



CALIFORNIA
REGIONAL ECONOMIES PROJECT

GOLDEN OPPORTUNITY, GROWING CRISIS

THE HEALTH SCIENCES AND SERVICES CLUSTER



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A Cluster Report of the
California Regional Economies Project
September 2004

*Prepared By
Collaborative Economics
with the support of J.K. Inc.*

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PREFACE

Purpose: The California Regional Economies Project

The California Regional Economies Project provides California's economic and workforce development system with information about changing regional economies and labor markets. The Project is a joint effort of the California Workforce Investment Board and the California Economic Strategy Panel. The Project was initiated in response to these challenges:

- California's economy is under-performing relative to its potential—we have tremendous talent, world-class companies, and a tradition of innovation.
- California lacks an economic and workforce investment strategy that focuses on regional strengths and opportunities, and connects state and local efforts for maximum impact.
- Local and state policymakers lack reliable and timely information about emerging industry and job opportunities, making good investment and policy decisions difficult.

The Project develops information that measures the performance of California's regional economies. This information provides a key resource in economic and workforce development planning, and a bridge connecting economic and workforce policies and programs at the state and regional levels.

Through its products and forums, The California Regional Economies Project fills a need for better information that can:

- improve specific decisions about state, regional, and local workforce investments and policies;
- connect state, regional, and local economic and workforce investment strategies;
- focus state, regional, and local marketing efforts on areas of regional economic advantage and opportunity;
- inform policy and investment decisions of government so that they promote, rather than discourage economic innovation and competitiveness; and,
- help individuals navigate their own transition to new employment opportunities.

Phase I of the Project: Products and Forums for Users

During 2003-4, information was compiled for each of the nine California Economic Strategy Panel regions—Northern California, Northern Sacramento Valley, Greater Sacramento, Bay Area, San Joaquin Valley, Central Sierra, Central Coast, Southern California, and the Southern Border Region (see following map).

Each of these reports was presented at a regional forum, and discussed with the regional user community (e.g., employers, workforce investment boards, local economic development organizations, local education and training institutions, local government agencies, and other interested community leaders). At each forum, users had the opportunity to discuss the findings and suggest priorities for further cluster analysis (see following chart).

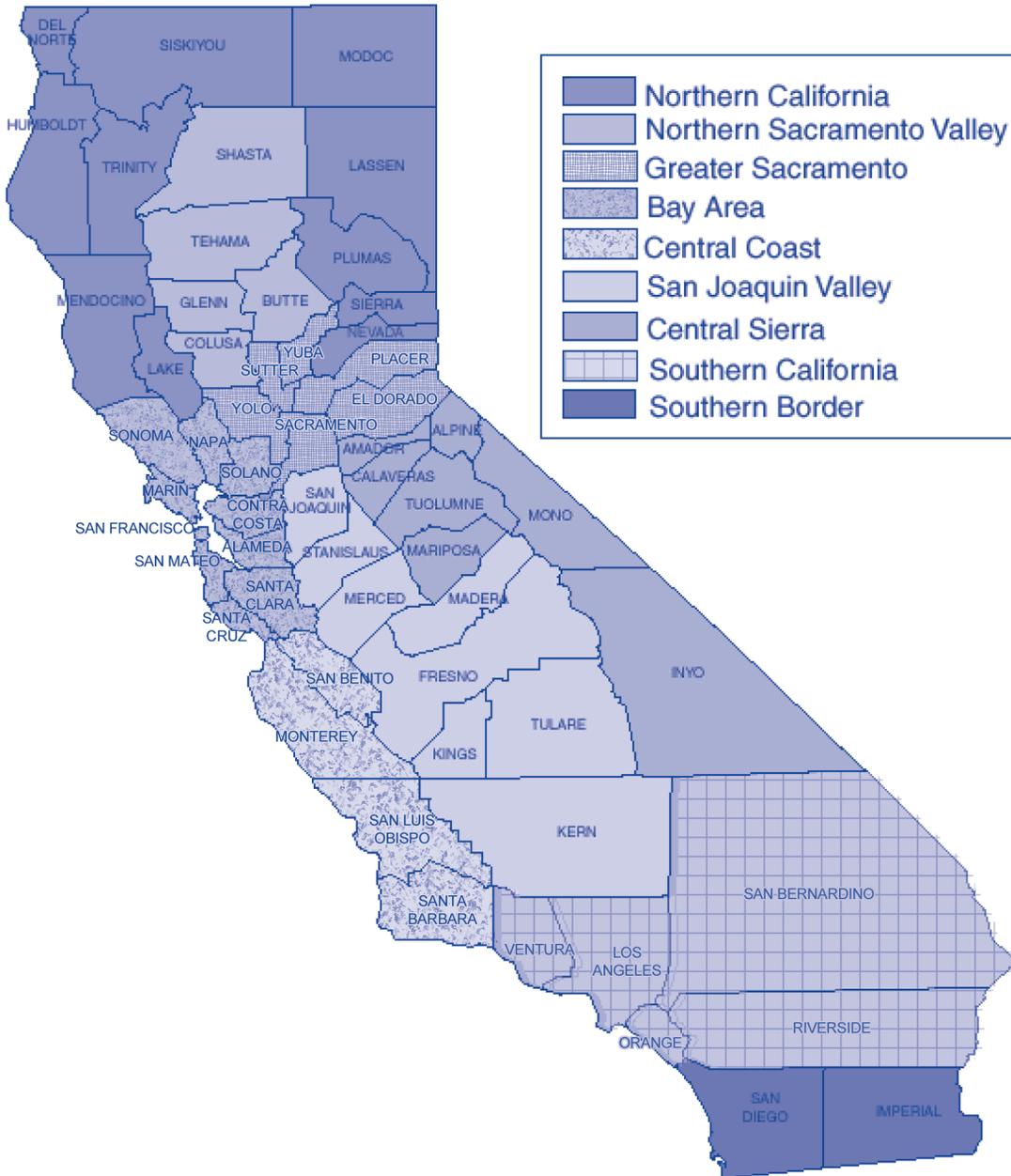
In addition, the Project compiled multi-region, cross-cutting Cluster of Opportunity reports. The focus for these reports was based on recommendations from the user community at regional forums and analysis of trends in the regional data. As a result, the Project focused on industries and occupations involved in:

- *Health Science and Services* (across all nine regions of California)
- *Manufacturing Value Chain* (the value chain of design, production, and logistics sectors in the five most urban regions of the state)
- *Regional Experience/Infrastructure* (in the four most rural regions California)

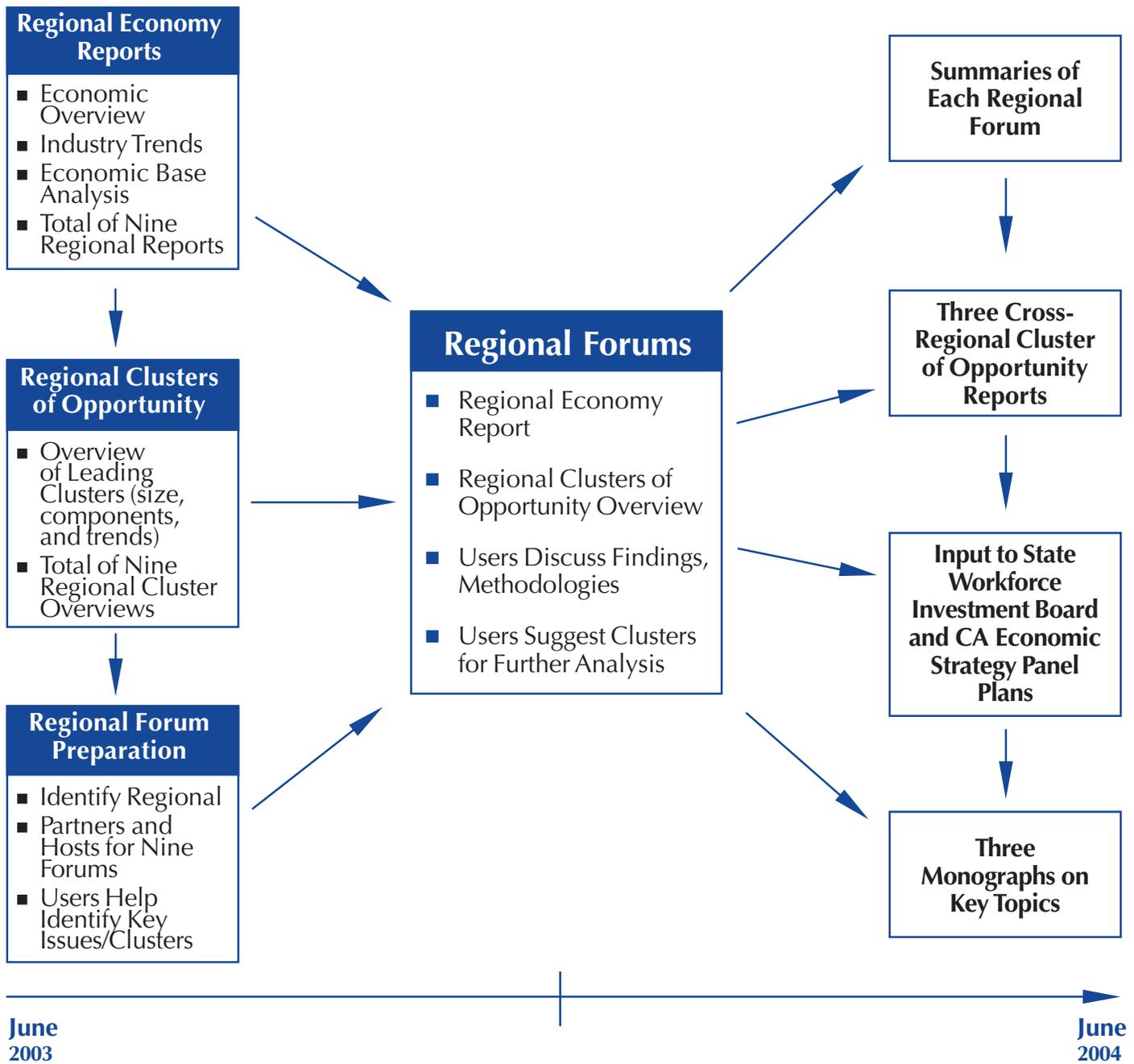
Each region was examined as part of the clusters of opportunity shown below.

