idea of matching neighborhood definitions to outcomes.

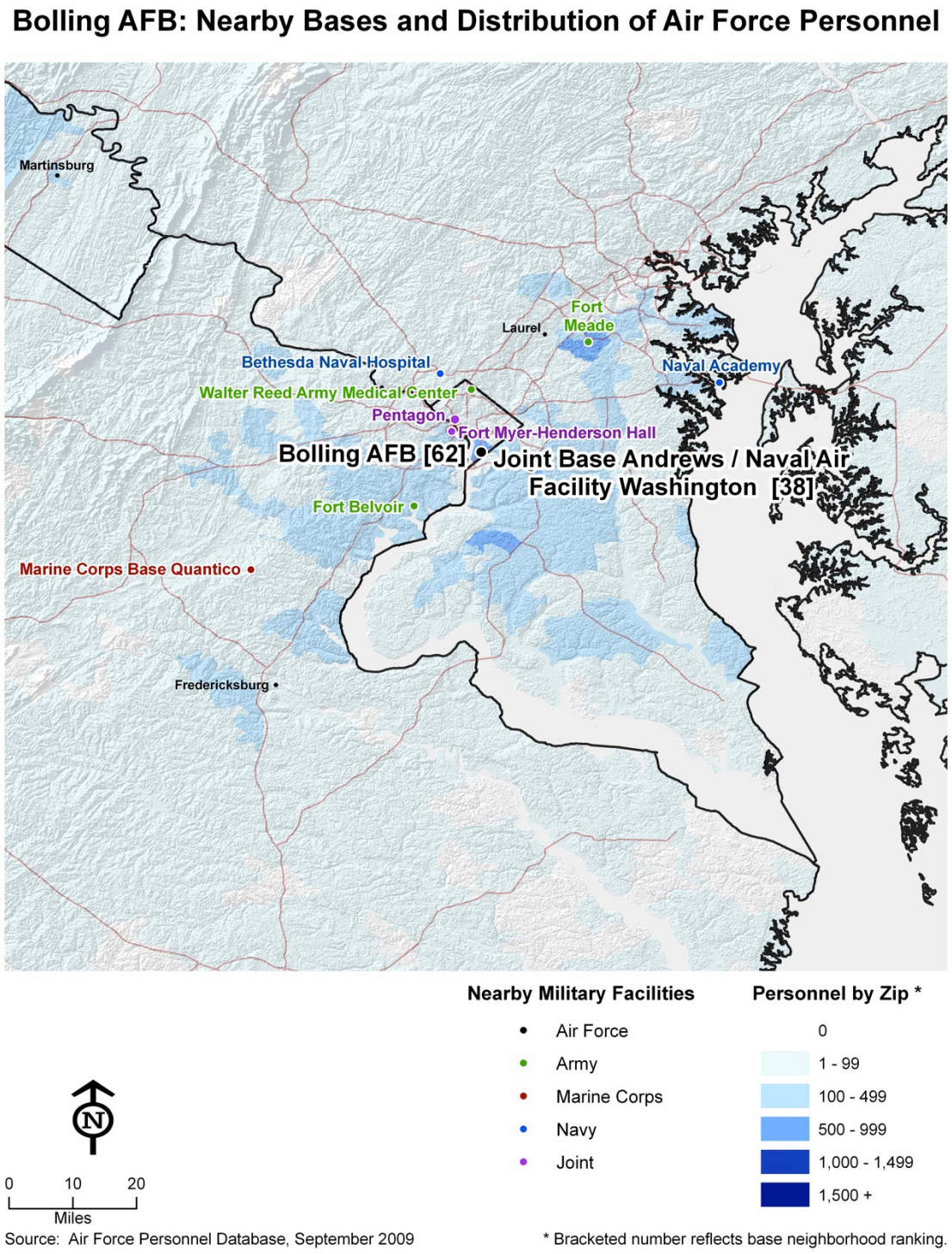
Similarly, the appropriate definition of neighborhood may depend on the population of interest. In our study, we defined a military base neighborhood as the ZIP Codes making up the base itself and all contiguous ZIP Codes. In less densely populated regions, ZIP Codes may cover a greater area of land than those more heavily populated. So the physical distance from the center of a base to the edge of the base neighborhood varies across bases. Moreover, travel time from the center to the periphery also varies, particularly if we take traffic into account. Our results may have been quite different if we had been able to root the definition in community members' own neighborhood definitions, based on where they live, work, shop, socialize, or otherwise spend time. Data constraints prevented us from doing this.

We considered other approaches to defining a military neighborhood using available data (as compared with collecting new survey data). After briefing this study to an audience in Air Force Services, we were given permission to use home-address ZIP Code data from the 2009 Air Force Personnel Database. With GIS software, we were then able to map the concentration of active component, guard, reserve, and civilian Air Force personnel. We use Bolling AFB, in Washington, D.C., as an example, in part because we knew that there were many alternative housing options for assigned Airmen. Recall that this neighborhood was ranked last on the MNRI. Our aim was to review where the residences of Airmen assigned to this installation might be concentrated.

Figure 6.1 shows the distribution of Air Force personnel in the broader geographic area around Bolling AFB. Notice that Bolling is in close proximity to other military installations, including Joint Base Andrews/Naval Air Facility Washington, which ranked 38 out of the 62 AFBs in the MRNI. Also nearby are Army installations Fort Meade, Walter Reed, and Fort Belvoir; Joint Base Fort Myer–Henderson Hall (Army–Marine Corps); and Marine Corps Base Quantico, Bethesda Naval Hospital, the Naval Academy, and the Pentagon. What can clearly be seen from the figure is that Air Force personnel are spread throughout the D.C., Northern Virginia, and Maryland area. The intensity of the blue color indicates the density of personnel living in that location, with darker shades indicating more personnel. Air Force personnel and their families who live off base have many options to live in Virginia and Maryland and are able to take advantage of facilities at other military installations (i.e., they are not restricted to the services of the installation to which they are assigned). Thus, our measure of base neighborhoods may not have captured the characteristics and qualities of the neighborhoods in which Air Force personnel and their families live, if they do not live on Bolling AFB or in the adjacent community. Using a technique like GIS would help the services and researchers map the residences of military personnel in order to get a better sense of which neighborhoods matter for the greatest number of service members.

Another approach to defining a base neighborhood might be driving distance to base. The basic allowance for housing (BAH) formula utilizes the average cost of rental units within a one-hour driving radius of the installation, in traffic. Driving-radius data could be compared with military personnel residential data to adopt a definition that would capture some proportion of members assigned to each installation.

Figure 6.1
Density Map of Air Force Personnel Residing Near Bolling Air Force Base, Washington, D.C., in 2009



Time Scale

Some service members are able to "homestead" with assignments in the same general location for years, while others must move every two or three years. Some move even more frequently. Additionally, although military personnel may have a consistent home address for multiple years, they may spend a significant portion of time serving in overseas deployments or in temporary assignments in the United States for education or training. We turned to the research literature to learn what has been discovered about how long someone must reside in an area for a neighborhood impact on health to be measurable and what may have been learned about populations who spend a considerable portion of time traveling or having residences in more than one location (e.g., children splitting time between two different parents' homes, college students who come home during breaks, "snowbirds" who spend winters in warmer climates).

Most neighborhood studies, we found, are cross-sectional, examining neighborhood characteristics or health outcomes at one point in time. Yet, cross-sectional designs are not equipped to take into account selective, health-related migration or stability.[40] Some work has used cohort studies to examine the relationship between exposure to specific neighborhood characteristics at a baseline and a specified health outcome over a follow-up period, but, to date, little attention has been paid to the time frame necessary for neighborhood conditions to affect health. In fact, little is known about what that time frame should be: If one wants to examine current health of a population, should neighborhood characteristics be collected at the time of the study, from a decade ago, or from longer ago? Should surveys attempt to capture how individuals' lives are distributed across different geographical spaces throughout the day or throughout the year?

Disentangling Endogeneity

We began the report with a broad overview of the neighborhood studies literature, including research from sociology, demography, psychology, and medicine. The idea that where one lives can impact his or her health and well-being is not new, and an increasing number of studies each year make significant contributions to this body of work. Nonetheless, there are gaps in the literature. Most notably, we found that the problem of

[40] Mcintyre and Ellaway (2003) offer a compelling example of selective, health-related migration: Of all those born in a particular neighborhood, only a small percentage may still reside there as adults. This group may be the ones with the least opportunity to move out of a neighborhood. They may be the least educated and least healthy, while residents who are the most healthy, motivated, mobile, and dynamic moved out already. A cross-sectional study may therefore only be considering the "unhealthy survivors" of childhood neighborhood exposures and may make incorrect inferences about the impact of the neighborhood on the health of all children who grow up there.

exposure has been one of the least studied. Exposure, of course, can be measured in several ways: the distribution of time one spends at home versus at work, time spent commuting, or how long one has lived in a neighborhood. For example, we were unable to find any studies that examined how long it takes to live in a neighborhood (i.e., be exposed to a neighborhood) before neighborhood characteristics have a discernible effect on health and well-being. This is particularly relevant for service members and their families, who typically move every two to three years. The question, then, is whether two- to three-year periods are enough time for neighborhoods to influence individual-level outcomes. This is not to say that existing studies do not include information about how long individuals have lived in a neighborhood; many do (see the review by Yen, Michael, and Perdue, 2009). However, length of time lived in a neighborhood is typically included in statistical models as a control variable rather than a mediator or moderator of the association between neighborhood characteristics and health and well-being.

Still fewer studies track residential history or include characteristics of neighborhoods that may change over time, such as unemployment, poverty, or crime rates (but see Murray et al., 2010, and the MTO experiment [U.S. Department of Housing and Urban Development, undated] for exceptions). In our review, we noted that the majority of neighborhood studies are cross-sectional and therefore cannot be used to infer causality. This highlights the need for more longitudinal neighborhood studies that examine not only changes in neighborhood characteristics but also changes in individual-level outcomes. Longitudinal studies of this type have their own difficulties, though. First, people move voluntarily, and where they move depends on individual and neighborhood characteristics. Thus, there is a selection component involved in neighborhood studies, although we note that selection is potentially not as strong in the military population because individual service members can express preferences but do not determine their own base assignments. However, once assigned to a base, for the most part, service members can select the specific neighborhood in which they live (unmarried service members are an exception because they are not allowed to live off base until they reach a certain rank). Second, longitudinal data are more expensive and difficult to collect, as well as to incorporate into models. Third, computationally, the modeling techniques used in neighborhood studies (i.e., propensity scores, multilevel models) require some adjustment when longitudinal data are used. These types of models are still being developed. Despite all the issues, longitudinal neighborhood studies are increasing in number, although many of them rely on longitudinal data on the independent side of the equation (i.e., neighborhood characteristics) rather than the dependent side (i.e., the outcomes).

Neighborhood Studies for the Military

As we have noted, data limitations affected our study in a variety of ways. In this section, we address several data issues that are especially relevant for studies examining the association between neighborhood and well-being and other outcomes among military populations. As we identify problems, we suggest methods for managing them.

Better Indicator Data

For this study, we were limited to indicator data available through the U.S. Census Bureau, however more labor-intensive efforts could include other measures, including those employed in other neighborhood studies, as noted in Chapter Two. For example, measures of pollution, crime, and natural disasters could account for particular geographically based threats to individual health and well-being. Standard measures of the quality, cost, and availability of schools, child care, the food environment, and recreational facilities could also be valuable. Acquiring these data, however, was beyond the resources of this exploratory project. In the absence of these data, economic data are the best proxy.

Better Outcome Data

For the Army case study in particular, we were confronted with a lack of adequate outcomes. Because we had to rely on personnel data, we were mainly limited to retention-related measures. *The ideal solution to this problem is to gain access to additional individual-level outcomes that can be linked to personnel files, allowing researchers to see where and for how long service members have been assigned to particular bases, as well as their history of installation assignments.* Such data might include health and well-being outcomes from medical records, such as service utilization (e.g., emergency room visits, mental health visits, routine care visits); the tracking of chronic conditions, such as diabetes; and the incidence of cardiac conditions, such as heart attacks or high blood pressure. Additional outcomes captured in surveys could provide information about self-rated physical health, drug and alcohol use, and mental health conditions, such as depressive symptoms, anxiety, or suicidal ideation.

In addition to service member data, we also strongly encourage an examination of family member outcomes, including spouses and children of family members. Families of service members may be more exposed, and thus more susceptible, to external neighborhood characteristics, if they live, work, attend school, or play off base. Unfortunately, we were unable to obtain outcome data on family members. There may also be a larger variance in health outcomes among family members because, unlike service members, they do not have to meet health criteria to attain their status. This

variance would increase the model's ability to find an association between neighborhoods and health if it does, in fact, exist.

Better Neighborhood Data

In our analyses, we examined the relationship between neighborhood characteristics on and surrounding bases and various outcomes of service members who were assigned to those bases. One of the issues with interpreting the results is that features of the base are not differentiated from neighborhood features. That is, data for a base's ZIP Code were merged with data from the contiguous ZIP Codes, so the defining features of each may have been diluted. For example, the indicator of the number of single mother–headed households may have been relatively low on base compared with off base, given that a disproportionate number of service members are male, compared with the general population. *The ideal solution to this problem would be to differentiate base-specific and external neighborhood-specific information.*

Similarly, individuals living off base may live in vastly different types of neighborhoods. Again, data from these neighborhoods were merged in our analysis. *The ideal solution to this problem would involve obtaining finer-grained neighborhood information about where the service member is currently living that is linked to the outcome data (i.e., more information paired with outcome data than on- versus off-base residence).* This would enable us to make direct comparisons of individuals on the same base but in different neighborhoods. It would also serve as a more nuanced measure of exposure. The larger the geographic area captured in the definition of neighborhood, the less likely it is that an individual's own, unique neighborhood experience is being captured. If we could assign people to smaller neighborhoods, we could better estimate what they really experience.[41] Ideally, the surveys collecting outcome data would ask respondents for the ZIP Code of their residence, so their responses could be assessed in terms of the ZIP Code where they live, as well as the ZIP Code of the installation. Also, ideally, any medical records used to obtain outcome data would also include patient's home-address ZIP Code.

Increasing the number of neighborhood measures would also dramatically increase the power of the study to detect such effects, even if the overall sample size were maintained. In a multilevel model, when examining the relationship between level 1 outcomes (i.e., individuals) and level 2 predictors (i.e., neighborhoods), the number of level 2 units is much more important in determining the level of power than is the number

[41] Of course, this assumes that people are most exposed to the geographic area that is in close proximity to where they live. This assumption, however, can be tested with the right data.

of level 1 units. Increasing the number of neighborhood measures is dictated, however, by the definition of the neighborhood. Because we used Census data at the ZIP Code level, we necessarily created neighborhoods based on ZIPs. It makes sense for military organizations to want to define neighborhoods relative to installations because their ability to enhance or counter neighborhood influences rests heavily on base leadership, facilities, services, and assignment practices. However, determining how to account for the variability in service member and family residences and exposure to both base and civilian community influences requires some careful thought.

