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#### **Author**

Nandi, Arindam

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**The Importance of  
the Global Health Sector  
in California:  
An Evaluation of  
the Economic Impact**

**FULL REPORT**

Arindam Nandi  
October 2009

## Acknowledgements

The planning team of the University of California Global Health Institute shares a vision with the greater community – a vision of California as a world leader in global health. This economic impact study, the very first of its kind in the context of global health in California, is a collaborative and multidisciplinary effort that reinforces this vision through facts.

This study has benefited from the contributions of several individuals and public and private organizations. The author would like to acknowledge funding by the Bill and Melinda Gates Foundation and the leadership and support of Anil Deolalikar, Ellen Switkes, and Charles Smukler. I thank Nicholas Leo for his excellent research assistance without which a large part of the economic analysis would not have been possible.

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Finally, I would like to thank our peer reviewers and editors – Claire Brindis, Jim Kahn, Thomas Coates, Paula Murphy, and others – for their valuable insights. In addition, I acknowledge the tremendous effort of Joyce McKinney in making the report more accessible to the general reader and Laura Myers Design for formatting and design.

Arindam Nandi  
University of California, Riverside  
[arindam.nandi@email.ucr.edu](mailto:arindam.nandi@email.ucr.edu)



GOVERNOR ARNOLD SCHWARZENEGGER

November 2009

California is the United States' gateway to the world – and the world's gateway to the United States – in every sense from tourism to immigration to trade. The global health economy is no exception, and this report documents that field's indisputable importance to our great state.

I am proud that California is such a leader in the emerging academic discipline of global health. The formation of the University of California multi-campus Global Health Institute and the efforts undertaken by other universities, nonprofit organizations and the business sector directly impact the health of California and the world.

We are home to a vibrant business community, as well as nonprofit, academic and government sectors, with a focus on global health as a substantial contribution to California's economy. But this is also about more than economic impacts: the health of people around the globe *is* the health of California. With the number of travelers through our state and the number of Californians who immigrated here from the far-flung countries of the world, the work done to improve global health has a very real impact here every day.

Sincerely,

A handwritten signature in black ink, appearing to read "Arnold Schwarzenegger".

Arnold Schwarzenegger

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## EXECUTIVE SUMMARY

California has the largest economy of any US state and one of the 10 largest in the world. It is known worldwide as a trendsetter and innovator, as the birthplace of biotechnology and the place where information technology was conceived and initially developed. California's economic position in the world, the depth of its intellectual and creative resources and its geographic position on the Pacific Rim and proximity to Latin America make it a magnet for international activity, including that related to global health.

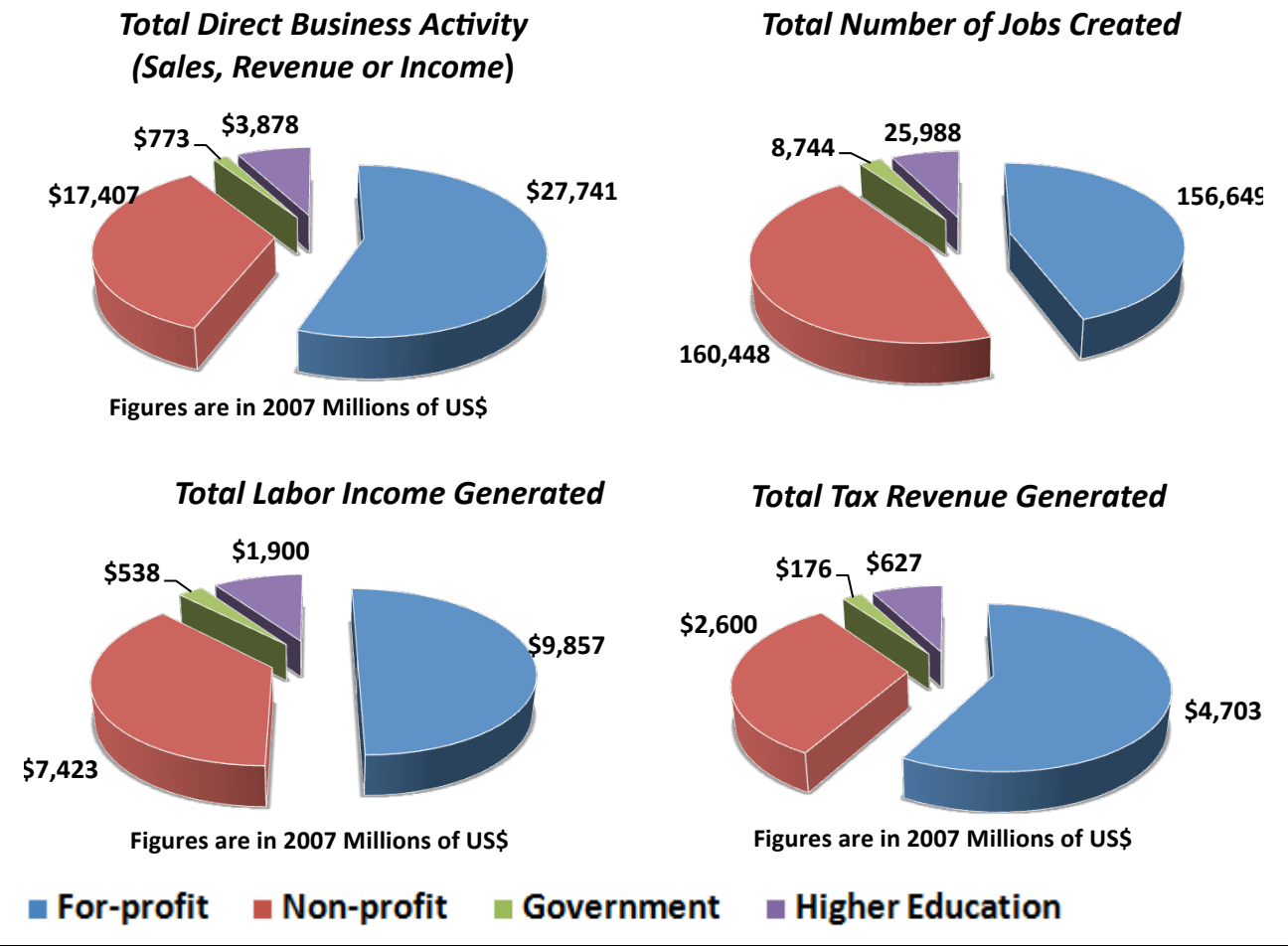
Global health is value-driven: California's commitment to health equity, water and food safety, and reversing environmental degradation here and around the world propels initiatives that have widespread benefits across all economic sectors. The state's outstanding universities, businesses and non-profits, along with government, create a robust and dynamic global health sector that has significant impacts on job creation, tax revenue and other areas affecting California and its population.

The study summarized here was commissioned by the UC Global Health Institute to quantify this impact. This report was prepared by Arindam Nandi, a doctoral candidate in economics at the University of California, Riverside, working under the close guidance and supervision of Anil Deolalikar, Professor of Economics at UC Riverside. The report evaluates the economic impact of global health on the state of California, using as a model similar studies conducted recently by the University of Washington and Duke University for their respective home states. Findings are based on economic data from 2007, which is the most recent year for which data are available.

The four sectors examined were private for-profit firms, non-profit organizations, higher education institutions and government entities. Since existing public and private economic indicator databases do not recognize the global health sector as an entity, individual for- and non-profit firms were individually identified. The business activities of all four sectors were categorized into world-market (emerging and developing economies) and domestic-market (California's international subpopulation).

The study estimated primary and secondary impacts of global health activities in California. Primary impacts are total business revenue, employment, labor income and tax revenue generated as a result of the relevant business activities in the selected entities. Secondary impacts are those economic outcomes generated in associated industries and through household spending of labor income. Figure 1 gives an overview of these findings by sector.

Fig. 1  
2007 Economic Impact (Primary and Secondary) of Global Health Activities in California by Sector



Although not recognized as a discrete economic sector, global health activities represent a substantially large part of California's economy.

For example, in volume it is comparable to the "Accommodation and Food Services" industry and bigger than many industries and service sectors such as "Agriculture, Forestry, Fishing and Hunting," or "Broadcasting and Telecommunications." It supports more jobs than many major occupation categories such as "Farming, Fishing and Forestry," "Healthcare Support" and "Architecture and Engineering."

Key findings include:

- In 2007 an estimated \$49.8 billion of business activity (revenue or income) was generated through global health activities.
- The global health sector supports 350,000 high quality jobs in California and \$19.7 billion in wages and salaries. For example, the average annual salary of workers in for-profit firms engaged in global health in the domestic market is greater than \$71,500.
- Global health-related business is a significant contributor to California's bottom line, accounting for an estimated \$8 billion or 7% of the \$114.7 billion total tax collected by the state of California in 2007.
- California's academic community is an important actor in global health in California with a total business activity of almost \$4 billion in 2007. This is almost certainly an underestimation of impact since the study was restricted to research activity only and, in addition, only research supported by local, state or federal grants.
- Non-profit organizations comprise a key element in the economics of global health in California, supporting a greater number of employees than the private sector although with a smaller overall business impact.

This report's findings demonstrate how global health activities are woven into the economic fabric of California. A picture emerges of California as a leader in global health across multiple communities — private for-profit, academia, government and nonprofit. The data presented in the full report will provide business, policymakers and institutions a sound platform for making investment decisions in global health in California.



# INTRODUCTION

This report presents the results of a study that looked at the impact of global health on the California economy. Sectors examined include business enterprises such as pharmaceutical and energy providers; non-profit organizations; federal, state and local government entities; and academic institutions. All of the enterprises included in the study contribute directly to the economy of California and have activities that intersect with global health.

## What Is Global Health?

Global health encompasses “...*health problems, issues, and concerns that transcend national boundaries, may be influenced by circumstances or experiences in other countries, and are best addressed by cooperative actions and solutions . . .*” (Institute of Medicine, 1997), and includes “...*the global ecosystem and other health determinants, such as poverty and genetics....*” (Murray and Lopez, 1996). The global health enterprise involves education, research, service, and commerce, and its opportunities and risks reflect the dynamics of a global economy: rapid movement of people, ideas, and pathogens; a changing climate; degraded and/or limited natural resources; and both human-made and natural disasters. Although a concept that continues to develop in meaning, global health in practice reflects the realities of a highly interconnected world.

The last decade has seen an intense surge of interest and engagement in global health, especially in academia, but in the general population as well. A recent opinion survey in California by Research!America found that 50% of Californians are concerned or very concerned about health problems facing the world today and 59% of Californians would be willing to pay more in state taxes to enable California to invest more in global health.

As an emerging academic discipline, global health covers highly interconnected areas ranging from all human and animal health science areas, agriculture, business, engineering, law, social and biological sciences. A poll of 45,000 University of California undergraduates showed that 65% had some degree of interest in global health, many with career interests in this new area. Global health programs have been established or are in development at the University of California campuses, Stanford, and the Claremont Graduate School. Since 2003 the number of university-based global health programs has increased from eight to 35. Programs are being established every year at such a rate that a US and Canadian university consortium (Consortium of Universities for Global Health) has been formed and incorporated in Washington, DC, to set standards, develop networks, and advocate for global health.

## Importance of Global Health in California

California has the largest economy of any US state and one of the 10 largest in the world. Given its power as a global economic force and its geographic location on the Pacific Rim, it is uniquely positioned to accrue the benefits and suffer the losses associated with global health. It is a pioneer in research and innovation and a magnet for immigrants and travelers. With some of the busiest sea- and airports in the nation, California is a hub of world commerce, but this exposure also makes it and its citizens vulnerable to external global threats such as infectious diseases, plant and animal pathogens, and terrorism. Many of the problems that adversely

affect health in developing countries worldwide are also found in communities within California — high rates of obesity, diabetes, and cardiovascular disease; limited access to health care, healthy food, and adequate shelter; infectious diseases such as HIV, malaria, tuberculosis and animal-to-human pathogens.

