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**Occupational Employment and Job Vacancy
Developments in Massachusetts 2000-2005:
Implications for Future Workforce
Development Policy**

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April 2006

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Introduction

Workforce development policymaking and program planning at the state and local level by a wide variety of economic actors, both private and public, is dependent upon the availability of timely and statistically reliable labor market and occupational information.¹ Knowledge of current trends in the level, industrial and occupational composition, and geographic distribution of employment and available job opportunities in the state is needed to guide a variety of employment and training activities at the state and local level.² Efforts to place jobseekers in One Stop Career Centers, other labor exchange offices, and training/education institutions require information on available job openings, the firms with available vacancies, their occupational characteristics, hiring requirements, pay levels/employee benefits, and geographic locations. The planning and design of job training programs should be based on knowledge of recent and anticipated employment developments by industry and occupation, the numbers of available job openings by industry and occupation, the geographic locations of the firms with these job openings, and the hiring requirements/wages of these job openings.

Public policies to promote labor market efficiency by more effectively matching job vacancies with the number of unemployed and underemployed/malemployed persons are dependent on information on the industrial and occupational characteristics of both job openings and available job seekers.³ Such information would help identify labor shortages and surpluses in industries and occupations and provide guidance to labor exchange and job training agencies in their efforts to place applicants in jobs and assist dislocated workers in finding new employment. Knowledge of the current and potential earnings of workers in such jobs would also help guide efforts to enable workers to achieve various levels of earnings adequacy.

¹ For a detailed description and analysis of the roles of labor market and occupational information systems in designing and planning employment and training programs at the state and local level,

See: Andrew Sum, Paul Harrington, and Lorraine Amico, Cracking the Labor Market for Human Resource Planning, National Governors Association, Washington, D.C., 1982.

² Jobs can be categorized along a variety of dimensions and at varying levels of disaggregation for each of these dimensions, including industries, size class of employer, occupations and education/literacy requirements.

³ For a review of the uses of job vacancy data in identifying occupational shortages at the state and local level and analyzing labor market developments,

See: (i) Andrew Sum and Paul E. Harrington, Job Vacancy Data and the Measurement of Occupational Shortages and Surpluses at the State and Local Level, Center for Labor Market Studies, Northeastern University, Boston, 1983; (ii) Harry J. Holzer, Unemployment, Vacancies, and Local Labor Markets, W.E. Upjohn Institute for Employment Research, Kalamazoo, 1989.

Until recently (2003), workforce development planners and labor market analysts in Massachusetts and many other states across the country were handicapped in their efforts to rigorously identify labor shortages and surpluses due to an absence of comprehensive and statistically representative job vacancy data by industry or occupation.⁴ Since the fall of 2002, however, the Massachusetts Department of Workforce Development through the Division of Unemployment Assistance has undertaken a statewide, semi-annual job vacancy survey that provides estimates of the number of job vacancies in the state as a whole, major industrial sectors, selected industries, major occupational groups, some individual occupations, and for seven geographic regions of the state. The job vacancy data by occupation can be combined with data on employment by occupation to generate estimates of job vacancy rates. The job vacancy estimates can be used together with data on employment developments and earnings of workers by occupation to identify occupations at the state and regional level that meet selected job openings and earnings criteria. These occupations, thus, can serve as targets for future job training and intensive job placement efforts. This research paper is designed to provide a comprehensive analysis of employment and job vacancy developments in Massachusetts by occupational category in recent years both at the state level and in selected substate areas and to assess the implications of these findings for future workforce development planning and policymaking in the Commonwealth.

An Overview of the Report's Findings

The analysis of occupational employment and job vacancy developments in Massachusetts will begin with a review of the key concepts, measures, and data sources underlying the estimates of employment, unemployment, and job vacancies by occupation. The employment and vacancy data are generated by a variety of household and establishment surveys undertaken by the U.S. Census Bureau and the Division of Unemployment Assistance in Massachusetts as well as an establishment-based job vacancy survey that has been conducted by the Massachusetts Department of Workforce Development since the fall of 2002.⁵ These

⁴ There were a number of ad hoc job vacancy surveys undertaken to identify job vacancies in selected occupations and industries in New England and Massachusetts during the late 1990s and the 2000-2001 period.

See: Paul Harrington and Neeta P. Fogg, Threats to Sustained Economic Growth: Science, Engineering, and Information Technology Labor Shortages in the Massachusetts Economy, Prepared for the Commission on High Technology Workforce Development, The New England Council, 2000.

⁵ We also use the employment findings of the 2000 decennial census to compare the occupational employment structure in Massachusetts with that of the U.S. at the time of the 2000 Census.

discussions of concepts, measures, and data sources will be followed by an analysis of historical and more recent trends in occupational employment in Massachusetts during the 1990s and over the 2000-2005 period. Key findings for Massachusetts will be compared to those for the U.S. with respect to employment growth rates by occupation and the changing occupational composition of employment. Employment trends in Massachusetts over the past five years have diverged markedly in many respects from those over the past decade, and the state's job growth performance has lagged considerably behind that of the nation since 2000.

The occupational employment analysis will be supplemented with a detailed examination of findings from the state job vacancy surveys with respect to the numbers and rates of job vacancies by major occupational area from the second quarter of 2003 through the second quarter of 2005. Estimates of job vacancies by occupational group also will be compared to the estimated number of unemployed persons by occupational group for selected time periods to identify the degree of shortage and surplus in these occupational groups. The analysis of vacancy rates will be provided for the state as a whole and for seven geographic regions across the state. Comparisons of job vacancy rates in occupational categories across these seven geographic regions also will be made to highlight geographical diversity in the pattern of job vacancy rates. An analysis of job vacancies and vacancy rates in selected individual occupations also will be provided.

Data on the wages being offered to workers in given occupations and their earnings potential in such occupations are important for evaluating their suitability for training investments. A variety of hourly wage and annual earnings data will be presented for a subset of occupations characterized by above average vacancy rates in recent months.⁶ The wage and earnings data will be used to identify selected occupations with a favorable number of job vacancies that could help workers obtain annual earnings above selected adequacy thresholds, including multiples of the federal government's poverty lines and the Self-Sufficiency Income Standards of the Women's Educational and Industrial Union for families of a given size and age composition in the Commonwealth.⁷ The final section of the report will provide a brief summary

⁶ The wage and earnings data used in the analysis are derived from a variety of sources, including the Massachusetts job vacancy surveys, the Occupational Employment Statistics program, and the 2000 Census.

⁷ For a review of the Self-Sufficiency Income Standards for Massachusetts families and their sizes relative to the federal government's poverty income thresholds,

of key findings, discuss their implications for the design, administration, and operation of future workforce development programs in the Commonwealth, and identify a series of desired future research and program evaluation activities.

Employment, Unemployment, and Job Vacancy Concepts, Measures and Data Sources

The empirical analyses appearing in this report track occupational employment developments, job vacancies by occupation, and unemployment developments by occupation across the state and selected substate areas over the past five years, 2000-2005.⁸ Some longer-term historical analyses of occupational employment trends in the state also are provided, including employment growth by major occupational area from 1989 through 2000. The bulk of the occupational employment estimates for Massachusetts are based on the findings of the monthly Current Population Surveys (CPS), a national household survey that is conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics.⁹

The CPS employment estimates are the most comprehensive of all existing employment surveys. They include wage and salary workers in both the private and public sectors, the self-employed, independent contractors, those with a job but not at work due to vacations, sick leave, and weather-related conditions, and persons working without pay in a family owned business for 15 or more hours per week. The CPS survey is also the source of our data on unemployment levels by occupation over the past few years. The unemployment data represent those individuals who were not working for pay or profit in the reference week of the survey, had actively looked for a job in the past four weeks, and were available to take a job in the reference week of the survey.¹⁰ The unemployed, thus, represent an effective available supply of labor in a given

See: Andrew Sum, Neeta Fogg, Ishwar Khatiwada, et.al., A New Look at Income Inadequacy Problems in Massachusetts, Center for Labor Market Studies, Northeastern University, Prepared for the Workforce Solutions Group, Boston, 2004.

⁸ The job vacancy estimates for the state begin in the fourth quarter of calendar year 2002 and have been generated on a semi-annual basis since then by the Massachusetts Department of Workforce Development. Massachusetts is the only New England state with an on-going job vacancy survey. Maine and Rhode Island have conducted ad hoc surveys.

⁹ For a review of the design features of the CPS survey and the labor force and employment concepts underlying the measures of labor force activity,

See: U.S. Bureau of Labor Statistics, Employment and Earnings, January 2005, "Appendix A," Washington, D.C., 2005.

¹⁰ The reference week is the calendar week immediately prior to the survey. The reference week for the CPS Survey is the week containing the 12th day of the month. Some jobless workers on temporary layoff who have a specific

occupation that can be compared to the stock of available job vacancies in the same occupational group to identify the degree of shortage or surplus in that occupational group at a given point in time.

The job vacancy measures appearing in this report are based on semi-annual surveys by the Massachusetts Division of Unemployment Assistance of private employers and government agencies throughout the state of Massachusetts.¹¹ Job vacancies represent currently available job openings in the firm for which the employer is making an active effort to recruit applicants from outside the firm. Positions for consultants, independent contractors, and other non-employee positions are excluded from the count of job vacancies.¹² The Massachusetts Job Vacancy Survey also collects information on the industries of the firms in which these vacancies exist, their geographic locations across the state, the occupational titles of the vacancies, their education and experience requirements, their full-time/part-time nature, their temporary/permanent nature, and their hourly/weekly wages.¹³ The job vacancy survey data by occupation can be used to estimate the number of job vacancies in a given occupational category and the job vacancy rate. The job vacancy rate is calculated by taking the ratio of the number of job vacancies in a given occupation to the level of employed persons in that occupation (V/E). Estimates of job vacancy levels and rates by major occupational group are available for the state as a whole and for seven geographic areas representing regional economic development districts.¹⁴ Statewide vacancy data also are available for a number of individual occupations. The data on the statewide number of job vacancies in an occupational category also can be compared to the number of unemployed persons. The ratio of U/V can be used to represent the relative

recall date from their employers or expect to be recalled within the next six months do not have to meet the active job search test but they must be available for work.

¹¹ The early rounds of the Massachusetts job vacancy survey in the fourth quarter of 2002 and the second quarter of 2003 did not cover the public sector. The data series on job vacancies in the government begins with the data for the fourth quarter of 2003.

¹² For a review of job vacancy concepts, measures, and their uses at the national level in the JOLTS survey, See: Kelly A. Clark and Rosemary Hyson, "New Tools for Labor Market Analysis: JOLTS," *Monthly Labor Review*, December 2001, pp. 32-37.

¹³ For a review of the findings from the job vacancy survey for the second quarter of 2005, See: Massachusetts Department of Workforce Development, *Massachusetts Job Vacancy Survey: Hiring Trends by Industry and Occupation, Second Quarter 2005*, Boston, January 2006.

¹⁴ While the U.S. Bureau of Labor Statistics does conduct a monthly national job vacancy survey, it does not collect data on job vacancies by occupational area. It does so only for industrial sectors and major geographic regions of the nation.

degree of shortage or surplus in a given occupational group. Shortage occupations often are the targets of job training and job placement initiatives.

Occupational Employment Developments in Massachusetts, 1989-2000

During the 1980's, the Massachusetts economy experienced a strong economic boom that generated a substantial number of new jobs through 1988 and raised the real annual earnings of workers and the real incomes of families at a rate well above the national average.¹⁵ The state economic boom unfortunately came to an abrupt end in early 1989, and the state and regional economies entered a severe downturn that would last through 1992. From 1992 through 2000, the state's employers added more than 500,000 jobs to their formal payrolls, with very strong job growth in business services, professional services, and the construction industries.¹⁶ Manufacturing payroll employment, however, never came close to recovering its levels that prevailed at the end of the 1980's boom. These important shifts in the industrial composition of employment had major impacts on the growth and decline of employment by major occupational group over the 1980's, with strong increases in the demand for workers in many professional, managerial, and service-related occupations. Blue collar craft and production workers in manufacturing, however, experienced declines in demand for their labor over the decade, reducing their employment opportunities and real earnings.

Between 1989 and 2000, the estimated number of employed persons (16+) in Massachusetts rose from 3.053 million to 3.238 million, a gain of 185,000 or slightly more than six percent (Table 1).¹⁷ The occupations of the jobs held by employed Massachusetts residents were classified into eleven major categories using the 1990 Census occupational classification system.¹⁸ The operators/ fabricators/ laborers category was disaggregated into the following three

¹⁵ For a more comprehensive review of industry and occupational employment developments in Massachusetts during the 1980s and 1990s decades, see: Andrew Sum, Paul Harrington, Neeta Fogg, et. al., The State of the American Dream in Massachusetts: 2002, Massachusetts Institute for a New Commonwealth, Boston, 2002.

¹⁶ The business services industries under the previous SIC industrial classification system included a very heterogeneous set of firms, including accounting services, computer software and data processing, computer networking, building cleaning, and temporary help/labor leasing.

¹⁷ The CPS employment counts are an unduplicated count of employed residents of Massachusetts regardless of their place of work. A Massachusetts resident who commutes to Rhode Island for his job is counted as an employed person in Massachusetts on the CPS survey. In-commuters into our state from other states are excluded from the count of the resident employed.

¹⁸ The occupational coding system used by the U.S. Census Bureau in tabulating results from the monthly CPS surveys was changed in 2003 when the new SOC- based occupational classification system was implemented. The

subgroups in order to capture important differences in the growth of employment among these three subgroups:

- Machine operators, assemblers, fabricators
- Transportation and material moving (truck drivers, vans, taxicabs, trains, buses, etc.)
- Handlers, equipment cleaners, laborers.

Rates of job growth/decline varied considerably across these 11 major occupational groups in Massachusetts over the 1989-2000 period. Seven of these occupational groups experienced some job growth with very high levels and rates of job growth in management-related and professional occupations. In contrast, employment levels declined in four occupational groups, including sales, clerical workers, blue collar production, and transportation and moving occupations.¹⁹ Management/ management support and professional workers were characterized by the highest levels and rates of growth over the decade (Table 1 and Chart 1). The number of employed residents holding management-related occupations rose by 115,000 or 25% while the number of professional workers increased by 104,000 or 20% over the same time period. Overall, employment in these two generally high skilled occupational groups combined rose by nearly 220,000 over the decade, accounting for all of the net increase in employment and nearly three-fourths of the gross gain in employment.²⁰ Employment in service-related occupations (+15%) and in handler/ cleaner/ laborer positions (+12%) also experienced double digit growth over the decade. The latter two sets of occupations contain a disproportionate share of workers with relatively low annual earnings. Thus, the high rates of job growth at the upper end of the earnings distribution combined with the above average growth at the bottom of the earnings distribution widened inequality in the Massachusetts earnings distribution over the decade of the 1990s.²¹ The declines in many skilled and semi-skilled blue collar jobs in

U.S. Census Bureau did recently release a new public use data set for the 2000 CPS surveys that contains both the older Census occupational codes and the new SOC based codes.

¹⁹ Within the sales occupations, employment of higher level sales workers (account managers, financial service representatives, stock and real estate brokers, buyers) increased while lower level sales workers (retail clerks, cashiers, door to door salespersons) declined. Educational requirements and annual earnings of high level and lower level sales workers vary considerably.

