SECTORAL AND GEOGRAPHIC MOBILITY OF THE PHARMACIST WORKFORCE: TRENDS AND DETERMINANTS

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Dedicated with love to all the teachers that taught me

ABSTRACT

The purpose of this study was to explore sectoral and geographic migration of the pharmacist workforce and to examine the occupational and non-occupational factors associated with this mobility. This study employed quantitative analysis of unique datasets to estimate the magnitude of pharmacist workforce migration, describe its temporal patterns and investigate the role of occupational and non-occupational factors as motivators for this phenomenon. Job history data from the 2000 and 2009 National Pharmacist Workforce Survey was used to investigate sectoral and geographic migration of pharmacists between 1980 and 2009 in the first section of the study while the 5% public use sample of the 2000 Census of the Population was employed to investigate geographic migration of pharmacists between 1995 and 2000 in the second section. The magnitude and temporal patterns of sectoral and geographic migration of pharmacists between 1980 and 2009 were described using non-parametric descriptive statistics while the motivators of sectoral and geographic migration of pharmacists during this period were investigated using survival analysis. Logistic regression analysis was used to examine the association between the odds of interstate migration and several occupational and non-occupational variables between 1995 and 2000. Out-migration of licensed pharmacists from large chain sector appeared to be greater than out-migration from independent/small chain and institutional sectors. When pharmacists migrate, they were more likely to move from their state of employment to another state within the same census region. Sectoral and geographic migration rates tended to be greater for female pharmacists compared to male pharmacists. Overall, absolute change across census regions between 1995 and 2000 advantage the south and the west regions. For

pharmacists, the strongest factors related to migration were non-occupational variables such as age, having dependents and level of educational attainment. The occupational variables that were significant motivators of migration from one state to another included number of new pharmacy graduates and the change in the pharmacist per population ratio at the state level. The study concluded that state level pharmacy labor market conditions impact migration decisions and are thus a viable focus of policy interventions.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Imbalances in the health workforce, defined as disequilibrium between demand and supply of labor is a major challenge in many countries since health care delivery is highly labor-intensive (Zurn, Poz, Stilwell, & Adams, 2002). Workforce imbalance can manifest as a surplus or a shortage of health care personnel and it can be static or dynamic; and it can be sectoral or geographic. Professional/sectoral imbalance occurs when there is a disequibrium between demand and supply of personnel in various health professions while geographic imbalance relates to disparities between geographic regions (e.g. states, provinces) and between urban and rural regions.

The quality, efficiency and equity of health care services are all dependent on the availability of skilled and competent providers where and when they are needed. Workforce imbalances negatively impact this "availability" and create concern about the adequacy of patient care. In the United States, there have been shortages of key health personnel including nurses, physicians and pharmacists. Compounding the impact of these shortages on the public health agenda is the geographic variation of their intensity leading to suboptimal distribution of the available supply of health workforce. Furthermore, there is maldistribution of the available personnel among the different sectors of each health profession; leading to adequate or surplus in some specialty/work sector and shortages in others.

Concerning the issue of maldistribution of healthcare workers and its attendant effect on equity of access to health care, there are essentially two broad questions that can be asked, one normative and one positive. Firstly, it is important to know the extent of

inappropriate distribution of health care providers. From this knowledge, sectors or geographic areas that are underserved by physicians; nurses or other health care workers can then be described. It is also pertinent to understand the optimum numbers of each health care worker relative to distribution of the population. These normative issues to a large extent are based on noneconomic definitions of 'appropriate distribution'. Secondly, given that health care providers are inappropriately distributed among work sectors and/or geographic locations, there is a need to understand why this distribution is observed. Identification of the factors responsible for the observed distribution can help guide policy prescriptions directed at a more appropriate distribution of the health care workforce. One of the factors responsible for observed distribution is migration of the health care workers.

Jack Ladinsky's work in the late 1960s provided an astute analysis of the migration of professional workers. It identified key factors associated with the mobility of such group of workers as physicians, dentists and lawyers and laid the foundation for later work on this topic. The observations made by Ladinsky and other researchers has brought to the fore the importance of the issue of migration to distribution of professional workforce and its implications for workforce policy and planning.

In the context of health care workforce, Diallo (2004) defined migration as movement of health professionals within national borders, across sub national administrative units, or between rural and urban areas. Migration has also been defined as the movement of health care workers between clinical specialties and practice sectors or locations.

Since 1998, there has been a national shortage of practitioners in the labor market for pharmacists (Knapp & Livesey, 2002). Although recent evidence suggest that this shortage may be abating (Elder et al., 2012), issues of imbalances in the pharmacy workforce continues to attract the attention of key stakeholders for good reasons. Healthcare cannot function without medicines, and pharmacists are the professionals primarily responsible for medication dispensing. Pharmacists also play important roles in disease state management, pharmaceutical care, and medication therapy management (MTM). Thus assuring the availability of adequately trained pharmacy personnel where they are needed is an important public health goal.

The pharmacist workforce is the third largest in the United States after the nursing and the physician workforce. While this workforce is relatively large, it suffers from imbalances and its geographical distribution relative to the geographic distribution of the general population is uneven (Shih, 1999a). Also, the pharmacist workforce is not evenly distributed among employment sectors (Health care Intelligence Pty, 2003). In the last three decades, the United States has experienced one dynamic surplus (in the early 80s) and two dynamic shortages of pharmacist (1988-1994 and 1998 to date). In recent years, a steady increase in the total number of pharmacists has led to an easing of the ongoing national shortage but areas of relative undersupply persist. Longitudinal tracking of the pharmacy labor market has revealed that, over the last decade, severity of the shortage and changes in this severity varies substantially across states and across different practice sectors (Knapp, Shah, & Barnett, 2010).

Because healthcare personnel imbalances and maldistribution exert negative pressures on public health and cause social welfare losses, there have been attempts to

forecast future healthcare labor demand and supply (both aggregate and sectoral numbers) and develop policies to meet such figures. According to Birch (2002), the main goal of health workforce planning is to reduce imbalances by making sure the health care personnel with the right skills are available in the right place and time to provide appropriate services to the people that need it. However, the main focus of discussions on pharmacy workforce issues have been the deficit in overall supply of pharmacists while geographic and sectoral distribution remains in the backburner.

Attrition and job turnover are major components of redistribution of manpower among employment sectors and geographic locations. While there is evidence that pharmacist job turnover is high, (Hardigan & Sangasubana, 2010; Mott, 2000) the nature of this turnover is poorly understood. The process of job turnover may involve changes in practice sector, as well as the mobility of pharmacists from one geographic location to another within the same state or out of state. Available evidence has shown that this mobility of pharmacists contributes to the geographic and sectoral distribution of pharmacy workforce (Walton, Cooksey, Knapp, Quist, & Miller, 2004; Walton, Knapp, Miller, & Schumock, 2007), but the magnitude and pattern of this mobility has not been adequately explored. Thus, it is important to understand migration of pharmacists because it contributes to geographic and sectoral redistribution of personnel, and it can exacerbate personnel imbalances.

In order to inform evidence-based policy prescriptions that will address geographic and sectoral imbalance in the pharmacy workforce, there is need to understand the nature, extent, and meaning of geographic and sectoral mobility over the life span of pharmacists. It is also imperative to understand the economic and sociological

motivators of this phenomenon, and this can be achieved only by considering both individual level factors and factors operating at the level of origin and destination sectors and geographic locations.

1.2 Purpose of the Study

The purpose of this study was (1) to explore practice sector and geographic migration of pharmacists, and (2) examine the occupational and non-occupational factors associated with this mobility. Despite the proliferation of theoretical explanations of migration, empirical support for motivators of professional health workers migration is scant. In this study, sectoral and geographic migration patterns of licensed pharmacists were examined in considerable detail, including differences by age group, gender, and across time periods. We also made an attempt to contrast short term migration tendencies to longer term migration (over the career of a pharmacist) by using two unique datasets for analysis. Guided by postulations of a sociological theory and economic theory of migration, we explored occupational and non-occupational explanations for pharmacists' migration.

The specific research questions that were examined in this study are as follows

1. What are the magnitude, temporal patterns, and determinants of pharmacists' migration between work sectors and across geographic locations over a long time period?
2. What are the occupational and non-occupational (socioeconomic, family structure and demographic) factors associated with geographic migration of pharmacists over a short time period?

This study examines the following specific objectives for research question # 1.

1. Describe the magnitude and temporal patterns of pharmacists' migration between work sectors and across geographic locations.
    a. Estimate annual between sector out-migration rates between 1980 and 2009.
    b. Estimate geographic out- migration rates for pharmacists between 1980-1991, 1990-2009, and 2000-2009.
    c. Identify trends in practice sector out- migration rates and geographic out-migration rates between 1980 and 2009.
    d. Describe the relationship between practice sector out- migration and geographic out-migration.
2. Describe the factors related to sectoral and geographic migration of pharmacists.

This study examines the following specific objectives for research question # 2.

1. Describe the magnitude and patterns of migration of pharmacists across geographic locations.
    a. Estimate general mobility for pharmacists by gender and by age between 1995 and 2000.
    b. Estimate in-migration, out-migration and net migration for pharmacists by region, division and states between 1995 and 2000.
    c. Describe the characteristics of states by pharmacists' net-migration status.
2. Examine the occupational and non-occupational (socio-economic, family life cycle and demographic) factors related to geographic migration of pharmacists, between 1995 and 2000.

1.3 Significance of the Study

The role of migration of health workers in shaping distribution has been acknowledged and studies have examined this for the physician and nurse's workforce. However, migration of pharmacists and its impact on distribution of the pharmacist workforce has not received much attention from researchers. This study provides an understanding of short term (over a five year period) and longer term (over a 30 year period) migration of the pharmacist workforce and identifies the key factors associated with the magnitude and pattern of migration. Findings may guide policy planners in developing future forecast of the need and supply of the pharmacist workforce.

1.4 Definition of Terms

A number of terms utilized in this write up may require classification. The following definitions, most of them derived from a number of literature sources was employed in this study.

MIGRATION can be sectoral or geographic. Sectoral migration involves the movement of pharmacists out of a practice sector into another practice sector, while remaining within the labor force. Geographic migration involves the movement of pharmacists from one geographic location to another. In-migration refers to moving to a particular sector or location while out-migration refers to moving out of a particular sector or location.

PRACTICE SECTOR is defined as independent or small chain, large chain, or institutional sectors. Independent/small chain pharmacies include single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies are defined as chains with eleven or more units. Institutional pharmacies include hospitals, nursing homes, and home health care sectors.

BETWEEN SECTOR MIGRATION EVENT is defined as a job transition to a new practice sector. For a job change to be defined as a between sector migration event, it must involve both a different employer and a different practice sector.

ANNUAL BETWEEN SECTOR MIGRATION RATE is the total number of between sector migration events in a year divided by the total number of respondents (pharmacists) employed in that year.

GEOGRAPHIC MIGRATION EVENT is defined as a job transition that involves a change in geographic location of employment or geographic residence of a pharmacist.

GEOGRAPHIC MIGRATION RATE is defined as total number of geographic migration events in a time period divided by the total number of respondents (pharmacists) employed within that period.

CHAPTER 2: REVIEW OF THE LITERATURE

2.1 Demand and Supply in the Pharmacist Labor Market

The demand for pharmacist manpower is derived from the demand for medical goods and services that pharmacists produce (Walton, Mott, Knapp, & Fisher, 2010). The demand for pharmacist manpower and the existing stock of trained pharmacist manpower will determine pharmacists' wages, the number of persons employed, and their participation rate. The pharmacy education programs determine the long run supply of pharmacists, and this long-run supply is also influenced by immigration and licensing requirements that affect entry by foreign-trained pharmacists (Feldstein, 2011, p. 364-394).

Pharmacists are responsible for dispensing pharmaceutical products and providing patient care services. The demand for pharmacists has risen dramatically in the recent past and it is likely to continue rising rapidly in the future (Knapp, Shah, & Barnett, 2010). The United States population has grown nearly 10% in the last decade (United States Census Bureau, 2012). This increasing growth of the population coupled with the sustained increase in life expectancy and aging of the population are major factors pushing up the demand for pharmacists. Older people exhibit a considerable greater use of prescriptions; as much as 3.1% of their total household income is spent on prescription drugs, a proportion that is twice as large as any other age group (Center for the study of Aging, 1999). Older people also suffer from many chronic diseases such as diabetes, asthma, cardiovascular diseases and degenerative diseases of the nervous system. The current growth trend and aging pattern of the US population is expected to continue for the next several decades. And since population growth and aging has been shown to

account for as much as 44% of growth in prescription volume, the demand for pharmacists is expected to continue to rise (Knapp, 2002).

According to Schondelmeyer (2009), the expansion of third-party insurance coverage is among the most significant variable driving prescription use growth. Before 1970, more than 90% of prescriptions were paid for in cash by the consumer. There was a huge increase in prescription coverage during the 1980s and the 1990s as a result of the provision of such benefits by Medicaid programs, private health insurance and managed care plans. By 1999, 78% of all retail prescriptions were covered by third –party payers. With the enactment of MMA and the introduction of Medicare Part D prescription drug program, comprehensive prescription drug coverage was provided to seniors and other Medicare recipients. By 2008, third party payers covered about 90% of all prescriptions (Schondelmeyer, 2009). This increase in prescription volume as a result of expanded access afforded by third-party coverage will continue to drive the demand for pharmacists.

Another contributing factor to the increased demand for pharmacists is the introduction of new and innovative drug therapies and the increasing use of drug therapy to supplement physician office visits, hospitalizations, and surgical procedures. Advancement in technology and pharmaceutical innovation has led to the introduction of drug products that can treat disease conditions that were hitherto considered untreatable. There has also been a trend towards development of biologics and specialty drugs that allow a greater array of health conditions to be treated more aggressively. At the same time, the pharmacy profession has expanded its roles in the community, institutional and industrial sector. Traditionally, pharmacists have been responsible for the safe and

efficient distribution of medicines to patients and they have also provided clinical expertise regarding selection, handling, preparation, procurement, and utilization of medications in patients. But more recently, this dispensing role has expanded to include ensuring appropriate therapy and outcomes, health promotion and disease prevention (Schommer et al., 2010). Increasing complexity of drug therapy and recent curriculum changes in pharmacy education towards training a more clinically oriented pharmacist practitioner have combined to create new patient-centered roles for pharmacists. Pharmacists have thus been recognized as the healthcare professional responsible for ensuring optimal medication therapy outcomes through medication therapy management (MTM) service provision (Schommer et al., 2010).

Other factors that are contributing to increasing demand for pharmacists include growth of the economy that allow people to purchase more health care goods and services; direct-to-consumer advertising of prescription drugs, increased number of professionals with prescribing authority and greater frequency of refills. Organizational and structural changes in the pharmaceutical marketplace have led to a replacement of independent retail pharmacy stores by chain drug stores. Between 1997 and 2007, there was a 9% growth in the total number of pharmacies but the number of independent pharmacies declined by 20% (Health Resources and Services Administration, 2008). This trend towards opening of new chain pharmacies and expansion of hours of operation has led to a higher demand for pharmacists because unlike independent pharmacies, chain pharmacies require a larger staffing level because their pharmacists tend to work fewer hours (Health Resources and Services Administration, 2000). Other factors that will contribute to demand for pharmacists in the future are the adoption of centralized drug

distribution technology and policy changes that will impact pharmacy/technician ratios. There are also emerging opportunities for more direct patient care roles for pharmacists, as advances in biotechnology and introduction of individualized drug therapy continue to evolve. As the population continues to age, it is expected that pharmacists will be in demand in sectors that take care of elderly members of the population, providing another source of job growth for pharmacists.

The current pharmacy workforce is estimated to be between 230,000 and 250,000 practitioners making it the third largest health care professional group (Knapp & Cultice, 2007) but the actual supply of pharmacists has been historically debated. The pharmacy workforce is currently predominately male and white. Men account for about 55% of the workforce while minorities make up only about 14% of the workforce. 88% of the current workforce was actively practicing while 20.9% work part-time. Also, 21.6% of the pharmacy workforce holds a Pharm.D degree (Midwest Pharmacy Workforce Research Consortium, 2009).

The factors influencing the supply of health care workforce include sociodemographic, economic and socio-political factors. The supply factors impacting the pharmacist workforce include pharmacists' education, changes in the organization structures of pharmacies, pharmacists' demographics, economic conditions and pharmacists' migration. The supply of new pharmacists to the labor market is largely dependent on the number of new pharmacy graduates, which in turn is a function of the number of US pharmacy schools and their class sizes.