While global health *issues* affect the environment and the lives of California's citizens, the results of this study demonstrate that the *economics* of global health is also important to the state's bottom line.

## Methodology

Following a methodology proposed by Beyers *et al.* (2007), this report estimates global health related economic activities and their resultant impacts on the state economy by sector. It uses a standard input-output framework to analyze the economic impact of global health activities in California. For each selected global health entity, financial data were collected for 2007, the most recent year for which complete information is available. For-profit private sector firms, non-profit and volunteer organizations, government and academic institutions were the sectors examined.

- Private sector corporations were identified in areas of biotechnology, energy, environment, medical, pharmaceuticals and computer software and were selected using a list of global health related keywords. Firms were then individually cross-referenced with business description and mission statement to eliminate those whose activities were not related to global health. This study identified about 600 companies in California with global health components. Their global health activities in the world and domestic markets were estimated. [Note: Our methodology defined world market global health activities as exports to emerging and developing countries<sup>1</sup>. Domestic market global health activities were the estimated amount of business conducted with the international subpopulation living in California.]
- There are more than 188,000 non-profit organizations of various kinds registered in California. From that group we selected approximately 350 involving areas such as philanthropy, voluntarism, grantmaking, foreign affairs and national security, public safety and disease preparedness and relief.
- For the government sector, using wage and employment information from local, state and federal agencies in California, we focused on government facilities, services and policies that serve California's international subpopulation and estimated the jobs directly involved in global health.
- Academic institutions included the University of California system and others within the state that received National Institutes of Health funding.

While the recent economic downturn may have attenuated business activities in the state as a whole, it is unlikely to have changed the share of the global health sector. One must note, however, that the report methodology generates an undoubtedly conservative estimate of the global health impact to California's economy. First, the identification technique constrains the

---

<sup>1</sup> We estimated that 36% of all exports from California were to emerging and developing countries. Sectoral output estimates were used in conjunction with this to calculate the world market activity of each firm. We followed the International Monetary Fund's (IMF) definition of emerging and developing countries.

results – a narrow search base implies possible exclusion of genuine global health entities not cataloged in one or more of the selected databases. Moreover, financial data were not available for some entities. Secondly, the for-profit sector methodology attributes only an estimated percentage of total business activities to global health. Given that the global health companies are individually selected in the first place, further decimation likely results in an underestimation of the economic impact. Finally, greater economic impacts in terms of the benefits of disease avoidance, the contributions of the undocumented work force, and remittances are not included. This report is divided into two sections plus references and appendices. Section One presents the economic impact estimates of global health activities in California by sector or entity. Section Two describes in detail the data and methodology used in this report.

# SECTION ONE: RESULTS

## 1. Economic impact results

Economic impact estimates of global health expenditures in various sectors of the California economy are presented in this section and are broadly classified as primary impacts and secondary impacts. Each type of impact has been reported separately for the for-profit, non-profit, government and higher education sectors of the state economy. Whenever applicable, we also individually present the impacts generated from the world market activities and domestic market activities of our global health private companies and other entities.

For the private sector firms, these impacts are generated by using the direct revenue information of the global health firms (\$5.4 billion of world market activities and \$10.3 billion domestic market activities) as inputs. For the non-profit sector, we use \$2.08 billion of world market activities and the remaining \$6 billion of domestic market activities as inputs for the impact estimation. The inputs for the government sector are \$419.7 million annual salary and 6,295 jobs, and \$1.86 billion worth of research projects in the education sector.

*Primary economic impacts* are the actual business activities (sales or income), along with the predicted number of jobs created, employee compensation and taxes paid at the selected private firms or other organizations directly involved in global health. *Secondary economic impacts* are the sales, employment and taxes generated in firms that are not directly involved in global health activities, but are related through backward and forward industry or sectoral links and include household expenditure links. Secondary impacts generated through industry links are known as indirect impacts, and those created through household expenditure links are known as induced effects. However, due to space considerations, we do not disaggregate our reported secondary impact estimates.

The aggregated economic impact results for all the global health sectors in California are presented in Table 1. The first row shows the primary global health business activities in the world and domestic markets. These estimates, computed from primary data sources on the for-profit, non-profit, and higher education global health entities – as described in the methodology section – were mainly used as inputs to generate the rest of the figures in this table. In addition, government sector activity inputs (payroll and number of jobs) were also used. Our results indicate that the primary domestic and world market business activities generated a secondary impact of \$6.9 billion and \$17.3 billion, respectively. Thus, total business activity impact of the global health sector in California is an astounding \$49.8 billion. The overall business activity multiplier effect has a value of 1.94, implying that the \$25.6 billion of primary activities (across domestic and world markets) at the chosen global health entities generate an almost equivalent amount of economic activities through related industries and households.

**Table 1**

**Economic Impact of Global Health on the Economy of California**

<b>Economic Impact Type</b>	<b>World Market Global Health Activities</b>	<b>Domestic Market Global Health Activities</b>	<b>All Global Health Activities</b>
<b>Business Activity (Sales, Revenue or Research Grants), in Millions of 2007 US\$</b>			
Primary Impact	7,483	18,123	25,606
Secondary Impact	6,906	17,289	24,194
Total Impact	14,388	35,412	49,800
Multiplier Effect (Total/ Primary Impact)	1.92	1.95	1.94
<b>Number of Jobs Supported</b>			
Primary Impact	55,477	136,685	192,162
Secondary Impact	44,698	114,969	159,667
Total Impact	100,175	251,654	351,829
Multiplier Effect (Total/ Primary Impact)	1.81	1.84	1.83
<b>Labor Income, in Millions of 2007 US\$</b>			
Primary Impact	2,741	8,536	11,277
Secondary Impact	2,468	5,972	8,440
Total Impact	5,209	14,507	19,717
<b>Tax Revenue Generated,</b> <i>in Millions of 2007 US\$</i>	2,237	5,869	8,106

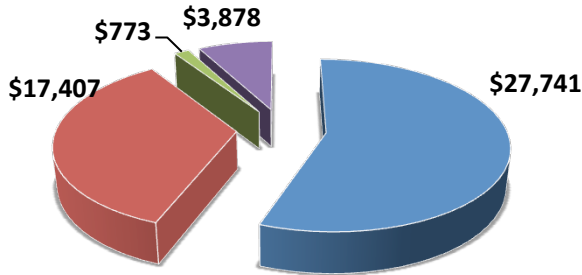
The primary business activities support a workforce of 55,477 employees involved in world market global health jobs; primary activities in the domestic world health market support more than twice the number of employees (estimated 136,685) than its world market counterpart. Altogether, global health activities generate 351,829 primary and secondary jobs in the state, with an overall multiplier effect (i.e., ratio of total impact to primary impact) of 1.83. The total labor income (employee compensation and proprietary income) generated is an estimated \$17.5 billion, 56% of which comes from the primary business activities of the global health entities.

Our reported tax revenues include state taxes generated from employee income tax, various forms of business taxes and secondary taxes on labor income spending. The primary business activities of the global health entities and secondary activities by the related industries and households produce \$8.1 billion in tax revenue. This is an estimated 7% of the \$114.7 billion total tax collected by the state of California in 2007<sup>2</sup>, an indicator of the strong significance of the global health sector in California from the perspective of policymakers.

<sup>2</sup> Source: U.S. Census Bureau, Governments Division <http://www.census.gov/govs/statetax/0705castax.html>

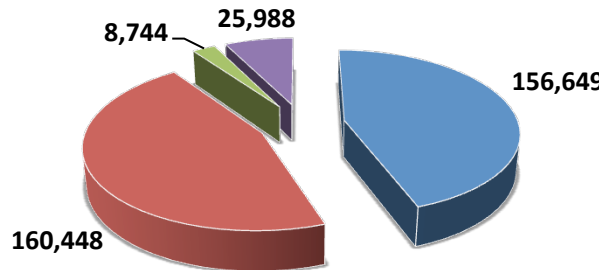
**Fig. 1**  
**2007 Economic Impact (Primary and Secondary) of Global Health Activities in California by Sector**

**Total Direct Business Activity  
(Sales, Revenue or Income)**

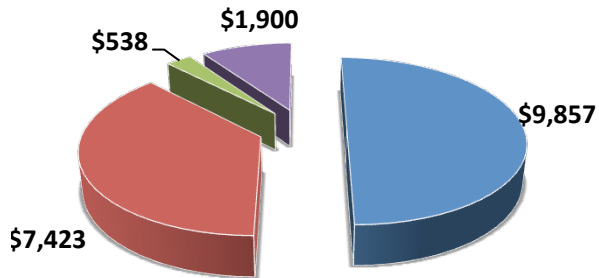


Figures are in 2007 Millions of US\$

**Total Number of Jobs Created**

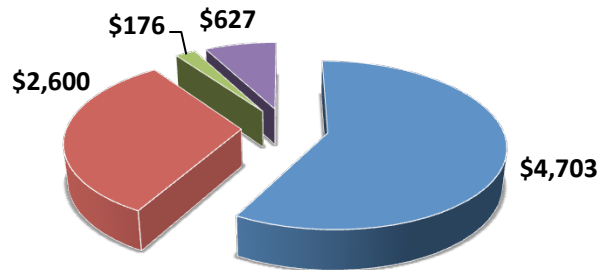


**Total Labor Income Generated**



Figures are in 2007 Millions of US\$

**Total Tax Revenue Generated**



Figures are in 2007 Millions of US\$

■ For-profit ■ Non-profit ■ Government ■ Higher Education

## 1.1 Private For-profit Sector Economic Impact

The private sector firms selected for our study produced an estimated \$15.7 billion global health related business activities (sales or output) in 2007. Approximately 34.5% of the revenue comes from business in the world market, i.e., exports to emerging and developing countries. Direct economic activity in the world and domestic markets generate 30,799 and 47,570 jobs, respectively. World market activities of global health private firms are primarily related to the manufacturing of electromedical and control equipments, pharmaceutical and medicinal goods, along with the retail sales of these commodities through mail-order and electronic shopping. In the domestic global health market, power generation and distribution firms along with architectural and engineering services hold most of the activity share. The average annual salary generated by primary activities of these firms is \$71,584, while annual salary in related (secondary) jobs is \$54,254.

**Table 2**

### **Economic Impact of Global Health Private Sector on the Economy of California**

<b>Economic Impact Type</b>	<b>World Market Global Health Activities</b>	<b>Domestic Market Global Health Activities</b>	<b>All Global Health Activities</b>
<b>Business Activity (Sales or Revenue), in Millions of 2007 US\$</b>			
Primary Impact	5,401	10,269	15,670
Secondary Impact	4,460	7,611	12,072
Total Impact	9,861	17,880	27,742
Multiplier Effect (Total/ Primary Impact)	1.83	1.74	1.77
<b>Number of Jobs Supported</b>			
Primary Impact	30,799	47,570	78,369
Secondary Impact	27,641	50,639	78,280
Total Impact	58,440	98,209	156,649
Multiplier Effect (Total/ Primary Impact)	1.90	2.06	2.00
<b>Labor Income, in Millions of 2007 US\$</b>			
Primary Impact	1,692	3,917	5,610
Secondary Impact	1,585	2,662	4,247
Total Impact	3,277	6,580	9,857
<b>Tax Revenue Generated,</b> <i>in Millions of 2007 US\$</i>	1,563	3,140	4,703

Table 3 presents the economic impact results of private firms by three major industrial sectors – manufacturing (NAICS codes 3119 through 3391), utilities or natural resources (NAICS codes 2211 through 2213) and services and others (NAICS codes 4541 through 6215). [See Section 2, page 21 for NAICS code descriptions.] We find that the service sector of the global health industry had the largest impact in terms of business activities and creation of employment, followed by the manufacturing and utilities industries. However, the biggest multiplier effect for business activities and employment creation belonged to the manufacturing and utilities industries, respectively.