Using the Findings to Influence Policy and Practice

Despite limitations, this analysis points to several ways in which the military could use the results for personnel management and to improve service member and family health and well-being.

Neighborhood Quality and Taste for Military Service

Military force management and personnel research incorporates many standard variables, such as gender, rank, race and ethnicity, occupation, and marital status, in its analyses to detect patterns of attrition, retention, and promotion. MNRI and domain scores could serve as additional variables by which demographic, attitudinal, and behavioral data are analyzed. For example, research could explore whether neighborhoods' social, demographic, and economic composition influence the desire of military personnel and their families to remain in the military. Which indicators, if any, are the most salient? Which individuals are most sensitive to the qualities of their neighborhoods? This knowledge could identify factors that the military would want to address or counterbalance to improve its ability to retain trained and experienced personnel. DoD already provides additional compensation to service members who serve overseas in locations where the QOL is well below what is typical in CONUS, with compensation rates reflecting the degree of hardship. For installations at the lowest end of the MNRI, where the neighborhood QOL is significantly below that of other locations, the services could extend a hardship-pay supplement in recognition of the additional challenges service members and their families face there.

Further, the MNRI could be an additional factor used in making staffing decisions. Service members who have served one or more tours at low-scoring bases could be given priority for a higher-ranked base or their base preference upon next assignment, given a spot available at those bases that fits the career path of the service member, as well as the service's needs.

Neighborhood Quality and Health

MNRI and domain scores could also be integrated into assessments of health outcomes, such as depression, posttraumatic stress disorder, and recovery from injuries, as well as behaviors, such as dietary choices, exercise habits, domestic violence, and suicide attempts. Previous work on civilian populations has demonstrated a connection between neighborhood characteristics and health behaviors and outcomes. Are vulnerable military populations who live in economically depressed neighborhoods at greater risk for depression and anxiety disorders than those living in other neighborhoods? Does living in a poor and unsafe neighborhood exacerbate posttraumatic stress disorder and delay healing? Neighborhood information can provide context for health and health behaviors and help health care providers understand and address additional types of stressors that might be in play. Counseling and medical care can be supplemented with additional strategies, such as helping vulnerable people move to better neighborhoods around or on base.

Addressing Neighborhood Challenges

The results of the neighborhood analysis suggest that neighborhoods can and do have an association with service member outcomes. Obviously, the services alone cannot fix all the problems in the areas where their bases, posts, and installations are located. This leaves two options. First, base leadership can work with community partners to make life better for everyone, military or civilian. As an example, the Army's Fort Carson has partnered with other federal agencies, local governments, businesses, and civilian community members to participate in the Pikes Peak Sustainability Indicator Project, which created a set of indicators to measure progress in the domains of the economy, wealth, and employment; housing and community facilities; land use and density; education and youth involvement; health and wellness; communications; recreation and culture; crime and safety; civic involvement and governance; and satisfaction (Lachman et al., 2009, pp. 100–103). The project began in 2003 and immediately grappled with narrowing down a wide range of indicators and finding suitable data, but this partnership leverages the ability of multiple organizations to help identify and provide information about the neighboring community and to come up with solutions to address its weaknesses.

Second, each service and installation management can provide services that substitute for what service members and their families cannot get in the external community. They could tailor the components of the MNRI to fit their purposes by including different types of indicators or domains. For example, if base leadership is particularly concerned about the well-being of children, an index focusing specifically on child-related indicators

could be created. Such an index might contain such indicators as the percentage of single parent–headed households, parent–teacher ratios at nearby schools, the capacity and quality of day-care facilities, the number of local pediatricians, or standardized test scores at local schools. Similarly, there is no reason that a ranking index like the MNRI has to include areas *external* to a base. It could just as easily be constructed with indicators that focus *on* a base and include such indicators as use of on-base recreation facilities, housing availability, or crime rates.

This information could be used to tailor base services, facilities, and activities to the needs of the population. Rather than distributing service resources across all bases equally or based on population size alone, resource allocation and base programming could take into account the characteristics of the surrounding neighborhood. For bases in neighborhoods with particularly poor employment markets, for example, a greater concentration of effort and resources could be devoted to help arriving spouses find suitable employment. Where transportation options are few, the base might sponsor shuttles for military members and their families to business centers, community colleges, and community recreational facilities, according to the interests of the base population. In sum, the MNRI and domain scores provide visibility of neighborhood characteristics to decisionmakers and program managers in Washington, D.C., who might not otherwise be aware of base-by-base variation in needs. It may also serve as a tool for service members to use in making decisions about where they may want to live.

Not only can the MNRI, or some derivative, be used to rank bases with respect to one another; it can also be used to track changes within a specific base over time. For example, have the neighborhood conditions around Bolling AFB gotten worse in the past five or ten years? Where might they be two, five, or even ten years from now? Again, individual base commanders and their support staff could use social indicators methodology to track progress (or decline) in base-level well-being over time. A requirement for this approach, however, is that consistent longitudinal data must be available.

Army Example

As we reported in Chapter Three, Fort Story, located in Virginia Beach, Virginia, had the lowest score on the housing domain of the MNRI. The domain is composed of four indicators: the percentage of the military neighborhood paying 35 percent or more of income in rent, the percentage of the military neighborhood paying 35 percent or more of income in homeownership costs, the percentage of units in the military neighborhood that are renter-occupied, and the (average) number of vacant housing units in the military neighborhood. The Fort Story military neighborhood scored well below the best military neighborhood on each of the indicators: 27 percent versus 10 percent for burdensome

rent, 19 percent versus 8 percent for homeowner costs, 50 percent versus 25 percent for renter- rather than homeowner-occupied units, and 2,546 versus 110 vacant housing units.

These neighborhood characteristics point to two possible actions on the part of installation management. First, the high percentage of the base neighborhood who are paying more than 35 percent of their income in rent or homeownership costs suggests that affordable housing is a problem in this area. Although the current BAH formula utilizes the average cost of rental units in the area (i.e., within a one-hour driving radius of the base or installation in traffic), it does not factor in the quality associated with the type of dwelling that can be rented at the median cost (e.g., is the building in good condition, is it located in a safe neighborhood). If a large portion of community members are spending more than one-third of their income on housing, it may suggest that, in order to find *quality* housing, they must spend more than the median. Cost for quality may be an additional measure that bases can factor into housing allowances.

Second, the high percentage of rental units and number of rental units suggests that residential turnover is also high, which may lead to low neighborhood cohesion. This turnover is likely influenced by the Navy, Marine Corps, Air Force, and other Army populations assigned to installations in the same area (Naval Station Norfolk, Joint Base Langley–Eustis). Thus the Virginia Beach area is home to many service members who often reside there for short periods of time. Navy personnel, who might hold residences there, may be gone to sea for extended periods of time. Fort Story could do more to create a sense of community despite high residential turnover by sponsoring both on-base community activities and off-base activities that integrate military and civilian community members. These activities could include neighborhood picnics, sports tournaments, and craft or cultural fairs. Regardless of the activity, the goal would be to focus on bringing community members together to create, and subsequently maintain, a sense of neighborhood unity. Together, housing allowance adjustments and community events could increase the financial and emotional well-being of Soldiers and their families by buffering against the particular sociodemographic and economic challenges surrounding Fort Story.

Air Force Example

In Chapter Four, we reported that, among Air Force officers who live off base, higher scores on the housing domain are associated with higher satisfaction with current housing. This was not true, however, for officers who live on base (in fact, the association was negative, but not significant). We also found that housing satisfaction ratings were significantly higher among officers who live off base than those who live on base. This means that living *off base* in a base neighborhood where housing is affordable

and residential turnover is low leads to more positive ratings of off-base residential living conditions.

The good news is that the Air Force does not necessarily need to do anything to improve housing options for officers who live in neighborhoods with high housing domain scores. The bad news is that it may need to do more for officers who live on base and for enlisted Airmen, regardless of whether they live on or off base. Additional efforts should then be taken to discern whether there are objective differences between on- and off-base housing or whether officers who live on base simply perceive their housing to be worse or less desirable for other reasons. A survey of on-base housing, especially in base neighborhoods where housing domain scores are high, could help to disentangle the two explanations for why the association between housing domain scores and ratings of housing satisfaction was not significant for on-base officers.

For enlisted Airmen, the problem could potentially be more complicated. They, too, could be comparing their on-base housing options with those available outside the gates and find them to be of lower quality. Lack of affordable housing may also be responsible for the nonsignificant results among both those who live on and off base. Enlisted Airmen typically have lower income than their officer counterparts, and, even though the local civilian neighborhood may not have a high percentage of individuals paying a large portion of their income in rent, mortgage, and other housing costs, the cost of housing may still be too high for many enlisted and their families. Again, the findings suggest that there is an association between the housing characteristics of a neighborhood and satisfaction with housing. This case is an example in which tapping into the expertise of local base service providers, such as the staff at the Airman and Family Readiness Centers or senior enlisted leaders, would likely shed additional light on housing concerns and help lead to strategies for addressing the challenges of enlisted Airmen and their families.

Appendix A. Detailed Army Results

This appendix provides material to supplement Chapter Four. Table A.1 contains additional information that readers may wish to review after reading the "Army Base Neighborhoods" section of Chapter Four because the domains and methods for arriving at these results are described there. After or while reading the "Multilevel Modeling Results" section of Chapter Four, readers may wish to view the additional results detailed in the remaining tables of this appendix.

Table A.1
Scores for All Army Military Neighborhoods on Six Domains and the Equally Weighted Index, or MNRI-D

Military Neighborhood	MNRI-D	Household Composition Domain	Social Domain	Employment Domain	Income and Poverty Domain	Transportation Domain	Housing Domain
Fort McPherson	–119.3	–48.2	–15.0	–159.1	–190.6	62.5	–338.4
Fort Story	–55.8	89.1	79.0	92.8	–1.7	52.6	–553.6
Hunter Army Airfield	–43.8	23.1	22.1	34.6	–77.2	61.2	–252.3
Fort Irwin	–43.1	55.1	45.1	6.7	–70.8	61.1	–292.9
Fort Lee	–42.8	12.4	9.6	25.1	–37.4	54.1	–262.3
Fort Bliss	–37.7	24.1	19.6	18.2	–79.1	53.9	–199.3
Fort Gordon	–34.9	19.1	23.1	21.7	–48.0	47.6	–222.7
Schofield Barracks	–26.7	35.7	50.9	31.8	–37.3	36.9	–237.9
Fort Rucker	–24.3	55.5	17.8	48.1	–91.0	54.6	–139.1
Fort Sill	–22.8	60.6	43.6	45.5	–62.3	61.4	–212.1
Fort Bragg	–22.4	41.6	45.8	28.4	–39.0	52.2	–217.4
Fort Benning	–20.8	18.0	21.8	44.3	–46.4	54.6	–161.1
Fort Campbell	–14.6	59.6	30.7	47.3	–32.0	50.7	–178.0
Fort Polk	–13.8	68.1	29.0	38.2	–55.3	41.9	–135.1
Fort Drum	–12.3	77.2	47.6	25.7	–73.1	65.0	–147.9
Fort Shafter	–12.2	39.5	52.3	52.9	–17.0	59.1	–214.9
Fort Stewart	–7.9	50.8	36.1	53.4	–72.9	45.5	–92.6
Fort Sam Houston	–2.1	44.5	52.7	59.5	–29.3	57.8	–149.3
Fort Huachuca	8.5	82.5	58.0	67.4	–27.1	56.8	–124.0

Military Neighborhood	MNRI-D	Household Composition Domain	Social Domain	Employment Domain	Income and Poverty Domain	Transportation Domain	Housing Domain
Fort Lewis	11.2	63.4	58.5	42.4	–24.8	44.6	–81.6
Fort Eustis	12.5	34.6	72.0	70.2	–2.6	50.6	–126.5
Fort Hood	13.2	63.4	48.3	53.7	–9.4	51.8	–85.4
Walter Reed Medical Center	15.4	55.2	62.1	60.6	32.1	68.2	–157.9
Fort Carson	15.7	68.7	57.5	66.2	3.9	55.0	–113.2
Fort Riley	19.0	88.6	79.9	45.9	–20.2	68.5	–108.6
Fort Wainwright	20.6	80.1	73.5	4.4	8.3	64.4	–97.9
Aberdeen Proving Ground	21.0	45.3	45.3	75.8	–10.3	41.5	–31.4
Fort Richardson	23.0	66.3	70.9	30.5	5.5	59.8	–80.2
Fort Myer	24.8	98.2	60.2	81.5	19.7	78.7	–127.4
Fort Knox	25.2	67.5	38.8	71.8	4.7	46.2	–29.4
Fort Jackson	28.9	56.8	68.1	73.0	23.2	51.6	–76.1
Fort Leonard Wood	39.7	81.6	62.4	79.2	10.2	63.1	–15.6
Fort Belvoir	45.4	58.7	62.9	88.3	46.9	39.8	–6.6
For Leavenworth	45.8	77.4	58.1	77.6	42.4	55.1	–6.9
Fort Meade	52.3	60.5	79.3	91.8	57.2	37.0	–6.9
West Point	58.5	80.0	83.7	98.5	29.3	42.9	38.2

Table A.2
Outcome Measures Used for Each Neighborhood, Army

Neighborhood	n	Attrition (%)	Separation (%)	BMI
Total	163,747	2.2	10.0	25.0
Aberdeen Proving Ground	834	1.5	12.2	26.1
Fort Belvoir	1,280	0.9	13.2	25.2
Fort Benning	7,219	2.1	9.8	25.1
Fort Bliss	5,162	2.2	9.7	25.1
Fort Bragg	20,724	2.2	8.6	24.6
Fort Campbell	13,321	2.2	8.2	24.7
Fort Carson	8,677	1.7	9.0	24.8
Fort Drum	5,116	2.5	12.9	25.0
Fort Eustis	3,073	2.5	11.5	25.1
Fort George Meade	1,893	2.4	14.0	25.1

Neighborhood	n	Attrition (%)	Separation (%)	BMI
Fort Gordon	3,959	2.0	13.3	25.1
Fort Hood	21,905	2.6	7.7	25.0
Fort Huachuca	2,727	2.2	12.8	24.9
Fort Irwin	2,670	2.1	12.8	25.0
Fort Jackson	2,690	1.8	9.8	25.4
Fort Knox	3,972	1.9	14.1	25.5
Fort Leavenworth	723	2.8	14.9	25.5
Fort Lee	1,792	3.1	9.3	25.2
Fort Leonard Wood	3,126	1.4	10.6	25.7
Fort Lewis	9,894	2.4	12.3	24.9
Fort McPherson	790	2.0	13.7	25.7
Fort Myer	921	0.9	14.0	24.7
Fort Polk	4,508	1.6	8.0	25.0
Fort Richardson	1,207	2.4	9.1	25.1
Fort Riley	5,200	2.6	10.7	24.8
Fort Rucker	1,737	2.8	27.6	25.3
Fort Sam Houston	2,854	1.8	12.5	25.3
Fort Shafter	272	1.3	11.9	25.3
Fort Sill	5,531	2.6	9.7	25.3
Fort Stewart	8,442	2.0	8.8	24.8
Fort Story	529	6.3	7.0	24.5
Fort Wainwright	1,936	3.1	8.0	25.0
Hunter Army Airfield	2,243	1.6	8.1	24.5
Schofield Barracks	5,295	2.8	6.6	24.7
West Point	450	1.5	11.5	26.2
Walter Reed	1,075	2.0	18.1	25.0

Table A.3
Results from the Basic Model, Army Enlisted

Outcome	Estimate	SE	p	OR
Attrition	–0.19	0.14	0.164	0.83
Separation	**0.29**	**0.14**	**0.040**	**1.33**
BMI	**0.43**	**0.19**	**0.026**	**NA**

NOTE: SE = standard error. p = probability (significant estimates are in bold).

