Respiratory Care and Imaging Technology in California: Education's Response to Workforce Shortages

Vincent Lok and Catherine Dower

UCSF Center for the Health Professions

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3333 California Street, Suite 410
San Francisco, CA 94118
(415) 476-8181
http://futurehealth.ucsf.edu

UCSF Center for the Health Professions

The mission of the Center for the Health Professions is to assist health care professionals, health professions schools, care delivery organizations and public policy makers respond to the challenges of educating and managing a health workforce capable of improving the health and well being of people and their communities.

The Center is committed to the idea that the nation's health will be improved if the public is better informed about the work of health professionals.

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HIGHLIGHTS OF FINDINGS

One of the many challenges facing America's health care system has been securing sufficient numbers of practitioners to fill jobs and meet patient needs. Allied health professions particularly hard hit in recent years include respiratory care and imaging or radiologic technology. To better understand California's experience, in early 2008, staff at the UCSF Center for the Health Professions interviewed more than 30 educational leaders identified as either directors of educational programs or clinical staff at affiliated service sites in respiratory care and radiologic technology.

A list of key findings includes:

- Most educational programs in the study were at enrollment capacity.
- Several programs were new or reported expanding recently.
- Very few programs plan to expand in the near future.
- The majority of respiratory care program directors perceive ongoing workforce shortages in their geographic area and/or nationally.
- The majority of radiologic technology program directors reported that workforce shortages have ended or eased significantly in their areas.
- Should educational directors want to expand their programs, the following limitations to doing so were cited:
    - Available clinical training positions
    - Faculty
    - Space and facility resources
    - Funding
- In addition to workforce supply and demand, study participants pointed to other pressing professional issues such as the need to update curricula, better prepare students for employment as clinicians and educators, and continue to bring regulations and accreditation standards up to date.

This study provides a snapshot of perspectives among California imaging technology and respiratory care program directors regarding their understanding of and responses to labor market supply and demand. It highlights both the capacity and challenges to adapt program size and content to changing employer and patient needs.

Some new programs opened and some established programs expanded to mitigate or even resolve past shortages. The study points out differences between the two professions; imaging technology generally found it easier to adapt quickly to increased demand while respiratory care was often limited by available clinical spaces in efforts to increase class size. Also apparent from the interviews were differences in labor market perceptions based on geographic location, differences in approaches between public and private programs, and differences in approaches to education and workforce challenges based on individual leadership styles.

INTRODUCTION

Recent years have witnessed many health care professions facing shortages; insufficient numbers of graduates are entering the labor market to fill all open employment positions. After nursing, two of the hardest hit groups have been respiratory care and imaging technologists, a term we use to include several non-physician workforce groups in radiology. In 2008, staff at the Center for the Health Professions completed a qualitative study to better understand perspectives and responses of educational program directors in these two professions to workforce shortages.

This report begins with background descriptions of respiratory care and imaging technology including summary reviews to date of workforce supply and demand issues in these professions. The following and largest section of the report provides aggregate findings from the Center's interviews with educational program and clinical directors in these professions. The final section offers a discussion of the findings and implications for leaders in these professions and policy makers.

A Note on Health Workforce Supply and Demand

The supply of health care practitioners can be affected by numerous elements, including number of available programs and class size; student interest, enrollment and graduation; student preparation and educational curriculum; regulations regarding entry into the profession; and rates of retirement or individuals exiting the profession.

Demand is affected by population demographics (including total numbers and trends in aging, illness acuity levels, and shifting disease and condition burdens); practice standards; technological developments; clinical guidelines; professional evolution; reimbursement and insurance policies; and care delivery setting administration choices.

An imbalance between supply and demand can lead to a number of unwanted outcomes. If demand for care is much higher than workforce supply, patients face reduced or limited access to care; job vacancies soar; employers and administrators may rely on temporary, per diem or "traveling" practitioners within the profession or on individuals from other professions; and technological substitutes are increasingly sought. If supply exceeds demand, trained health care workers may find themselves un- or under-employed or transitioning to new careers.

BACKGROUND

Respiratory Care / Respiratory Therapy

Respiratory therapists (also known as respiratory care practitioners) work in hospitals, home care, health centers, emergency units, and other service sites. They "assess, treat, and care for patients with breathing disorders." In addition, they are responsible for all respiratory care modalities and supervising respiratory therapy technicians.[1]

Several studies have been conducted recently on the respiratory care workforce. The American Association of Respiratory Care (AARC) reported that between 2000 and 2005, the total number of working therapists in the U.S. climbed 19%, but the hospital vacancy rate grew from about 6% to almost 9%.[2] The mean age of respiratory therapists increased from 40 to 45 during the same period and the report's authors predicted that, in the next 10 years, respiratory care educational programs would lose almost half of their program directors and a third of their clinical directors.[3] At the same time, demand appears to be rising due to population growth, an aging population, and the availability of new technology. A 2006 study and analysis found that most hospitals "indicated that they would like to add 1-2 more staff members for ICU coverage" but also underscored the cyclical nature of health workforce shortages due to a "'dyssynchrony' between the health systems demand cycle and the educational system's supply cycle."[4]

Background research for this project indicated that California's situation might be an exaggerated version of the nation's. Although the total number of respiratory therapists increased between 2001 and 2007 (see Table 1), California's ratio of employed respiratory therapists to general population continued to trail the U.S. (see Table 2). This is despite that fact that salaries are good (California's mean hourly wage was almost $30 in 2007[5]) and salaries in California have historically been higher than the national average.[6] A comprehensive 2007 report[7] for the Respiratory Care Board of California compiled data from surveys targeting respiratory care practitioners, employers, and educators in California about the current workforce. One finding was that roughly 50% of educators expected their programs' enrollment to increase by an average of 24%.[8] In addition to the shortage of practitioners available, employers and educators were concerned about the education and qualifications of respiratory care practitioners, with roughly 38% and 35%, respectively, indicating that graduates entering the workforce were, in some ways, unprepared for their duties.[9]

Imaging Technology / Allied Radiology

Imaging technologists include several related professions. Radiologic technologists (also known as x-ray technologists and radiographers) can be found in hospitals (in radiology, oncology, angiography, mammography, and other units) and imaging centers. Radiologic technologists in California "take X-rays and CAT scans or administer nonradioactive materials into [a] patient's blood stream for diagnostic purposes." Technologists may also specialize in modalities such as computed tomography (CT) and magnetic resonance (MRI).[10]

Allied radiology also includes radiation therapists and nuclear medicine technologists. Both fields are smaller than the radiologic technologist workforce. In addition to supportive care services, radiation therapists "provide radiation therapy to patients as

prescribed by a radiologist according to established practices and standards."[11] Nuclear medicine technologists "prepare, administer, and measure radioactive isotopes in therapeutic, diagnostic, and tracer studies utilizing a variety of radioisotope equipment."[12]

The American Society of Radiologic Technology (ASRT) has produced reports for the last several years assessing national enrollment, graduation, and job opportunity in the fields of radiography, radiation therapy, and nuclear medicine. In their latest report (2007),[13] national data indicated that, after several years of increases, particularly in radiography, enrollment numbers were leveling off (see Appendix A for detail). National projections for the number of radiography graduates were expected to be slightly lower than Bureau of Labor Statistics (BLS) projected growth in this field.[14] Numbers of radiation therapists and nuclear medicine technologists however, are expected to exceed BLS projections.[15]

In California, employment figures for radiologic technologists are expected to increase in the future but have fluctuated in recent years (see Table 1). Notably, employment has gone down in some years. These downward turns in employment, combined with increases in the general population during the same period have resulted in decreased ratios of employed practitioners to general population in some years relative to earlier years. Like respiratory care, despite good salaries (mean hourly wage for radiologic technologists in California in 2007 was $28.41)[16], the state's ratio of employed radiologic technologists trails national averages (see Table 2).