²⁰ The gross gain was 299,000. This total represents the amount of the employment changes in the seven occupational groups in which employment increased over the decade.

²¹ For a review of findings on the changing levels and distribution of earnings among Massachusetts workers over the past two decades, see: Andrew Sum & Ishwar Khatiwada with Sheila Palma, Trends in the Levels, Distribution,

manufacturing industries depressed the real annual earnings of males with no post-secondary schooling and increased their difficulties in securing jobs with adequate annual earnings.

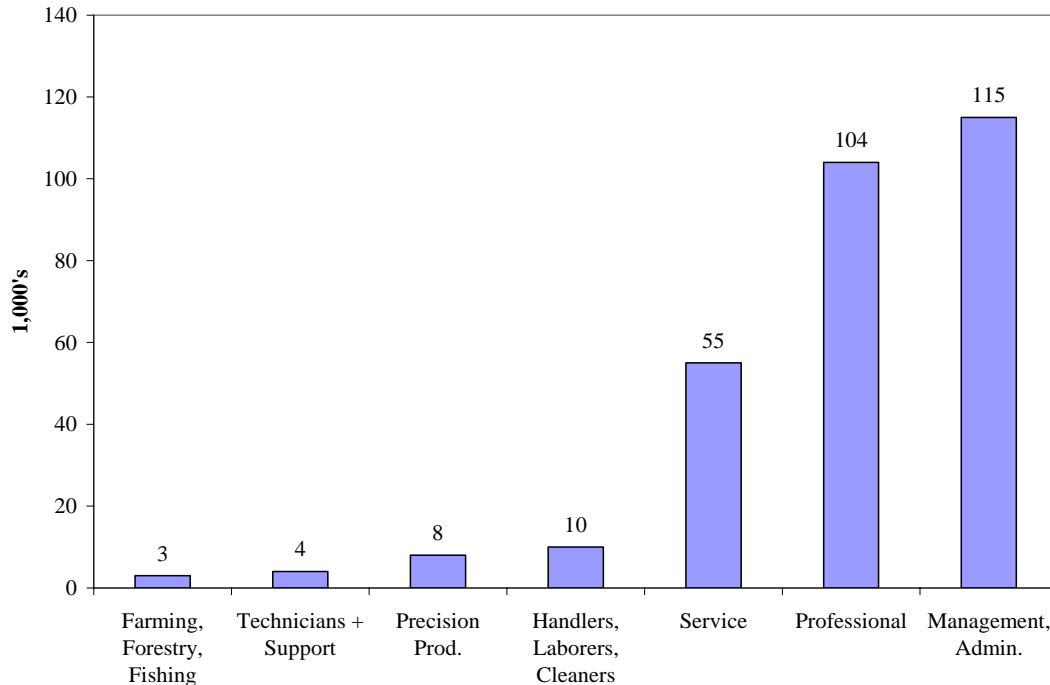
Table 1:
Changes in the Number of Employed Residents (16 and older) in Massachusetts by
Major Occupational Group, 1989-2000 (Annual Averages in 1000s)

Occupational Group	(A) 1989	(B) 2000	(C) Absolute Change	(D) % Change
Professional specialty	528	632	+104	+20%
Executives, managers, admin.	451	566	+115	+25%
Technicians and support	110	114	+4	+4%
Sales occupations	375	346	-29	-8%
Administrative support including clerical	514	452	-62	-12%
Service	375	430	+55	+15%
Farm, forestry, fishing	35	38	+3	+8%
Precision production, craft, and repair	312	320	+8	+3%
Operators, fabricators, laborers	353	341	-12	-3%
• Machine operators, assemblers, fabricators	172	156	-16	-9%
• Transportation and material moving	95	89	-6	-6%
• Handlers, equipment cleaners, laborers	86	96	+10	+12%
All occupations	3,053	3,238	+185	+6.1%

Source: (i) U.S. Bureau of Labor Statistics, 1989 Geographic Profile of Employment and Unemployment, 1990; (ii) 2000 CPS Public Use Files, with new 2000 Census population weights, tabulations by CLMS.

and Adequacy of Earnings of Massachusetts Workers: Implications for the Boston Workforce Development Initiative, Prepared for the Workforce Solutions Group, Boston, 2004.

Chart 1:
Ranking of Occupational Groups With Employment Increases Between 1989 and 2000
by Size of Employment Increase in 1000's



The labor market boom in Massachusetts came to an abrupt end in the first quarter of calendar year 2001. Payroll employment in the state fell steadily and steeply over the next three years. Between the first quarters of 2001 and 2004, the number of wage and salary jobs (seasonally adjusted) as measured by the payroll survey declined from 3.370 million to 3.174 million, a drop of 196,000 jobs over this three year period, far exceeding the rate of job decline in the U.S. Payroll Job growth in Massachusetts was not renewed until early 2004. By the last quarter of 2005, the state's employers had added approximately 30,000 net new workers to their payrolls, but total wage and salary employment in the final quarter of calendar year 2005 still remained nearly 168,000 below its peak level in 2001 I.²² Several industrial sectors, including education and health services, leisure and hospitality, and construction, added jobs from 2001 I to 2005 IV, while nearly all other sectors shed jobs, including manufacturing, financial activities,

²² For a more detailed review of industry employment developments in the state over the 2000-2005 period, see: Andrew Sum, Paulo Tobar, Joseph McLaughlin, Ishwar Khatiwada with Sheila Palma, Employment and Job Vacancy Developments Across Massachusetts and Local Workforce Development Areas/ Economic Development Districts, Report Prepared for the Workforce Solutions Group, Boston, 2005.

professional and business services, information services, and trade/ transportation/ utilities. Since the jobs recovery began in the first quarter of 2004, seven of the eleven major industrial sectors have added jobs although the bulk of the job growth has been in professional and business services industries (+18,000) and education and health services (+12,000).

The industrial patterns of job growth and decline over the past five years have dramatically impacted the occupational distribution of employment across the state. Between 2000 and 2005, the total number of employed residents in the state according to findings of the CPS household surveys is estimated to have declined by 34,300 or 1.1% (Table 2).²³ Several occupational groups, including health care practitioner and technician, health care support, education and training, life/ physical/ social science, building and grounds maintenance, and transportation, experienced strong employment growth over this five year period (Chart 2). Employment in the two health occupation clusters increased by more than 72,000 or over 30 percent while education and training occupations expanded by just under 25 percent and building and grounds maintenance/ cleaning workers increased by nearly 14%. On the other end of the growth spectrum, there were double digit declines in business and financial occupations (-28%), computer and mathematical science (-20%), architecture and engineering (-12%) and production occupations (-40%). Construction craft employment in Massachusetts increased by nearly 9 percent over this five year period, reflecting the growth in construction industry employment.

²³ The occupational employment estimates for 2000 are based on a recently released set of public use files of the CPS surveys incorporating 2000 Census-based population weights and the new Standard Occupational Classification Codes (SOC). For a detailed discussion of the shift to the 2000 SOC coding system by the U.S. Census Bureau in the CPS survey, see: Mary Bowler, Randy Ilg, et. al., "Revisions to the Current Population Survey Effective in January 2003," Employment and Earnings, January 2003, Washington D.C., 2003, pp. 4-23.

Table 2:
Trends in Employment of Massachusetts Residents 16 and Older by Major Occupational Group, 2000 to 2005 (Annual Averages)

Occupational Group	(A) 2000	(B) 2005	(C) Absolute Change	(D) % Change
Management occupations	371,948	362,757	-9,191	-2.5
Business and financial operations occupations	171,246	122,664	-48,582	-28.4
Computer and mathematical science occupations	116,880	92,861	-24,018	-20.5
Architecture and engineering occupations	88,777	77,951	-10,827	-12.2
Life, physical, and social science occupations	56,241	63,912	7,671	13.6
Community and social service occupations	55,054	59,228	4,174	7.6
Legal occupations	47,500	48,434	934	2.0
Education, training, and library occupations	172,044	214,629	42,586	24.8
Arts, design, entertainment, sports, and media occupations	74,032	70,920	-3,112	-4.2
Healthcare practitioner and technical occupations	162,446	214,024	51,577	31.8
Healthcare support occupations	64,666	85,498	20,832	32.2
Protective service occupations	58,261	59,674	1,413	2.4
Food preparation and serving related occupations	173,025	167,540	-5,485	-3.2
Building and grounds cleaning and maintenance occupations	101,716	115,754	14,039	13.8
Personal care and service occupations	77,303	83,772	6,469	8.4
Sales and related occupations	324,074	349,378	25,304	7.8
Office and administrative support occupations	478,095	441,767	-36,328	-7.6
Farming, fishing, and forestry occupations	6,069	8,386	2,317	38.2
Construction and extraction occupations	162,424	176,650	14,226	8.8
Installation, maintenance, and repair occupations	98,396	96,490	-1,906	-1.9
Production occupations	243,880	133,891	-109,989	-45.1
Transportation and material moving occupations	134,050	157,620	23,570	17.6
Total	3,238,127	3,203,800	-34,327	-1.1

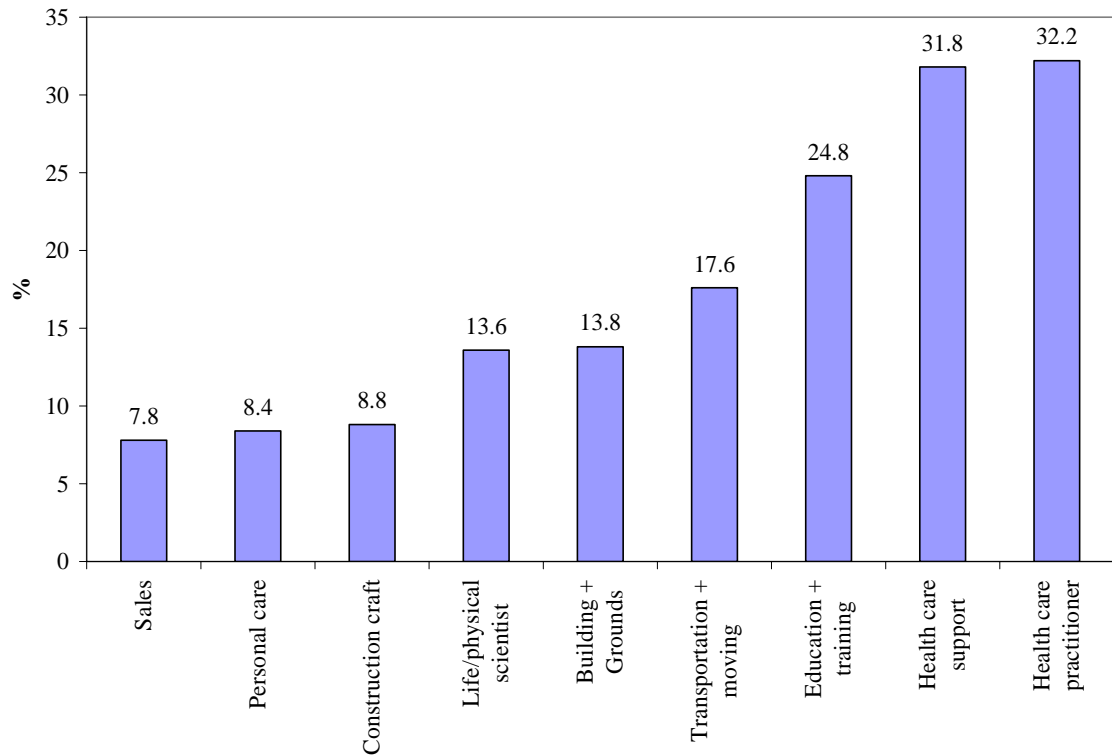
Source: 2000 and 2005 Monthly CPS surveys, public use files, tabulations by CLMS, Northeastern University.

Table 3:
Trends in Employment of U.S. Residents 16 and Older by Major Occupational Group,
2000 to 2005 (Annual Averages)

Occupational Group	(A) 2000	(B) 2005	(C) Absolute Change	(D) % Change
Management occupations	14,347,877	14,707,061	359,184	2.5
Business and financial operations occupations	5,277,108	5,770,534	493,426	9.4
Computer and mathematical science occupations	3,318,069	3,244,979	-73,090	-2.2
Architecture and engineering occupations	2,989,832	2,793,951	-195,881	-6.6
Life, physical, and social science occupations	1,253,064	1,407,685	154,621	12.3
Community and social service occupations	1,925,281	2,142,437	217,156	11.3
Legal occupations	1,438,004	1,616,031	178,027	12.4
Education, training, and library occupations	7,238,574	8,129,451	890,877	12.3
Arts, design, entertainment, sports, and media occupations	2,668,181	2,742,371	74,190	2.8
Healthcare practitioner and technical occupations	5,908,830	6,758,963	850,133	14.4
Healthcare support occupations	2,443,770	3,101,308	657,538	26.9
Protective service occupations	2,583,075	2,900,737	317,662	12.3
Food preparation and serving related occupations	6,705,681	7,427,751	722,071	10.8
Building and grounds cleaning and maintenance occupations	4,927,855	5,265,970	338,115	6.9
Personal care and service occupations	4,172,465	4,550,989	378,524	9.1
Sales and related occupations	15,764,588	16,496,691	732,102	4.6
Office and administrative support occupations	20,480,631	19,590,993	-889,638	-4.3
Farming, fishing, and forestry occupations	1,169,805	980,878	-188,927	-16.2
Construction and extraction occupations	7,619,504	9,164,137	1,544,633	20.3
Installation, maintenance, and repair occupations	4,819,712	5,234,712	415,000	8.6
Production occupations	11,466,578	9,404,756	-2,061,822	-18.0
Transportation and material moving occupations	8,582,768	8,694,745	111,977	1.3
Total	137,101,254	142,127,129	5,025,876	3.7

Source: 2000 and 2005 Monthly CPS surveys, public use files, tabulations by CLMS, Northeastern University.

Chart 2:
Employment Growth Rates of Selected Occupational Groups in Massachusetts, 2000-
2005 (in%)



An identical analysis of occupational employment developments over the 2000-2005 period was undertaken for the U.S. labor market (Table 3). In contrast to the decline in employment in our state, the total number of employed persons in the U.S. in 2005 was more than 5 million or 3.7% above the number of employed in calendar year 2000. A careful comparison of the findings on the magnitudes and patterns of growth and decline in employment by major occupational group in the state and the nation over the past five years reveals a number of interesting findings (Tables 4 and 5). The jobs held by all employed persons in the U.S. and Massachusetts were assigned to one of 22 occupational groups based on the 2000 SOC classification system. Of these 22 occupational groups, employment in the U.S. increased in 16 occupational groups between 2000 and 2005 versus 13 occupational groups in the state. Among these 13 growth occupations in Massachusetts, employment increased by 215,112 or 2.55% of the increase in employment in growing occupations in the U.S. The state's percentage share of U.S. job growth in these growing occupations was slightly above the 2.36% share of all jobs in

the U.S. held by Massachusetts residents in 2000. The state's poor job generating performance between 2000 and 2005 was due to the higher number of occupational groups in which employment declined (8 in Massachusetts vs. 5 for the U.S.) and the very high share of job losses in these occupations accounted for by Massachusetts workers (7.3%) (Table 5).

