



Pennsylvania Health Care & Service Employment & Training Through 2005: Prospects & Uncertainties

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Background

The Call For Health Care Reform

The physical health of Americans improved remarkably between 1960 and 1990. Average life expectancy increased by more than 5 years due to changes in behavior and improvements in medical technology. Yet, health problems persist as a result of diseases with no current cure (e.g., breast cancer), from emerging diseases (e.g., AIDS) and from reemerging diseases (e.g., tuberculosis). In addition, access to health care continues to vary over income levels and ethnic groups.

Total spending on health care has risen—from 5% of gross national product (GNP) in 1960 to 12% in 1990—more rapidly than the growth of income. The Health Care Financing Administration projects that health care could comprise 16% of GNP by 2000 and 26% by 2030 if historical trends in health care prices, volume of health care services consumed, and quality of health care continue. In addition, the burden of financing health care has shifted. Between 1960 and 1990, federal, state, and local governments took on a greater share of the financial consequences of health care from individuals. Employer-provided health insurance benefits have increased since World War II to the point where most Americans are insured through their employers.

Lack of health insurance that is portable over employers and exclusion of some preexisting health conditions from some employer-provided insurance have led to "job lock," a reluctance to find new, maybe better, job opportunities

for fear of becoming uninsurable. The number of uninsured, who are typically poor and young, has increased recently to an estimated 37 million people. Many of the employed uninsured work in small firms.

Growing concerns over providing and paying for health care in the United States have led to various proposals for containing health care costs and improving access to care. One proposal offered by the Clinton administration mandates universal coverage, with employers paying 80% of average costs. Proposals for managed competition organize those paying for health care into large alliances. Health plans then compete for alliances' business. So-called "play-or-pay" proposals require that firms either provide health insurance to employees and dependents ("play") or pay a payroll tax to cover enrollment in a public health care plan ("pay"). Most play-or-pay proposals offer sliding subsidies to those who are not attached to the work force. Other proposals advocate global budgets specifying fixed sums that health care providers throughout the United States economy can spend.

Strong, partisan, and, at times, acrimonious debate continues about the practicality, financial soundness, economic and social viability, and political acceptability of the many health care reforms on the table. Resolution of this debate is taking longer than anticipated. A reform is not a revolution.

Employment, Education, And Training Uncertainties Accompanying Reform

The nation's health care and service industries employed approximately 10 million people in 1992, up from 7 million in 1988. The job growth rate in health and service industries surpassed the rate of job growth in the rest of the private nonfarm economy. Hospitals and nursing homes account for about six of every ten employees in health care and service industries in the United States, although workers in these occupations also are employed in offices and clinics of medical doctors, specialized care facilities, and managed care organizations.

Employment in health care and service industries is projected by the United State Bureau of Labor Statistics

(BLS) to grow from 8.9 million to 12.8 million between 1992 and 2005. The BLS anticipates employment in home health care services (the fastest growing industry in the economy), nursing homes, and offices and clinics of physicians and other health practitioners to increase most rapidly throughout this period. However, not all health care and service industries will grow at the same rate. For example, hospitals, both public and private, are likely to be the largest, but slowest growing, health-related industry. Information about expanding employment opportunities in health care and service industries is disseminated widely. For instance, *Occupational Outlook Quarterly*

(Spring, 1992) reports that between 1990 and 2005:

Most new jobs [in professional specialty occupations] will be in education and health services....Jobs for health technologists and technicians are expected to account for almost half of all the jobs [for technicians and workers in related support occupations]...Among health service occupations, medical assistants—one of the fastest growing occupations in the economy—and nursing and psychiatric aides will grow faster than average.

Education and training provide a decided edge in the health care and service job market. In fact, occupational licenses and certifications, for which education and training provide qualification, are barriers to entry into many health care and service occupations. According to a BLS report, *How Workers Get Their Training: A 1991 Update* (Bulletin 2407), nine of every ten workers in health diagnosing, assessment, and treating occupations and health technology occupations believe that they needed training or technical skills to obtain their current jobs. Seven of every ten workers in health service occupations perceive that training or technical skills are needed. The BLS report reveals that high proportions of workers in health diagnostics (98%) and assessment and treatment (95%) and of workers employed as health technologists and technicians (90%) reported that they obtained their specific skills through formal schooling. Seventy percent of health service workers described formal schooling as their source of training.