Historically, the US pharmacists' population has grown at a faster rate than the general population. Between 1980-2000, the average annual growth rate of pharmacists'

population was 1.6% which was about 200 percent greater than the average annual growth rate of the US resident population within the same period (Gershon, Cultice, Knapp, 2000). The period of most rapid growth in the national supply of pharmacists occurred from 1975 to 1980, and this dramatic expansion in supply was fueled by the Federal capitation programs during the 1970s (Health Resources and Services Administration, 2000). Following this period of expansion, growth slowed dramatically in the 1980s. Since 2004, a sustained growth in the number of US graduates entering the workforce has resulted in an all time high in the pharmacist supply (American Association of Colleges of Pharmacy, 2010). As a result of increasing number of new pharmacy programs and expansion of existing ones, the national supply of pharmacists is expected to continue to increase.

International pharmacy graduates (IPG) can achieve pharmacist licensure in the United States by taking equivalency and qualifying examinations and completing internship experiences. Such IPGs represent another source of new supply of pharmacists into the pharmacy labor market. In a 2007 article using National Association of Boards of Pharmacy data, Knapp & Cultice revealed that the number of IPGs achieving US licensure has been increasing over time. They stated that numbers of IPGs entering the labor market were 470 in 2003, 875 in 2004, 763 in 2005, and 883 in 2006. Although actual data are unknown, Knapp & Cultice estimated that IPGs comprise of less than 5% of the pharmacist workforce.

An important sociodemographic factor affecting the pharmacy workforce is the aging of the workforce. In 2009, 37.1% of pharmacists were over 55yrs in age compared to 30.7% in 2004, and 21.6% in 2000. The average age of men and women pharmacists

was 45.4 years and 36.2 years, respectively, in 1990, and 52.0 years and 41.7 years, respectively, in 2004. Between 2000 and 2009, the average age of licensed pharmacists has increased much more than the average age of the United States workforce (MPWRC, 2000; MPWRC, 2005; & MPWRC, 2009). Implications of the ageing pharmacy workforce are important because older pharmacists have a reduced capacity to participate in the workforce and were likely to work part-time.

Separation from the workforce through death and retirement is an important factor affecting pharmacist supply. In the last decade, lower separation rates have contributed to increased supply. Factors that could have contributed to lower separation rates include rise in wages that occurred in response to the pharmacist shortage, economic downturn in 2000 and 2008, rise in demand for pharmacists and availability of part –time work (Knapp& Cultice , 2007). There has also been a trend towards feminization of the pharmacy profession with increased proportion of pharmacy school graduates being women. This is important because compared to men, women tend to work fewer hours per week, they tend to change job more often and they may be temporarily separated from the workforce during their childbearing years (Mott et al., 2006).

2.2 Imbalance in the Pharmacist Labor Market

Disequilibrium between demand and supply of labor represents an imbalance and this poses serious challenges to the smooth running of the health care system (Zurn et al., 2002). Workforce imbalances can manifest as a surplus or a shortage of health care personnel and it can be static or dynamic. Compared to surpluses, shortages usually attract a lot of attention from stakeholders and the popular media because of the adverse consequences on access to health care and quality of health care.

In the past 3 decades, the US pharmacy labor market has experienced two dynamic pharmacist shortages. The earlier one began around 1988 (Manasse, 1989) and abated somewhat by 1994. The current shortage began around 1998 (Knapp & Livesey, 2002) and might be abating. The earlier shortage appeared to have been driven by the decline in the supply of pharmacists in the post-capitation years (supply declined by 23% between 1980 and 1985) while the current shortage is driven by strong growth in demand (Health Resources and Services Administration, 2000). During workforce shortages, changes in the mix of pharmacists' personnel across work sectors can be a signal of an intense competition among sectors for available workers. Certain patient populations can thus be rendered underserved, especially if they get their pharmacy services from sectors that lost pharmacists. Although the community retail sector remains the primary work setting that employs the largest proportion of pharmacists, independently owned pharmacies have been closing while there have been a growth in chains and mass merchandiser practice settings. Many independently owned pharmacies were dramatically impacted by pharmacist shortages and decreasing margins, with some forced to close (Stratton, 2001). Independently owned pharmacies in geographically sparse rural communities, and high-risk inner city areas are the most affected by these demand – supply imbalances (Schondelmeyer, 2009). Another employment sector that has been gaining pharmacists is the non-traditional settings such as wholesale trade, government agencies, pharmacy benefits managers (PBMs) and other insurance business services.

From an economic point of view, a shortage in pharmacist manpower occurs when the quantity of pharmacist labor demanded exceeds the quantity supplied at a given wage or market price (Feldstein, 2011, p. 364-394). In freely operating labor markets,

shortages can occur in the short run but not in the long run because when there is a shortage, attendant wage increase encourage suppliers to produce more of the goods and services hence correcting the imbalance. In contrast to the economic perspective of shortages, normative judgments of pharmacist manpower shortages are based on a determination of need in the population or on some professional estimate of pharmacist manpower requirements.

Imbalances in the health workforce can be professional/sectoral or geographic. The different type of imbalances can impact the health care system in varying ways. Professional/sectoral imbalance occurs when there is a disequibrium between demand and supply of personnel in various health professions while geographic imbalance relates to disparities between geographic regions (states, provinces) and between urban and rural regions.

According to a 2000 report from the Health Resources and Services Administration, number of pharmacists has consistently grown faster than the population beginning around the 1980s, but the rate of growth varies significantly across regions and states. In the same report, it was stated that between 1973 and 1991, the north east region consistently had pharmacists per 100,000 population ratios above the nation average, the south region had the highest growth rate during this period, and the west region consistently had the lowest pharmacists per 100,000 population ratios. This historical trends show that there have been large differences in pharmacist per population across state and regional levels. Since pharmacist practice is regulated at state levels, it is important to understand state –level distribution of the pharmacist workforce and associated factors.

Using data from the bureau of labor statistics, Walton, Cooksey & Knapp (2004) assessed the differences in number of filled pharmacist position per 100,000 population across states and found significant state level differences. States with relatively high supply of pharmacists included the District of Columbia, Hawaii and Maryland; having about 20% above the US average of filled pharmacist positions. On the other hand, Arizona, Delaware, New Hampshire and Vermont were found to be at least 20% below the national average in numbers of filled pharmacist positions. The investigators noted that there was no significant correlations between number of pharmacy graduates and number of filled pharmacist positions in a state, suggesting that migration of pharmacists after graduation is playing a huge role in the state-level redistribution of available pharmacist personnel.

Another evidence of state level variation in pharmacist supply is from the aggregate demand index. The aggregate demand index(ADI), developed by the Pharmacist Manpower Project (PMP) is a tool that is used for tracking the difficulty of filling open pharmacist positions throughout the United States. Knapp and Livesey (2002) conducted an evaluation of the performance of the ADI measure between 1991 and 2001. They found differences in the ADI measure between states, between regions, and between different pharmacy sectors. The investigators noted that on average, majority of Americans lived in regions where demand for pharmacists exceeded supply, and only two states were in balance. The substantial but unexplained differences between states, regions, and type of practice settings report in this analysis suggests that factors other than supply of new pharmacists, including but not limited to migration patterns between states; are at play.

2.3 Pharmacist Workforce Imbalance and Migration

While the pharmacist workforce is relatively large, its geographic distribution is uneven. Variations in the pharmacists supply and distribution exists between states, and between urban, rural and remote areas. For the purpose of provision of health care, areas that experience shortage of providers are designated as underserved. In such areas, the number of available pharmacists often cannot meet needs of the population. Workforce imbalances are necessarily dependent on migration patterns because migration of pharmacists across practice settings and across geographic locations contributes significantly to the observed pharmacist workforce distribution (Walton et al., 2004; Walton et al., 2007). Migration can exacerbate personnel imbalances which can negatively affect the capacity of the health system to maintain adequate coverage, access and utilization of health care services.

Migration does not correct personnel imbalances at the national level, but it impacts distribution of available personnel between geographic locations and practice sector, thus compounding workforce planning difficulties (Canadian Institute for Health Information, 2007). For instance, a Health Resources and Services Administration report (2000) discussed how during the 1980s and 1990s, migration of pharmacists to the "business services sector mostly involved the most experienced and highly educated pharmacists who are often lost to patient care services". This attrition of experienced personnel occasioned by practice sector migration can impose substantial logistic and economic impact on the origin sector or location.

Since the seminal work of Ravenstein (1882), researchers have been conducting studies aimed at understanding the determinants of labor force migration, the direction of

migrations and the impact of migration on migrants. However, research on pharmacist workforce migration is very scant in the United States. Such studies appear to be more common abroad and those done in the United States are focused on physicians and nurses. For example, Canadian Institute for Health Information (CIHI) used census data to track the migration of health care professionals between 1991 and 2001 in Canada (CIHI, 2007). They found out that the Canadian pharmacist workforce was less migratory in 2001 compared to 1991 and they identified the provinces with the highest net migration rates and the most preferred provinces for migrating Canadian pharmacists. Sloan & Elnicki (1979) found that observed wage differentials do not provide a significant explanation of the observed interstate migration patterns of the United States nursing workforce. In a more recent analysis of the nursing workforce migration trends, Sanchez & Ramer (2004) found that the net migration of nurses into and out of any two regions in the State of Texas was numerically similar. However, higher percentage of nurses migrated into metropolitan counties from rural counties, likely contributing to the rural-urban differences of the Texas nursing workforce.

The decision of a licensed pharmacist to move from one employment station to another is a personal one and it may be based on a number of occupational and non-occupational factors. Since migration of a pharmacist can be viewed as an event that is associated with job turnover, understanding job turnover can offer a peak into understanding pharmacists migration because the more the proportion of pharmacists changing jobs, the more the proportion that are likely to change employment sectors and geographic locations. A number of studies have examined pharmacists' job turnover rates and associated factors while other studies have reported the changes in pharmacists' job

turnover rates over time. Researchers have found that pharmacists' job turnover rates vary by gender, tenure and practice settings (Wolfgang, 1987; Smith, Stewart, & Grussing, 1986; Schulz & Baldwin, 1990; Schulz, Bigoness & Gagnon, 1987; Gaither, 1998). As reported by Mott (2000), pharmacists' job turnover rate in 1991 was higher than the turnover rate of U.S workers in the professional and related services sector of the economy, suggesting that the pharmacist workforce may be very mobile.

While job turnover rates may help us to understand the frequency of leaving, they do not provide a description of the nature of job turnover. The process of job turnover may involve changes in practice setting. It may also involve the pharmacist personnel migrating from one geographic location to another within the same state, or out of state. Work sector transition and migration of licensed pharmacists occasioned by job turnover can thus influence the supply side of the pharmacist's workforce. Understanding the magnitude and pattern of pharmacist workforce migration will thus contribute to a more comprehensive understanding of the supply and distribution of the pharmacist workforce.

As reported by Mott (2000), about half of pharmacist job turnover events occur before a pharmacist has worked three years for an employer. Since every job turnover event has the likelihood of being a migration event, it is reasonable to assume that migration occurs more frequently in pharmacists with shorter tenure of professional practice. In a study examining state-level changes in the pharmacist labor market between 1990 and 2000 using census data, Walton et al. (2007) found that younger pharmacists (age 24-35) migrated more frequently than older pharmacists and the population in general. Older, more experienced pharmacists have a lower probability of migrating probably because their expected working life is shorter. Thus, they have a shorter length

of time over which to realize the benefits of migrating, which makes the rate of return on migration lower for them. Job security and family ties are also likely to be more important for older pharmacists than for younger ones, which will further discourage older pharmacists from migrating.

In a study of the geographic mobility of professional workers, Ladinsky found that between 1955 and 1960, pharmacists tend to be less migratory than other health care professionals, because back then, most pharmacists were self-employed or worked in independently–owned stores where the model of practice required close cultivation of clienteles (Ladisnsky,1967). Lack of reciprocity in state licensing requirements across jurisdictions also discouraged interstate migration of pharmacists, such that when pharmacists do move, they do so locally. Changing organizational structure in American pharmacy has led to the rise of large chain store as the dominant employer in retail pharmacy sectors (Schondelmeyer, 2009) leading to a decrease in the number of self-employed pharmacists. The largest chain stores have many salaried pharmacists in geographically scattered locations and the "flat" hierarchies in these organizations limit opportunity for advancement (Cardinale, 1991).

2.4 Theoretical Framework

Migration is a form of human behavior that is important to researchers in diverse fields. In 1885 Ravenstein postulated certain empirical laws concerning the relationship of migration to age and distance. Since then, there has been an abundance of migration research and different models have been developed to explain the volume or rate of migration in relation to characteristics of the migrants and areas of origin and destination (Stouffer, 1960; Castles, 2008). However, there are yet no universal laws of migration

that are currently accepted by migration researchers. The present study was based on elements of the labor mobility approach (favored by economists) and socio-demographic framework of migration as proposed by Lee.

2.4.1 Labor Mobility Framework of Migration

Since the early 1930s, the position of orthodox economic thought on the question of geographic labor mobility is that net economic differences, mainly wage differentials, are the most important drivers of migration. However, it was Sjaastad (1962) that first recognized migration as a 'form of investment in human capital'. The investment approach of migration decisions requires a cost-benefit calculation. Individuals and households incur out-of –pocket expenses, earning forgone, and psychic and informational costs. The potential returns include increments to earnings, potential improvements in non-pecuniary aspects of jobs and the availability of amenities at an alternative location. Formulated in the context of individual utility maximization, migration will occur where the present value of future benefit exceeds the costs (Greenwood, 1975).

Greenwood (1975) postulated that migration is directly proportional to the size of the origin and destination populations, and inversely related to distance. Migration decreases substantially with increased distance probably because distance has been postulated as serving as a proxy for both the out-of-pocket and psychic costs of movement; and information availability. The psychic costs emphasized are separation from family and friends.

Although net benefits are expressed in terms of the economic advantage of one location over another, the human capital framework recognizes that there are other

reasons for moving other than earning potential. Speare (1971) posits that migration could not just be a response to a wage differential between two places, because only a small proportion of the people at the place with the lower wages migrate. Thus, in addition to market conditions of origin and destination areas, it is pertinent to consider factors that describe non-market conditions of those areas. Some of these factors include the presence of family and friends, amenities and services (Ritchey, 1976).

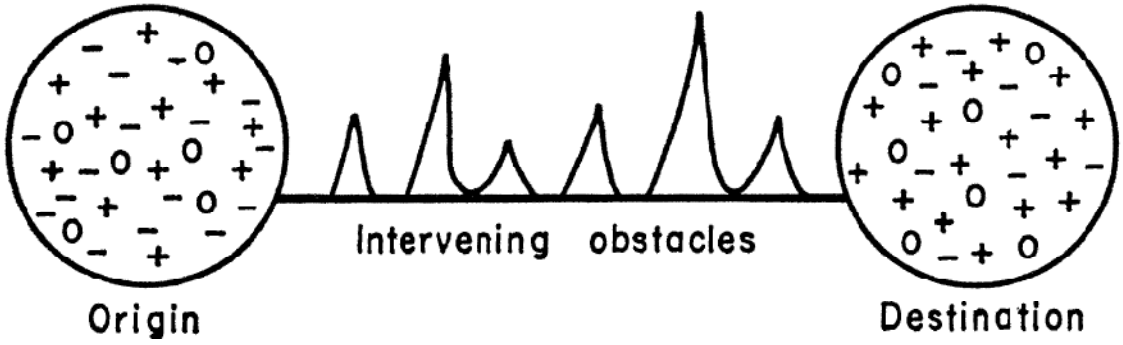
2.4.2 Lee's Schema

Lee (1966) suggested a simple behavioral framework for the study of determinants of migrations. According to Lee, the decision to migrate includes consideration of 'positive and negative factors associated with the area of origin, positive and negative factors associated with the area of destination, intervening obstacles and personal factors'.

Lee recognized that factors at origin and destination can either be positive or negative in that they either act to attract people to a place or repel them from it. The set of positive and negative factors is defined differently for each individual, but people can be classified by their response to a general set of factors at origin and destination. After an individual makes a comparison of factors at origin and destination, he chooses to migrate when a large enough balance is found in favor of the move. In addition, influencing this decision is a set of intervening factors between the origin and destination and the existence of many personal factors which affect individual's threshold.