**Table 3**  
**Industry-specific Economic Impact of Global Health Private Sector**

<b>Economic Impact Type</b>	<b>Private Global Health Firms by Industry</b>		
	<b>Utilities or Natural Resources</b>	<b>Manufacturing</b>	<b>Services and Others</b>
<b>Business Activity (Sales or Revenue), in Millions of 2007 US\$</b>			
Primary Impact	3,776	3,802	8,092
Secondary Impact	1,509	3,683	6,879
Total Impact	5,285	7,485	14,971
Multiplier Effect (Total/ Primary Impact)	1.40	1.97	1.85
<b>Number of Jobs Supported</b>			
Primary Impact	3,345	8,895	66,130
Secondary Impact	9,243	21,255	47,781
Total Impact	12,588	30,150	113,911
Multiplier Effect (Total/ Primary Impact)	3.76	3.39	1.72
<b>Labor Income, in Millions of 2007 US\$</b>			
Primary Impact	788	1,242	3,580
Secondary Impact	501	1,304	2,442
Total Impact	1,289	2,546	6,022
<b>Tax Revenue Generated,</b> <i>in Millions of 2007 US\$</i>	1,098	995	2,610



## 1.2 Non-profit Sector Economic Impact

The economic impact estimates for global health non-profit entities are reported in Table 4. The 344 selected non-profit organizations have an economic impact that is more than half as large as that of the for-profit sector. The primary business activity of \$8.08 billion generates another \$9.3 billion in sales or output through related industries and household spending of labor income. An estimated 26% of the total business impact comes from the world market. Primary economic activities in both world and domestic markets yield very strong (higher than double) multiplier effects.

Although the direct business impact of the non-profit sector is substantially smaller than the for-profit sector, the former supports more employees. Altogether, 41,735 jobs are created through world market non-profit activities while domestic market activities generate 118,714 jobs. In the domestic global health market, more than 80% of the non-profit sector economic impact is a consequence of philanthropic, voluntary and grant making activities. An estimated \$2.6 billion in state taxes are generated from employee compensation, business taxes and household expenditure.

**Table 4**  
**Economic Impact of Global Health Non-Profit Sector on the Economy of California**

<b>Economic Impact Type</b>	<b>World Market Global Health Activities</b>	<b>Domestic Market Global Health Activities</b>	<b>All Global Health Activities</b>
<b>Business Activity (Income or Budget), in Millions of 2007 US\$</b>			
Primary Impact	2,082	5,998	8,079
Secondary Impact	2,445	6,883	9,329
Total Impact	4,527	12,881	17,408
Multiplier Effect (Total/ Primary Impact)	2.17	2.15	2.15
<b>Number of Jobs Supported</b>			
Primary Impact	24,678	70,804	95,482
Secondary Impact	17,057	47,910	64,966
Total Impact	41,735	118,714	160,448
Multiplier Effect (Total/ Primary Impact)	1.69	1.68	1.68
<b>Employee Compensation, in Millions of 2007 US\$</b>			
Primary Impact	1,049	3,011	4,060
Secondary Impact	883	2,480	3,363
Total Impact	1,932	5,491	7,423
<b>Tax Revenue Generated, in Millions of 2007 US\$</b>	674	1,926	2,600

### 1.3 Higher Education Sector Economic Impact

For the purpose of this report, we have analyzed the economic impact of global health related research activities in the University of California (UC) and other institutions of higher education in California. Table 5 reports the economic effect of research projects extramurally funded by various agencies across UC, and only NIH funded projects at other institutions. Although our identification technique did not allow us to distinguish a world market and a domestic market component from the selected projects, the rigorous selection approach ensured that only global-health related projects were chosen.

Primary business activities comprise direct extramural funding. The \$1.86 billion research spending has an additional impact of \$2.02 billion through related industries and household wage spending. Primary global health research activities support an estimated 12,016 direct jobs in UC and other institutions. Almost 14,000 additional jobs are created in allied industries that are connected through forward and backward linkages. The total tax impact is an estimated \$627 million.

**Table 5**  
**Economic Impact of Global Health Higher Education Sector on the Economy of California**

<b>Economic Impact Type</b>	<b>Global Health Activities</b>
<b>Business Activity (Research Budget or Income), in Millions of 2007 US\$</b>	
Primary Impact	1,856
Secondary Impact	2,022
Total Impact	3,878
Multiplier Effect (Total/ Primary Impact)	2.09
<b>Number of Jobs Supported</b>	
Primary Impact	12,016
Secondary Impact	13,972
Total Impact	25,988
Multiplier Effect (Total/ Primary Impact)	2.16
<b>Labor Income, in Millions of 2007 US\$</b>	
Primary Impact	1,188
Secondary Impact	712
Total Impact	1,900
<b>Tax Revenue Generated, in Millions of 2007 US\$</b>	627

## 1.4 Government Sector Economic Impact

Government sector impact of global health originates from the activities of federal, state and local administration of public health programs in California. In particular, we estimate that 27.2% of employment and wages paid in these government bodies are associated with the healthcare and well being of the international population living in the state. Due to the localized nature of these entities, all activities are assumed to be in the domestic global health market. One must also note that in terms of direct business activities, a government entity cannot be compared to a private firm or a non-profit organization. Since an administrative body does not produce any “output” in the conventional sense, it does not have a primary business impact (sales or revenue). The wages and salaries paid to and spent by its employees, however, have a secondary business activity impact for other industries. This estimated secondary impact for 2007 was \$773 million, as described in Table 6. The results, disaggregated by federal, state and local agencies are reported in Table 7.

**Table 6**  
**Economic Impact of Government Global Health Sector**

<b>Economic Impact Type</b>	<b>Global Health Activities</b>
<b>Business Activity (Sales or Revenue), in Millions of 2007 US\$</b>	
Secondary Impact	772.65
Total Impact	772.65
<b>Number of Jobs Supported</b>	
Primary Impact	6,295
Secondary Impact	2,449
Total Impact	8,744
Multiplier Effect (Total/ Primary Impact)	1.39
<b>Labor Income, in Millions of 2007 US\$</b>	
Primary Impact	419.73
Secondary Impact	117.92
Total Impact	537.65
<b>Tax Revenue Generated, in Millions of 2007 US\$</b>	176.14

**Table 7****Economic Impact of Government Global Health Sector by Government Agency Type**

<b>Economic Impact Type</b>	<b>Federal</b>	<b>State</b>	<b>Local</b>
<b>Business Activity (Sales or Revenue), in Millions of 2007 US\$</b>			
Secondary Impact	25.62	388.26	358.78
Total Impact	25.62	388.26	358.78
<b>Number of Jobs Supported</b>			
Primary Impact	150	2,761	3,384
Secondary Impact	82	1,230	1,137
Total Impact	232	3,991	4,521
Multiplier Effect (Total/ Primary Impact)	1.55	1.45	1.34
<b>Labor Income, in Millions of 2007 US\$</b>			
Primary Impact	13.83	210.96	194.94
Secondary Impact	3.94	59.24	54.74
Total Impact	17.77	270.20	249.68
<b>Tax Revenue Generated, in Millions of 2007 US\$</b>	5.67	88.60	81.87

An estimated 6,295 government workers were directly employed at global health related jobs. These employees, who earned a total of \$420 million in wages and salaries, created an additional employment of almost 2,500 through their spending of labor income at various businesses. Finally, the state collected an estimated \$176 million in taxes from the government employees, related businesses and others.

## 1.5. Conclusion

With a \$1.8 trillion GDP (2007), California is the biggest among state economies, nearly 57% bigger than the next largest, which is Texas. If considered independently, California would be among the world's ten largest economies<sup>3</sup>. Analyzing the impact of global health activities in California is a difficult task due to their sheer magnitude and complex nature. For the purpose of this report, we adopted a systematic approach consisting of several steps ranging from the identification of private and public stakeholders in the global health sector to the approximation of economic activities and the calculation of impact estimates.

Our results are estimated using financial information from approximately 590 private sector for-profit global health firms, 344 non-profit organizations, research data from UC campuses, NIH, and payroll data from several government bodies. Employing primary and secondary California data (2007) from various sources, we find the total business activity (in sales or output) generated by global health entities to be \$49.8 billion. Approximately 29% of the revenue comes from activities related to the world market and the rest is attributed to the international subpopulation living in California. However, this is likely to be an underestimation of the true volume of global health activities in California. Our particular choice of data sources is likely to play a role in determining the accuracy of our estimates. For example, the for-profit firm data have been collected from two private databases of businesses registered in California. Our results do not take into account the global health firms in California that are not cataloged in those databases. Again, for higher education institutions other than the University of California, we were able to capture only a small fraction of global health research represented by NIH grants.

The true impact of global health activities is indeed multidimensional and our methodological approach only captures a part of it. For example, beyond its direct and indirect economic impacts measured in this report, the production of vaccines has a tertiary productivity impact on workers. A healthy workforce is the economic driving force of a nation; a comprehensive analysis of economic impact should incorporate the “counterfactual” effect, i.e., the cost of work days lost due to disease in the possible absence of a vaccine. In today's world of rapid integration of international economies – characterized by the migration of people and diseases – this counterfactual effect is likely to be massive. Indeed, the domestic and world market global health activities create a virtuous cycle of economic growth and human development across the globe. The dynamic benefits of disease avoidance and improvement in quality of life are translated into higher productivity and higher income for generations to come.

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<sup>3</sup> California was the world's sixth largest economy in 2004, [http://www.lao.ca.gov/2004/cal\\_facts/2004\\_calfacts\\_econ.htm](http://www.lao.ca.gov/2004/cal_facts/2004_calfacts_econ.htm)

Another dimension that is absent from this study is the greater impact of the immigrant labor force of the economy. First, remittance income sent by immigrants to developing nations could provide access to better nutrition and healthcare in those countries. Secondly, at home, a large undocumented workforce contributes toward the well being of Californians. Due to lack of comprehensive data on the use of remittances or the global health activities in the informal economy, accommodating these effects is beyond the scope of our report.

The private for-profit sector alone accounted for more than half (\$27.7 billion) of the total revenue impact. Roughly 78,000 direct jobs, 40% of which were associated with world market activities, were supported by the private global health sector. An equivalent amount of indirect jobs were generated through industry links and labor income spending. The government and higher education sectors together accounted for the remaining \$22.1 billion in revenue impact and 194,000 in employment impact. Of the total generated employment (all sectors), approximately 100,000 jobs were related to world market global health activities and the rest were engaged in the domestic market.

Even when underestimated, the global health sector is a substantially large part of the California economy. For example, in volume it is comparable to the “Accommodation and Food Services” industry and bigger than many industries and service sectors including “Agriculture, Forestry, Fishing, and Hunting,” “Mining,” “Transportation and Warehousing,” “Legal Services,” “Broadcasting and Telecommunications,” etc<sup>4</sup>. More than 350,000 jobs were supported by global health spending in California in 2007, higher than the employment in many major occupation categories such as “Community and Social Services,” “Farming, Fishing, and Forestry,” “Healthcare Support” and “Architecture and Engineering”<sup>5</sup>. Our analysis reveals that the global health sector makes a strong contribution to the government exchequer – in 2007, an estimated 7% of the total state tax revenue of \$114 billion could be attributed to global health activities.