Regions	Health Science And Services	Manufacturing Value Chain	Regional Exp/Infra
Northern California	XX		XX
Northern Sacramento Valley	XX		XX
Greater Sacramento	XX	XX	
Bay Area	XX	XX	
San Joaquin Valley	XX	XX	
Central Sierra	XX		XX
Central Coast	XX		XX
Southern California	XX	XX	
Southern Border	XX	XX	

THE PROJECT REGIONS



CALIFORNIA REGIONAL ECONOMIES PROJECT



The Project also produced monographs focused on key policy areas of concern to the regional user community and state-level policymakers. These monographs are focused on:

- *The Conditions of Competitiveness of California's Economy.* This monograph provides a balanced look at California's business climate by examining both cost and productivity factors with a special focus on the role of talent.
- *Innovation, Productivity and California's Prosperity.* This monograph examines the role of innovation in changing industry clusters, the impact of innovation and technology on productivity as well as the impact of productivity on the dynamics of job change.
- *Creating a Workforce Transition System in California:* Based on the regional analysis, this monograph recommends how a workforce transition system could be designed to help workers make transitions both within industries through career progression from entry to mid and higher occupational levels as well as transition across industries through adjustment to structural economic changes.

The monographs reinforce findings from the cluster reports as well—namely the importance of a balanced business climate based on cost and productivity, the imperative of innovation across all industries, and the need for a more effective workforce transition system to support California employers in their drive to innovate and remain competitive in the global economy.

Project Team and Sponsors

The Project Team includes Collaborative Economics (www.coecon.com), Center for the Continuing Study of the California Economy, (www.ccsce.com), California Center for Regional Leadership (www.calregions.org), and J.K., Inc.

The *California Workforce Investment Board* was established in 1998 to provide strategic guidance to the state's workforce investment system. For more information, visit <http://www.calwia.org>.

The bipartisan *California Economic Strategy Panel* was established in 1993 to develop a statewide vision and strategy to guide public policy decisions for economic growth and competitiveness. For more information visit www.labor.ca.gov.

EXECUTIVE SUMMARY

- *Health Sciences and Services is one of the largest, fastest-growing clusters of opportunity in both urban and rural California.* Some of the cluster is largely population-driven, some of it is largely export-oriented, and overall it provides a wealth of occupations with career potential. Workforce shortages exist at all levels. Not surprisingly, participants at all nine regional forums identified health science and services at or near the top priority for further analysis.
- *The Health Sciences and Services cluster integrates two critical components of the health industry: Health sciences include activities focused on the development of a body of knowledge through scientific research in medicine, pharmacology, biology, drug discovery, genomics, and many other areas. Health services focus on the delivery of health care to patients; employment in this sector is comprised of medical and support staff in many settings, including hospitals, clinics, care facilities, at home, and on-line.*
- *Urban and rural regions show distinct patterns of cluster development.* In urban regions, health service and health science industries are converging into specialized health science and service “complexes”. Health sciences are increasingly integrated with the health services through activities like clinical trials and testing, a necessary step towards the successful commercialization of biomedical and pharmacological products and services. Meanwhile, in rural regions health services is the major focus, but with regions developing their own specializations depending on its demographics and economy.
- *Population growth and population change continue to fuel growth and change the nature of regional demand.* Average annual population growth in California between 1990-2002 was 1.2% while health sciences and services employment grew by 2.2% statewide; 3% in rural areas and 2% in urban areas. Population growth and restructuring also drives health sciences and services in both urban and rural areas but especially in rural areas with in-migration of retirees (which shows up particularly in growth of home, elderly and residential care).
- *The ongoing convergence of Health Sciences and Services creates new economic opportunities in urban regions across California.* Urban hospitals face tremendous competition to distinguish themselves by offering specialty medical care and establishing linkages to research universities in the region (e.g. Stanford, UCSF, UC Davis, UCLA). In turn, these universities serve as major incubators for highly sought after medical care, scientific R&D and medical technology. They also serve to educate and train a skilled medical staff. In addition, the renowned universities are able to leverage capabilities to attract major Federal funding, e.g. from the National Institutes of Health (NIH), as well as business, angel and venture capital funding to the region to promote cluster development.
- *Given their assets, California and its regions have the opportunity to be a world leader in the convergence of health sciences and services.* California is the birthplace of biotechnology and continues to be at the center for innovation in biomedical and life sciences. California leads among states in biotech firms, patents and university R&D. Its urban regions rank among the leaders in biomedical and life sciences.

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- *Current trends also suggest that health services options are expanding rapidly, along with needs for health care workers in many different settings. Some of the fastest growth in care and employment are taking place in non-hospital settings. This is a natural expansion of choices based on cost, new enabling technologies, changes in insurance, and customization to customer demand. With an enormous, diverse consumer base, including an aging baby boom generation, California will have the opportunity to meet the health needs of its population in new and creative ways, as well as draw consumers from outside the state into areas of specialization.*
 - *Despite this growing potential, critical infrastructure and workforce requirements are not yet in place. There is nothing less than a crisis in terms of workforce shortages in critical skills areas such as nursing where there is clear demand and often there is a failure to understand the importance of health sciences and services as an economic driver in many regions. Health sciences and services is still viewed as primarily a social service or part of the community infrastructure, rather as an economic priority, a growing cluster of opportunity with many career pathways.*
 - *The good news is that health sciences and services is a large, fast-growing economic driver in every California region, offering a wide variety of jobs with career potential. The bad news is that the state must act boldly to ensure that this cluster remains strong and competitive in the years ahead—or risk losing ground to other, more aggressive states and regional health care complexes nationwide and globally.*

There are clear implications from this cluster analysis for state and regional workforce and economic policy. California and its regions must be bold in:

- *Rapidly and substantially expanding the workforce pipeline*
 - *Fueling the innovation process in health sciences and services*
 - *Promoting California as a leader in health sciences and services.*
- *Take bold state and regional action to attack the workforce crisis. The stakes are too high to muddle through with marginal approaches any longer. Without an adequate talent pool and an effective talent pipeline, the future of health sciences and services in California is at risk. California is not alone. Other states and countries are rushing to try to figure out how to address this challenge. With its already-strong assets in health sciences and services, California can and should be among the leaders. The state can and should be able to capitalize on this golden opportunity for economic and social progress, rather than settle for the crisis-driven system that is in place today.*

The first step is to recognize that health sciences and services is more than just an essential part of community infrastructure and quality of life, but a significant contributor to the economic well-being of Californians. Health sciences and services must be embraced as not only a *social need*, but an *economic priority* in regions and the state as a whole. This requires a shift of thinking from conventional wisdom about the sources of economic growth in California, which have tended to focus on agriculture in the rural areas, manufacturing as an export industry, and “high tech” information industries.

State leaders could declare a state of emergency for health care professions, including increasing the capacity at public institutions through new funding and changes in state funding formulas and other provisions to create incentives and remove disincentives for expanding education programs for health care professions. For strong economic opportunity and development reasons, health care professions can be targeted as “critical occupations” justifying differential treatment within the public systems. Today, there exist waiting lists of already-qualified applicants for education programs in the health professions at public institutions.

Even with increases in existing programs at public institutions, new kinds of “intermediaries” are likely required to accelerate the speed and scope of change. These regionally-based intermediaries would involve partnering among Workforce Investment Boards, community colleges, universities, and health providers. Experiments are already being pursued in regions across the state with some success, as well as in other states across the country. A major scaling-up of the most effective initiatives and state and regional seed money for innovative efforts that have strong employer involvement and investment would be bold steps in the right direction.

- ***Take targeted and sustained state and regional action to fuel innovation.*** California and especially its urban regions currently have a lead in health sciences that must be maintained through continued investments in R&D and commercialization through focused innovation strategies. Discovery and inventions in these fields will drive future economic growth as they change the nature of the health care system, converge with other emerging industries such as nanotechnology as well as information technologies (e.g. bioinformatics, genomics). California needs to provide continued support for its world-class universities and research centers for advances in health sciences and services. Targeted and sustained action includes:

State leadership in actively providing targeted investment and aggressively pursuing federal funding for biomedical fields and institutions in California, including convergence with fields such as information and nanotechnology.

Regional collaboration among localities and institutions to leverage existing strengths in biomedical fields, ensure strong connections between innovation in health sciences and services, and align workforce and economic development strategies in these fields.

- ***Promote California as a Leader in Health Sciences and Services.*** California has the right ingredients for developing a new model of health care that better integrates advances in health sciences with health services to provide higher quality care for individuals at reduced costs through major innovations in the health care system. In the future, there is the possibility of personalized medicine based on advances in bioscience including genomics, which would allow health care to be tailored to the specific needs of the individuals. Some regions of the country such as Southern Border, the Bay Area and Southern California regions along with the Greater Boston region could become the leaders in creating this innovative health care system. It will require new thinking on the part of industry, government and educational leaders at both the state and regional levels. While the state has begun to move along this path, the question remains as to whether California will promote its assets and intention to be a national and global leader in a new, emerging system of health science and services.

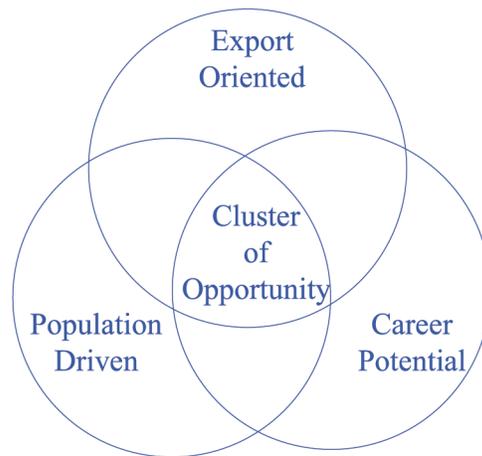
I. IDENTIFYING A CLUSTER OF OPPORTUNITY

What is a Cluster of Opportunity?

Using a mix of criteria, the California Regional Economies Project identified several clusters of opportunity in regions across California:

- Consistent with most research and practice, the Project identified clusters that are export-oriented, geographically-concentrated, and interdependent industry sectors characterized by competing firms and buyer-supplier relationships, as well as shared labor pools and other specialized infrastructure.
- Building on this general definition, the Project added two additional considerations that focused on “opportunity”—that is, employment opportunities for regional residents. Thus, the definition of a “cluster of opportunity” focuses not only on export-oriented sectors, but also population-driven sectors—as well as sectors that offer occupations with “career potential.”

Clusters of Opportunity



The California Regional Economies Project responds to two separate sets of regional priorities. Many regional organizations are focused on efforts to promote long-term economic growth that is broadly shared among each region’s residents. The project’s economic base analyses helped identify sectors that have the potential for high-wage job growth such as, for example, biotech.

Workforce investment boards play a role in promoting economic growth but they also have mandates to help residents train for and find jobs when they are unemployed. Workforce boards are moving beyond the traditional job-finding role to develop programs focused on career paths and upward mobility.

Many areas of workforce shortage are not in the center of a region's economic base. They are in the many population-serving sectors like health care, construction and education. So, the Project focuses on the size of sectors, not just their potential for rapid growth, and look closely at population-serving activities as well as each region's economic base.

