



An Era of Growth and Change:

A CLOSER LOOK AT PHARMACY
EDUCATION AND PRACTICE

FEBRUARY 2014

UNIVERSITY
OF
CALIFORNIA

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I. BACKGROUND

Across the nation, people are living longer. This longevity is attributable to healthier lifestyles, a well-trained health workforce, advances in science and understanding of human health and disease, and continuing discovery of new therapies for managing acute and chronic conditions. As the population ages, however, its interaction with the health care system often increases. Larger patient populations in general, and increasing numbers with chronic diseases in particular, contribute to demands for health providers and facilities that must stretch to meet changing needs.

Across the pharmacy workforce, evidence of this demand has been seen in the dramatic increase in prescriptions written and dispensed in the United States over the last two decades. During the 1990s alone, the number of retail prescriptions dispensed increased by 44%, from 1.9 billion in 1992, to almost 2.8 billion in 1999. By 2010, this number increased to approximately 3.7 billion prescriptions. Although a recent study of the IMS Institute for Healthcare Informatics reported a national decline in overall per capita use of medications in 2011, utilization is expected to increase as the economy stabilizes and as the population continues to grow.

Among the factors contributing to this growth are development of new medications and drug therapies, identification of new uses for existing medications, increased numbers of authorized prescribers, broader insurance coverage for some medications, increased affordability and availability of more generic drugs, and direct marketing to the public by pharmaceutical companies. Not surprisingly, this growth generated a demand for pharmacists in hospitals and clinics, as well as in retail, government, and academic settings. Because growth of the workforce had not kept pace with the demand for services – due in part to the lack of growth in educational opportunities for many years – a nationwide pharmacist shortage developed in the late 1990s. In California, this shortage was significant and well documented in chain store pharmacies, hospital practices, and other clinical settings.

Since then, several factors have had a significant impact on the pharmacy workforce. Among these are the rapid growth of new pharmacy schools; enrollment expansion in schools across the nation; and the economic challenges experienced by all states over the last decade. Implementation of the Patient Protection and Affordable Care Act, also referred to as the Affordable Care Act (ACA), will have an enormous impact on California's demand for health services. The state has more than eight million uninsured residents and approximately half of these individuals will become eligible for Medi-Cal (Medicaid) benefits beginning in January 2014. As pressures to improve quality and reduce costs increase, new models of care will be required. Multi-disciplinary, patient-centered, team-based care will require improved communication and collaboration with patients and the members of health care teams. The expanding roles of pharmacy professionals are also likely to include increased responsibilities for activities such as chronic disease management, drug benefit plan management, medication therapy management (MTM), and development of clinical and translational research leadership. These and other changes are expected to be an important factor in the demand for highly trained pharmacists.

This report was prepared by the University of California (UC) Office of the President's Health Sciences and Services division, with review and guidance provided by the UC health professions community (see Acknowledgments). The report reviews state and national pharmacy workforce projections; provides commentary on the scope of practice for licensed pharmacists; reviews educational programs, application and enrollment trends, and pharmacy licensure requirements in California; and provides findings and recommendations regarding future steps the University of California (UC) might take in addressing current and projected needs.

II. THE PHARMACY WORKFORCE

Current Estimates and Trends

Pharmacists represent the third largest health professional group in the U.S. Although some pharmacists work in non-patient care settings (e.g., teaching, research, and administration), most work in a variety of patient care settings (Figure 1). In 2011, there were 272,320 working pharmacists and an estimated 343,550 pharmacy technicians in the U.S. workforce. This corresponds to a national average of 87 pharmacists and 108 pharmacy technicians per 100,000 population. According to the Bureau of Labor Statistics, the total number of pharmacists in the U.S. is expected to increase by 69,700 (25%) between 2010 and 2020 and by 95,680 (35%) by 2030. National trends suggest that the supply of pharmacists is growing faster than previously projected, primarily as a result of the recent rapid growth of new pharmacy education programs and expansion of enrollment at existing schools across the country (see section below entitled “Pharmacy Education”). In California, pharmacy workforce shortages are also decreasing and beginning to fall in balance with the state’s supply of pharmacists. In 2011, 22,960 pharmacists and 28,670 pharmacy technicians and aides served approximately 38 million Californians. This ratio of 63 pharmacists and 79 pharmacy technicians per 100,000 population indicates that California still lags the nation despite the growing supply of pharmacy professionals throughout the state.

Although the supply of the nation’s pharmacists is rapidly growing, according to the national Aggregate Demand Index (ADI) – a monthly survey of unmet demand for pharmacists initiated in 1999 by the Pharmacy Manpower Project (Figure 2), there is currently no surplus of pharmacists in any state. However, the ADI ranks California, New Mexico, Texas, Kansas, and Missouri as the five states with greatest unmet demand (Appendix A). In 2007, the ADI for California was higher than that of any other state at 4.54 (on a scale of 1 to 5). As of September 2012, the ADI for California declined to

3.58 making it the fifth state with the greatest unmet demand identified by this index. According to the Pharmacy Manpower Project, the decline is strongly linked to U.S. unemployment rates and the economic downturn.

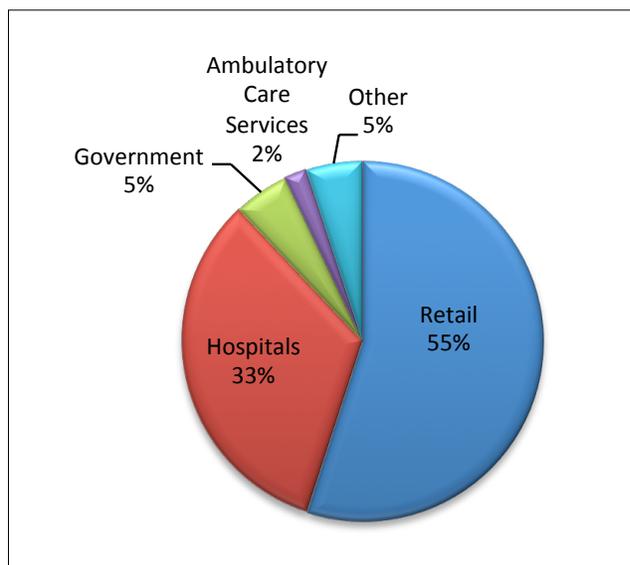


Figure 1: Distribution of California’s Pharmacists by Worksetting, 2008

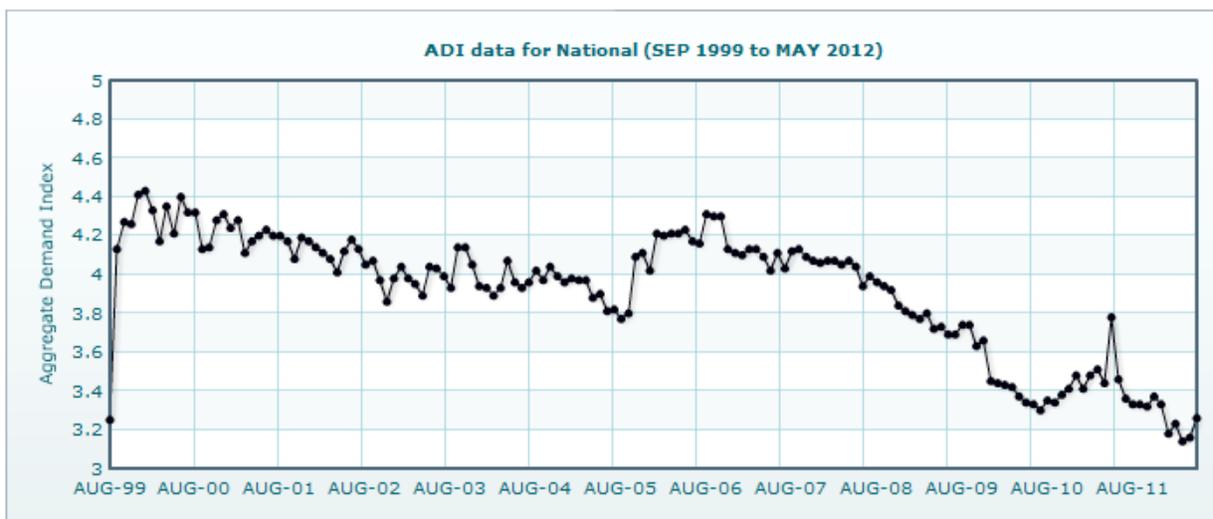


Figure 2: The ADI reflects “unmet demand” rather than “demand” as the index reflects the extent to which the available supply of pharmacists meets the demand of open positions or vacancies.