Table A.4
Results from the Full Model for Attrition, Army Enlisted

Variable	Estimate	SE	p	OR
MNRI	–0.07	0.15	0.616	0.06
Married	**0.61**	**0.07**	**<0.001**	**1.84**
Spouse in Army	–0.24	0.19	0.208	0.79
Male	**–0.90**	**0.06**	**<0.001**	**0.41**
Age (in years)	**0.04**	**0.01**	**<0.001**	**1.04**
Black[a]	–0.07	0.06	0.257	0.93
Hispanic[a]	**–0.21**	**0.09**	**0.022**	**0.81**
Asian[a]	**–0.46**	**0.16**	**0.005**	**0.63**
Native American	0.01	0.25	0.974	1.01
Race or ethnicity unknown[a]	–0.24	0.16	0.138	0.78
College education	**–0.52**	**0.09**	**<0.001**	**0.60**
AFQT	0.00	0.00	0.241	1.00
Number of dependent adults	**–0.85**	**0.07**	**<0.001**	**0.43**
Number of dependent children	0.00	0.03	0.993	1.00
Years of service	**–0.19**	**0.01**	**<0.001**	**0.83**
Time in grade	**0.10**	**0.01**	**<0.001**	**1.11**
Prior OCONUS deployment	**–0.16**	**0.05**	**0.001**	**0.85**
MOS: combat support[b]	–0.007	0.08	0.426	0.94
MOS: combat service support[b]	–0.04	0.07	0.596	0.96
MOS: other[b]	–0.03	0.10	0.736	0.97
Intercept	**–2.80**	**0.21**	**<0.001**	**0.06**

NOTE: Significant estimates are in bold.
[a] White is the reference group.
[b] Combat is the reference group.

Table A.5
Results from the Full Model for Separation, Army Enlisted

Variable	Estimate	SE	p	OR
MNRI	**0.17**	**0.18**	**<0.001**	**0.02**
Married	**0.15**	**0.04**	**<0.001**	**1.16**
Spouse in Army	**–1.02**	**0.07**	**<0.001**	**0.36**
Male	–0.04	0.04	0.333	0.96
Age (in years)	**0.04**	**0.00**	**<0.001**	**1.05**
Black[a]	**–0.19**	**0.03**	**<0.001**	**0.83**
Hispanic[a]	–0.03	0.05	0.542	0.97
Asian[a]	**–0.19**	**0.08**	**0.018**	**0.82**
Native American[a]	–0.20	0.16	0.204	0.82
Race or ethnicity unknown[a]	**–0.20**	**0.08**	**0.014**	**0.82**
College education	0.03	0.03	0.320	1.04
AFQT	**0.00**	**0.00**	**0.024**	**1.00**
Number of dependent adults	**–0.41**	**0.03**	**<0.001**	**0.66**
Number of dependent children	**–0.20**	**0.01**	**<0.001**	**0.82**
Years of service	**–0.05**	**0.00**	**<0.001**	**0.95**
Time in grade	**0.22**	**0.01**	**<0.001**	**1.25**
Prior OCONUS deployment	**0.31**	**0.03**	**<0.001**	**1.36**
MOS: combat support[b]	**0.13**	**0.04**	**0.005**	**1.13**
MOS: combat service support[b]	**0.08**	**0.04**	**0.023**	**1.09**
MOS: other[b]	**0.20**	**0.05**	**<0.001**	**1.22**
Intercept	**–4.06**	**0.13**	**<0.001**	**0.02**

NOTE: Significant estimates are in bold.
[a] White is the reference group.
[b] Combat is the reference group.

Table A.6
Results from the Full Model for Body Mass Index, Army Enlisted

Variable	Estimate	SE	p
MNRI	0.15	0.09	0.070
Married	**0.28**	**0.04**	**<0.001**
Spouse in Army	**–0.26**	**0.05**	**<0.001**
Male	**1.33**	**0.04**	**<0.001**
Age (in years)	**0.13**	**0.00**	**<0.001**
Black[a]	**0.60**	**0.03**	**<0.001**
Hispanic[a]	**0.58**	**0.04**	**<0.001**
Asian[a]	**0.31**	**0.07**	**<0.001**
Native American	**0.52**	**0.13**	**<0.001**
Race or ethnicity unknown[a]	**0.39**	**0.07**	**<0.001**
College education	**0.18**	**0.03**	**<0.001**
AFQT	**0.01**	**0.00**	**<0.001**
Number of dependent adults	**–0.08**	**0.03**	**0.012**
Number of dependent children	**0.09**	**0.01**	**<0.001**
Years of service	0.00	0.00	0.841
Time in grade	**0.07**	**0.01**	**<0.001**
Prior OCONUS deployment	–0.03	0.02	0.265
MOS: combat support[b]	–0.05	0.04	0.208
MOS: combat service support[b]	–0.04	0.03	0.202
MOS: other[b]	**0.11**	**0.04**	**0.009**
Intercept	**19.14**	**0.11**	**<0.001**

NOTE: Significant estimates are in bold.
[a] White is the reference group.
[b] Combat is the reference group.

Table A.7
Association Between Outcomes and the Housing Domain, Army Enlisted

	Basic				Full			
Outcome	**Est.**	**SE**	**p**	**OR**	**Est.**	**SE**	**p**	**OR**
Attrition	–0.07	0.05	0.140	0.93	–0.01	0.05	0.860	0.99
Separation	0.08	0.05	0.107	1.08	0.06	0.06	0.337	1.06
BMI	**0.18**	**0.06**	**0.004**	**NA**	**0.08**	**0.03**	**0.004**	**NA**

NOTE: Est. = estimate. Significant estimates are in bold.

Table A.8
Number of Cases and Outcomes for Neighborhoods in the Army Officer Analysis

Neighborhood	n	Attrition (%)	Separation (%)	BMI
Total	32,322	2.45	6.36	25.32
Aberdeen Proving Ground	286	0.38	7.02	25.63
Fort Belvoir	739	0.29	7.87	25.13
Fort Benning	1,495	1.98	5.73	25.63
Fort Bliss	1,089	2.05	5.90	25.17
Fort Bragg	3,923	2.71	4.32	25.19
Fort Campbell	1,744	1.80	4.43	25.28
Fort Carson	1,175	3.58	7.66	25.22
Fort Drum	818	0.93	7.77	25.30
Fort Eustis	364	2.45	10.67	25.57
Fort George Meade	348	4.04	7.76	24.95
Fort Gordon	1,025	3.04	7.23	25.21
Fort Hood	3,221	2.11	4.47	25.26
Fort Huachuca	558	3.61	5.94	25.04
Fort Irwin	503	0.84	4.81	25.44
Fort Jackson	698	1.31	12.90	25.23
Fort Knox	728	2.81	7.19	25.73
Fort Leavenworth	1,732	0.72	4.24	25.73
Fort Lee	720	2.53	6.83	25.32
Fort Leonard Wood	832	2.70	6.66	25.26
Fort Lewis	1,398	4.71	6.06	25.35
Fort McPherson	632	0.54	12.40	26.23
Fort Myer	268	5.15	65.02	25.20
Fort Polk	761	2.19	4.30	25.49
Fort Richardson	760	6.28	1.68	25.44
Fort Riley	533	5.24	3.56	25.24
Fort Rucker	1,847	2.59	6.22	25.04
Fort Sam Houston	978	1.64	6.54	25.63
Fort Shafter	1,070	4.34	3.22	25.23
Fort Sill	33	3.45	12.50	25.59
Fort Stewart	237	5.24	3.56	25.03
Fort Story	790	0.94	5.75	25.42
Fort Wainwright	1,017	1.51	8.77	24.82

Table A.9
Results from the Basic Model, Army Officers

Outcome	Estimate	SE	p	OR
Attrition	–0.20	0.39	0.605	0.82
Separation	**0.03**	**0.24**	**0.893**	**1.03**
BMI	**–0.18**	**0.16**	**0.242**	**NA**

NOTE: Significant estimates are in bold.

Table A.10
Results from the Full Model for Attrition, Army Officers

Variable	Estimate	SE	p	OR
MNRI	–0.15	0.33	0.653	0.86
Married	0.24	0.19	0.208	1.27
Male	**–0.41**	**0.18**	**0.019**	**0.66**
Age (in years)	–0.01	0.02	0.724	0.99
Black[a]	–0.10	0.20	0.614	0.90
Hispanic[a]	0.03	0.29	0.928	1.03
Asian[a]	–0.54	0.37	0.140	0.58
Native American[a]	–5.50	11.58	0.635	0.00
Race or ethnicity unknown[a]	–0.54	0.59	0.363	0.58
College education	**–0.64**	**0.27**	**0.016**	**0.53**
Number of dependent adults	**–0.53**	**0.18**	**0.004**	**0.59**
Number of dependent children	0.03	0.06	0.593	1.03
Years of service	**–0.14**	**0.02**	**<0.001**	**0.87**
Time in grade	**0.33**	**0.04**	**<0.001**	**1.39**
O1[b] (second lieutenant)	**–1.67**	**0.85**	**0.049**	**0.19**
O2[b] (first lieutenant)	–1.44	0.78	0.065	0.24
O3[b] (captain)	–0.74	0.72	0.305	0.48
O4[b] (major)	–0.82	0.65	0.209	0.44
O5[b] (lieutenant colonel)	–0.99	0.71	0.166	0.37
Prior OCONUS deployment	0.15	0.14	0.284	1.17
Combat service support[c]	0.08	0.20	0.676	1.09
Combat[c]	0.06	0.20	0.752	1.07
Intercept	–1.65	1.18	0.172	0.19

NOTE: Significant estimates are in bold.
[a] White is the reference group.
[b] O6 (colonel) is the reference group.
[c] Combat support is the reference group.

Table A.11
Results from the Full Model for Separation, Army Officers

Variable	Estimate	SE	p	OR
MNRI	–0.05	0.32	0.872	0.95
Married	0.18	0.14	0.205	1.20
Male	**–0.34**	**0.13**	**0.010**	**0.71**
Age (in years)	0.01	0.02	0.351	1.01
Black[a]	–0.20	0.15	0.184	0.82
Hispanic[a]	–0.46	0.27	0.085	0.63
Asian[a]	–0.18	0.25	0.469	0.83
Native American[a]	0.42	0.42	0.365	1.53
Race or ethnicity unknown[a]	–0.31	0.39	0.423	0.73
College education	**–0.58**	**0.23**	**0.012**	**0.56**
Number of dependent adults	–0.16	0.11	0.157	0.85
Number of dependent children	**–0.17**	**0.05**	**<0.001**	**0.84**
Years of service	**–0.04**	**0.02**	**0.020**	**0.96**
Time in grade	**0.21**	**0.02**	**<0.001**	**1.23**
O1[b] (second lieutenant)	**–2.11**	**0.54**	**<0.001**	**0.12**
O2[b] (first lieutenant)	**–1.24**	**0.37**	**0.001**	**0.29**
O3[b] (captain)	**–0.97**	**0.31**	**0.002**	**0.38**
O4[b] (major)	**–1.30**	**0.25**	**<0.001**	**0.27**
O5[b] (lieutenant colonel)	–0.25	0.21	0.228	0.78
Prior OCONUS deployment	**0.35**	**0.10**	**<0.001**	**1.42**
Combat service support[c]	–0.003	0.15	0.847	0.97
Combat[c]	**0.00**	**0.15**	**1.00**	**1.00**
Intercept	**–2.45**	**0.69**	**0.001**	**0.09**

NOTE: Significant estimates are in bold.
[a] White is the reference group.
[b] O6 (colonel) is the reference group.
[c] Combat support is the reference group.

Table A.12
Results from the Full Model for Body Mass Index, Army Officers

Variable	Estimate	SE	p
MNRI	–0.03	0.08	0.74
Married	0.02	0.05	0.74
Male	**2.55**	**0.05**	**<0.001**
Age (in years)	**0.04**	**0.01**	**<0.001**
Black[a]	**0.76**	**0.05**	**<0.001**
Hispanic[a]	**0.28**	**0.07**	**<0.001**
Asian[a]	**–0.24**	**0.09**	**<0.001**
Native American[a]	0.38	0.20	0.056
Race or ethnicity unknown[a]	**0.27**	**0.12**	**0.029**
College education	**0.18**	**0.09**	**0.043**
Number of dependent adults	**0.10**	**0.04**	**0.009**
Number of dependent children	**0.10**	**0.04**	**0.010**
Years of service	**0.04**	**0.01**	**0.001**
Time in grade	0.01	0.01	0.178
Prior OCONUS deployment	0.00	0.04	0.937
O1[b] (second lieutenant)	**1.10**	**0.14**	**<0.001**
O2[b] (first lieutenant)	**0.96**	**0.13**	**<0.001**
O3[b] (captain)	**0.72**	**0.12**	**<0.001**
O4[b] (major)	**0.69**	**0.10**	**<0.001**
O5[b] (lieutenant colonel)	**0.35**	**0.09**	**<0.001**
Combat service support[c]	0.06	0.05	0.183
Combat[c]	**0.16**	**0.05**	**0.001**
Intercept	**20.35**	**0.25**	**<0.001**

NOTE: Significant estimates are in bold.
[a] White is the reference group.
[b] O6 (colonel) is the reference group.
[c] Combat support is the reference group.

Table A.13
Association Between Outcomes and the Income and Poverty Domain, Army Officers

	Unadjusted				Adjusted			
Outcome	**Est.**	**SE**	**p**	**OR**	**Est.**	**SE**	**p**	**OR**
Attrition	–0.45	0.29	0.12	0.64	–0.43	0.28	0.12	0.65
Separation	**0.40**	**0.18**	**0.03**	**1.49**	0.09	0.17	0.58	1.10
BMI	–0.05	0.12	0.68	NA	–0.04	0.08	0.62	NA

NOTE: Est. = estimate. Significant estimates are in bold.