Table 4:
Comparisons of Massachusetts and U.S. Job Generating Performance Between 2000 and 2005 in 21 Major Occupational Groups

Geographic Area	(A) # of Growth Occupations	(B) Increase in Employment	(C) # of Declining Occupations	(D) Decrease in Employment
MA	13	215,112	8	-249,349
U.S.	16	8,435,234	5	-3,409,358
MA Share of U.S. Employment Change		2.55%		7.31%

Source: 2000 and 2005 CPS surveys, public use files, tabulations by CLMS.

Table 5:
Listing of Key Occupational Groups in which Massachusetts Employment Grew Faster or Declined More Rapidly than the U.S., 2000-2005

Growth Occupations	MA Share of National Job Growth
Healthcare practitioner and technical	6.1
Life, physical, social science	5.0
Education, training, and library	4.8
Building grounds, cleaning	4.1
Declining Occupations	MA Share of National Job Decline
Computer mathematical science	33.0
Architecture and engineering	5.5
Office and administrative support	4.0
Production occupations	5.3

Among the growth occupations, there were four groups in which Massachusetts obtained an above average share of new national employment. They were health care practitioner, life/ physical/ social scientists, education/ training, and building and grounds/cleaning occupations (Table 5).²⁴ On the other end of the spectrum, computer and mathematical science, architecture and engineering, production, and office/clerical occupations in Massachusetts accounted for a disproportionately high share of all job losses in these occupations nationwide between 2000 and 2005.²⁵ In addition, Massachusetts is estimated to have experienced job losses in management and business/financial occupations while employment nationwide in these two occupational groups rose by more than 852,000 over this five year period.

Job Vacancy Developments in Major Occupational Groups in Massachusetts

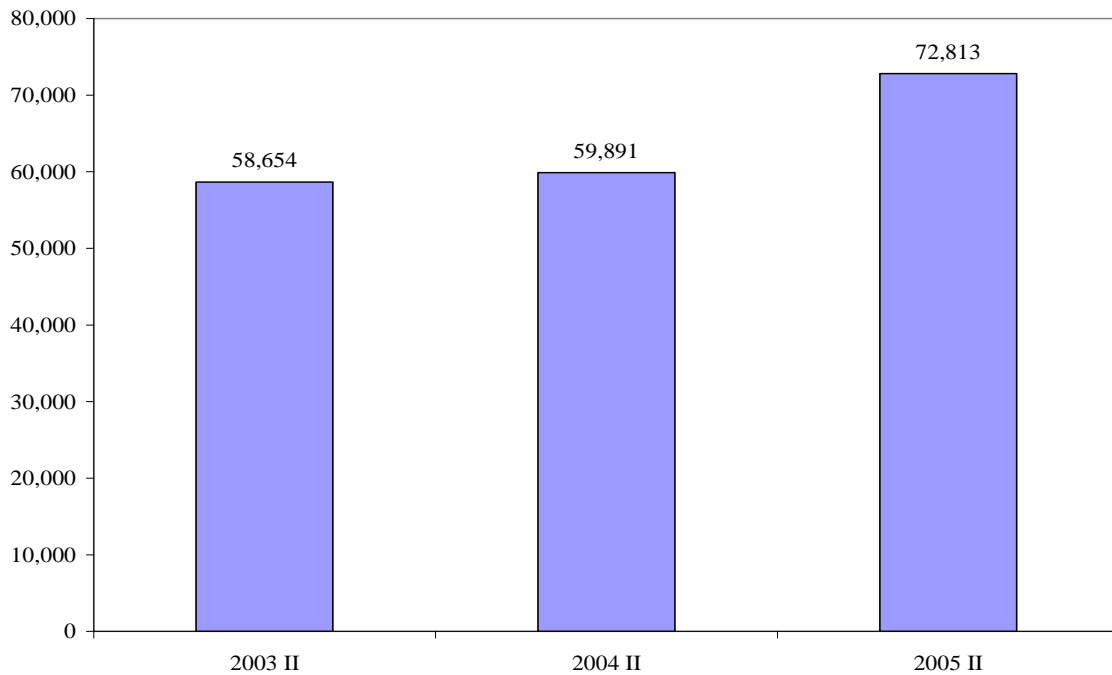
As noted earlier, the Massachusetts Division of Unemployment Assistance through its semi-annual survey of job vacancies across the state provides estimates of job vacancy levels and job vacancy rates for the state as a whole, seven geographic regions, major industries, and major occupational groups²⁶. The job vacancy survey yielded a higher number and rate of vacancies in the second quarter of 2005 than in prior years. Total job vacancies in the second quarter of 2005 were estimated to be over 72,800 versus 59,891 in the second quarter of 2004 and 58,654 vacancies in the second quarter of 2003 (Chart 6). The job vacancy rate for the state as a whole rose from 2.0% in the second quarter of 2004 to 2.6% in the second quarter of 2005. Job vacancy rates rose in all seven geographic regions of the state over this time period.

²⁴ Within the life/ physical/ social science occupations, medical scientists appear to account for a relatively high share of all job vacancies in this occupational category.

²⁵ Surprisingly, employment in food preparation and serving occupations declined modestly in Massachusetts while it rose by 722,000 in the nation over the past five years. Given growth in employment in leisure and hospitality industries in the state, this result seems puzzling.

²⁶ For a more detailed review of findings from the 2005 II job vacancy survey, see: Andrew Sum, Paulo Tobar with Ishwar Khatiwada, Joseph McLaughlin and Sheila Palma, Massachusetts Labor Markets in Mid-2005: An Assessment of Job Vacancy and Unemployment Developments and Their Implications for Workforce Development Policy; Report prepared for the Workforce Solutions Group, Boston, February 2006.

Chart 3:
Trends in the Total Number of Job Vacancies in Massachusetts during 2003 II, 2004 II, and 2005



II

Table 6:
Number and Rate of Job Vacancies in the State by Geographic Region, 2nd Quarter 2004 and 2nd Quarter 2005

Region	2nd Quarter 2004		2nd Quarter 2005		Change in Job Vacancy Rate 2004 II - 2005 II (in Percentage Points)
	Number of Job Vacancies	Job Vacancy Rate	Number of Job Vacancies	Job Vacancy Rate	
Massachusetts	59,891	2.0	72,813	2.6	0.6
Berkshire	1,819	3.1	2,048	3.7	0.6
Cape & Islands	3,523	2.9	3,448	3.3	0.4
Central	4,959	2.0	5,720	2.4	0.4
Greater Boston	29,908	2.0	36,408	2.5	0.5
Northeast	7,740	1.9	9,206	2.4	0.5
Pioneer Valley	5,316	2.0	6,396	2.4	0.4
Southeast	6,626	1.8	9,587	2.7	0.9

The job vacancy survey also collects information on the occupational characteristics of the job openings. The vacancy data are estimated for a variety of individual occupations and for

21 to 22 major occupational groups. Job vacancy rate estimates are now available for 21 major occupational groups for the state during the second quarters of 2003, 2004 and 2005 (Table 7). The job vacancy rates presented in Table 7 were calculated by the Division of Unemployment Assistance by dividing the number of job vacancies in a specific occupational group by the estimated number of wage and salary jobs in that occupational group during the same time period as estimated by the Occupational Employment Statistics Program (OES).

Over the 2003 II to 2005 II period, the overall job vacancy rate of the state increased from 2.1% to 2.6% (Table 7) as a result of an increase in the estimated number of vacancies in most occupations.²⁷ Over this two year period, vacancy rates increased in 15 out of the 21 occupational groups for whom vacancy data were available. Six major occupational groups experienced a decline in their estimated vacancy rates over this two year period. The size of these declines ranged from lows of -.2 percentage points among installation, maintenance and repair workers and health support occupations to a more substantial decline of 1.1 percentage points in the protective service occupations. The other 15 occupational groups were characterized by rising job vacancy rates, with the size of these increases ranging from .1 percentage points in food preparation and serving related occupations, office and administrative support, and arts, design, entertainment, sports and media occupations to highs of 1.6 percentage points in computer related and mathematical occupations and 1.4 percentage points in architecture and engineering. The increased job growth in the professional and technical services industries were beginning to boost employment opportunities in a number of scientific and computer related fields that had been hard hit by job declines from 2000 through early 2004.

²⁷ It should be noted that the 2003 II vacancy survey excluded the public sector. The vacancy rates for that survey pertain only to the private sector. The exclusion of the public sector however does not artificially lower the vacancy rate for most occupations since the public sector vacancy rate is below average.

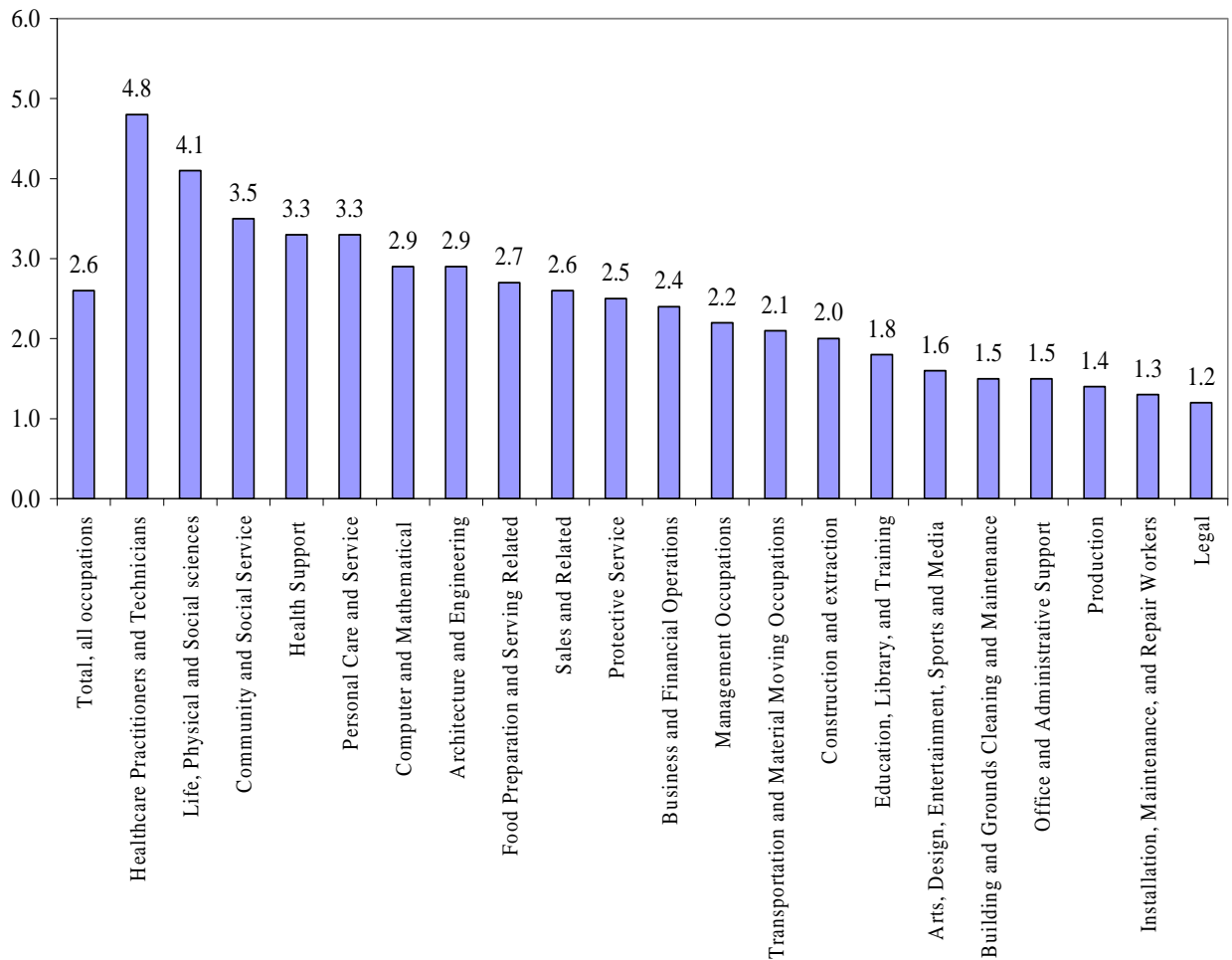
Table 7:
Job Vacancy Rates in Major Occupational Groups of Massachusetts, 2003 II, 2004 II, and 2005
II (in %)

	(A)	(B)	(C)	(D)
Occupational Group	2003 II	2004 II	2005 II	Change 2003-2005
Total, all occupations	2.1	2.0	2.6	0.5
Computer and Mathematical	1.3	2.5	2.9	1.6
Architecture and Engineering	1.5	2.0	2.9	1.4
Education, Library, and Training	0.5	1.5	1.8	1.3
Business and Financial Operations	1.2	1.8	2.4	1.2
Life, Physical and Social sciences	2.9	2.5	4.1	1.2
Management Occupations	1.1	1.3	2.2	1.1
Sales and Related	1.6	1.8	2.6	1.0
Healthcare Practitioners and Technicians	3.8	3.7	4.8	1.0
Building and Grounds Cleaning and Maintenance	0.7	1.0	1.5	0.8
Community and Social Service	3.0	2.5	3.5	0.5
Legal	0.9	2.1	1.2	0.3
Production	1.2	1.2	1.4	0.2
Arts, Design, Entertainment, Sports and Media	1.5	1.7	1.6	0.1
Office and Administrative Support	1.4	1.3	1.5	0.1
Food Preparation and Serving Related	2.6	2.2	2.7	0.1
Installation, Maintenance, and Repair Workers	1.5	1.6	1.3	-0.2
Health Support	3.5	4.0	3.3	-0.2
Transportation and Material Moving Occupations	2.5	2.0	2.1	-0.4
Construction and extraction	2.5	1.9	2.0	-0.5
Personal Care and Service	3.8	3.3	3.3	-0.5
Protective Service	3.6	1.0	2.5	-1.1

Job vacancy rates in Massachusetts continued to vary quite considerably across major occupational groups during the second quarter of 2005. (Table 7 and Chart 4). These job vacancy rates ranged from lows of 1.2 to .1.3 percent in the legal and installation/maintenance/ and repair occupations to highs of 4.8 percent in health care practitioner and technician occupation (doctors, registered nurses, health technicians, therapists) and 4.1 percent in life, physical and social science occupations. Healthcare related occupations ranked among the top occupations in the

vacancy rate distribution in each of the three time periods observed in Table 1. Occupations in the healthcare practitioner and technician fields were characterized by the highest job vacancy rate in the 2nd quarter of 2005 and they ranked first or second in the two previous years.

Chart 4:
Job Vacancy Rates by Major Occupational Groups in Massachusetts, 2005 II (in %)



The job vacancy surveys of the Massachusetts Division of Unemployment Assistance also collect data on the part-time, full-time nature of the available job openings. Overall 32 percent of job vacancies were categorized as part time in 2005 II, however, in the personal care service occupations a substantial majority of job vacancies were part time (79%). Other occupational groups with a relatively high share of job vacancies in the part-time category were the food preparation and serving related occupations (68%), building & grounds, cleaning and

maintenance (52%), healthcare support (51%), protective service (46%), and healthcare practitioner and technical (44%). Although a relatively high share of job vacancies in some of the health related occupations were part-time, the majority of these (98%) were permanent positions, while 52% of the vacancies in personal care and service occupations were only temporary or seasonal.