The Twin Challenges of Economic Growth and Workforce Investment

Economic Growth

- Identify sectors for innovation and growth, for example, biotech and nanotech
- Identify workforce and other policies to support high growth sectors
- Focus primarily on the region's economic base

Workforce Investment

- Identify sectors where people can find career paths and upward mobility, for example, nursing and construction
- Identify workforce policies that support both individuals and sectors
- Focus significantly on population-serving sectors

The Cluster of Opportunity provides a bridge connecting the goals of workforce and economic development. Workforce development is naturally most focused on preparing people for jobs that exist today, while economic development is often about nurturing not only the industries of today, but those of tomorrow as well. Thus, the sectors or clusters championed for long-term economic development purposes may be providing few jobs today, and even fewer opportunities with career potential, simply because it is not yet at the necessary size and maturity in a given region. The Cluster of Opportunity enables regions to bridge this natural gap between these goals by including some sectors and occupations with requiring immediate workforce development, and some sectors and occupations that are emerging and may be more important in the future.



How Was This Cluster Chosen For Further Analysis?

Using these criteria, potential clusters of opportunity were identified for discussion at each of the nine regional forums. In identifying potential clusters of opportunity, the Project examined the size, concentration relative to the California average (location quotient), growth, and wages (when available)—as well as past cluster studies and perspectives from regional employers. A panel of employers at each forum offered their perspectives on key clusters, with users concluding the meeting by suggesting certain clusters of opportunity for further analysis.

In the end, three major clusters of opportunity were defined for further analysis, each including a mix of industries and occupations that are export-oriented, population-driven, and have career potential. Since each of these clusters were important in multiple regions, they were analyzed with attention to regional similarities and variations. Supplementing the quantitative employment data, the Project team also interviewed employers from these clusters, identifying opportunities and requirements for future growth and competitiveness.

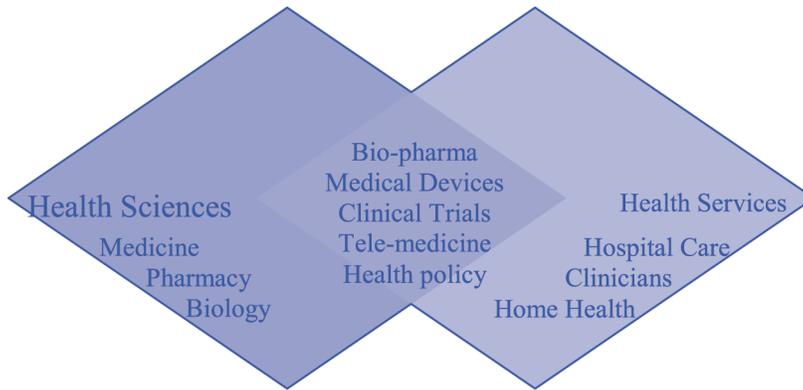
Health Sciences and Services was chosen because it is one of the largest, fastest-growing clusters of opportunity in both urban and rural California. Some of the cluster is largely population-driven, some of it is largely export-oriented, and overall it provides a wealth of occupations with career potential. Workforce shortages exist at all levels. Not surprisingly, participants at all nine regional forums identified health science and services at or near the top priority for further analysis.

What Comprises This Cluster of Opportunity?

Health Services and Sciences: More Than Health Care Delivery

The Health Sciences and Services cluster integrates two critical components of the health industry:

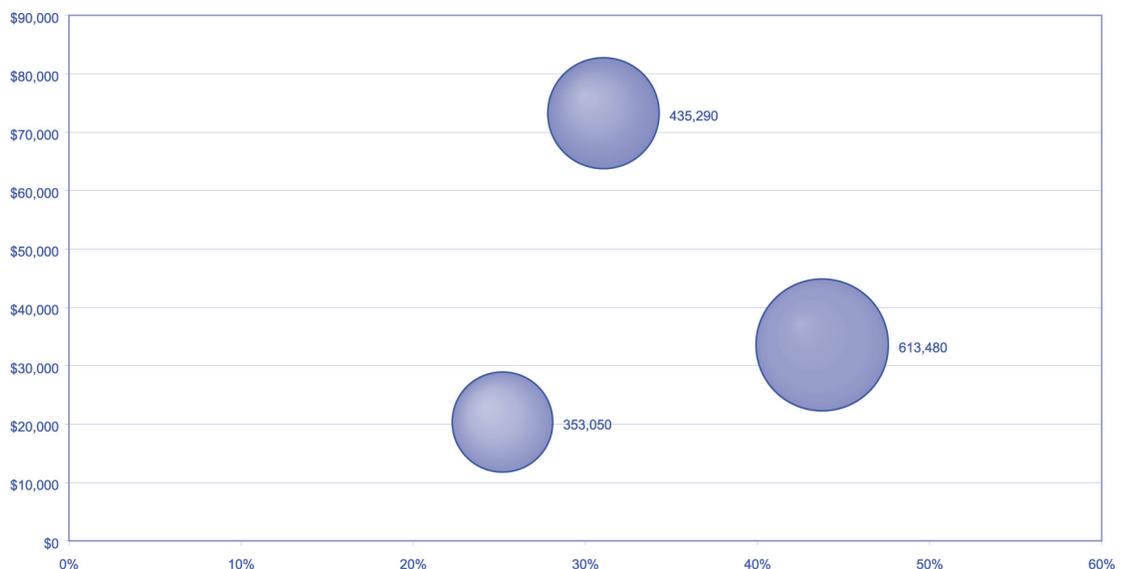
- *Health sciences* include activities focused on the development of a body of knowledge through scientific research in medicine, pharmacology, biology, drug discovery, genomics, and many other areas
- *Health services* focus on the delivery of health care to patients; employment in this sector is comprised of medical and support staff in many settings, including hospitals, clinics, at home, and on-line
- *Intersection of health sciences and services* is a category that increasingly depends on health services for clinical trials and testing to move biomedical products out of the laboratory and into commercial applications. The activities in this segment include the engineering and development of medical devices, the delivery of remote medical care e.g. through telemedicine, and clinical trials



Health Services and Sciences: An Even Distribution of High, Mid, and Entry-Level Employment

Health Sciences and Services occupations are fairly evenly spread across high, mid and entry-level occupations. This cluster of opportunity creates jobs at all occupational levels and offers careers with advancement potential through additional on-the-job experience, education, and training.

The following chart shows average wage levels for the occupations in the high, mid- and entry-levels. Levels are based on statewide wage distribution: entry-level occupations are considered to be those that are below the 25th percentile on the state wage distribution; mid-level occupations are between the 25th and 75th percentile; and higher-level occupations are above the 75th percentile.



Health Occupational Clusters:
Employment Size, Share of Cluster, and Wage Level

● High-Level ● Mid-Level ● Entry-Level

Source: California Employment Development Department,
US Bureau of Labor Statistics

About 31% of Health Science and Services occupations are in the high-level category with average wages greater than \$48,900 annually. Examples of high-level occupations in the Health Sciences and Services are Family and General Practitioners with average wages of \$135,000 annually, or Medical and Clinical Laboratory Technologists who make about \$59,500 per year.

Forty-four percent of all Health Sciences and Services employment is in the mid-level category; this includes Dental Assistants and Medical Secretaries who make about \$33,000 on average and Medical Assistants who earn \$27,000 annually. The entry-level occupations make up about 25% of those employed in the cluster, with average wages at or below \$24,000 per year. In this group are Nursing Aides, Orderlies and Attendants who make \$23,000 on average and Home Health Aides who earn slightly more than \$20,000 on average. The following table highlights some occupations in the Health Sciences and Services along with their average hourly wages and annual incomes across California in 2003.

<u>Examples of Health Occupations With Average Wages</u>		
<u>Higher-Level Occupations</u>	<u>CA Average Hourly Wage</u>	<u>CA Average Annual Wage</u>
Family and General Practitioners	\$64.91	\$135,001
Medical Scientists, Except Epidemiologists	\$34.08	\$70,877
Registered Nurses	\$30.56	\$63,560
Medical and Clinical Laboratory Technologists	\$28.60	\$59,493
Business and Financial Operations Occupations	\$25.74	\$53,530
<u>Mid-Level Occupations</u>	<u>CA Average Hourly Wage</u>	<u>CA Average Annual Wage</u>
Dental Assistants	\$15.78	\$32,830
Medical Secretaries	\$15.69	\$32,644
Office and Administrative Support Occupations	\$15.12	\$31,452
Medical Assistants	\$13.12	\$27,283
Office Clerks, General	\$12.38	\$25,743
<u>Entry-Level Occupations</u>	<u>CA Average Hourly Wage</u>	<u>CA Average Annual Wage</u>
Nursing Aides, Orderlies, and Attendants	\$10.84	\$22,549
Building and Grounds Cleaning and Maintenance Occupa	\$10.50	\$21,853
Personal Care and Service Occupations	\$10.44	\$21,708
Food Preparation and Serving-Related Occupations	\$10.19	\$21,201
Home Health Aides	\$9.66	\$20,103

Source: EDD

Urban and Rural Regions Show Distinct Patterns of Cluster Development

Employment growth in the health sciences and services sub-sectors varies across California's nine diverse regions. In general, urban and rural regions tend to show distinctly different employment trends and employment concentrations by sector, with each having different requirements for future growth and development of the industry. Accordingly, the cluster analysis is divided into two components, urban and rural. The urban regions include the Bay Area, Southern California, Sacramento and Southern Border. The more rural regions include the Central Coast, Central Sierra, Northern California, Northern Sacramento Valley, and the San Joaquin Valley.

Urban Regions

Health service and health science industries are converging into specialized health science and service “complexes”. According to a recent study by the Milken Institute, California has six of the top 12 bio tech and life science metro areas: San Diego, San Jose, San Francisco, Los Angeles-Long Beach and Orange County.

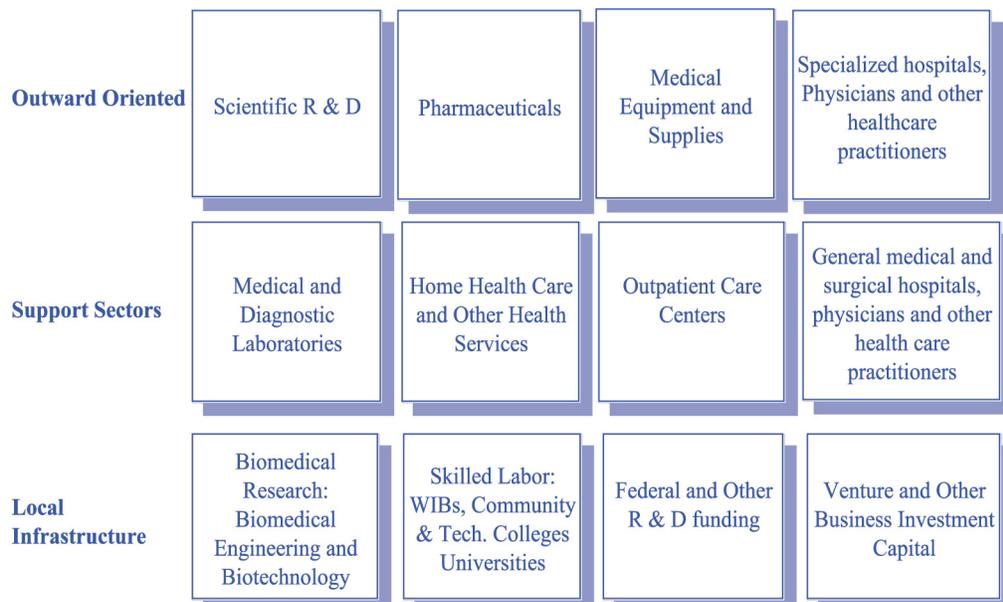
In urban regions, health sciences are increasingly integrated with the health services through activities like clinical trials and testing, a necessary step towards the successful commercialization of biomedical and pharmacological products and services. Those regions with effective innovation pipelines need both advanced health services as well as research based biomedical industries. This is increasingly clear as the biomedical industry matures in the Southern Border, the Bay Area and Southern California regions.