With regard to the determinants of interstate migration of pharmacists, factors at state of origin and state of destination are likely to be those related to the pharmacist labor market. Such factors include wage differential between the states, number of available

Figure 2.1: Schematic Diagram of Lee's Model

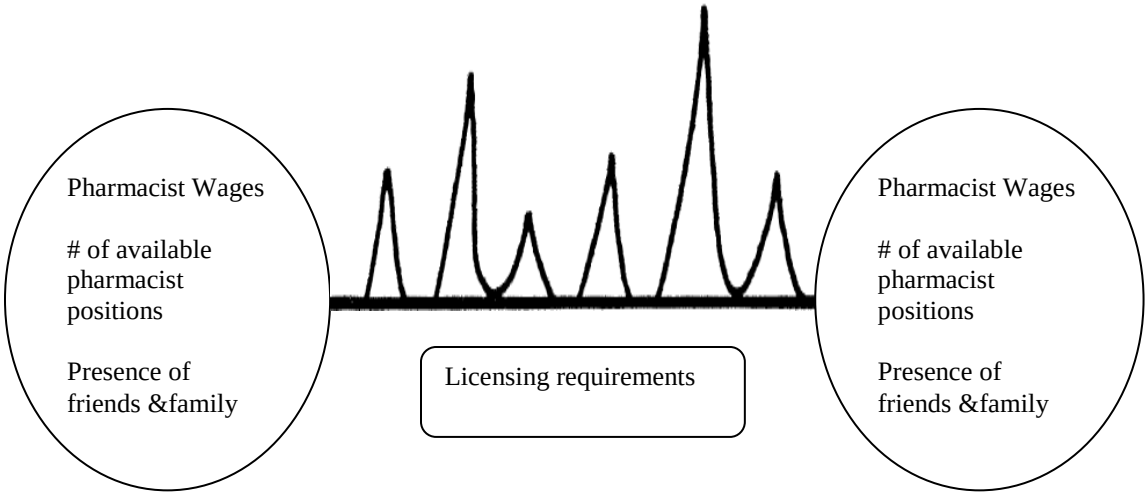


Source: Lee, 1966.

positions and distribution of available positions across practice sectors since migration frequently involves not only a change of region of employment, but also a change of work sectors (Schlottmann, & Herzog, 1984). Intervening obstacles will include distance between the destination and origin states and the degree of reciprocity in licensing requirements between the states. The intervening obstacles include any physical, legal or economic impediment to mobility. The effect of a given set of obstacles varies with the number of dependents and some other factors. One of the intervening factors that have been widely reported in migration literature is the distance of the move. It is possible that migration decreases substantially with increased distance because distance is a proxy for costs of mobility (Greenwood, 1975).

Facilitating or impeding the decision of a pharmacist to migrate are personal factors including age, level of education, income, employment status, gender, marital status, and race/ethnicity. Some of these factors are constant throughout the life of the individual, while others may be associated with stages in the life cycle. Ritchey (1976) opined that life –cycle may be described as lifelines representing individuals moving

Figure 2.2: Lee's Schema Highlighting Pharmacist's Variables



between "stations" in life. Because life cycle factors are difficult to observe, age is frequently cited as being representative of life-cycle position.

In the context of its impact on migration decisions, life-cycle could be seen as incorporating a number of influences including job-career position (Ritchey, 1976). For instance, the higher rates of migration of younger pharmacists compared to older pharmacists (as reported by Walton, 2007) may indicate the process of searching for employment opportunities and testing out different career options during the early working years. Also, pharmacists who are married, or have children or other dependents would have increased ties to the community thus minimizing their propensity to migrate (Miller, 1976). Hence, migration, especially among less experienced pharmacists, is expected to involve not only a change of geographic location of employment, but also a change of work sectors (Lansing & Mueller, 1967).

One feature that sets the Lee's framework apart from other frameworks is that it presents migration as the decision-making behavior of individuals being exposed to stimuli inducing them to migrate. Unlike the human capital framework which frames migration decisions as rational choices mainly driven by wage differences, this behavioral approach recognizes the possibility that migration decisions are imposed on some individuals by external forces beyond their control.

2.5 Summary and Study Objectives

Pharmacist migration could exert a considerable impact on the distribution of the pharmacists' workforce at the state level and between different work sectors. There is not a good empirical understanding of the factors related to this phenomenon. Researchers have examined pharmacists' job turnover rates and associated factors; and aggregate state-level migration rates of pharmacists have been published. But overall, review of the literature reveals that pharmacist migration in the US remains a neglected area of study.

Because variations in migration occurs across the life cycle, it is not too far-fetched to posit that there are differences and similarities between migration that occur within a short time period and those that occur over a relatively longer time period. For instances magnitude, pattern and structural determinants of pharmacist's migration tendencies within the first five years of being licensed would be different from that of the migration events that occur over the course of a pharmacist's career (spanning 30 or more years). Hence, this study examines the following research questions:

1. What are the magnitude, temporal patterns, and determinants of pharmacists' migration between work sectors and across geographic locations over a long time period?

2. What are the occupational and non-occupational (socioeconomic, family structure and demographic) factors associated with geographic migration of pharmacists over a short time period?

This study examines the following specific objectives for research question # 1.

A. Describe the magnitude and temporal patterns of pharmacists' migration between work sectors and across geographic locations.
    i. Estimate annual between sector out-migration rates between 1980 and 2009.
    ii. Estimate geographic out-migration rates for pharmacists between, 1980-1989, 1990-1999, and 2000-2009.
    iii. Identify trends in practice sector out-migration rates and geographic out-migration rates between 1980 and 2009.
    iv. Describe the relationship between practice sector out-migration and geographic out-migration.
B. Describe the factors related to sectoral and geographic migration of pharmacists.

This study examines the following specific objectives for research question # 2.

A. Describe the magnitude and patterns of migration of pharmacists across geographic locations.
    i. Estimate general mobility for pharmacists by gender and by age between 1995 and 2000.
    ii. Estimate in-migration, out-migration and net migration for pharmacists by region, division and states between, 1995 and 2000.

iii. Describe the characteristics of states by pharmacists' net-migration status.

B. Examine the occupational and non-occupational (socio-economic, family life cycle and demographic) factors related to geographic migration of pharmacists, between 1995 and 2000.

CHAPTER 3: MAGNITUDE, TEMPORAL PATTERNS, AND DETERMINANTS OF PHARMACISTS' MIGRATION BETWEEN WORK SECTORS AND ACROSS GEOGRAPHIC LOCATIONS; 1980 TO 2009

3.1 Data Sources

To assess the magnitude, patterns and determinants of between sector and geographic migration of the pharmacist workforce between 1980 and 2009, we used job histories collected from a cross-section of pharmacists.

The sources of data for this section of the study were the 2000 and 2009 National Pharmacist Workforce Survey (NPWFS). Sponsored by the Pharmacy Workforce Center, Inc., the NPWFS is a nationally representative survey of licensed pharmacists in the US. The surveys target population was all licensed pharmacist in the country. Using the Dillman method, this self-administered, mailed survey obtained a response rate of 46% and 52% in 2000 and 2009 respectively. A detailed discussion of the sampling design, sampling error and non-response bias can be found elsewhere (MPWRC 2000; MPWRC 2009).

Pharmacists were asked questions on demographics, work schedule, family characteristics and work history. The work history section solicited information related to all the jobs that pharmacists had held in their working career. A job was defined as a position with a new employer. Survey respondents were asked to provide the work sector, and date when they started and left a job. In the 2000 survey, respondents were also asked to provide approximate number of months worked and the state in which they were employed. Similarly, respondents to the 2009 survey were asked to provide the city and state of their employment.

A database of pharmacy jobs was created from the work history section of the survey. For each job, data fields included a respondent identifier, sex of respondent, age of respondent when he started and left the job, serial number of the job and practice sector of the job.

3.2 Study Variables

Three types of migration events were identified; between sector out-migration, geographic out-migration and between sector out-migration accompanied by a geographic migration event.

Between sector out-migration rates were determined for each year between 1980 and 2009. For geographic migration, migration rates were computed for each decade between 1980 and 2009 i.e. 1980-1989, 1990-1999, and 2000-2009.

3.2.1 Between Sector Out-migration

A between sector out-migration event was defined as a job transition to a new practice sector. Although closely related, practice sector migration and job turnover are distinct in the context of this study; while job turnover is defined as job change involving a different employer, practice sector migration is a job change involving both a different employer and a different employment sector. Furthermore, job changes for which the reason for leaving was related to closings were not classified as a practice sector migration event. Following Mott's (2000) classification, practice sector was defined as independent or small chain, large chain, or institutional. Independent/small chain pharmacies included single ownership pharmacies, small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care sectors.

Annual between sector out-migration rate was computed by dividing the total number of events in a year by the total number of respondents employed in that year. Because each individual can have multiple events in a single year, using the number of events rather than the number of respondents experiencing an event (s) will give more accurate migration rate.

3.2.2 Geographic Out-migration

A geographic migration event was defined as a job transition that involves a change in state of occupation (interstate migration). We evaluated ten-year interstate migration rates for each of the four US census regions; rather than annual migration rates because it was expected that migration events was rare (out-of-state movers as a percentage of all members was calculated as 7.1 % for pharmacists between 1965 and 1970 by Ladinsky). For each ten-year period, migration rate was computed by dividing the total number of interstate migration events out of states in a census region by the total number of pharmacist-years employed in states located in that region within that period. Although migration rates are typically calculated based on state of residence in the geographic migration literature, we accounted for pharmacist's state of employment, rather than state of residence; because respondents were asked where they worked, not where they lived.

3.2.3 Between Sector Out-migration Accompanied by a Geographic Out-migration Event

The third type of migration event studied was between sector out-migration accompanied by a geographic migration event. Empirical studies have shown that among active labor force participants, there exist an interactive dimension between sectoral

migration and geographic migration; such that a change in job sector is frequently accompanied by a change in geographic location, especially for younger professional workers (Schlottmann, & Herzog, 1984; Ricketts, 2010). Thus, we defined 'combined' migration events as those involving both a between sector migration event and a geographic migration (interstate) event.

Other variables of interest include demographic variables such as age of pharmacists at each job, gender and race.

3.3 Data Analysis

Various non-parametric descriptive analyses were conducted to characterize the magnitude and temporal patterns of sectoral and geographic migration of pharmacists. For graphical illustration, trend curves were plotted for between sector out-migration rates for each practice sector by gender between 1980 and 2009.

To assess differences in the average between sector migration rates across the different practice sectors (independent or small chain, large chain and institutional), Kruskal -Wallis test of analysis of variance was used; this analysis was computed for the entire study period and separately for each decade. We also conducted this analysis for all respondents and separately for each gender.

To assess differences in median between sector out-migration rates across decades (1980s, 1990s, 2000s), Kruskal-Wallis test of analysis of variance was used; this analysis was computed separately for each practice sector (independent/small chain, large chain and institutional) and examined by gender.

When an omnibus Kruskal-Wallis analysis yielded a p-value less than 0.05 signifying that two or more medians were statistically different, we performed post-hoc

comparison of medians using Dunn's tests or Nemenyi test. Dunn's test is used for post-hoc comparisons when there are equal sample sizes per group and no tied ranks, while Nemenyi test is used when sample sizes are unequal, or in the presence of tied ranks (Elliot, & Hynan, 2011). We implemented Dunn's and Nemenyi tests using a SAS macro authored by Elliot and Hynan (2011).

To assess differences in median between-sector out-migration rates by gender , Mann –Whitney U test was used; this analysis was computed separately for each practice sector (independent/small chain, large chain and institutional) and examined by decade.

Chi-square statistics was used to examine if there was an association between practice sector migration and geographic migration.

To assess differences in the median geographic migration rates across the four US census regions (Northeast, Midwest, South and West), Kruskal -Wallis test of analysis of variance was used; this analysis was computed for the entire study period and separately for each decade.

To assess differences in median geographic migration rates for each of the four US census region across decades (1980s, 1990s, and 2000s), Kruskal-Wallis test of analysis of variance was used.

3.3.1 Survival Analysis

We used survival analysis to study factors related to sectoral and geographic migration of pharmacist workforce. Survival analysis consists of analytic techniques that typically focus on time to event data. Performing a survival analysis allows you to investigate both the occurrence and timing of events. Survival analysis is very useful for

studying many different kinds of events and has recently been used to examine career change and labor force separation of the nursing workforce (Nooney, Unruh, & Yore, 2010; Cho, Lee, Mark, & Yun, 2012). In this study three types of migration events were examined (sectoral, geographic, and combined sectoral and geographic migration events). Because these events had different rates of occurrence, they were examined separately in survival analysis.

To examine factors related to migration, Cox regression was conducted. Cox regression is a semi-parametric model predicting the hazards of an event. The dependent variable in each of the three Cox regression models examined were time to migration event and censorship (whether a migration event occurred or not). The independent variables were practice sector, job serial number, demographic variables (age, gender, and race), time period (1980s, 1990s, and 2000s) and region (northeast, Midwest, south and west). To correct for dependence among individual pharmacists having multiple jobs (hence multiple observations), hazard ratios were calculated using Cox regression models with robust sandwich estimators, following the methods of Wei & Lin (1989). All models were fitted using PROC tPHREG in SAS version 9.1.3.

3.4 Results

Our analysis showed that of the 1,391 pharmacists who responded to the 2009 survey, 55.2% were men while 44.8% were women. A total of 78(6.6%) were retired but still working, 83(7.4%) were retired, 23(2.0%) were working in a profession other than pharmacy and 34(3.0%) were unemployed. The mean age for the respondent was 51.9 years (standard deviation=12 years). A total of 2,250 pharmacists responded to the 2000

survey, 43.3% of whom were females. 6.2% of respondents were retired while only 2.6% of were not working at all.

Our analysis identified 3,139 pharmacists (1,872 and 1,267 from the 2000 and 2009 surveys respectively) who provided information on their job histories for a total of 11,751 jobs. A total 1459 jobs were removed because they had end dates earlier than January 1980. Another 239 jobs with missing start or end dates were also removed. Thus 10,053 jobs with start dates ranging from 1948 to 2009 were included in the analytic database.

Respondents in this study had a total of 1,986 between-sector job changes between 1980 and 2009. Figures 3-1, 3-2 and 3-3 show the annual between sector migration rates for pharmacists who left independent/small chain, large chain and institutional sectors. Overall, migration out of large chain sectors appeared to be the highest over the entire study period, while out-migration rates for female pharmacists appeared to be greater than out-migration rates for male pharmacists for each sector.

Table 3-1 presents the between sector migration rates out of independent/small chain, large chains and institutional sectors for all respondents, male respondents and female respondents over the study period.

For all respondents, the median annual migration rate for pharmacists leaving independent/small chain, large chain and institutional sectors was 4.61%, 4.92% and 3.7% respectively over the entire 30 years study period. The difference in median annual migration rates across practice sectors was significant (Kruskal-Wallis test, $p < 0.01$). Similar trends were observed in the magnitude of between-sector migration between 1980-1989 and 1990-1999. For the 2000-2009 period, median between sector out-

migration for the independent/small chain sector appeared to be greater than that of the large chain sector, but the difference was not statistically significant at the 0.05 level (Dunn's test).

For male respondents, the median annual between sector out-migration rates across the 30-year study period for pharmacists leaving independent/small chain, large chain and institutional sectors was 4.43%, 4.03% and 3.46% respectively. Median between sector out-migration out of the institutional sector was significantly lower than the rate for either independent/small chain or large chain sector (Dunn's test, $p < 0.05$). Median annual out-migration rates for male pharmacist leaving the three practice sectors studied were not statistically significantly different between 1980-1989 and 1990-1999. However, between 2000 and 2009, the median annual out-migration rate for pharmacists leaving institutional sectors was significantly lower than those leaving either independent/small chain (Dunn's test, $p<0.05$).

The median annual between sector out-migration rates across the 30-year study period rate for female pharmacists leaving independent/small chain, large chain and institutional sectors was 5.3%, 6.14% and 4.0% respectively. The median between sector out migration rate out of the large chain sector was significantly higher than the rate of those leaving institutional sector in the 1990-1999 period (Dunn's test, $p < 0.05$).

Table 3-2 presents the difference in median between sector out-migration rates across decades for each sector. For independent/small chain sector, median between sector out-migration appeared to increase with time, but the differences were not statistically significant. For the large chain sector, between sector out-migration in the 2000-2009 period was statistically significantly lower than for the 1990-1999 period

(Dunn's test, $p<0.05$). For the institutional sector, between sector out-migration in the 2000-2009 period was statistically significantly lower than for the 1980-1989 period (Dunn's test, $p<0.05$). Thus, it appeared that between sector out-migration rates out of the large chain and institutional sectors decreased with time during our study period.