Table 8:
Percent of Job Vacancies that were Part-Time By Major Occupational Sector in Massachusetts,
II 2005

Occupational Group	% Part Time
Total Job Vacancies	32.0
Personal Care and Service	79.0
Food Preparation and Serving Related	68.0
Building & Grounds Cleaning & Maintenance	52.0
Healthcare Support	51.0
Protective Service	46.0
Healthcare Practitioner and Technical	44.0
Community and Social Service	36.0
Sales Related	36.0
Office and Administrative Support	34.0
Transportation and Material Moving	34.0
Arts, Design, Entertainment, Sports, & Media	27.0
Education, Training and Library	26.0
Production	10.0
Life, Physical, and Social Science	6.0
Computer and Mathematical	4.0
Legal	3.0
Management	2.0
Business and Financial Operations	1.0
Construction and Extraction	1.0
Installation, Maintenance, and Repair	1.0
Architecture and Engineering	0.0

Job Vacancies and Vacancy Rates by Major Occupational Group and by Geographic Region During the 2nd Quarter of 2005

The Massachusetts job vacancy survey also provides data on the estimated number of job vacancies and job vacancy rates in major occupations across seven geographic regions categorized along the lines of economic development districts. The geographic specific occupational vacancy data allow us to identify which occupations are experiencing above average vacancy rates in only a few specific regions or whether a high vacancy rate in an occupation statewide also prevails across the different regions of the state. In most of the regions, there were three occupational groups that accounted for the largest absolute number of job vacancies. They were health care practitioner and technical, food preparation and serving, and sales related occupations.

A summary of the main findings of our geographic analysis is presented below with more detailed data for each region displayed in Table 9.

- The Berkshire region was characterized by the highest job vacancy rate in the state. The overall vacancy rate for this region in the second quarter of 2005 was 3.7%, more than a full percentage point above the job vacancy rate for the state as a whole (2.6%). The four major occupational groups with the highest job vacancy rates in this region were community and social services (9.6%), computer and mathematical related (7.8%), transportation and material moving (6.8%), and healthcare practitioner and technical occupations (5.2%). A few other occupational groups, including personal care and service and healthcare support, also had relatively high job vacancy rates at 4.9 percent and 4.7 percent, respectively. The occupational group with the highest number of job vacancies in the Berkshire region was the office and administrative support occupations with a total of 307 vacancies in the second quarter of 2005, followed by 236 vacancies in the food preparation and serving occupations, and 204 vacancies in transportation and material moving occupations.
- In the Cape and the Islands, the region with the second highest job vacancy rate (3.3%), the highest job vacancy rates were found in life, physical, and social science occupations (6.1%), building and grounds cleaning (6.0%), food preparation and serving related (5.1%), and healthcare practitioner and technical (5.0%). Sales and related occupations and food preparation and serving related occupations had the highest number of vacancies in this

region, at 708 and 692 respectively, accounting for 41% of the total number of vacancies in this region. Many of these jobs were in the tourist-related industries of the Cape Cod and islands.

Table 9:
Job Vacancy Rates by Regions and by Major Occupational Group, 2005 II (in %)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Major Occupational Group	Berkshire	Cape & Islands	Central	Greater Boston	Northeast	Pioneer Valley	Southeast
Total Job Vacancy Rate	3.7	3.3	2.4	2.5	2.4	2.4	2.6
Healthcare Practitioner and Technical	5.2	5.0	4.7	4.5	4.4	5.7	4.8
Life, Physical, and Social Sciences	0.7	6.1	3.3	4.9	2.9	1.3	4.1
Community and Social Services	9.6	4.3	2.8	3.4	3.5	3.5	3.5
Healthcare Support	4.7	3.9	2.0	2.7	3.4	5.2	3.3
Personal Care and Service	4.9	0.5	2.4	1.9	2.2	2.6	3.3
Business and Financial Operations	1.6	0.7	3.0	2.8	3.3	4.0	2.9
Computer and Mathematical	7.8	0.7	3.0	2.8	3.3	4.0	2.9
Architecture and Engineering	1.0	0.6	1.1	3.2	2.9	4.5	2.9
Food Preparation and Serving Related	2.5	5.1	2.2	2.3	3.4	2.3	2.7
Sales Related	3.2	4.6	3.5	1.8	2.9	3.2	2.6
Protective Service	3.0	3.9	1.1	1.4	4.1	1.8	2.5
Management	1.2	1.0	1.5	2.8	1.5	2.1	2.2
Transportation and Material Moving	6.8	2.0	1.2	2.7	1.4	1.2	2.1
Construction and Extraction	0.3	4.9	0.6	2.5	2.0	0.6	2.0
Education, Training and Library	3.5	2.1	2.1	1.7	1.5	1.0	1.8
Arts, Design, Entertainment, Sports, & Media	0.7	1.4	1.9	1.7	1.4	1.3	1.6
Building & Grounds Cleaning & Maintenance	2.4	6.0	2.3	1.1	0.2	3.9	1.5
Office and Administrative Support	3.1	1.2	2.0	1.6	1.4	1.2	1.5
Production	1.4	2.6	0.8	1.4	1.8	0.6	1.6
Installation, Maintenance, and Repair	1.3	2.0	4.4	0.7	1.2	1.7	0.5
Legal	1.2	1.5	*	1.1	1.3	1.0	0.9

- The Central region, which includes Worcester County, was one of the three regions with a vacancy rate of 2.4%, slightly below the statewide average. However, there were three occupational groups in this region with high vacancy rates. They were healthcare practitioner (4.7%), sales and related (3.5%) and life, physical and social sciences (3.3%). The greatest number of job vacancies were found in the sales and related occupations (931), office and administrative support (902), healthcare practitioner and technical occupations (812), and food preparation and service (504).
- In the Greater Boston region, the occupational groups with the highest job vacancy rates were life, physical, and social sciences (4.9%), healthcare practitioner and technical (4.5%), community and social services (3.4%), and architecture and engineering (3.2%). The greatest numbers of job vacancies were found in office and administrative support occupations (4,680) and healthcare practitioner and technical occupations (4,446). Other occupational groups with a high number of vacancies were management (3,463), sales and related (2,758), food preparation and serving (2,723), business and financial operations (2,363), and computer and mathematical occupations (2,160). A growing number of the job vacancies in the Greater Boston region were in professional, business and management related occupations which predominantly are filled by workers with bachelor and higher degrees.
- The highest job vacancy rates in the Northeast region were found in healthcare practitioner and technical (4.4%), protective service occupation (4.1%), community and social service (3.5%), healthcare support (3.4%), and food preparation and serving occupations (3.4%). The largest numbers of job vacancies were found in sales and related occupations (1,190), food preparation and serving (1,145), office and administrative support (1,031), and healthcare practitioner and technical (957).
- Within the Pioneer Valley region, the occupational groups with the highest job vacancy rates were healthcare practitioner and technical (5.7%), healthcare support (5.2%), architecture and engineering (4.5%), and business and financial operations (4.0%). The healthcare practitioner and technical occupations had 989 job vacancies, followed by sales and related occupations with 937 job openings. There were 591 job vacancies in the office and administrative support occupations.

- In the Southeast region, the occupational groups with the highest job vacancy rates were healthcare practitioner and technical (4.8%), life, physical and social sciences (4.1%), community and social services (3.5%), and healthcare support occupations (3.3%). The largest numbers of vacancies in this region were in the sales and related occupations with 1,692 vacancies and personal care and healthcare practitioner and technical with 1,200 vacancies in each of these two occupational categories.

Geographic Variations in Job Vacancy Rates for Selected Major Occupational Groups Across Regions of the State.

The above analyses of job vacancy rates for major occupational groups across geographic regions of the state in 2005 have revealed a fairly considerable degree of variability in job vacancy rates for occupational groups across these regions during the second quarter of 2005. For some occupational groups, especially the health-related, food preparation and serving, and community/social service occupations, the vacancy rates across regions tended to vary across a fairly narrow range. For example, among the health care practitioner and technical occupations, vacancy rates in the second quarter of 2005 ranged from a low of 4.4% in the Northeast region to a high of 5.7% in the Pioneer Valley, a fairly uniform set of high vacancy rates for such occupations (Chart 5). Among healthcare support occupations, the vacancy rate was below average in the Central region (2.0%) but reached 3.3% or higher in five of the other six regions (Chart 6). Among community and social service occupations, job vacancy rates were above average in all seven regions. In six of these seven regions, the vacancy rates for such workers ranged from 2.8 to 4.4 percent. The Berkshire region was an outlier with a near 10 percent vacancy rate for workers in this occupational group (Chart 7).

Chart 5:
Job Vacancy Rates in the Health Practitioner and Technical Occupations in Massachusetts by Geographic Region, 2005 II Quarter

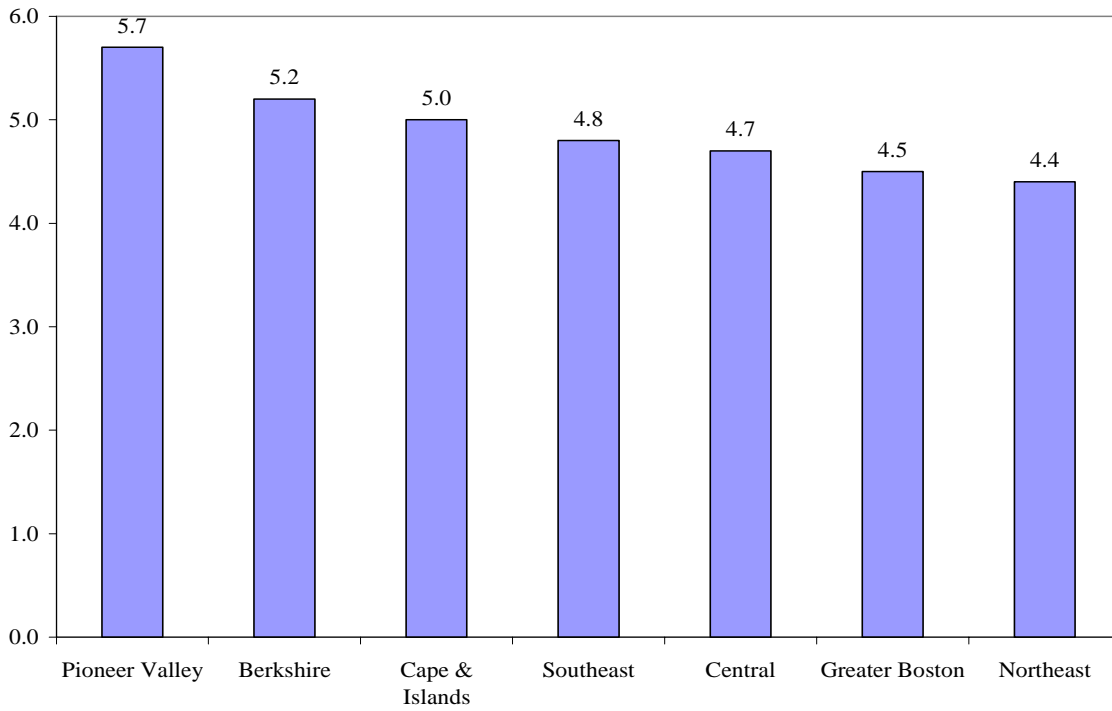


Chart 6:
Job Vacancy Rates in the Healthcare Support Occupations in Massachusetts by Geographic Region, 2005 II Quarter

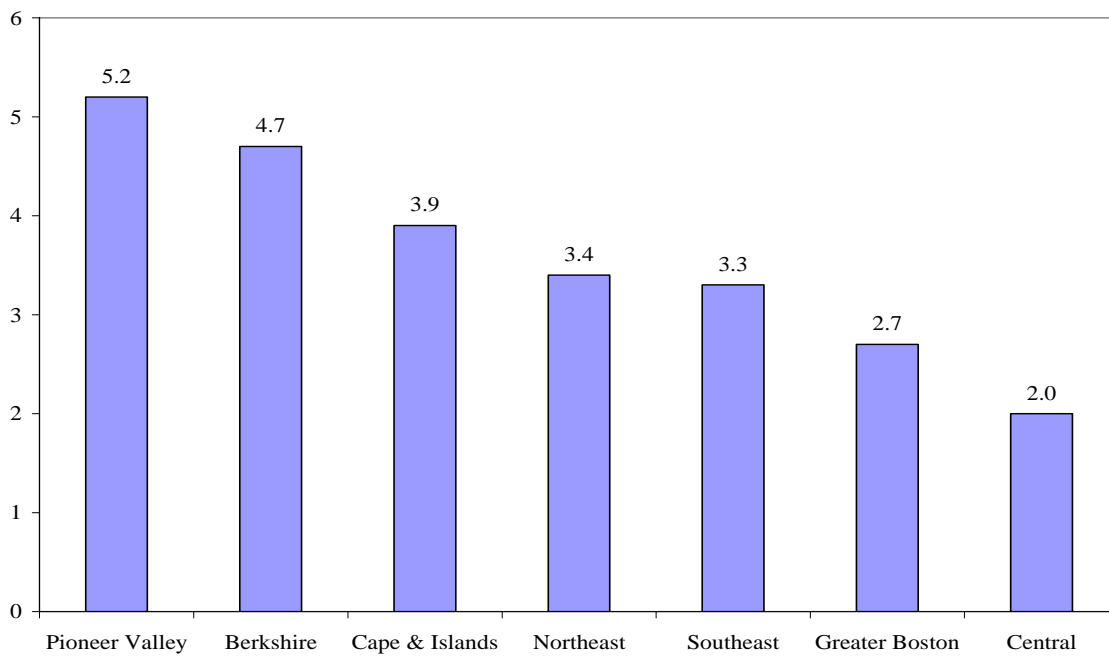
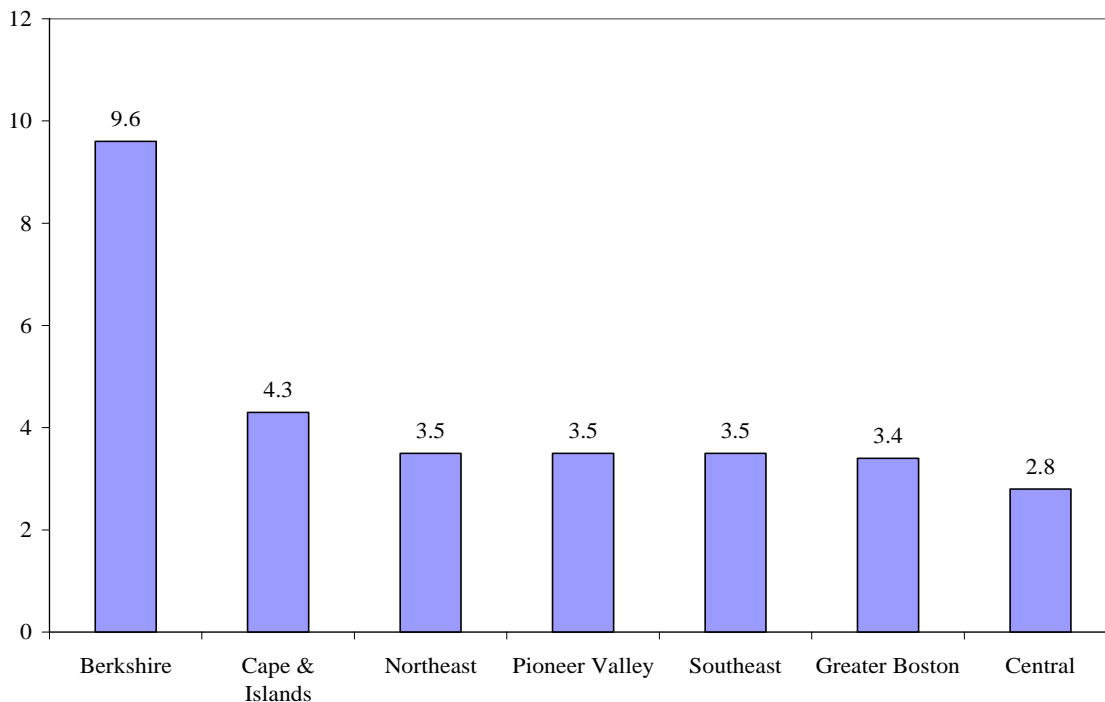