Thus, estimates even as conservative as ours indicate that the global health sector in California is a major economic driving force. In a dynamic market with an ever-changing composition of industrial production and services, emerging sectors such as this one surely play a crucial role in generating more income and employment. Moreover, pertinent contemporary issues governing the quality of life, such as migration and diseases, environmental degradation and renewable energy, emphasize the need for vertical and horizontal growth of the global health sector in California.

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<sup>4</sup> 2007 Industry GDP estimates in California are – Accommodation and Food Services \$49.4 billion; Agriculture, forestry and fishing \$30.1 billion; Mining \$14.2 billion; Transportation and warehousing \$41.9 billion; Legal services \$28.6 billion; Broadcasting and telecommunications \$46.3 billion.

<sup>5</sup> Bureau of Labor Statistics, May 2007 State Occupational Employment and Wage Estimates (California). Employment estimates are - Community and Social services 190,470; Farming, Fishing, and Forestry 189,510; Healthcare Support 331,290; Architecture and Engineering 334,030.

## SECTION TWO: METHODOLOGY AND DATA

### 2.1 Input-Output Models Explained

Input-output models are a popular tool for economic impact analysis among researchers. These models are widely used for calculating the effect of one or more economic events on the local, state or the national economy. For the purpose of our study, we use a California specific input-output structure for 2007<sup>6</sup>. Our input-output framework uses inputs in the form of global health related sales (alternatively output, revenue or income) information from the for-profit private sector, the non-profit sector, and the higher education sector. For the government sector, employment and wage information are used as inputs. These inputs, estimated from carefully selected individual global health entities, are further described in the Data and Methodology section.

Using economic activities as inputs, the model generates the impact (output) in terms of various indicators such as further sales or revenue, labor income, and the number of jobs created. The generated impacts are broadly classified into two types – primary and secondary. Primary impacts of global health activities are the amount of revenue (or sales), employment, labor income and tax revenue generated by the direct business activities in the selected global health entities.<sup>7</sup>

Secondary impacts can be indirect or induced. Private firms, non-profit organizations and other entities that are directly involved in global health are also connected to the rest of the state economy by various forward and backward linkages. For example, let us consider a global health firm that manufactures plastic syringes for administering vaccines. The production process at this particular firm uses raw materials, such as plastic and steel, produced by those respective industries. In turn, plastic and steel industries are dependent on various other industries, thus creating a network of backward linkages.

On the contrary, other firms such as courier services used for the transportation of produced syringes and healthcare facilities that purchase the syringes are connected to the original firm through forward linkages. To add a final layer to this network, the produced syringes could be used by workers across several industries, further helping production processes by ensuring the well-being of the employees<sup>8</sup>. The network of secondary industries, as described above, produces an indirect effect in the form of additional sales or revenue, employment generated, labor income and tax revenue.

Secondary induced effects are mainly generated by consumer spending. The workers who are employed either directly in the global health entities or indirectly in related industries (industries that generate the indirect effects, as described above) earn salaries and benefits for their labor. These wages, when spent locally at other businesses, e.g., grocery stores or public transport, generate additional sales or revenue, employment, and taxes from those business entities.

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<sup>6</sup> We use a standard input-output analysis software, IMPLAN, by the Minnesota IMPLAN Group Inc., [www.implan.com](http://www.implan.com); 2007 state level IMPLAN multipliers for California were used.

<sup>7</sup> Primary revenue (output or income) impacts, due to the nature of our analysis, are by definition the same as the inputs in magnitude.

<sup>8</sup> The economic impact of a healthier workforce could not be included in our estimation due to data paucity.

## 2.2. Methodology and Data

Much of this report follows the methodology proposed by Beyers *et al.* (2007). We attempt to estimate the global health related economic activities and the resultant impacts on the state economy. The economy in California is the largest among all states. In 2007, California's Gross Domestic Product (GDP) was a staggering \$1.8 trillion, approximately 13% of the US GDP. The enormous volume of business taking place across various sectors and subsectors along with the complex nature of global health activities make the evaluation exercise a very complex task. The biggest challenge is that the existing public and private economic indicator databases do not recognize the global health sector as an entity; neither do they provide any straightforward ways to identify the pertinent economic activities.

For the purpose of our study, we have included four major types of economic establishments that are engaged in global health activities – the for-profit private sector firms, non-profit and volunteer organizations, government administration, and higher education entities involved in research activities. For each of these broad sectors, we identified individual entities whose work directly involves global health. Then, using various primary and secondary data sources, we estimated the extent of global health economic activities during year 2007 in the selected establishments. The identification and estimation exercises are described in detail in the following sections.

We classify the global health related activities of the selected establishments according to the target subpopulation. Activities directed toward emerging and developing countries are considered to be world market global health activities. In particular, for the private sector, we use the list of emerging economies as defined by the International Monetary Fund (IMF)<sup>9</sup>. For the domestic market, we use an approximation of the economic activities targeted towards the international subpopulation living in California.

Our study deviates from Beyers *et al.* (2007) in certain aspects. While their study primarily uses employment and wage information as inputs, our input-output framework typically uses sales (alternatively, revenue or income) information as input. The estimated impact results, however, are equally reliable. Other sector-specific methodological differences are detailed in the relevant sections of this report.

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<sup>9</sup> Emerging and Developing Economies, the IMF,  
<http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/groups.htm#oem>



### 2.3. For-profit Sector Methodology and Data

In 2007, there were an estimated 1.3 million private firms doing business in California across more than 2,300 categories and sub-categories of the North American Industry Classification System (NAICS)<sup>10</sup>. However, none of the industry classification systems directly identifies firms with global health related activities. Hence, we conducted a systematic identification exercise as described below.

We employed the services of Corporate Technology Information Services, Inc. (CorpTech™)<sup>11</sup>, a large repository of information on US technology firms. We determined that the global health companies in California broadly belonged to six categories (core competency) of for-profit firms in the CorpTech™ database – Biotechnology, Energy, Medical, Pharmaceutical, Computer Software, and Environmental. For each of these core competencies, we prepared a list of global health related keywords, which, if matched with the business or product description of a firm, would identify that particular firm as a global health firm. The preliminary list of global health firms, thus identified, was revised through further refinement of the search keywords. Finally, the firms were individually cross-referenced with their business description and mission statements (available on their official websites) to eliminate firms whose activities were not related to global health.

Box 1: Example of Global Health Keywords		
Global health	Maternal health	Child health
Pandemic	HIV	AIDS
Malaria	Infectious Disease	Tuberculosis
Poverty	Hunger	Environmental Degradation

Following the above steps, we identified 658 global health companies located in California. Except for a few public for-profit entities (e.g., UCSD Medical Center), most of these firms were private establishments. Hence, for simplicity, we will generally refer to the for-profit sector as private sector. For revenue information on these firms, we entered into a confidential agreement with InfoUSA<sup>12</sup>, a large private database firm with financial information on 14 million US businesses. InfoUSA provided us with annual sales information for year 2007 for more than half of our firms. For the rest of the firms, we collected 2007 annual sales information from the

<sup>10</sup> Source: Employment Development Department of California, 2007 data  
<http://www.labormarketinfo.edd.ca.gov/?PAGEID=138>

<sup>11</sup> [www.corptech.com](http://www.corptech.com)

<sup>12</sup> [www.infousa.com](http://www.infousa.com), a member of InfoGROUP

CorpTech™ database<sup>13</sup>. Our estimation yields a total of approximately \$99 billion direct business activity (revenue from sales) by 589 selected global health firms for which data were available (or estimated) for 2007.

The 4-digit NAICS codes to which our 590 odd global health firms belong are presented in Table 8. Even though the global health firms were individually identified from their business descriptions and mission statements, the business activity of a chosen firm may only partially relate to developing global health at home and abroad. As a consequence, the true global health direct business activity will likely be only a part of the estimated \$99 billion. We follow the methodology proposed by Beyers *et al.* (2007) to estimate these types of activities.

**Box 2: Example of Global Health For-Profit Firms in California**

***Novartis Vaccines and Diagnostics Inc.* is the world's second largest manufacturer of influenza vaccines, with a wide range of products capable of fighting against more than 20 vaccine-preventable diseases.**

***Pharsight®*, a Certara™ company, is a market-leading provider of software products and scientific consulting services to help pharmaceutical and biotechnology companies improve their drug development process, regulatory compliance and strategic decision-making.**

***Pollution Prevention International, Inc. (PPI)* is an environmental engineering firm specializing in multimedia pollution prevention and environmental compliance management programs.**

The global health business activity of a firm comprises sales activities in foreign and domestic global health markets. We consider the annual exports of a firm to emerging and developing countries as world market global health activity and its annual sales to the international subpopulation in the state as domestic market global health activity. These definitions, along with the associated estimation techniques, are described later in this section.

<sup>13</sup> Some firms in the CorpTech™ database have annual sales information from another recent year instead of 2007. We used the yearly growth rate of real state GDP of California to estimate the projected 2007 sales of these firms.

**Table 8: Estimated Global Health Activities of the Private For-profit Sector in California**

NAICS Code	NAICS Code Description	% of Global Health Activities in World Market	% of Global Health Activities in Domestic Market	Total
2211	Electric Power Generation, Transmission and Distribution	Only domestic	27.2%	27.2%
2212	Natural Gas Distribution	Only domestic	27.2%	27.2%
2213	Water, Sewage and Other Systems	Only domestic	27.2%	27.2%
3119	Other Food Manufacturing	2.95%	3.3%	6.25%
3251	Basic Chemical Manufacturing	6.42%	3.3%	9.72%
3254	Pharmaceutical and Medicine Manufacturing	6.42%	3.3%	9.72%
3259	Other Chemical Product and Preparation Manufacturing	6.42%	3.3%	9.72%
3271	Clay Product and Refractory Manufacturing	2.49%	3.3%	5.80%
3324	Boiler, Tank, and Shipping Container Manufacturing	4.63%	3.3%	7.93%
3329	Other Fabricated Metal Product Manufacturing	4.63%	3.3%	7.93%
3332	Industrial Machinery Manufacturing	4.63%	3.3%	7.93%
3333	Commercial and Service Industry Machinery Manufacturing	23.85%	3.3%	27.15%
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	23.85%	3.3%	27.15%
3335	Metalworking Machinery Manufacturing	23.85%	3.3%	27.15%
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	23.85%	3.3%	27.15%
3341	Computer and Peripheral Equipment Manufacturing	23.85%	3.3%	27.15%
3342	Communications Equipment Manufacturing	23.85%	3.3%	27.15%
3344	Semiconductor and Other Electronic Component Manufacturing	16.3%	3.3%	19.6%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	16.3%	3.3%	19.6%
3351	Electric Lighting Equipment Manufacturing	16.3%	3.3%	19.6%
3353	Electrical Equipment Manufacturing	16.3%	3.3%	19.6%
3391	Medical Equipment and Supplies Manufacturing	20.59%	3.3%	23.9%
4541	Electronic Shopping and Mail-Order Houses	20.59%	3.3%	23.9%
5112	Software Publishers	11.23%	3.3%	14.53%
5182	Data Processing, Hosting, and Related Services	6.47%	3.3%	9.78%
5413	Architectural, Engineering, and Related Services	6.47%	3.3%	9.78%
5415	Computer Systems Design and Related Services	6.47%	3.3%	9.78%
5416	Management, Scientific, and Technical Consulting Services	Only domestic	27.2%	27.2%
5417	Scientific Research and Development Services	Only domestic	27.2%	27.2%
5622	Waste Treatment and Disposal	Only domestic	27.2%	27.2%
5629	Remediation and Other Waste Management Services	Only domestic	27.2%	27.2%
6215	Medical and Diagnostic Laboratories	Only domestic	27.2%	27.2%

Some of the NAICS codes (2211 through 2213, and 5413 through 6215) in Table 8 contain firms that mostly operate in a localized market inside California. We exclude these firms (e.g., Natural Gas Distribution, Waste Treatment and Disposal) from the domain of world market global health activities. For the rest of the sectors, firms are considered to have both a world and a domestic market component of global health business.