Sensitivity Of Employment To Reform

The various reforms proposed are meant to affect the availability and cost of health care and services provided, which, in turn, will create ripples throughout the economy. Production of goods and services by health care and service industries also stimulates demand for goods and services outside health-related industries. For instance, every dollar spent by consumers for pharmaceuticals not only creates demand for production directly from the drug industry. It also indirectly stimulates production in industries, such as paper, plastics, or glass, that are used as inputs to drug industry production. Production needs dictate requirements for all resources, including human resources. In this way, health care reform can affect employment. Analyses of the general employment effects of specific health care reform proposals have projected job losses (e.g.: -82,000 jobs in a RAND study; -212,000 jobs in a Princeton University study) as well as job gains (e.g., +250,000 jobs gained in manufacturing industries alone in a study by the Economic Policy Institute).

The BLS takes a more general approach to the problem of estimating the employment effects of health care reform. The BLS projects national employment in 2005 by industry and occupation under low and high aggregate national health care expenditure scenarios ("Health care alternatives: Employment and occupations in 2005," *Monthly Labor Review*, April 1994). The appeal of the BLS approach is that these economic scenarios are not tied to any particular health care reform scheme. Rather, the employment estimates from these scenarios present a range of employment changes that might occur should health care spending in 2005 fall between low and high spending levels.

Figure 1 contains descriptions of both scenarios. Employ-

A 1992 BLS report, *Occupational Projections And Training Data* (Bulletin 2401), shows the following comparison between 1989–1990 degrees and subbaccalaureate awards and annual average job openings (due to growth and need for replacement) between 1990 and 2005 in health care and service occupations:

<u>Occupation</u>	<u>Degrees & Awards (1989-1990)</u>	<u>Average Annual Job Openings (1990-2005)</u>
Health Diagnosing	31,277	37,000
Health Assessment & Treating.....	125,163	105,000
Health Service	72,216	84,000

Not all people receiving degrees and awards enter the occupation for which they are prepared. Also, degree and award completions might not stay at 1989–1990 levels. However, if this pattern persists, new entrants into the health care labor market could face competition for available jobs. Moreover, the prospect of health care reform, for which plans remain murky, injects uncertainty into decisions by individuals to enter training programs, by education and training providers to offer programs, and by government policymakers and private lenders to continue financing the costs of education and training for employment in health care and service occupations.

ment effects of the spending scenarios are simulated by examining deviations between employment estimates from a moderate spending scenario and the low and high spending scenarios. The moderate spending scenario assumes an average real growth rate of 3.2% between 1990 and 2005. Levels of health care expenditures in ten health-related industries in 1990 and under low, moderate, and high spending scenarios in 2005 are shown in Table 1.

The BLS adds two twists in its analyses of the employment effects of the low and high spending scenarios. In one case, changes in spending in the ten health-related industries are offset by changes in all other industries, resulting in constant gross domestic product. In another case, changes in spending in health-related industries are made without offsetting changes in other spending levels, and, as a consequence, gross domestic product is not constant.

The BLS simulated employment effects of variations in health-related industry spending for the low and high scenarios under conditions of constrained and unconstrained gross domestic product using its input-output model of the United States economy. In each simulation a total industry requirements matrix (a Leontief inverse of a matrix of interindustry transactions) is multiplied by a vector of industry employment-output ratios, producing a vector of industry employment requirements. Occupational requirements are derived by multiplying industry employment requirements by an occupational staffing pattern matrix showing the relative frequency distribution of occupational employment within industries. The process produces estimates of employment generated directly by health-related industry activity and indirectly by activity in industries from which health-related industries purchase goods and services.

Figure 1. Two BLS Alternative Health-Related Industry Spending Scenarios

Low Health-Related Industry Spending

The low spending alternative could arise from a variety of circumstances, such as increased use of health maintenance organizations (HMO's) or greater efficiency in the health care system through improved coordination among health care providers. Equally, it could come about because of resistance by payer individuals, businesses, and governments to increases in health care costs.