Table 1: Respiratory Therapists and Radiologic Technologists Employment, California, 2001, 2004, 2007, 2014.

	Employment 2001	Employment 2004	Employment 2007	Projected Employment 2014
Respiratory Therapist	9,000	10,700	11,510	13,100
Radiologic Technologist[a]	15,270	14,800	15,270	17,800

Sources: US Department of Labor: Bureau of Labor Statistics - Occupational Employment Statistics - California (2001 & 2007); California Employment Development Department: Employment Projections, 2004–2014.

Table 2: Employed Respiratory Therapists and Radiologic Technologists per 100,000 Population, California and US, 2001 and 2007

	California		United States	
	2001	2007	2001	2007
Respiratory Therapist	26.1	31.6	29.1	33.8
Radiologic Technologist[a]	44.3	41.9	55.8	66.9

Sources: UCSF Center for the Health Professions[17, 18]; US Department of Labor: Bureau of Labor Statistics - Occupational Employment Statistics – California & U.S. (2001 & 2007); U.S. Census Bureau (2006)[19].

[a] The BLS Occupational Employment Statistics report radiologic technologists and technicians together.

CALIFORNIA EDUCATIONAL STRUCTURE AND PIPELINE

As of 2008, California has 31 recognized respiratory care educational programs[20] (up from 23 in 2003).[21] Collectively, the programs graduated just fewer than 900 respiratory therapists in 2006 (the latest year for which data were available).[22] The vast majority of programs offer associate degrees, which is required for licensure as a respiratory therapist in California. At least one program offers a bachelor's degree in respiratory care. Most of the programs leading to an associate degree are two years in length although some 18-month programs are available.

The state has about 34 approved radiography programs in 2008[23] (up from 32 in 2003).[24] Like respiratory care, the radiography programs also produced close to 900 graduates in 2006.[25] California "certifies" (but does not license) radiologic technologists based on completion of an approved or accredited program and successful passing of the examination administered by the American Registry of Radiologic Technologists (ARRT). Many of the approved radiologic programs offer associate degrees but approved programs need not be degree-granting. Most of the programs run for approximately two years. In addition, the ARRT recognizes six radiation therapy and six nuclear medicine technologist programs.[26]

Respiratory care and radiography programs include clinical as well as didactic components. Program directors are responsible for creating and maintaining a network of locally affiliated service sites. Suitable training environments for students include imaging centers and various units within hospitals.

Educational programs seeking state approval or national accreditation must meet standards established by respective accrediting bodies. Some standards have significant effects on a program's ability to expand or contract enrollment size. See sidebar for some examples regarding radiologic technology accreditation.

Joint Review Committee on Education in Radiologic Technology Standards

Standards required for radiologic technology schools to maintain accreditation by the Joint Review Committee on Education in Radiologic Technology (JRCERT) include[27]:

- During training at clinical sites, the student to clinical staff ratio must not exceed 1:1.
- There must be at least one full-time equivalent clinical instructor per ten students in the program.
- There must be at least one clinical instructor at each clinical site.
- Both job placement (within six months) and examination pass rate (on the ARRT exam) must be 75% or higher.

EDUCATIONAL AND WORKFORCE STUDY FINDINGS

Building on the existing research, the Center for the Health Professions undertook this qualitative analysis to investigate the experiences of California's respiratory care and imaging technology educational leaders regarding workforce supply, demand and related issues.

Do Workforce Shortages Still Exist?

Program directors were asked a series of questions regarding their current enrollment, local job market, and any recent or future plans to expand or contract program size.

Applications and Enrollment

Of the 15 respiratory care program directors interviewed, 12 indicated that they were at program capacity. Eight of the twelve also perceived ongoing workforce shortages in the field. However, only two program directors reported plans to expand their class size in the future. This finding appears to be in contrast with Cowles' 2007 finding that ten programs expected the number of students in their program to increase during the next five years.[28] Assuming no data collection or management error in either study, the reasons for this discrepancy may include the higher response rate in the Cowles study (69%) compared to the UCSF study (50%); the phrasing of the questions posed; and the slightly different time period. In a quickly changing job market and educational environment, a single semester might change a person's perspective.

Table 3: Characteristics of Selected Aspects of Cowles et al. study (2007) and UCSF Center for the Health Professions study (2008)

	Time Period of Research	Response Rate of Respiratory Care Programs	Question Posed About Enrollment/Expansion
Cowles et al. 2007	Spring 2007[29]	20/29 programs (69%)	Overall, in the next five years, do you expect the number of students in your program to increase, decrease, or remain the same?[30]
UCSF Center for the Health Professions	Spring 2008	15/30 programs (50%)	If you are at program capacity, do you plan on expanding?

Participants in the UCSF study offered multiple reasons on why programs were not expanding. Some programs were quite new and still getting established. A few had recently expanded and were waiting to see whether their increased numbers of students would all be able to secure jobs upon graduation. A handful saw insufficient need for or interest in additional class spots, in part due to a number of new programs or expansion of existing programs nearby in recent years. As discussed in more detail below, of those

who would expand if they could, program directors usually cited clinical position opportunities for their students as the primary limiting factor.

Of the 12 radiologic technology program directors interviewed, 10 reported being at enrollment capacity. However, in contrast to respiratory care, the majority of radiologic technology program directors interviewed did not think their field was currently facing workforce shortages. Only one radiologic technology program planned to expand capacity in the near future. Although the workforce environment for radiologic technologists differed from that for respiratory therapists, radiologic technology program directors also cited limited clinical training positions available for students as the primary reason for not expanding should a need for more workers be identified in the future.

Directors from respiratory care and radiologic technology programs were careful to underscore their perception that workforce supply and demand is of a cyclical and evolving nature. For example, many program directors suggested that the extreme shortages of a few years ago have subsided and that graduates are meeting current workforce needs but that another shortage may be imminent due to anticipated retirements.

The two professions face different issues and challenges. California requires respiratory therapy licensure applicants to have successfully passed the Certified Respiratory Therapist (CRT) examination offered by the National Board for Respiratory Care but many programs now prepare their students to be able to take the Registered Respiratory Therapy (RRT) examination, a higher level of certification. Some respiratory care program directors focused on a need for more Registered Respiratory Therapists or requiring two-year or baccalaureate degrees for entry into the profession.[31] For imaging technology, the challenge is specialization. Several radiography program directors noted that there are now enough basic radiologic technologists but that imaging professionals in advanced practice modalities such as positron emission tomography (PET), magnetic resonance imaging (MRI), computed tomography (CT) and even mammography are in short supply. This perspective was also shared by a clinical site director.

Program directors in both respiratory care and allied radiology noted increases in applicants to their respective schools over the last few years and, as noted above, many are at capacity. Programs at capacity reported 10-100+ more qualified applicants per year than they could accept.

The selection process differs between public and privately run educational institutions. Program directors in community colleges reported compliance with the state's Master Plan for Higher Education[32] and do not use selective admissions processes; they typically accept students as they finish their pre-requisites. Lottery systems are often used to choose from qualified applicants and waitlists may be utilized for filled or "impacted" programs, thus permitting all qualified applicants to – eventually – begin their professional training. A few program directors reported that they have locked up class registration for the next few terms and some would-be students are waiting a year or more to actually start.

Private educational institutions not bound by an all-qualified admissions policy can employ a selective process to screen potential students for admission. Examples shared with us include the use of a point system, interviews, and supplemental courses or

volunteer requirements to applications. Even private institutions using selective admissions criteria reported using waitlists for these popular programs.

Program directors at community colleges reported enrollment classes of about 20-25 students and, despite some attrition, typically graduate most students that enroll. Privately funded and run schools that were interviewed reported larger enrollments per class and some programs start multiple classes during a single calendar year.