We followed several steps to arrive at the estimated world market global health activities of our selected firms. More precisely, for each of the NAICS codes, our objective was to estimate the percentage of output that is exported to emerging and developing countries. Using publicly available international trade data for 2007, we estimated that 36% of all exports from California were to emerging and developing countries. Then, for NAICS codes 3119 through 5182, we estimated the California specific percentage of 2007 annual output of all firms that was exported abroad. This was calculated separately for each of the NAICS codes in Table 8, using data from the Bureau of Economic Analysis and the International Trade Administration of the US Department of Commerce<sup>14</sup> <sup>15</sup>. The foreign market share of firms in each NAICS code, thus computed, was multiplied by 36% to arrive at the world market global health activity estimates in Table 8.

The share of domestic global health activities is defined as the percentage of business conducted with the international population in California. For companies in NAICS codes 3119 through 5182, we first estimated their “domestic sales” as gross output less exports. Using 2005-07 US Census Bureau data<sup>16</sup>, we estimated that California constituted 12.1% of the US population and that 27.2% of the California population was foreign-born. Finally, the percentage of global health activities related to the domestic subpopulation was computed as 3.3% (i.e.,  $12.1\% \times 27.2\% = 3.3\%$ ) of domestic sales.

Global health firms that are assumed to operate only inside California are estimated to have 27.2% of their business activities directed toward the international subpopulation. Following all the above steps, we finally estimate the total direct world market global health activities of these firms to be approximately \$5.4 billion and the domestic market counterpart to be \$10.3 billion. These estimates were then used to generate the economic impact of the for-profit global health sector in California.

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<sup>14</sup> Since gross output by industry (NAICS) is not yet available for year 2007 in California, we first estimated the 2007 CA-to-US percentage of GDP for each NAICS. Applying these percentages to the 2007 US gross output by industry, we estimated the gross output by industry in CA. Finally, we used actual 2007 industry export data for CA from TradeStats Express™ (US Dept. of Commerce) to estimate the California specific exports-to-output percentage by industry .

<sup>15</sup> For firms in NAICS codes 4541 through 5182, the industry specific exports-to-output percentage could not be estimated due to lack of appropriate data. Instead, we used the estimated exports-to-output percentage for entire California in 2007 as an approximation.

<sup>16</sup> 2005-2007 American Community Survey 3-Year Estimates, US Census Bureau.

One must note the conservative nature of our estimates. As a consequence of the possible lack of comprehensiveness of the business databases we have used, our exercise may fail to include some genuine global health firms. We only capture firms with a registered office in California. Hence, firms that do not have a California location but conduct business with the state’s population are not included in our analysis. Secondly, the business databases themselves may not contain all global health firms, even if they are registered in California.

## 2.4 Non-profit Sector Methodology and Data

We identified non-profit organizations that participate in global health activities from the GuideStar® database<sup>17</sup>, a comprehensive database of more than 188,000 non-profit organizations of various kinds registered in California. With the aid of global health related keyword search and cross referencing with the non-profit classification system developed by the National Center for Charitable Statistics, we initially selected 724 global health non-profit entities.

In order to ensure that the chosen non-profit organizations were indeed engaged in global health activities, we conducted a web search and cross checked the mission statement of each of these entities. This exercise enabled us to finally shortlist 344 non-profit organizations whose work was directly related to global health.

<b>Box 3: Example of Global Health Non-Profit Organizations in California</b>
<b><i>AIDS Healthcare Foundation</i> is the largest specialized provider of HIV/AIDS medical care and HIV testing services in the United States and operates free AIDS treatment clinics in the US, Africa, Asia, and Latin America/Caribbean.</b>
<b><i>blueEnergy</i> provides a low-cost, sustainable solution to the energy needs of marginalized communities through the construction, installation, and maintenance of hybrid wind-solar energy systems.</b>
<b><i>Child Family Health International (CFHI)</i> is the leading nongovernmental organization (NGO) placing health science students on global health education programs in ways that are socially responsible and financially just.</b>

We extracted financial information for these entities from the GuideStar® database and estimated their total revenue in 2007 to be in excess of \$8 billion. The activities of the selected organizations were categorized according to major National Taxonomy of Exempt Entities (NTTE) codes. Table 9 presents the financial information on the chosen global health non-profit organizations.

<sup>17</sup> [www.guidestar.org](http://www.guidestar.org)

**Table 9: Estimated Income (2007) of Global Health Non-Profit Organizations in California**

<b>NTTE Activity Code</b>	<b>NTTE Activity Type</b>	<b>Income Amount (Millions of 2007 US\$)</b>
T	Philanthropy, Voluntarism and Grantmaking	5,055
Q	International, Foreign Affairs and National Security	2,082
M	Public Safety, Disease Preparedness and Relief	275
H	Medical Research	181
G	Diseases, Disorders and Medical Disciplines	186
F	Mental Health and Crisis Intervention	180
C	Environment	88
D	Animal-related	20
P	Human Services	9
S	Community Improvement and Capacity Building	2
K	Food, Agriculture and Nutrition	2
U	Science and Technology	0.5
	<b>Total (All Activities)</b>	<b>8,079</b>

For simplicity, we assumed that non-profit activity of \$2.08 billion under the NTTE code Q (International, Foreign Affairs and National Security) belonged to world health activities and the rest constituted activities pertaining to the domestic global health community. These income estimates were then used to generate economic impact of the non-profit global health sector.

## 2.5 Higher Education Sector Methodology and Data

With the help of three huge public university and college networks, along with numerous private research universities and other institutions, California boasts a large community of intellectuals devoted to global health related research activities. However, many of these higher education institutions do not maintain a centralized database of research projects undertaken. In the case of institutions that regularly collect information on these projects, many lack the proper tools to help identify the global health related research ventures. Therefore, gathering information on all individual global health research initiatives across the entire higher education sector in California is a difficult and highly resource intensive task, something clearly beyond the scope of this study.

For the purpose of our study, we attempted to collect selective information on extramurally funded global health research projects. First, we conducted a rigorous identification exercise across the University of California (UC) campuses. We started by creating a pool of 689 faculty members in all 10 UC campuses who were engaged in global health related research. These faculty members were identified from an existing database of UC researchers maintained by the

California Policy Research Center, in conjunction with direct faculty interviews and indirect nominations by the vice-chancellors.

At the next stage, the selected faculty members were surveyed about their research activities in 2007. The survey collected information on various extramurally funded projects and, in particular, financial data for those initiatives. Around 13.4% of these projects were determined to be global health related. We found an estimated \$1.73 billion worth of ongoing global health projects across all UC campuses, more than 70% of which were federally funded.

For the rest of the higher education sector in California, we were able to collect information on research projects funded by the National Institutes of Health (NIH). From a publicly available database of NIH research grants<sup>18</sup>, we performed a global health related keyword search, similar to the for-profit sector analysis. Among all NIH funded projects active across the California higher education sector (except UC) in 2007, we identified 246 global health projects worth \$125 million.

The grant amounts awarded to the UC and other NIH projects were used in our input-output model to generate the economic impacts of those research initiatives. We wish to remind our reader that the estimates for all non-UC global health research represent a mere “floor;” we were forced to leave out all non-NIH projects, which could possibly amount to billions of dollars.

## 2.6 Government Sector Methodology and Data

We realized that government activities pertaining to global health were mostly localized inside the state. Therefore, we focused on government facilities, services and policies that serve the international subpopulation living in California, e.g., public healthcare facilities for immigrants. We used the 2007 employment and wage data for the “government administration of health programs” sector (NAICS code 923120), publicly available from the Employment Development Department (EDD) of California. Using the percentage of the international population living in California, we assumed that 27.2% of this government health expenditure was targeted toward the domestic global health subpopulation.

We collected wage and employment information separately for federal, state and local public health administration entities in California. The 2007 annual global health related payroll<sup>19</sup> in these government bodies were in the order of \$13.8 million, \$211 million and \$194.9 million, respectively, for federal, state and local offices. There were respectively 150, 2,761 and 3,384 jobs directly involved in global health. The above salary and employment information were used as inputs to generate economic impact in terms of additional output, labor income, employment and taxes.

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<sup>18</sup> <http://report.nih.gov/award/state/state.cfm>

<sup>19</sup> 27.2% of the total payroll

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# Appendix

## Technical Note: Input-output Models

The impact estimates presented in this paper have been generated using a California-specific input-output model. These models, originally developed by the Nobel laureate economist Wassily Leontief, are widely used by economists and social scientists to evaluate the effects of economic events on the regional, state or national economy. The core of an input-output structure comprises the forward and backward linkages between industries.

Let us consider the balance equations for each industry –

$$X_i = x_{i,1} + x_{i,1} + x_{i,1} + \dots + x_{i,k} + Y_i \quad (1)$$

$$X_j = x_{1,j} + x_{2,j} + x_{3,j} + \dots + x_{k,j} + W_j \quad (2)$$

Where  $X_i$  and  $X_j$  respectively denotes the total output in industry- $i$  and total purchase of inputs in industry- $j$ . We assume that are  $k$  number of industries and  $x_{i,j}$  denotes the sales of output of industry- $i$  to industry- $j$ . Finally,  $Y_i$  and  $W_j$  respectively denotes the final output in industry- $i$  and the sum of imports and value added in industry- $j$ .

The regional purchase coefficients,  $a_{i,j}$  are defined as  $a_{i,j} = \frac{x_{i,j}}{X_j}$

Thus, equation (1) can be rewritten as –

$$X_i = a_{i,1}X_1 + a_{i,2}X_2 + \dots + a_{i,k}X_k + Y_i$$

In a vector-matrix form, the above equation can be written as –

$$X = AX + Y$$

The above system of equations can be rearranged to find a relationship between the inputs (X) and the outputs (Y) produced by all industries,

$$X(I - A) = Y$$

$$\text{or, } X = (I - A)^{-1}Y$$

**Table 1: Global Health Direct Business Activities of For-profit Firms (2007 Millions of US\$)**

NAICS Code	NAICS Code Description	Global Health Activities in World Market	Global Health Activities in Domestic Market	Total
2211	Electric Power Generation, Transmission and Distribution	Only domestic	3,743.4	3,743.4
2212	Natural Gas Distribution	Only domestic	3.9	3.9
2213	Water, Sewage and Other Systems	Only domestic	28.7	28.7
3119	Other Food Manufacturing	0.1	0.1	0.3
3251	Basic Chemical Manufacturing	11.2	4.7	15.9
3254	Pharmaceutical and Medicine Manufacturing	1,210.0	511.5	1,721.6
3259	Other Chemical Product and Preparation Manufacturing	1.0	0.4	1.4
3271	Clay Product and Refractory Manufacturing	0.1	0.1	0.2
332*	Fabricated Metal Product Manufacturing	0.6	0.4	1.0
3324	Boiler, Tank, and Shipping Container Manufacturing	3.2	2.0	5.2
3329	Other Fabricated Metal Product Manufacturing	0.1	0.0	0.1
333*	Machinery Manufacturing	54.6	2.6	57.1
3332	Industrial Machinery Manufacturing	0.4	0.0	0.4
3333	Commercial and Service Industry Machinery Manufacturing	97.3	4.6	101.9
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	37.8	1.8	39.6
3335	Metalworking Machinery Manufacturing	2.1	0.1	2.2
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	51.4	2.4	53.8
3341	Computer and Peripheral Equipment Manufacturing	6.0	0.7	6.6
3342	Communications Equipment Manufacturing	18.4	2.0	20.4
3344	Semiconductor and Other Electronic Component Manufacturing	3.8	0.4	4.2
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1,014.8	112.5	1,127.3
3351	Electric Lighting Equipment Manufacturing	5.3	0.4	5.7
3353	Electrical Equipment Manufacturing	0.4	0.0	0.5
3391	Medical Equipment and Supplies Manufacturing	529.5	107.2	636.7
4541	Electronic Shopping and Mail-Order Houses	1,417.7	593.1	2,010.8
5112	Software Publishers	928.9	388.6	1,317.6
5182	Data Processing, Hosting, and Related Services	6.0	2.5	8.6
541*	Professional, Scientific and Technical Services	Only domestic	2.5	2.5
5413	Architectural, Engineering, and Related Services	Only domestic	3,156.9	3,156.9
5415	Computer Systems Design and Related Services	Only domestic	275.3	275.3
5416	Management, Scientific, and Technical Consulting Services	Only domestic	205.9	205.9
5417	Scientific Research and Development Services	Only domestic	64.6	64.6
5622	Waste Treatment and Disposal	Only domestic	3.8	3.8
5629	Remediation and Other Waste Management Services	Only domestic	988.1	988.1
6215	Medical and Diagnostic Laboratories	Only domestic	57.8	57.8

\* Some firms were classified only with a 3-digit NAICS code. Appropriate aggregation techniques were employed in computing the economic impact of these firms.