Specialization and distinctiveness is the key to creating value in the health sciences and services system. As Michael Porter and Elizabeth Olmstead Teisberg point out in a recent Harvard Business Review article “Redefining Competition in Health Care” (June 2004):

Health providers should not attempt to match competitor’s every move. Instead, they should develop clear strategies around unique experience and tailor facilities in those areas where they are most distinctive. Most hospitals would retain a wide range of service areas, but they would not try to be all things to everyone. In most business, it is common sense to develop products and services that create unique value. For many hospitals, developing uniqueness is a significant change of mind-set and deciding what *not* to do is an even more radical idea.

As the following chart shows, the urban health science and services cluster includes key outward or export-oriented sectors, support sectors, and local infrastructure.

URBAN HEALTH SCIENCE AND SERVICES CLUSTERS



Outward Oriented Sectors—Health science and service firms exporting products and services to entities located outside of the region are outward oriented because they bring outside revenue into the region. In California’s urban regions, the outward-oriented components of the health sciences and services cluster include companies that conduct research and development as well as develop pharmaceuticals, companies that design and produce medical equipment and supplies, firms engaged in scientific research and development as well as specialized hospitals and physicians’ offices that deliver diagnostics and health sciences and services to patients.

- An estimate of employment in 2002 suggests that approximately 800,000 people were employed in the urban outward-oriented health sectors, making up more than 70% of employment in the urban health sciences and services cluster.

Support Sectors—Support sectors to the outward-oriented components of the cluster include medical and diagnostics laboratories, home health care, outpatient care centers, and other health care services.

- Together these sectors account for more than 260,000 jobs or about 30% of all health sciences and services jobs in the urban regions.

Local Infrastructure—There are established linkages between hospitals and distinguished universities in the urban areas (e.g., Stanford, UCSF, UC Davis, UCLA, etc.). These research universities with well-developed medical centers serve as major incubators for highly sought after specialty medical care, scientific R&D and medical technology. They also serve to educate and train a skilled medical staff. In addition, the renowned universities are able to leverage capabilities to attract capital into an area. The role of local workforce investment boards, community colleges and technical institutes and other specialized training facilities is a key infrastructure component of the health sciences and service cluster. Skilled technicians, support staff and other medical service providers are primarily trained at these essential, regional institutions. In addition, sources of R&D funding (federal, state, corporate, philanthropic) and business investment capital (venture, seed, etc.) are critical elements of the infrastructure supporting this cluster.

Rural Regions

While health sciences and services employment is growing in every rural region, each region is developing its own specializations depending on its population and economy.

For example, health sciences and services is also one of the fastest growing industries with high concentrations in the North Sacramento Valley, especially in community and residential care, and the San Joaquin Valley. Overall, in rural areas, health sciences and services is heavily concentrated in care for the local community, attracting some from outside the region for specialized forms of care.

RURAL HEALTH SCIENCE AND SERVICES CLUSTERS



Outward Oriented Sectors—The health cluster in the rural areas is heavily concentrated in care for the local community, attracting some from outside the region. In the rural regions, the offices of health practitioners, including physicians, dentists and others draw patients from around the region to smaller, regional centers. General medical and surgical hospitals—and those specializing in psychiatric and substance abuse—are outward-oriented components of the rural health sciences and services cluster. Various health sciences and services such as ambulatory health services, nursing care facilities, residential mental health facilities, community care facility for the elderly, and vocational rehabilitation and other residential care facilities are also a part of the outward-oriented components of the health cluster in rural regions.

- In 2002, approximately 120,000 people were employed in the outward sectors, making up 66% of all the employees in health sciences and services in the rural areas.

Support Sectors—Firms specializing in medical equipment, medical diagnostic laboratories and home health and residential nursing facilities make up the support sectors of the rural health cluster.

- In 2002, approximately 56,200 were employed in the secondary sectors, making up 31% of all the employees in health sciences and services in the rural areas.

Local Infrastructure—Local infrastructure elements of the health sciences and services cluster make up the final supporting tier. These institutions such as regional colleges and universities, community colleges and private training facilities, and workforce investment boards provide training and support for the rural health sciences and services industry. In addition, local universities provide research and development, and workforce training to the health-care industry and other industries in the region.

II. PROFILING THE CLUSTER OF OPPORTUNITY

The Cluster is a Key Economic Driver and in Crisis in Every Region of California

The health sciences and services cluster has become a major economic driver in California. Health sciences and services comprise about 9% of the state's total employment, growing from an 8% share in 1990. During the last 12 years, California added 296,100 jobs in health sciences and services, up from 1.01 million in 1990 to 1.31 million in 2003, an increase of 29%.

Across California, some of the fastest-growing sectors are pharmaceuticals and medicine manufacturing which added about 17,000 jobs from 23,200 jobs in 1990 to more than 40,000 in 2002, a gain of 4.7%. Also fast-growing are home health and nursing care employment (3.6%); other health services such as emergency and ambulatory health care (3.2%); and jobs for health practitioners (2.3%).

Overall in California, the highest concentrations are in medical equipment and supply manufacturing (1.17) and scientific R&D services (1.26), which result from the state's leadership in biomedical industries. However, the greatest increase in jobs from 1990-2002 were in offices of physicians (47.1%), medical and surgical hospitals (42.6%), dentists (30.5%), and residential mental facilities (24.6%).

Population growth and population change continue to fuel growth and change the nature of regional demand. Average annual population growth in California between 1990-2002 was 1.2% while health sciences and services employment grew by 2.2% statewide; 3% in rural areas and 2% in urban areas. Population growth and restructuring also drives health sciences and services in both urban and rural areas but especially in rural areas with in-migration of retirees (which shows up particularly in growth of home, elderly and residential care).

However, the job increases in health sciences and services across California is driven by more than population growth alone. Health sciences and services is also driven by specialization of services in rural and urban health centers and the growing importance of the biomedical industry in general in California.

In every region, health sciences and services offer career opportunities with advancement potential at multiple levels: from entry to mid to higher levels across all health industry sectors. (This section to be completed with Occupational Analysis).

As the health sciences and services system grows, it also becomes more specialized and takes on a different form in each of California's regions depending on unique demographics and economies. Competition spurs innovation and distinctiveness. With its distinctive assets, California and its regions can be leaders in developing a new kind of health sciences and services system, one that provides quality services and utilizes world-class biomedical research to promote significant advances in health.

However, critical infrastructure and workforce requirements are not yet in place. There is nothing less than a crisis in terms of workforce shortages in critical skills areas such as nursing where there is clear demand and often there is a failure to understand the importance of health sciences and services as an economic driver in many regions. Health sciences and services is still viewed as primarily a social service or part of the community infrastructure, rather as an economic priority, a growing cluster of opportunity with many career pathways.

The Health Sciences and Services Cluster has distinctive urban and rural forms that are profiled separately in this chapter, including region-by-region overviews and trends.

What are Key Characteristics of the Cluster in Urban Areas?

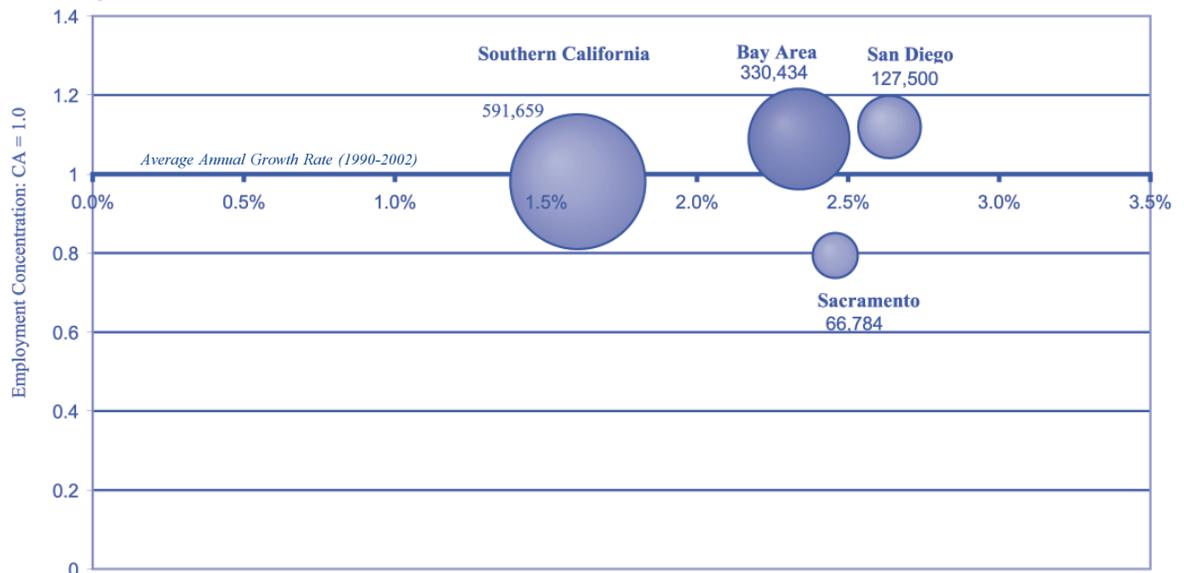
The ongoing convergence of Health Sciences and Services creates new economic opportunities in urban regions across California. Urban hospitals face tremendous competition to distinguish themselves by offering specialty medical care and establishing linkages to research universities in the region (e.g. Stanford, UCSF, UC Davis, UCLA). In turn, these universities serve as major incubators for highly sought after medical care, scientific R&D and medical technology. They also serve to educate and train a skilled medical staff. In addition, the renowned universities are able to leverage capabilities to attract major Federal funding, e.g. from the National Institutes of Health (NIH), as well as business, angel and venture capital funding to the region to promote cluster development.