Factors Driving Workforce Demand

Population growth and changing demographics – including the aging of the population and diversity of its citizenry – are among the factors contributing to California’s need for more pharmacists. The population age 65 and older is expected to grow significantly faster than younger citizens and will nearly double over the next 20 years. Because the elderly will utilize a disproportionate share of pharmacy services, demographic changes will continue to drive health workforce demand.

Other factors include:

Expanding Roles of Pharmacy Practice The expanding scope of practice for pharmacists has resulted in increased educational requirements for students and increased responsibilities for practitioners. Today, pharmacists participate in such diverse patient-care activities as drug monitoring and disease management, multidisciplinary clinical care, and patient education. As members of clinical care teams, their expertise extends to advising patients and prescribers with regard to potential drug/drug and drug/disease interactions, the changes in management of chronic and acute illnesses, and assessing and improving outcomes of drug therapy. As the number and types of medications have grown and the needs of patients have changed, pharmacists have reported longer work hours, reduced flexibility in scheduling,

and insufficient time to perform the range of tasks for which they are trained and accountable. Although it is possible that fewer pharmacists may be needed for dispensing and drug distribution (i.e., as a result of the expanded use of pharmacy technicians and aides, automation, and standardization of dispensing and distribution processes), clear evidence of the workforce impact of these changing practice patterns has not yet been widely seen.

During the 2013 California legislative session, Senator Ed Hernandez (D – 24th district) introduced Senate Bill 493 that updates Pharmacy Law to authorize pharmacists to perform certain functions including, among other things, to furnishing self-administered hormonal contraceptives, nicotine replacement products, and authorizing pharmacists to initiate and administer routine vaccinations, as specified. The bill also establishes board recognition for “advanced practice pharmacists (APP)”, and specifies additional functions that may be performed by an APP, including performing patient assessments, and ordering and interpreting drug therapy-related tests. The proposed changes envisioned in SB 493 bring California into closer alignment with the practice environment and innovative care models used in federal pharmacy programs in the Department of Defense, the Veterans Administration, and the U.S. Public Health Service, where pharmacists have been

practicing in collaborative ways for more than forty years. On October 1, 2013, the bill was signed into law by Governor Brown and will become effective January 1, 2014.

Utilization of Pharmaceuticals Demand for pharmacists is driven by the demand for prescriptions and the increasing demand for their contributions to the safety and efficacy of drug therapy. According to the IMS National Prescription Audit, the change in the number of prescriptions dispensed in the U.S. has slowed in growth. Overall, per capita utilization of medicines declined in 2011 as patient office visits and non-emergency room hospital admissions declined. Utilization by patients 65 and older also decreased. Although the downward trend in prescription drug use has only been seen in recent years, possibly as a result of the economic recession and high unemployment in the U.S., the trend toward increased utilization is generally expected to continue as the economy stabilizes, as more therapies and innovations in treatment are developed, as more generic drugs become available, and as the population grows and ages.

Changing Federal Policies and Programs Following the enactment of the ACA in March 2010, numerous lawsuits challenging provisions of the new law were filed in the federal courts. Although many of those cases were dismissed, the U.S. Supreme Court agreed to consider several issues related to the constitutionality of the ACA, including the individual mandate and the Medicaid expansion. On June 28, 2012, the court upheld the constitutionality of health reform. However, given that most states are confronting major budget deficits, there is uncertainty about their ability to implement the provisions of the ACA. Notwithstanding these uncertainties, health care reform efforts will continue to be required and will focus on both improving the quality of care and decreasing health care costs. The ACA will also substantially increase the number of Californians who will have health insurance. While estimates vary, statewide projections indicate that between 3.7 million and 4.3 million Californians will become eligible for Medi-Cal (Medicaid) benefits in January 2014. Because studies show that individuals with health insurance use more health services than those who are uninsured, the ACA offers historic

opportunities for improving the health of more people. These reforms, however, will also heighten California's existing health workforce challenges.

A recent report from the California Program on Access to Care states that the greatest increase in demand will be for primary care providers, which in turn is expected to increase demands for other health professionals who contribute to the delivery of primary care, including pharmacists and other pharmacy personnel who process prescriptions. These trends are already being seen in the growing utilization of prescriptions among 19-25 year olds (since 2011), which coincides with the provision of the ACA that expands the age for parental health coverage of dependents to age 26.

Community pharmacists are also likely to contribute to meeting the unmet primary care needs of underserved communities by providing direct patient care services (i.e., as do other non-physician providers in settings where access to primary care physicians is limited). *Improving Patient and Health System Outcomes Through Advanced Pharmacy Practice: A Report to the U.S. Surgeon General* (released March 2012), outlines the rationale for pharmacists delivering expanded services to support the objectives of health reform.

Expanding Pharmaceutical and Biotechnology Industries

Biotechnology companies and an advanced technology sector located near universities and research centers continue to draw the pharmaceutical industry to California. Leaders such as Pfizer, Johnson & Johnson, Merck, and Novartis have large research and development sites in La Jolla. Amgen and Allergan are in Thousand Oaks and Irvine, and Genentech, Gilead, and Roche maintain primary facilities in the San Francisco Bay Area. The San Francisco and San Diego areas now support the nation's first and third largest biotechnology communities. As these businesses mature, and as approved investigational new drugs and clinical trials become critical to product lines, demand for pharmacy graduates in this sector will increase. Activities devoted to developing, producing, and assessing the clinical application of pharmaceuticals are

likely to stimulate state and local economies and generate new demands for PharmD expertise in the pharmaceutical sciences. The breadth of knowledge and advanced skills of California graduates are considered well suited to – and highly desirable by – this industry.

The Need for Cultural Competence Nationwide, the majority of pharmacists are white, followed most closely by Asian-Pacific Islanders. Among recipients of PharmD degrees conferred in 2009-2010, graduates were white (60%); Asian-Pacific Islander (21%); African American (7%); Hispanic/Latino (4%); and American Indian (0.4%). These data reflect a lack of diversity in the pharmacy profession, which is similar to that seen for many health professions.

In California, these data differ in that the majority of the state's pharmacy graduates are Asian-American (64%), followed by whites (20%). The U.S. Census Bureau, however, reports that the majority of Californians are white (40%) and that the state's next largest ethnic group is of Hispanic/Latino origin (38%). The profile of California's pharmacy workforce thus differs substantially from that of its residents.

The relative lack of diversity among U.S. and California health providers, together with growing evidence of health disparities among various ethnic and racial groups, underscores the need for renewed efforts to increase diversity and improve the cultural and linguistic competency of all health professionals. By training culturally competent faculty and practicing pharmacists, California's medically underserved groups and communities are likely to have improved access to pharmaceutical counseling and drug therapy management services, and in turn to benefit by improved health outcomes. Needs are also increasing for multilingual and multicultural pharmacists to communicate complex drug information and to address cultural beliefs relevant to the use of pharmaceuticals among multicultural populations. These issues are particularly important for California's rural populations, many of which are found in designated Health Professions Shortage Areas.