For men, table 3-2, shows that median between sector out-migration rates out of the institutional sector in the 2000-2009 period was statistically significantly lower than in the 1990-1999 period (Dunn's test. Similarly, for women respondents, median between sector out-migration rates out of the institutional and large chain sectors in the 2000-2009 period were statistically significantly lower than in the 1990-1999 period (Nemenyi test, $p<0.05$).

Table 3-3 presents the differences in median between sector out-migration rates for each sector by gender. Overall, for each of the three sectors studied, median out-migration rates for women appear to be statistically significantly greater than for men over the entire study period.

Table 3-4 presents the destination practice sector of pharmacists when they migrate between sectors, for all respondents and for male and female respondents separately. When pharmacists migrate out of the independent/small chain sectors, their most popular destination sector was the large chain sector. This was true for both male and female pharmacists. However, when pharmacists migrate out of the large chain sector, independent/small chain sector was their least popular destination; and this was true for both male and female pharmacists. Pharmacists who migrated out of the institutional sectors were most likely to move to sectors other than the community sector (independent/small chain and large chain sectors).

Table 3-5 presents the annual inter-state migration rates across geographic regions by decade. For the entire study period and separately for each decade (1980-1989, 1990-1999, 2000-2009), median interstate migration did not differ significantly among the regions (northeast, midwest, south and west). Pharmacists employed in states located in the south, west, and the midwest regions had the highest migration rates out of their states of employment between 1980-1989, 1990-1999 and 2000-2009 respectively.

Table 3-6 presents the differences in median interstate migration rates across decades for each region. For the northeast region, median interstate migration in the 2000-2009 period was statistically significantly lower than for the 1980-1989 period (Nemenyi test, $p<0.05$). Similarly trend was observed for the midwest and south region. For the west region, median interstate migration in the 2000-2009 period was statistically significantly lower than for the 1990-1999 period (Nemenyi test, $p<0.05$). Thus, it appeared that interstate migration rates decreased with time during our study period.

The distribution of pharmacists who migrated out of their state of practice between 1980 and 2009 according to their origin and destination regions is shown in Table 3-7. This table revealed that the highest proportion of migrant pharmacists moved from their state of employment to another state within the same region. Other than the region in which the state of employment was located, the next preferable destination for migrant pharmacists was to a state in the South census region.

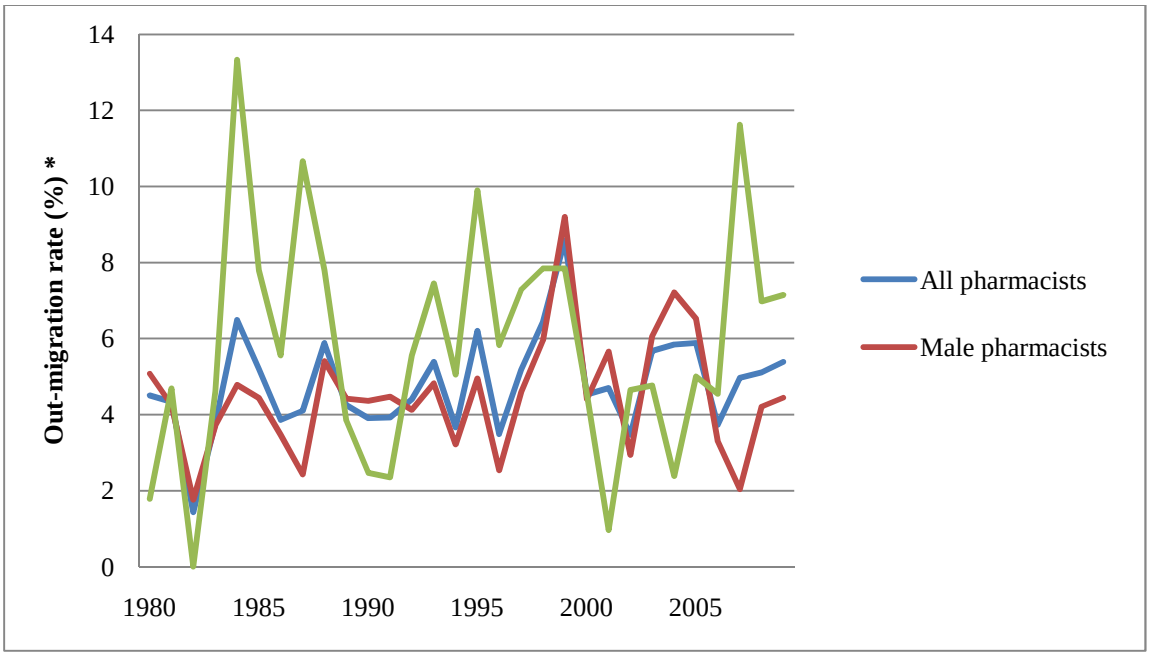
Table 3-8 shows the result of Chi-square analysis examining the association between between sector migration and geographic migration. The percentage of between sector migrants who were also interstate migrants was 19.4 % compared to 6.97 % for

between sector non-migrants who were interstate migrant. This difference was statistically significant (Chi-square, $p<0.0001$).

Results from the Cox regression analyses are presented in Table 3-9. Pharmacists were significantly more likely to change practice sector if they worked in independent/small chain pharmacies and were male. Higher job serial number has an increased hazards of between sector out-migration, indicating that pharmacists who had changed sectors before were more likely to change sectors again (HR =1.43, $p <0.001$). Hazards of between sector out-migration significantly decrease with age (HR =0.92, $p<0.0001$). Compared to the 1980s, the hazards of between sector out-migration were smaller for both the 1990s and 2000s. Compared to the northeast, hazards of between sector out-migration were higher for pharmacists who worked in the south and west region, over the entire study period. Our findings showed similar relationships between the study variables and combined between sector and geographic (interstate) migration event.

The relationships of the study variables with interstate migration were different in a number of ways. Pharmacists were significantly more likely to change state of practice if they worked in a sector other than independent/small chain pharmacies. Gender and race did not significantly predict interstate migration of pharmacists. Also, hazards of interstate migration did not differ significantly between regions during the study period.

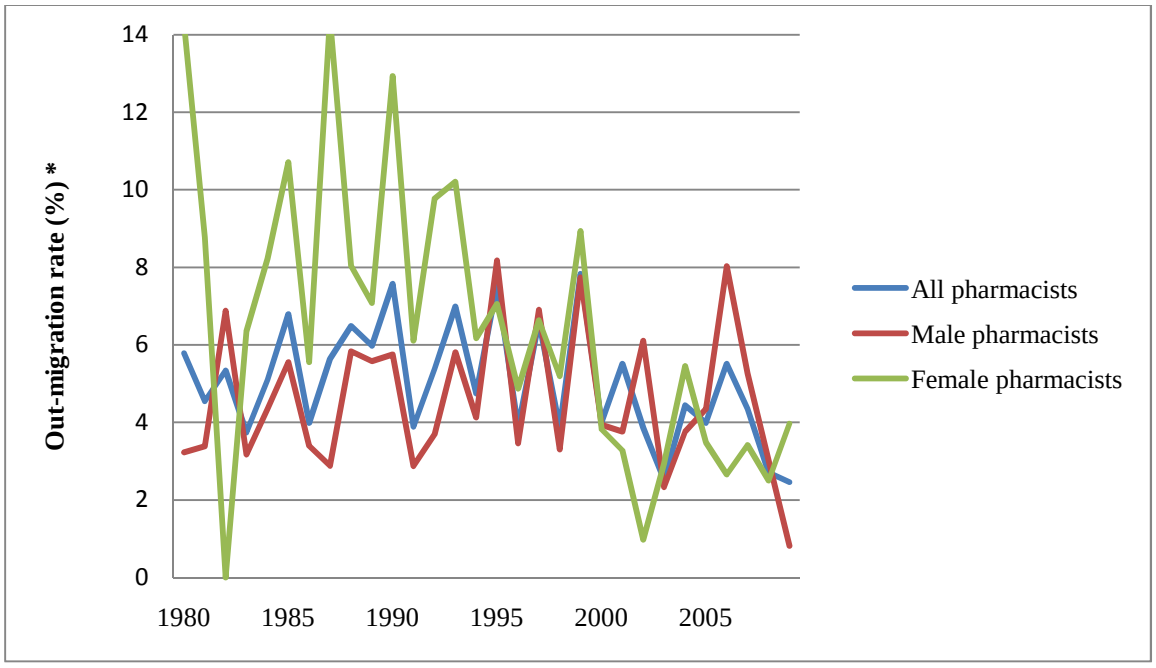
Figure 3-1. Annual Migration Rates out of Independent/small Chain Practice Sectors; 1980-2009 [&]



*Out- migration rates calculated as the percentage of pharmacists who left independent/small chain practice sector in each year, to take up employment in large chain, institutional or other sectors.

[&]Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings. Other settings include academia, nuclear, pharmacy benefit managers and other settings.

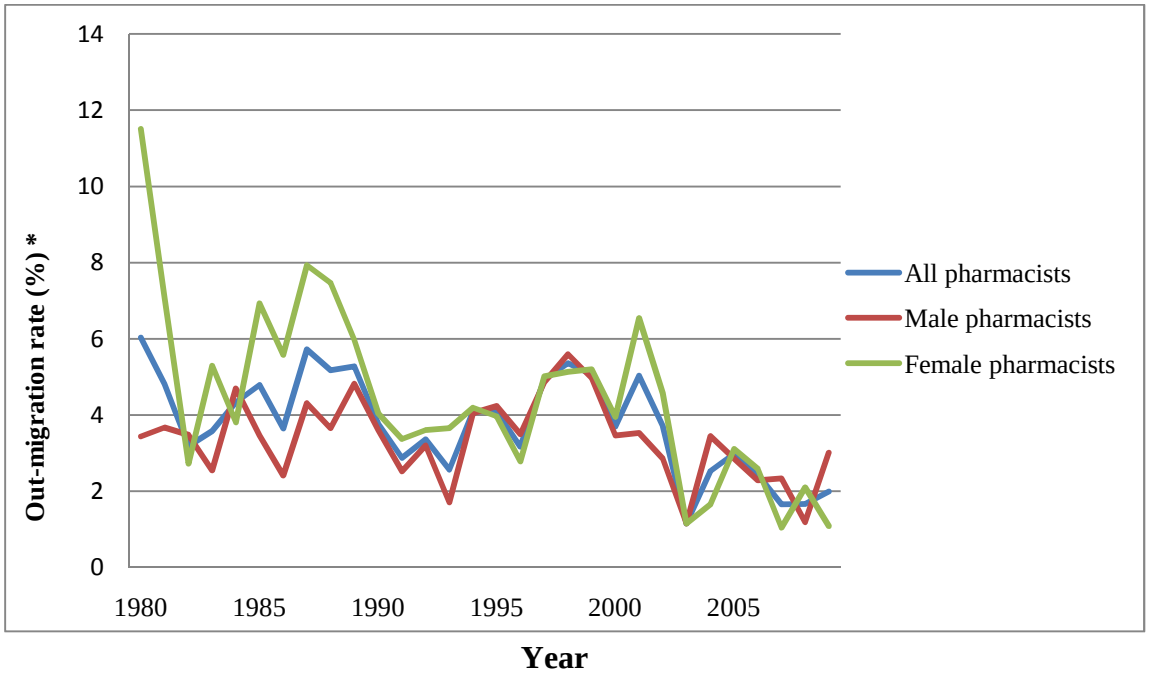
Figure 3-2. Annual Migration Rates out of Large Chain Practice Sector; 1980-2009[&]



*Out- migration rates calculated as the percentage of pharmacists who left large chain practice sector in each year, to take up employment in independent/small chain, institutional or other sectors.

[&]Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings. Other settings include academia, nuclear, pharmacy benefit managers and other settings.

Figure 3-3. Annual Migration Rates out of Institutional Practice Sector; 1980-2009[&]



*Out- migration rates calculated as the percentage of pharmacists who left institutional practice sector in each year, to take up employment in independent/small chain, large chain or other sectors.

[&]Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings. Other settings include academia, nuclear, pharmacy benefit managers and other settings.

Table 3-1. Between sector Out-migration Rates for All Respondents, by Sex and by Practice Sector; 1980-2009

Practice sectors[&]	Annual between-sector migration rates (%)*			
	1980-2009 Median (5%-95%)	1980-1989 Median (5%-95%)	1990-1999 Median (5%-95%)	2000-2009 Median (5%-95%)
All Respondents				
Independent/small chain	4.61 (3.5-6.5)[a]	4.30 (1.4-6.5)	4.79 (3.5-8.6)[a,b]	5.04 (3.5-5.9)[a]
Large chain	4.92 (2.5-7.6)[a]	5.49 (3.7-6.8)	5.99 (3.9-7.8)[a]	3.99 (2.5-5.5)[a,b]
Institutional	3.7 (1.7-5.7)[b]	4.8 (3.2-6.0)	3.94 (2.6-5.4)[b]	2.48 (1.2-5.0)[b]
P-value	0.002	0.20	0.03	0.001
Men				
Independent/small chain	4.43 (2.0-7.2)[a]	4.34 (1.8-5.4)	4.53 (2.5-9.2)	4.42 (2.0-7.2)[a]
Large chain	4.03(2.3-8.0)[a]	3.87 (2.9-6.9)	4.94 (2.9-8.2)	3.85 (0.8-8.0)[a,b]
Institution	3.46 (1.2-5.0)[b]	3.56 (2.4-4.8)	3.83 (1.7-5.6)	2.86 (1.2-3.5)[b]
P-value	0.005	0.62	0.30	0.02
Women				
Independent/small chain	5.30 (1.0-11.6)	5.12 (0-13.3)	6.56 (2.4-9.9)[a,b]	4.71 (1.0-11.6)
Large chains	6.14 (1.0-14.3)	8.13 (0-14.4)	6.85 (4.9-12.9)[a]	3.35 (1.0-5.5)
Institution	4.00 (1.1-7.9)	6.45 (2.7-11.5)	4.0 (2.8-5.2)[b]	2.35 (1.0-6.5)
P-value	0.05	0.20	0.003	0.05

* Annual between –sector out-migration rates calculated as the percentage of pharmacists who leave a practice sector in each year.

& Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings.

Medians with the same letters are not significantly different (Dunn's test for post hoc comparison of medians).

P-values are derived from Kruskal-Wallis' test of statistically significant difference between medians for all respondents, and separately for men and women.

Table 3-2. Differences in Median between sector Out-migration Rates across Decades (1980-2009) for Each Sector by Gender

Practice sectors	Annual between-sector out-migration rates (%)*			P-value
	1980-1989 Median (5%-95%)	1990-1999 Median (5%-95%)	2000-2009 Median (5%-95%)	
All Respondents				
Independent/small chain	4.30 (1.4-6.5)	4.79 (3.5-8.6)	5.04 (3.5-5.9)	0.69
Large chain	5.49 (3.7-6.8)[a,b]	5.99 (3.9-7.8)[a]	3.99 (2.5-5.5)[b]	0.03
Institutional	4.8 (3.2-6.0)[a]	3.94 (2.6-5.4)[a,b]	2.48 (1.2-5.0)[b]	0.004
Men				
Independent/small chain	4.34 (1.8-5.4)	4.53 (2.5-9.2)	4.42 (2.0-7.2)	0.57
Large chain	3.87 (2.9-6.9)	4.94 (2.9-8.2)	3.85 (0.8-8.0)	0.54
Institution	3.56 (2.4-4.8)[a,b]	3.83 (1.7-5.6)[a]	2.86 (1.2-3.5)[b]	0.02
Women				
Independent/small chain	5.12 (0-13.3)	6.56 (2.4-9.9)	4.71 (1.0-11.6)	0.44
Large chains	8.13 (0-14.4)[a]	6.85 (4.9-12.9)[a]	3.35 (1.0-5.5)[b]	0.0005
Institution	6.45 (2.7-11.5)[a]	4.0 (2.8-5.2)[a,b]	2.35 (1.0-6.5)[b]	0.001

*
Annual between –sector out-migration rates calculated as the percentage of pharmacists who leave a practice sector in each year.

&
Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings.

P-value: test of statistically significant difference between medians, across decades; Kruskal-Wallis test.