Among the urban regions, health sciences and services employment grew at an average annual rate of 2% with the outward sectors at 1.6% from 1990-2002 and the support sectors at 3% over the same time period. In the Southern Border, Southern California, Bay Area, as well as Greater Sacramento, the convergence of health sciences and health services are creating new opportunities for the biomedical industry to test products from R&D in clinical trials and research hospitals.

In Southern California, a director of medical research at a major research university says that for every research doctor, there is a need for 20 technicians, nurses and support personnel. The ripple effect of research dollars from the National Institutes of Health (NIH), National Science Foundation (NSF) and private funding results in impacts beyond the first line of PhDs and research scientists into a wide range of supporting occupations.

The chart below is a portfolio of the urban health sciences and services clusters, showing average annual growth rate (1990-2002) on the x-axis, employment concentration on the y-axis and employment (size of circle). What follows is a discussion of the chart information for each of the four urban health sciences and services clusters.

Portfolio of Regional Health Care Clusters for California's Urban Areas



Size (2002), Concentration relative to CA (2002) and Growth Rate of Urban Health Care Cluster (1990-2002)

Southern California

Southern California has the largest health cluster (45% larger than any of the four urban regions) as measured by jobs. The region had more than 591,000 people employed in health sciences and services in 2002 – 71% of jobs are in the outward sectors and 25% are in the support sectors.

The cluster is growing at a steady clip, with an average annual employment growth of 1.6% during the past 12 years. This pace increased in the past two years, where average annual growth reached 3% during the period from 2000 to 2002. In total, Southern California health sciences and services employment grew from approximately 488,800 jobs in 1990 to nearly 591,700 jobs in 2002.

Within the region, the importance of health sciences and services employment is increasing as cluster employment becomes a larger share of regional employment. Health sciences and services employment grew as a percentage of regional employment from 7.7% in 1990 to 8.7% of regional employment in 2002.

However, relative to the other regions across California, Southern California's employment in health sciences and services is no more specialized today than it was 12 years ago in 1990. Cluster employment concentration has remained close to 1.0, relative to the concentration of employment in health sciences and services across the California.

In fact, when compared to the U.S., Southern California's health sciences and services cluster does not look like a competitor on the national scene. Relative to the U.S. Southern California's health sciences and services cluster shows employment well below average; in 2002, health sciences and services was .71 (about 70%) of the average employment concentration in the health sciences and services cluster across the U.S.

Southern California Health Care Subsectors

Southern California	AAGR 2000-02	US LQ 2002
Pharmaceuticals	3.1%	1.04
Medical Testing Labs and R & D	0.8%	0.69
Medical Equipment and Devices	-0.2%	1.26
Hospitals	2.7%	0.64
Home Health and Residential/ Nursing Care	4.0%	0.57
Health Practitioners	3.4%	0.87
Other Health Services	5.2%	0.71

Source: EDD, BLS

The following table shows the sub-sectors where Southern California specializes, relative to the U.S. and compares that information to employment growth during the past two years.

Two health sciences and services sub-sectors show higher than average employment concentrations compared to California as a whole. In Southern California these sub-sectors are Pharmaceuticals (1.04), and Medical Equipment and Devices (1.26). Employment growth areas during the past two years tend to fall into the health services category with the exception of growth in Pharmaceuticals.

- In the past two years, employment growth has been strongest in Other Health Services; within emergency and other relief services leading growth at a 10% increase from 2000-02.
- In Home Health and Residential/Nursing Care, employment in community care services for the elderly grew 10%, followed by 7% growth in home health sciences and services.
- Among health practitioners, illustrative examples of the fastest-growing category of employment include optometrists, chiropractors, mental health practitioners, midwives and dental hygienists.

The Southern Border

The Southern Border Region, concentrated primarily in San Diego County, has become a prototype biomedical cluster. Among the urban regions of California, Southern Border has the strongest export sectors in scientific R&D and hospitals and the overall highest employment concentration for health sciences and services in California. Since 1990, the cluster has exhibited continued and steady growth (average annual growth rate of 3%). It has been able to leverage the R&D strengths of UC San Diego, Scripps and the Salk Institute and their ability to attract NIH and other research dollars to help seed and the spin off over 50 biomedical firms.

Southern Border's health sciences and services cluster is the fastest growing of the four urban regions and by comparison, it has the third-largest number of health sciences and services jobs.

- In 2002, there were approximately 127,500 employees in the cluster and health sciences and services makes up about 10% of regional employment.
- The region added more than 34,000 jobs during the past 12 years, growing from 93,300 jobs in 1990 to 127,500 jobs in 2002.
- During the past 12 years, health sciences and services job growth outstripped the pace of regional job growth. While health sciences and services grew 2.6% annually between 1990 and 2002, regional jobs grew 2%.

The importance of the health sciences and services cluster and its employment continues to increase as health sciences and services is a growing share of total employment in the region. As a share of regional employment health sciences and services grew from 9.1% in 1990 to about 10% in 2002.

Southern Border has developed strong regional specialization in health sciences and services. Compared to California as a whole, the health sciences and services cluster is 12% more concentrated in the region than elsewhere. This is a slight decline from an employment concentration of 1.16 in 1990.

The following table shows the sub-sectors where Southern Border specializes, relative to the U.S. and compares that information to employment growth during the past two years.

Southern Border Health Care Subsectors		
Southern Border	AAGR 2000-02	US LQ 2002
Pharmaceuticals	3.5%	1.45
Medical Testing Labs and R & D	8.2%	3.14
Medical Equipment and Devices	1.9%	1.46
Hospitals	3.0%	0.47
Home Health and Residential/ Nursing Care	0.8%	0.56
Health Practitioners	3.0%	0.87
Other Health Services	1.9%	0.91

Source: EDD, BLS

During the 1990s, Southern Border continued to keep a firm grasp on its biotechnology industry employment. This specialization shows in the data, especially in terms of high employment concentrations in highly specialized research, medicine manufacturing and new product development.

- Southern Border specializes in Medical Testing Labs and Research and Development. This sub-sectors' employment concentration is three-times that of the nation, 3.1 in 2002. Employment in the sub-sector grew by 8.2% annually during 2000 and 2002.
- Pharmaceuticals and Medical Equipment and Devices are strong sub-sectors for the region that show important employment concentration compared to the U.S., 1.45 and 1.46 respectively.

Employment growth during the past two years has focused on two areas, the R & D activities that have continued to be a source of growth for the region throughout the 1990s and increasingly in health services. Hospital employment grew 3% as did Health Practitioners.

The Bay Area

The Bay Area Region has the second largest number of health sciences and services jobs of the four urban regions and has the highest percentage (76%) of its health sciences and services jobs in the outward sectors.

The cluster overall has experienced growth (2.3% AAGR from 1990-2002) with a slight decline in recent years (AAGR down from 4% from 1994-2002 to 3% from 2000-2002).

- Today, health sciences and services-related firms in the Bay Area employ more than 330,400 people, an increase from 250,400 jobs in 1990.
- Since 1990, the region added more than 80,000 jobs, growing 2.3% on an annual basis and 32% overall.
- Bay Area health sciences and services employment growth (2.3%) outstripped regional employment growth (1.0%) and also out-performed California's overall health sciences and services cluster growth (2%) during the same period from 1990 through 2002.

The importance of health sciences and services to the Bay Area region has grown as health sciences and services employment becomes an increasing share of regional employment. In 1990, the health sciences and services cluster was 8.2% of all regional employment. By 2002, that percentage shifted to 9.6%.

Relative to California as a whole, the concentration of Bay Area health sciences and services employment suggests a regional comparative advantage. Growth in the Bay Area's employment concentration relative to California suggests increasing comparative advantage in the sector.

- The concentration of employment in Bay Area health sciences and services grew from 1.04 in 1990 to 1.09 in 2002.
- As a whole, relative to the U.S., however, the Bay Area health sciences and services cluster is not as concentrated, and was about .78 in 2002. However, within specific sub-sectors, the Bay Area shows strong specialization.

Bay Area Health Care Subsectors

Bay Area	AAGR 2000-02	US LQ 2002
Pharmaceuticals	3.1%	1.49
Medical Testing Labs and R & D	4.0%	2.04
Medical Equipment and Devices	-4.3%	1.41
Hospitals	1.7%	0.6
Home Health and Residential/ Nursing Care	4.4%	0.53
Health Practitioners	3.8%	0.93
Other Health Services	-0.4%	0.78

Source: EDD, BLS

The Bay Area's strongest health sciences and services sectors are in the Health Sciences. The Bay Area shows comparative advantage in employment concentration relative to the U.S. in Medical Testing and Labs and R&D (2.04), Pharmaceuticals (1.49) and Medical Equipment and Devices (1.41). During the past two years, employment growth in Pharmaceuticals and Medical Testing and Labs has outpaced regional health sciences and services growth (3.1%) and regional job growth as a whole (1%). The Medical Equipment and Device sub-sector actually lost jobs (-4.3%).

In Health Services, jobs growth is highest in Home Health and Residential Nursing Care – within this category, employment grew 6.6% in Outpatient Care Centers and 5.7% in Other Residential Care Facilities. This may be explained by greater Hospital outsourcing of less-intensive patient care, a trend that is widely expected to continue as an economic response to the rising cost of health sciences and services.

Greater Sacramento

The Greater Sacramento region is the smallest of the urban health sciences and services clusters with 66,784 jobs in 2002. However, the cluster continued to grow throughout the 1990s and into 2002 at a 2.5% AAGR from 1990-2002 and 3% from 2000-2002. Health sciences and services is an increasing driver of new job growth in the region, especially in the most recent period from 2000 to 2002.

- The number of health sciences and services jobs in Greater Sacramento increased by 34% from 49,900 in 1990 to 66,800 in 2002.
- Between 1990 and 2002, health sciences and services was responsible for about 8% of the Greater Sacramento Region's overall job growth. However, between 2000 and 2002, 13% of Greater Sacramento's new jobs were created in the health sciences and services cluster.

While health sciences and services has grown in the region, it is only growing incrementally as a proportion of total regional employment. Health sciences and services employment was 6.8% of regional employment in 1990 and about 7% of regional employment in 2002.

Relative to rest of California, Greater Sacramento has not yet distinguished itself as a health sciences and services center. Although health sciences and services employment is growing in the region, it is not keeping pace with the growth of health sciences and services across the rest of the state.

- Greater Sacramento's cluster employment concentration was .87 in 1990 and was reduced to .79 by 2002.
- Relative to the U.S., Greater Sacramento fares even worse, its employment concentration is .57 when compared with the same cluster nationally.