**Table 2: List of Emerging and Developing Countries, the International Monetary Fund**

Afghanistan	Dem. Rep. of Timor-Leste	Liberia	Senegal
Albania	Djibouti	Libya	Serbia
Algeria	Dominica	Lithuania	Seychelles
Angola	Dominican Republic	Macedonia, FYR	Sierra Leone
Antigua and Barbuda	Ecuador	Madagascar	Slovak Republic
Argentina	Egypt	Malawi	Solomon Islands
Armenia	El Salvador	Malaysia	Somalia
Azerbaijan	Equatorial Guinea	Maldives	South Africa
Bahamas, the	Eritrea	Mali	Sri Lanka
Bahrain	Estonia	Mauritania	St. Kitts and Nevis
Bangladesh	Ethiopia	Mauritius	St. Lucia
Barbados	Fiji	Mexico	St. Vincent and the Grenadines
Belarus	Gabon	Moldova	Sudan
Belize	Gambia, The	Mongolia	Suriname
Benin	Georgia	Montenegro	Swaziland
Bhutan	Ghana	Morocco	Syrian Arab Republic
Bolivia	Grenada	Myanmar	Tajikistan
Bosnia and Herzegovina	Guatemala	Namibia	Tanzania
Botswana	Guinea	Nepal	Thailand
Brazil	Guinea-Bissau	Nicaragua	Togo
Brunei Darussalam	Guyana	Niger	Tonga
Bulgaria	Haiti	Nigeria	Trinidad and Tobago
Burkina Faso	Honduras	Oman	Tunisia
Burundi	Hungary	Pakistan	Turkey
Cambodia	India	Panama	Turkmenistan
Cameroon	Indonesia	Papua New Guinea	Uganda
Cape Verde	Iran	Paraguay	Ukraine
Central African Republic	Iraq	Peru	United Arab Emirates
Chad	Jamaica	Philippines	Uruguay
Chile	Jordan	Poland	Uzbekistan
China	Kazakhstan	Qatar	Vanuatu
Colombia	Kenya	Rep. Boliv. De Venezuela	Vietnam
Comoros	Kiribati	Rep. of Mozambique	Yemen
Congo, Rep. of	Kuwait	Romania	Zambia
Costa Rica	Kyrgyz Republic	Russia	Zimbabwe
Côte d'Ivoire	Lao PDR	Rwanda	
Croatia	Latvia	Samoa	
Czech Republic	Lebanon	São Tomé and Príncipe	
Dem. Rep. of Congo	Lesotho	Saudi Arabia	

**Table 3: List of For-profit Firms Involved in Global Health in California**

3E Company	Analytic & Computational Research, Inc.	Bechtel National, Inc.
3i International, Inc.	Ancon Marine Services	Beckman Coulter, Inc.
AAA Lead Consultants & Inspections, Inc.	Andermac, Inc.	Benchmark Softec, Inc.
Aardex USA	Andros Inc.	Bidshift Inc
Aatech Inc	Anesthesia Associates Inc	Biocheck, Inc.
ABB Business Management Systems, Inc.	Animated Software Company	BioDiscovery, Inc.
Acal Corp.	Aonix	BioGenex Laboratories, Inc.
Accelerated Technologies, Inc.	APEX Voice Communications, Inc.	BIOPAC Systems, Inc.
Accelrys, Inc.	Apogee Software, Inc.	Bio-Rad Laboratories, Inc.
ACON Laboratories, Inc.	Applied Biosystems Group	BioSure, Inc.
ACTA, Inc.	Applied Biotech, Inc.	Biovir Laboratories, Inc.
Activant Solutions, Inc.	Applied Voice & Speech Technologies Inc	Bonadiman Consultants, Inc.
ActivCard, Inc.	Apriso Corp.	Bondline Products
activePDF, Inc.	Aps Water Svc Corp	Boston Scientific Corp.
ADP National Account Services	Aptech Engineering Services, Inc.	Boyle Engineering Corp.
ADPAC Corp.	Aqua Man, Inc.	Brelje & Race Laboratories Inc
Advance Fabrication	AquaCell Technologies, Inc.	Brendan Scientific
Advanced American Biotechnology, Inc.	Aquadyne Computer Corp.	Breveon, Inc.
Advanced Cleanup Technology, Inc.	Aquafine Corp	Britesmile, Inc.
Advanced Respiratory Care	Aradigm Corp.	Brown, Vence & Associates, Inc.
ADVENTRX Pharmaceuticals, Inc.	Archive Arts	BSK Analytical Laboratories
Advocate Software, Inc.	Arena Solutions	BSK Associates
AEI Consultants, Inc.	Arete Associates, Inc.	Burton Medical Products Corp.
Aeros Environmental Inc	Asl Acquisition Inc	Business Objects Americas, Inc.
AeroVironment, Inc.	Aspect Software, Inc.	C M Ind Supplies
Affymetrix, Inc.	Assay Technology, Inc.	Cadence Design Systems, Inc.
Agensys, Inc.	AssurX, Inc.	CADMAN Corp.
Air Cleaning Technology	Astera Software, Inc.	Cal Water, Inc.
Air Exchange, Inc.	ATAC Corp.	Calapro, Inc.
Air Gap International, Inc.	Atempo, Inc.	CalCoast Laboratories, Inc.
Air Instruments & Measurments, LLC	Atesto Technologies, Inc.	California Analytical Instruments, Inc.
Air Purification Systems, Inc.	Atmospheric & Environmental Research, Inc.	Caltest Analytical Laboratory
All Chemical Disposal, Inc.	Automation ONSPEC Software, Inc.	CAM Commerce Solutions, Inc.
Allergene	AVANIR Pharmaceuticals, Inc.	CaminoSoft Corporation
Allergy Free, LP	AVC Specialists Inc	Canto Software, Inc.
Alliance Pharmaceutical Corp.	Aware Systems	Cantor & Co.
Almen Laboratories, Inc.	Axiom Technologies International, LLC	CAPCO Analytical Svc Inc
Alpha Analytical Laboratories	Axon Instruments, Inc.	Cardiac Science Corporation
Alpha Star Corporation	Azerity	Cardinal Health, Inc.
Alpine Gloves, Inc.	B I Nutraceuticals	CardioDynamics
American Analytics	B&B Medical Technologies, Inc.	CardioGenesis Corporation
American Bantex Corp.	B&C Nutritional Products, Inc.	Carollo Engineers, P.C.
American Environmental Testing	Bambeck Systems, Inc.	Catalytica Energy Systems, Inc.
American Medical Systems	Barefoot Medical	Celera Diagnostics
Amgen, Inc.	BD Biosciences	Centrum Analytical Laboratory
Anabolic Laboratories Inc.	BEA Systems, Inc.	CERCO Analytical
Anabolic Laboratories, Inc.	BEA Systems, Inc.	Cerner Etreby
		Cerus Corp.
		CFM Enterprises, Inc.
		CheckFree-IDS

Chemical Engineering Partners  
 ChevronTexaco Energy Research and Technology Co.  
 Claritas, Inc.  
 Clary Corp.  
 Claude Laval Corp.  
 Clean Air Products Technology  
 Clear Creek Systems, Inc.  
 Climet Instruments Co.  
 Clinical Lab Of San Bernardino  
 ClinPro International Co., LLC  
 CMS Solutions, Inc.  
 Coalesce Corp.  
 Coast Filtration, Inc.  
 CODAN U.S. Corporation  
 Cogco, Inc.  
 CoHort Software  
 CollabNet, Inc.  
 Columbia Analytical Svc  
 Commercial Programming Systems, Inc.  
 Comp Pro Med, Inc.  
 Compulink Management Center, Inc.  
 CompuMed, Inc.  
 Condor Reliability Services, Inc.  
 Converse Consultants  
 Conversion Products Inc  
 Core Software Technology  
 Corticon Technologies, Inc.  
 CorVel Corporation  
 CPU Medical Management Systems, Inc.  
 CPU Technology, Inc.  
 Creations Gardens Corp.  
 Creative Computer Applications, Inc.  
 Creditron Corporation  
 Crosby & Overton, Inc.  
 Curtis & Tompkins Ltd  
 Custom Probiotics  
 CytoCulture International, Inc.  
 Cytokinetics, Inc.  
 CytRx Corp.  
 D & D Electro-Mech Inc  
 Data Domain, Inc.  
 Data Strategies, Inc.  
 Data Systems Group of California, Inc.  
 Decision Management Co., Inc.  
 Del Mar Analytical, Inc.  
 DEL Ozone, Inc.  
 Delstar Technologies, Inc.  
 DEY L.P.  
 diaDexus, Inc.  
 Dime Water, Inc.  
 Discovery Ventures Biomed, Inc  
 Distinct Software, Inc.  
 D-K Environmental  
 Document Sciences Corporation  
 Dorado Software, Inc.  
 Douglas Engineering  
 DryVac Environmental, Inc.  
 DYK Incorporated  
 Dynamic Graphics, Inc.  
 Dynamic, Inc.  
 Dynavax Technologies Corporation  
 EBA Engineering  
 EcoMat, Inc.  
 Edison International  
 Edison Mission Energy  
 Eiffel Software, Inc.  
 Eloret Corporation  
 Embarcadero Systems Corp.  
 EMC Corp.  
 Emerald Laboratories  
 Encirq Corporation  
 Endocare, Inc.  
 Endocrine Technologies, Inc.  
 E-N-G Mobile Systems, Inc.  
 Engineering Management Concepts Inc.  
 Entech Analytical Labs Inc  
 Entelos, Inc.  
 EnVectra, Inc.  
 Enviance, Inc.  
 Enviro-Chem Inc  
 Environmental Analytical Svc  
 Environmental BioTechnologies, Inc.  
 Environmental Business Solutions  
 Environmental Chemical Corp.  
 Environmental Microbiology Laboratory, Inc.  
 Environmental Monitoring Co  
 Environmental Products and Technologies Corporation  
 Environmental Sampling Services  
 Environmental Software Providers, Inc.  
 Environmental Store  
 Environmental Systems Research Institute, Inc.  
 Environmental Testing & Tech  
 EORM, Inc.  
 ePocrates, Inc.  
 Equipment Manufacturing Corp.  
 ESHconnect, Inc.  
 Evault, Inc.  
 Evergreen Oil, Inc.  
 Evergreen Scientific, Inc.  
 everStor Software Corp.  
 EvolveWare, Inc.  
 Exavio, Inc.  
 Exergy Technologies Corp.  
 Expandable Software, Inc.  
 Fallbrook Engineering, Inc.  
 FAMIS Software, Inc.  
 Fero Environmental Engineering, Inc.  
 Filtronics, Inc.  
 First Consulting Group, Inc.  
 First DataBank Inc.  
 Florence Filter Corp.  
 Flow Designs, LLC  
 Fluidlines, Inc.  
 Focus Diagnostics  
 Forecross Corp.  
 Fossil Energy Research Corp.  
 Franz Inc.  
 Future Resources Associates, Inc.  
 Galaxy Advanced Engineering, Inc.  
 GE Energy & Environmental Research Corp.  
 GenBio  
 Genelabs Technologies, Inc.  
 General Atomics  
 Gen-Probe Inc.  
 GenVault Corporation  
 Geoscientific Systems & Consulting  
 Giles Scientific, Inc.  
 gINT Software  
 Global Water Instrumentation, Inc.  
 Glycozyme, Inc.  
 Google, Inc.  
 Gordon Williams Co.  
 Gregg In-Situ, Inc.  
 H M Pitt Labs Inc  
 Hansen Information Technologies Inc.  
 HEPA Corp.  
 HI-Q Environmental Products Co.  
 Hi-Temp Insulation, Inc.  
 Hi-Z Technology, Inc.  
 Hollis Eden Pharmaceuticals, Inc.  
 Horiba Instruments, Inc.  
 Houston Fearless 76, Inc.  
 HSQ Technology  
 Human Resource MicroSystems, Inc.  
 Hydronic Engineering Corp.  
 IBM Micromuse Inc.  
 IBM Software Group  
 ICU Medical, Inc.  
 IDM Pharma, Inc.  
 I-Flow Corp.  
 ILAR Systems, Inc.