The share of expenditures for health-related industries that include home health care and alcohol and drug treatment centers increases because of efforts to reach the currently insured population and because of an emphasis on less expensive health care alternatives. Similarly, relative expenditures for health insurance increase due to expanded insurance coverage. Also, relative expenditures for goods and services provided by nursing and personal care facilities, private hospitals, new hospital construction, x-ray and other electromedical apparatus, and state and local hospitals decrease with a shift toward greater reliance on home health care, more outpatient treatment, greater use of clinics, improved preventative care, more efficient use of existing hospital capacity, less overlap of equipment purchases, and some rationing of procedures. And, relative expenditures for goods and services provided by office of health practitioners, medical instruments and supplies, and pharmaceuticals do not change because of the offsetting effects of such factors as expanded health insurance coverage and cost containment measures. The 1990-2005 average annual growth rate is 2.0%.

High Health-Related Industry Spending

The high spending alternative could arise from expansion of insurance coverage to the currently uninsured without concurrent health care cost reductions, continued development of new technologies that lead to more expensive medical procedures, and continued increases in consumer demand for costly medical services.

Relative expenditures in offices of health practitioners, nursing and personal care facilities, and private as well as state and local hospitals do not change because the increase in expenditures on these services caused by expansion of insurance coverage and consumer demand for state-of-the-art medicine is offset by less expensive care. Relative spending on health insurance does not change, even though insurance coverage may expand. The share of expenditures for medical instruments and supplies, x-ray and other electromedical apparatus, and pharmaceuticals increases because of expanded insurance coverage and growing demand without success in controlling costs. Relative expenditures for new hospital construction decrease as a result of better utilization of the current oversupply of hospital beds. The 1990-2005 average annual growth rate is 4.6%.

Source: Pfleeger, J., & Wallace, B. (1994). Health care alternatives: Employment and occupations in 2005. *Monthly Labor Review*, 117(4), 29-37.

The BLS report reveals that, with gross domestic product held at a constant level, total employment in 2005 under the low spending scenario is estimated to be 680,000 workers lower than moderate spending scenario and 1,063,000 higher under the high spending scenario. The moderate spending scenario projects 147,482,000 non-

farm workers in 2005. Both low and high spending scenarios show growth in total employment over the baseline year (1990). The regional employment effects of the BLS changes in national health-related industry spending remain unknown.

Table 1. Health-Related Industry Spending (Millions \$7S) In 1990 & Forecast To 2005 Under Alternate Bureau Of Labor Statistics Spending Scenarios

Industry	1990	2005		
		Moderate Growth	Low Spending	High Spending
<i>Total, Health-Related Industries</i>	\$491,206	\$783,282	\$659,894	\$964,352
Offices of health practitioners	153,187	232,939	196,233	286,789
Nursing & personal health care facilities	32,750	54,074	42,936	66,575
Private hospitals	160,426	263,981	209,606	325,008
Health services not elsewhere classified	33,408	68,058	72,581	85,512
New hospital construction	14,426	16,767	12,207	16,780
Medical instruments and supplies	13,093	31,944	26,921	40,136
X-ray and other electromedical apparatus	5,599	10,737	8,525	13,491
Drugs	24,689	41,796	35,235	52,515
Health insurance	24,986	30,191	29,610	37,170
State & local hospitals	28,642	32,795	26,040	40,376

Source: Pfleeger, J., & Wallace, B. (1994). Health care alternatives: Employment and occupations in 2005. *Monthly Labor Review*, 117(4), 29-37.

Note: Spending scenarios are described in Figure 1.