Concern was expressed by some community college program directors that, while recently-opened private sector educational programs may be graduating individuals who can help alleviate earlier shortages in these professions, such proprietary schools have significantly increased competition for space at clinical sites for students, which established programs may see as a negative development. In addition, these schools may, according to publicly-financed program directors, seek to enroll as many students as possible without regard for the potential to flood the market with graduates. We are unaware of any data to support or counter such assertions.

Several program directors reported efforts to adjust their admissions and enrollment numbers to match the needs of the local job market, based on informal surveys. These directors believed that it was important not to over-saturate the market and to maximize their graduates' chances of employment.

Employment Market

While class enrollment and the number of graduates have increased over the past several years, the majority of program directors reported that 100 percent of their graduates were able to secure employment. Not all jobs however, were graduates' first choices and many employed practitioners are working more than one job.

Program directors also noted that workforce supply and demand varied by geographic region (northern or southern California; rural or urban setting; number of competing schools in the area). A new or expanded program in the region could have a significant impact on the supply of practitioners. Several directors noted differences between public and private educational institutions as being critical factors in whether and how programs could respond to labor market demands.

Mapping Programs and Professionals

To explore and illustrate geographic distribution, we mapped educational programs (with detail on type of school and number of graduates) and ratio of licensed or certified professionals per 100,000 population by county throughout California. Figure 1 is a map of respiratory care programs in California and Figure 2 is a map of radiologic technology programs in California. Appendix B displays similar maps for radiation therapy and nuclear medicine technology programs in California.[b]

The California Department of Consumer Affairs reported 14,694 active, licensed respiratory care practitioners in 2008, equating to a statewide ratio of 40.3 practitioners

[b] Calculations and ratios in Figures 1 and 2 and in Appendix B are estimates. Due to availability, the data are from different years; see source notes and references for details.

per 100,000 general population. With 15,628 certified radiographers residing in-state[c], California has an overall ratio of 42.9 radiographers to 100,000 population.[d]

As would be expected in a state as large as California, however, the ratio of practitioners to population varies significantly by county and by region. Some counties have fewer than 15 or 20 radiologic technologists or respiratory care practitioners respectively per 100,000 population and some counties have more than 50.

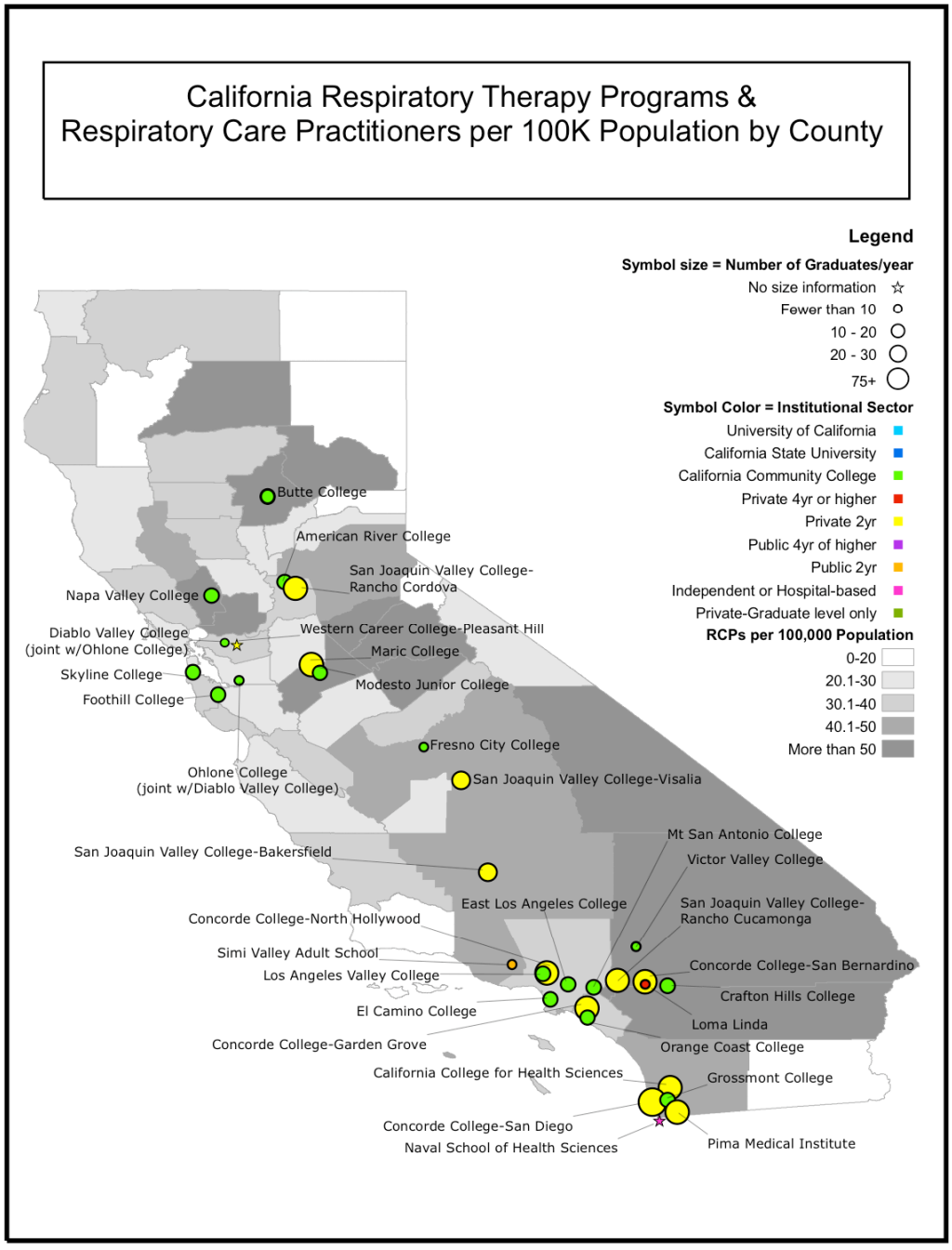
As can be seen in Figures 1 and 2, the majority of educational institutions offering respiratory care and radiologic technology programs are located in the Bay Area, Los Angeles and San Diego. These regions generally have robust ratios of practitioners to population. However, the highest ratios are not always in regions where schools are plentiful. For example, even in Los Angeles County (which has numerous programs outputting many graduates into the field), the ratio falls in the middle because of the county's enormous population (over ten million). Another example of an anomaly is Butte County; even though the county has only one respiratory care school, its graduates are sufficient to land Butte in the highest ratio category because of the small county population (around 220,000).

One notable difference between the two professions can be found in type of institution. Although a slight majority of respiratory care programs are located in community colleges, California is home to at least twelve private respiratory care programs. In contrast, the vast majority of radiologic technology programs are in community colleges; there are very few private programs in this field.

[c] The number of certified radiographers with addresses in California and out-of-state was 18,545 in 2008.