Factors Affecting Workforce Supply

The size of the active pharmacist workforce is primarily driven by work participation (i.e., the number of pharmacists who enter/re-enter and exit the workforce). Historically, the supply of licensed pharmacists in California had been restricted by revised standards for licensure and the state's rigorous pharmacy licensing examination. Other factors influencing the supply of pharmacists include the capacity of schools of pharmacy to train new pharmacists, the economy, changing demographics of the pharmacist workforce, demand for drug therapy management in primary care and specialized chronic drug therapy management, automated dispensing and refilling systems, mail order filling of prescriptions, and the complementary workplace role of pharmacy technicians.

Revised Standards for Licensure Until the 1990s, a Bachelor of Science (B.S.) degree from an accredited school of pharmacy was the minimum educational requirement for graduation. The B.S. degree was considered sufficient preparation for the North American Pharmacist Licensure Examination (NAPLEX) – the standard licensing exam in all states except California. Only 17 of the nation's 72 schools offered the PharmD degree. By contrast, two of California's schools (UCSF and USC) have offered the PharmD degree since the 1950s. In the 1970s, California's then three schools of pharmacy, along with the California State Board of Pharmacy agreed upon a common set of competencies to prepare students for a level of expertise beyond product dispensing. As a result, California's pharmacy education programs broadened their curricula to include training in the appropriate use of drugs in patients, managing drug therapy of chronic diseases, therapeutic counseling, and more recently, the use of pharmacogenomics in the selection of therapy.

In the late 1980s and early 1990s, the pharmacy profession adopted "pharmaceutical care" as its philosophy. In 1995, the American Association of Colleges of Pharmacy (AACP) voted to grant the PharmD as the entry level degree for practicing pharmacists and in 2000, the Accreditation Council for

Pharmacy Education (ACPE) announced that it would accredit only PharmD programs. The NAPLEX was updated and the PharmD was established as the required entry-level degree for more recent graduates to practice in all 50 states.

California's Pharmacy Licensure Examination Until January 1, 2004, all pharmacy graduates – including those previously licensed in other states, were required to pass California's state-specific licensure examination. This examination, which was originally intended to assure that all of California's new licensees were capable of meeting the advanced "clinical pharmacy" competencies adopted by the Board of Pharmacy and California's long standing schools of pharmacy (i.e. those in operation during the 1970s), served as an additional barrier to the migration of pharmacists trained outside of California. Evidence of this barrier was demonstrated by the fact that in 2002, first time pass rates for in-state graduates was 75%, while the pass rate of out-of-state graduates was only 32%. By contrast, the national pass rate for NAPLEX in 2002 was 94%.

To reduce this barrier, and in recognition of increasing pharmacy workforce needs, the California Legislature passed Senate Bill 361. This legislation directed the California Board of Pharmacy to license as a pharmacist those applicants who have passed a written and practical examination given by the Board prior to December 31, 2003, or who passed the NAPLEX on or after January 1, 2004. Pass rates for this examination for all licensure applicants are significantly higher than they were on the former California licensure exam. Among graduates of California programs in 2011, first time pass rates for in-state graduates was 99% and the national pass rate was 97%. The State Board maintains the California Pharmacist Jurisprudence Examination (CPJE) for licensure in California for candidates who have successfully completed the NAPLEX. The 2011 CPJE pass rate for California schools of pharmacy graduates was 90%. The pass rate for U.S. non-California schools of pharmacy was 74% and for foreign schools of pharmacy graduates it was 48%. While the effects of this change on the California workforce will not be fully known for some time, the move to adopt the national licensure examination is

considered useful from a variety of educational, licensure, and employment perspectives.

Notwithstanding this change, it is important to note that international graduates of pharmacy schools, like foreign medical school graduates, face additional barriers to achieving U.S. licensure. Difficulties with language, knowledge of specific U.S. pharmacopoeia, limited transfer of educational credits, and other obstacles reduce opportunities for foreign-trained graduates to enter the workforce.

Changes in Workforce Participation The results of the 2009 National Pharmacist Workforce Survey suggest that the proportion of licensed pharmacists actively practicing is increasing as a result of the economic downturn in recent years. As the recession negatively impacted other business sectors, pharmacists working in other fields or not working may have decided to enter or re-enter the pharmacy workforce. It is important to note that although the proportion of pharmacists working in the profession is increasing, the Full Time Equivalent (FTE) total positions have not increased due to rising rates of part-time work among both male and female pharmacists. This increasing trend of more pharmacists working part-time has been observed since 2000. Employers accommodated more flexible work schedules of employees (i.e., those who preferred to work only part time) given the high demand for pharmacists. But in recent years, the economy has also contributed to this downward shift in work hours. Nearly one-third of hospitals and chain settings report that they have restructured schedules and reduced hours as a result of the recession.

Workforce Demographics The demographics of the pharmacy workforce are also changing. In 1970, the proportion of pharmacists who were women was less than 13%. Today, half of all pharmacists are women. This growth is expected to increase as most new graduates are female while the majority of pharmacists approaching retirement are male. By 2025, two out of three pharmacists are likely to be women. Pharmacists are also aging with many expected to retire in the coming

years. Female pharmacists tend to work fewer hours than their male counterparts of the same age. Older pharmacists similarly report fewer work hours. According to HRSA, FTE supply (which takes into account projected changes in the average hours worked doing patient care activities) is expected to grow at a slower rate than active supply. However, this gap may be influenced by expanded responsibilities and roles for pharmacists, the proliferation of new schools of pharmacy, and increased numbers of graduates.

Pharmacy Technicians in the Workplace Certified pharmacy technicians assist pharmacists with prescription dispensing and other tasks. When paired in required technician/pharmacist ratios (2:1 in hospital settings, and either 1:1 or 2:1 in retail settings, depending on the number of pharmacists on duty), pharmacists are able to extend their reach and to fulfill more of the professional and patient-oriented responsibilities for which they are specifically trained. The skill set of pharmacy technicians is variable, however, because for many years they received only on-the-job training. The establishment of formal and comprehensive pharmacy technician training programs, and the introduction of a certification examination by the Pharmacy Technician Certification Board, are leading to an increasingly qualified and competent workforce of allied professionals, making this one of the fastest growing occupations nationally. Employment of pharmacy technicians is expected to increase nationally by approximately 108,300 or 32% between 2010 and 2020. In California, the number of pharmacy technicians registered every year has tripled over the past decade, largely driven by the rapid proliferation of private for-profit pharmacy technician training programs around the state (approximately 80% of these programs are now for-profit). The number of technicians is projected to increase by nearly 9,600 or 33% in California by 2020.

Automation and Technologic Advances Automated, computerized refilling and robotic dispensing systems have proved reliable in helping pharmacists with dispensing medications and other productivity-enhancing activities but

varies by setting. The use of electronic prescribing software increases the time available to pharmacists for health education, drug monitoring, and patient care, and can reduce the incidence of medical errors created by illegibly written prescription orders. The vast majority of pharmacies use some form of automated order and dispensing technology, however, these automated environments have not yet been shown to decrease the number of pharmacists and work hours needed to oversee prescription management and monitoring. New costs, restrictive legislation, and greater applicability to large health facilities than to small facilities have limited the adoption of automation and technology on a widespread basis.

The growing utilization of pharmacy benefit management by insurance companies that require its members to order prescription refills by mail is likely to have a significant impact on the pharmacy workforce. While mail order filling of prescriptions is still a small percentage of pharmacy employment (less than 2%), the Bureau of Labor Statistics projects that it will grow to 47% by 2018, much faster than the projected growth of pharmacy jobs overall.