Research Plan

In the remainder of this paper we report our findings from a simulation study of the sensitivity of Pennsylvania health care and service employment to alternate national health-related industry spending patterns. To accomplish this, we use United States and Pennsylvania economic and demographic forecasting and simulation models provided by Regional Economic Models, Inc. (REMI). To conduct a simulation of effects of economic policies or changes, a baseline forecast first is calculated by the REMI model. Then, an alternative forecast is made based upon the policies or changes. The baseline forecast is subtracted from the alternative forecast. The difference reveals the impact of economic policies or changes. Technical aspects of REMI models are documented by George Treyz, *et al.*, in "The REMI Economic-Demographic Forecasting and Simulation Model" (*International Regional Science Review*, 1992, 14(3), 221-253) and in a book by Treyz, *Regional Economic Modeling: A Systematic Approach to Economic Forecasting and Policy Analysis* (Boston, MA: Kluwer Publishing Inc.).

In one analysis using the 1993 Pennsylvania REMI 53-Sector Economic/Demographic Forecasting and Simulation Model we, first, forecast employment of health care and service workers in Pennsylvania in 2005. The calibration of the Pennsylvania REMI Model depends upon calibration parameters and values for generated variables in the United States REMI Model. The United States REMI Model through 2005 is based upon a moderate growth benchmark projection made by the BLS (published in *Monthly Labor Review*, November 1993). Therefore, characteristics of the United States REMI Model are "pushed down" to the Pennsylvania REMI Model.

Taking advantage of the dependence of the Pennsylvania REMI Model on the United States REMI Model, we, then, adjust the United States REMI Model according to low and high BLS alternate national spending patterns in 2005 for the ten health-related industries shown in Table 1, and we forecast again Pennsylvania employment of health care and service workers in 2005. Deviations in employment required in low and high spending forecasts from the baseline forecast show the Pennsylvania employment changes that could result from alternate health-related industry spending patterns. In this way, we estimate the sensitivity of requirements for Pennsylvania health care and service working to a wide range of national spending changes. This analysis allows estimation of the gross changes in Pennsylvania health care and service employ-

ment between 1990 and 2005 under alternate national health-related industry spending patterns.

Our analysis of gross employment changes does not place budget constraints on the spending changes we simulate. Expenditures are merely added to or subtracted from baseline spending patterns, but we do not offset health-related industry changes by reconciling spending in other industries to yield a constant level of gross regional product for Pennsylvania. As a result, the level, not just the pattern, of industry output changes. While the BLS acknowledges that, "Such an analysis is inconsistent with the fact that longrun employment changes are primarily generated by supply side forces," BLS believes that allowing industrial output to vary rather than to remain constant, "is valuable as a partial analysis of the relative impact of alternative health-related spending levels on employment and on the distribution of employment by industry and occupation ('Health care alternatives...,' *Monthly Labor Review*, April 1994)."

Our second analysis calculates net employment changes by maintaining constant industry output. We accomplish this by offsetting health-related industry spending changes by adding (in the case of the low spending scenario) or subtracting (for the high spending scenario) the equivalent spending from other industries. Spending is distributed among other industries according to their relative weight in total industrial output forecast for the United States economy in 2005.

At least three cautions are in order. First, our analysis does not take into account especially stringent or loose health-related industry spending plans that might occur concurrently in Pennsylvania with national health care reform. Second, our forecasts do not take into account the labor-labor substitution that might result from changes in the relative prices of various types of health care and service labor under alternate spending patterns. For instance, lower priced and plentiful workers might substitute for health workers who are higher priced or are in short supply. And, third, we make no claims that our analysis produces results that are consistent with the BLS projections. We introduce BLS industry spending patterns as exogenous changes in the United States REMI Model. From that point forward, REMI technologies and assumptions take over in ways that differ substantially from the BLS methods.

Simulation Findings

Gross Effects: Industrial Output Not Constant

Shown in Table 2 are estimates of health care and service occupational employment in 1990 from the 1993 Pennsylvania REMI Model, projected to 2005, and projected to 2005 under two national health-related industry spending alternatives. Based upon the difference between 1990 employment and projected 2005 baseline employment, the number of full- and part-time Pennsylvania civilian nonfarm workers is expected to grow by 16.8% between 1990 and 2005. During this same period, employment of Penn-

sylvanians health care and service workers is projected to grow by 36.9%, over twice the rate of growth of the civilian nonfarm workforce. The low as well as the high health-related industry spending scenarios show growth of employment of civilian nonfarm workers and health care and service workers between 1990 and the baseline projection to 2005. In fact, health care and service worker employment grows by 17.8% even in the low spending scenario. Civilian nonfarm employment in Pennsylvania under the