Sacramento Health Care Subsectors

Sacramento	AAGR 2000-02	US LQ 2002
Pharmaceuticals	3.4%	0.19
Medical Testing Labs and R & D	2.1%	0.28
Medical Equipment and Devices	-0.1%	0.31
Hospitals	2.6%	0.55
Home Health and Residential/ Nursing Care	3.6%	0.49
Health Practitioners	2.2%	0.77
Other Health Services	16.6%	0.8

Source: EDD, BLS

The Greater Sacramento's employment strengths are in the health services with the highest employment concentrations among Health Practitioners and Other Health Services. This matches the industry composition of the more rural regions of California. However, recent employment growth in the Health Sciences indicates the beginning of a shift within the region.

In the Greater Sacramento region, UC Davis is beginning to play an important role in the development of an emerging biomedical cluster. According to UC Connect with data from the National Science Foundation, UC Davis ranks 1st in total R&D expenditures in a number of areas, #1 in agricultural sciences, 6th in biological sciences and 11th in life sciences. UC Davis has developed a Biotechnology Program to train all levels of life scientists from the Bachelors to PhDs for a growing industry base lead by Genentech in Vacaville. Genentech recently announced a business expansion in Solano County, next to Davis, because of the availability of talent both from the University and bio technicians (Associate Degrees) from the Solano Community College.

What are Key Characteristics of the Cluster in Urban Areas?

While health sciences and services employment is growing in every rural region, each region is developing its own specializations depending on its population and economy. Overall, in rural areas, health sciences and services is heavily concentrated in care for the local community, attracting some from outside the region for specialized forms of care.

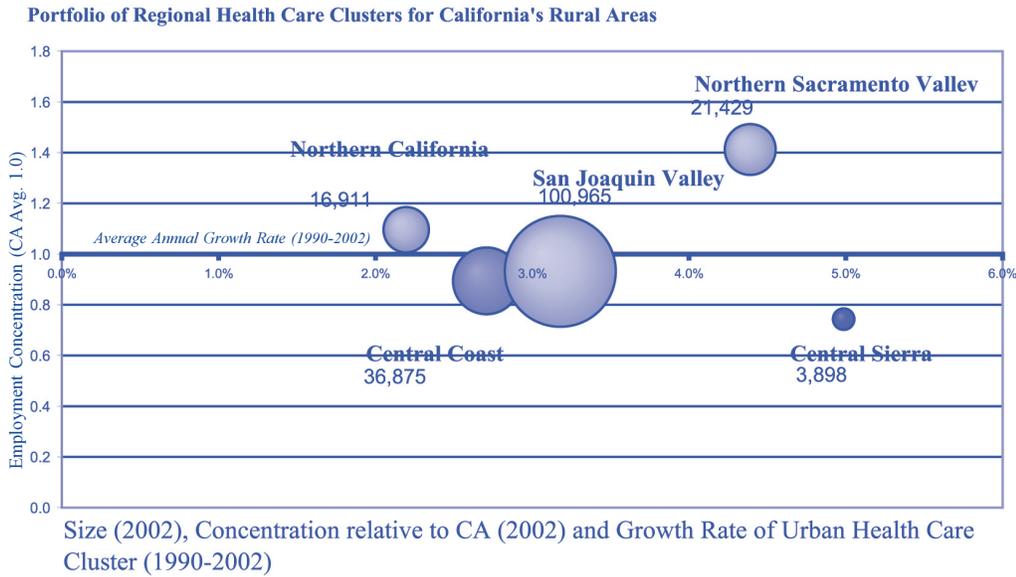
In 2002, approximately 120,000 people were employed in the outward oriented sectors, making up 66% of all the employees in health sciences and services in the rural areas, with an average annual growth rate of 2.7% since 1990. In 2002, approximately 56,200 were employed in the secondary sectors, making up 31% of all the employees in health sciences and services in the rural areas, with an average annual growth rate of 4.5%. Overall in the rural regions, the health sciences and services sector has grown considerably since 1990 with an average annual growth rate of 3% from 1990-2002.

Much rural health expansion has been driven by population growth and retirement. Some regional health centers have emerged which attract specialized health services to the area. With this growth has been an increasing need for better partnerships between hospitals and local health providers and educational institutions to address shortages in staffing—primarily for nursing, and specialty health professions. In addition, information technology is becoming more important in hospitals today, with staff needing to be trained to use this technology.

Increasing specialization within rural areas creates regional opportunities for exporting health services as well as building regional health centers. In rural areas the integration of health sciences and health services creates opportunities to differentiate services through the application of health sciences and information technologies to the specific issues of rural health delivery. Increasingly, rural health centers will begin to differentiate and specialize in areas of high demand, e.g. serving the changing character of rural regions (becoming more populated and older).

Northern Sacramento Valley has the overall highest concentration of employment with particular concentrations in community care facilities and residential care facilities. It is also the second fastest growing cluster with 4% growth. It is the third largest region in terms of employment. San Joaquin Valley is the largest region in terms of employment with strongest sectors in residential care and vocational rehabilitation. Central Coast is the second largest rural region with concentrations in residential care, medical equipment and vocational rehabilitation. Northern California is the second smallest rural health sciences and services region with strong concentrations in vocational rehabilitation and residential care and a higher than 1.0 concentration in physician services, which indicates that people come from outside the area for medical professional services. Central Sierra is the smallest rural health sciences and services region with concentration in residential care and ambulatory services.

The chart below is a portfolio of the rural health sciences and services clusters, showing average annual growth rate (1990-2002) on the x-axis, employment concentration on the y-axis and employment (size of circle). What follows is a discussion of the chart information for each of the five rural health sciences and services clusters.



Northern Sacramento Valley

Of the five rural regions, the Northern Sacramento Valley is the third largest with more than 21,400 health sciences and services cluster jobs in 2002. Health sciences and services in the Northern Sacramento Valley added more than 8,600 jobs increasing from 12,800 jobs in 1990 to 21,400 in 2002. This is an annual average growth rate of 4.4%. As a comparison, the total number of regional jobs grew at a rate of 1.8% during the same period.

Within the cluster, the largest employment sub-sectors are in the health services. The region has more than 7,300 jobs in General and Medical Surgical Hospitals, 3,300 are employed in Physicians offices, and more than 2,000 are employed in Nursing Care Facilities. These same sectors, Hospitals, Home Health, Health practitioners, and Other Health Services show regional employment specialization with employment concentrations greater than one, relative to the U.S.

Northern Sacramento Valley Health Care Subsectors

Northern Sacramento Valley	AAGR 2000-02	US LQ 2002
Pharmaceutical	NA	0.00
Medical Testing Labs and R & D	10.2%	0.49
Medical Equipment and Devices	6.0%	0.52
Hospitals	0.7%	1.11
Home Health and Residential/ Nursing Care	8.9%	1.05
Health Practitioners	6.5%	1.11
Other Health Services	3.0%	1.07

Source: EDD, BLS

Medical testing labs and R&D had the strongest employment growth within the sub-sector: 10.2% in the 2000 to 2002 period. Regional employment in medical and diagnostic testing labs more than doubled from about 150 employees in 1990 to more than 350 in 2002. The job increase in this sector far outpaced the growth of the same sector across the state, as shown by an increasing employment concentration relative to California. Medical and diagnostic testing labs grew from an employment concentration of .8 in 1990 to 1.57 in 2002. A second area of growth was in the Scientific Research and Development Services, which grew rapidly in the 2000-2002 period adding jobs at a 20% rate (albeit growing from a small base of 124 in 2000 to 180 jobs in 2002).

Some growth has also taken place in the Redding area with the location of several large medical device headquarters and subsidiary manufacturing and design companies. Arthrotek, a sports-medicine subsidiary of Biomet focusing on the design and engineering of machines used in arthroscopic surgery and Perdell International which manufactures electrodes for use in rehabilitation, have both located in the region.

San Joaquin Valley

The San Joaquin Valley region has the largest health sciences and services cluster with nearly 101,000 jobs in 2002. Growth has been steady in the cluster with an AAGR of 3.2% from 1990-2002. This compares to an overall regional job growth rate of 1.7% during the same period.

Within the cluster, the largest employment sub-sectors are found in the health services. Offices of physicians employed more than 20,000 people, general medical and surgical hospitals were more than 28,000 people, and more than 11,000 jobs were in residential nursing care facilities.

San Joaquin Valley Health Care Subsectors

San Joaquin Valley	AAGR 2000-02	US LQ 2002
Pharmaceutical	0.8%	0.05
Medical Testing Labs and R & D	8.5%	0.33
Medical Equipment and Devices	-3.2%	0.47
Hospitals	1.7%	0.62
Home Health and Residential/ Nursing Care	2.6%	0.64
Health Practitioners	4.8%	0.89
Other Health Services	7.4%	0.89

Source: EDD, BLS

Between 2000 and 2002, the strongest areas of employment growth were in medical testing labs and R&D. This is a recent phenomenon, as this sub-sector showed unremarkable employment growth through the 1990s. However all of the growth in the sub-sector during the past two years is as a result of growth in medical testing labs, employment increased 14% annually from nearly 900 jobs in 2000 to more than 1,165 in 2002.

Other areas of strong employment growth are in outpatient care facilities, home health, and other health services including residential care, vocational rehabilitation, and emergency relief services.

Central Coast

Central Coast employment in health sciences and services is the second largest among the rural regions. In 2002 the region had 37,000 jobs in the cluster. Within the cluster, the largest employers are general and medical surgical hospitals with more than 8,000 employees in 2002 and about 22% of the region's total employment in the cluster. More than 2,500 were employed in nursing care and facilities while the offices of dentists employed about 2,100 people.

As a whole, the health sciences and services cluster on the Central Coast grew 2.7% annually while the rest of the economy grew 1.6% annually during the period from 1990 to 2002. Growth in health sciences and services accelerated in the most recent period: 3.8% from 2000 – 2002 while the rest of the economy grew at a rate of 0.7%.

Between 1994 and 2000, one of the region's fastest-growing sub-sectors outside of the health services was medical equipment and supplies manufacturing. Employment grew 6.3% annually from 1,475 jobs in 1994 to 2,124 in 2000. Since 2000, however, this sub-sector has added few jobs. Recent growth is in pharmaceutical companies (9.6%), among health practitioners (5.8%) and in other health services (14.3%).

Central Coast Health Care Subsectors

Central Coast	AAGR 2000-02	US LQ 2002
Pharmaceutical	9.6%	0.29
Medical Testing Labs and R & D	-10.2%	0.74
Medical Equipment and Devices	0.0%	1.59
Hospitals	2.4%	0.47
Home Health and Residential/ Nursing Care	5.2%	0.60
Health Practitioners	5.8%	0.82
Other Health Services	14.3%	0.74

Source: EDD, BLS

The health services, however, are the sectors with the strongest comparative advantage relative to the U.S. The strongest health cluster concentrations are in: other residential care facilities (2002 US LQ 1.64), medical equipment and supplies manufacturing (2002 US LQ 1.59) and vocational rehabilitation services (2002 US LQ 1.13). The residential care facilities and vocational rehabilitation have both experienced tremendous growth in recent years (AAGR of 44.3% and 21.3%, respectively from 2000-2002).