III. PHARMACY EDUCATION

Nationally, there are 129 colleges and schools of pharmacy with some formal level of accreditation status from the Accreditation Council for Pharmacy Education (ACPE). Among these, 124 colleges and schools are accredited professional degree programs (full or candidate status), with five schools having pre-candidate status. Of these, 66 are offered by private institutions and 63 are in publicly-supported universities. In fall 2013, 129 colleges and schools will offer the PharmD degree as a first professional degree; and 71 will offer other graduate programs in the pharmaceutical sciences (e.g., Masters and/or Ph.D. degrees).

The professional pharmacy curriculum is designed to produce pharmacists who have the abilities and skills to provide drug information, education, and pharmaceutical care to patients; manage the pharmacy and its medication distribution and control systems; and promote public health. Required coursework for all pharmacy students includes pharmaceutical chemistry; pharmaceuticals (drug dosage forms, delivery, and disposition in the human body); pharmacology; therapeutics (the clinical use of drugs and dietary supplements in patients); drug information and analysis; pharmacy administration (including pharmacy law, bioethics, health systems, pharmacoeconomics, medical informatics); clinical skills (physical assessment, patient counseling, drug therapy monitoring for appropriate selection, dose, effect, interactions, use); and clinical pharmacy practice in pharmacies, industry, health maintenance organizations, hospital wards, and ambulatory care clinics.

Rapid Growth in Educational Programs

The number of U.S. pharmacy professional schools has increased substantially over the past decade, with much of this growth occurring in recent years. Prior to 1987, for example, there were 72 U.S. pharmacy schools. This number and the total U.S. pharmacy student enrollment had been relatively constant for many years. Since 1995, however, there has been unprecedented growth in total U.S. pharmacy enrollment. This growth has been a result of both expansion of existing programs, and the establishment of new schools – including satellite pharmacy programs offered at new locations (i.e., at

parent institutions that had not previously offered pharmacy education). Since 2005 alone, the number of accredited pharmacy schools has grown from a total of 87 to 129 (a 48% increase), with most of this growth occurring at private institutions. The establishment of “new schools” is occurring in parent institutions that differ substantially from those of schools in operation before 1995. The “older schools” are more likely to be affiliated with health care institutions, located in research institutions (i.e., Carnegie Foundation Classification, Category I – Research/Doctoral Universities) with a research mission, and more likely to be engaged in interprofessional education. This rapid expansion over a relatively short time period has raised concerns within the profession about the ability of schools to recruit and retain faculty, the availability of suitable clinical training sites, and the potential to compromise the quality of pharmacy school graduates. A May 2012 American Public Media news story highlighted the difficulty some pharmacy school students are having finding employment given the increased number of new graduates in the marketplace.

Application and Enrollment Trends

The expansion of existing programs and the opening of new schools have corresponded to increases in student applications and total enrollment. The number of applications for admission to accredited U.S. schools of pharmacy rose for more than ten consecutive years. In 2009-10, 111,744 applications were submitted to first professional degree programs, up from 23,530 in the 1998-99 academic year (an increase of more than 300%). Institutions reported an average applicant to enrollment rate of 7.0:1 for admission in fall 2011. First professional degree enrollment ranged from 53 to 1,961 students per college or school in fall 2011. In fall 2011, professional degree enrollments in the U.S. totaled 58,915, a 70% increase from the 34,481 students enrolled in fall 2000.

Pharmacy Education in California

In California, two UC (public) campuses and six private universities offer pharmacy degree programs. In 2010,

approximately 3,600 students were enrolled at UC San Francisco, UC San Diego, Loma Linda University, Western University of the Health Sciences (WUHS), University of Southern California, University of the Pacific, Touro University, and California Northstate University. In 2011, the number of graduates from California schools ranged from 0 students at California Northstate University (inaugural class graduated in 2012), to a high of 210 at the University of the Pacific (see Appendix B) with California programs graduating a total of 849 pharmacists that year. With the continued ramp up of enrollments in California's two newest pharmacy schools (Touro University and California Northstate University), California will contribute an increasing number of new graduates to the pharmacy workforce in future years. A 2011 press account further suggests that there may be up to eight additional educational institutions in California with plans to open pharmacy schools within the next few years. These include programs in the Central Valley, the Inland Empire, and Southern California.

Reflecting national trends, the number of qualified applicants to California's pharmacy programs exceeds the number of available positions (Table 1). Although increases in educational opportunities have occurred over the past several years, the number of applicants for all programs continues to be substantial.

By contrast to increasing national enrollment trends, and despite increasing numbers of highly qualified applicants to UC programs, total enrollment at UCSF between 2008 and 2010 remained steady, ranging from 486 to 490 students across all years of the educational program (or approximately 122 graduates annually). UCSD's program in that same time

period enrolled approximately 238 students (or roughly 60 graduates per year). In both UC schools, the majority of enrollees are women. In fall 2011, the percentage of students from underrepresented minority groups (including Black/African-Americans, American Indians, Mexican Americans, and mainland Puerto Ricans) was less than 15% of all enrolled students at UCSF and less than 10% of all enrollees at UCSD. Nationally, Black/African Americans, individuals of Hispanic or Latino ethnicity, and American Indian/Alaska Natives composed approximately 11% of U.S. pharmacy enrollments.

Although the percentage of UC's underrepresented minority (URM) pharmacy students is comparable to public and private comparison institutions, UC is intensifying efforts to increase enrollment of URM students in their programs through targeted outreach and recruitment efforts. In fact, at UCSF the percent of URM students in the Fall 2012 class will be greater than 20 percent. Targeted outreach efforts include activities such as diverse UC faculty engaging pre-pharmacy undergraduate students through panel discussions and events, working with the Office of Student Affairs and Admissions to conduct outreach opportunities at UC sister campuses and California State University Information Days. In addition, UC faculty and students participate in programs (such as BioBridge/Science Bridge and Doc-4-a Day) for middle and high schools with diverse student populations, introducing science principles and teaching tools to encourage a pipeline of diverse students for pharmacy and the health sciences. UCSF's Doctors Academy/Early Conditional Admissions Program for UCSF School of Pharmacy is an example of a successful pipeline program that has led middle school students in the Central Valley towards careers in pharmacy.

Table 1. Total Applicants to California PharmD Programs vs. Total First-Year Class in 2009-10

	Loma Linda University	UC San Francisco	UC San Diego	University of Southern California	Western University	University of the Pacific	California Northstate	Touro University
Applications	1,094	1,607	1,421	1,572	1,759	2,083	1,839	2,543
1 st year enrollment	73	121	60	187	123	218	90	107

Strengths of UC Schools of Pharmacy

Interdisciplinary educational programs In response to scientific advances and expanding professional standards, UC pharmacy programs have increased their academic and degree offerings and developed new areas of study to address changes in pharmacy practice and to meet changing accreditation requirements for advanced level pharmacy training. UC's university-based programs are affiliated with highly acclaimed academic medical centers which provide students the opportunity to interact and learn from other health professions students and practitioners.

- At UCSF, major changes began in the early 1970s with required fourth year clerkships (inpatient and outpatient) designed to prepare students for the expanded role of the pharmacist as a member of the clinical care team. Students combine required and elective courses (e.g., chemotherapy and clinical oncology, pediatric and women's health issues, and clinical toxicology) and complete *initial* and *advanced pharmacy practice experiences*, involving applied learning in acute, ambulatory, long-term care, and community care settings alongside physicians and nurses.
- The UCSF School of Pharmacy professional curriculum allows students to emphasize one of three areas: pharmaceutical care, health services and policy research, or pharmaceutical sciences. UCSF has also launched joint degree programs (PharmD/MPH, PharmD/PhD, PharmD/MSCR) and new graduate offerings in interdisciplinary fields such as chemistry and chemical biology, pharmaceutical sciences and pharmacogenomics; and biological and medical informatics by initiating and establishing collaborations with research colleagues beyond the UC community (e.g., California Poison Control System, Center for Self Care, Drug Product Services Laboratory, Drug Studies Unit, Drug Research Unit, Center for Chemical Screening and Diversity, California Institute for Quantitative Biomedical Research). The UCSF School of Pharmacy Drug Product

Services Laboratory provides specially compounded veterinary products to veterinary pharmacists and veterinarians at the UC Davis Medical Center.