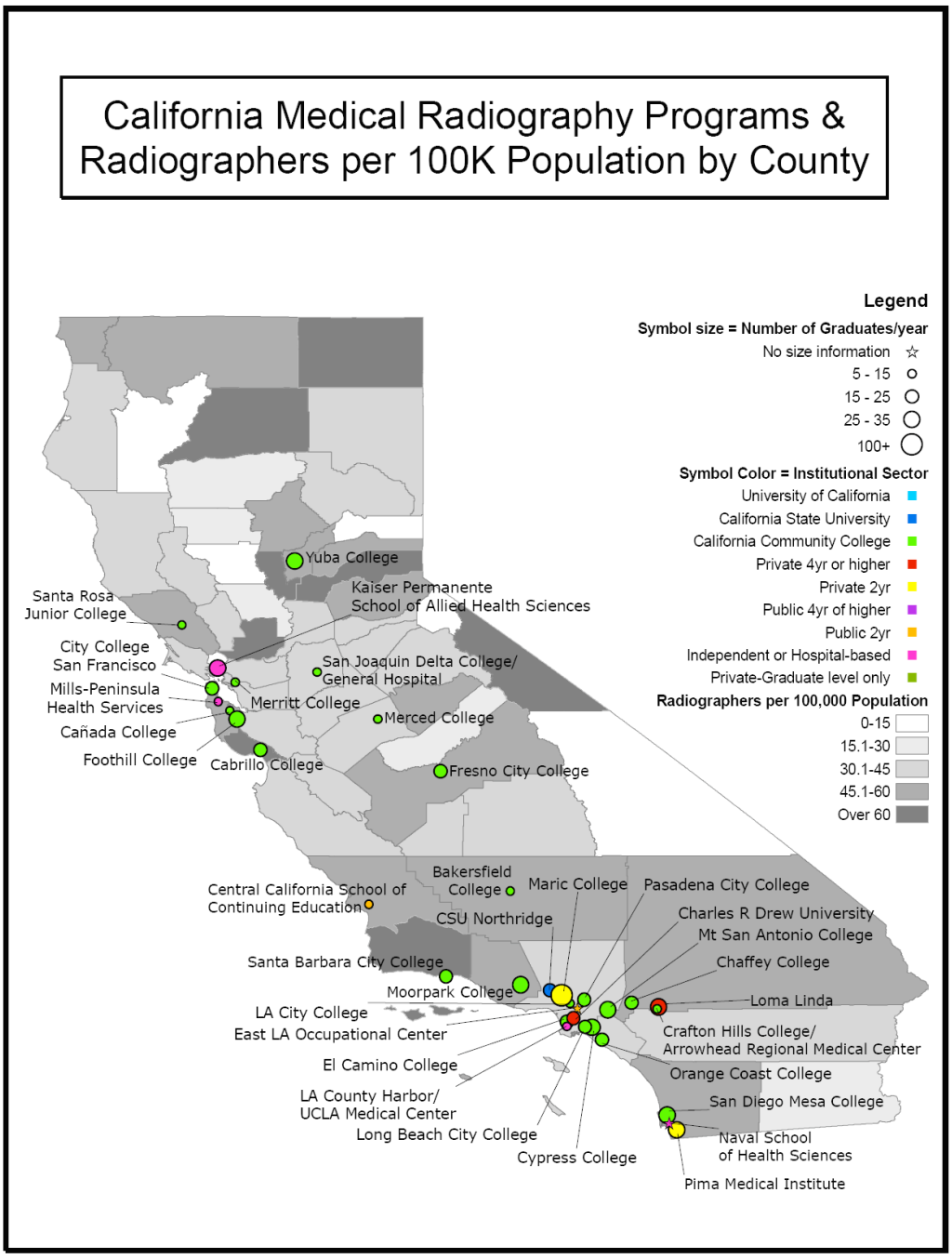
[d] The ratio of licensed respiratory care practitioners to 100,000 population (40.3) is higher than the ratio of employed respiratory therapists to 100,000 population (31.6; see Table 2). Similarly, the ratio of certified radiographers to 100,000 population (42.9) is higher than the ratio of employed radiographers to 100,000 population (41.9; see Table 2). These gaps illustrate real differences between being licensed or certified and being employed in a particular field; individuals recognized by the state through licensure or certification may be employed in other fields or retired from the employment market. The differences may also be due to primary data collection and management systems; for example, it is possible that not all licensed and practicing respiratory therapists are being captured in employment figures.

Figure 1: California Respiratory Therapy Programs and Respiratory Therapists per 100,000 Population



Sources: Bates T & Chapman S. *Tracking the Supply of Health Professions Education Programs in California*. UCSF Center for the Health Professions, 2007 citing data from the U.S. Department of Education, National Center for Education Statistics, Integrated Post-Secondary Education Data System (IPEDS): *Awards & Degrees Conferred* (2005); California Department of Consumer Affairs, 2008; California State Association of Counties, 2006.

Figure 2: California Radiography Programs and Radiographers per 100,000 Population



Sources: Bates T & Chapman S. *Tracking the Supply of Health Professions Education Programs in California*. UCSF Center for the Health Professions, 2007 citing data from the U.S. Department of Education, National Center for Education Statistics, Integrated Post-Secondary Education Data System (IPEDS): *Awards & Degrees Conferred* (2005); California Radiologic Health Branch, 2008; California State Association of Counties, 2006.

What is the Demographic Profile of the Student Body?

In terms of racial and ethnic representation, according to data from the Integrated Postsecondary Education Data System (IPEDS), recent graduates of California respiratory care and allied radiology programs are more diverse than earlier classes and respective workforces in these fields nationally. For the most part, however, they do not reflect the state's general population. Higher percentages of Asian/Pacific Islanders and African Americans graduated from respiratory care programs in 2006 than would be found in the general population while Whites and Hispanic/Latinos were underrepresented. Similarly, 2006 graduates of radiography programs were overrepresented by Asian/Pacific Islanders and African Americans and underrepresented by Whites and Hispanic/Latinos compared to the general population. See Appendix C for details.

During this project's qualitative interviews, program directors were asked demographic questions about their students. About a third of program directors provided data about both the gender and race and ethnicity of their students. The remaining program directors gave rough descriptions of their class demographics. Most program directors thought their programs were becoming more racially and ethnically diverse over time, which is consistent with published IPEDS data. The majority of program directors were of the opinion that their class demographics represented their larger schools or colleges and local communities. They noted that the gender is well balanced in respiratory care, but that radiology was slightly overrepresented with males. Program directors also suggested that entering students are older than in the past, and some are in the midst of career changes. Due to the limited amount of data we received on this topic and the inconsistency of how data were collected and reported, we were unable to analyze it for findings or trends.

Word of Mouth

A few program directors reported that within some minority communities (e.g. Hmong), word of mouth acts as a very strong tool for program exposure and recruitment. Program applicants are often family members and friends of a graduate who has already completed the program and successfully secured a job in the field. This perspective is consistent with earlier research that found the most effective method to recruit students was by direct recruitment mailing, followed by referral from friend or family member. [33]

Reasons for Not Expanding

As noted above, most programs are declining to expand at this time, due in large part to perceived alleviation in the workforce shortages of a few years ago. During the interviews, however, program directors were asked about the feasibility of expanding should they wish to or should the environment shift again. Among program directors who would expand class size if they could, the lack of available clinical spots for students was most frequently voiced as the limiting factor. Other challenges included faculty to teach additional students; physical space to accommodate more students; limited funds; and equipment on which to train students.

Number of Available Clinical Spots at Service Provider Sites

Program directors frequently responded that not having enough clinical spots for the training practicum portion at service sites was a key limiting factor in program expansion. Urban programs in particular often found it difficult to compete with nearby programs for the finite number of local clinical positions. Rural programs were somewhat less likely to see this as the primary limiting factor, but were much more likely to have numerous affiliations with clinical sites, including several that were 50 or more miles away from the school. One of the key limitations at clinical sites is finding sufficient numbers of clinical staff willing and able to supervise students as required by law or accreditation standards.[34]

Program directors had differing views on whether they could share sites with other programs. Some thought such arrangements would violate accreditation requirements; others thought such arrangements were fine if the program that set up the first affiliation with a particular site agreed to share the site with a second program; and still others thought such arrangements were fine and common.

Staffing Educational Programs with Sufficient Faculty

Many program directors felt their faculty and staff numbers were just barely sufficient to teach the number of currently enrolled students; they could not envision increasing student enrollment without hiring more teachers. However, even without expansion, they anticipated significant challenges in coming years as teachers retire because of the limited pool of qualified individuals willing to step into faculty positions. This is reportedly due to salary gaps between practicing clinicians and educators, to gaps between what is required to practice and what is required to teach, and to a failure on the part of the professions to adequately develop a faculty career track.