Chart 7:
Job Vacancy Rates in the Community and Social Service Occupations in Massachusetts by
Geographic Region, 2005 II Quarter



Among a number of the professional and craft occupational groups, vacancy rates varied much more widely across geographic regions. For example, among the engineering and architecture occupations, vacancy rates were above average in the Pioneer Valley (4.5%) and Greater Boston regions (3.2%), but were very low in the Central (1.1%), Berkshire (1.0%) and Cape & the Islands regions (0.6%) (Chart 8). Both surpluses and shortages in this occupational group appeared to exist simultaneously across regions. In the life/physical, and social science occupations, vacancy rates were well above average in the Cape & Islands, Greater Boston, and Southeast regions, but were very low in the Pioneer Valley and Berkshires (Chart 9).²⁸ Finally, in the construction trades, job vacancy rates were under 1 percent in three regions (the Berkshires, Central, and Pioneer Valley) but were 2.5% in the Greater Boston region and nearly 5% on Cape Cod (Chart 10). Within the construction trades, there were high vacancy rates in some occupations (carpenters, plumbers + pipe-fitters) but were quite low in other occupations.

²⁸ More details are needed on the specific occupations generating job vacancies in this occupational group. Medical scientists, the vast majority of whom hold a bachelors or higher degree, accounted for the largest number of vacancies in this occupational group.

Chart 8:
Job Vacancy Rates in the Architecture and Engineering Occupations in Massachusetts by
Geographic Region, 2005 II Quarter

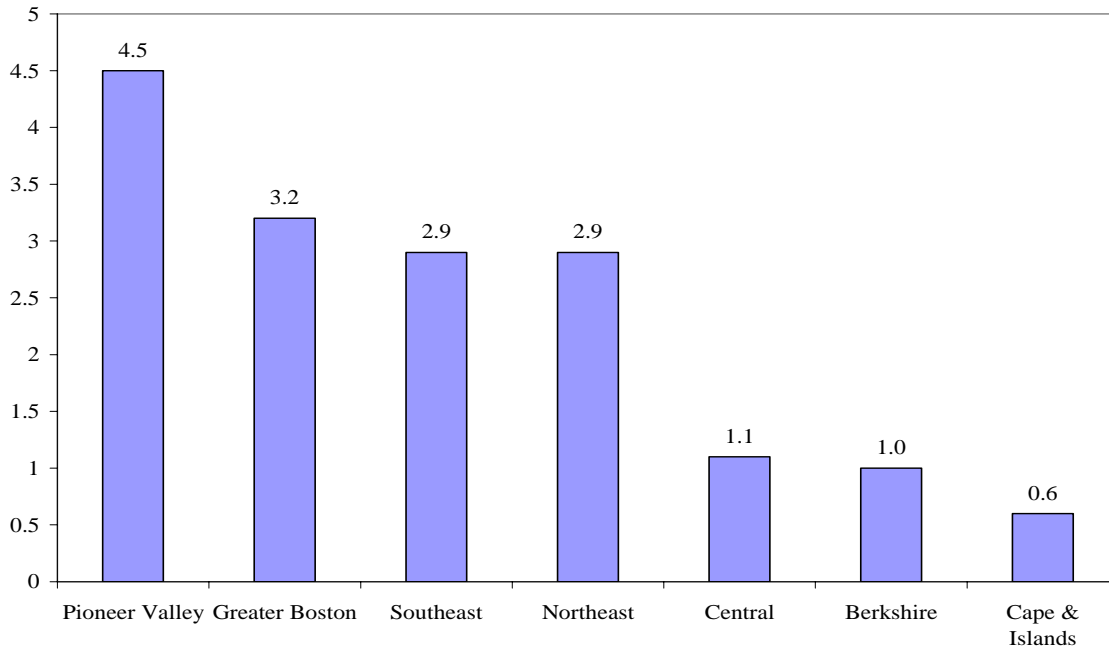


Chart 9:
Job Vacancy Rates in the Life, Physical, and Social Science Occupations in Massachusetts by
Geographic Region, 2005 II Quarter

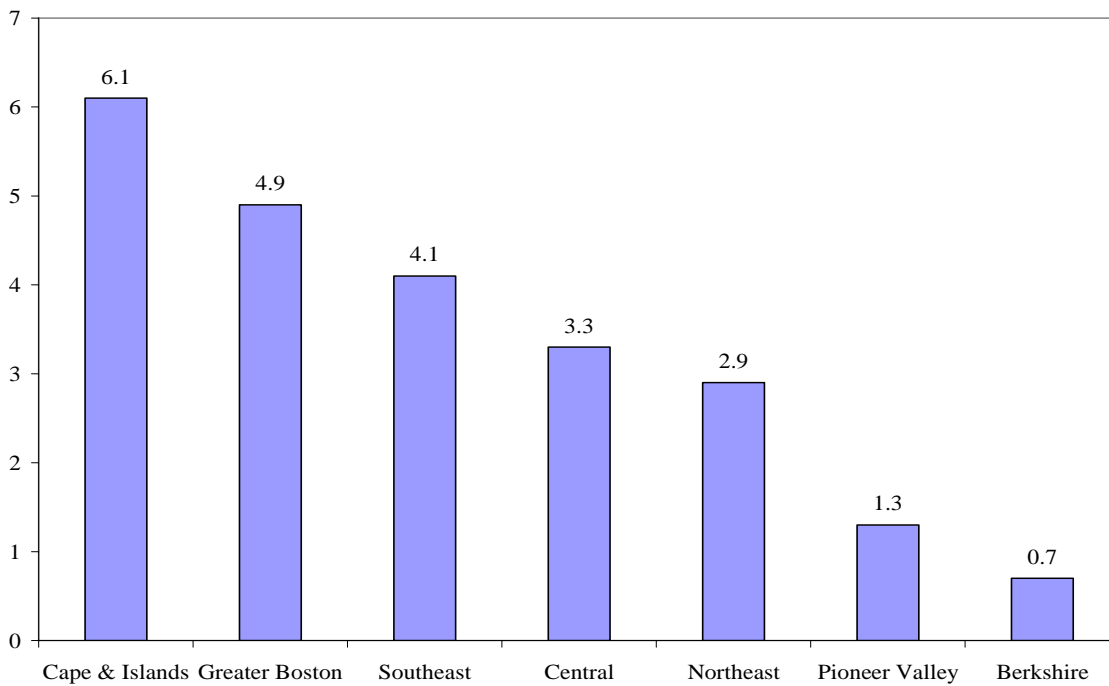
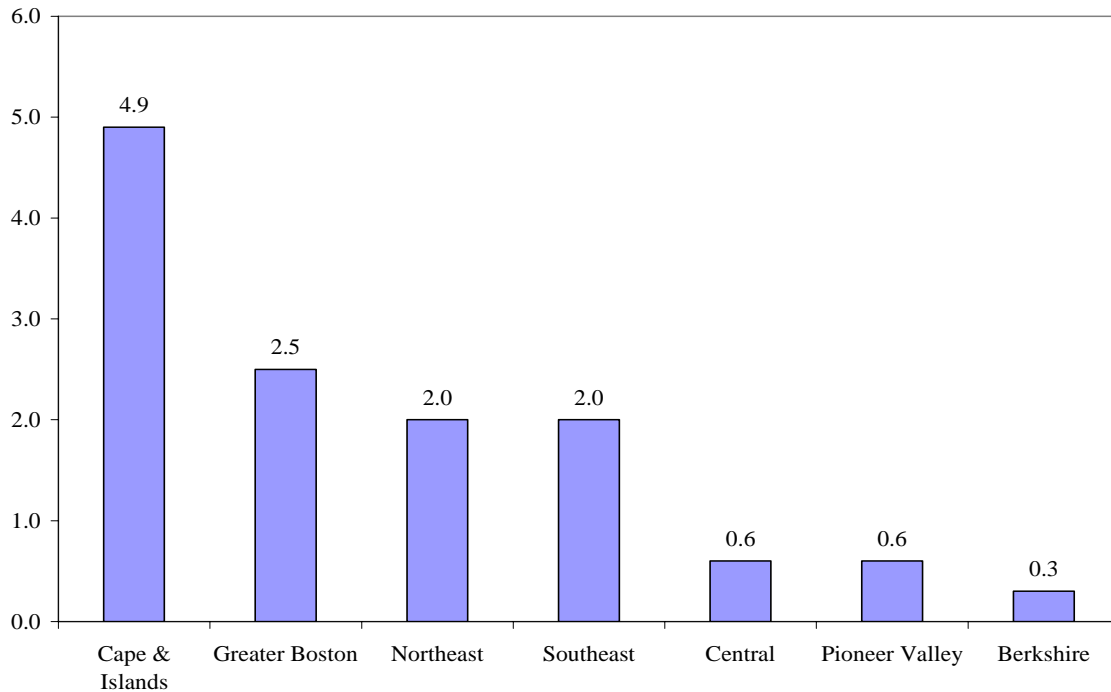


Chart 10:
Job Vacancy Rates in the Construction and Extraction Occupations in Massachusetts by
Geographic Region, 2005 II Quarter



The nature and degree of occupational shortages, thus, varied in some cases quite widely across geographic areas. The selection of occupational areas for job training should, thus, be expected to vary across the state. Local workforce investment boards should, however, share information on best practices in recruiting and training workers for employment in selected shortage occupational areas across the state. What types of training and education techniques and approaches (on-the-job, classroom, apprenticeship) seem to be most successful in preparing workers for entry into particular types of occupations? Having trainees obtain and retain employment in occupations that utilize the skills received in the training program is essential for long term success. Former trainees who hold jobs that do not utilize the skills obtained in training receive no positive long term economic benefit from such training.²⁹

²⁹ For a review of program evaluation findings on this issue, See: (i) Andrew Sum, Paul Harrington, and Lorraine Amico, Cracking the Labor Market for Human Resource Planning,.....
(ii) Robert E. Taylor, Howard Rosen, et. al., Job training for Youth, The National Center for Research in Vocational Education, Washington D.C., 1982

Identifying Occupational Shortages and Surpluses; the Combined Use of Data on Job Vacancies and the Unemployed by Major Occupational Group in Massachusetts, 2005 II and in 2004

Among the many uses of job vacancy data at the state and local level is that of identifying occupational shortages and surpluses.³⁰ Labor economists and other labor market analysts have identified a variety of models and criteria for identifying occupational shortages in national, state, and local markets. One method for identifying occupational shortages involves comparisons of the number of available job openings with the number of unemployed at a given point in time. The effective demand for workers at a given wage is equal to the number of workers currently employed in the occupation plus the number of vacancies.³¹ Let us call the effective demand $LD = E + V$ where E equals the number of workers currently employed and V equals the number of job openings. The effective available supply of workers at a given wage is equal to the number who are currently employed plus those unemployed.³² Let us call effective supply $Ls = E + U$ where U equals the number of unemployed workers in a given occupation. If labor demand exceeds labor supply, then $E+V > E+U$, hence, $V>U$; i.e., the number of job openings exceeds the number of unemployed, indicating a shortage. On the other hand, if labor supply exceeds labor demand, then $E+U > E+V$, i.e., the number of unemployed exceeds the number of job vacancies. The relative magnitude of a labor shortage can be gauged by the ratio of V to U while the relative size of a labor surplus can be represented by the ratio of U to V .

The estimates of job vacancies by major occupational category for the second quarter of 2005 were combined with data on the estimated number of unemployed by major occupational group during the first six months of calendar year 2005 to generate values of the ratios of the unemployed to job vacancies in each of these occupational groups. The (CPS) monthly household surveys for the January – June period of 2005 were used to generate these estimates of the unemployed by major occupational group. There was one occupational group, community

³⁰ For a comprehensive review of alternative shortage concepts and measures, see: Andrew Sum and Paul E. Harrington, Job Vacancy Data and the Measurement of Occupational Shortages and Surpluses at the State and Local Level, Center for Labor Market Studies, Northeastern University, Boston, 1983.

³¹ Not all vacancies in a given occupation are characterized by the same wage. Some firms are seeking to hire workers at below market wages and are facing difficulties in filling their vacancies due to these below average wage offers. These job openings will appear in the vacancy count.

³² Some of the unemployed may have reservation wages (their minimum acceptable wage) that exceed market wages for many job openings. Some of these unemployed workers may thus, be considered to be voluntarily unemployed; i.e., unwilling to work at prevailing market wages for the occupation in which they are seeking employment.

and social service workers, for which the CPS survey estimates suggest there was no unemployed persons in the state.³³ For this occupational group, the U/V ratio was zero.

Table 10:
Unemployment to Vacancy Ratios by Major Occupational
Group in Massachusetts, 2nd Quarter 2005

Occupational Group	(A) Average Unemployment of First 6 Months of 2005	(B) Vacancies 2 nd Quarter 2005	(C) U/V Ratio
Total	165,610	72,813	2.27
Farming, fishing, and forestry occupations	1,615	128	12.62
Construction and extraction occupations	25,907	2,353	11.01
Building and grounds cleaning, and maintenance occupations	17,085	1,624	10.52
Legal occupations	1,639	298	5.50
Arts, design, entertainment, sports, and media occupations	2,904	686	4.23
Transportation and material moving occupations	15,268	3,621	4.22
Production occupations	10,824	2,655	4.08
Office and administrative support occupations	26,121	8,260	3.16
Life, physical, and social science occupations	3,747	1,647	2.28
Management occupations	9,858	4,758	2.07
Sales and related occupations	14,650	8,419	1.74
Personal care and service occupations	4,153	2,417	1.72
Business and financial operations occupations	5,368	3,371	1.59
Food preparation and serving related occupations	10,489	6,878	1.52
Education, training, and library occupations	4,216	3,527	1.20
Protective service occupations	1,721	1,781	0.97
Installation, maintenance, and repair occupations	1,133	1,351	0.84
Architecture and engineering occupations	1,392	2,096	0.66
Computer and mathematical science occupations	1,936	3,056	0.63
Healthcare practitioner and technical occupations	4,344	8,862	0.49
Healthcare support occupations	1,239	3,065	0.40
Community and social service occupations	0	1,961	0.00

Sources: CPS Household Survey, first 6 months of 2005 averages; Massachusetts Job Vacancy Survey, 2nd quarter 2005.