Appendix B. Detailed Air Force Results

This appendix provides material to supplement Chapter Five. Table B.1 provides additional information that readers may wish to review after reading the "Air Force Base Neighborhoods" section of Chapter Five because the domains and methods for arriving at these results are described there. After or while reading the "Multilevel Modeling Results" section of Chapter Five, readers may wish to view the additional results detailed in the remaining tables of this appendix.

Table B.1
Scores for All Air Force Military Neighborhoods on Six Domains and the Equally Weighted Index

Military Neighborhood	MNRI-D	Household Composition Domain	Social Domain	Employment Domain	Income and Poverty Domain	Transportation Domain	Housing Domain
Altus AFB	–69.6	43.1	–81.1	47.7	–129.5	62.1	–191.2
Andrews AFB	–34.9	–55.8	–25.2	22.9	11.6	8.6	–158.4
Barksdale AFB	–15.5	26.8	–32.8	58.6	–34.2	43.8	–68.8
Beale AFB	–83.0	30.9	–86.5	–14.3	–140.8	31.5	–182.6
Bolling AFB	–234.9	–198.2	–174.8	–186.3	–278.2	43.9	–522.4
Brooks AFB	–109.2	–21.3	–175.9	19.3	–133.8	41.1	–199.5
Buckley AFB	–44.7	12.6	–70.2	40.7	–35.3	32.8	–147.7
Cannon AFB	–113.1	32.9	–99.3	9.1	–178.3	59.7	–315.9
Charleston AFB	–86.7	0.3	–88.6	10.4	–100.1	47.7	–259.9
Davis-Monthan AFB	–115.0	1.0	–120.9	23.2	–125.1	46.1	–341.5
Dover AFB	–39.7	17.2	–60.4	22.7	–40.6	47.1	–132.1
Dyess AFB	–20.4	52.2	–8.9	34.1	–30.8	59.8	–148.4
Edwards AFB	–141.0	–3.2	–119.5	–71.8	–199.5	17.3	–322.4
Eglin AFB	–41.7	55.7	–35.2	52.5	–59.4	31.4	–179.8
Eielson AFB	13.4	80.3	28.8	–3.2	0.2	49.6	–45.8
Ellsworth AFB	–48.8	23.0	–40.1	21.4	–110.2	61.9	–139.4
Elmendorf AFB	–50.0	28.7	–17.3	–23.4	–67.0	58.7	–211.7
F. E. Warren AFB	–22.6	67.1	7.2	40.3	–75.0	60.5	–140.7
Fairchild AFB	–24.2	75.7	–21.6	–14.5	–67.6	47.7	–82.7
Goodfellow AFB	–76.1	36.5	–104.6	9.9	–98.1	54.4	–203.3
Grand Forks AFB	–36.3	79.7	39.9	59.5	–4.0	62.3	–370.6
Hanscom AFB	25.4	76.0	59.1	87.5	6.3	41.1	–69.1
Hickam AFB	–62.8	6.8	–45.5	33.7	–61.5	45.4	–254.5

Military Neighborhood	MNRI-D	Household Composition Domain	Social Domain	Employment Domain	Income and Poverty Domain	Transportation Domain	Housing Domain
Hill AFB	–3.2	39.3	14.4	34.4	–25.4	42.3	–76.0
Holloman AFB	–105.6	43.8	–60.4	18.5	–148.3	48.1	–372.4
Hurlburt Field	–42.7	53.2	–9.6	50.0	–60.0	41.1	–227.7
Keesler AFB	–86.1	12.4	–94.2	20.2	–124.3	57.8	–236.4
Kirtland AFB	–116.9	13.8	–103.2	–10.8	–166.9	50.5	–318.7
Lackland AFB	–122.2	–49.6	–207.5	–2.0	–174.2	41.9	–148.6
Langley AFB	5.0	44.1	18.8	73.7	32.6	45.1	–134.5
Laughlin AFB	–155.7	21.3	–228.1	–45.8	–212.5	53.8	–276.6
Little Rock AFB	–48.3	37.3	–52.1	26.7	–57.2	38.0	–176.8
Los Angeles AFB	–100.3	–5.5	–117.0	–13.1	–112.3	36.9	–254.2
Luke AFB	–29.9	26.3	–70.9	37.3	11.1	25.9	–123.3
MacDill AFB	–35.7	50.6	–33.9	50.2	–45.1	48.0	–175.4
Malmstrom AFB	–51.4	54.2	–27.9	15.5	–137.1	63.6	–151.9
Maxwell AFB	–122.5	–53.1	–141.7	–17.9	–200.8	50.9	–212.7
McChord AFB	–58.4	20.0	–33.8	8.0	–95.4	36.0	–192.2
McConnell AFB	–35.7	43.8	–41.4	29.3	–68.7	53.8	–125.4
McGuire AFB	6.2	65.2	–41.0	84.3	23.9	47.9	–44.8
Minot AFB	–1.1	63.0	29.4	52.5	–73.2	68.3	–67.5
Moody AFB	–79.6	9.1	–109.0	33.6	–116.8	50.7	–187.5
Mountain Home AFB	–43.2	65.6	4.2	52.3	–62.1	52.8	–265.1
Nellis AFB	–162.1	–10.5	–245.6	–46.8	–145.6	38.7	–341.7
Offutt AFB	–10.1	39.3	–29.6	53.9	–33.4	51.1	–54.3
Patrick AFB	–18.7	80.4	40.8	62.9	18.9	38.1	–288.0
Peterson AFB	–33.4	23.0	–23.7	25.2	–49.9	44.1	–142.8
Pope AFB	–50.5	14.7	–17.0	22.3	–55.9	42.0	–232.2

Military Neighborhood	MNRI-D	Household Composition Domain	Social Domain	Employment Domain	Income and Poverty Domain	Transportation Domain	Housing Domain
Randolph AFB	4.0	45.9	2.0	48.4	–3.7	37.5	–51.8
Robins AFB	–28.0	28.9	–31.7	48.9	–46.9	46.8	–121.8
Schriever AFB	–10.0	78.0	–5.0	54.0	–35.6	3.7	–72.0
Scott AFB	8.0	52.6	10.2	59.9	–1.1	40.0	–56.0
Seymour Johnson AFB	–69.1	14.5	–95.9	26.8	–76.2	44.7	–195.1
Shaw AFB	–22.4	28.0	–52.9	42.6	–49.8	42.8	–48.9
Sheppard AFB	–34.7	31.7	–61.7	72.4	–93.0	55.8	–76.0
Tinker AFB	–42.5	1.1	–44.0	36.0	–76.0	49.3	–128.0
Travis AFB	–40.4	29.7	–46.6	32.0	–38.6	21.7	–151.4
Tyndall AFB	–73.9	26.2	–69.7	42.9	–94.1	38.4	–247.6
U.S. Air Force Academy	39.1	79.4	84.0	76.3	32.1	42.7	–60.9
Vandenberg AFB	–50.7	38.0	–68.4	9.1	–79.9	40.8	–130.7
Whiteman AFB	21.5	72.7	–2.6	97.4	0.7	61.7	–10.3
Wright-Patterson AFB	11.5	51.2	–17.4	34.0	1.7	45.8	–116.4

Table B.2
Satisfaction with Current Housing, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Household Composition Domain						
Officer	Basic	On Base	–0.07	0.09	0.419	NA
		Off Base	**0.24**	**0.12**	**0.051**	
	Full	On Base	–0.03	0.09	0.710	NS
		Off Base	**0.26**	**0.13**	**0.042**	
Enlisted	Basic	On Base	–0.09	0.07	0.181	***
		Off Base	0.13	0.07	0.085	
	Full	On Base	–0.07	0.07	0.350	NS
		Off Base	0.03	0.08	0.683	
B. Transportation Domain						
Officer	Basic	On Base	**–0.54**	**0.25**	**0.027**	*
		Off Base	0.24	0.32	0.452	
	Full	On Base	**–0.55**	**0.26**	**0.032**	*
		Off Base	0.31	0.34	0.357	
Enlisted	Basic	On Base	–0.27	0.18	0.144	NS
		Off Base	–0.04	0.19	0.835	
	Full	On Base	–0.24	0.19	0.219	NS
		Off Base	–0.08	0.21	0.717	
C. Housing Domain						
Officer	Basic	On Base	–0.01	0.03	0.842	*
		Off Base	0.08	0.04	0.053	
	Full	On Base	–0.01	0.03	0.761	*
		Off Base	**0.09**	**0.04**	**0.050**	
Enlisted	Basic	On Base	–0.01	0.02	0.781	*
		Off Base	0.04	0.03	0.171	
	Full	On Base	0.01	0.03	0.653	NS
		Off Base	0.04	0.03	0.178	

NOTE: B = coefficient. Diff. = significant difference between on- and off-base estimates. NS = not significant. Significant estimates are in bold. * = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$.

Table B.3
Satisfaction with Housing Stock, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Transportation Domain						
Officer	Basic	On Base	**–0.54**	**0.25**	**0.027**	*
		Off Base	0.24	0.32	0.452	
	Full	On Base	**–0.55**	**0.26**	**0.032**	*
		Off Base	0.31	0.34	0.357	
Enlisted	Basic	On Base	–0.27	0.18	0.144	NS
		Off Base	–0.04	0.19	0.835	
	Full	On Base	–0.24	0.19	0.219	NS
		Off Base	–0.08	0.21	0.717	
B. Housing Domain						
Officer	Basic	On Base	–0.01	0.03	0.842	*
		Off Base	0.08	0.04	0.053	
	Full	On Base	–0.01	0.03	0.761	*
		Off Base	**0.09**	**0.04**	**0.050**	
Enlisted	Basic	On Base	–0.01	0.02	0.781	*
		Off Base	0.04	0.03	0.171	
	Full	On Base	0.01	0.03	0.653	NS
		Off Base	0.04	0.03	0.178	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates. * = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$. NS = not significant.

Table B.4
Rating of the Civilian Area as a Place to Live, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Overall MNRI						
Officer	Basic	On Base	**0.53**	**0.14**	**<0.001**	**
		Off Base	**0.79**	**0.16**	**<0.001**	
	Full	On Base	**0.54**	**0.14**	**<0.001**	**
		Off Base	**0.83**	**0.16**	**<0.001**	
Enlisted	Basic	On Base	**0.55**	**0.12**	**<0.001**	*
		Off Base	**0.64**	**0.13**	**<0.001**	
	Full	On Base	**0.62**	**0.12**	**<0.001**	*
		Off Base	**0.73**	**0.13**	**<0.001**	

Rank	Model	Residence	B	SE	p	Diff.
B. Household Composition Domain						
Officer	Basic	On Base	**0.52**	**0.23**	**0.026**	**
		Off Base	**0.87**	**0.25**	**0.001**	
	Full	On Base	**0.53**	**0.23**	**0.021**	**
		Off Base	**0.96**	**0.26**	**<0.001**	
Enlisted	Basic	On Base	**0.64**	**0.20**	**0.001**	NS
		Off Base	**0.74**	**0.20**	**<0.001**	
	Full	On Base	**0.74**	**0.20**	**<0.001**	NS
		Off Base	**0.88**	**0.20**	**<0.001**	
C. Social Domain						
Officer	Basic	On Base	**0.42**	**0.11**	**<0.001**	**
		Off Base	**0.60**	**0.12**	**<0.001**	
	Full	On Base	**0.43**	**0.11**	**<0.001**	**
		Off Base	**0.63**	**0.12**	**<0.001**	
Enlisted	Basic	On Base	**0.39**	**0.10**	**<0.001**	NS
		Off Base	**0.44**	**0.10**	**<0.001**	
	Full	On Base	**0.43**	**0.10**	**<0.001**	NS
		Off Base	**0.50**	**0.10**	**<0.001**	
D. Employment Domain						
Officer	Basic	On Base	**0.60**	**0.21**	**0.006**	*
		Off Base	**0.88**	**0.23**	**<0.001**	
	Full	On Base	**0.59**	**0.21**	**0.006**	*
		Off Base	**0.92**	**0.23**	**<0.001**	
Enlisted	Basic	On Base	**0.70**	**0.18**	**<0.001**	NS
		Off Base	**0.82**	**0.18**	**<0.001**	
	Full	On Base	**0.77**	**0.18**	**<0.001**	NS
		Off Base	**0.86**	**0.18**	**<0.001**	
E. Income and Poverty Domain						
Officer	Basic	On Base	**0.52**	**0.11**	**<0.001**	NS
		Off Base	**0.65**	**0.12**	**<0.001**	
	Full	On Base	**0.52**	**0.11**	**<0.001**	NS
		Off Base	**0.66**	**0.12**	**<0.001**	
Enlisted	Basic	On Base	**0.48**	**0.09**	**<0.001**	NS
		Off Base	**0.54**	**0.09**	**<0.001**	
	Full	On Base	**0.52**	**0.09**	**<0.001**	NS
		Off Base	**0.58**	**0.10**	**<0.001**	

Rank	Model	Residence	B	SE	p	Diff.
F. Housing Domain						
Officer	Basic	On Base	0.16	0.09	0.061	NS
		Off Base	**0.25**	**0.09**	**0.007**	
	Full	On Base	0.16	0.09	0.062	*
		Off Base	**0.27**	**0.09**	**0.004**	
Enlisted	Basic	On Base	**0.16**	**0.07**	**0.033**	*
		Off Base	**0.21**	**0.07**	**0.005**	
	Full	On Base	**0.18**	**0.07**	**0.014**	NS
		Off Base	**0.23**	**0.08**	**0.002**	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates. * = p < 0.05. ** = p < 0.01. *** = p < 0.001. NS = not significant.

Table B.5
Rating of Civilian Friendliness, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Overall MNRI						
Officer	Basic	On Base	0.07	0.08	0.354	**
		Off Base	**0.23**	**0.09**	**0.008**	
	Full	On Base	0.08	0.08	0.275	*
		Off Base	**0.24**	**0.09**	**0.009**	
Enlisted	Basic	On Base	0.10	0.08	0.173	***
		Off Base	**0.24**	**0.08**	**0.002**	
	Full	On Base	0.10	0.08	0.173	*
		Off Base	**0.24**	**0.08**	**0.002**	
B. Household Composition Domain						
Officer	Basic	On Base	0.11	0.11	0.323	**
		Off Base	**0.40**	**0.13**	**0.003**	
	Full	On Base	0.14	0.11	0.230	**
		Off Base	**0.41**	**0.14**	**0.003**	
Enlisted	Basic	On Base	0.21	0.11	0.051	***
		Off Base	**0.44**	**0.11**	**<0.001**	
	Full	On Base	**0.24**	**0.10**	**0.017**	***
		Off Base	**0.47**	**0.11**	**<0.001**	
C. Social Domain						
Officer	Basic	On Base	0.04	0.06	0.513	*
		Off Base	**0.14**	**0.07**	**0.046**	

Rank	Model	Residence	B	SE	p	Diff.
	Full	On Base	0.05	0.06	0.405	NS
		Off Base	0.13	0.07	0.056	
Enlisted	Basic	On Base	0.03	0.06	0.664	***
		Off Base	**0.13**	**0.06**	**0.036**	
	Full	On Base	0.05	0.06	0.410	*
		Off Base	**0.12**	**0.06**	**0.038**	
D. Employment Domain						
Officer	Basic	On Base	0.17	0.11	0.110	NS
		Off Base	**0.32**	**0.12**	**0.007**	
	Full	On Base	0.18	0.11	0.093	NS
		Off Base	**0.34**	**0.12**	**0.005**	
Enlisted	Basic	On Base	**0.20**	**0.10**	**0.050**	NS
		Off Base	**0.33**	**0.10**	**0.002**	
	Full	On Base	**0.22**	**0.10**	**0.031**	NS
		Off Base	**0.28**	**0.10**	**0.005**	
E. Income and Poverty Domain						
Officer	Basic	On Base	0.06	0.06	0.309	NS
		Off Base	0.12	0.07	0.073	
	Full	On Base	0.07	0.06	0.261	NS
		Off Base	0.12	0.07	0.088	
Enlisted	Basic	On Base	0.09	0.06	0.121	*
		Off Base	**0.16**	**0.06**	**0.010**	
	Full	On Base	0.10	0.06	0.065	NS
		Off Base	**0.12**	**0.06**	**0.032**	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates. * = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$. NS = not significant.