Medians with the same letters are not significantly different (Dunn's test or Nemenyi test for post hoc comparison of medians).

Table 3-3. Differences in Median between sector Out-migration Rates by Gender within Each Sector (1980-2009)

Practice sector[b]	Annual between-sector out-migration rates (%)[a]		P-value[c]
	Male pharmacists Median (5%-95%)	Female pharmacists Median (5%-95%)	
1980-2009			
Independent/small chain	4.43 (2.0-7.2)	5.3 (1.0-11.6)	0.03
Large chain	4.03(2.3-8.0)	6.14 (1.0-14.3)	0.03
Institutional	3.46 (1.2-5.0)	4.0 (1.1-7.9)	0.048
1980-1989			
Independent/small chain	4.34 (1.8-5.4)	5.12 (0-13.3)	0.15
Large chain	3.87 (2.9-6.9)	8.13 (0-14.4)	0.007
Institution	3.56 (2.4-4.8)	6.45 (2.7-11.5)	0.003
1990-1999			
Independent/small chain	4.53 (2.5-9.2)	6.56 (2.4-9.9)	0.13
Large chains	4.94 (2.9-8.2)	6.85 (4.9-12.9)	0.03
Institution	3.83 (1.7-5.6)	4.0 (2.8-5.2)	0.6
2000-2009			
Independent/small chain	4.42 (2.0-7.2)	4.71 (1.0-11.6)	0.5
Large chains	3.85 (0.8-8.0)	3.35 (1.0-5.5)	0.26
Institution	2.86 (1.2-3.5)	2.35 (1.0-6.5)	0.73

[a] Annual between –sector out-migration rates calculated as the percentage of pharmacists who leave a practice sector in each year.

[b] Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings.

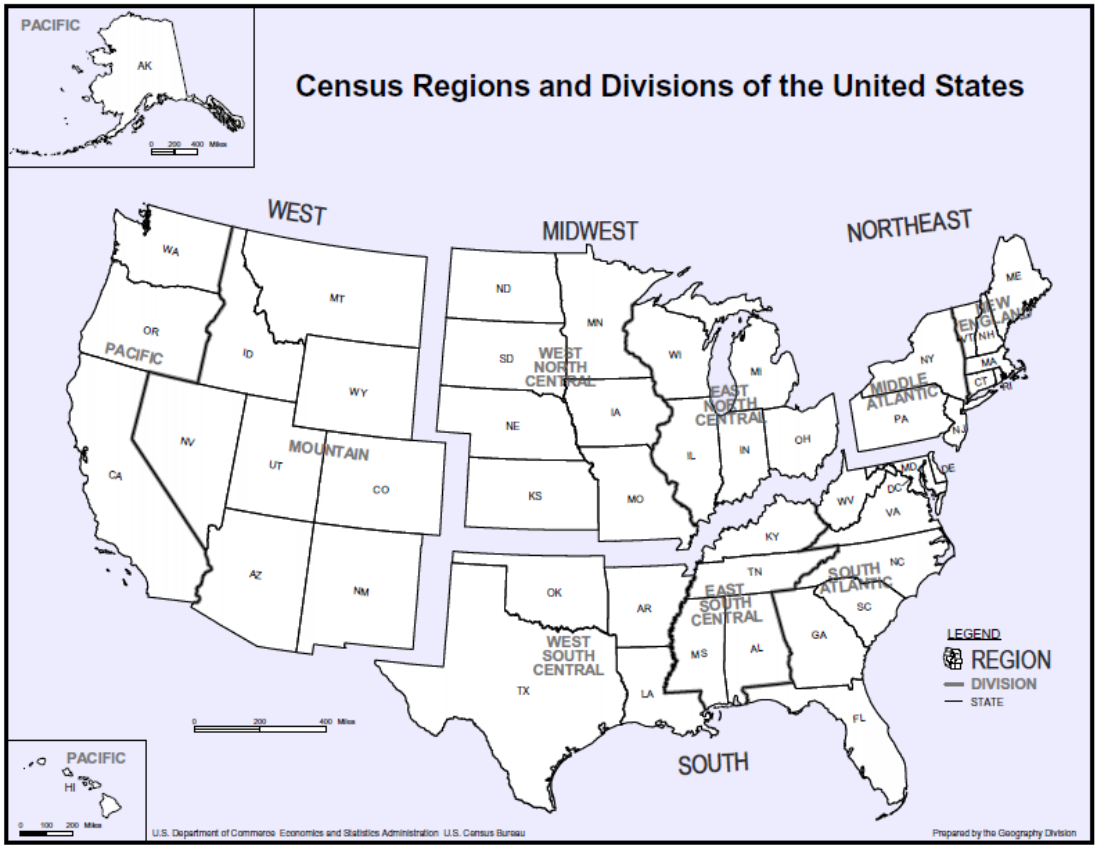
[c] P-values obtained from the Mann-Whitney U test.

Table 3-4. Destination Sectors of between sector Movers

Origin sector[a]	Destination sector (%)[b]				
	Independent/ small chain	**Large chain**	**Institutional**	**Others**	**Total**
All Respondents					
Independent/small chain	0	46.3	25.1	28.6	100
Large chain	24.3	0	32.6	43.1	100
Institutional	15	26.4	0	58.6	100
Men					
Independent/small chain	0	49	21.7	29.3	100
Large chain	28.2	0	30.9	40.9	100
Institution	15.4	25.2	0	59.4	100
Women					
Independent/small chain	0	40	33.1	26.9	100
Large chains	19.1	0	34.9	46.1	100
Institution	14.6	27.6	0	57.8	100

[a] Independent/small chain pharmacies included single ownership pharmacies and small chains with less than eleven units. Large chains pharmacies were defined as chains with eleven or more units. Institutional pharmacies included hospitals, nursing homes, and home health care settings. Other settings include academia, nuclear, pharmacy benefit managers and other settings.

Figure 3-4. Census Regions and Divisions of the United States



Source: US Bureau of the Census

Table 3-5. Inter-state Out-migration Rates across Geographical Regions by Decade (1980-2009)[a]

Census region[c]	Migration rate (%)[b]			
	1980-2009 Median (5%-95%)	1980-1989 Median (5%-95%)	1990-1999 Median (5%-95%)	2000-2009 Median (5%-95%)
Northeast	1.89(0.5-3.1)	2.17 (0.8-3.1)	2.06 (1.0-3.2)	1.12 (0-2.2)
Midwest	1.80 (0.4-3.3)	2.41 (1.2-4.3)	1.72 (1.0-3.2)	1.4 (0.3-2.7)
South	1.94 (0.3-3.8)	3.25 (1.2-4.0)	2.3 (1.1-3.2)	1.36 (0.3-2.1)
West	2.09 (0.6-4.2)	2.27 (0.9-3.2)	2.4 (1.9-3.1)	1.17 (0-4.3)
P-value	0.77	0.39	0.34	0.89

[a] Inter-state out- migration was defined as the movement of a pharmacist out of his/her state of employment to another state.

[b] Migration rate was computed for each time period by dividing the total number of interstate migration events out of states located in a census region by the total number of pharmacist-years employed in states located in that region.

[c] Northeast region include Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania.
Midwest region include Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.
South region include Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas.
West include Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming, Alaska, California, Hawaii, Oregon, Washington.

Table 3-6. Inter-state Migration Rates across Geographical Regions by Decade*

Census regions***	Migration rate (%)**			
	1980-1989 Median (5%-95%)	1990-1999 Median (5%-95%)	2000-2009 Median (5%-95%)	P-value
Northeast	2.17 (0.8-3.1)[a]	2.06 (1.0-3.2)[a,b]	1.12 (0-2.2) [b]	0.02
Midwest	2.41 (1.2-4.3)[a]	1.72 (1.0-3.2)[a,b]	1.4 (0.3-2.7)[b]	0.01
South	3.25 (1.2-4.0)[a]	2.3 (1.1-3.2)[a,b]	1.36 (0.3-2.1)[b]	0.004
West	2.27 (0.9-3.2)[a,b]	2.4 (1.9-3.1)[a]	1.17 (0-4.3)[b]	0.008

* Inter-state out- migration was defined as the movement of a pharmacist out of his/her state of employment to another state.

** Migration rate was computed for each time period by dividing the total number of interstate migration events out of states located in a census region by the total number of pharmacist-years employed in states located in that region.

*** Northeast region include Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania.
Midwest region include Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.
South region include Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas.
West include Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming, Alaska, California, Hawaii, Oregon, Washington.

P-value: test of statistically significant difference between medians, across decades; Kruskal-Wallis test.

Medians with the same letters are not significantly different (Nemenyi test for post hoc comparison of medians).

Table 3-7. Distribution of Migrant Pharmacists

Origin Region*	Destination Region*				Total
	Northeast N (%)	Midwest N (%)	South N (%)	West N (%)	
Northeast					
1980-1989	22 (38.6)	10 (17.5)	15 (26.3)	10 (17.5)	57(100)
1990-1999	34 (39.1)	10 (11.5)	31 (35.6)	12 (13.8)	87(100)
2000-2009	14 (58.3)	1 (4.2)	6 (25.0)	3 (12.5)	24 (100)
1980-2009	70 (41.7)	21 (12.5)	52 (40.0)	25 (14.9)	168(100)
Mid-West					
1980-1989	14 (13.6)	41 (39.8)	34 (33.0)	14 (13.6)	103 (100)
1990-1999	9 (8.3)	47 (43.5)	33(30.6)	19 (17.6)	108 (100)
2000-2009	3 (6.4)	21 (44.7)	15 (31.9)	8 (17.0)	47 (100)
1980-2009	26 (10.1)	109 (42.3)	82 (31.8)	41 (15.9)	258 (100)
South					
1980-1989	11 (9.3)	28 (23.7)	52 (44.1)	27 (22.9)	118 (100)
1990-1999	18 (12.6)	32 (22.4)	67 (46.9)	26 (18.2)	143 (100)
2000-2009	4 (8.2)	13 (26.5)	26 (53.1)	6 (12.2)	49 (100)
1980-2009	33 (10.7)	73 (23.6)	145 (46.8)	59 (19.0)	310 (100)
West					
1980-1989	3 (5.3)	9 (15.8)	21 (36.8)	24 (42.1)	57 (100)
1990-1999	11 (11.8)	22 (23.7)	25 (26.9)	35 (37.6)	93 (100)
2000-2009	1 (3.6)	4 (14.3)	12 (42.9)	11 (39.3)	28 (100.0)
1980-2009	15 (8.40	35 (20.0)	58 (32.6)	70 (39.3)	178 (100)

* Northeast region include Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania.
Midwest region include Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.
South region include Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas.
West include Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming, Alaska, California, Hawaii, Oregon, Washington.

Table 3-8. Chi-square Analysis; Between sector Out-migration by Interstate Migration

Between sector migrant	Interstate migrant		Row Total
	No	Yes	
No	7059 (93.03)	529 (6.97)	7588 (100.0)
Yes	1601 (80.61)	385 (19.39)	1986 (100.0)

Cells represent number of pharmacists and row percentages.
Chi-square = 280.88
P-value <0.0001

Table 3-9. Cox Regression Models Predicting Migration of Pharmacists; 1980-2009

	Between sector migration	Interstate migration	Between sector and interstate migration
	HR (95% CI)	**HR (95% CI)**	**HR (95% CI)**
Practice Sector			
Independent/ small chain	Reference	Reference	Reference
Large chain	0.87 (0.76-1.00)*	1.15 (0.87-1.51)	0.86 (0.62-1.20)
Institutional	0.51 (0.45-0.58)***	1.52 (1.18-1.96) **	0.73 (0.53-1.00)
Others	0.53 (0.46-0.61)***	1.65 (1.27-2.15) **	0.90 (0.65-1.27)
Job serial number	1.43 (1.39-1.47)***	1.26 (1.19-1.33)***	1.37 (1.27-1.47) ***
Demographic variables			
Age	0.92 (0.91-0.93)***	0.90 (0.89-0.91) ***	0.90 (0.88-0.92)***
Female	0.90 (0.81-0.999)*	1.10 (0.92-1.31)	0.99 (0.78-1.27)
White	0.94 (0.78-1.12)	1.32 (0.98-1.76)	1.13 (0.77-1.67)
Decade			
1980s	Reference	Reference	Reference
1990s	0.79 (0.71-0.89)***	0.79 (0.67-0.93)**	0.75 (0.58-0.97)*
2000s	0.16 (0.14-0.19)***	0.17 (0.13-0.21) ***	0.17(0.12-0.24)***
Region			
North east	Reference	Reference	Reference
Mid west	1.05 (0.90-1.21)	1.02 (0.82-1.26)	0.95 (0.70-1.30)
South	1.30 (1.12-1.50)**	1.18 (0.95-1.45)	1.21 (0.89-1.65)
West	1.20 (1.01-1.40)*	1.27 (0.99-1.61)	1.25 (0.87-1.80)
Model statistics			
LR X^2	2663.31	1430.08	580.56
Wald (Sandwich) X^2	1467.22	640.63	351.87
Event cases	1980	912	384
Censored cases	7544	8612	9140

Notes: HR= Hazard ratio, CI= Confidence interval, LR = Likelihood ratio.
*p<0.05.
**p<0.01
***p<0.001.

CHAPTER 4: THE OCCUPATIONAL AND NON-OCCUPATIONAL FACTORS ASSOCIATED WITH GEOGRAPHIC MIGRATION OF PHARMACISTS OVER A SHORT TIME PERIOD

4.1 Data Sources

The decision of a pharmacist to move his/her practice to another state may be based on a number of different factors. In this section of the study, a pharmacist's migration responses to occupational, socioeconomic, family life cycle and demographic variables associated with interstate mobility was investigated.

This was a two points in time study using existing secondary data sources. The studied population included pharmacists who were active labor force participants.

The first source of data consists of records of pharmacists taken from the five percent (5%) Public Use Sample of the 2000 US Census of Population. The Public use sample is very useful for analysis of pharmacists labor market patterns because it provides very detailed information on professional pharmacist migration status and income, on their spouses and on their children and other dependents.

Other sources of data include the American Association of Colleges of Pharmacy (AACP) Institutional Research Reports and the National Boards of Pharmacy (NABP) Survey of Pharmacy Law; 95/96 and 2000/01.

4.2 Study Variables

4.2.1 Dependent Variable

The dependent variable for this study is the probability of a pharmacist being a migrant. Migrants were defined as those pharmacists whose state of residence in 2000 was different from their state of residence in 1995.

4.2.2 Independent Variables

The definitions of independent variables are presented below:

Demographic variables include age, sex and ethnicity of each pharmacist. These variables have been shown to be associated with decision of professional workers to migrate across state lines.

Family structure variables include marital status (married, not currently married) and having dependents in the home.

Socioeconomic variables include annual household income for each pharmacist in 2000, and the highest degree earned (bachelors, masters, doctoral).

Occupational variables include the following:

Change in pharmacist per population ratio in the state: Pharmacist per population ratio is the number of licensed pharmacist in a state divided by the total population of people greater than 65 years old in the state. This variable is change in this metric between 1995 and 2000.

Number of new pharmacy graduates: This is the number of graduates of pharmacy schools with first professional degrees in the state in which the pharmacist resides in 2000.

Change in supply of substitute employers: This variable is measured by the change in the number of active pharmacy licenses in the state between 1995 and 2000.

4.3 Analysis

4.3.1 Descriptive Analysis

Descriptive analyses provided pharmacists' characteristics and involve summary parameters such as means and proportions. We also used graphs to illustrate migration rates and origin and destination states.

4.3.2 Logistic Regression

In order to assess the factors influencing pharmacists' decision to move their practice across states, we used logistic regression to model the probability, for a given pharmacist, of changing state of residence between 1995 and 2000. The logistic regression was used to investigate the association between various occupational and non-occupational factors and interstate migration of pharmacists. A logistic regression is an analytic technique that is used when the outcome variable is dichotomous. A logistic regression can model a dichotomous outcome variable even when some or all of the independent variables are continuous. The main assumption of the logistic model is that the outcome variable in the regression equation should be binomially distributed. While the response variable in a logistic regression is a dichotomous (0/1 variable), the logistic regression equation, which is a linear equation, predicts the log odds that an observation will have an indicator equal to one (1).

The outcome variable in this study (whether a pharmacist is a migrant or not) was binomial and was thus suitable for modeling with a logit function. The logit function shown below specifies that the log odds of event x is linearly related to a set of covariates denoted as x_1 ……..x_k .

$$\text{Log}\,[p(x)/\{1-p(x)\}] = \beta 0 + \beta_1 x_1 + \ldots\ldots\ldots \beta_k x_k.$$

The covariates that were included in the logit function above have been previously defined.