Study participant responses were consistent with published literature. In an article regarding shortages of allied radiology educators in the U.S., Giordano lists contributing factors starting with “the compensation difference between the clinical environment and academia.”[35] By the time a practitioner has gained enough experience to qualify as an instructor or program director, he or she would have to take a reduction in pay to make the career shift. Another hurdle is academic preparation. Only 2.4% of radiologic technologists in the U.S. have masters degrees, in part because “the majority of R.T.s receive their education through associate degree programs,” and therefore are not qualified for graduate studies’ admission. Furthermore, many instructors and program directors have clinical experience but success and experience from clinical work does not necessarily translate well to teaching students, budgeting and other academic responsibilities.[36,37]

Adequate Facility and Classroom Resources

Educational programs also take into consideration available space and resources at their institutions when deciding the class size they can accommodate for the upcoming school year. Program directors from both professions reported classroom space and equipment on which to train students as limiting any potential plans to expand. Program directors from rural regions were more likely than their urban colleagues to indicate that space to teach additional students was more problematic than the number of clinical spots

available. Program directors in institutions that house numerous professional training programs reported much competition with other health programs for laboratory space and equipment.

Funding for Educational Programs

Not surprisingly, program directors in both professions reported funding to be a limiting factor in considering class size expansion. Representatives from community colleges in particular, which largely rely on State money to operate, noted challenges in securing additional funds that would be necessary to cover the costs of larger programs. Indeed, they felt vulnerable to shortages and cuts in the State budget, Board of Education decisions, and their own college administrators' financial choices. Colleges and schools that also house other health professions programs, such as nursing, have reportedly directed any "extra" funds to those programs to address well-publicized workforce shortages.

Private schools were less likely to cite funding as a limitation as increased costs for additional students could be covered for the most part by student tuition.

Respiratory care and radiography programs are expensive to operate. Directors of both types of programs noted the high prices of machinery and technology required to train students. They also commented on the ongoing need for new laboratory equipment; current textbooks and teaching materials; and competitive salaries for faculty.

Is the curriculum current enough to prepare students for clinical work?

In addition to workforce supply and demand, study participants pointed to other pressing professional issues such as the need to update curricula, better prepare students for employment as clinicians and educators, and modernize regulations and accreditation standards. These issues raised by program directors were echoed by clinical site staff, who noted that educators may have too many organizations and state regulations to appease and that the primary objective of preparing students for clinical cases can be lost. Program directors in both the fields studied expressed concern about their respective professions.

An example of outdated curriculum content can be found in film technology taught to radiologic technicians. Digital services are being more commonly used in clinical settings, yet students are still taught and tested for radiography with film. Key informants also suggested that instructors may not be knowledgeable in current clinical procedures if a significant period of time has elapsed since they entered academia.

IMPACTS AND IMPLICATIONS

The study findings and issues brought up by interview subjects have impacts on students, educators, employers, policy makers, and leaders within the professions.

Students

According to study participants, applicant and student enrollment numbers are higher than they were five-to-seven years ago. These impressions are consistent with published literature. Would-be students appear to have responded to much-publicized shortages in health care and contractions in other industries. Several respondents noted significant increases in numbers of applicants to their programs as the "dot-com" industry in California collapsed. During this same time, state and national attention to workforce shortages, particularly in nursing, but also in allied health professions, drew career-seekers to these professions. As noted above, students embarking in these fields are older and more likely to be transitioning to a second or third career.

With nursing and now other allied health programs filling at community colleges and becoming increasingly competitive, program directors reported students applying to multiple health care programs at the same time to maximize their chances of getting into at least one. Some program directors thought students might be applying to a respiratory care or radiology program as a second choice to nursing or with the intention of transferring to a nursing program at the earliest opportunity. Confirming this hypothesis, some students have reportedly left in the middle of a respiratory care program to enroll in a nursing program upon acceptance.

Students have thus responded to the labor market appropriately and have made the best out of the college system. Further research on attrition from educational programs and mid-career separations from these professions might be informative for long-term planning. However, at this point, potential students in these professions might be served with good information and counseling about these fields to best ensure individuals are starting careers they truly want to pursue.

Educators: Program Directors and Faculty

Significant increases in applications have changed the scene for program directors and faculty at respiratory care and allied radiology programs. While several years ago, they were trying to find students to fill program seats and meet employers' needs, now they must deal with managing impacted programs and quickly changing technology.

It has been particularly difficult for program faculty to keep up with constantly evolving technology. Some educators reported finding themselves unprepared or lacking teaching material and resources. According to study participants, for example, the switch from film to digital methodologies in radiography has left teachers with few if any textbooks from which to teach. Much of the current curriculum is pulled from conference materials. Study findings are consistent with a national study on this issue, which found that "only about one-third of radiography program directors and three-fifths of radiation and nuclear medicine program directors felt their programs had 'adequate resource materials' to teach digital imaging." [38]

Today's program directors face a new set of questions:

- How should the program balance increased numbers of applicants with market needs, which in some fields and some locations appear to be reaching equilibrium?
- How do we comply with the state's Master Plan guidelines to accept all qualified applicants when our programs are filled to capacity? How do we define "qualified" and can we adjust pre-requisites? How can we use lottery systems and wait-lists fairly and effectively?
- How can we best ensure that students are applying to and enrolling in programs they want, are prepared for and are most likely to complete? How can we work with high school and college counselors to advise students appropriately about these fields?
- How should we adapt curricula to meet changing technological and professional developments?
- As a large cohort of program directors and faculty retire, how can we identify and prepare the potential professional educators, administrators and leaders of the future? Can we play any role in addressing the salary gap between educators and practitioners in our fields?

Employers

All educational programs for respiratory therapists and radiology technologists have clinical training components that are conducted at delivery sites. As such, hospitals and other future employers are actively engaged in the education and training of tomorrow's workers. All interviewed program directors reported good working relationships with their affiliated clinical sites.

As educational program enrollments grow, program directors also noted the challenges hospitals sometimes have in determining the number of students they can accommodate. Educational program directors reported that hospitals might expand or contract in size or services offered; they face changing censuses and patient needs which affect clinical spots and scheduling permitted. They must have sufficient space and equipment on which to train the students. Perhaps most important, they must have sufficient numbers of competent staff members able and willing to supervise the students at all times during the clinical experience. According to educational program directors, hospitals sometimes are willing to affiliate with more than one school for clinical students; other times they want to maintain just one affiliation. Some hospitals reportedly have changed their affiliations over the years, possibly in search of higher- or differently-qualified students.

The concern among program directors about keeping up with changing technology was echoed by the couple of clinical site directors who were interviewed. For example, a more thorough job of teaching digital imaging technology would be very helpful at the hospitals that have moved completely away from older film technologies. Similarly, while the demand for basic radiography has maintained or leveled off, demand for advanced modalities such as magnetic resonance imaging (MRI), computed tomography (CT), mammography, angiography, and oncology has increased. However, educational curriculum and attention to these advanced modalities has not kept pace with the needs at the work site.

Hospital leadership reportedly also played roles – to varying degrees – on advisory committees to the school programs. All clinical affiliations include agreements regarding number of students, scheduling and oversight. Active participation on meaningful advisory committees, however, allows employers to play a more significant role, providing a forum for them to discuss current and future workforce needs; program enrollment; and quality and relevance of curricula to the workplace.

Several study participants noted that innovations, such as tele-radiology (see sidebar), are emerging in work settings. These developments are worth watching for their potential contribution to issues of workforce shortage or distribution as well as quality of care.

Teleradiology

With advances in Internet and networking technology, large packets of imaging data can be archived and shared electronically among health centers and radiologic staff members across large geographic distances. Hospitals and other delivery sites that are under-staffed or in rural regions may find teleradiology most useful. Vendor systems for teleradiology can be contracted by service sites to act as an extension of their staff and handle, among other tasks, preliminary readings from diagnostic machines.[39]

Policymakers

This study provides additional reminders that California's physical size, geographic diversity and large population make it difficult to generalize. Study participants repeatedly noted that their perceptions about workforce supply and demand would differ depending on whether we wanted to know about their local job market, the larger regional area, the Northern versus the Southern half of the state, or all of California. Another distinction was often between rural and urban areas or between public and private educational institutions.