Table 2. Gross Change In Pennsylvania Health Care & Service Employment Under Alternate National Health-Related Industry Spending Patterns, 1990-2005

Occupation	1990 Employment	Forecast 2005 Baseline Employment	Forecast Employment In 2005 Under Alternate Health-Related Industry Spending Patterns			
			Low Spending		High Spending	
			Employment	Deviation From Baseline	Employment	Deviation From Baseline
<i>Civilian Nonfarm Workers</i>	6,093,223	7,116,198	6,908,650	-207,548	7,648,613	532,415
<i>Health Care & Service Workers</i>	385,696	528,059	454,593	-73,466	698,420	170,361
<i>Health Diagnosis</i>	29,902	39,263	33,321	-5,942	51,888	12,625
Dentists	4,019	4,317	3,596	-721	6,000	1,683
Optometrists	1,025	1,251	1,051	-200	1,718	467
Physicians	23,747	31,989	27,076	-4,913	43,452	11,463
Podiatrists	350	519	434	-85	718	199
Veterinarians & inspectors	761	1,187	1,164	-23	1,248	61
<i>Health Assessment/Treatment</i>	134,207	186,521	159,963	-26,558	248,550	62,029
Dietitians & nutritionists	2,702	3,184	2,865	-319	3,920	736
Pharmacists	9,311	10,710	10,018	-692	12,362	1,652
Physician assistants	2,711	3,451	2,877	-574	4,791	1,340
Registered nurses	103,998	145,887	124,133	-21,754	196,678	50,791
Therapists	15,485	23,289	20,070	-3,219	30,799	7,510
<i>Health Technology</i>	107,440	146,044	126,261	-19,783	192,366	46,322
Clinical lab technologists	15,711	18,991	15,851	-3,140	26,325	7,334
Dental hygienists	4,660	6,248	5,188	-1,060	8,724	2,476
EEG technologists	417	626	519	-107	875	249
EKG technicians	991	880	730	-150	1,230	350
Emergency medical technicians	7,072	8,897	8,514	-383	9,870	973
Licensed practical nurses	38,547	52,046	44,638	-7,408	69,359	17,313
Medical records technicians	3,109	4,642	3,914	-728	6,341	1,699
Nuclear medicine technologists	660	973	808	-165	1,361	388
Opticians	3,333	4,305	3,955	-350	5,137	832
Radiologic technologists	8,723	14,058	11,697	-2,361	19,572	5,514
Surgical technologists	2,432	3,636	3,017	-619	5,083	1,447
Other	21,785	30,742	27,430	-3,312	38,489	7,747
<i>Health Service</i>	114,147	156,231	135,048	-21,183	205,616	49,385
Dental assistants	8,505	10,843	9,025	-1,818	15,087	4,244
Medical assistants	8,556	13,995	11,718	-2,277	19,302	5,307
Nursing & psychiatric aides	81,699	111,355	96,708	-14,647	145,495	34,140
Occupational therapy assistants	565	847	713	-134	1,160	313
Pharmacy assistants	5,042	5,843	5,328	-515	7,060	1,217
Physical therapy aides	2,557	3,951	3,324	-627	5,416	1,465
Other	7,223	9,397	8,232	-1,165	12,096	2,699

Source: 1993 Pennsylvania REMI 53-Sector Economic/Demographic Forecasting and Simulation Model.

low spending pattern is 2.9% lower than projected 2005 baseline employment and is 7.5% higher under the high spending pattern. Employment totals in 2005 could vary between low and high spending patterns by as much as 740,000 workers. Estimates of employment for health and service workers could vary by as much as 244,000 workers between the low and high health-related spending patterns. In other words, about one-third of the uncertainty in forecasted employment between the boundaries of low and high health-related industry spending is absorbed by health care and service worker jobs. Based upon data in Table 2, employment in major health care and service occupation groups could differ from projected 2005 baseline employment by the following percentages under high and low spending alternatives:

Major Occupational Group	Spending Alternative	
	Low	High
Health Diagnosis	-15.1%	+32.2%
Health Treatment/Assessment	-14.2%	+33.3%
Health Technology.....	-13.5%	+31.7%
Health Service	-13.6%	+31.6%

However, increases or decreases in health-related industry spending could not occur by themselves in the real economic world. The economy would adjust to these spending shocks. Changes in spending in some sectors would react to spending changes in other sectors. Therefore, a more realistic simulation involves offsetting changes in health-related industry spending by changes in other industries.

Net Effects: Industrial Output Constant

Shown in Table 3 are the net changes in health care and service employment under two alternate spending scenarios *after* offsetting increases or decreases in health-related industry spending by keeping total industry output constant. The first noticeable difference between information in Table 2 and Table 3 is that, as expected, redistribution of industrial output to (from) health-related industries from (to) other industries dampens the gross effect of changes in health-related industry spending on total civilian nonfarm employment. The employment lost or gained as a result of health-related industry spending changes is balanced to some extent by losses or gains in employment in other industries. Table 3 indicates that the net total employment effect for Pennsylvania still is posi-

tive for the high spending scenario and negative for the low spending scenario. Also, total employment as well as health care and service employment increase over 1990 levels under both scenarios.

Another conclusion possible from comparisons between Table 2 and Table 3 is that the gross and net effects of the low and high spending scenarios on health care and service worker employment are approximately the same. If anything, the variation in health care and service worker employment is narrower when changes in health-related industry spending are offset by changes in spending in other industries.

Table 3. Net Change In Pennsylvania Health Care & Service Employment Under Alternate National Health-Related Industry Spending Patterns, 1990-2005

Occupation	1990 Employment	Forecast 2005 Baseline Employment	Forecast Employment In 2005 Under Alternate Health-Related Industry Spending Patterns			
			Low Spending		High Spending	
			Employment	Deviation From Baseline	Employment	Deviation From Baseline
<i>Civilian Nonfarm Workers</i>	6,093,223	7,116,198	6,996,245	-119,953	7,394,776	278,578
<i>Health Care & Service Workers</i>	385,696	528,059	455,267	-72,792	693,501	165,442
<i>Health Diagnosis</i>	29,902	39,263	33,358	-5,905	52,716	13,453
Dentists	4,019	4,317	3,599	-718	5,953	1,636
Optometrists	1,025	1,251	1,052	-199	1,704	453
Physicians	23,747	31,989	27,095	-4,894	43,136	11,147
Podiatrists	350	519	435	-84	712	193
Veterinarians & inspectors	761	1,187	1,177	-10	1,211	24
<i>Health Assessment/Treatment</i>	134,207	186,521	160,182	-26,339	246,401	59,880
Dietitians & nutritionists	2,702	3,184	2,866	-318	3,896	712
Pharmacists	9,311	10,710	10,047	-663	12,216	1,506
Physician assistants	2,711	3,451	2,880	-571	4,754	1,303
Registered nurses	103,998	145,887	124,319	-21,568	194,985	49,098
Therapists	15,485	23,289	20,070	-3,219	30,550	7,261
<i>Health Technology</i>	107,440	146,044	126,521	-19,523	190,441	44,397
Clinical lab technologists	15,711	18,991	15,868	-3,123	26,114	7,123
Dental hygienists	4,660	6,248	5,192	-1,056	8,655	2,407
EEG technologists	417	626	520	-106	868	242
EKG technicians	991	880	731	-149	1,220	340
Emergency medical technicians	7,072	8,897	8,530	-367	9,690	793
Licensed practical nurses	38,547	52,046	44,734	-7,312	68,687	16,641
Medical records technicians	3,109	4,642	3,919	-723	6,289	1,647
Nuclear medicine technologists	660	973	808	-165	1,350	377
Opticians	3,333	4,305	3,968	-337	5,075	770
Radiologic technologists	8,723	14,058	11,707	-2,351	19,419	5,361
Surgical technologists	2,432	3,636	3,020	-616	5,043	1,407
Other	21,785	30,742	27,524	-3,218	38,031	7,289
<i>Health Service</i>	114,147	156,231	135,206	-21,025	203,943	47,712
Dental assistants	8,505	10,843	9,034	-1,809	14,969	4,126
Medical assistants	8,556	13,995	11,725	-2,270	19,161	5,166
Nursing & psychiatric aides	81,699	111,355	96,833	-14,522	144,279	32,924
Occupational therapy assistants	565	847	714	-133	1,150	303
Pharmacy assistants	5,042	5,843	5,339	-504	6,989	1,146
Physical therapy aides	2,557	3,951	3,329	-622	5,370	1,419
Other	7,223	9,397	8,232	-1,165	12,025	2,628