Table B.6
Satisfaction with Base Assignment, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Overall MNRI						
Officer	Basic	On Base	0.16	0.08	0.059	NS
		Off Base	0.12	0.10	0.232	
	Full	On Base	**0.18**	**0.08**	**0.022**	NS
		Off Base	0.15	0.10	0.143	
Enlisted	Basic	On Base	0.11	0.10	0.282	NS
		Off Base	0.19	0.10	0.055	
	Full	On Base	0.17	0.10	0.077	NS
		Off Base	**0.20**	**0.10**	**0.049**	
B. Income and Poverty Domain						
Officer	Basic	On Base	**0.20**	**0.07**	**0.002**	NS
		Off Base	0.12	0.08	0.137	
	Full	On Base	**0.22**	**0.06**	**<0.001**	NS
		Off Base	0.13	0.08	0.086	
Enlisted	Basic	On Base	**0.19**	**0.07**	**0.011**	NS
		Off Base	**0.23**	**0.07**	**0.002**	
	Full	On Base	**0.23**	**0.07**	**0.002**	NS
		Off Base	**0.23**	**0.08**	**0.003**	
C. Transportation Domain						
Officer	Basic	On Base	**–1.06**	**0.34**	**0.002**	NS
		Off Base	–0.76	0.41	0.065	
	Full	On Base	**–1.10**	**0.33**	**0.001**	NS
		Off Base	–0.65	0.41	0.112	
Enlisted	Basic	On Base	–0.72	0.39	0.063	NS
		Off Base	–0.66	0.39	0.093	
	Full	On Base	–0.44	0.39	0.262	NS
		Off Base	–0.52	0.40	0.191	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates. *p < 0.05. ** = p < 0.01. *** = p < 0.001. NS = not significant.

Table B.7
Neighborhood Cohesion, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Overall MNRI						
Officer	Basic	On Base	0.10	0.06	0.072	*
		Off Base	–0.07	0.08	0.397	
	Full	On Base	**0.12**	**0.05**	**0.016**	*
		Off Base	–0.08	0.08	0.303	
Enlisted	Basic	On Base	**0.10**	**0.04**	**0.022**	NS
		Off Base	0.06	0.05	0.201	
	Full	On Base	**0.12**	**0.05**	**0.008**	NS
		Off Base	0.06	0.05	0.293	
B. Social Domain						
Officer	Basic	On Base	**0.10**	**0.04**	**0.026**	**
		Off Base	–0.07	0.06	0.257	
	Full	On Base	**0.12**	**0.04**	**0.003**	***
		Off Base	–0.08	0.06	0.180	
Enlisted	Basic	On Base	**0.07**	**0.03**	**0.031**	NS
		Off Base	0.02	0.04	0.563	
	Full	On Base	**0.08**	**0.04**	**0.023**	NS
		Off Base	0.02	0.04	0.563	
C. Employment Domain						
Officer	Basic	On Base	**0.23**	**0.08**	**0.005**	*
		Off Base	0.02	0.11	0.863	
	Full	On Base	**0.22**	**0.07**	**0.002**	*
		Off Base	0.01	0.10	0.958	
Enlisted	Basic	On Base	**0.23**	**0.06**	**<0.001**	NS
		Off Base	**0.13**	**0.06**	**0.031**	
	Full	On Base	**0.24**	**0.06**	**<0.001**	NS
		Off Base	**0.15**	**0.07**	**0.028**	
D. Income and Poverty Domain						
Officer	Basic	On Base	**0.10**	**0.05**	**0.027**	*
		Off Base	–0.04	0.06	0.496	
	Full	On Base	**0.11**	**0.04**	**0.007**	**
		Off Base	–0.05	0.06	0.423	
Enlisted	Basic	On Base	**0.09**	**0.03**	**0.010**	NS
		Off Base	0.05	0.04	0.181	
	Full	On Base	**0.09**	**0.04**	**0.013**	NS

Rank	Model	Residence	B	SE	p	Diff.
		Off Base	0.03	0.04	0.388	
E. Housing Domain						
Officer	Basic	On Base	0.06	0.03	0.089	NS
		Off Base	–0.01	0.04	0.795	
	Full	On Base	0.05	0.03	0.067	NS
		Off Base	–0.01	0.04	0.796	
Enlisted	Basic	On Base	0.03	0.02	0.147	NS
		Off Base	0.03	0.02	0.264	
	Full	On Base	**0.05**	**0.02**	**0.028**	NS
		Off Base	0.02	0.03	0.408	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates.* = p < 0.05. ** = p < 0.01. *** = p < 0.001. NS = not significant.

Table B.8
Residence and Neighborhood Safety, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Overall MNRI						
Officer	Basic	On Base	**0.13**	**0.04**	**0.001**	NS
		Off Base	0.08	0.05	0.136	
	Full	On Base	**0.13**	**0.04**	**0.001**	NS
		Off Base	**0.09**	**0.05**	**0.118**	
Enlisted	Basic	On Base	**0.17**	**0.04**	**<0.001**	NS
		Off Base	**0.16**	**0.04**	**<0.001**	
	Full	On Base	**0.20**	**0.05**	**<0.001**	NS
		Off Base	**0.13**	**0.05**	**0.006**	
B. Household Composition Domain						
Officer	Basic	On Base	**0.20**	**0.05**	**<0.001**	NS
		Off Base	**0.20**	**0.08**	**0.010**	
	Full	On Base	**0.22**	**0.05**	**<0.001**	NS
		Off Base	**0.21**	**0.08**	**0.010**	
Enlisted	Basic	On Base	**0.29**	**0.06**	**<0.001**	**
		Off Base	**0.40**	**0.06**	**<0.001**	
	Full	On Base	**0.31**	**0.06**	**<0.001**	NS
		Off Base	**0.36**	**0.07**	**<0.001**	
C. Social Domain						
Officer	Basic	On Base	**0.12**	**0.03**	**<0.001**	NS

Rank	Model	Residence	B	SE	p	Diff.
		Off Base	0.04	0.04	0.321	
	Full	On Base	**0.11**	**0.03**	**<0.001**	NS
		Off Base	0.04	0.04	0.328	
Enlisted	Basic	On Base	**0.14**	**0.03**	**<0.001**	NS
		Off Base	**0.11**	**0.03**	**0.001**	
	Full	On Base	**0.16**	**0.04**	**<0.001**	NS
		Off Base	**0.10**	**0.04**	**0.010**	
D. Employment Domain						
Officer	Basic	On Base	**0.20**	**0.06**	**<0.001**	NS
		Off Base	0.07	0.07	0.334	
	Full	On Base	**0.19**	**0.06**	**0.001**	NS
		Off Base	0.09	0.07	0.247	
Enlisted	Basic	On Base	**0.27**	**0.06**	**<0.001**	NS
		Off Base	**0.16**	**0.06**	**0.009**	
	Full	On Base	**0.29**	**0.07**	**<0.001**	NS
		Off Base	0.13	0.07	0.063	
E. Income and Poverty Domain						
Officer	Basic	On Base	**0.11**	**0.03**	**<0.001**	*
		Off Base	0.02	0.04	0.560	
	Full	On Base	**0.11**	**0.03**	**0.001**	*
		Off Base	0.03	0.04	0.493	
Enlisted	Basic	On Base	**0.09**	**0.04**	**0.009**	NS
		Off Base	0.06	0.04	0.083	
	Full	On Base	**0.12**	**0.04**	**0.002**	***
		Off Base	0.04	0.04	0.342	
F. Housing Domain						
Officer	Basic	On Base	0.04	0.02	0.071	NS
		Off Base	0.04	0.03	0.151	
	Full	On Base	0.04	0.02	0.075	NS
		Off Base	0.04	0.03	0.154	
Enlisted	Basic	On Base	**0.05**	**0.02**	**0.031**	NS
		Off Base	**0.07**	**0.02**	**0.008**	
	Full	On Base	**0.06**	**0.03**	**0.012**	NS
		Off Base	**0.06**	**0.03**	**0.018**	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates.* = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$. NS = not significant.

Table B.9
Safety in Civilian Areas Around the Installation, Air Force

Rank	Model	Residence	B	SE	p	Diff.
A. Overall MNRI						
Officer	Basic	On Base	**0.26**	**0.09**	**0.005**	***
		Off Base	**0.93**	**0.11**	**<0.001**	
	Full	On Base	**0.26**	**0.09**	**0.006**	***
		Off Base	**0.91**	**0.11**	**<0.001**	
Enlisted	Basic	On Base	**0.39**	**0.10**	**<0.001**	***
		Off Base	**0.72**	**0.10**	**<0.001**	
	Full	On Base	**0.43**	**0.10**	**<0.001**	***
		Off Base	**0.74**	**0.11**	**<0.001**	
B. Household Composition Domain						
Officer	Basic	On Base	**0.57**	**0.11**	**<0.001**	***
		Off Base	**1.66**	**0.14**	**<0.001**	
	Full	On Base	**0.56**	**0.12**	**<0.001**	***
		Off Base	**1.67**	**0.14**	**<0.001**	
Enlisted	Basic	On Base	**0.73**	**0.12**	**<0.001**	***
		Off Base	**1.40**	**0.13**	**<0.001**	
	Full	On Base	**0.78**	**0.13**	**<0.001**	***
		Off Base	**1.45**	**0.13**	**<0.001**	
C. Social Domain						
Officer	Basic	On Base	**0.23**	**0.07**	**0.002**	***
		Off Base	**0.66**	**0.08**	**<0.001**	
	Full	On Base	**0.22**	**0.07**	**0.002**	***
		Off Base	**0.64**	**0.08**	**<0.001**	
Enlisted	Basic	On Base	**0.30**	**0.08**	**<0.001**	***
		Off Base	**0.52**	**0.08**	**<0.001**	
	Full	On Base	**0.32**	**0.08**	**<0.001**	***
		Off Base	**0.53**	**0.08**	**<0.001**	
D. Employment Domain						
Officer	Basic	On Base	**0.35**	**0.13**	**0.009**	***
		Off Base	**1.11**	**0.15**	**<0.001**	
	Full	On Base	**0.35**	**0.14**	**0.012**	***
		Off Base	**1.09**	**0.15**	**<0.001**	
Enlisted	Basic	On Base	**0.56**	**0.15**	**<0.001**	***
		Off Base	**0.91**	**0.15**	**<0.001**	
	Full	On Base	**0.59**	**0.15**	**<0.001**	***

Rank	Model	Residence	B	SE	p	Diff.
		Off Base	**0.91**	**0.15**	**<0.001**	
E. Income and Poverty Domain						
Officer	Basic	On Base	**0.15**	**0.08**	**0.058**	***
		Off Base	**0.54**	**0.09**	**<0.001**	
	Full	On Base	**0.15**	**0.08**	**0.071**	***
		Off Base	**0.54**	**0.09**	**<0.001**	
Enlisted	Basic	On Base	**0.24**	**0.09**	**0.008**	***
		Off Base	**0.40**	**0.09**	**<0.001**	
	Full	On Base	**0.27**	**0.09**	**0.003**	***
		Off Base	**0.40**	**0.09**	**<0.001**	
F. Transportation Domain						
Officer	Basic	On Base	**1.11**	**0.41**	**0.007**	NS
		Off Base	**1.60**	**0.45**	**<0.001**	
	Full	On Base	**1.14**	**0.41**	**0.006**	NS
		Off Base	**1.54**	**0.46**	**0.001**	
Enlisted	Basic	On Base	**1.03**	**0.46**	**0.025**	***
		Off Base	**1.70**	**0.46**	**<0.001**	
	Full	On Base	**1.05**	**0.47**	**0.024**	***
		Off Base	**1.70**	**0.47**	**<0.001**	
G. Housing Domain						
Officer	Basic	On Base	**0.07**	**0.06**	**0.237**	***
		Off Base	**0.33**	**0.06**	**<0.001**	
	Full	On Base	**0.06**	**0.06**	**0.262**	***
		Off Base	**0.32**	**0.06**	**<0.001**	
Enlisted	Basic	On Base	**0.12**	**0.06**	**0.044**	***
		Off Base	**0.23**	**0.06**	**<0.001**	
	Full	On Base	**0.14**	**0.06**	**0.022**	***
		Off Base	**0.23**	**0.06**	**<0.001**	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates.* = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$. NS = not significant.

Table B.10
Career Intentions, Air Force

Rank	Model	Residence	B	SE	p	OR	Diff.
A. Social Domain							
Officer	Basic	On Base	-0.13	0.10	0.174	0.88	*
		Off Base	0.10	0.13	0.431	1.10	
	Full	On Base	-0.16	0.09	0.071	0.85	**
		Off Base	**0.29**	**0.15**	**0.049**	**1.34**	
Enlisted	Basic	On Base	-0.02	0.05	0.763	0.98	**
		Off Base	**0.17**	**0.06**	**0.003**	**1.18**	
	Full	On Base	0.01	0.05	0.822	1.01	NS
		Off Base	0.12	0.06	0.058	1.13	
B. Income and Poverty Domain							
Officer	Basic	On Base	–0.05	0.10	0.606	0.95	NS
		Off Base	0.18	0.13	0.152	1.20	
	Full	On Base	–0.13	0.09	0.156	0.87	**
		Off Base	**0.34**	**0.15**	**0.022**	**1.41**	
Enlisted	Basic	On Base	0.07	0.05	0.187	1.07	NS
		Off Base	0.06	0.06	0.260	1.07	
	Full	On Base	**0.13**	**0.05**	**0.015**	**1.14**	NS
		Off Base	0.06	0.06	0.349	1.06	

NOTE: B = coefficient. SE = standard error. p = probability (significant estimates are in bold). Diff. = indicates significant difference between on and off-base estimates.* = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$. NS = not significant.