4.4 Results

Our analysis identified 192,569 pharmacists who are active labor force participants, using the occupational score variable in the 5% Public Use sample of the 2000 US Census data. Our findings revealed that female pharmacists had higher propensity to migrate (Table 4-1). Younger pharmacists, non-whites, unmarried pharmacists and those who had no dependents living at home were also more likely to change location from one state to another.

Table 4-2 shows general mobility for pharmacists by sex and age groups. Among the pharmacists who lived in the United States in 1995 and 2000, pharmacists less than 35 years old constituted 64.3 % of those residing in a different state at the end of the 5-year period. This percentage is higher for female compared to male pharmacists (70.2% to 54.6 %). In contrasts, pharmacists 65-75 years make up only 0.9% of migrants.

Table 4-3 shows in-migration, out-migration and net-migration rates for pharmacists by region, division and state between 1995 and 2000. More pharmacists (4880) moved to the south than any other region. However, the west region had the net highest migration rate of all the four regions.

Figure 4-1 shows that the states with the highest net migration rates were Nevada (46.7%) and Arizona (26.6%), while the states with the lowest net migration rates were District of Columbia (81.6%) and Wyoming (45.6%). Figure 4-2 and Figure 4-3 show the top five states of origin of pharmacists who moved to Nevada and Arizona respectively.

Table 4-4 shows characteristics of states by net migration status between 1995 and 2000. 25 states had net in-migration while 26 states had net out-migration.

Results from the logistic regression model predicting odds of being migrant pharmacists between 1995 and 2000 are presented in Table 4-5. Our findings show that pharmacist's age, gender and race were statistically associated with interstate migration. Odds of migration were greater for younger pharmacists, for female pharmacists and non-white pharmacists. Of the family structure variables, only having dependents was significantly associated with the migration. Also, pharmacists who earned a master or doctorate degree were significantly more likely to migrate than those who earned a bachelor's degree. Occupational variables associated with interstate migration of pharmacists included number of pharmacy graduates in 1999 and change in pharmacists per population ratio between 1995 and 2000.

Table 4-1. Personal Characteristics of Migrants and Non-migrant Pharmacists*

Characteristics	All N=192569	Migrants N=22905	Non-migrants N=169664	P-value
Age (mean [sd])**	42.1(11.9)	34.1(9.1)	43.2(11.8)	<0.0001
Female (%)	45.5	61.8	43.3	<0.0001
Race /ethnicity				
Black (%)	5.0	6.2	4.9	<0.0001
Asian (%)	11.5	18.3	10.6	<0.0001
White (%)	83.1	74.8	84.2	<0.0001
Other (%)	0.4	0.7	0.3	<0.0001
Married (%)	74.5	65.8	75.7	<0.0001
Dependents(mean [sd])	1.0(1.1)	0.8(1.0)	1.0(1.2)	<0.0001
Income (1000$, median [iqr])***	97(72.6-129.1)	90.2 (65.0-124.0)	98.0 (73.7-130.0)	<0.0001
Educational (%)				<0.0001
Bachelor's degree	61.3	53.8	62.3	
Master's degree	6.4	7.2	6.3	
Professional degree	25.4	28.9	24.9	
Doctorate degree	6.9	10.1	6.5	

*Migrants are pharmacist whose state of residence in 1995 is different from their state of residence in 2000. Non-migrants are pharmacists whose state of residence in 1995 is the same as their state of residence in 2000.

**SD is standard deviation.

** Total household income in thousand dollars. IQR is interquartile range.

Table 4-2. General Mobility for Pharmacists by Gender and Age; 1995 to 2000

	Age group (years)					Total
	<35	35-44	45-54	55-64	65-75	
All (n=192569)*						
Non-migrants (%)	27.3	29.1	25.8	12.4	5.4	100%
Migrants (%)	64.3	22.2	9.4	3.4	0.9	100%
Male (n=104878)						
Non-migrants (%)	17.1	24.1	32.1	17.9	8.8	100%
Migrants (%)	54.6	21.9	14.6	6.5	2.4	100%
Female (n=87691)						
Non-migrants (%)	40.6	35.6	17.7	5.1	1.1	100%
Migrants (%)	70.2	22.4	6.1	1.3	0.0	100%

*Migrants are pharmacist whose state of residence in 1995 is different from their state of residence in 2000.
Non-migrants are pharmacists whose state of residence in 1995 is the same as their state of residence in 2000.

Table 4-3. In-migration, Out-migration, and Net migration for Pharmacists by Region, Division and State; 1995 to 2000

Area	In-migrants	Out-migrants	Net migration	Pharmacist population in 1995	Net-migration rate/%
Northeast	1701	2988	-1287	41288	-3.1
New England	728	786	-58	9538	-0.6
Maine	148	108	40	544	7.4
Vermont	58	0	58	277	20.9
New Hampshire	101	59	42	611	6.9
Massachusetts	517	585	-68	4954	-1.4
Rhode Island	57	100	-43	708	-6.1
Connecticut	281	368	-87	2444	-3.6
Middle Atlantic	1369	2598	-1229	31750	-3.9
New York	536	1332	-796	14171	-5.6
New Jersey	893	702	191	6656	2.9
Pennsylvania	593	1217	-624	10923	-5.7
Midwest	1952	3059	-1107	46628	-2.4
East north Central	1854	2252	-398	32104	-1.2
Ohio	494	639	-145	8347	-1.7
Indiana	255	455	-200	5443	-3.7
Illinois	675	1138	-463	8705	-5.3
Michigan	508	293	215	5963	3.6
Wisconsin	494	299	195	3646	5.3
Total					
West North Central	1143	1852	-709	14524	-4.9
Minnesota	624	297	327	3222	10.1
Iowa	268	424	-156	2564	-6.1
Missouri	459	658	-199	3438	-5.8
North Dakota	32	251	-219	876	-25.0
South Dakota	0	232	-232	785	-29.6
Nebraska	224	419	-195	1448	-13.5
Kansas	309	344	-35	2191	-1.6
South	4880	2681	2199	66912	3.3
South Atlantic	4006	2363	1643	33471	4.9

Delaware	161	125	36	455	7.9
Maryland	514	424	90	3752	2.4
District of Columbia	31	111	-80	98	-81.6
Virginia	918	492	426	3801	11.2
West Virginia	91	320	-229	1681	-13.6
North Carolina	933	452	481	4516	10.7
South Carolina	328	504	-176	3305	-5.3
Georgia	826	530	296	6090	4.9
Florida	1540	741	799	9565	8.4
East South Central	1130	875	255	13109	1.9
Kentucky	322	205	117	2802	4.2
Tennessee	670	363	307	4344	7.1
Alabama	298	364	-66	3794	-1.7
Mississippi	139	242	-103	2169	-4.7
Total					
West South Central	1637	1336	301	20332	1.5
Arkansas	139	49	90	1823	4.9
Louisiana	285	590	-305	3928	-7.8
Oklahoma	262	502	-240	3050	-7.9
Texas	1785	1029	756	11531	6.6
West	3891	1559	2332	35604	6.5
Mountain	2501	1053	1448	9658	15.0
Montana	104	238	-134	665	-20.2
Idaho	268	187	81	671	12.1
Wyoming	0	159	-159	349	-45.6
Colorado	778	279	499	1931	25.8
New Mexico	189	303	-114	1295	-8.8
Arizona	1023	288	735	2765	26.6
Utah	127	66	61	949	6.4
Nevada	579	100	479	1025	46.7
Total					
Pacific	2438	1554	884	25946	3.4
Washington	756	492	264	3889	6.8
Oregon	534	159	375	2339	16.0
California	1664	1331	333	18614	1.8
Alaska	49	114	-65	255	-25.5
Hawaii	66	89	-23	849	-2.7

Note: In-migrants refers to pharmacists who moved into a state between 1995 and 2000.Out-migrants refer to pharmacists who moved out of a state between 1995 and 2000. Net migrants refer to the difference between number of in-migrants and out-migrants.

Figure 4-1. States with the Highest and Lowest Net Migration Rates for Pharmacists; 1995 to 2000

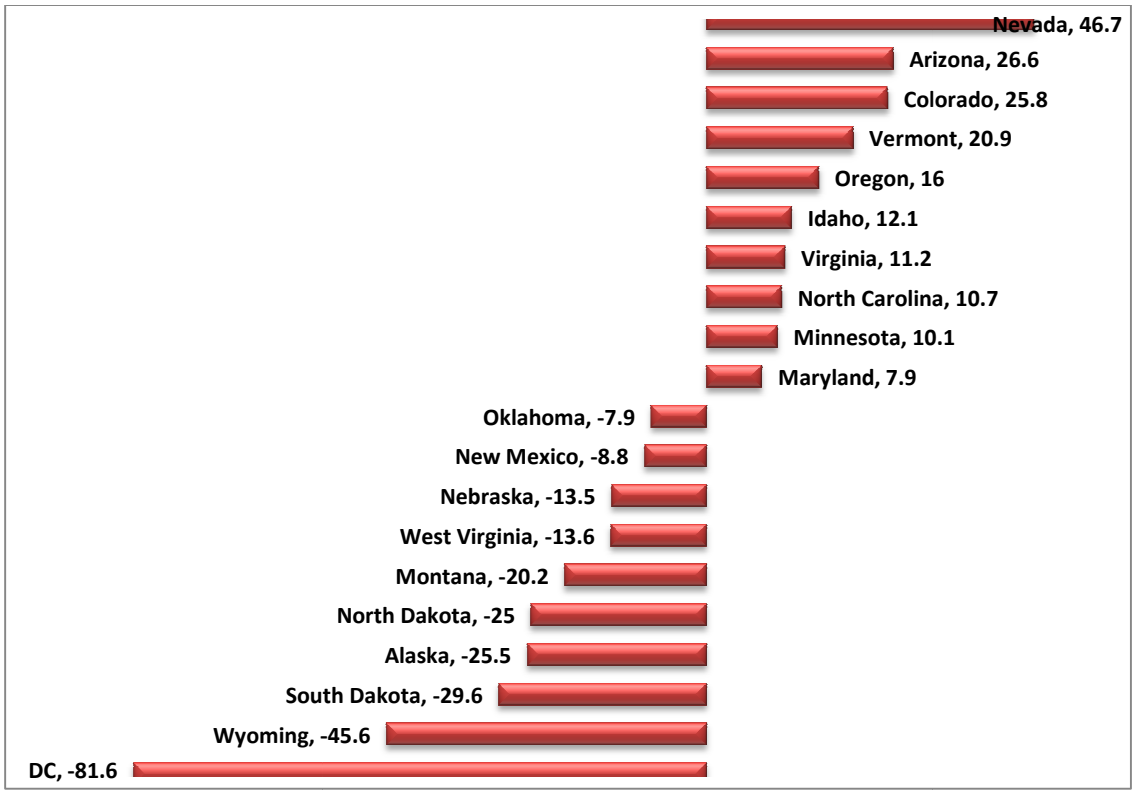


Figure 4-2. State of Origin of Pharmacists who Moved to Nevada; 1995 to 2000

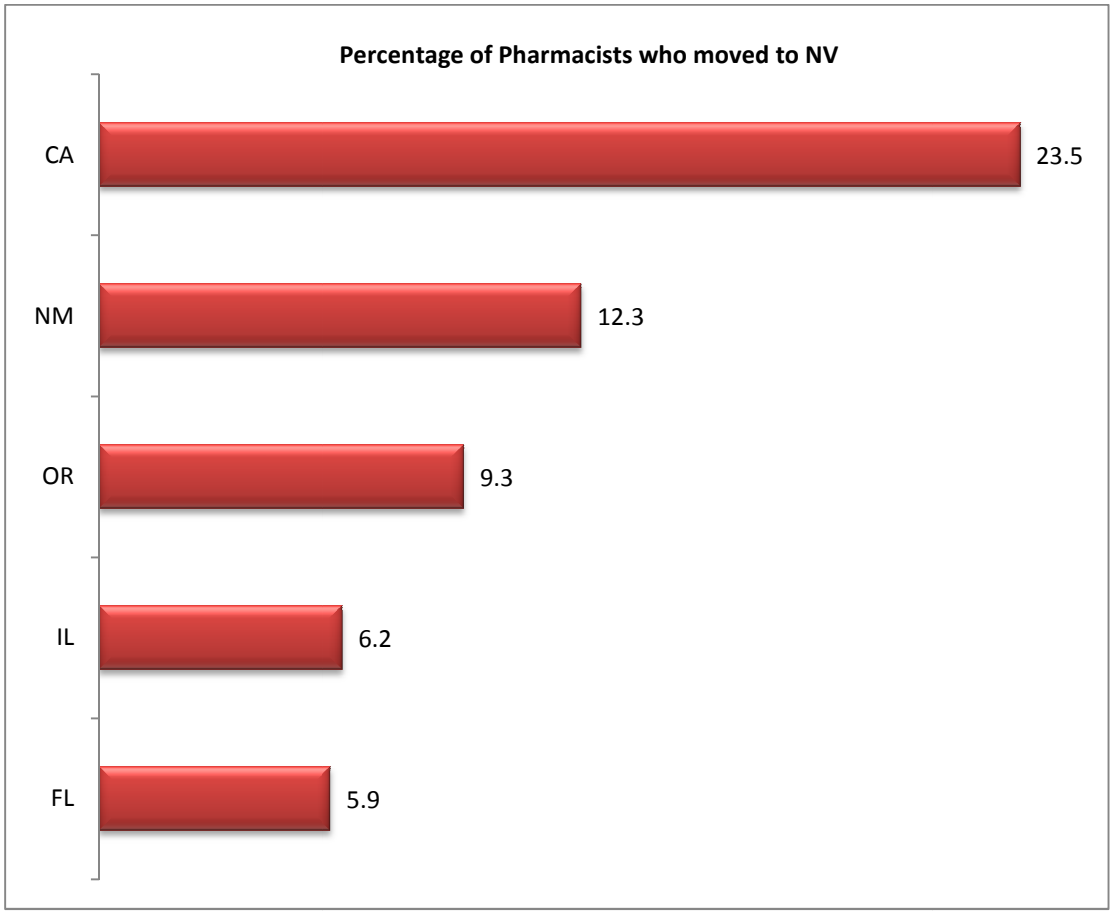


Figure 4-3. State of Origin of Pharmacists who Moved to Arizona; 1995 to 2000

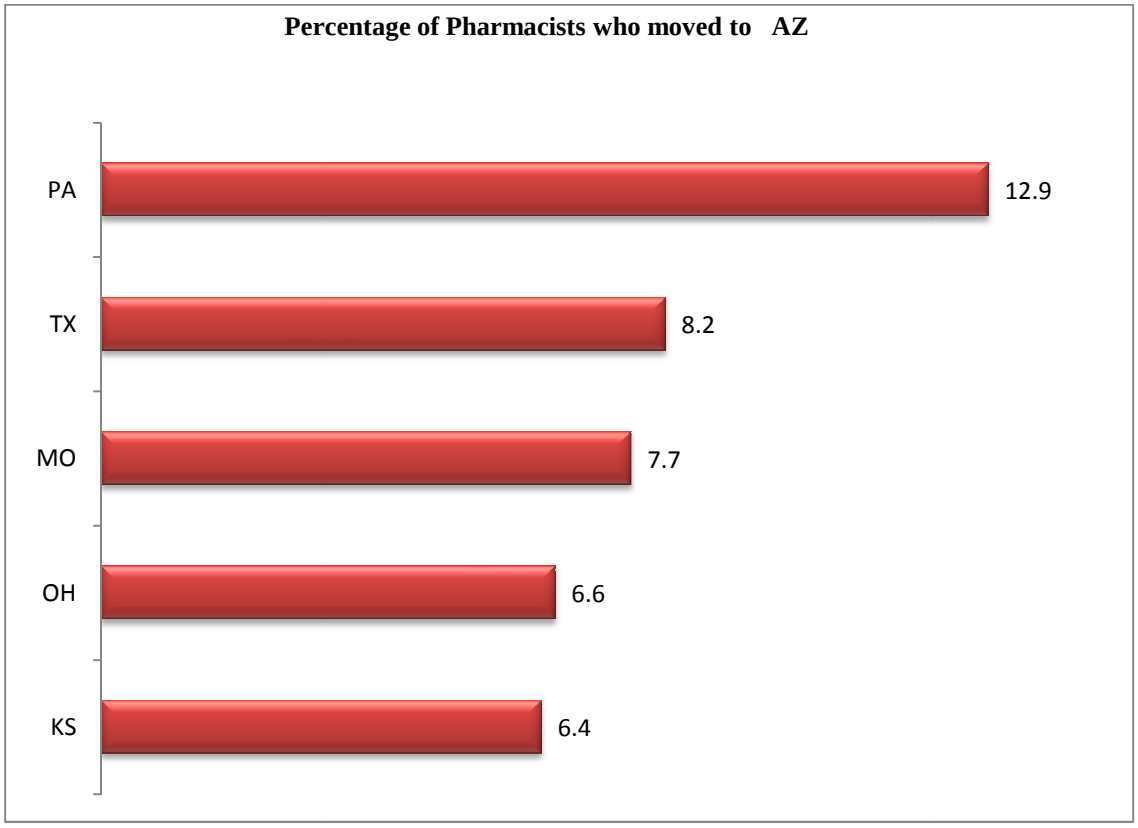


Table 4-4. Characteristics of States by Net-migration Status Between 1995 and 2000

Variables	States*		P-value
	Net in-Migration (n=25) Mean (SD)	Net out-migration (n=26) Mean (SD)	
Pharmacist per 1000 population >=65 years, 1995	6.4 (1.2)	6.7 (1.5)	0.38
Pharmacist per 1000 population >=65 years, 2000;	7.1 (2.2)	7.3 (1.6)	0.66
Change in Pharmacist per 1000 population >=65 years, 1995 to 2000	0.7 (1.6)	0.6 (0.8)	0.79
Number of pharmacies licensed ,1995	1,561 (150-5,424)	1,119 (107-4,552)	0.24
Number of pharmacies licensed ,2000	1,711 (154-6,271)	1,191 (111-4,456)	0.2
Change in number of pharmacies licensed ,1995 to 2000	150 (-249-1,095)	72 (-124-336)	0.19
Pharmacy graduates in 1999	122 (0-584)	154 (0-468)	0.40

*Net in-migration states are states that had more in-migration than out-migration of pharmacists between 1995 and 2000.
Net out-migration states are states that had more out-migration than in-migration of pharmacists between 1995 and 2000.