Respondents also differed in their view on the role of policymakers. For example, few respondents would decline state financial support. However, some study participants would welcome state intervention in the form of more regulation or guidance while others requested less government involvement.

Leaders within the Professions

The professions of respiratory care and allied radiology are growing and changing. Dramatic shifts in supply, demand and educational programs have occurred in just the past few years. As noted by many of the study participants, there is considerable room for leaders to help ensure good futures for these professions. For example, some program directors stressed the need for students to recognize that much of health care – including that done by respiratory therapists and radiologic technologists – is not only the performance of clinical skills but also a service. Successful practitioners will be personable and professional in addition to being clinically competent.

Many program directors also expressed concern about the future sustainability of their fields. Based on their observations, many students are in programs to secure jobs and pursue careers. However, there may not be enough students who care about the field and profession in addition to their own employment. Program directors are looking for students who can be encouraged and mentored to be tomorrow's teachers, directors and leaders.

REVIEW OF FINDINGS, PROMISING APPROACHES AND AREAS FOR IMPROVEMENT

Key findings

Based on the results of the interviews with directors of respiratory care and radiologic technology programs, many allied health educational program directors appear to be responding and adapting appropriately to the market for graduates of their programs. In response to descriptions of "serious", "crisis" or "crazy" shortages a few years back, many programs added space for more students to enter the programs, resulting in full programs and overall enrollment increases. Now that shortages appear to be ebbing or ending in many markets, particularly for basic imaging technology, program directors are no longer planning to expand.

On the other hand, many program directors in respiratory care think workforce shortages continue in their areas. They may also have reached program enrollment capacity, but are not able to expand because of external limitations, the primary one being clinical space at local hospitals and other employment settings for students to receive their practical training.

Promising approaches

The challenges of being aware of and responding to market demands while administering a high quality educational program were acknowledged by virtually all study participants. To address the challenges, many program directors described their most promising approaches, which usually included improving and maintaining good communication among the various stakeholders.

Advisory committees

Several programs reported that active advisory committees were extremely helpful in guiding programs. In addition to including students and educators as members, these committees often invited representatives from local hospitals and other employers who provided meaningful perspectives on program size, development and direction. In particular, the advisory committee meetings kept program directors well-informed about local job markets and how programs might respond to market demands.

Strong and supportive relationships with administration

Program directors with solid support from school administrators found it easier to adapt program size and structure to respond to market changes. Program directors who reported spending time cultivating these relationships – either on their own initiative or in response to the administration's overtures – found the efforts well worth while. While requests were not always granted, administration often expressed willingness to listen, to experiment and to be flexible.

Creative approaches to space and class size

One of the biggest challenges to program directors who want to be responsive to job market developments is the physical space the program is currently allocated.

Classrooms, desks, equipment and enrollment caps are often dictated by administration and can be difficult to adjust, particularly in schools with multiple, competing programs. Solutions currently being used or proposed by programs include staggering class start dates, shifting program coursework to prerequisite categories, sharing classroom space through flexible scheduling, and distance learning (including having an instructor's lecture conveyed electronically to a remote site where another classroom of students attend the class with a proctor in attendance).[40]

Information and data collection

Program directors who appeared to be successfully navigating the health care workforce market by expanding and contracting program size as necessary must rely on up-to-date information. Annual workforce snapshots of these professions are very useful because of the evolving environment. If program directors did not have access to job market data from external sources, they collected their own to avoid over-saturation of the job market. Finally, they maintained contact with professional, accrediting and regulatory leaders to stay abreast of policy developments (see, for example, sidebar about recent legislative activity) that would affect their curricular, program, training or enrollment decisions.

Collaborative partnerships with clinical site administrators

Programs dealing successfully with workforce challenges reported good partnerships with clinical sites. The strongest collaborations had open communication regarding needs, opportunities and limitations or concerns. Representatives from both the academic and the clinical site were proactive in contacting each other when necessary to establish or update agreements. They were innovative, not hesitating to consider new shift schedules, shared oversight responsibility, and financing arrangements that met accrediting requirements and answered their mutual needs. They also dealt transparently with the challenges and opportunities of two or more academic sites sharing one clinical site for training.

Additional Issues to Consider

This study found that directors of respiratory care and radiologic technology programs identified several additional issues and concerns worthy of focus that were not receiving adequate attention.

- To improve recruitment and retention of students, program directors pointed to the potential of more support and involvement from hospitals and service sites, as well as more effort from high school and college counselors to publicize, inform and advise students about these fields of respiratory care and imaging technology. Within guidelines and policies, programs and faculty could better encourage students who want to be in their chosen profession to stay in the programs while guiding others, who may not be in the best program for them, to another profession in which they would be more likely to succeed. Hospitals and other clinical training sites might also play a bigger role in helping students finance their training.

- Better and more deliberate efforts could be made to track promising students into faculty positions to address likely faculty shortages in coming years. To make the most of these efforts, some attention will need to be placed on addressing significant salary gaps between faculty and clinical practice positions. Additionally, students – particularly those with leadership potential – could be encouraged and mentored to understand and lead their respective professions.

- Loan assumption and forgiveness plans for graduates willing to practice in rural and underserved areas might help distribute practitioners throughout California more evenly.

Recent California Legislative and Regulatory Efforts Affecting Respiratory Care and Radiologic Technology

Two 2007 bills (AB 13[41] and AB 520[42]), both introduced by Assemblymember Brownley would require that California hospitals have a protocol for determining non-nurse professional workforce needs.

♦

California is the first state in the country to regulate staffing ratios for respiratory therapists in acute respiratory care services in hospitals. Under the regulations, hospitals must have "sufficient respiratory therapists and/or respiratory therapy technicians to provide support for resuscitation and maintenance of the mechanical ventilators in a ratio of 1:2 or fewer on each shift."[43]

♦

In 2008, California State Senator Denham introduced SB 1125,[44] also known as the "Polysomnographic Technologist Act, which would provide for the licensing and regulation of polysomnographic technologists by the [California Respiratory Care] board."[45] The bill would provide polysomnographic technologists with limited practice authority in respiratory-related services.

♦

SB 1670[46] (Aanestad) was signed into law in September 2006. Under the new law, educational institutions with radiography programs are required to include at least 20 hours of instruction in digital radiography; and limited permit x-ray technicians should have at least 50 hours of education in radiological protection and safety. For the current workforce, providers must devote portions of their continuing education towards digital radiography. Attention is being focused on digital radiography because automated functions of the machinery may put patients at high risk for unnecessary doses of radiation treatment and hospital committees have recommended that staff members who provide radiologic services devote more time to education and training in digital radiologic technology.[47]

CONCLUSION

This study provides a snapshot of perspectives among California imaging technology and respiratory care program directors regarding their understanding of and responses to labor market supply and demand. It highlights both the capacity and challenges to adapt program size and content to changing employer and patient needs.

Some new programs opened and some established programs expanded to mitigate or even resolve past shortages. The study points out differences between the two professions; imaging technology generally found it easier to adapt quickly to increased demand while respiratory care was often limited by available clinical spaces in efforts to increase class size. Also apparent from the interviews were differences in labor market perceptions based on geographic location, differences in approaches between public and private programs, and differences in approaches to education and workforce challenges based on individual leadership styles.

Tremendous steps have been taken to enable educational programs to respond to market changes while maintaining and improving educational quality. As educators, policy makers and employers continue to work on refining these efforts to best avoid severe workforce shortages and oversupplied professions, several elements will play important roles. These include ensuring the availability of good market and student enrollment data, school administrators who can see the big picture as well as focus attention on each program's needs, regulations and standards that are neither too stringent nor too flexible, and knowledgeable program directors with leadership skills.