References

Acevedo-Garcia, Dolores, "Residential Segregation and the Epidemiology of Infectious Diseases," *Social Science and Medicine*, Vol. 51, No. 8, October 16, 2000, pp. 1143–1161.

Aneshensel, Carol S., and Clea A. Sucoff, "The Neighborhood Context of Adolescent Mental Health," *Journal of Health and Social Behavior*, Vol. 37, No. 4, December 1996, pp. 293–311.

Auchincloss, Amy H., Ana V. Diez Roux, Mahasin S. Mujahid, Mingwu Shen, Alain G. Bertoni, and Mercedes R. Carnethon, "Neighborhood Resources for Physical Activity and Healthy Foods and Incidence of Type 2 Diabetes Mellitus: The Multi-Ethnic Study of Atherosclerosis," *Archives of Internal Medicine*, Vol. 169, No. 18, October 2009, pp. 1698–1704.

August, Debra, *Army Life v. Life in the Army: The Relationship Between Quality of Life Program Utilization and Army Career Intentions*, Santa Monica, Calif.: RAND Corporation, RGSD-125, 1996. As of October 22, 2012: http://www.rand.org/pubs/rgs_dissertations/RGSD125.html

Barker, D. J. P., and C. Osmond, "Inequalities in Health in Britain: Specific Explanations in Three Lancashire Towns," *British Medical Journal*, Vol. 294, No. 6574, March 21, 1987, pp. 749–752.

Berkman, Lisa F., and S. Leonard Syme, "Social Networks, Host Resistance, and Mortality: A Nine-Year Follow-Up Study of Alameda County Residents," *American Journal of Epidemiology*, Vol. 109, No. 2, 1979, pp. 186–204.

Boardman, J. D., "Stress and Physical Health: The Role of Neighborhoods as Mediating and Moderating Mechanisms," *Social Science and Medicine*, Vol. 58, No. 12, June 2004, pp. 2473–2483.

Booth, Bradford, "Contextual Effects of Military Presence on Women's Earnings," *Armed Forces and Society*, Vol. 30, No. 1, Fall 2003, pp. 25–52.

Booth, Bradford, Mady Wechsler Segal, and D. Bruce Bell, *What We Know About Army Families: 2007 Update*, Fairfax, Va.: Caliber, 2007. As of October 22, 2012: http://www.mwrbrandcentral.com/HOMEPAGE/Graphics/Research/whatweknow2007.pdf

Bowen, Gary L., James A. Martin, Jay A. Mancini, and John P. Nelson, "Community Capacity: Antecedents and Consequences," *Journal of Community Practice*, Vol. 8, No. 2, 2000, pp. 1–21.

Bradbury, Bruce, "Family Size Equivalence Scales and Survey Evaluations of Income and Well-Being," *Journal of Social Policy*, Vol. 18, No. 3, July 1989, pp. 383–408.

Britton, Malcolm, ed., *Mortality and Geography: A Review in the Mid-1980s*, London, UK: Her Majesty's Stationery Office, Series DS No. 9, 1990.

Browing, Christopher R., and Kathleen A. Cagney, "Neighborhood Structural Disadvantage, Collective Efficacy, and Self-Rated Physical Health in an Urban Setting," *Journal of Health and Social Behavior*, Vol. 43, No. 4, December 2002, pp. 383–400.

Buddin, Richard, *Building a Personnel Support Agenda: Goals, Analysis Framework, and Data Requirements*, Santa Monica, Calif.: RAND Corporation, MR-916-OSD, 1998. As of October 22, 2012: http://www.rand.org/pubs/monograph_reports/MR916.html

Burrell, Lolita M., Gary A. Adams, Doris Briley Durand, and Carl Andrew Castro, "The Impact of Military Lifestyle Demands on Well-Being, Army, and Family Outcomes," *Armed Forces and Society*, Vol. 33, No. 1, October 2006, pp. 43–58.

Caliber Associates, *MWR Programs and Readiness Links: 2003 Update*, Fairfax, Va., 2003. As of October 23, 2012: http://www.army.mil/fmwrc/documents/planning/abstractReport.pdf

Carpiano, Richard M., "Neighborhood Social Capital and Adult Health: An Empirical Test of a Bourdieu-Based Model," *Health and Place*, Vol. 13, No. 3, September 2007, pp. 639–655.

Cerdá, M., A. V. Diez-Roux, E. T. Tchetgen, P. Gordon-Larsen, and C. Kiefe, "The Relationship Between Neighborhood Poverty and Alcohol Use: Estimation by Marginal Structural Models," *Epidemiology*, Vol. 21, No. 4, July 2010, pp. 482–489.

Chaix, Basile, "Geographic Life Environments and Coronary Heart Disease: A Literature Review, Theoretical Contributions, Methodological Updates, and Research Agendas," *Annual Review of Public Health*, Vol. 30, April 2009, pp. 81–105.

Chandra, Anita, Laurie T. Martin, Stacy Ann Hawkins, and Amy Richardson, "The Impact of Parental Deployment on Child Social and Emotional Functioning: Perspectives of School Staff," *Journal of Adolescent Health*, Vol. 146, No. 3, March 2010, pp. 218–223.

Cobb, Clifford W., and Craig Rixford, *Lessons Learned from the History of Social Indicators*, San Francisco, Calif.: Redefining Progress, November 1998. As of October 23, 2012: http://rprogress.org/publications/1998/SocIndHist.pdf

Cohen, Deborah, Suzanne Spear, Richard Scribner, Patty Kissinger, Karen Mason, and John Wildgen, "'Broken Windows' and the Risk of Gonorrhea," *American Journal of Public Health*, Vol. 90, No. 2, February 2000, pp. 230–236.

Coleman, James S., "Social Capital in the Creation of Human Capital," *American Journal of Sociology*, Vol. 94, 1988, pp. S95–S120.

———, *Foundations of Social Theory*, Cambridge, Mass.: Harvard University Press, 1990.

Collins, James W. Jr., and R. J. David, "The Differential Effect of Traditional Risk Factors on Infant Birthweight Among Blacks and Whites in Chicago," *American Journal of Public Health*, Vol. 80, No. 6, June 1990, pp. 679–681.

Collins, James W. Jr., and Nancy Fisher Schulte, "Infant Health: Race, Risk, and Residence," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 223–232.

Cooke, Thomas, and Karen Speirs, "Migration and Employment Among the Civilian Spouses of Military Personnel," *Social Science Quarterly*, Vol. 86, No. 2, June 2005, pp. 343–355.

Coulton, Claudia J., Jill E. Korbin, and Marilyn Su, "Neighborhoods and Child Maltreatment: A Multi-Level Study," *Child Abuse and Neglect*, Vol. 23, No. 11, November 1999, pp. 1019–1041.

Cutrona, Carolyn E., Daniel W. Russell, Robert M. Hessling, P. Adama Brown, and Velma Murry, "Direct and Moderating Effects of Community Context on the Psychological Well-Being of African American Women," *Journal of Personality and Social Psychology*, Vol. 79, No. 6, December 2000, pp. 1088–1102.

Deaton, Angus, "Health, Inequality, and Economic Development," *Journal of Economic Literature*, Vol. 41, No. 1, March 2003, pp. 113–158.

Decision Engineering Associates, *2002 Quality of Life in the U.S. Marine Corps Study*, Dumfries, Va., September 20, 2002.

DeNavas-Walt, Carmen, Bernadette D. Proctor, and Jessica C. Smith, *Income, Poverty, and Health Insurance Coverage in the United States: 2010*, Washington, D.C.: U.S. Census Bureau, Current Population Reports: Consumer Income, P60-239, September

2011. As of October 23, 2012: http://www.census.gov/prod/2011pubs/p60-239.pdf

Diez-Roux, Ana V., "Investigating Neighborhood and Area Effects on Health," *American Journal of Public Health*, Vol. 91, No. 11, November 2001, pp. 1783–1789.

———, "The Examination of Neighborhood Effects on Health: Conceptual and Methodological Issues Related to the Presence of Multiple Levels of Organization," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 45–64.

———, "Neighborhoods and Health: Where Are We and Where Do We Go from Here?" Revue d'Épidémiologie et de Santé Publique, Vol. 55, No. 1, February 2007, pp. 13–21.

Diez-Roux, Ana V., and Allison E. Aiello, "Multilevel Analysis of Infectious Diseases," *Journal of Infectious Diseases*, Vol. 191, Suppl. 1, 2005, pp. S25–S33.

Diez-Roux, Ana V., F. Javier Nieto, Laura Caulfield, Hermann A. Tyroler, Robert L. Watson, and Moyses Szklo, "Neighborhood Differences in Diet: The Atherosclerosis Risk in Communities (ARIC) Study," *Journal of Epidemiology and Community Health*, Vol. 53, No. 1, January 1999, pp. 55–63.

Diez-Roux, Ana V., F. Javier Nieto, C. Muntaner, Hermann A. Tyroler, G. W. Comstock, E. Shahar, L. S. Cooper, R. L. Watson, and M. Szklo, "Neighborhood Environments and Coronary Heart Disease: A Multilevel Analysis," *American Journal of Epidemiology*, Vol. 146, No. 1, July 1997, pp. 48–64.

DiPrete, Thomas A., and Jerry D. Forristal, "Multilevel Models: Methods and Substance," *Annual Review of Sociology*, Vol. 20, August 1994, pp. 331–357.

Dolan, Paul, and Mathew P. White, "How Can Measures of Subjective Well-Being Be Used to Inform Public Policy?" *Perspectives on Psychological Science*, Vol. 2, No. 1, 2007, pp. 71–85.

Donley, Michael, "The Year of the Air Force Family," remarks to the Air Force Sergeants Association, August 19, 2009. As of November 7, 2009: http://www.af.mil/information/speeches/speech.asp?id=497

Downey, Douglas B., "When Bigger Is Not Better: Family Size, Parental Resources, and Children's Educational Performance," *Annual Sociological Review*, Vol. 60, No. 5, October 1995, pp. 746–761.

Drummet, Amy Reinkober, Marilyn Coleman, and Susan Cable, "Military Families Under Stress: Implications for Family Life Education," *Family Relations*, Vol. 52, No. 3, July 2003, pp. 279–287.

Duncan, C., K. Jones, and G. Moon, "Context, Composition and Heterogeneity: Using Multilevel Models in Health Research," *Social Science and Medicine*, Vol. 46, No. 1, January 1998, pp. 97–117.

———, "Smoking and Deprivation: Are There Neighbourhood Effects?" *Social Science and Medicine*, Vol. 48, No. 4, February 1999, pp. 497–507.

Ellaway, A., A. Anderson, and S. Macintyre, "Does Area of Residence Affect Body Size and Shape?" *International Journal of Obesity and Related Metabolic Disorders*, Vol. 21, No. 4, April 1997, pp. 304–308.

Elliott, Delbert S., William Julius Wilson, David Huizinga, Robert J. Sampson, Amanda Elliott, and Bruce Rankin, "The Effects of Neighborhood Disadvantage on Adolescent Development," *Journal of Research in Crime and Delinquency*, Vol. 33, No. 4, November 1996, pp. 389–426.

Entwisle, Barbara, "Micro-Macro Theoretical Linkages in Social Demography: A Commentary," in Joan Huber, ed., *Macro-Micro Linkages in Sociology*, Newbury Park, Calif.: Sage Publications, 1991, pp. 280–286.

Fernandez, Raquel, and Richard Rogerson, "Income Distribution, Communities, and the Quality of Public Education," *Quarterly Journal of Economics*, Vol. 111, No. 1, February 1996, pp. 135–164.

Foster, Sarah, and Billie Giles-Corti, "The Built Environment, Neighborhood Crime and Constrained Physical Activity: An Exploration of Inconsistent Findings," *Preventive Medicine*, Vol. 47, No. 3, September 2008, pp. 241–251.

Fox, A. J., D. R. Jones, and P. O. Goldblatt, "Approaches to Studying the Effect of Socio-Economic Circumstances on Geographic Differences in Mortality in England and Wales," *British Medical Bulletin*, Vol. 40, No. 4, 1984, pp. 309–314.

Fullilove, Mindy Thompson, "Neighborhoods and Infectious Diseases," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 211–222.

Gay, Jennifer L., Kelly R. Evenson, and Jessalyn Smith, "Developing Measures on the Perceptions of the Built Environment for Physical Activity: A Confirmatory Analysis," *International Journal of Behavioral Nutrition and Physical Activity*,

Vol. 7, 2010. As of October 23, 2012: http://www.ijbnpa.org/content/7/1/72

Gardner, M. J., "Using the Environment to Explain and Predict Mortality," *Journal of the Royal Statistical Society*, Series A (General), Vol. 136, No. 3, 1973, pp. 421–440.

Greenberg, Michael, and Dona Schneider, "Violence in American Cities: Young Black Males in the Answer, but What Was the Question?" *Social Science and Medicine*, Vol. 39, No. 2, July 1994, pp. 179–187.

Guthrie, Tanya J., *Career Intentions and Behavior of Army Officers: A Model Testing Approach*, Arlington, Va.: U.S. Army Research Institute for the Behavioral and Social Sciences, ARI-TR-946, 1992. As of October 23, 2012: http://handle.dtic.mil/100.2/ADA246291

Hagerty, Michael R., Robert A. Cummins, Abbott L. Ferriss, Kenneth Land, Alex C. Michalos, Mark Peterson, Andrew Sharpe, Joseph Sirgy, and Joachim Vogel, "Quality of Life Indexes for National Policy: Review and Agenda for Research," *Social Indicators Research*, Vol. 55, No. 1, July 2001, pp. 1–96.

Hagerty, Michael R., and Kenneth C. Land, "Constructing Summary Indices of Quality of Life: A Model for the Effect of Heterogeneous Importance Weights," *Sociological Methods and Research*, Vol. 35, No. 4, May 2007, pp. 455–496.

Handy, Susan L., Marlon G. Boarnet, Reid Ewing, and Richard E. Killingsworth, "How the Built Environment Affects Physical Activity: Views from Urban Planning," *American Journal of Preventive Medicine*, Vol. 22, No. 2, Supp. 1, August 2002, pp. 64–73.

Hansen, Michael, and Jennie Wenger, *Return on Investment in Quality-of-Life Programs*, Alexandria, Va.: Center for Naval Analyses, Research Memorandum D0006807, 2002a.

———, *Use of and Satisfaction with Quality-of-Life Programs*, Alexandria, Va.: Center for Naval Analyses, Research Memorandum D0006805, 2002b.

———, *Is Enlisted Retention Too High?* Alexandria, Va.: Center for Naval Analyses, October 2003. As of October 23, 2012: http://handle.dtic.mil/100.2/ADA421030

Harding, David J., "Counterfactual Models of Neighborhood Effects: The Effect of Neighborhood Poverty on Dropping Out and Teenage Pregnancy," *American Journal of Sociology*, Vol. 109, No. 3, November 2003, pp. 676–719.