Image-X, Inc.  
Immune Response Corp., The  
Immusol, Inc.  
IMPAC Medical Systems, Inc.  
InfoGain Corporation  
Informatica Corp.  
Information Concepts, Inc.  
Infrared Analysis, Inc.  
Ingenuity Systems, Inc.  
Innovative Interfaces, Inc.  
Inspection Consultants Inc  
Instead, Inc.  
Intarcia Therapeutics Inc  
Integrity Environmental  
Intermap Systems, Inc.  
InterMune, Inc.  
International Business Systems Inc.  
InterWorking Labs, Inc.  
InterWorld Group, Inc.  
IntraBiotics Pharmaceuticals, Inc.  
Invensys SimSci-Esscor  
Ionics Ultrapure Water Corp.  
IPC - The Hospitalist Company  
IPEC Global, Inc.  
Irwin Naturals  
Isis Pharmaceuticals, Inc.  
Item Software USA, Inc.  
Jacobs Engineering Group Inc.  
Kapur International, Inc.  
Keane Healthcare Solutions  
Kemstar Corp.  
Kennedy/Jenks Consultants, Inc.  
Kentec Medical, Inc.  
Kinetico Quality Water Systems  
KKI Corp.  
Kleinfelder, Inc.  
KnowNow, Inc.  
Lakos Separators and Filtration  
Systems  
Lantec Products, Inc.  
Large Scale Biology Corp.  
Lawrence Livermore National  
Laboratory  
Lazar Research Laboratories, Inc.  
LEE & RO, Inc.  
Lee Engineering Enterprises  
International  
Lee Pharmaceuticals  
Legato Software  
LFR Levine-Fricke  
LG&E Power, Inc.  
LifeMasters Supported SelfCare, Inc.  
LIFEMED of California  
Lightspeed Systems, Inc.

LINC Software Services  
Lipomics Technologies, Inc.  
Loprest Water Treatment Co  
M.W. Sausse & Co., Inc.  
Magic Software Enterprises, Inc.  
MAJARO InfoSystems, Inc.  
Mallinckrodt  
Mallinckrodt Nellcor Puritan-Bennett  
MannKind Corporation  
Masimo Corp.  
Masterplan  
Maxygen, Inc.  
Mazzei Injector Corp.  
MBA Polymers, Inc.  
McCoy Moria Crystal, Inc.  
Medical Associates Networks, Inc.  
Medical Packaging Corp.  
MedImmune Vaccines, Inc.  
Medizone International, Inc.  
Medrium  
Medsn  
Membrane Technology & Research,  
Inc.  
Mentor Graphics Corp.  
Merry X-Ray Chemical Corp  
Metalclad Insulation Corp.  
MetiLinx, Inc.  
Michelson Laboratories Inc  
Micro Search Environmental Corp.  
Micro Specialties, Inc.  
Microbac Laboratories, Inc.  
Miller Manufacturing, Inc.  
Mirage Systems, Inc.  
Mobitor Corporation  
Monogram Biosciences, Inc.  
Montague Co  
Montana Testing & Geotechnical, Inc.  
Monterey Bay Unified Air  
MR3 Systems, Inc.  
MSE Environmental, Inc.  
MWH Laboratories  
NanoLogic, Inc.  
Natrol, Inc.  
Natural Logic, Inc.  
NBTY Mfg, LLC  
Neil O. Anderson & Associates, Inc.  
NetManage, Inc.  
Netscape Communications Corp.  
New Logic Research, Inc.  
NewBiotics, Inc.  
NHK Laboratories Inc  
Nilsen Associates  
Nimbus Water Systems, Inc.

NOLO, Inc.  
Noranda Recycling, Inc.  
Norcal Waste Systems, Inc.  
NovaLynx Corporation  
Novartis Vaccines & Diagnostics, Inc.  
Novartis Vaccines and Diagnostic,  
Inc.  
NuGEN Technologies, Inc.  
NutraCea, Inc.  
NYAD, Inc.  
OAO HealthCare Solutions  
Oasis Medical, Inc.  
Omnicell, Inc.  
Online Power, Inc.  
Optimizer Pharmaceuticals, Inc.  
Oracle Corp.  
Oracle Corp.  
Orative Corp.  
OSIsoft  
Osmosis Technology, Inc.  
OuterBay Technologies  
Ozotech, Inc.  
Pacific Analytical Inc  
Parsons Infrastructure & Technology  
Group, Inc.  
Pathfinder Instruments, Inc.  
Patriot Environmental Services  
Pentagon Technologies  
Perennial, Inc.  
Pharsight Corp.  
Phl  
Physician WebLink of California, Inc.  
Physician WebLink of North Carolina  
Physio Systems, Inc.  
Pneumapress Filter Corp.  
Pollution Prevention International, Inc.  
Polymetrics Inc  
PQP, Inc.  
Precision Dynamics Corp.  
Products For Medicine  
Promega Corporation  
ProSurg, Inc.  
Pro-Systems Fabricators, Inc.  
Protein Research Associates  
PTS Laboratories  
Pulsar UV Technologies  
PULSCO  
PURE Bioscience  
Q&S Engineering, Inc.  
QED Bioscience, Inc.  
QED Environmental Systems, Inc.  
Quantitative Medical Systems, Inc.  
Quest Software, Inc.

Quidel Corp.  
 R O Ultratec USA Inc  
 R2 Technology, Inc.  
 Raining Data Corp.  
 RelayHealth Corporation  
 Relsys International, Inc.  
 RenderX, Inc.  
 RES Environmental  
 ResMed, Inc.  
 Respiratory Support Products, Inc.  
 RES-Q Healthcare Systems, Inc.  
 Romic Environmental Technologies Corp.  
 Rotonics Manufacturing, Inc.  
 RUN Technologies Company  
 S L Corp  
 S.D. Carmack Dirtmoving  
 S4i Systems, Inc.  
 Safety Equipment Corp.  
 Safety Storage, Inc.  
 Sagantec  
 Salter Labs  
 Sans Souci Consulting  
 Santa Cruz Biotechnology, Inc.  
 SAP Corp.  
 SAS Insitute Inc  
 SAS Institute Inc  
 SAS Institute Inc  
 SAS Institute Inc  
 SCEC  
 Scheduling.com, Inc.  
 SciClone Pharmaceuticals, Inc.  
 Scimagix, Inc.  
 Scope Industries, Inc.  
 SCS Engineers  
 Sea Recovery Corp.  
 Secure Computing Corp.  
 Sensoria Corp.  
 Separation Processes, Inc.  
 Separation Systems Technology, Inc.  
 Sequence Design, Inc.  
 Siemens Medical Solutions Diagnostic  
 Simulation Services  
 SkyePharma Inc.  
 Smith Micro Software  
 Software Development, Inc.  
 Sorenson Engineering, Inc.  
 Specialty Laboratories, Inc.  
 Spectrum Laboratories, Inc.  
 Sphere Health Systems, Inc.  
 Spintek Filtration Inc  
 SpinTek Filtration, Inc.  
 Spray-Chem Chemical Corp  
 Sprite Industries, Inc.  
 Stantec  
 Starkey California  
 StoreAge Networking Technologies, Inc.  
 Strategic Healthcare Programs  
 SunGard AvantGard  
 Sunscope International, Inc.  
 Supreme Supply Co., Inc.  
 Survivair, Inc.  
 Survivor Industries, Inc.  
 Swab Plus Inc  
 Sybase, Inc.  
 Symantec Corp.  
 SymphonyRPM, Inc.  
 Symtrax Corp.  
 Symyx Discovery Tools, Inc.  
 Synbiotics Corp.  
 Synergex International Corp.  
 Tacit Software  
 Tarari, Inc.  
 Taurus Software, Inc.  
 Tayco Engineering, Inc.  
 Tech2O Engineering, Inc.  
 Technology Visions Group, Inc.  
 Temcor  
 Terra Vac, Inc.  
 Terra-Kleen Response Group, Inc.  
 Tetra Tech, Inc.  
 ThermoGenesis Corp.  
 Theta Engineering, Inc.  
 Thomas Hill, Inc.  
 Timely Medical Innovations Ltd  
 TISCOR  
 Titan Pharmaceuticals, Inc.  
 Trackware, Inc.  
 TRADOS, Inc.  
 TRC Alton Geoscience, Inc.  
 TRC Lowney Associates, Inc.  
 Trimeddyne, Inc.  
 Trinity Biosystems, Inc.  
 TriZetto Group, Inc. φThe  
 Trolltech Inc.  
 Truesdail Laboratories Inc  
 Trust For Public Land, The  
 Tumbleweed Communications Corp.  
 UCSD Medical Center  
 Ultimate Formulations, Inc.  
 UltraViolet Devices, Inc.  
 UltraViolet Devices, Inc.  
 Unipure Corp.  
 Universal Detection Technology  
 US Technology Resources LLC  
 Vacumetrics, Inc.  
 Valley Oak Systems, Inc.  
 Valterra Products, Inc.  
 Valutech, Inc.  
 VantageMed Corp.  
 Varian Medical Systems, Inc.  
 VaxGen, Inc.  
 Vege Mist, Inc.  
 Velos, Inc.  
 Veridium Inc  
 Verity, Inc.  
 Versaform Systems Corp.  
 VertiQ Software LLC  
 Viador, Inc.  
 VIASYS Healthcare Inc.  
 Vical Inc.  
 Vidius, Inc.  
 Vista Research, Inc.  
 Vitria Technology, Inc.  
 Wailani Pools, Inc.  
 Waste Connections, Inc.  
 Waterway Products  
 Weathernews Americas, Inc.  
 Website Asp  
 Western Water Products, Inc.  
 Western Water Purifier Co.  
 Weston Solutions Inc  
 Whitewing Labs  
 Wildland Resource Management, Inc.  
 Wire Technology Corp  
 Workshare  
 XOMA Ltd.  
 Yosemite Technologies, Inc.  
 ZANTAZ, Inc.  
 ZymaX envirotechnology, Inc.