Northern California

Northern California's health sciences and services cluster employed about 16,200 people in 2002.

The largest employment was in General and Medical Surgical hospitals (5,100 jobs) followed by employment in the Offices of Physicians (3,000 jobs) and nearly 1,500 in Nursing Care Facilities.

Northern California Health Care Subsectors

Northern California	AAGR 2000-02	US LQ 2002
Pharmaceutical	14%	0.05
Medical Testing Labs and R & D	-10%	0.16
Medical Equipment and Devices	-2%	0.17
Hospitals	0%	0.77
Home Health and Residential/ Nursing Care	2%	0.75
Health Practitioners	5%	1.01
Other Health Services	-1%	1.26

Source: EDD, BLS

During the past twelve years, the health sciences and services cluster in the Northern California region grew 2.2% from 13,000 jobs in 1990 to 16,900 jobs in 2002. High growth sub-sectors were pharmaceuticals (15.3%) followed by scientific research and development services (8.7%).

At the same time health services continues to grow with substantial employment gains in home health care, outpatient care, and vocational rehabilitation services. The region has strong employment concentrations in vocational rehabilitation (2002 US LQ of 1.95) and other residential care facilities (2002 US LQ of 1.44) and has an overall cluster concentration of .79.

In addition, physicians' offices and dentists' offices also exhibited LQs greater than 1.0, which suggests that the region serves people from outside of the local area in medical professional services.

Central Sierra

Central Sierra is the smallest of the rural regions in terms of health sciences and services employment. In 2002, the region had approximately 3,900 jobs. Annual growth in the cluster was approximately 5% from 2,170 jobs in 1990 to 3,900 in 2002. Much of the employment growth during this period took place between 1990 and 1994 when the region added 1,100 jobs. Many of these jobs were in the health services, particularly in offices of physicians, dentists, and other health sciences and services practitioners and in care for the elderly.

Regional employment specialization is in the health services. The largest components of the cluster are general and medical surgical hospitals (1,180), and the offices of physicians, dentists, and other health care professionals employed 1,170 people. The overall cluster LQ relative to the U.S. was .54 in 2002. Employment growth often appears volatile in the region because the employment base is small and changes to the base have large effects. For example in the period from 1990 to 2002 – the AAGR from 1990-1994 was 11.5% whereas the AAGR from 2000-2002 was 1%. These types of growth patterns characterize employment in cluster across the region.

Central Sierra Health Care Subsectors

Central Sierra	AAGR 2000-02	US LQ 2002
Pharmaceutical	-64.6%	0.01
Medical Testing Labs and R & D	-14.3%	0.06
Medical Equipment and Devices	0.0%	0.12
Hospitals	4.0%	0.52
Home Health and Residential/ Nursing Care	2.1%	0.54
Health Practitioners	-3.5%	0.67
Other Health Services	8.2%	0.86

Source: EDD, BLS

Within the home health and residential/nursing care sub-sector is a high concentration of employment in other residential care facilities, with a U.S. location quotient of 1.78. Within the other health services category, ambulatory services have high employment also with a U.S. LQ of 1.78.

Key Opportunities and Requirements for Future Growth and Competitiveness

California has a golden opportunity to leverage its health sciences and services cluster for enormous economic and social benefit to the state. However, California also faces an immediate crisis of workforce shortages in every region, at every occupational level. Reconciling this opportunity and crisis must be a top priority of workforce and economic development, and local, regional, and state leaders.

Opportunity Driven By Expanding Convergence and Choice

Opportunities for future growth and competitiveness will be driven by convergence of health sciences and services and the expansion of choices in health services, often enabled by technology, including home, residential, and other health care options.

Given their assets, California and its regions have the opportunity is to be a world leader in the convergence of health sciences and services. California is the birthplace of biotechnology and continues to be at the center for innovation in biomedical and life sciences. California leads among states in biotech firms, patents and university R&D. Its urban regions rank among the leaders in biomedical and life sciences.

To date, biomedical research has not been fully connected to health services. California's regions, especially in the Southern Border, the Bay Area and Southern California have the opportunity to demonstrate how stronger linkages can be forged in the innovation pipeline to accelerate the commercialization of biomedical products and services through clinical trials and production through partnerships between California's research universities and biomedical firms.

Current trends also suggest that health services options are expanding rapidly, along with needs for health care workers in many different settings. Some of the fastest growth in care and employment are taking place in non-hospital settings. This is a natural expansion of choices based on cost, new enabling technologies, and customization to customer demand.

With an enormous, diverse consumer base, including an aging baby boom generation, California will have the opportunity to meet the health needs of its population in new and creative ways, as well as draw consumers from outside the state into areas of specialization.

Requirements: Attack the Statewide Health Workforce Crisis and Accelerate the Convergence of Sciences and Services

Attack the Statewide Health Workforce Crisis

In every region, both urban and rural, health workforce shortages have been identified as a critical challenge that must be urgently addressed. The situation in the San Joaquin Valley, as described in a recent Great Valley Center report, is similar across the state, from the most urban to the most rural regions of California:

Severe shortages exist, not only in selected occupations, but also across the occupational and industry spectrum. People are needed at all levels—from entry-level jobs such as home health aides to mid-level occupations such as medical technicians to high-skill, high-pay positions such as registered nurses. There are opportunities along many career pathways—in clinical, administrative, and technical fields. The situation is not that of isolated mismatches, but rather a systematic shortfall of skilled people in the health care field. (*Good Medicine: Making Health Services an Economic Priority in the San Joaquin Valley*, Great Valley Center, 2003).

There are shortages in nursing, among pharmacists, imaging and x-ray technicians and clinical lab technicians—statistics and anecdotes abound. According to Bay Area Works, 65% of hospitals in that region report that these shortages at crisis proportions. Hospitals are using foreign recruitment, aggressive wage and salary retention programs, incentive sign-on bonuses, and bonuses to stay on. Some hospitals are paying up to \$25,000 per head for employees through recruiters.

California's urban areas face an additional "talent squeeze" as demand for skilled workers increase while housing costs continue to rise. Each region needs to both continue to recruit top talent to their areas while producing more homegrown talent from local educational institutions. More education and training is needed because the high cost of housing is making it increasingly difficult to recruit young talent from other parts of the country and the world; this talent shortage becomes a constraint to moving biomedical research into commercialization in urban areas. It should be noted that the talent squeeze caused by high housing costs is also increasingly impacting some rural areas of California.

A substantial portion of the talent squeeze comes from a dearth of skilled technicians with certificates and 2-year degrees. A recent study of biomedical industry in the Bay Area found "hundreds of biotech jobs in Alameda, Contra Costa and Solano Counties go begging due to lack of qualified talent." The report commissioned by eight economic development groups suggests that the most difficult positions to fill involve skilled technicians with two years of community college or the equivalent training, who can expect to earn about \$35,000 annually.

The requirements for skilled staff extend to rural regions where trained, skilled and computer-savvy medical staff are in short supply. In rural regions there is a need to work with local community colleges and technical schools to retool the curriculum to more tightly link the clinical with the technical. Well-trained staff will help rural health services integrate new technologies with health care delivery.

Smaller and rural hospitals struggle to integrate new technologies into their delivery of care, but they are acutely aware that they must make the difficult and expensive transition to an integrated IT hospital-wide system. Rural hospitals struggle to apply information technology to the streamlined delivery of services and patient processing. Big HMOs like Kaiser are at the forefront of integrating information technologies into daily health services operations. In the long run, such a transition will help to improve efficiency of the system and could allow health care professionals to spend more time with their patients.

In sum, acute shortages are having an immediate impact on the quality of health sciences and services and are driving up health costs as providers have to recruit talent from outside of the state. Just as importantly, over the long term, they will constrain California from benefiting economically and socially from the growing convergence and choices in the global health field.

The problem is clear. Health sciences and services is one of the fastest growing industries in every region, yet the supply of skilled talent has not kept pace with growing demand. Regions with high unemployment such as the San Joaquin Valley have experienced an especially rapid growth in health sciences and services demand creating critical skills shortages. In these regions, there exist a major labor demand and supply mismatch, due to a wide range of barriers, some of which are “induced” by public policies.

At its core, the problem is a “pipeline” issue that requires partnerships among industry and education at each stage of the pipeline to get youth interested in health sciences and services early and then build greater capacity for nursing and other health programs through the community college and university systems. Career pathways need to be targeted, helping to expand the supply of skilled health professionals at all levels through preparation, transition, promotion through skills upgrading.

The problem is, however, too big for any one region or stakeholder in the system to solve. Individual employers are pursuing a number of creative strategies to recruit and train a skilled workforce. Individual educational institutions are trying to expand their programs, but are often constrained by funding decisions made in Sacramento or by competing priorities within the institution or their community. Both employers and institutions have created innovative partnerships, but those efforts have thus far remained relatively small in scale and impact.

Instead, what is needed is an unprecedented partnership between California’s regions and state government to attack the health workforce crisis.

To date, employers have tried many strategies, with limited success:

- Stepped up their local and regional recruiting, luring employees from one another. These strategies have proven to be no more than a short-term fix, with most health care executives agreeing that it does not offer a long-term solution.
- Tried to recruit talent from other regions with sporadic success. The shortage in key occupations, such as nursing, is a national problem, so the competition is fierce for a limited pool of skilled workers.
- Tried to grow the pool of workers locally, investing in local colleges, universities, and other education and training programs. While this strategy has expanded programs over time, the production of graduates in most health care fields remains a fraction of what is needed.

- Offered scholarships, flexible work-education arrangements, and other incentives. Some have tried to increase awareness of health careers early in the K-12 educational system: providing information to students, teachers, and counselors. Although these steps are positive, these individual strategies have had only an incremental impact on workforce shortages.
- Tried to collaborate with one another as well as with educational institutions. However, employers are widely dispersed, strongly competitive, and often financially strapped, discouraging lasting collaboration in addressing workforce shortages. Thus far, current collaborations have been limited in scope and experimental in nature, only slightly increasing the number of graduates.

While workforce shortages are growing, student demand for health-care careers is expanding. Several institutions have made new commitments in recent years, creatively assembling resources to pay for essential, but expensive, programs. In fact, many health care executives interviewed give generally good marks to the institutions for doing what they can under difficult constraints. But, education and training programs in health services are not expanding as quickly as student demand, resulting in waiting lists and lotteries to ration access to some programs.