Table 4-5. Determinants of Interstate Migration*

Variable	Odds ratio	P-value
Demographic		
Age	0.93	<0.0001
Female (versus male)	1.22	0.0099
White (versus non-white)	0.65	<0.0001
Family structure		
Married (versus not married)	0.98	0.78
Having Dependents (versus having no dependents)	0.82	<0.0001
Socioeconomic		
Household income	1.00	0.58
Earned Master/Doctoral degree	1.42	<0.0001
Occupational (state-level variables)		
Pharmacy graduates in 1999	0.997	<0.0001
Change in pharmacist per 1000 pop >=65 years, 1995 to 2000	0.59	<0.0001
Change in number of pharmacies licensed, 1995 to 2000	0.98	0.85

*Logistic regression modeling the odds of a pharmacist migrating to a different state of residence between 1995 and 2000.

Model Chi-square=788.29 with 10 df (p<0.0001); pseudo R-square=0.0806

CHAPTER 5: DISCUSSION AND CONCLUSION

This study was designed to explore the phenomenon of migration of the pharmacists' workforce; specifically to understand the magnitude and motivations for sectoral and geographical migration of pharmacists. This study employed quantitative analysis of unique datasets to investigate the role of occupational and non-occupational factors as motivators for pharmacist's migration.

Migration is a complex behavior that often involves many diverse factors some of which are not readily observable. Although there are about as many migration theories as migration researchers, there is a lack of a generally accepted theoretical framework to explain why some professional workers are mobile and others are not; and the consequences of such mobility. Despite the lack of a generally accepted theoretical framework for migration, this study combined principles from economic (human capital) and sociologic theory (Lee's schema) of migration in an attempt to explain both short term and longer term migration tendencies of licensed pharmacists.

Over the years, migration of people across geographical location has been an important mechanism for the redistribution of human capital. Distribution of human resources for health across geographic locations (e.g. rural-urban distribution, regional and provincial differences) and across sectors or specialties has been on the radar of numerous stakeholders especially because it has implications for health disparities and equitable distribution of health care resources. It is thus important to understand the motivators for migration of healthcare workers.

Understanding the motivation for migration is informed not only by concern for individual choice; but also by a recognition that careers of individuals unfold within a

social and economic context which involves interplay of personal preferences and labor market contingencies. This is especially important for pharmacy because the profession has experienced dynamic changes in recent times which have directly impacted the pharmacy workforce. Furthermore, the relationship between migration of health care workers and their distribution among work settings and geographic locations suggests that knowledge of the motivators of migration can help contribute to proposing policy ideas that can tackle maldistribution of health workers.

5.1 Summary of Research Question 1 Results

The first section of this study used descriptive and survival analysis to answer the first research question that was outlined on Page 5 and 6. The specific objectives are related to the magnitude, patterns and determinants of sectoral and geographic migration of the pharmacist workforce between 1980 and 2009.

The findings showed that between 1980 and 2009, median out-migration of licensed pharmacists from large chain sector was significantly higher than that from independent/small chain and institutional sectors. This is not surprising as studies of pharmacists job turnovers has consistently shown that turnover rates are greatest for pharmacists working in the community sectors (Mott, 2000; Maio, Goldfarb, & Hartmann, 2004).

Migration rate out of both large chain and institutional settings were higher in the 1980s compared to the 1990s and 2000s. One possible explanation for this trend could be the glut of pharmacists that existed in the early 1980s has a result of the huge supply of pharmacists that was brought about by the capitation years in the 1970s. On the other hand, while not statistically significant, migration out of the independent sector to other

sectors was highest in the 2000s compared to the 1990s and 1980s. This could possibly be explained by the changing mix in pharmacy ownership as a result of increasing numbers of chain stores and closing of independently owned pharmacies.

For each sector studied, out-migration of pharmacists appeared to be greater for female than male, a finding that was consistent with the finding presented by Hassell & Seston (2008). Other finding revealed that when pharmacists out-migrate from large chain and institutional sectors but remained within the labor force, they tend to move to "other" sector. The 'other' sector was defined in this study to include academia, nuclear, pharmacy benefit managers, industry and other non- patient care settings. Similar to this finding, the Health Resources and Services Administration (HRSA) revealed in a 2000 report that there was migration of experienced pharmacists from patient care services to the business sector. Hence future studies should explore the characteristics of pharmacists who are more likely to move out of chain and institutional sectors.

Our findings show that between 1980 and 2009, when pharmacists move across states, they tend to move a state in the same region followed by a state in the south. However, we found no statistically significant differences between geographic migration rates across regions during the entire study period. For the Northeast, Midwest and the South region, median interstate migration rate in the 2000-2009 period were statistically significantly lower than for the 1990-1999 period. While this is an important trend that can play a role in the re-distribution of pharmacists across geographical areas over different time period, we have no ready explanation for this observed trend.

Results of this study confirmed that between 1980 and 2009, when pharmacists migrate, they are more likely to move from their state of employment to another state

within the same region. This finding suggests that regional similarities and differences are important when pharmacists consider the decision to migrate and should thus be taken into account when making workforce policy plans.

Another finding from this study shows that between 1980 and 2009 geographic migration was significantly associated with sectoral migration such that when pharmacists move across states, they were also more likely to change work sectors. Compared to older pharmacists, younger pharmacists are new entrants into the pharmacy labor market and their higher rates of migration is probably indicative of the career decision making in the early working years. The decision to migrate especially among the young may thus be closely related to other career moves. As opportunities for job growth in pharmacy shifts from traditional dispensing type of establishments into direct patient care services and other non-traditional services some of which are not even housed in licensed pharmacies, it will be important to observe the impact that sectoral and geographic migration decisions of pharmacists will have on career selectivity.

Results from the survival analysis modeling the three types of migration events studied closely mirrors the findings from the descriptive and univariate analysis described above. The findings revealed that in a multivariable model, variables that are associated with propensity to migrate (hazards of migration) between 1980 and 2009 include practice sector type, the serial number of jobs, demographic variables and the time period.

5.2 Summary of Research Question 2 Results

The second section of this study used logistic regression to model the likelihood of a pharmacist migrating across states between 1995 and 2000. Our findings show that

overall, absolute change across regions between 1995 and 2000 advantages the south and the west. We found that net geographic migration rate was negative for the northeast (-3.1%) and the midwest (-2.4) and positive for the south (3.3%) and the west (6.5%); during this period. This apparent western and southern migration pattern for pharmacists is consistent with the western and southern migration pattern for the general population that has been reported in recent times (Perry, 2006).

This study revealed an inverse relationship between age and the propensity for geographic migration, a finding that is consistent with those presented by Walton (2007). This study showed that geographic migration is an activity of the 'young' thus confirming the findings of several studies that have reported an inverse relationship between age and the propensity to move. Similar to findings presented by Vanasse et al. (2007) for geographic mobility of physicians, it appears that female pharmacists tend to be more geographically mobile than their male counterparts. It is possible that female pharmacist's higher job turnover rate is a contributory factor. However, the explanation for variation in geographic migration rate by gender is unclear.

According to Ritchey (1976) certain life cycle factors can facilitate or impede geographic migration. Such factors include age, level of education, gender and marital status, and ethnicity. We found that having dependents and level of educational attainment were significantly associated with interstate migration between 1995 and 2000. However, within this period, we found no differences between married and unmarried pharmacists as it relates to likelihood of geographic migration.

Migration has been viewed as a decision process involving consideration of multiple factors and occupational variables reflecting the attributes of places of origin and

destination are important in shaping the decision to move or not to move. The findings of this study revealed that between 1995 and 2000, occupational variables that were significantly associated with geographic migration include number of new pharmacy graduates and the change in the pharmacist per population ratio. This finding is not surprising as new graduates account for the largest proportion of new entrants into the pharmacy workforce each year (Walton et al., 2011). Also, this finding indicates that the dynamics of the pharmacy labor market within origin and destination states is an important correlate of migration decisions of licensed pharmacists. However, we found no association between household income and interstate migration, suggesting that factors other than income are more important motivators of pharmacist migration.

5.3 Policy Implications

The findings of this study provides important information for policy makers, researchers and other stakeholders involved in pharmacy workforce policy, especially with respect to the relationship between demand and supply balance and migration and it's on impact on workforce distribution. The critical shortage of pharmacists that was experienced beginning from the late 1990s prompted a number of responses including increasing class sizes in existing schools of pharmacy and establishment of new schools of pharmacy. In fact, the number of pharmacy schools increased from about 80 in 2000 to about 130 today. The effect of these trends is to lead to a substantial increase in the supply of new pharmacists (Walton, Mott, Knapp, & Fisher, 2010). Coupled with the slow growth of prescriptions occasioned by the economic recession of 2008, it should not be surprising that there is growing evidence that the supply of pharmacists in the aggregate, nationally and in many states, currently has met requirements, especially for

the retail pharmacy sector (Brown, 2010). There is even suggestion of a surplus of pharmacists in some states (Elder et al., 2012; Talley, 2011). Given this emerging dynamic in the pharmacy labor market in various states, it is not inconceivable in the light of our finding that increased migration of pharmacists across states and geographic locations is in the horizon. Going forward, this may have implication for public financing support of state owned, or state-affiliated schools of pharmacy in states that experience persistent out-migration if lawmakers and taxpayers perceive that such states are training a disproportionate share of the nation's pharmacists.

Another implication of this study relates to the effectiveness of student loan repayment program in correcting rural-urban maldistribution of pharmacists. Pharmacist's student loan debt has been increasing astronomically (Yusuf et al., 2011) and it is thus expected that loan repayment programs will attract new pharmacists to medically underserved areas. The important question for policy makers is whether such programs are effective in not only attracting graduates to rural areas but also in keeping them there. Although this study did not specifically investigate the migration tendencies of new graduates, the findings will tend to suggest that the student loan forgiveness programs may not keep pharmacists in rural areas once the mandatory period of employment is over because new graduates are younger and thus more migratory.

5.4 Scientific Contributions of the Research

To our knowledge this is the first study to investigate the motivators of workforce migration among US pharmacists. The magnitude and trends of pharmacist's workforce sectoral and geographic migration was characterized and its motivators evaluated. Most studies of migration of health care workers focus either on short term migration or long

term migration. Employing two main unique datasets, short term migration (within a five–year period) and multiple, longer term (within 30 years) migration tendencies were explored and illuminated. Since geographic migration of professional workers has been shown to be linked to career stage and career decisions, we explored the relationship between geographic migration and change in practice sector of licensed pharmacists.

These findings would be of great importance to researchers in the discipline of Social and Administrative Pharmacy, particularly to researchers in the domain of Pharmacy workforce. Previous research in the area of pharmacists' migration has identified that propensity to migrate increases with age. The results from the current study build upon these findings by identifying other non-occupational factors (gender, educational attainment, stage of family life cycle) and occupational factors (supply of new pharmacy graduates, change in pharmacy per population ratios) that play a role in determining migration tendencies of licensed pharmacists. Researchers interested in the role of migration in rural-urban distribution, regional distribution and sectoral distribution can employ these findings to help them formulate better research questions.

5.5 Limitations

The weaknesses and limitations of this study are largely related to the quality and completeness of the data sources employed. The 2000 and 2009 National Pharmacists workforce surveys were not designed to collect information about migration. Hence, some variables related to migration were not collected. Such variables include income information and family structure information as at each job that a study subject reported. Since respondents were asked to report events that happened in the past, there is a possibility of recall bias.

Based on the Lee's model, a model of change in location should presumably be a function of change in the variables that determine location. The models employed in this study included only level variables rather than change variables for some of the important independent factors.

5.6 Conclusions

The important role that pharmacists play in the delivery of health care means that maldistribution (especially shortage) of pharmacists has serious implications for health outcomes and pharmacy education systems. Enabling effective policies that can guide regulation of the educational system and the job market towards an equitable distribution of health workers requires an adept understanding of the factors related to sectoral and geographical distribution. Migration of providers across sectors and geographic locations is one of such factors. While this phenomenon has been widely studied for nurses and physicians, little is known about the trends and determinants of migration among pharmacists. This study explored these issues and its findings provided an understanding of both the short term and long term migration tendencies of pharmacists. Findings show that female pharmacists were more likely to migrate than male pharmacists, and sectoral migration was higher in the 1980s compared to more recent decades. Findings also show that pharmacists working in institutional settings were the least likely to migrate to other sectors. Furthermore, this study shows that geographic migration can play a significant role in distribution of the pharmacy workforce across locations. We found that this phenomenon generally advantages the South and the West region, and probably parallels the movement of the general population.

Results of this study also revealed the important occupational and non-occupational motivators for pharmacists' migration. Findings show that age is one of the most important determinants of migration tendencies, reflecting the thinking of researchers that has found a link between family life cycle position and the migration decision making of skilled workers. Occupational factors related to the geographic migration of pharmacists include the supply of new pharmacy graduates and the change in pharmacy population ratios. This finding is important for two reasons. First, there is a suggestion that migration may increase in the coming years as more and more pharmacy graduates are produced by many of the new schools of pharmacy that has been established in the last few years. Second, state level pharmacy labor market conditions impact migration decisions and are thus a viable focus of policy interventions. Despite the postulations of economists who follow the human capital approach to understanding workforce migration, this study revealed that household income is not associated with pharmacists' propensity to migrate between 1995 and 2000. This finding has serious policy implications especially related to the effectiveness of student loan forgiveness programs.

In order to achieve the lofty goal of equitable distribution of pharmacy personnel, and an appropriate mix of pharmacy professionals in various sectors responsive to the needs of the population, it is necessary to design evidence-based policies. This is the singular goal of workforce policy planning and findings of this study can guide policy makers when embarking on such endeavor.

5.7 Recommendations for Future Research

The results of this study provide an understanding of the motivators of pharmacists' migration. The role of occupational and non-occupational variables was examined and this provides a foundation for further research. However, certain important variables such as household income at each job and marital status at each job were not collected in the 2000 and 2009 National Pharmacists Workforce Surveys. Research should explore how this variables impact long term sectoral and geographic migration of pharmacists. Research could also explore the influence of quality of education on attitudes that drive the intention to migrate from one sector to another.