- At the newer UCSD Skaggs School of Pharmacy & Pharmaceutical Sciences, which matriculated its inaugural class in fall 2002, pharmacy students take the basic biomedical sciences courses with UCSD medical students and thus develop a common fund of knowledge in several preclinical science subjects during their first and second years. Following a year of distinct coursework and training specific to each profession, pharmacy and medical students return to share common clinical experiences at UCSD hospitals and clinics during their advanced pharmacy practice experiences and clinical service rotations, respectively.
- UCSD also offers a PharmD/PhD program, and recently launched a Seven-Year BS Chemistry/Doctor of Pharmacy Program for students that entered UCSD as "normal" freshmen in Fall 2010. There have also been discussions regarding offering a PharmD/MBA dual degree with UCSD's Rady School of Management. UCSD currently offers a multidisciplinary course that relates to preparation for careers in industry (Drug Discovery, Development & Commercialization) that involves students from the pharmacy school, UCSD's medical school, business school, graduate school (biomedical sciences program), and UC Irvine's law school.

Preparation of future pharmacy faculty UC's advanced-level training – including residency and fellowship programs – are critical for ensuring an adequate supply of future pharmacy faculty in California and nationally. Advanced training among the faculty is regarded as both desirable and valuable for maintaining high educational and professional standards. Both UC Schools of Pharmacy offer accredited residency training programs (see section that follows entitled "Residency and fellowship training opportunities.").

Advanced-level clinical training for practicing pharmacists

UC's accredited pharmacy residency and fellowship training programs yield qualified graduates who fill critical roles in the pharmacy workforce. Completion of a residency program is a requirement for inpatient pharmacy practice at UC and other academic health centers, and is a preferred qualification for pharmacists holding leadership positions at UC.

Professional preparation of industry leaders and researchers

UC's broad-based curriculum and advanced degree offerings prepare future leaders in both clinical practice and investigational research. By opening the UCSD Skaggs School of Pharmacy, UC demonstrated its ongoing commitment to preparing highly qualified students to enter the pharmacy workforce and to maintain a comprehensive educational program in southern California's growing biotechnology and pharmaceutical research sector.

Innovative Pharmaceutical Sciences Research

Research is a central element of UC's tripartite mission. UC School of Pharmacy faculty members improve the lives of people by conducting cutting edge research in the discovery of drug targets and therapeutic agents for translation into the clinical setting for prevention, diagnosis, and treatment of human disease. UC provides a unique environment in which leading scholars expand fundamental knowledge, discover new approaches to improving health care quality and outcomes, thereby making substantial economic and social contributions. Collaboration and partnerships occur with colleagues across UC, nationwide and worldwide.

Ongoing Challenges for UC Pharmacy Programs

Required resources for accredited PharmD training programs

The allocation of funding for UC's pharmacy educational and advanced-level training opportunities has not kept pace with the increasing requirements of pharmacy education. In 1970, support for faculty instruction was calculated at a ratio deemed sufficient to ensure the quality of the training offered at UCSF. Forty years later, the same level of funding

does not provide the resources needed to support a dramatically changed educational paradigm that requires small group, problem-based learning and mentoring, and clinical training, nor does it recognize the needs of a high-caliber graduate program. UC faculty must stretch to meet the demands of the field's widened scope of practice, broadened training and licensure requirements, and resulting changes in the pharmacy curriculum. UC's newest school of pharmacy at its San Diego campus first matriculated students a decade ago (in 2002). With its beginning and growth occurring during a time of budget constraints for the University, state funding to UCSD for student instructional support differed from allocations for UC's first pharmacy school. Current budget constraints, together with increasing accreditation requirements and the limited ability to cross-subsidize, continue to pose challenges for pharmacy education and research programs at UCSD and UCSF.

Contributions of Voluntary Clinical Faculty

The UC schools of pharmacy rely heavily on volunteer faculty members and community sites to meet the experiential educational needs of their students. Faculty volunteers serve as preceptors to students, mentoring and supervising them in ACPE accreditation required "introductory pharmacy practice experiences" (IPPEs) and "advanced pharmacy practice experiences" (APPEs). Volunteer faculty are provided a UC non-salaried faculty title requiring a minimum number of teaching hours per year. UCSF requires initial training for all "Without Salary" (WOS) faculty, as well as ongoing, intermittent continuing education. In 2011-12, UCSF and UCSD had more than 900 WOS faculty (as compared to approximately 150 salaried faculty), the majority of whom are supported via outside grants and contracts. The generosity of these volunteer faculty is vital to the education and training of current students.

Historically, UC has relied on goodwill and the value seen by pharmacists who have an affiliation with UC through their work as clinical faculty. Increasingly, however, there is interest expressed by preceptors and host institutions in monetary

compensation for their time, thereby creating additional financial strain for the UC schools. With hundreds of WOS faculty, UC schools will need to consider new ways to ensure consistency in teaching and improve recognition of volunteers for their service.

Clinical training sites As new schools open and classes increase in size, the availability of suitable clinical training sites has become more limited. As a result of the economic downturn and increased competition from California's other schools of pharmacy for instructors/teaching sites, current UC volunteer faculty report having less time to supervise students. Clinical sites are also interested in the support of paid faculty to oversee the students and the experiential program, and in some situations to provide per capita student support. Some community based hospitals and clinics have refused to provide UCSD access to training sites without such compensation. In select situations, UCSD and UCSF have provided joint resident support. The ACPE's Professional Degree Program Standards 2007 presented new requirements that IPPEs must be at least 5% of the curriculum or a minimum of 300 hours. This has added an additional academic requirement to UC programs, and increased the need for adequate numbers of quality training sites and preceptors for students.

Student costs and indebtedness In parallel with recent growth of new pharmacy schools is the substantial upward trend of increased cost of attendance for pharmacy students, including those enrolled in public institutions. Between fall 2004 and fall 2011, the national average for first year tuition and mandatory fees for a state resident in a public pharmacy school increased from \$10,297 per year to \$18,712 per year (an 82% increase in eight years). Total costs to pharmacy students at UCSF and UCSD significantly exceed the national public school average, with fall 2011 tuition and fees totaling more than \$30,000 for California residents (\$32,217 and \$31,665, respectively). This represents a more than 80% increase in costs for California students since 2004-05. Cost to attend a California private pharmacy school ranged from \$39,625 to \$45,400 in fall 2011. A 2011 study that surveyed pharmacists

concluded that student loan indebtedness has been increasing over time, especially for minority pharmacy students – who incurred debt at a significantly higher level and in higher proportion by comparison to white respondents. As part of the same study, the graduate's level of indebtedness was self-reported as being associated with his or her initial choice of practice setting, with those graduating with higher debt more likely to choose employment at higher-paying chain pharmacies as compared to independent pharmacies.