Harrell, Margaret C., Nelson Lim, Laura Werber, and Daniela Golinelli, *Working Around the Military: Challenges to Military Spouse Employment and Education*, Santa Monica, Calif.: RAND Corporation, MG-196-OSD, 2004. As of October 23, 2012: http://www.rand.org/pubs/monographs/MG196.html

Harrison, Lee, Mark A. Brennan, and Alan M. Levine, "Comparison of Service Member and Military Spouse Satisfaction with Installation Fitness Facilities and Exercise Programs, *Military Medicine*, Vol. 165, No. 9, September 2000, pp. 701–706.

Heckman, James, Hidehiko Ichimura, Jeffrey Smith, and Petra Todd, "Characterizing Selection Bias Using Experimental Data," *Econometrica*, Vol. 66, No. 5, September 1998, pp. 1017–1098.

Heubner, Angela J., Jay A. Mancini, Gary L. Bowen, and Dennis K. Orthner, "Shadowed by War: Building Community Capacity to Support Military Families," *Family Relations*, Vol. 58, No. 2, April 2009, pp. 216–228.

Hipp, John R., "Block, Tract, and Levels of Aggregation: Neighborhood Structure and Crime and Disorder as a Case in Point," *American Sociological Review*, Vol. 72, No. 5, October 2007, pp. 659–680.

———, "What is the 'Neighbourhood' in Neighbourhood Satisfaction? Comparing the Effects of Structural Characteristics Measured at the Micro-Neighbourhood and Tract Levels," *Urban Studies*, Vol. 47, No. 12, November 2010, pp. 2517–1536.

Hix, William M., *Taking Stock of the Army's Base Realignment and Closure Selection Process*, Santa Monica, Calif.: RAND Corporation, MR-1337-A, 2001. As of October 23, 2012: http://www.rand.org/pubs/monograph_reports/MR1337.html

Hosek, James, Beth J. Asch, C. Christine Fair, Craig Martin, and Michael G. Mattock, *Married to the Military: The Employment and Earnings of Military Wives Compared with Those of Civilian Wives*, Santa Monica, Calif.: RAND Corporation, MR-1565-OSD, 2002. As of October 23, 2012: http://www.rand.org/pubs/monograph_reports/MR1565.html

Hosek, James, Jennifer Kavanagh, and Laura L. Miller, *How Deployments Affect Service Members,* Santa Monica, Calif.: RAND Corporation, MG-432-RC, 2006. As of October 23, 2012: http://www.rand.org/pubs/monographs/MG432.html

Humphreys, Keith, and Roy Carr-Hill, "Area Variations in Health Outcomes: Artefact or Ecology," *International Journal of Epidemiology*, Vol. 20, No. 1, 1991, pp. 251–258.

Janega, J. B., and M. G. Olmsted, "U.S. Navy Sailor Retention: A Proposed Model of Continuation Behavior," *45th Annual Conference of the International Military Testing Association, Pensacola, Florida, 3–6 November 2003*, International Military Testing Association, c. 2003, pp. 150–155. As of October 23, 2012: http://www.internationalmta.org/2003/2003Proceedings/03IMTAproceedings.pdf

Jans, Nicholas Andrew, and Judy Frazer-Jans, *Retention Strategies for General Service Officers: HR DSS Project for GSO and Logistics Officers*, Canberra: Directorate of Strategic Personnel Planning and Research, 2006.

Jaros, Stephen J., "An Assessment of Meyer and Allen's (1991) Three-Component Model of Organizational Commitment and Turnover Intentions," *Journal of Vocational Behavior*, Vol. 51, No. 3, December 1997, pp. 319–337.

Jencks, Christopher, and Susan E. Mayer, "The Social Consequences of Growing Up in a Poor Neighborhood," in Laurence E. Lynn and Michael G. H. McGeary, eds., *Inner-City Poverty in the United States*, Washington, D.C.: National Academy Press, 1990, pp. 111–186. As of October 23, 2012: http://www.nap.edu/catalog.php?record_id=1539

Jowers, Karen, "Help for Kids Takes Many Forms," *Army Times*, August 31, 2007. As of July 14, 2010: http://www.armytimes.com/community/family/military_kidstress_help_070904w/

Kaplan, George A., Thomas W. Wilson, Richard D. Cohen, Jussi Kauhanen, Melien Wu, and Jukka T. Salonen, "Social Functioning and Overall Mortality: Prospective Evidence from the Kuopio Ischemic Heart Disease Risk Factor Study," *Epidemiology*, Vol. 5, No. 5, September 1994, pp. 495–500.

Kawachi, Ichiro, and Lisa F. Berkman, "Social Cohesion, Social Capital, and Health," in Lisa F. Berkman and Ichiro Kawachi, eds., *Social Epidemiology*, New York: Oxford University Press, 2000, pp. 174–190.

———, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003a.

———, "Introduction," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003b, pp. 1–19.

Kawachi, Ichiro, Bruce P. Kennedy, and Roberta Glass, "Social Capital and Self-Rated Health: A Contextual Analysis," *American Journal of Public Health*, Vol. 89, No. 8, August 1999, pp. 1187–1193.

Kawachi, Ichiro, Bruce P. Kennedy, Kimberly Lochner, and Deborah Prothrow-Stith, "Social Capital, Income Inequality, and Mortality," *American Journal of Public Health*, Vol. 87, No. 9, September 1997, pp. 1491–1498.

Kelling, George L., and James Q. Wilson, "Broken Windows: The Police and Neighborhood Safety," *Atlantic*, Vol. 127, March 1982, pp. 29–38. As of October 24, 2012: http://www.theatlantic.com/magazine/archive/1982/03/broken-windows/304465/

Kleinman, Joel C., and Samuel S. Kessel, "Racial Difference in Low Birth Weight," *New England Journal of Medicine*, Vol. 317, September 17, 1987, pp. 749–753.

Kleinman, Joel C., Mitchell B. Pierre Jr., Jennifer H. Madans, Garland H. Land, and Wayne F. Schramm, "The Effects of Maternal Smoking on Fetal and Infant Mortality," *American Journal of Epidemiology*, Vol. 127, No. 2, 1988, pp. 274–282.

Kleinschmidt, Immo, Michael Hills, and Paul Elliott, "Smoking Behaviour Can Be Predicted by Neighbourhood Deprivation Measures," *Journal of Epidemiology and Community Health*, Vol. 49, Supp. 2, December 1995, pp. S72–S77.

Koopman, James S., and Ira M. Longini Jr., "The Ecological Effects of Individual Exposures and Nonlinear Disease Dynamics in Populations," *American Journal of Public Health*, Vol. 84, No. 5, May 1994, pp. 836–842.

Koopman, James S., Ira M. Longini Jr., John A. Jacquez, Carl P. Simon, David G. Ostrow, William R. Martin, and David M. Woodcock, "Assessing Risk Factors for Transmission of Infection," *American Journal of Epidemiology*, Vol. 133, No. 12, 1991, pp. 1199–1209.

Koopman, James S., and John W. Lynch, "Individual Causal Models and Population System Models in Epidemiology," *American Journal of Public Health*, Vol. 89, No. 8, August 1999, pp. 1170–1174.

Krieger, Nancy, Pamela Waterman, Jarvis T. Chen, Mah-Jabeen Soobader, S. V. Subramanian, and Rosa Carson, "Zip Code Caveat: Bias Due to Spatiotemporal Mismatches Between Zip Codes and US Census–Defined Geographic Areas—The Public Health Disparities Geocoding Project," *American Journal of Public Health*, Vol. 92, No. 7, July 2002, pp. 1100–1102.

Lachman, Beth E., Ellen M. Pint, Gary Cecchine, and Kimberly Colloton, *Developing Headquarters Guidance for Army Installation Sustainability Plans in 2007,* Santa Monica, Calif.: RAND Corporation, MG-837-A, 2009. As of October 23, 2012: http://www.rand.org/pubs/monographs/MG837.html

LaGrange, Teresa C., "The Impact of Neighborhoods, Schools, and Malls on the Spatial Distribution of Property Damage," *Journal of Research in Crime and Delinquency*, Vol. 26, No. 4, November 1999, pp. 393–422.

Lanctôt, Nadine, and Carolyn A. Smith, "Sexual Activity, Pregnancy, and Deviance in a Representative Urban Sample of African American Girls," *Journal of Youth and Adolescence*, Vol. 30, No. 3, June 2001, pp. 349–372.

Land, Kenneth C., "Social Indicators," in Edgar F. Borgatta and Rhonda J. V. Montgomery, eds., *Encyclopedia of Sociology*, 2nd ed., New York: Macmillan Reference, 2000, pp. 1844–1850.

Land, Kenneth C., Vicki L. Lamb, and Sarah Kahler Mustillo, "Child and Youth Well-Being in the United States, 1975–1998: Some Findings from a New Index," *Social Indicators Research*, Vol. 56, No. 3, December 2001, pp. 241–320.

Lane, Sandra D., Robert H. Keefe, Robert Rubinstein, Brooke A. Levandowski, Noah Webster, Donald A. Cibula, Adwoa K. Boahene, Olabisi Dele-Michael, Darlene Carter, Tanika Jones, Martha Wojtowycz, and Jessica Brill, "Structural Violence, Urban Retail Food Markets, and Low Birth Weight," *Health and Place*, Vol. 14, No. 3, September 2008, pp. 415–423.

Lee, A. C. K., and R. Maheswaran, "The Health Benefits of Urban Green Spaces: A Review of the Evidence," *Journal of Public Health*, Vol. 33, No. 2, 2010, pp. 213–222.

Leiby, James, *Carroll Wright and Labor Reform: The Origin of Labor Statistics*, Cambridge, Mass.: Harvard University Press, 1960.

Lim, Nelson, Daniela Golinelli, and Michelle Cho, *"Working Around the Military" Revisited: Spouse Employment in the 2000 Census Data*, Santa Monica, Calif.: RAND Corporation, MG-566-OSD, 2007. As of November 8, 2012: http://www.rand.org/pubs/monographs/MG566.html

Lin, Nan, and Walter M. Ensel, "Life Stress and Health: Stressors and Resources," *American Sociological Review*, Vol. 54, No. 3, June 1989, pp. 382–399.

Lipari, Rachel, Anna Winters, Kenneth Matos, Jason Smith, and Lindsay Rock, "Military Child Well-Being in the Face of Multiple Deployments," in Steven Carlton-Ford and Morten G. Ender, eds., *The Routledge Handbook of War and Society: Iraq and Afghanistan*, New York: Routledge, 2010, pp. 283–293.

Lippman, Laura H., "Indicators and Indices of Child Well-Being: A Brief American History," *Social Indicators Research*, Vol. 83, No. 1, August 2007, pp. 39–53.

Ludwig, Jens, Jeffrey B. Liebman, Jeffrey R. Kling, Greg J. Duncan, Lawrence F. Katz, Ronald C. Kessler, and Lisa Sanbonmatsu, "What Can We Learn About Neighborhood Effects from the Moving to Opportunity Experiment?" *American Journal of Sociology*, Vol. 114, No. 1, 2008, pp. 144–188.

MacDermid, Shelley M., Rita Samper, Rona Schwarz, Jacob Nishida, and Dan Nyaronga, *Understanding and Promoting Resilience in Military Families*, West Lafayette, Ind.: Military Family Research Institute, Purdue University, 2008. As of October 24, 2012: https://www.mfri.purdue.edu/resources/public/reports/Understanding%20and%20Promoting%20Resilience.pdf

MacDermid, Shelley M., Rachelle Strauss, Natashia Robbins, Heather Wenz, Yuhsuan Chang, Rona Schwarz, and Howard Weiss, *Child Care Use and Satisfaction Among Military Families with Preschool Children*, West Lafayette, Ind.: Military Family Research Institute, Purdue University, 2004. As of October 24, 2012: https://www.mfri.purdue.edu/resources/public/reports/Child%20Care%20Use.pdf

MacDonald, John M., Robert J. Stokes, Deborah A. Cohen, Aaron Kofner, and Greg K. Ridgeway, "The Effect of Light Rail Transit on Body Mass Index and Physical Activity," *American Journal of Preventive Medicine*, Vol. 39, No. 2, August 2010, pp. 105–112.

Macintyre, Sally, "Inequalities in Health—Geographical Inequalities in Mortality, Morbidity, and Health-Related Behaviour in English," in Daniel Dorling, David Gordon, Mary Shaw, George Davey Smith, and Peter Townsend, eds., *Inequalities in Health: The Evidence Presented to the Independent Inquiry into Inequalities in Health*, Bristol, UK: Policy Press, 1999, pp. 148–154.

Macintyre, Sally, and Anne Ellaway, "Ecological Approaches: Rediscovering the Role of the Physical and Social Environment," in Lisa F. Berkman and Ichiro Kawachi, eds., *Social Epidemiology*, Oxford, UK: Oxford University Press, 2000, pp. 332–348.

———, "Neighborhoods and Health: An Overview," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 20–42.

Macintyre, Sally, Anne Ellaway, and Steven Cummins, "Place Effects on Health: How Can We Conceptualise, Operationalise and Measure Them?" *Social Science and Medicine*, Vol. 55, No. 1, July 2002, pp. 125–139.

Mancini, Jay A., Gary L. Bowen, and James A. Martin, "Community Social Organization: A Conceptual Linchpin in Examining Families in the Context of Communities," *Family Relations*, Vol. 54, No. 5, December 2005, pp. 570–582.

Markowitz, Fred E., Paul E. Bellair, Allen E. Liska, and Jianhong Liu, "Extending Social Disorganization Theory: Modeling the Relationships Between Cohesion, Disorder, and Fear," *Criminology*, Vol. 39, No. 2, May 2001, pp. 293–319.

Marmot, Michael, "The Influence of Income on Health: Views of an Epidemiologist," *Health Affairs*, Vol. 21, No. 2, 2002, pp. 31–46.

Marsh, Robert M., "Predicting Retention in the U.S. Navy: Officers and Enlisted," *Journal of Political and Military Sociology*, Vol. 17, No. 1, Spring 1989, pp. 1–26.

Mason, Michael J., and Jeremy Mennis, "An Exploratory Study of the Effects of Neighborhood Characteristics on Adolescent Substance Use," *Addiction Research and Theory*, Vol. 18, No. 1, 2010, pp. 33–50.

Mason, William M., "Problems in Quantitative Comparative Analysis: Ugly Ducklings Are to Swans as Ugly Scatter Plots Are to . . . ?" in Joan Huber, ed., *Macro-Micro Linkages in Sociology*, Newbury Park, Calif.: Sage Publications, 1991, pp. 231–243.

Matthews, Stephen A., and Tse-Chuan Yang, "Exploring the Role of the Built and Social Neighborhood Environment in Moderating Stress and Health," *Annals of Behavioral Medicine*, Vol. 39, No. 2, May 2010, pp. 170–183.

Mayer, Susan E., and Christopher Jencks, "Growing Up in Poor Neighborhoods: How Much Does It Matter?" *Science*, Vol. 243, No. 4897, 1989, pp. 1441–1445.