Future research is needed to understand migration tendencies and motivators in solely new graduates. Although studies have found that job turnover is related to income, research is needed to explore the degree to which income affects sectoral migration especially among new graduates. Another reason to focus on new graduates is that Pharm.D. is now the entry level degree into the pharmacy profession while subjects included in our studies have a mix of Pharm.D. and bachelor degrees. It is also possible that changing skill sets of pharmacy graduates impact their career choices and thus the propensity to change sectors or geographical locations in the process of job search.

The maldistribution of the pharmacy workforce is important from a health equity point of view. Thus future research should look at how migration to and from underserved areas contributes to or ameliorates maldistribution of the pharmacy workforce. This study employed the concepts from the economic theory and a sociological theory of migration. Other studies should look at the concept of pharmacy migration using different migration theories.

REFERENCES

American Association of Colleges of Pharmacy. (2010). *Fall 2010 Profile of Pharmacy students*. Alexandria, VA: American Association of Colleges of Pharmacy.

Birch, S. (2002). Health Human Resource Planning for the New Millennium: Inputs in the production of health, illness, and recovery in populations. *Canadian Journal of Nursing Research, 33*(4), 109–114.

Blumetithal, D.S. (1994). Geographic imbalances of physician supply: an international comparison. *Journal of Rural Health, 10* (2), 109-118.

Brown, D. (2010). From shortage to surplus: the hazards of uncontrolled academic growth. *American Journal of Pharmaceutical Education, 74*(10), 185.

Canadian Institute for Health Information. (2007). *Distribution and internal migration of Canada's Pharmacist Workforce*. Ottawa, ON: Canadian Institute for Health Information.
Cardinale, V. (1991, Mar 25). Pharmacists' salaries reaching new levels . . . but the climb's getting tougher. *Drug Topics, 135*, 43-44.

Casey, M. M., Klingner, J., & Moscovice, I. (2002). Pharmacy services in rural areas: Is the problem geographic access or financial access? *Journal of Rural Health, 18*(3), 467-477.

Castles, S. (2008). Understanding global migration: a social transformation perspective [PowerPoint slides]. Retrieved from http://hdr.undp.org/en/media/Stephen_Castles.ppt.

Center for the Health Professions. (1995). *Critical Challenges: Revitalizing the Health Professions for the Twenty-First Century.* San Francisco, CA: Pew Health Professions Commission, Center for the Health Professions, University of California-San Francisco.

Center for the study of Aging. (1999). *Prescription drugs and the elderly: Policy implications of Medicare coverage*. Santa Monica, CA: Center for the study of Aging, RAND.

Cho, S., Lee, J. Y., Mark, B. A., & Yun, S. (2012). Turnover of new graduates nurses in their first job using survival analysis. *Journal of Nursing Scholarship, 44*(1), 63-70.

Cooksey, J. A., Knapp, K. K., Walton, S.M., & Cultice, J. M. (2002). Challenges to the pharmacist profession from an escalating pharmaceutical demand. *Health Affairs, 21,182*-188.

Cooksey, J. A., Walton, S. M., Stankewicz, T., Knapp, K. K. (2003). Pharmacy school graduates by state and region: 1990-1999. *Journal of the American Pharmacists Association, 43*(4), 463-469.

Diallo, K. (2004). Data on the migration of health-care workers: sources, uses, and challenges. *Bulletin of the World Health Organization, 82,601*-607.

Elder, N., Estep, G., Kandilian, R., Kocher, K., Le, K., Lew, M., Ly, T., McBane, S., & Colbert, J. (2012, Feb 15). How the opening of new schools in California may affect pharmacy manpower. *Drug Topics*.

Elliot, A.C., & Hynan, L. S. (2011). A SAS macro implementation of a multiple comparison post hoc test for a Kruskal-Wallis analysis. *Computer Methods and Programs in Biomedicine, 102*, 75-80.

Feldstein, P. (2011). Health manpower shortages and surpluses: Definitions, measurements, and policies. In Feldtein, P., *Health care economics* (pp. 364-394).Clinton Park, NY: Delmar.

Fraher, E. P., Smith, L. M., Dyson, S., & Ricketts, T.C. (2002). *The pharmacist workforce in North Carolina*. Chapel Hill, NC: Cecil G Sheps Center for Health Services Research.

Gaither, C. A. (1998). The predictive validity of work/ career-related attitudes and intentions on pharmacists' turnover behavior. *Journal of Pharmaceutical Marketing & Management, 12*(4), 3-25.

Gershon, S.K., Cultice, J. M., & Knapp, K. K. (2000). How many pharmacists are in our future? The bureau of health professions projects supply to 2020. *Journal of the American Pharmacists Association*. , *40,757*-64.

Gilliland, M. (1997). Workforce reduction: Low morale, reduced quality care. *Nursing Economics, 15*,320-3.

Greenwood, M.J. (1975). Research on internal migration in the United States: A survey. *Journal of Economic Literature, 13*(2), 397-433.

Hardigan, P.C., &Sangasubana, N. (2010). A latent class analysis of job satisfaction and turnover among practicing pharmacists. *Research in Social and Administrative Pharmacy, 6*, 32-38.

Hassell, K., & Seston, E.M. (2008). Inter-sector mobility in the United Kingdom pharmacy workforce between 2003 and 2005. *International Journal of Pharmacy Practice, 16*(S1), A46-A48.

Health care Intelligence Pty Ltd. (2003). *A study of the demand and supply of pharmacists, 2000-2010*. Australia: Health care Intelligence Pty Ltd.

Health Resources and Services Administration. (2008). *The adequacy of pharmacist supply, 2004 to 2030*. Rockville, MD: Health Resources and Services Administration, Department of Health and Human Services.

Health Resources and Services Administration. (2000). *The pharmacist workforce: a study of the supply and demand for pharmacists*. Rockville, MD: Health Resources and Services Administration, Department of Health and Human Services.

Kaiser Family foundation. (2010, Dec 12). *Trends in Health Care Costs and Spending*. Retrieved from http://www.kff.org/insurance/upload/7692_02.pdf.

Knapp, D.A. (2002). Professionally determined need for pharmacy services in 2020. *American Journal of Pharmaceutical Education*, 66(5), 421-429.

Knapp, D.A., & Knapp, D.E. (2009). Attributes of colleges and schools of pharmacy in the United States. *American Journal of Pharmaceutical Education*, *73*(5), 1-6.

Knapp, K. K. (2000). Building a pharmacy workforce mosaic: New studies help to fill in the gaps. *Journal of the American Pharmacists Association*, *40*(1), 13-14.

Knapp, K. K. (1999). Charting the demand for pharmacists in the managed care era. *Journal of the American Pharmacists Association*, *39*(4), 531-536.

Knapp, K. K., Cultice, J. M. (2007). New pharmacist supply projections: Lower separation rates and increased graduates boost supply estimates. *Journal of the American Pharmacists Association*, *47*,463-470.

Knapp, K. K., Livesey, J.C. (2002). The Aggregate Demand Index: measuring the balance between supply and demand. *Journal of the American Pharmacists Association, 42,391*-398.

Knapp, K. K., Quist, R. M., Walton, S. M., & Miller, L. M. (2005). Update on the pharmacist shortage: National and state data through 2003. *American Journal of Health-System Pharmacy*. *62*, 492-499.

Knapp, K. K, Shah, B. M., & Barnett, M. J. (2010). The pharmacist aggregate demand index to explain changing pharmacist demand over a ten-year period. *American Journal of Pharmaceutical Education*, 74(10), 1-8.

Ladinsky, J. (1967). Occupational determinants of geographic mobility among professional workers. *American Sociological Review*, *32*(2), 253-26.

Ladinsky, J. (1967). Sources of geographic mobility among professional workers: A multivariate analysis. *Demography*, *4*(1), 293-309.

Lansing, J. B., Mueller, E. (1967). *The geographic mobility of labor*. Ann Arbor, MI: Institute for Social Research, University of Michigan.

Lee, E. S. (1966). A theory of migration. *Demography*, *3*(1), 47-57.
Lin, S. (2004). Access to community pharmacies by the elderly in Illinois: A geographic information systems analysis. *Journal of Medical Systems*, *28*(3), 301-9.

Maio V, Goldfarb NI, Hartmann CW. (2004). Pharmacists' job satisfaction: variation by practice setting. *Pharmacology & Therapeutics*, *29*(3), 184-190.

Manasse, H. R. (1988). Pharmacy's manpower: is our future in peril? *American Journal of Hospital Pharmacy*, *45*(10), 2183-91.

Manasse, H. R., Speedie, M. K. (2007). Pharmacists, pharmaceuticals, and policy issues shaping the workforce in pharmacy. *American Journal of Health-System Pharmacy*, *64* (12), e30-48.

Midwest Pharmacy Workforce Research Consortium. (2000). *Final report of the National Pharmacist Workforce Study*. Midwest Pharmacy Workforce Research Consortium.

Midwest Pharmacy Workforce Research Consortium. (2005). *Final report of the National Sample Survey of the Pharmacist Workforce to Determine Contemporary Demographic and Practice Characteristics.* Midwest Pharmacy Workforce Research Consortium.

Midwest Pharmacy Workforce Research Consortium. (2009). *Final report of the 2009 National Sample Survey of the Pharmacist Workforce to Determine Contemporary Demographic and Practice Characteristics* Midwest Pharmacy Workforce Research Consortium.

Miller, S. J. (1976). Family life cycle extended family orientations, and economic aspirations as factors in the propensity to migrate. *The Sociological Quarterly, 17,323*-335.

Miriam, K., Steven, R., Alexander, J. T., Flood, S., Genadek, K., Schroeder, M. B., Trampe, B., & Vick, R. (2010). Integrated Public Use Microdata Series, Current Population Survey: Version 3.0. [Machine-readable database]. Minneapolis, MN: University of Minnesota.

Morris, L.V., & Palmer, H. (1994). Rural and urban differences in employment and vacancies in ten allied health professions. *Journal of Allied Health, 23* (3), 143-153.
Mott, D. A. (2000). Pharmacist job turnover, length of service, and reasons for leaving, 1983–1997. *American Journal of Health-System Pharmacy*, *57*,975-984.

Mott, D. A., Doucette, W. R., Gaither, C. A., Pedersen, C. A., Kreling, D. H., Schommer, J. C. (2006). Pharmacist participation in the workforce: 1990, 2000, and 2004. *Journal of the American Pharmacists Association*, *46*(3), 322-30.

Mott, D. A., Doucette, W. R., Gaither, C. A., Pedersen, C. A., Schommer, J. C. (2002). A ten-year trend analysis of pharmacist participation in the workforce. *American Journal of Pharmaceutical Education*, *66*,223-233.

National Association of Boards of Pharmacy. (1996).*Survey of Pharmacy Law 1995/96*. Mount Prospect, IL: National Association of Boards of Pharmacy.

National Association of Boards of Pharmacy. (2001). *Survey of Pharmacy Law 2000/01*. Mount Prospect, IL: National Association of Boards of Pharmacy.

Nooney, J. G., Unruh, L., & Yore, M. M. (2010). Should I stay or should I go? Career change and labor force separation among registered nurses in the US. *Social Science & Medicine, 70, 1874*-81.

O'Brien-Pallas, L. (2002). Where to from here? *Canadian Journal of Nursing Research*, *33*(4), 3-14.

Perry, M.J. (2006). Domestic net migration in the United States: 2000 to 2004. In: MJ Perry (Ed.), *Current Population Reports*. Washington, DC: US Census Bureau.
Prescott, P.A. (1991). Forecasting requirements for health care personnel. *Nursing Economics, 9*(1), 18-24.

Ricketts, T. C. (2010). The migration of surgeons. *Annals of Surgery, 251*(2), 363-367.

Ritchey, P .N. (1976). Explanations of migration. *Annual Review of Sociology, 2*,363-404.

Sanchez, E. J., & Raimer, B. G. (2004). *Migration trends: Texas RN and LVN workforce*. Austin,TX: Health Professions Resource Center, Center for Health Statistics, Texas Department of State Health Services Texas Department of State Health Services.

Schlottmann, A.M, & Herzog, H. W. (1984). Career and geographic mobility interactions: Implications for the age selectivity of migration. *The Journal of Human Resources*, *29*(1), 72-86.

Schommer, J. C., Planas, L. G., Johnson, K. A., Doucette, W. R., Gaither, C. A., Kreling, D. H., & Mott, D. A.(2010). Pharmacist contribution to the US health care system. *Innovations in Pharmacy*, *1*(1), 1-16.

Schondelmeyer, S. W. (2009). Recent economic trends in American pharmacy. *Pharmacy in His*tory, *51*(3), 103-27.

Schulz, R. M., & Baldwin HJ. (1990). Chain pharmacist turnover. *Journal of Social & Behavioral Pharmacy*, *7*(1), 26-33.

Schulz, R. M., Bigoness, W. J., & Gagnon, J. P. (1987). Determinants of turnover intentions among retail pharmacists. *Journal of Retailing, 63*, 89-98.

Seifer, S. D., Vranizan, K., & Grumbach, K. (1995). Graduate medical education and physician practice location. Implications for physician workforce policy. *Journal of the American Medical Association, 274* (9), 685-691.

Shih, Y. T. (1999a). Growth and geographic distribution of selected health professions, 1971-1996. *Journal of Allied Health*, *28*(2), 61-70.

Shih, Y. T. (1999b). Trends in full-time pharmacists' labor market characteristics. *Journal of the American Pharmacists Association. , 40*(1), 26-35.

Sjaastad, L. A. (1962).The Costs and Returns of Human Migration. *The Journal of Political Economy*, 80-93.
Sloan, F. A., & Elnicki, R. A. (1979). Determinants of professional nurses' wages. *Research in Health Economics*, *1*,*217*-254.

Smith, D. B. (2003). The perils of healthcare workforce forecasting: A case study of the Philadelphia metropolitan area. *Journal of Healthcare Management*, *48*(2), 99-111.

Smith, S. N., Stewart, J. E., & Grussing, P. G. (1986). Factors influencing the rate of job turnover among hospital pharmacists. *American Journal of Hospital Pharmacy*, *43,* 1936-41.

Speare, A. (1971). A cost-benefit model of rural to urban migration in Taiwan. *Population Studies*, *25*(1), 117-130.

Stouffer, S.A. (1960). Intervening opportunities and competing migrants. *Journal of Regional. Science*, *2*, 1-26.

Stratton, T. P. (2001). The economic realities of rural pharmacy practice. *Journal of Rural Health*, *17*, 77–81.

Talley, R.C. (2011). Too many, already. *American Journal of Health-System Pharmacy*, *68*(22), 2127.

United States Census Bureau. (2012, April 1). *Population Profile of the United States*. Retrieved from http://www.census.gov/population/www/pop-profile/natproj.html.

Vannase, A., Ricketts, T. C., Courteau, J., Orzanco, M. G., Randolph, R., & Asghari, S. Long term regional migration patterns of physicians over the course of their active practice careers. *Rural and Remote Health*, *7*(812), 1-15.

Walton, S. M., Cooksey, J. A., Knapp, K. K., Quist, R. M., & Miller, L. M.(2004). An analysis of pharmacists and pharmacist-extender workforce in 1998–2000: assessing

predictors and differences across states. *Journal of the American Pharmacists Association.44*, 673-84.

Walton, S. M., Knapp, K. K., Miller, L., Schumock, G. T. (2007). Examination of state-level changes in the pharmacist labor market using Census data. *Journal of American Pharmacist Assocociation, 47,348*-357.

Walton, S. M., Mott, D. A., Knapp, K. K. & Fisher, G. (2010). Association between increased number of US pharmacy graduates and pharmacists counts by state from 2000-2009. *American Journal of Pharmaceutical Education, 75*(4), Article 76.
Wolfgang, A. P. (1987). Is pharmacist turnover a function of job stress? *American Pharmacy, NS27* (5), 33-7.

Wei, L., Lin, D. Y., & Weissfeld, L. (1989). Regression analysis of multivariable incomplete failure time data by modeling marginal distributions. *Journal of the American Statistical Association, 84*, 1065-73.

Yusuf, A.A, Schommer, J. C., Mott, D. A., Doucette, W. R., Gaither, C. A., & Kreling, D. H.(2011). Association Between Student Loan Debt on Graduation, Demographic Characteristics and Initial Choice of Practice Setting of Pharmacists. *Innovations in Pharmacy*, *2*(3), Article 51, 1-10.

Zurn, P., Poz, M. D., Stilwell, B., & Adams, O. (2002, March). *Imbalances in the health workforce.* Geneva, Switzerland: Evidence and Information for Policy Health Service Provision, World Health Organization.