³³ The CPS survey interviews approximately 1,700-1,800 labor force participants per month in Massachusetts, with repeat interviews for four consecutive months. To increase the sample size of the unemployed in Massachusetts, we used all 6 months of the CPS surveys for the January – June period of 2005 to estimate the number of unemployed in each major occupational group.

The ratios of the number of unemployed to job vacancies varied quite considerably across the 22 major occupational groups during the second quarter of 2005 (Table 10). The higher the ratio, the greater is the degree of labor surplus. The lower the ratio is below one, the greater the shortage. These ratios ranged from lows of .00 to .97 in seven major occupational groups to highs of 10 or more in three occupational groups. Of the seven occupational groups with more job vacancies than unemployed persons, two were in the health-related field, including health care support (nurse aides/orderlies) as well as health care professionals and technicians (registered nurses, LPN's, physical therapists), two were in high technology/ professional occupations (including computer scientists and engineers), and one was in a blue collar craft occupational field (installation and repair occupations). The installation, maintenance, and repair occupations include automotive technicians and auto body repair positions that have been cited as being in shortage in our state in recent years. At the time of the 2005 II survey, there were slightly over 400 job openings for workers in such occupations. The number of occupational groups in which available job vacancies equal or exceed the number of unemployed has been rising in our state in recent years. These occupations are quite diverse in terms of their skill composition and their education/training requirements and will require a diverse array of workforce development strategies to alleviate current and future shortages.

To track changes over time in the degree of shortages and surpluses within major occupational groups, we conducted a similar analysis using job vacancy data for the second and fourth quarters of 2004. The findings from these two surveys were averaged to provide an estimate of the average monthly number of job vacancies in the state during 2004 within 22 occupational groups. The twelve monthly CPS public use files for Massachusetts for 2004 were used to estimate the average monthly number of unemployed persons in each of these occupational groups. Across the entire state, in 2004, there were approximately 2.4 unemployed persons for every available job vacancy (Table 11).

Table 11:
Ratios of Unemployment to Job Vacancy Levels in Massachusetts During 2004 by Major Occupational Sector

	Job Vacancies			Annual Average Unemployment	Ratio U/V
	2nd Q	4th Q	Annual Average		
Total Job Vacancies	59,891	71,934	65,913	156,938	2.4
Building & Grounds Cleaning & Maintenance	1,073	888	981	13,250	13.5
Construction and Extraction	2,277	2,304	2,291	18,379	8.0
Production	2,484	1,888	2,186	11,480	5.3
Legal	597	159	378	1,307	3.5
Management	2,907	3,838	3,373	10,333	3.1
Office and Administrative Support	7,538	11,763	9,651	26,253	2.7
Farming, Fishing, and Forestry	457	76	267	696	2.6
Transportation and Material Moving	3,465	4,361	3,913	9,757	2.5
Installation, Maintenance, and Repair	1,759	1,963	1,861	4,054	2.2
Education, Training and Library	3,024	1,991	2,508	5,428	2.2
Personal Care and Service	2,346	2,025	2,186	4,713	2.2
Life, Physical, and Social Services	1,050	1,613	1,332	2,750	2.1
Sales Related	5,719	12,335	9,027	18,398	2.0
Arts, Design, Entertainment, Sports, & Media	708	688	698	1,414	2.0
Business and Financial Operations	2,414	3,135	2,775	5,602	2.0
Architecture and Engineering	1,467	1,615	1,541	2,846	1.8
Food Preparation and Serving Related	5,646	4,753	5,200	9,154	1.8
Protective Service	767	1,348	1,058	1,407	1.3
Computer and Mathematical	2,588	2,693	2,641	3,237	1.2
Healthcare Support	3,445	2,364	2,905	2,660	0.92
Community and Social Services	1,368	2,516	1,942	945	0.49
Healthcare Practitioner and Technical	6,792	7,618	7,205	2,877	0.40

The ratios of the unemployed to job vacancies varied quite considerably across the twenty two major occupational groups. These ratios ranged from lows of .40 in healthcare practitioner and technical occupations, .49 in community and social service occupations and .92 in healthcare support occupations to highs of 8.0 and 13.5 in construction and extraction occupations and building & grounds cleaning and maintenance. Production occupations located primarily in the manufacturing sector also were characterized by a substantial degree of labor surplus in 2004, with five unemployed workers for every job vacancy.

The healthcare related occupations and community and social services were the only three occupational groups in the state characterized by more job openings than unemployed persons in 2004. These three occupational groups combined had a total of 12,000 job openings during 2004, accounting for one of every 5 job openings in the state. Most of the employment openings in these three major occupational groups are found in the healthcare sector of the state. Other occupational groups with a large number of job vacancies were the office and administrative support occupations, with 9,651 job vacancies; however, a relatively high share of these jobs appeared to be part-time and/or seasonal, especially in the 4th quarter of 2004. Sales related occupations had also a large number of job openings (9,027), but a substantial majority of them also were part-time openings. About 5,200 job openings were in the food preparation and serving related occupations, with a slight majority being part-time opportunities. Many of the part-time job openings in the clerical/administrative support, sales related, and food preparation and serving occupations would be desirable job openings for high school students and young high school dropouts. Employment rates of these two groups of teens have fallen sharply over the past few years with young high school dropouts and low income high school students facing some of the lowest employment rates in the entire country. Only 1 of 7 high school students from poor families were employed on an average month during 2004.

The above findings on job vacancy levels and unemployment levels by major occupational group in Massachusetts during 2004 and 2005 reveal that workers in most blue collar occupational groups, including many construction workers were in substantial surplus in our state in recent years. The number of unemployed workers in these occupational groups substantially exceeded the estimated number of job vacancies indicating the existence of severe structural unemployment problems among most blue collar workers. As will be noted below, there are a few occupational niches in construction craft and repair occupations in which shortages appear to exist but they are the exception rather than the norm.³⁴ These findings have important implications for the state's workforce development system. Previous national research on dislocated workers has consistently revealed that displaced blue collar workers incur among

³⁴ For a review of empirical evidence on the wage and earnings losses experienced by different groups of dislocated workers upon re-employment, See (i): Louis Jacobson, Robert Lalonde, and Daniel Sullivan, The Costs of Worker Dislocation, W.E. Upjohn Institute for Employment Research, Kalamazoo, 1993. (ii) Peter Kuhn and Arthur Sweetman, Does Multiskilling Matter? Evidence from Displaced Workers, W.E. Upjohn Institute, Kalamazoo, February 2005.

the highest wage and earnings losses when they do become re-employed. The size of these earnings losses among blue collar workers tend to increase with the length of their job tenure in these occupations.

State workforce development policy, including WIA dislocated worker programs, should aim to recruit and retain more of these dislocated, blue collar workers to boost their re-employment prospects and reduce the size of the earnings losses that they typically experience upon becoming re-employed. For older blue-collar workers, such re-training and intense job development efforts may also succeed in retaining them in the civilian labor force, helping avert early retirement and further reductions in the size of the state's resident civilian labor force. In addition, retirees who were forced into retirement as a consequence of an involuntary loss of their career job express significantly less satisfaction with life in retirement.

Establishing Criteria for the Selection of Shortage Occupations for Future Training

The combined use of job vacancy data for occupations together with employment and unemployment data for the same set of occupations allowed us to calculate job vacancy rates and unemployment rates for occupations. Comparisons of the number of job vacancies in an occupation with the number of unemployed then enabled us to identify the degree of labor shortage or surplus in an occupation.³⁵ Further analysis of occupations meeting high job vacancy rate or shortage criteria was undertaken to identify the educational characteristics of workers who were employed in these occupations in Massachusetts at the time of the 2000 Census and the annual earnings of workers employed full-time for 40 or more weeks in calendar year 1999. The advisory board for the Workforce Solutions Group had established certain criteria to guide the selection of occupations for training: entry into the occupation typically did not require any formal schooling beyond an Associate's degree and the average full-time, year-round worker in

³⁵ Other methods for identifying occupational shortages including the Blank-Stigler methodology rely on calculating real wage or earnings changes for individual occupations. If wages quickly respond to changes in labor demand and supply, then a labor shortage will drive up wages above the average rate for all occupations. While the monthly CPS household survey does collect weekly wage data from one-fourth of the sample of employed wage and salary workers each month, the sample sizes for individual occupations are too small at the state level to reliably estimate wage changes over time. Findings on the weekly earnings of full-time wage and salary workers in the U.S. over the 2000-2005 period reveal little to no changes in the real weekly earnings of men and small (2 to 3 percentage points) changes in the weekly earnings of full-time employed women, with the gains taking place primarily at the upper end of the educational attainment distribution.

the occupation could expect to obtain annual earnings above selected income adequacy thresholds, including twice the federal government's official poverty line for a family of three and the Family Economic Self-Sufficiency (FESS) income level for a family of three in the state of Massachusetts.³⁶

In deriving our list of targeted occupations for training consideration, we conducted the following analyses. First, we reviewed job vacancy data (both levels and rates) for all of the individual occupations that accounted for more than one half of all job vacancies in the state during the second quarter of calendar year 2005. This list of occupations was initially published by the Massachusetts Division of Unemployment Assistance in its report on the findings of the 2nd quarter 2005 survey. At the request of the Center for Labor Market Studies, DUA staff supplemented this information with a listing of blue collar occupations that were estimated to have 140 or more job vacancies statewide (See Appendix A for a listing of both sets of occupations).³⁷ Both of these lists then were examined to identify individual occupations that had a minimum level of job vacancies (at least 400 vacancies for occupations outside of the blue collar ranks and at least 140 vacancies for blue collar positions), a job vacancy rate equal to or greater than the statewide average of 2.6%, and were viewed as unlikely to require more than an Associate's degree to gain entry into the ranks of the employed in this occupation. Some occupations that met the above vacancy criteria but were found to either require little training, provide few full-time job opportunities, or be characterized by relatively low mean wages (under \$10.00 per hour) according to the state OES survey were excluded from consideration. These excluded occupations included cashiers, waiters, counter attendants, dishwashers, and security guards. A total of 21 occupations met our initial screening criteria. The titles of these individual occupations, the major occupational group with which they are associated, and their estimated job vacancy rate in the second quarter of 2005 are displayed in Table 12.

³⁶ For a review of the uses of these income measures and other adequacy thresholds in judging the earnings adequacy of Massachusetts workers, see: Andrew Sum, Ishwar Khatiwada, and Sheila Palma, Recent Trends in the Levels, Distribution, and Adequacy of the Annual Earnings of Massachusetts Workers...

³⁷ See: Massachusetts Department of Workforce Development, Massachusetts Job Vacancy Survey: Hiring Trends by Industry and Occupation, 2nd Quarter 2005, Boston, 2006.

Table 12:
A Listing of the 19 Occupations That Met Our Initial Job Vacancy and Potential Wage Screening Criteria for Training Consideration by Major Occupational Category

Occupation	Job Vacancy Rate
<u>Management</u>	
• Medical health service managers	6.8
<u>Life/ physical sciences</u>	
• Medical scientists	7.0
<u>Health practitioner and technical</u>	
• Physical therapists	7.4
• Registered nurse	6.5
• Licensed practical nurse	4.0
<u>Health support</u>	
• Nurse aides, orderlies	4.2
<u>Clerical/administrative support</u>	
• Receptionist and information clerks	3.5
• Secretaries and admin. assistants	2.6
• Bank tellers	4.8
• Medical secretaries	2.5
<u>Social and community service</u>	
• Social service + community service specialists	4.0
<u>Food preparation and serving</u>	
• Short order cooks	13.5
<u>Personal care and service</u>	
• Fitness trainers and aerobics	8.3
<u>Production crafts/ Industrial crafts</u>	
• Carpenters	4.0
• Plumbers/ Pipe fitters	3.7
• Tool and die makers	8.9
<u>Installation, maintenance/ repair</u>	
• Automotive service technicians and auto body repair	2.6
• Heating, air conditioning, and refrigeration	3.6*
<u>Transportation and moving</u>	
• Bus drivers, urban transit/ intercity	3.5
• Heavy truck drivers	3.1
<u>Production workers</u>	
• Welders, cutters, solderers	6.2

Note: (*) The vacancy rate for this occupation was averaged over the 4th quarter of 2004 and 2nd quarter of 2005

One of the criteria that were selected to prioritize occupations for training was that an individual could gain entry into the occupation with no formal schooling beyond the associate's degree. For each of the targetted occupations, we identified the educational characteristics of those persons who were employed in the occupation at the time of the 2000 Census. The educational attainment of each employed person was assigned to one of the following two categories: some high school up to an Associate's degree and a Bachelor's degree or higher. The findings of our analysis are displayed in Table 13.

For all 21 occupations combined, 93 per cent of the employed had completed 14 or fewer years of schooling. The only occupation for which a Bachelor's or higher degree was required for entry was medical scientist. Ninety-six per cent of the employed workers in this occupation in 2000 held a Bachelor's or higher degree. Approximately one-third of the medical health service managers and physical therapists also reported a bachelor's degree as did one-sixth of the registered nurses.³⁸

A BS nursing degree, however, is becoming a minimum credential for entry into RN positions in some hospitals and for more specialized nursing positions. For each of the remaining occupations, except community and social service representatives, fewer than 10 per cent of the workers held a Bachelor's degree. A number of the high skilled blue collar occupations, however, do require completion of an apprenticeship program and licensure to become employed as a journeyman.

The second set of criterion to guide selection of occupations for training was related to the annual earnings potential for workers employed in these occupations. In conducting our earnings analysis, we selected only those workers who were employed full-time for 40 or more weeks during the year. Part-time (under 35 hours per week) and part year (under 40 weeks) workers were excluded from the analysis to prevent their lower earnings from distorting the average annual earnings for workers. It should be noted, however, that part-time and part year workers were quite frequent in some of these occupations, including registered nurses, nurse aides, tellers, short order cooks and bus drivers.

³⁸ Past research has indicated that some workers reporting their occupational titles as registered nurses are actually employed in less skilled nursing positions. The educational attainment of RNs may thus be somewhat downward biased.

Both the mean and median annual earnings of full-time, year-round workers in these occupations were calculated.³⁹ In nearly all cases, the mean was higher than the median due to skewness on the right hand tail of the distribution, reflecting the high earnings of those at the very top. Median annual earnings ranged from a low of slightly under \$20,000 for short order cooks and \$22,000 to \$23,000 for tellers and receptionists/information clerks to highs of \$45,000 to \$48,000 for medical scientists, physical therapists, registered nurses, and medical health service managers (Table 14).