Mcclure, Peggy, and Walter Broughton, "Measuring the Cohesion of Military Communities," *Armed Forces and Society*, Vol. 26, No. 3, Spring 2000, pp. 473–487.

McEwen, Bruce S., "Stress, Adaptation, and Disease: Allostasis and Allostatic Load," *Annals of the New York Academy of Sciences*, Vol. 840, 1998, pp. 33–44.

McLanahan, Sara, and Gary D. Sandefur, *Growing Up with a Single Parent: What Hurts, What Helps*, Cambridge, Mass.: Harvard University Press, 1996.

Meadows, Sarah O., Kenneth C. Land, and Vicki L. Lamb, "Assessing Gilligan vs. Sommers: Gender-Specific Trends in Child and Youth Well-Being in the United States, 1985–2001," *Social Indicators Research*, Vol. 70, No. 1, January 2005, pp. 1–52.

Miles, Jeremy, and Mark Shevlin, *Applying Regression and Correlation: A Guide for Students and Researchers*, London: SAGE, 2000.

Miringoff, Marc L., and Marque-Luisa Miringoff, *The Social Health of the Nation: How America Is Really Doing*, New York: Oxford University Press, 1999.

Mitchell, Wesley C., *Recent Social Trends in the United States: Report of the President's Research Committee on Social Trends*, Vol. 1, New York: McGraw-Hill, 1933.

Morenoff, Jeffrey D., Robert J. Sampson, and Stephen W. Raudenbush, "Neighborhood Inequality, Collective Efficacy, and the Spatial Dynamics of Urban Violence," *Criminology*, Vol. 39, No. 3, August 2001, pp. 517–558.

Mujahid, M. S., Ana V. Diez Roux, M. Shen, D. Gowda, B. Sánchez, S. Shea, D. R. Jacobs Jr., and S. A. Jackson, "Relation Between Neighborhood Environments and Obesity in the Multi-Ethnic Study of Atherosclerosis," *American Journal of Epidemiology*, Vol. 167, No. 11, June 2008, pp. 1349–1357.

Murray, Emily T., Ana V. Diez Roux, Mercedes Carnethon, Pamela L. Lutsey, Hanyu Ni, and Ellen S. O'Meara, "Trajectories of Neighborhood Poverty and Associations with Subclinical Atherosclerosis and Associated Risk Factors," *American Journal of Epidemiology*, Vol. 171, No. 10, May 15, 2010, pp. 1099–1108.

Nord, Christine W., Shelley Perry, and Betty D. Maxfield, *Evaluation of MWR Services and Family Programs: Results from the 1992 DoD Surveys of Officers and Enlisted Personnel and Military Spouses—Final Report*, Rockville, Md.: Westat, April 1997. As of October 24, 2012: http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA324452

O'Campo, P., A. C. Gielen, R. R. Faden, X. Xue, N. Kass, and M. C. Wang, "Violence by Male Partners Against Women During the Childbearing Year: A Contextual Analysis," *American Journal of Public Health*, Vol. 85, No. 8, Pt. 1, August 1995, pp. 1092–1097.

Ogden, Cynthia L., Cheryl D. Fryar, Margaret D. Carroll, and Katherine M. Flegal, "Mean Body Weight, Height, and Body Mass Index, United States 1960–2002," *Advance Data from Vital and Health Statistics*, No. 347, October 27, 2004. As of October 24, 2012: http://www.cdc.gov/nchs/data/ad/ad347.pdf

Opdycke, Sandra, and Marque-Luisa Miringoff, *The Social Health of the States 2008*, New York: Institute for Innovation in Social Policy, Vassar College, 2008. As of July 23, 2010: http://iisp.vassar.edu/SocialHealthofStates.pdf

Papas, Mia A., Anthony J. Alberg, Reid Ewing, Kathy J. Helzlsouer, Tiffany L. Gary, and Ann C. Klassen, "The Built Environment and Obesity," *Epidemiological Reviews*, Vol. 29, No. 1, 2007, pp. 129–143.

Park, Robert, Roderick D. McKenzie, and Ernest W. Burgess, *The City: Suggestions for the Study of Human Nature in the Urban Environment*, Chicago, Ill.: University of Chicago Press, 1925.

Perkins, Douglas D., and Ralph B. Taylor, "Ecological Assessments of Community Disorder: Their Relationship to Fear of Crime and Theoretical Implications," *American Journal of Community Psychology*, Vol. 24, No. 1, 1996, pp. 63–107.

Peterson, Ruth D., Lauren J. Krivo, and Mark A. Harris, "Disadvantage and Neighborhood Violent Crime: Do Local Institutions Matter?" *Journal of Research in Crime and Delinquency*, Vol. 37, No. 1, February 2000, pp. 31–63.

Pickett, K. E., and M. Pearl, "Multilevel Analyses of Neighbourhood Socioeconomic Context and Health Outcomes: A Critical Review," *Journal of Epidemiology and Community Health*, Vol. 55, No. 2, February 2001, pp. 111–122.

Putnam, Robert D., "The Strange Disappearance of Civic America," *American Prospect*, Vol. 7, No. 24, Winter 1996, pp. 34–48.

Radloff, Lenore Sawyer, "The CES-D Scale: A Self-Report Depression Scale for Research in the General Population," *Applied Psychological Measurement*, Vol. 1, No. 3, June 1977, pp. 385–401.

Raudenbush, Stephen W., "The Quantitative Assessment of Neighborhood Social Environments," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 112–131.

Rawlings, James S., Virginia B. Rawlings, and John A. Read, "Prevalence of Low Birth Weight and Preterm Delivery in Relation to the Interval Between Pregnancies Among White and Black Women," *New England Journal of Medicine*, Vol. 332, No. 2, January 12, 1995, pp. 69–74.

Robert, Stephanie A., "Community-Level Socioeconomic Status Effects on Adult Health," *Journal of Health and Social Behavior*, Vol. 39, No. 1, March 1998, pp. 18–37.

———, "Socioeconomic Position and Health: The Independent Contribution of Community Socioeconomic Context," *Annual Review of Sociology*, Vol. 25, 1999, pp. 489–516.

Ross, Catherine E., "Neighborhood Disadvantage and Adult Depression," *Journal of Health and Social Behavior*, Vol. 41, No. 2, June 2000, pp. 177–187.

Ross, Catherine E., and John Mirowsky, "Disorder and Decay: The Concept and Measurement of Perceived Neighborhood Disorder," *Urban Affairs Review*, Vol. 34, No. 3, January 1999, pp. 412–432.

Rountree, Pamela Wilcox, and Kenneth C. Land, "Perceived Risk Versus Fear of Crime: Empirical Evidence of Conceptually Distinct Reactions in Survey Data," *Social Forces*, Vol. 74, No. 4, June 1996, pp. 1353–1376.

Rubin, D. B., "Estimating Causal Effects from Large Data Sets Using Propensity Scores," *Annals of Internal Medicine*, Vol. 127, No. 8, Pt. 2, October 15, 1997, pp. 757–763.

Sampson, Robert J., "Neighborhood-Level Context and Health: Lessons from Sociology," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 132–145.

Sampson, Robert J., and W. Byron Groves, "Community Structure and Crime: Testing Social-Disorganization Theory," *American Journal of Sociology*, Vol. 94, No. 4, January 1989, pp. 774–802.

Sampson, Robert J., Jeffrey D. Morenoff, and Felton Earls, "Beyond Social Capital: Spatial Dynamics of Collective Efficacy for Children," *American Sociological Review*, Vol. 64, 1999, pp. 633–660.

Sampson, Robert J., Jeffrey D. Morenoff, and Thomas Gannon-Rowley, "Assessing 'Neighborhood Effects': Social Processes and New Directions in Research," *Annual Review of Sociology*, Vol. 28, August 2002, pp. 443–478.

Sampson, Robert J., and Stephen W. Raudenbush, "Systematic Social Observation of Public Spaces: A New Look at Disorder in Urban Neighborhoods," *American Journal of Sociology*, Vol. 105, No. 3, 1999, pp. 603–651.

Sampson, Robert J., Stephen W. Raudenbush, and Felton Earls, "Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy," *Science*, Vol. 277, No. 5328, August 15, 1997, pp. 918–924.

Schulz, Amy, David Williams, Barbara Israel, Adam Becker, Edith Parker, Sherman A. James, and James Jackson, "Unfair Treatment, Neighborhood Effects, and Mental Health in the Detroit Metropolitan Area," *Journal of Health and Social Behavior*, Vol. 41, No. 3, September 2000, pp. 314–332.

Schwerin, Michael J., Paul G. Michael, Dale N. Glaser, and Kara L. Farrar, "A Cluster Evaluation of Navy Quality of Life Programs," *Evaluation and Program Planning*, Vol. 25, No. 3, August 2002, pp. 303–312.

Scribner, R. A., D. A. Cohen, and T. A. Farley, "A Geographic Relation Between Alcohol Availability and Gonorrhea Rates," *Sexually Transmitted Diseases*, Vol. 25, No. 10, November 1998, pp. 544–548.

Sharkey, Patrick, "The Intergenerational Transmission of Context," *American Journal of Sociology*, Vol. 113, No. 4, January 2008, pp. 931–969.

Smith, William R., Sharon Glave Frazee, and Elizabeth L. Davison, "Furthering the Integration of Routine Activity and Social Disorganization Theories: Small Units of Analysis and the Study of Street Robbery as a Diffusion Process, *Criminology*, Vol. 38, No. 2, May 2000, pp. 489–523.

South, Scott J., and Eric P. Baumer, "Deciphering Community and Race Effects on Adolescent Premarital Childbearing," *Social Forces*, Vol. 78, No. 4, June 2000, pp. 1379–1407.

Spera, Christopher, "Spouses' Ability to Cope with Deployment and Adjust to Air Force Family Demands: Identification of Risk and Protective Factors," *Armed Forces and Society*, Vol. 35, No. 2, January 2009, pp. 286–306.

Sprenkle, Douglas H., Mei-Ju Ko, and Shelley M. MacDermid, *Military OneSource: Its Use, Impact and Effectiveness*, Purdue, Ind.: Military Family Research Institute, Purdue University, June 2006. As of October 24, 2012: https://www.mfri.purdue.edu/resources/public/reports/Military%20OneSource.pdf

Steptoe, Andrew, and Pamela J. Feldman, "Neighborhood Problems as Sources of Chronic Stress: Development of a Measure of Neighborhood Problems, and Associations with Socioeconomic Status and Health," *Annals of Behavioral Medicine*, Vol. 23, No. 3, 2001, pp. 177–185.

Stockdale, Susan E., Kenneth B. Wells, Lingqi Tang, Thomas R. Belin, Lily Zhang, and Cathy D. Sherbourne, "The Importance of Social Context: Neighborhood Stressors, Stress-Buffering Mechanisms, and Alcohol, Drug, and Mental Health Disorders," *Social Science and Medicine*, Vol. 65, No. 9, November 2007, pp. 1867–1881.

Subramanian, S. V., and Ichiro Kawachi, "Income Inequality and Health: What Have We Learned So Far?" *Epidemiologic Reviews*, Vol. 26, No. 1, 2004, pp. 78–91.

Tanielian, Terri, and Lisa H. Jaycox, eds., *Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery*, Santa Monica, Calif.: RAND Corporation, MG-720-CCF, 2008. As of October 24, 2012: http://www.rand.org/pubs/monographs/MG720.html

Upchurch, Dawn M., Carol S. Aneshensel, Clea A. Sucoff, and Lené Levy-Storms, "Neighborhood and Family Contexts of Adolescent Sexual Activity," *Journal of Marriage and Family*, Vol. 61, No. 4, November 1999, pp. 920–933.

U.S. Air Force, *USAF Almanac*, Vol. 93, No. 5, May 2010. As of July 22, 2010: http://www.airforce-magazine.com/MagazineArchive/Pages/2010/May%202010/0510cover.aspx

U.S. Army, *Army Stationing and Installation Plan*, Army Regulation 5-18, June 5, 2009. As of November 8, 2012: http://www.apd.army.mil/pdffiles/r5_18.pdf

U.S. Army OneSource, "Army Family Covenant," undated. As of July 14, 2010: http://www.myarmyonesource.com/CommunitiesandMarketplace/ArmyFamilyCovenant/default.aspx

U.S. Census Bureau, "Census Tracts and Block Numbering Areas," April 19, 2000. As of October 24, 2012: http://www.census.gov/geo/www/cen_tract.html

U.S. Department of Housing and Urban Development, "Moving to Opportunity for Fair Housing," undated. As of September 22, 2011: http://portal.hud.gov/hudportal/HUD?src=/programdescription/mto

U.S. Government Printing Office, *Congressional Register* searchable website, 1999.

Veysey, Bonita M., and Steven F. Messner, "Further Testing of Social Disorganization Theory: An Elaboration of Sampson and Groves's 'Community Structure and Crime,'" *Journal of Research in Crime and Delinquency*, Vol. 36, No. 2, May 1999, pp. 156–174.

Wang, Youfa, and May A. Beydoun, "The Obesity Epidemic in the United States—Gender, Age, Socioeconomic, Racial/Ethnic, and Geographic Characteristics: A Systematic Review and Meta-Regression Analysis," *Epidemiologic Reviews*, Vol. 29, No. 1, 2007, pp. 6–28.

Wenger, Jennie, and Apriel Hodari, *Does School Quality Influence Housing Choices of Navy Personnel?* Alexandria, Va.: Center for Naval Analyses, Research Memorandum D0007150, 2002.

Westhuis, Dave, and Richard Fafara, "Linkage Between Morale, Welfare and Recreation (MWR) Programs and Mission," briefing, U.S. Army Family and MWR Command, 2007.

Whyte, William Foote, *Street Corner Society: The Social Structure of an Italian Slum*, Chicago, Ill.: University of Chicago Press, 1943.

Wright, Rosalind J., and Edwin B. Fischer, "Putting Asthma into Context: Community Influences on Risk, Behavior, and Intervention," in Ichiro Kawachi and Lisa F. Berkman, eds., *Neighborhoods and Health*, New York: Oxford University Press, 2003, pp. 233–262.

Yen, Irene H., and George A. Kaplan, "Poverty Area Residence and Changes in Depression and Perceived Health Status: Evidence from the Alameda County Study," *International Journal of Epidemiology*, Vol. 28, 1999, pp. 90–94.

Yen, Irene H., and S. L. Syme, "The Social Environment and Health: A Discussion of the Epidemiologic Literature," *Annual Review of Public Health*, Vol. 20, 1999, pp. 287–308.

Yen, Irene H., Yvonne L. Michael, and Leslie Perdue, "Neighborhood Environment in Studies of Health of Older Adults: A Systematic Review," *American Journal of Preventive Medicine*, Vol. 37, No. 5, November 2009, pp. 455–463.

Zellman, Gail L., Susan M. Gates, Joy S. Moini, and Marika Suttorp, "Meeting Family and Military Needs Through Military Child Care," *Armed Forces and Society*, Vol. 35, No. 3, April 2009, pp. 437–459.