Residency and fellowship training opportunities The number of advanced-level pharmacy training opportunities in California is not considered adequate for meeting employment needs or sufficient for accommodating the number of qualified applicants. According to the American Society of Health-System Pharmacists (ASHP), which accredits the nation's residency programs, applications to U.S. pharmacy residency programs have outnumbered available positions for the last eight years (2003 – 2010), with the number of “unmatched” applicants doubling between 2007 to 2010 (from 557 to 1,114). A higher percent of UC pharmacy graduates pursue residencies and fellowships than the national average of graduates (~15-16%). At UCSF, nearly 50% of pharmacy graduates choose to pursue postgraduate training, and at UCSD, approximately 60% of graduates pursue specialty training through residencies and fellowships. The high number of successfully matched candidates reflects the strength of UC pharmacy education programs, competitiveness of its students and contribution to health care systems. During the 2011-12 academic year, however, the UCSF School of Pharmacy was able to accommodate only 26 pharmacy residents (16 first-year positions for Pharmacy Practice and 10 second-year specialty residents), and UCSD School of Pharmacy had enrolled 29 residents (18 first-year positions and 11 second-year specialty residents). In addition, there are accredited residency programs offered at three UC campuses with medical centers (Davis, Irvine, and Los Angeles). However, fewer residents are trained in these hospital-based programs (approximately 19 total residents at three UC campuses in 2011-12).

The American College of Clinical Pharmacy's (ACCP) vision for the future of the pharmacy profession includes a statement that "formal postgraduate training will become mandatory before one can enter practice." If such a mandate occurs in the profession, then a significant number of new residency training programs will be needed. In 2010, 11,487 PharmD degrees were conferred, and approximately 2,600 PGY1 and 2 positions were available nationwide. The gap between supply and demand is thus substantial. With additional new schools of pharmacy planned, and ramping up to 'steady state' enrollment in the coming years, there will be still greater numbers of PharmD graduates in the future. In 2011, ASHP convened a Pharmacy Residency Capacity Stakeholders conference in Washington, DC, to work with their partner organizations on recommendations to accelerate the rate of expansion of residency programs to meet the needs of the public and the profession.

Faculty training, recruitment, and retention Without an adequate supply of faculty to support the courses, programs, and research endeavors that are central elements of pharmacy education and pharmaceutical science, programs training

practicing pharmacists, researchers, and industry leaders will be limited in their capacity to meet changing demands. With substantial numbers of new schools and enrollment growth in the profession, the need for qualified faculty has increased and exacerbated existing shortages. UCSF, for example, faces an acute problem, in part, due to the large numbers of faculty members who will be retiring over the next decade. Recruitment challenges include the high cost of living where UC's schools of pharmacy are located (San Francisco Bay Area and La Jolla), as well as competition due to substantially higher salaries in the private sector. Effective recruitment strategies (including the ability to offer competitive start-up packages) and expansion of residency and fellowship training opportunities will help draw future faculty to UC schools. Promoting faculty development and analyzing resource requirements for education and research will be essential for both planning and for successful recruitment and retention of future faculty.

IV. SUMMARY OF FINDINGS

- (1) California’s demand for pharmacists is beginning to fall in balance with the state’s growing supply of pharmacists.** Because growth of the pharmacy workforce had not kept pace with the demand for services, a nationwide pharmacist shortage developed in the late 1990s. Since then, several factors have had a significant impact on the pharmacy workforce, particularly the rapid growth of new pharmacy schools and enrollment expansion in California and nationwide. Additional factors contributing to the increasing supply of the state’s pharmacists include changes in workforce participation, revised standards for licensure, the economy, changing demographics of the pharmacist workforce, automated dispensing and refilling systems, mail order filling of prescriptions, and the complementary workplace role of pharmacy technicians. National and state trends suggest that the supply of pharmacists is growing faster than previously projected. However, population growth, the aging of the population, changing demographics, and the expanding role of pharmacists will continue to drive the demand for more pharmacists throughout the state. Implementation of the ACA will heighten existing workforce challenges and will drive changes in delivery systems and development of new models of care, with pharmacists taking on increased responsibilities for chronic disease management, medication therapy management (MTM), clinical and translational research, and other activities. These variables – including those driving increases in demand through health reform, as well as those increasing supply through recent expansion of educational programs – contribute to the difficulty in accurately predicting future pharmacy workforce needs.
- (2) Significant growth in pharmacy educational opportunities has occurred throughout California, with the majority of enrollment increases at private institutions.** Largely in response to a documented workforce shortage of pharmacists, many educational institutions across the country responded by both creating new schools and expanding existing enrollments. Since 2002, four new schools of pharmacy have opened in California, doubling the number of programs in the state from four to eight. The addition of Loma Linda University, University of California, San Diego, Touro University and California Northstate University resulted in a combined increase of 330 first-year positions by 2009-10, or nearly 34% of the number of positions in the state. Three of these four new programs are at private institutions. A 2011 press account suggests that there may be up to eight additional educational institutions in California with plans to open pharmacy schools within the next few years. These include programs in the Central Valley, the Inland Empire, and Southern California.
- (3) California faces a shortage of well-qualified faculty to train future pharmacists.** An adequate supply of well-trained faculty is essential for meeting pharmacy workforce needs and maintaining high standards in education and practice. Faculty recruitment and retention is one of the top challenges for schools of pharmacy. UC needs to retain current faculty and increase future faculty hires at UCSF and UCSD when expected retirements occur in the coming decade. The recruitment of pharmacy faculty has become increasingly difficult. Salaries offered in the private sector are typically higher, making recruitment more difficult, particularly as state funding for public higher education is reduced. Faculty members moving to another school of pharmacy is also a concern given increased competition from new programs in the country (with possibly higher paying positions and the opportunity to build new programs).

- (4) **The pharmacy workforce shortages in underserved communities disproportionately affect the quality of care delivered to vulnerable populations and rural areas of California.** The shortfall of well-trained pharmacists is acute in rural and some urban areas of the state. The historically high rate of uninsurance/underinsurance in California and the increasing use and cost of pharmaceuticals continue to outpace the state's safety net pharmacy workforce. Establishing early outreach programs and educational links to clinics and practices in underserved areas would expand clinical training opportunities, improve health care delivery locally, and offer opportunities to recruit prospective students from medically underserved communities who may be more likely to return and practice in those communities.
- (5) **Disparities in health status, changing demographics, and the role of pharmacists in health care delivery require increased diversity and cultural competency of the workforce.** As the cultural and ethnic diversity of the population increases, pharmacists must add cultural competence to their skill set in order to effectively deliver high-quality health care. For California's diverse patient populations, professional counseling and communication by pharmacists with both pharmaceutical expertise and cultural and linguistic competency contributes substantially to patient satisfaction and the quality of care provided.
- (6) **There is a substantial mismatch between the number of residency training positions available and student interest.** An increasing number of pharmacy school graduates are interested in pursuing advanced-level training for a variety of reasons, including the desire to gain additional knowledge, experience and specialized training, interest in faculty careers, desire to secure better employment opportunities/enhanced marketability, and the recognition of new and challenging roles for pharmacists which continue to evolve. Although the number of residencies and residency positions continues to grow, the number of graduates seeking a residency position is greatly outpacing the growth of new residency programs. Applications to accredited programs have outnumbered available positions in the past eight years. UC graduates pursue residencies at a higher percentage (50-60%) as compared to the national average of PharmD graduates (14-16%). Currently, UC pharmacy schools and health systems have a modest number of residency positions available (fewer than 100 systemwide). The AACP's vision for the future of the pharmacy profession includes a statement that "formal postgraduate training will become mandatory before one can enter practice." If such a mandate occurs in the profession, then a significant number of new residency training programs will be needed. In 2010, 11,487 PharmD degrees were conferred, and approximately 2,600 PGY1 and 2 positions were available in the United States. With additional new schools of pharmacy planned, and others continuing to "ramp up" to steady state enrollment in the coming years, there will likely be more graduates interested in residency training in the future.