Source: 1993 Pennsylvania REMI 53-Sector Economic/Demographic Forecasting and Simulation Model.

Implications

Total civilian nonfarm employment in Pennsylvania is sensitive to the level and distribution of national spending in health-related industries. Forecasts of Pennsylvania employment in 2005 fluctuate by about one-quarter of a million workers over a wide range of health-related industry spending alternatives, even after holding total industrial output constant. However, employment of Pennsylvania health care and service workers is especially sensitive to national spending patterns in health-related industries. Forecasts of requirements in 2005 for health care and service workers are about 73,000 to 74,000 jobs lower when national health-related industries spend below the baseline spending forecast and are about 615,000 to 170,000 jobs higher if a higher spending path is taken. Either way, job growth is expected for health care and service workers in Pennsylvania through 2005. Forecasts of the rate of Pennsylvania job growth remain risky, especially in light of the uncertainty in plans for implementing national health care reform.

There are many uses of this information about uncertainty in health care and service employment dictated by lack of clear direction in health care reform. Evaluation of risks in training investments is one use. Consider investment decisions related to the training of dental hygienists. The "plain vanilla" baseline forecast shown in columns 2 and 3 of Table 2 and Table 3 indicates that employment of dental hygienists could grow from 4,660 in 1990 to 6,248 in 2005, a growth rate of 34.1%. At this rate, the Pennsylvania economy could add an average of 113 new jobs for dental hygienists annually over this period. Knowing these labor market factors, potential trainees could make personal training and career decisions and training providers could make curriculum decisions that are consistent with expected labor market opportunities. However, the baseline forecast for Pennsylvania employment of health care and service workers is quite sensitive to national health-related spending trends and movements. The consequent risk in forecasting Pennsylvania employment in health care and service occupations translates into risk and uncertainty in training investments by individuals and

training providers.

Using information from Table 3 on net employment changes, we estimate that at the lower boundary of national health-related industry spending the Pennsylvania economy could grow by an additional 532 hygienists between 1990 and 2005, or an annual average of 38 new workers between 1990 and 2005. On the other hand, at the higher national spending boundary, the Pennsylvania economy could require an additional 3,995 hygienists between 1990 and 2005, or an annual average of 285 new workers. The difference between high and low spending scenarios is a difference of 247 job placements of training program completers annually, which is a significant, and perhaps problematic, variation for training program operators, trainees, and those who fund training to accommodate. For dental hygiene training programs that are allocated the resources to respond to the baseline growth scenario, the extremes of these variations in employment could produce an oversupply or a shortage of new dental hygienists.

Of course, Pennsylvania dental hygienists who leave the occupation permanently through death, retirement, and movement to other occupations create jobs in addition to those created by economic growth and change alone. Moreover, competition for available jobs is exerted by people who are poised to reenter the labor market for dental hygienists. However, the variation in the possibilities for new job creation for Pennsylvania dental hygienists is wide and, at the boundaries of the range of possibilities, could lead to substantially different training investment decisions. Similar risk and uncertainty in education and training investments are evident in all Pennsylvania health care and service occupations. Furthermore, this type of risk and uncertainty is greater in health and service occupations than in all civilian nonfarm occupations in Pennsylvania. Long-anticipated clarification and acceptance of national health reform plans will reduce much of the risk and uncertainty associated with job trends in health care and service occupations.

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