METHODOLOGY

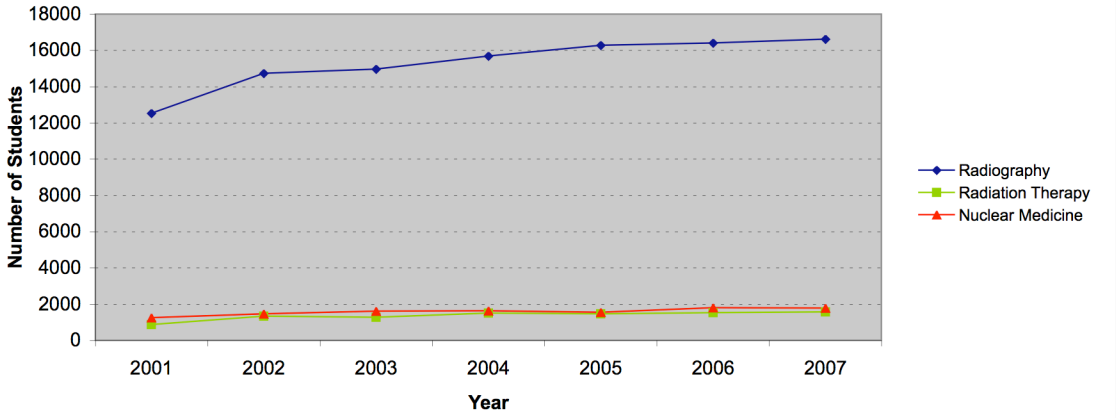
In early 2008, Center for the Health Professions staff electronically mailed directors at all California educational programs in respiratory care and imaging technology (including radiography, radiation therapy and nuclear medicine technology) explaining the study and inviting their participation. Program lists were obtained from the Respiratory Care Board of California[48] and the American Registry of Radiologic Technology.[49] Initial efforts to contact by electronic mail were followed up by telephone calls and subsequent e-mail messages. Program directors who choose to participate were interviewed by Center staff by telephone between January and June 2008. Directors from 15 respiratory care programs and 15 imaging technology programs participated (50% and 32% respective response rates). In addition, two clinical practice site directors were interviewed. Interviews and data management were conducted in accordance with UCSF Committee on Human Research guidelines. Table 4 displays participant characteristics.

Table 4: Characteristics of Programs Participating in 2008 Study

	Northern California	Southern California	Private	Public/Community College	Total
Respiratory Care	5	10	7	8	15
Imaging Technology	9	6	6	9	15

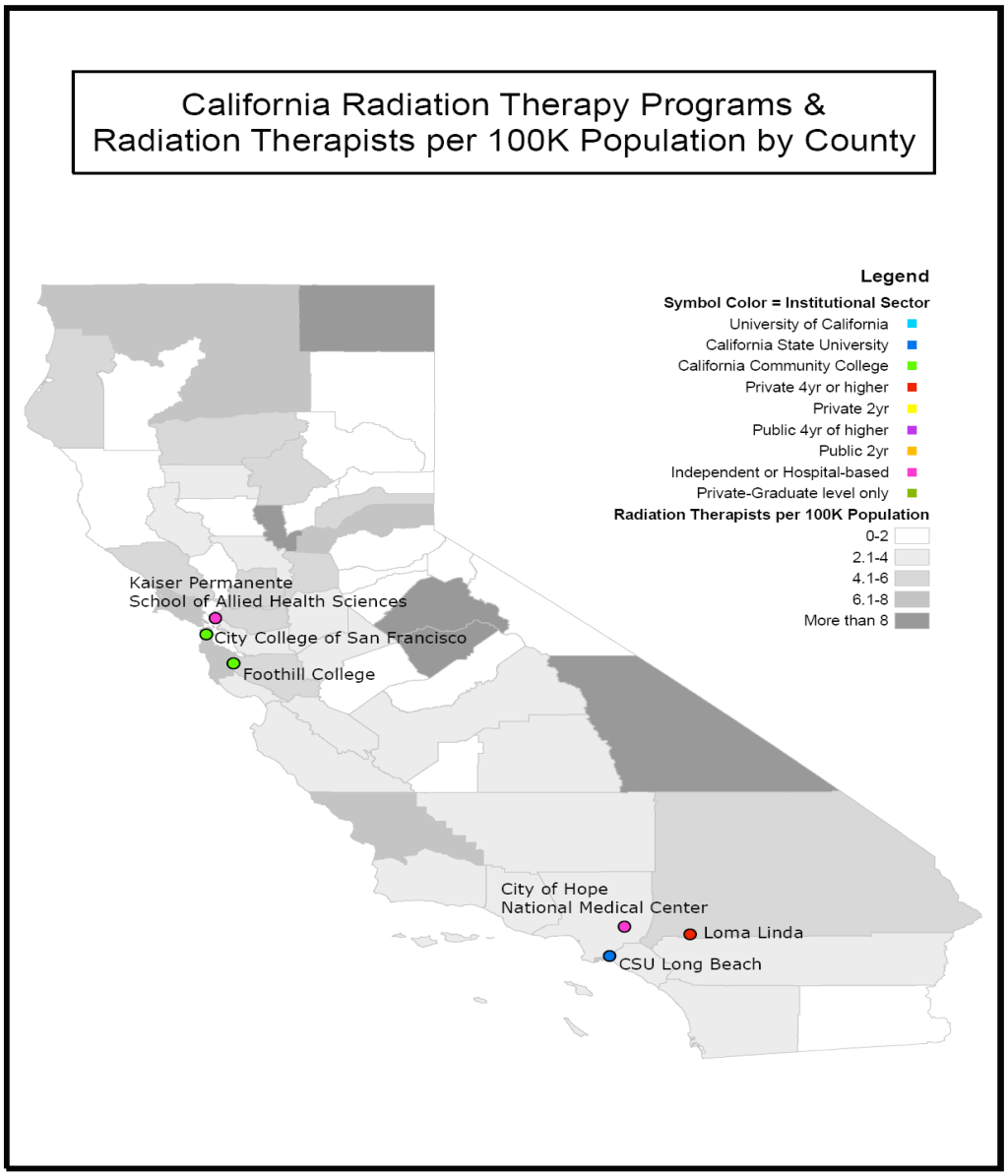
APPENDICES

Appendix A: Number of Enrolled Students in Radiography, Radiation Therapy, and Nuclear Medicine in the US: 2001-2007