V. RECOMMENDATIONS

In the face of increasing demands created by California's growing and aging population and changing roles across pharmacy practice, the UC Health Sciences Committee offers the following recommendations:

- (1) UC should prepare for health reform by identifying and implementing best practices and by harnessing the intellectual capacity of UC health sciences faculty, researchers and institutional leaders by:**
 - Developing new models of health care delivery that improve quality and utilize health providers in a more cost efficient manner (e.g., multi-disciplinary, patient-centered, team-based care and training);
 - Evaluating innovations in care delivery and reimbursement by pursuing and participating in federally sponsored demonstration projects authorized under the new law; and
 - Sharing and disseminating innovations in health sciences education and clinical care that will transform California's health care system and improve health outcomes through systemwide initiatives such as those offered by the UC Center for Health Quality and Innovation.
- (2) UC should pursue efforts to increase residency training opportunities contingent upon the identification of appropriate resources to support such growth. From the standpoints of both educational demand and workforce need, a meaningful change could occur by:**
 - Increasing the number of first-year residency training and fellowship opportunities by 50% (i.e., approximately 30 total new UC positions). Growth of UC postgraduate training opportunities will increase access to advanced training for UCSF and UCSD graduates and provide a resource for training future faculty and
 - Examining opportunities for development of new joint training programs with UCSF and UCSD, and/or creation of new joint pharmacy programs with other UC health professions campuses.
- (3) UC should expand efforts to increase the diversity and cultural competency of its faculty and students by:**
 - Reviewing and adopting best practices in outreach, recruitment, and education. For example, programs such as the Latino Center for Medical Education and Research in Fresno and the UC Programs in Medical Education (PRIME) initiative offer models that could be adapted and considered for pharmacy education and
 - Promoting efforts to develop skills relevant to multiculturalism, cultural competence, and professionalism.
- (4) UC should support efforts to address current and future needs for faculty by:**
 - Supporting underrepresented pharmacy students in graduate studies and other activities to build the faculty pipeline of pharmacy students to enhance their preparation for future faculty careers (e.g., UC Diversity Pipeline Initiative);
 - Implementing effective recruitment and professional development strategies to recruit and retain outstanding faculty (e.g., National Institutes of Health's T35 research program);
 - Identifying opportunities for collaboration and resource sharing among training programs and public and non-profit institutions (e.g., by expanding satellite training sites and increasing outreach efforts);
 - Developing a "toolkit" for Without Salary (WOS) faculty to more clearly and consistently convey expectations for student training; and

- Identify additional opportunities to recognize and value the contributions of WOS faculty to the education of UC pharmacy students.

(5) UC should continue to support a research-intensive and clinically active faculty base by:

- Encouraging UC faculty to not only carry out teaching responsibilities, but also to pursue scholarly activity, including development of innovative programs that enhance drug discovery and development, improve therapeutic outcomes, and expand the role of the practicing pharmacist as a therapeutic consultant in the health care team and
- Recognizing and supporting faculty contributions to these important programs that frequently serve as an economic stimulus and resource for pharmaceutical sciences and biotechnology in California.

(6) UC should contribute to increasing the number of pharmacists practicing in underserved areas by:

- Recruiting students from underserved communities throughout the state and supporting efforts to improve preclinical and health sciences education in these settings and
- Developing new clinical training programs at sites in medically underserved areas such as California's San Joaquin Valley and Inland Empire.

VI. ACKNOWLEDGEMENTS

The University of California Office of the President's Division of Health Sciences regularly convenes meetings and discussions with the leadership of the UC health professions community, including the deans and faculty of UC's seventeen health professional schools. In view of recent trends in health professions education – including the recent establishment of new schools and enrollment growth in many existing programs – and in light of projected increasing demands for health services as a result of health reform, the UC Division of Health Sciences and Services has taken a closer look at recent changes that are relevant for many of California's health professions programs. A previous UC report entitled "A New Era of Growth: A Closer Look at Recent Trends in Health Professions Education" was issued in May 2013 and is accessible at: <http://health.universityofcalifornia.edu/2013/05/30/health-professions-education-growing-in-new-directions-uc-report-finds>.

This report builds on that work with a focus on trends relevant for California's pharmacy education programs and practice in this state. Preparation of this report would not have been possible without the "enduring commitment and thoughtful guidance" provided by UC Associate Vice President for Health Sciences, Dr. Cathryn Nation. Special appreciation and gratitude are also expressed to Dena Bullard, coordinator for academic programs and special

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VII. APPENDIX A

Aggregate Demand Index – Pharmacy Manpower Project, March 2012

Pharmacist Demand Levels for the Five States with the Highest Demand Levels in the United States, March 2012			
State	Census 2010 Population	Pharmacist Demand on a Scale of 1-5 (See Demand Category Interpretation below)	
		March 2012	March 2007
New Mexico	2,059,179	3.8	4.0
Texas	25,145,561	3.75	4.14
Kansas	2,853,118	3.71	4.25
Missouri	5,988,927	3.67	4.4
California	37,253,956	3.58	4.54

*Source: Pharmacy Manpower Project, 2012

NOTE: The five states with “highest demand” are those evolving from “moderate demand” to “demand in balance with supply.”

Demand categories

- 5 = High demand: difficult to fill open positions
- 4 = Moderate demand: some difficulty filling open positions
- 3 = Demand in balance with supply
- 2 = Demand is less than the pharmacist supply available
- 1 = Demand is much less than the pharmacist supply available

California Schools of Pharmacy		PharmD Degrees Conferred													
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
University of California, San Francisco	San Francisco	106	113	112	118	116	115	115	117	124	116	127	117	118	125
University of Southern California	Los Angeles	183	164	151	163	170	186	178	170	196	187	178	177	174	179
University of the Pacific	Stockton	202	203	201	208	190	211	199	193	191	201	189	201	210	210
Western University	Pomona	1 st Class admitted 1998		99	103	119	91	99	103	103	113	112	115	123	
Loma Linda University	Loma Linda	1 st Class admitted 2002		-	-	-	-	34	39	51	55	58			
University of California, San Diego	La Jolla	1 st Class admitted 2002		-	-	-	-	24	23	32	60	60	60	57	
Touro University	Vallejo	1 st Class admitted Fall 2005		-	-	-	-	-	-	-	61	76	97		
California Northstate University	Rancho Cordova	1 st Class admitted Fall 2008		-	-	-	-	-	-	-	-	-	-	-	
TOTAL GRADUATES/YEAR		491	480	464	489	575	615	611	571	668	669	690	783	811	849
Estimated Percent Increase from 2000-01 graduating classes				26%	25%	17%	37%	41%	60%	65%	74%				
Source: The American Association of Colleges of Pharmacy (AACCP), 2012															