For both external and internal reasons, institutions have not responded adequately to the problem:

- They are under severe budget constraints, especially with recent state-level deficits and cutbacks. They simply cannot *significantly increase* programs of any kind without additional resources. Health employers have provided some additional resources so institutions could expand beyond what they would otherwise be able to do with public funds alone, but the long-term ability of employers to provide this funding is uncertain.
- They face a major structural impediment. The prevailing state funding formula based on a total enrollment cap discourages expansion of comparatively more expensive programs, such as many of those in health services. Public institutions are funded per full-time equivalent student (FTE) up to a capped total amount—making the cost of individual programs per FTE a critical factor. Programs with more expensive laboratories, equipment needs, instructor costs, and low faculty-student ratio requirements compete with programs that can accommodate more students at lower costs. This structural disincentive constrains growth of higher-cost programs, even in the face of enormous employer needs and student career opportunities in a field such as health services.
- Also, the relative shortage of instructors in key health fields and clinical sites for student training constrains expansion of programs.

Even with these external constraints, institutions also make internal choices that limit the expansion of health services programs. Institutions can (but in many cases do not) significantly reallocate resources to grow more expensive programs that serve clear local needs, even if it means serving fewer students overall. With external funding constraints and many competing interests among the faculty, administrative staff, and elected boards, internal reallocation of resources means one program will expand at the expense of another—a politically unpalatable choice in many cases. Without strong leadership from within the institution, a strong rationale for educating people for good careers in the region, and strong state-level incentives and priority, there is little chance significant reallocations will occur.

Whatever their merits on other grounds, new nursing ratios established at the state level by the California Department of Health in January 2004 are exacerbating an already severe problem. The new rules require that hospitals have a 1:6 nurse ratio for all inpatient care, with the ratio becoming 1:4 in certain hospitals in 2005. While this creates even greater demand for nurses, hospitals are looking at hiring fewer certified nursing assistants and more licensed and registered nurses. This eliminates an important career ladder opportunity within the health system and creates more shortages in the nursing pipeline. If the state of California is going to mandate these kind of staffing ratios, but not pay for the education and training required to meet the increased workforce demand, then the problem will likely worsen.

In addition to these employer, institutional, and state-level constraints, local communities and broader regions have not generally made health services an economic priority. Many elected officials, community leaders, and others have naturally focused on access and affordability to health care as a priority. However, few have championed growing health sciences and services as a priority source of economic opportunity, creating good jobs with career potential and generating increases in much-needed public revenues. Many business leaders in communities and regions have made economic prosperity a priority, but few outside of health care are working aggressively to promote health services as a promising opportunity.

Global Companies Will Locate Where They Can Find Talent

The bottom-line is that global companies in the biomedical field make location decisions based on access to talent. Will California be able to meet their needs?

Genentech is one of the “stars” of the California biotech industry along with Amgen based in Southern California; they are the oldest and most profitable of these R&D intensive businesses. When *Genentech* based in South San Francisco needed 1,000 new technicians in 2004, it participated in a retraining program with Skyline College. The program helped laid off workers from the United Airlines Maintenance Facility at San Francisco Airport gain the skills necessary to enter *Genentech* as technicians. Because of its decision to expand manufacturing operations in Vacaville, *Genentech* is now doubling its facility in that location with a need for an additional 500 technicians. Most of these technicians will be filled by Solano Community College, which has a program in biomanufacturing. The availability of this talent pipeline has been credited with influencing *Genentech*’s decision to expand in the region.

Genencor, formed as a joint venture between *Genentech* and *Corning*, spun off as a separate company in 1994 and chose to locate its headquarters and R&D in Palo Alto. This was to take advantage of talent supply from local Stanford University regional UC campuses as well as have access to additional bio-related talent generated by nearby *Genentech* and its offspring. While its 400 employee Palo Alto office is mostly focused on R&D and drug discovery it draws about 80% of its workforce from universities and 20% from community colleges. Lab technicians entering with AA degrees can combine internal training and on the job experience to reach the equivalent of a BA once in the firm. *Genencor* has clearly benefited from the regional talent cluster, which is essential to its global success. However, its leadership raises the concern that recent cutbacks in funding for public universities and colleges will have a “ripple effect” across the cluster. Will funding cuts diminish the ability of California firms to attract and retain the talent required to stay on the leading edge of innovation?

Accelerate the Convergence of Sciences and Services

Health sciences and services are converging into a single world-class set of clusters in California. The key to the future of these clusters is promoting continued innovation through support for R&D and commercialization and filling the talent “pipeline” from K-12, through community colleges to universities. As the director of the UC Davis Biotechnology program has observed: “we must have a workforce when our firms are ready to expand.” Better science education in K-12 is key to a better health sciences workforce, which, in turn, is key to a competitive health science and services. “Kids need to be turned on to science by the fifth grade or we lose them.”

California must forge stronger linkages among R&D, commercialization and incubation, and education and workforce training. State funding of collaborative university based research centers such as the California Quantitative Biomedical Research (QB3) involving UC San Francisco, UC Berkeley and UC Santa Cruz is a step in the right direction. So is the UC Davis Biotechnology Program, which is focused on increasing multidisciplinary education and training in biotechnology. The UC Davis program partners with corporations, CSU Sacramento and community colleges to produce PhDs, MS/BS and AA level talent.

The monograph on innovation and competitiveness provides additional insights into the importance of state and regional strategies to promote a pro-innovative economic strategy, especially at the leading edges of science and technology. California has a clear lead in this area and we need to ensure that we continue to maintain that lead by investing in the human and technology infrastructure essential for future competitiveness.

III. IMPLICATIONS FOR STATE AND REGIONAL ACTION

Implications for State and Regional Workforce and Economic Policy

The good news is that health sciences and services is a large, fast-growing economic driver in every California region, offering a wide variety of jobs with career potential. The bad news is that the state must act boldly to ensure that this cluster remains strong and competitive in the years ahead—or risk losing ground to other, more aggressive states and regional health care complexes nationwide and globally.

There are clear implications from this cluster analysis for state and regional workforce and economic policy. California and its regions must be bold in:

- Rapidly and substantially expanding the workforce pipeline
- Fueling the innovation process in health sciences and services
- Promoting California as a leader in health sciences and services.

Bold State and Regional Action to Attack the Workforce Crisis

Bold action is clearly required. There needs to be, in effect, a declared “state of emergency” regarding the workforce crisis in health sciences and services. The stakes are too high to muddle through with marginal approaches any longer. Without an adequate talent pool and an effective talent pipeline, the future of health sciences and services in California is at risk.

California is not alone. Other states and countries are rushing to try to figure out how to address this challenge. With its already-strong assets in health sciences and services, California can and should be among the leaders. The state can and should be able to capitalize on this golden opportunity for economic and social progress, rather than settle for the crisis-driven system that is in place today.

The first step is to recognize that health sciences and services is more than just an essential part of community infrastructure and quality of life, but a significant contributor to the economic well-being of Californians. Health sciences and services must be embraced as not only a *social need*, but an *economic priority* in regions and the state as a whole. This requires a shift of thinking from conventional wisdom about the sources of economic growth in California, which have tended to focus on agriculture in the rural areas, manufacturing as an export industry, and “high tech” information industries.

State leaders could declare a state of emergency for health care professions, including increasing the capacity at public institutions through new funding and changes in state funding formulas and other provisions to create incentives and remove disincentives for expanding education programs for health care professions. For strong economic opportunity and development reasons, health care professions can be targeted as “critical occupations” justifying differential treatment within the public systems. Today, there exist waiting lists of already-qualified applicants for education programs in the health professions at public institutions.

Even with increases in existing programs at public institutions, new kinds of “intermediaries” are likely required to accelerate the speed and scope of change. These regionally-based intermediaries would involve partnering among Workforce Investment Boards, community colleges, universities, and health providers. Experiments are already being pursued in regions across the state with some success (e.g., the Paradigm program in the San Joaquin Valley), as well as in other states across the country. However, these efforts have been small in scale. A major scaling-up of the most effective initiatives and state and regional seed money for innovative efforts that have strong employer involvement and investment would be bold steps in the right direction.

Targeted and Sustained State and Regional Action to Fuel Innovation

California and especially its urban regions currently have a lead in health sciences that must be maintained through continued investments in R&D and commercialization through focused innovation strategies. Discovery and inventions in these fields will drive future economic growth as they change the nature of the health care system, converge with other emerging industries such as nanotechnology as well as information technologies (e.g. bioinformatics, genomics). California needs to provide continued support for its world-class universities and research centers for advances in health sciences and services. Targeted and sustained action includes:

- State leadership in actively providing targeted investment and aggressively pursuing federal funding for biomedical fields and institutions in California, including convergence with fields such as information and nanotechnology
- Regional collaboration among localities and institutions to leverage existing strengths in biomedical fields, ensure strong connections between innovation in health sciences and services, and align workforce and economic development strategies in these fields

Promote California as a Leader in Health Sciences and Services

California has the right ingredients for developing a new model of health care that better integrates advances in health sciences with health services to provide higher quality care for individuals at reduced costs through major innovations in the health care system. The first evidence of this shift to a new model can be found in the specialization within the health providers and the convergence of research and services. In the future, there is the possibility of personalized medicine based on advances in bioscience including genomics which would allow health care to be tailored to the specific needs of the individuals. Some regions of the country such as the Southern Border, the Bay Area and Southern California along with the Greater Boston region could become the leaders in creating this innovative health care system. It will require new thinking on the part of industry, government and educational leaders at both the state and regional levels. While the state has begun to move along this path, the question remains as to whether California will promote its assets and intention to be a national and global leader in a new, emerging system of health science and services.

Conclusion: How this Cluster Report Can Be Used

The information and analysis generated by The California Regional Economies Project, including this cluster report, can be used in many ways by many users across the state. It can:

- Provide local general purpose government, councils of governments and other municipal bodies with timely information on employment growth and decline by industry statewide and in each economic region to help them prepare targeted infrastructure investment plans and identify economic development priorities
- Provide State and local employment training and education organizations with detailed information on high demand occupations by industry statewide and in each economic region to assist in the development of targeted workforce investment plans, curriculum development, school to career partnerships, and industry sector initiatives
- Provide State and local economic development organizations with an analysis of industry trends in employment growth and concentration by industry statewide and in each economic region to assist them in the development of successful local economic strategies
- Provide human resource officers, employment agencies, labor councils, and community services partners with timely information about changing industry needs and occupational demands to better serve employers and workers
- Provide State and local business and industry associations and their members with an analysis of industry trends in employment growth and concentration for their industry statewide and in each economic region, to adjust their business plans to documented economic trends and conditions and assess workforce needs and gaps
- Provide State and local research organizations and consulting firms with base line data for comparative studies on the employment growth and decline of key industries statewide and in each region to assess the potential causes for these trends and their impact on the economy statewide and by region.
- Provide the Legislature (at the State and district levels) and the Administration with the ability to track the economic impact of employment growth and decline on an ongoing basis, for informing policy debates about the state of the California economy and aligning state resources and policies to support regional strategies
- Provide the general public, news organizations and opinion makers with accurate information about employment growth and decline by industry statewide and in each economic region to build a better understanding of economic trends and their implication for California workers, businesses and investors