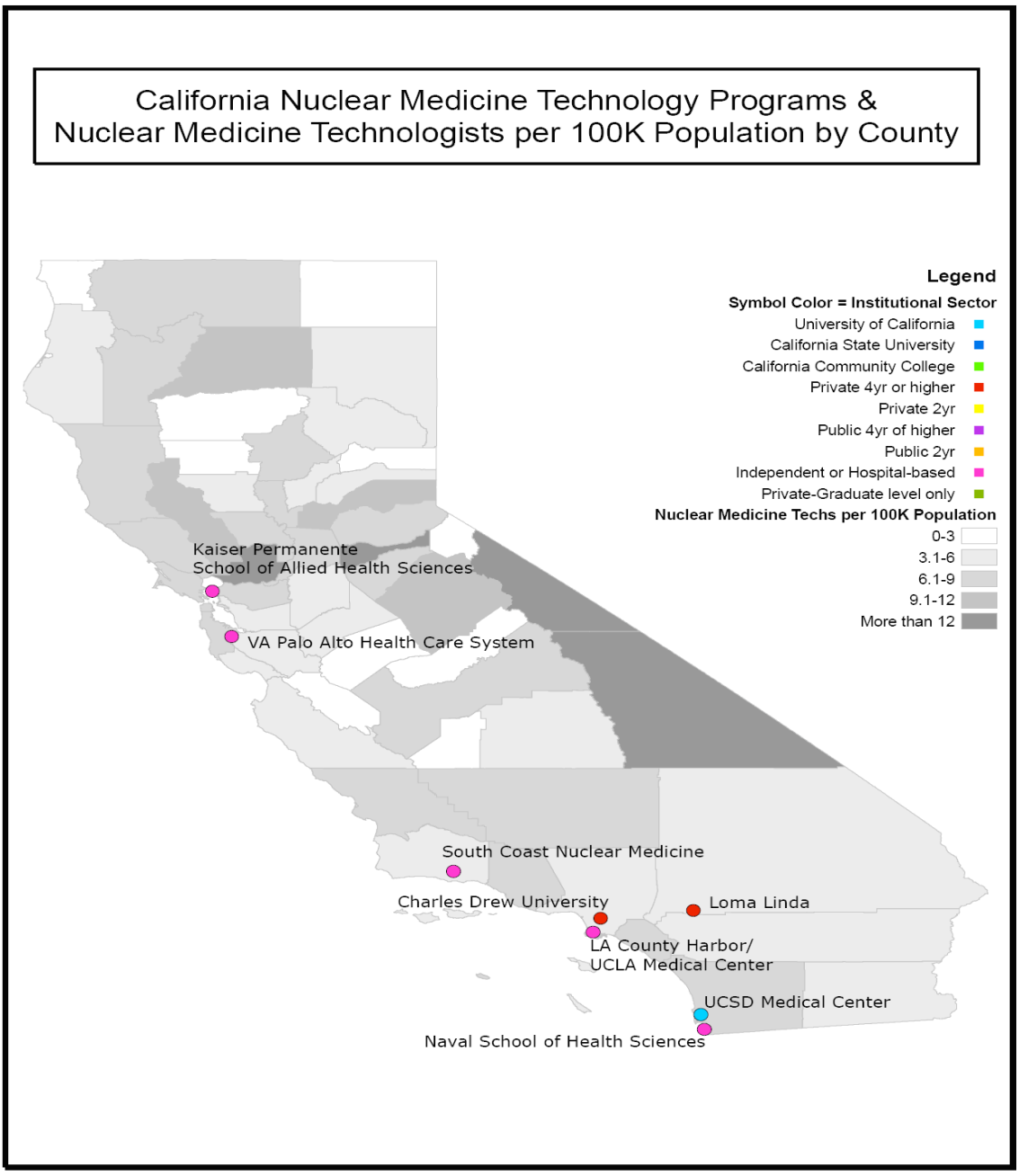
Source: Enrollment Snapshot of Radiography, Radiation Therapy and Nuclear Medicine Programs, 2001-2007

Appendix B: Maps of California Educational Programs for Radiation Therapy and Nuclear Medicine Technology



- As of early 2008, there were 6 radiation therapy programs in California, and the Radiologic Health Branch reported 1,499 radiation therapists in the state.

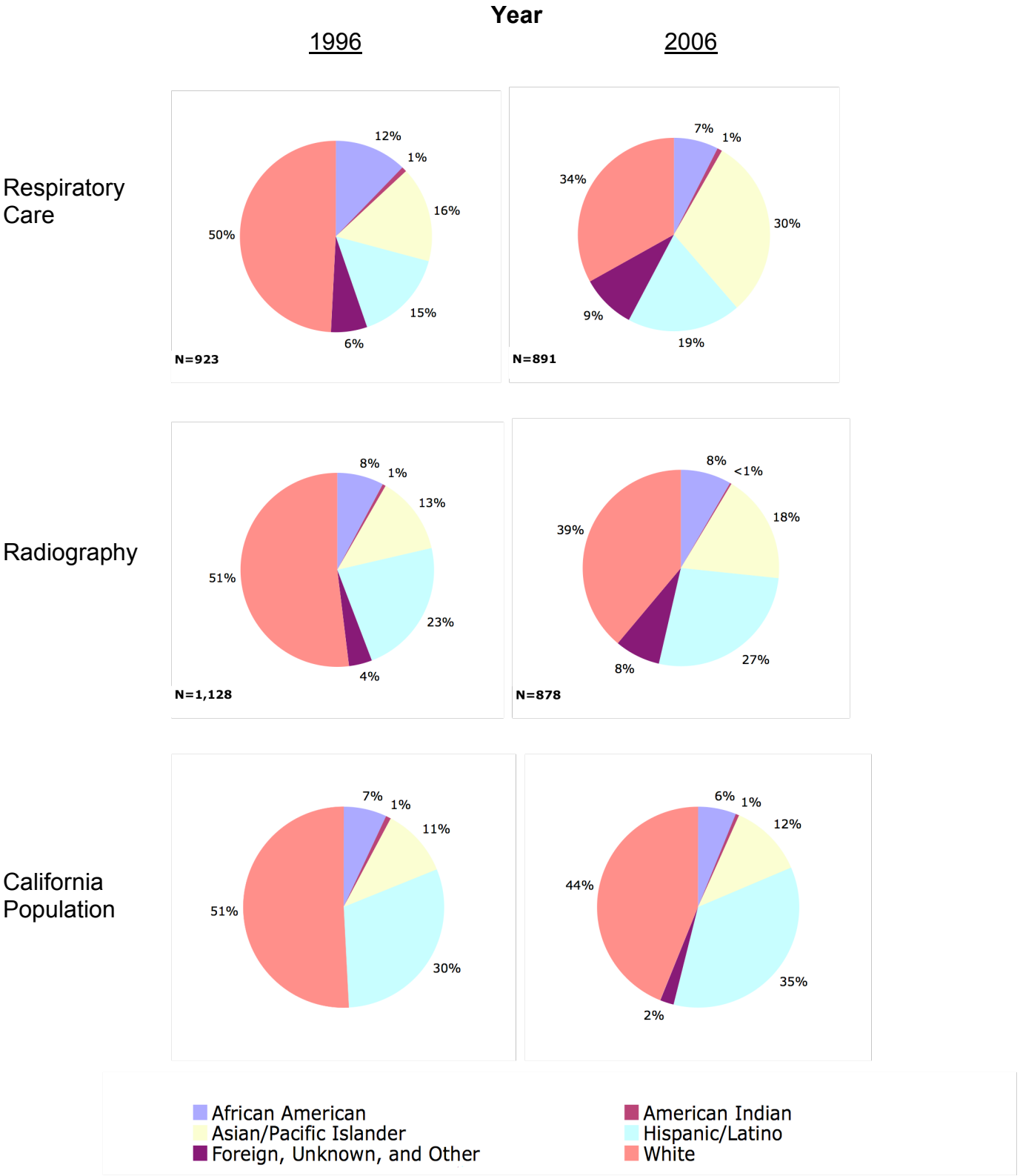
Sources: Bates T & Chapman S. *Tracking the Supply of Health Professions Education Programs in California*. UCSF Center for the Health Professions, 2007 citing data from the U.S. Department of Education, National Center for Education Statistics, Integrated Post-Secondary Education Data System (IPEDS): *Awards & Degrees Conferred* (2005); California Radiologic Health Branch, 2008; California State Association of Counties, 2006.



- As of early 2008, there were eight nuclear medicine technology programs in California (two of which are not recognized by ARRT), and the Radiologic Health Branch reported 2,556 nuclear medicine technologists in the state.

Sources: Bates T & Chapman S. *Tracking the Supply of Health Professions Education Programs in California*. UCSF Center for the Health Professions, 2007 citing data from the U.S. Department of Education, National Center for Education Statistics, Integrated Post-Secondary Education Data System (IPEDS): *Awards & Degrees Conferred* (2005); California Radiologic Health Branch, 2008; California State Association of Counties, 2006.

Appendix C: Respiratory Care and Radiography Graduates, and General Population, by Race and Ethnicity, California, 1996 and 2006[50]



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