VIII. REFERENCES

- American Association of Colleges of Pharmacy (AACP). ACADEMIC PHARMACY'S VITAL STATISTICS. <http://www.aacp.org/about/pages/vitalstats.aspx> Accessed October 2012.
- American Association of Colleges of Pharmacy (AACP). PHARMACY SCHOOL ADMISSION REQUIREMENTS, 2011-12. TABLE 8. CHARACTERISTICS OF FALL 2009 FIRST-YEAR CLASS FOR PHARM.D. DEGREE PROGRAMS. Accessed July 2012.
- American Association of Colleges of Pharmacy (AACP). TREND DATA. <http://www.aacp.org/resources/research/institutionalresearch/Pages/TrendData.aspx> Accessed June 2012.
- ACCP Position Statement. AMERICAN COLLEGE OF CLINICAL PHARMACY'S VISION OF THE FUTURE: POSTGRADUATE PHARMACY RESIDENCY TRAINING AS A PREREQUISITE FOR DIRECT PATIENT CARE PRACTICE. *Pharmacotherapy* 2006; 26(5) Article 722-733. <http://www.aacp.com/docs/positions/positionStatements/paper013.pdf>
- American Society of Health-System Pharmacists (ASHP). PHARMACY RESIDENCY CAPACITY STAKEHOLDERS CONFERENCE. <http://www.ashp.org/menu/Accreditation/Resources/Residency-Capacity-Conference.aspx> Accessed July 2012.
- American Society of Health-System Pharmacists (ASHP). ONLINE RESIDENCY DIRECTORY. <http://accred.ashp.org/aps/pages/directory/residencyProgramSearch.aspx> Accessed June 2012.
- American Society of Health-System Pharmacists (ASHP). RESIDENT MATCHING PROGRAM. SUMMARY OF PROGRAMS AND POSITIONS OFFERED & FILLED BY PROGRAM TYPE FOR THE 2012 MATCH. <http://www.natmatch.com/ashprmp/stats/2012summpos.html> Accessed May 2012.
- American Pharmacists Association and the American Society of Health-System Pharmacists. CONCERNS ABOUT THE ACCELERATING EXPANSION OF PHARMACY EDUCATION: TIME FOR RECONSIDERATION. November 23, 2010. <http://www.ashp.org/DocLibrary/News/Accelerating-Expansion-of-Pharmacy-Education.aspx>
- American Federation of Labor and Congress of Industrial Organizations. PHARMACISTS AND PHARMACY TECHNICIANS: FACTS AND FIGURES. Department for Professional Employees, AFL-CIO. Fact Sheet 2011.
- Bipartisan Policy Center Health Project. THE COMPLEXITIES OF NATIONAL HEALTH CARE WORKFORCE PLANNING. October 18, 2011. <http://www.bipartisanpolicy.org/projects/health-professional-workforce/about>. Accessed August 2012.
- Bucci KK, Knapp KK, Ohri LK, Brooks PJ. FACTORS MOTIVATING PHARMACY STUDENTS TO PURSUE RESIDENCY AND FELLOWSHIP TRAINING. *American Journal of Health System Pharmacists* 1995; 52(23) Article 2696-701.
- California Department of Consumer Affairs. DCA ANNUAL REPORT: CALIFORNIA STATE BOARD OF PHARMACY 2009 & 2011. <http://www.pharmacy.ca.gov>. Accessed September 2012.
- California Healthcare Foundation. CALIFORNIA HEALTH CARE ALMANAC QUICK REFERENCE GUIDE: CALIFORNIA'S PHARMACISTS AND PHARMACY TECHNICIANS, 2011. <http://www.chcf.org/publications/2011/02/californias-health-care-workforce>. Accessed August 2012.
- Center for the Health Professions, University of California, San Francisco. CALIFORNIA'S HEALTH CARE WORKFORCE: READINESS FOR THE ACA ERA. December 2011.

Center for the Health Professions, University of California, San Francisco. PHARMACY TECHNICIANS IN CALIFORNIA: SNAPSHOT OF AN EMERGING PROFESSION. March 2003.

Farmer B. AN OVERDOSE OF PHARMACY STUDENTS. American Public Media, Marketplace Life.
<http://www.marketplace.org/topics/life/overdose-pharmacy-students>
May 21, 2012.

Health Resources and Services Administration (HRSA). THE ADEQUACY OF THE PHARMACIST SUPPLY: 2004 TO 2030. Bureau of Health Professions, HRSA, Department of Health and Human Services. December 2008.

Hines L. CAL BAPTIST PLANS INLAND AREA'S THIRD PHARMACY SCHOOL. The Press-Enterprise. May 21, 2011.
<http://www.pe.com/local-news/topics/topics-health-care-headlines/20110522-cal-baptist-plans-inland-areas-third-pharmacy-school.ece> Accessed May 2012.

IMS Institute for Healthcare Informatics. THE USE OF MEDICINES IN THE UNITED STATES: REVIEW OF 2011. April 2012.
<http://www.theimsinstitute.com> Accessed June 2012.

Knapp K, Shah B, Barnett M. THE PHARMACIST AGGREGATE DEMAND INDEX TO EXPLAIN CHANGING PHARMACIST DEMAND OVER A TEN-YEAR PERIOD. *American Journal of Pharmaceutical Education* 2010; 74(10) Article 189.

McAnally D. PHARMACY JOB TRENDS: ADAPTING TO TODAY'S MARKET. *Pharmacy Times*. June 2010.

Personal communication. David Adler, University of California, San Diego (UCSD), Skaggs School of Pharmacy and Pharmaceutical Sciences. October 10, 2012.

Personal communication. Joseph Guglielmo, University of California, San Francisco, School of Pharmacy. July 12, 2012 and October 1, 2012.

Personal communication. Danielle Taylor, AACP. June 28, 2012.

Personal communication. Palmer Taylor, UCSD, Skaggs School of Pharmacy and Pharmaceutical Sciences. July 23, 2012.

Pharmacy Manpower Project. AGGREGATE DEMAND INDEX.
<http://pharmacymanpower.com>. Accessed May 2012.

Pharmacy Workforce Center. 2009 NATIONAL PHARMACIST WORKFORCE SURVEY. March 1, 2010.
<http://www.aacp.org/resources/research/pharmacymanpower/Documents/2009%20National%20Pharmacist%20Workforce%20Survey%20-%20FINAL%20REPORT.pdf> Accessed August 2012.

Teeters, Janet. Director of Accreditation Services, ASHP. THE CURRENT LANDSCAPE OF PHARMACY RESIDENCY TRAINING.
<http://www.ashp.org/DocLibrary/Accreditation/PRC2011/Current-Landscape.aspx> Accessed July 2012.

University of California, Corporate Student System. Enrollment Reports. Fall 2011.

University of California Health Sciences Committee. PHARMACY EDUCATION AND THE UNIVERSITY OF CALIFORNIA – FINAL REPORT. University of California, Office of the President. April 2004.

University of California, San Diego. SSPPS Strategic Plan, Pharmacy Education, Pharmaceutical Sciences Research, Clinical Pharmacy Practice. April 30, 2012.

University of California San Francisco, Leadership Profile. Dean, School of Pharmacy. April 2012. Witt/Kieffer.
<http://www.wittkieffer.com/file/UCSF%20Pharmacy%20Leadership%20Profile.pdf>

University of California, STATISTICAL SUMMARY OF STUDENTS AND STAFF, FALL 2011. TABLE 5: HEALTH SCIENCES ENROLLMENT BY CAMPUS, DISCIPLINE, AND LEVEL. <http://www.ucop.edu/ucophome/uwnews/stat/statsum/fall2011/statsumm2011.pdf> Accessed July 2012.

University of Maryland, School of Pharmacy handout. WHERE DID ALL THESE NEW PHARMACY SCHOOLS COME FROM? (AN INCREASE OF 58% IN 15 YEARS!) David Knapp. 2010.

U.S. Department of Labor, Bureau of Labor Statistics. Occupational Employment and Wages: Pharmacists, 2011. <http://www.bls.gov/oes/current/oes291051.htm#nat> Accessed October 2012.

U.S. Public Health Service. IMPROVING PATIENT AND HEALTH SYSTEM OUTCOMES THROUGH ADVANCED PHARMACY PRACTICE – A REPORT OF THE U.S. SURGEON GENERAL 2011. Office of the Chief Pharmacist.

Yusuf, Akeem A., Schommer, Jon C., Mott, David A., Doucette, William R., Gaither, Caroline A., and Kreling David H. ASSOCIATION BETWEEN STUDENT LOAN DEBT ON GRADUATION, DEMOGRAPHIC CHARACTERISTICS AND INITIAL CHOICE OF PRACTICE SETTING OF PHARMACISTS. *Innovations in Pharmacy* 2011; 2(3) Article 51. http://www.pharmacy.umn.edu/innovations/prod/groups/cop/@pub/@cop/@innov/documents/article/cop_article_355738.pdf



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