Table 13:
Distribution of Employed Persons in Massachusetts by Educational Attainment Within the Targetted List of Occupations, 2000

Occupation	<u>Number of Employed</u>			<u>% Dist. By Education</u>	
	Associate's or Less	Bachelor's or Higher Degree	Total	Associate's or Less	Bachelor's or Higher Degree
Medical Health Service Managers	8,785	4,534	13,319	66.0	34.0
Medical Scientist	272	6,359	6,631	4.1	95.9
Misc. Social Services and Community Service Specialist	6,050	2,034	8,084	74.8	25.2
Registered Nurses	58,086	11,034	69,120	84.0	16.0
Physical Therapist	3,652	1,596	5,248	69.6	30.4
Licensed Practical and Licensed Vocational Nurses	10,755	759	11,514	93.4	6.6
Nursing Aides, Orderlies, & Attendants	44,772	1,466	46,238	96.8	3.2
Cook, Short Order	30,343	215	30,558	99.3	0.7
Recreation and Fitness Workers	5,934	646	6,580	90.2	9.8
Tellers	9,520	193	9,713	98.0	2.0
Receptionist and Information Clerks	25,130	665	25,795	97.4	2.6
Secretaries and Adm. Assistants	91,915	2,674	94,589	97.2	2.8
Carpenters	33,255	399	33,654	98.8	1.2
Pipe Layers, Plumbers, Pipe Fitters and Steam Fitters	11,279	138	11,417	98.8	1.2
Automotive Service Technicians and Mechanics Heating, air conditioning, and refrigeration mechanics	21,178	198	21,376	99.1	0.9
Machinist	5,386	80	5,466	98.5	1.5
Tool and Die Workers	13,583	19	13,602	99.9	0.1
Welding, Soldering and brazing workers	2,301	51	2,352	97.8	2.2
Bus Drivers	7,837	16	7,853	99.8	0.2
Driver/Sales Worker and Truck Drivers	12,371	178	12,549	98.6	1.4
Total	54,197	463	54,660	99.2	0.8
Total	456,601	33,717	490,318	93.1	6.9

³⁹ The median earnings level is that earnings which divides the distribution into two equal parts. One half of the workers make more than the median and the other half make less than the median.

Table 14:
Mean and Median Annual Earnings of Full-Time, Year-Round Workers in
Massachusetts in Selected Occupations, 1999

	(A)	(B)	(C)
Occupation	Mean	Median	Number
Medical Health Service Managers	\$60,884	\$47,200	12,288
Medical Scientist	\$59,505	\$45,000	5,937
Registered Nurses	\$49,978	\$48,000	40,703
Physical Therapist	\$47,558	\$45,000	3,452
Pipe Layers, Plumbers, Pipe Fitters and Steam Fitters	\$43,561	\$40,000	10,499
Tool and Die Workers	\$42,800	\$39,000	2,304
Heating, air conditioning and refrigeration mechanics	\$42,507	\$40,000	5,220
Misc. Social Services and Community Service Specialist	\$38,725	\$33,000	6,097
Driver/Sales Worker and Truck Drivers	\$37,404	\$34,900	46,300
Machinist	\$37,114	\$35,300	13,268
Carpenters	\$36,465	\$32,700	28,826
Licensed Practical and Licensed Vocational Nurse	\$36,447	\$34,200	6,933
Bus Drivers	\$34,658	\$27,000	6,011
Automotive Service Technicians and Mechanics	\$34,449	\$32,000	19,074
Welding, Soldering and brazing workers	\$34,094	\$30,500	7,507
Secretaries and Adm. Assistants	\$31,703	\$30,000	68,752
Recreation and Fitness Workers	\$30,218	\$27,000	3,250
Nursing Aides, Orderlies, & Attendants	\$26,653	\$23,300	29,550
Receptionist and Information Clerks	\$25,121	\$23,000	13,084
Tellers	\$22,646	\$22,000	5,583
Cook, Short Order	\$20,989	\$19,500	20,479
Total	\$36,364	\$31,800	355,117

Two sets of income adequacy criteria were used to determine the annual earnings adequacy of workers in each occupation. (See appendix B for a more detailed discussion of these adequacy earnings criteria and their construction.). The first criterion was an earnings level that would equal or exceed the poverty income threshold for a family of three persons in the US in 1999. In 1999, the earnings level needed to satisfy this criterion was \$26,580. The percentage share of full-time workers in Massachusetts that had annual earnings above this threshold in 1999 varied widely across the 21 occupations on our targetted list. At the upper end of the distribution, there were eight occupations in which 78% or more of the employed achieved the earnings criterion. In two of these eight occupations, registered nurses and physical therapists, 90% or more had earnings above the low income threshold. At the lower end of the earnings distribution, there were two occupations (bank tellers and short order cooks) in which one-third or fewer of the workers were able to achieve the annual earnings adequacy criteria.

Our second, more demanding earnings criterion involved the use of the family income budget data from the Family Economic Self-Sufficiency methodology of the Women's Educational and Industrial Union and Wider Opportunities for Women. (See Appendix B for a more detailed discussion of this methodology and our applications of it to this exercise.) The annual earnings criterion for this adequacy measure was \$36,481. In only seven of the 21 occupations were fifty per cent or more of the workers in 1999 able to achieve an annual earnings level above this threshold. Three of the health-related occupations (registered nurses, physical therapists, and medical health service managers) were at the very top of the list. In seven other occupations, including nurse aide, short order cook, teller, information clerk, fewer than one-third of the workers were able to achieve the more demanding earnings criterion. This factor by itself should not rule them out for future funding consideration. A careful analysis of the private and social returns from investments in such training is needed to determine the economic worthwhileness of such investments.

Table 15:
Percent of Full-Time Year-Round Workers in Massachusetts in Selected Occupations
With Earnings Above 2-Times the Poverty Threshold for a 3-Person Family, 1999

Occupation	Percent
Registered Nurses	91.5%
Physical Therapist	90.8%
Medical Health Service Managers	87.0%
Heating, air conditioning and refrigeration mechanics	81.3%
Medical Scientist	80.9%
Tool and Die Workers	79.9%
Licensed Practical and Licensed Vocational Nurses	79.2%
Pipe Layers, Plumbers, Pipe Fitters and Steam Fitters	78.8%
Machinist	75.7%
Misc. Social Services and Community Service Specialist	70.6%
Driver/Sales Worker and Truck Drivers	69.2%
Carpenters	66.9%
Automotive Service Technicians and Mechanics	66.2%
Secretaries and Adm. Assistants	63.6%
Welding, Soldering and brazing workers	62.6%
Recreation and Fitness Workers	52.3%
Bus Drivers	51.2%
Receptionist and Information Clerks	35.0%
Nursing Aides, Orderlies, & Attendants	34.5%
Cook, Short Order	20.8%
Tellers	20.4%
Total	64.0%

Table 16:
Percent of the Full-Time Year-Round Employed in Massachusetts With Annual
Earnings Above the FESS Family Budget For a Married Couple With 1 Child Over 6 Years of
Age (\$36,481) Within Selected Occupations, 1999

Occupation	Percent
Registered Nurses	77.1%
Physical Therapist	75.0%
Medical Health Service Managers	69.1%
Medical Scientist	60.1%
Pipe Layers, Plumbers, Pipe Fitters and Steam Fitters	60.1%
Heating, air conditioning and refrigeration mechanics	59.3%
Tool and Die Workers	51.5%
Machinist	47.8%
Driver/Sales Worker and Truck Drivers	44.3%
Misc. Social Services and Community Service Specialist	42.1%
Carpenters	41.2%
Licensed Prac and Licensed Voc Nurse	38.4%
Welding, Soldering and brazing workers	38.2%
Automotive Service Technicians and Mechanics	36.7%
Bus Drivers	34.6%
Recreation and Fitness Workers	27.5%
Secretaries and Adm. Assistants	26.0%
Nursing Aides, Orderlies, & Attendants	12.4%
Receptionist and Information Clerks	9.9%
Cook, Short Order	7.0%
Tellers	6.2%
Total	38.9%

Summary of Key Findings and Their Implications for Future Workforce Development Policy in Massachusetts

This research report has provided both a description and an assessment of key trends in occupational employment and job vacancies across Massachusetts over the past five years (2000-2005) together with selected comparisons of job growth by occupation in earlier time periods. Selected findings on job vacancies by occupational group also were provided for seven regional economic development districts across the state. The educational requirements and earnings potential for occupations with above average vacancy rates also were examined. A summary of key findings of our analysis, an assessment of their implications for future workforce development policy in the Commonwealth, and desired future research and evaluation activities in this area are presented below.

(i) Overall employment in the state whether measured by the monthly payroll survey of establishments (private firms and government agencies) or the household survey fell between 2000 and 2005. According to findings of the establishment-based payroll survey, annual average wage and salary employment in 2005 was only 3.195 million, or 127,000 below its level in 2000. Payroll employment in the state fell sharply and substantially between the first quarter of 2001 and the first quarter of 2004 and has risen modestly since then. Substantial changes in the industrial composition of employment in the state since 2000 have had important impacts on the occupational structure of employment over the past five years. The steep declines in manufacturing employment and job losses in key business services and finance/insurance industries sharply reduced job opportunities for blue collar production and operative workers, office and administrative support workers, and for workers in a number of high skilled occupations, including financial operations, computer science occupations, and engineering occupations.

(ii) During the decade of the 1990's, occupational employment growth rates in Massachusetts were highest in executive/ managerial (+25%), professional (+20%), service (+15%), and handler/cleaner/ laborer occupations (+12%). Employment growth in management-related and professional occupations combined was equal to 219,000, accounting for all of the net increase in the total volume of employment. In contrast to these positive job developments, employment declined in lower level sales, clerical, blue collar production, and transportation moving occupations. These substantial shifts in the occupational composition of employment in the state between 1989-2000 drove up the demand for many workers with college degrees, especially Bachelor and higher degrees, and improved the real annual earnings of most of these more highly educated groups. Workers with more limited formal schooling, especially males without high school diplomas, saw their real annual earnings decline over the decade despite record low unemployment rates in Massachusetts labor markets at the end of the decade. Earnings inequality among state workers also increased sharply over the decade as workers in the top decile of the distribution achieved the highest earnings gains while those in the bottom few deciles actually lost economic ground.

(iii) Despite renewed payroll job growth in the state since the beginning of 2004, the total number of employed residents (16+) in Massachusetts in 2005 was still more than 34,000 or 1.1% below its level in 2000. Trends in employment within the 21 major occupational groups

were quite mixed over the 2000-2005 period. Employment increased in 13 of these 21 occupational groups, with substantial job growth in education/training, healthcare practitioner and technical, health care support, construction, and building and grounds cleaning and maintenance occupations. At the same time, however, there were very steep job losses in business and financial operations, computer and mathematical science, engineering, office support, and blue collar production occupations. Total job losses in these declining occupations were equal to nearly 250,000, offsetting all of the job gains in the growing occupations. In a few of the occupations with substantial job losses (computer science, engineering), there has been some renewed job growth over the past two years, with rising job vacancies in a number of these occupations.

(iv) The aggregate number and rate of job vacancies in Massachusetts has been rising over the past two years. Between the second quarters of 2003 and 2005, the estimated total number of job vacancies has risen from 58,600 to 72,800 while the job vacancy rate rose from 2.1% to 2.6%. The job vacancy rate in Massachusetts in the second quarter of 2005 was estimated to be 2.6%, exactly identical to the job vacancy rate for the nation as a whole during the same time period. Job vacancy rates varied across geographic regions of the state, ranging from 2.4% in the Central and Northeast regions to a high of 3.7% in the Berkshire region. While job vacancies were rising, the number of unemployed persons in the state declined during 2004 and 2005. As a consequence, the ratio of the number of unemployed workers to the number of job vacancies fell from 3.6 in the fourth quarter of 2002 to 2.1 in the second quarter of 2005. While labor surpluses still exist in many industries and occupations, the relative degree of these surpluses has been diminishing in many occupational and geographic areas.

(v) Job vacancy rates have been rising in most of the major occupational groups of the state over the past two years. Of the 21 major occupational groups, job vacancy rates rose in 15 of these occupational groups between the second quarters of 2003 and 2005 and declined by only .2 percentage points in two other occupational groups. In the second quarter of 2005, job vacancy rates in these major occupational groups varied quite considerably, ranging from lows of 1.2 to 1.5 percent in four major occupational groups (legal, production, office) to highs of 4.1 to 4.8 percent in life/ physical/ social sciences and healthcare practitioner and technical occupations. The job vacancy rates for major occupational groups in the second quarter of 2005 exhibited quite varying patterns across geographic regions of the state. For the two categories of health

care occupations, community and social services, food preparation and serving, and office support occupations, job vacancy rates were fairly uniform across most of the seven geographic regions. In contrast, job vacancy rates in such occupational groups as life/ physical/ social sciences, business and financial operations, computer and mathematical occupations, engineering, construction, and installation/ maintenance/ and repair occupations varied widely across geographic regions of the state. For example, job vacancy rates for life/ physical/ social scientists ranged from a low of .7% to a high of 6.1% across the seven regions. In the construction trades, job vacancy rates in the second quarter of 2005 ranged from a low of .3% to a high of 4.9%. Many occupational shortages appear to be limited to specific regions of the state than being present in all regions of the state, especially in occupations outside of the health care field.

(vi) Comparisons of the number of unemployed with the number of job vacancies in major occupational groups during the second quarter of 2005 yielded substantial variability in the degree of labor shortages and surpluses. The ratios of unemployed/ vacancies ranged from 0 to .50 in community/ social service, healthcare support, and healthcare practitioner/technical occupations to highs of 10 and above in building and grounds cleaning, construction, and farm/ forestry/ fishing occupations. Seven of the 21 major occupational groups were characterized by more job vacancies than unemployed workers while another seven occupational groups had four or more times as many unemployed workers as they did job vacancies.

(vii) Within many of the 21 major occupational groups, job vacancy rates also varied fairly widely across individual occupations. In the health care practitioner and technical occupational group, vacancy rates were highest for registered nurses, licensed practical nurses, and physical therapists. In the computer and mathematical science occupations, the vacancy rate was highest for computer application software engineers. In management related occupations, job vacancy rates were highest for sales managers and medical health service managers. In the construction and installation/ repair occupations, job vacancy rates were highest for carpenters, plumbers/ pipe fitters, and automotive technicians. Some occupational shortages appeared to exist in nearly every major occupational group except production workers where substantial job losses had taken place over the past five years.

(viii) Educational requirements and average hourly wages/ annual earnings varied widely across occupations characterized by high vacancy rates/ labor shortage conditions. Not surprisingly, in many business and financial, management, and life/physical science occupations, a substantial majority of the employed held bachelor or higher degrees. In many other shortage areas, however, an overwhelming share of the workers had not completed more than an associate's degree. Mean annual earnings and the percent of workers able to obtain earnings adequacy varied considerably across these shortage occupations. We identified the annual earnings potential for a substantial subset of occupations with relatively high vacancies. This subset of occupations should be given high priority for future training initiatives in the state. There are other shortage occupations (retail sales, clerks, cashiers, security guards, counter clerks, cooks, information clerks) where intensive job development and placement activities should be undertaken to improve employment prospects for high school students and young high school dropouts (16-24) whose employment prospects in our state and across the country have deteriorated substantially in recent years.