**Table 4: List of Non-Profit Organizations in Global Health in California**

100 Friends	Asian Community Mental Health Board	Committee For Health Rights In The Americas
A Touch Of Love Foundation	Assist International, Inc.	Community Environmental Council, Inc.
Academy Of Friends	Assyrian Aid Society Of America	Community Food Security Coalition Inc
Adequation USA	Asylum Access	Community Institute For Psychotherapy
Afghan Friends Network	Ayala Foundation USA	Conexions Partnerships For A Sustainable Future
Africajack Foundation	Baker Places Inc	Conservation And Preservation Charities Of America
African American AIDS Support And Survival Institute	Bella Vista Foundation	Daughters Of Charity Foundation
African Community Resource Center	Berkeley Boosters Association	Developing Indigenous Resources
African Millennium Foundation	Bhaktivedanta International Charities Inc	Development Engineering Research Institute
African-American AIDS Policy And Training Institute DBA, Black Aids Institute	Bi-National AIDS Advocacy Project	Diabetes Society
Aggressive AIDS Prevention, Inc.	Biosphere Foundation	Direct Relief International
AIDS Education Global Information System	Blue Energy	Discover The World Inc
AIDS Healthcare Foundation	Brentwood Biomedical Research	Do Unto Others Americas: Emergency Relief Development And Humanitarian Outreach Charities
AIDS Project Los Angeles, Inc.	Business For Social Responsibility	Drew Cares International
AIDS Project Of The East Bay	Butuan City Charities Foundation Of Southern California	Earth Island Institute Inc
AIDS Research Alliance	Cal-Pep	Earthjustice
AIDS.Org, Inc.	California Endowment	East Bay Zoological Society
AIDSail	Cambodian Children's Fund	East Meets West Foundation
Airline Ambassadors International Inc	Campus California Tg	Eastfield Ming Quong, Inc.
Alfred E. Mann Foundation For Scientific Research	Canvasback Missions, Inc.	Echo Endangered Creatures Habitats & Organisms Fund Inc
All Species	Care	Ecocity Builders
Alliance For African Assistance	Center For Ecosystem Survival	Effort Inc
Alternative Gift Markets, Inc.	Center Point	Ensaaf Inc
Alyson Ilene Kaplan Memorial Foundation	Centro Binacional Para El Desarrollo Indigena Oaxaqueno	Entertainment Industry Foundation
Amazon Watch	Change For A Penny, Inc.	Environmental Education Media Project For China
American Friends Service Committee (AFSC)	Chi Rho Corp.	Environmental Media Association Inc
American Jewish World Service	Child Family Health International (Cfhi)	Face AIDS
American Service To India Medical & Educational Foundations	Children Of Grace	Firelight Foundation
Americans Helping Asian Children Foundation	Children Of The Americas	Floresta USA, Inc.
Anai Inc	Children's Health, Education And Leadership Project (H.E.L.P.)	Flying Samaritans
Anand Chairty	Children's Hunger Fund	Focus On AIDS
Apeca, Inc.	Children's Network International	Forge
Api Wellness Center	Children's Voice	Foundation For Sustainable Development
Ark De Yahweh	Children's Art Village, Inc.	Foundation For The People Of Burma
Artists For A New South Africa	Children's Hunger Fund Foundation	Free Wheelchair Mission
Arusha Project Inc	Church World Service	Freedom From Hunger
Asian & Pacific Islander American Health Forum	Clarence Foundation	Friends Of Burkina Faso Inc
Asian American Recovery Services, Inc.	Club Of Geneva	
Asian American-Pacific Islanders In Philanthropy	Clueit Foundation	
	Coalition For Clean Air	
	Coalition Of Women From Asia And The Middle East	
	Colombia Vision	



Friends Of Calakmul, Inc. A Delaware Corp.  
 Friends Of Gardenia Willows Wetland Preserve Inc  
 Friends Of The Mothers Programmes Inc  
 Friends Vinhson Montagnard Catholic Orphanage & Mission-Vietnam  
 Fritz Institute  
 Geothermal Education Office  
 Global Action International  
 Global AIDS Interfaith Alliance  
 Global Catalyst Foundation  
 Global Classrooms For Peace  
 Global Energy Network International  
 Global Equal Access Incorporated  
 Global Exchange  
 Global Fund For Women  
 Global Health Access Program  
 Global Inter-Action  
 Global Lifeworks  
 Global Operations And Development- Giving Children Hope  
 Global Partners For Development  
 Global Resource Alliance Inc  
 Global Service Corps  
 Global Solutions For Infectious Diseases  
 Global Village Foundation  
 Global Water  
 Globaleyes  
 Grace USA  
 Green Visions Center For Renewable Energy  
 Harbor-UCLA Research And Education Institute  
 Health And Medical Research Charities Of America  
 Healthy Child Healthy World, Inc.  
 Heifer International  
 Helen Woodward Animal Center  
 Helping Ugandans Grow Stronger  
 Hesperian Foundation  
 Hope Ethiopia, Inc  
 Hope For Africa  
 Hope For Future Victory, Inc.  
 Hope For Hearing Foundation  
 Hope For The Future  
 Human Rights Congress For Bangladeshi Minorities  
 Human Strategies For Human Rights

Humanitarian Wave  
 Indians For Collective Action (Ica)  
 Institute For Applied Biomedicine  
 Institute For Education Research And Scholarships  
 Institute For Food And Development Policy Inc  
 Instituto De Educación Popular Del Sur De California  
 Instituto Familiar De La Raza  
 Insurance Industry Charitable Foundation Inc  
 Interfaith Indonesian Children's Fund  
 International Child Resource Institute (ICRI)  
 International Children's Charity Foundation Inc  
 International Committee Of Artists For Peace  
 International Development Exchange  
 International Medical Corps  
 International Pemphigus Foundation  
 International Relief Teams  
 Internet Sexuality Information  
 Interplast Inc  
 Invisible Children Inc  
 Islamic Relief  
 J David Gladstone Institutes  
 Jewish Federation Council Of Greater Los Angeles  
 Josh Groban Foundation  
 Kacyra Family Foundation  
 Katalysis Partnership Inc  
 Kenya Kids In Need  
 Kham Aid Foundation  
 Kickstart-International, Inc.  
 Kiva Microfunds  
 Kni Foundation  
 Korean Youth And Community Center, Inc.  
 Laca Foundation  
 Laguna De Santa Rosa Foundation  
 Latino Policy Coalition  
 Lawrence Foundation  
 Liberty Hill Foundation  
 Lifespan Learning Institute  
 Lifewater Inc  
 Live Again Ministries  
 Los Niños  
 Love And Action Inc  
 Lucile Packard Foundation For Children's Health

Mama Makeka House Of Hope  
 Matibabu Foundation  
 Matter Of Trust Inc  
 Medicines Global GB  
 Meridian Health Foundation  
 Mexican American Alcoholism Program Inc  
 Mexican Christian Childrens Aid Inc  
 Mexican Medical Incorporated  
 Middle East Children's Alliance  
 Migration Dialogue  
 Mobilization Against AIDS International Inc  
 Monterey Institute Of International Studies;  
 International Environmental Policy  
 Morgan Foundation  
 Music For Relief  
 Myelin Repair Foundation  
 Napa Valley AIDS Project  
 National Infectious Disease Research Center  
 Nature And Culture International  
 Nautilus Of America, Inc.  
 Nepalese Youth Opportunity Foundation Inc  
 New Field Foundation  
 New Leaf Services For Our Community  
 Newport Balboa Rotary Club Foundation  
 Nokr Inc.  
 Nonprofit Enterprise And Self-Sustainability Team, Inc.  
 Northern California Solar Energy  
 Oak Crest Institute Of Science  
 Occupational Knowledge International  
 One World Children's Fund  
 Operation Orphans International  
 Operation USA  
 Organization For Chemical Sciences In Development Incorporated  
 Orphan Aid Africa  
 Otto Family Foundation  
 Pacific Asian Counseling Services  
 Pacific Environment  
 Pacific Institute For Women's Health  
 Pacific Safety Council  
 Pangaea Global AIDS Foundation  
 Parents International Ethiopia Inc

Physicians For Social Responsibility Inc  
Physicians For Social Responsibility Inc  
Planet Care  
Postpartum Support International  
Practical Ocean Energy Management Systems, Inc.  
Project Baobab  
Project Concern International  
Project Inform Inc  
Quaker Bolivia Link  
Rainbow World Fund  
Real Medicine Inc  
Recycled AIDS Medicine Program  
Redwood Environmental Education Institute Dba Redwood Alliance  
Reef Check Foundation  
Refugee Relief International, Inc.  
Relief International  
Renewable Energy Development Institute  
Renewable Energy For Medicine And Education  
Rescue Task Force  
Rogers Charitable Fund  
Rudolf Steiner Foundation, Inc. DBA RSF Social Finance  
S.H.I.P. Aid  
Sahaya International Inc  
San Francisco AIDS Foundation  
San Joaquin AIDS Foundation  
Sankofa Center For African Dance & Culture  
Save Mount Diablo  
Serving Hands International

Serving Our World  
Seva Foundation  
Shenpen America  
Shower Our Spirit Inc.  
Siempre Unidos  
Sierra Club Foundation  
Skoll Community Fund  
Sogan Foundation  
Streams Of Life International Inc  
Sunnyvale Community Services  
Sunrise Community Counseling Center  
Sunwork Renewable Energy Projects  
Supporting Gulf Efforts Foundation  
Surfrider Foundation  
Three Guineas Fund  
Threshold Ministries Inc  
Through The Looking Glass  
Tias Arms  
Tibet Justice Center  
Tiger Woods Foundation, Inc.  
Tigeraid Foundation  
Tijuana Christian Mission City Of Refuge  
Tipping Point Community  
To Love Children Educational Foundation International Inc  
Torrey Pines Institute For Molecula Studies  
treach CharitiesGlobal Health And Education Foundation  
Tri-Valley Communities Against A Radioactive Environment  
Uganda Children's Fund, Inc.  
United Iriguenos, Inc.

United Jewish Appeal Federation Of Ventura County  
United States Doctors For Africa, Inc.  
United Support Of Artists For Africa  
Upper Sacramento River Exchange  
Vanguard Public Foundation  
Ventana Wildlife Society  
Vietnamese Heritage Institute  
Vijay Amitraj Foundation  
Village Enterprise Fund, Inc.  
Volunteers For Interamerican Development Assistance  
Volunteers In Asia  
Walden House, Inc.  
Wall-Las Memorias Project  
Wells For Life  
Wildaid Inc  
Wilderness Conservancy  
Women Children And Family Service Charities Of America  
Women's Empowerment International  
Women's Intercultural Network - Win  
Women's Recovery Association Of San Mateo County Inc  
World Action For Humanity  
World Emergency Relief  
World Neighbors  
World Runners  
World Vision International  
Yad Ezra Vshulamit

Recognizing the long-standing and emerging challenges to global health, the University of California Global Health Institute will create multi-campus, transdisciplinary Centers of Expertise to address these challenges through a novel problem-based and action-oriented approach. By integrating and leveraging the diverse intellectual capacity of faculty on the ten UC campuses, this groundbreaking University-wide initiative will focus on producing leaders and practitioners of global health, conducting innovative research, and developing international partnerships to improve the health of vulnerable people and communities in California and world-wide. The Institute will take advantage of cutting-edge technology to enable teaching and research and to connect faculty, researchers, students and partners around the world.



UC Global Health Institute  
3333 California Street, Suite 285  
San Francisco, CA 94118  
415.502.6045



Web: [ucghi.universityofcalifornia.edu](http://ucghi.universityofcalifornia.edu)  
Email: [ucghi@globalhealth.ucsf.edu](mailto:ucghi@globalhealth.ucsf.edu)