(ix) While we have been able to identify a subset of 19 occupations in Massachusetts that had above average vacancy rates in 2005 and met selected educational and earnings criteria, some further research on these occupations would be desirable. There is a need to gain more detailed insights into the specific nature of the labor shortages in particular occupations in the healthcare practitioner/technician, social service, construction (carpenters, plumbers/ pipe fitters), transportation equipment operators (transit and intercity bus drivers, truck drivers), tool and die makers, welders, automobile repair technicians, cooks, and teller occupations. Knowledge of the education and training requirements for entry into these positions, the specific skill sets being sought by employers, the current sources of supply for these occupations, the ability of available training institutions to expand supply into these fields, and the potential role of a combination of on-the-job training and offsite classroom training activities to meet the immediate labor requirements of these employers is needed to develop appropriate workforce development strategies.

(x) In the healthcare field, there have been several training initiatives, including the Extended Care Career Ladder Initiative (ECCLI) of the Commonwealth Corporation, that were designed to develop new career ladders that would help employers meet their skill needs, boost the labor productivity and the wages of entry level workers, and reduce labor turnover.

Evaluations of the success of these job restructuring and career ladder building efforts in enhancing the skills and wages of the program participants and reducing labor turnover need to be reviewed and analyzed to determine the desirability of replicating these initiatives in other occupational fields. Some of these occupational areas will be experiencing above average growth in our state over the coming decade, and the ability to restructure existing work so as to make it more economically rewarding and satisfying for workers and more productive for employers would be a classic “win, win” situation. The state needs many more higher paying jobs for workers with modest formal schooling to assist them in achieving economic self-sufficiency and to help narrow the high and rising degree of wage and earnings inequality in the state.

(xi) While the job vacancy surveys of the Massachusetts Department of Workforce Development have substantially improved our knowledge base on the numbers and the industrial/occupational characteristics of job vacancies in the state, we do not have a very good understanding of the role of the state’s one stop career centers and other workforce development programs in filling these available job vacancies. There is a clear and immediate need to measure the performance of the WIA career centers in attracting job orders from firms and government agencies in the aggregate and by industry and occupation and in filling these job openings with available applicants. What share of the job openings identified by the vacancy survey are captured by the one stop centers, how successful are they in filling the job orders that they receive, and how does their performance in obtaining and filling job orders vary across geographic areas of the state (e.g., across WIA service delivery areas)? How do the job placement outputs of the WIA, DTA, DOE, and community college workforce development programs by occupational area and industry compare to the distribution of job vacancies across industries and occupations? Where are there important gaps in addressing skill shortages?

(xii) There also is a need to track the longer-term labor market experiences of graduates from WIA-funded training programs for older youth, adults, and dislocated workers, the adult education programs of the Massachusetts Department of Education, vocational education programs at the secondary and adult level, and community college degree and certificate programs. How successful are the graduates of these programs in obtaining employment in training-related fields and in boosting their longer-term employability and earnings? Which occupational fields appear to be associated with higher levels of employment and annual

earnings for the graduates of these training programs? Which programs are deserving of further financial support?

Appendix A: The Selection of Target Occupations for Training Consideration by the Boston Workforce Development Initiative

One of the main objectives of this study was to analyze job vacancy rates by major occupational group and individual occupations to identify employment fields in which labor shortages appeared to exist in late 2004 and mid-2005. The state job vacancy survey for 2005 II was the primary source of data for identifying job vacancy rates in individual occupations. This appendix provides a description of the methods that we used to come up with our list of priority occupations for training consideration.

In its report on findings of the job vacancy survey for the second quarter of 2005, the Massachusetts Division of Unemployment Assistance generated a list of individual SOC-based occupations that accounted for one-half of all job openings in the state.⁴⁰ This list provided information on the estimated number of job vacancies in each occupation and the job vacancy rate in the second quarter of 2005. We organized this list of individual occupations by major occupational group (Table A-1). The fact that an individual occupation made this initial list did not automatically imply that it was characterized by an above average vacancy rate. For example, there were 473 estimated job openings for secondary education school teachers but this yielded a job vacancy rate of only 1.9%, which was below the statewide average of 2.6%. Any occupation with a job vacancy rate below the statewide average was excluded from further consideration in our list of targeted occupations.

The initial list of occupations with a high absolute number of job openings published by the Massachusetts Division of Unemployment Assistance (DUA) was supplemented by a further list of blue collar occupations for whom vacancy data and vacancy rates were graciously provided to the authors by DUA staff. From this list, we identified a number of blue collar occupations (tool and die makers, welders, automotive technicians) that both had a minimum number of job vacancies (140 or more) and an above average job vacancy rate. A listing of blue collar occupations with 140 or more job vacancies at the time of the 2005 II job vacancy survey is displayed in Table A-2. The occupations are listed in rank order by the absolute number of job vacancies at the time of the survey. Additional information on the job vacancy rates in these occupations was supplied by DUA and used to identify those with above average job vacancy rates.

⁴⁰ See: Massachusetts Department of Workforce Development, Massachusetts Job Vacancy Survey: Hiring Trends by Industry and Occupation, Second Quarter 2005, Boston, 2006.

We further pared down the list of occupations for training consideration by reviewing training time needed to gain entry into these occupations and the average wage levels paid to such workers according to the state's Occupational Employment Statistics survey (OES). Any occupation paying an average wage less than \$11.000 per hour was excluded from further consideration.

For the final list of 19 occupations, we conducted three additional sets of analyses. We used the findings of the PUMS data files from the 2000 Census to identify the educational characteristics of the workers in these occupations, with particular emphasis on estimating the share of workers in each occupation who had no formal schooling beyond an Associate's degree. We then estimated the mean and median annual earnings of workers who were employed full-time for 40 or more weeks during 1999 in each of these occupations. Finally, we estimated the share of full-time year round workers who were able to obtain annual earnings above two adequacy thresholds: twice the official poverty line for a family of three in 1999 and the family income level equivalent to the Family Economic Self Sufficiency (FESS) Standard for a married couple family in Massachusetts with one child between the ages of 6 and 17.

Table A-1:
Job Vacancies by Major Occupational Group and Detailed Occupations Accounting for
More than Half of All Job Vacancies in Massachusetts, 2nd Quarter 2005

	(A)	(B)
Occupational Group	Vacancies	Vacancy Rate
All Job Vacancies	72,813	2.6
Healthcare Practitioner and Technical	8,862	4.8
Registered Nurses	4,898	6.5
Licensed Practical & Licensed Voc Nurse	695	4.0
Physical therapists	412	7.4
Sales Related	8,419	2.6
Retail Salespersons	3,166	3.0
Cashiers	2,139	2.9
First line sup/mgr of retail sales	711	2.7
All other sales and related workers	683	-
Office and Administrative Support	8,260	1.5
Exec Secretaries & Admin Assistants	1,099	2.6
Customer service Reps	1,046	2.1
Receptionists & Information Clerks	813	3.5
Tellers	709	4.8
Stock Clerks and Order Fillers	670	1.7
Medical secretaries	420	2.4
Office Clerks, General	440	0.7
Food Preparation and Serving Related	6,878	2.7
Waiters and Waitresses	1,719	3.1
Combined food prep and serving workers	1,490	3.1
Counter Attendant. Café, Food, Coffee	569	3.0
Bartenders	507	3.0
Dishwashers	464	3.5
Cooks, short orders	458	13.5
Dining room & cafeteria attendants	442	5.0
Management	4,758	2.2
Financial managers	641	3.2
Sales Managers	605	5.2
Medical health service managers	492	6.8
Transportation and Material Moving	3,621	2.1

Laborers & Freight, Stock, & Mat Movers	978	2.3
Truck Driver, Heavy & Tractor-Trail	747	3.1
Education, Training and Library	3,527	1.8
Secondary school teachers, ex spec & voc	473	1.9
Elementary School teachers, excl. special ed.	447	1.4
Business and Financial Operations	3,371	2.9
Accountants and Auditors	845	3.2
All other business operators specialists	566	-
Management Analysts	459	3.2
Healthcare Support	3,065	3.3
Nursing aides, Orderlies, & Attend	1,852	4.2
Computer and Mathematical	3,056	2.9
Comp Software Engineers, Applications	951	4.5
Comp Software Engineers, systems soft	400	2.2
Production	2,655	1.4
All other production workers	470	
Personal Care and Service	2,417	3.3
Fitness trainers and aerobics instructors.	549	8.3
Construction and Extraction	2,353	2.0
Carpenters	743	4.0
Plumbers, pipe fitters, & steamfitters	440	3.7
Architecture and Engineering	2,096	2.9
Community and Social Services	1,960	3.5
Social and Human Service Assistants	509	4.0
All Other Community and Social Service Spec	448	
Protective Service	1,781	2.5
Security Guards	928	4.1
Life, Physical, and Social Services	1,647	4.1
Medical scientists, excluding epidemiology	409	7.0
Building & Grounds Cleaning & Maintenance	1,624	1.5
Janitor & cleaner	771	1.4
Maids and housekeeping cleaners	447	2.2
Installation, Maintenance, and Repair	1,351	1.3
Arts, Design, Entertainment, Sports, & Media	686	1.6
Legal	298	1.2

Table A-2:
Job Vacancies in Blue Collar Occupations with 140 or More Vacancies in
Massachusetts, 2005 II

	(A)	(B)
Occupation	Vacancy Level	Vacancy Rate
Laborers & Freight, Stock, & Material Moving	978	2.3%
Truck Driver, Heavy & Tractor-Trailer	747	3.1%
Carpenters	743	4.0%
All Other Production Workers	470	na
Plumbers, Pipe fitters, & Steamfitter	440	3.7%
Taxi Drivers and Chauffeurs	361	8.0%
Automotive Service Tech & Mechanics	332	2.1%
All Other Assemblers & Fabricators	251	na
Structural Metal Fabricators & Fitters	233	na
Welders, Cutters, Solderers, & Brazers	216	6.2%
All Other Construction Workers	214	na
Packers and Packagers, Hand	204	1.2%
Tool and Die Makers	163	8.9%
Truck Driver, Light or Delivery Service	162	0.8%
Painters, Construction & Maintenance	156	2.9%
Bus Drivers, Transit and Intercity	147	3.5%
Inspect, Test, Sorters, Samplers, & Weighers	141	1.4%

Appendix B: Methodologies for Estimating the Annual Earnings Level and Earnings Adequacy for Workers in Targeted Occupations

In selecting the list of individual occupations for training consideration, we analyzed the recent annual earnings of workers in Massachusetts in individual occupations and the degree to which employed workers were able to achieve earnings levels above two adequacy thresholds. The primary data base for this analysis was the 2000 Census 5% PUMS files. For each occupation, we estimated the median and mean 1999 annual earnings for those workers who were employed full-time for 40 or more weeks during the calendar year.⁴¹ The definition of full-time worker is one who worked on average for 35 or more hours per week of employment during the year. The estimated mean and median annual earnings of these workers were displayed and discussed in the text.

The Workforce Solution Group had recommended that priority occupations for training should meet minimum earnings adequacy criteria. Two definitions of earnings adequacy were used in the analysis. The first definition is the annual, pre-tax money income level equivalent to twice the poverty line for an average family of three in the United States. The use of such an income threshold (twice the poverty line) has been used by a number of poverty and welfare reform researchers to define the “low income population” of the United States.⁴² The second definition of earnings adequacy was an earnings level equivalent to the annual income that would allow a family of three in Massachusetts (a married couple family with one child over 6) to achieve the Family Economic Self Sufficiency Standard (FESS) of the Women’s Educational and Industrial Union.⁴³

The annual average earnings level that would allow Massachusetts worker to earn at least two times the poverty threshold for a 3-person family is based on the poverty income thresholds used by the U.S. Census Bureau to measure poverty. The U.S. Census Bureau annually produces weighed average poverty income thresholds by size of family and the number

⁴¹ The annual earnings data include wages and salaries as well as self-employed income. For those holding more than one job, the occupation coded is one on the job accounting for the most hours at work.

⁴² See: Gregory ACS, Katherine Ross, and Daniel McKenzie, Playing by The Rules But Losing the Game: America’s Working Poor, The Urban Institute, Washington D.C., 2000.

⁴³ For a review of the construction and interpretation of the self-sufficiency standards, see: Jean Bacon, Laura Henze Russell, and Diana Pearce, *The Self-Sufficiency Standard: Where Massachusetts Families Stand*, Women’s Educational and Industrial Union, United Way of Massachusetts Bay, Boston, 2000.

of related children under 18 years of age.⁴⁴ In 1999, the weighted average poverty income threshold for a 3-person family in the U.S. was \$13,290. The federal government's poverty income thresholds are not adjusted to take into consideration differences in the cost of living across states or within states. Multiplying the poverty income threshold for a 3-person family by a factor 2 yields \$26,580. We apply this earnings threshold to all workers in Massachusetts who worked full-time for 40 or more weeks during 1999 in each occupation.

Our second measure of earnings adequacy is based on the Family Economic Self-Sufficiency (FESS) developed jointly in Massachusetts by the Women's Educational and Industrial Union and Wider Opportunities for Women. This methodology attempts to address the above mentioned shortcomings of the federal government's poverty thresholds. The FESS measure takes into account variations in the cost of housing and childcare, also considers federal and state income taxes and EITC tax credit in determining the amount of gross income needed by a family to achieve the desired consumption bundle, and varies childcare costs with both the age of the children in the family and local childcare costs. However, the FESS measures estimate only for selected types of families. Researchers at the Center for Labor Market Studies estimate FESS budgets for 42 additional types of families.⁴⁵ The FESS budget of the base group family with the closest characteristics is multiplied by an equivalency scale to determine the FESS budget for a family of given size and age composition.⁴⁶ The Women's Union and Wider Opportunities for Women estimated FESS budgets for 1997 and 2003. We imputed the values of these budgets for 1999 and applied equivalency scales to derive FESS budget for different types of families. Table 1 displays the estimated 1999 FESS budget for a married couple family with one child over 6 years of age by county in Massachusetts. To estimate the value of this budget for the entire state, we took a simple arithmetic average of counties' FESS budgets to derive 1999 FESS budget for this particular family type across the state. We, then, applied this threshold of \$36,505 to estimate from the public use data files of the 2000 Census of Population

⁴⁴ See: U.S. Census Bureau, Housing and Household Economic Statistics Division, Income, Poverty, and Health Insurance Coverage in the United States: 2004, P60-229, U.S. Government Printing Office, Washington D.C., 2005.

⁴⁵ See: Andrew Sum, Ishwar Khatiwada, Neeta Fogg and Susan Perron, A New Look at Income Adequacy Problems in Massachusetts, Report Prepared for the Workforce Solutions Group, Boston, August 2004.

⁴⁶ The equivalence scale formula that we used was recommended by the National Research Council's Panel on Poverty and Family Assistance in their final report to the U.S. Congress in 1995 titled "Measuring Poverty: A New Approach".

and Housing for Massachusetts on how many Massachusetts full-time year-round workers had an annual earnings above this FESS income standard.

Table B-4:
CLMS Imputed FESS Budgets for a Married Couple Family With One Child Over 6 Years of
Age by County in Massachusetts, 1999

County	FESS Budget
Berkshire	\$30,926
Hampden	\$33,208
Hampshire	\$33,359
Franklin	\$33,598
Bristol	\$33,647
Worcester	\$34,821
Barnstable, Dukes and Nantucket	\$36,761
Essex	\$37,634
Norfolk	\$39,934
Plymouth	\$39,934
Suffolk	\$40,819
Middlesex	\$43,416
Simple Arithmetic Average of All Counties	\$36,505