HEALTHCARE IN ARIZONA: WORKER SHORTAGES, ECONOMIC IMPACT, AND SOCIOECONOMIC BENEFITS

April 2024

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P3 | PRODUCTIVITY AND PROSPERITY PROJECT

ASU W. P. CAREY SCHOOL of BUSINESS
ARIZONA STATE UNIVERSITY

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A Report from the Productivity and Prosperity Project (P3), Supported by the Office of the University Economist

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SUMMARY

Overall, there appears to be a shortage of healthcare workers in Arizona that will continue through the next decade. Among the causes cited for any shortages are population growth exceeding the growth of the healthcare workforce, an aging population that boosts demand for healthcare services, increased demand apart from that caused by an aging and growing population, insufficient training and and/or educational programs for healthcare workers, and geographic maldistribution of healthcare workers. Among the possible effects of shortages of healthcare workers are longer wait times, reduced access to healthcare, overworked healthcare providers, increased turnover of workers, and a decrease in the quality of healthcare.

However, not all healthcare occupations have a shortage and the projected change over the next 10 years in the supply-demand balance varies by occupation. Worker shortages appear to be most severe and are expected to worsen over the next decade in behavioral health occupations, including psychologists, counselors, and social workers. Physicians and registered nurses (RNs) are among other occupations in short supply, though the situation may improve among RNs.

The economic impact of eliminating healthcare workforce shortages in Arizona is substantial, resulting in a total of 125,126 additional workers in Arizona, $11.9 billion in additional state GDP, and $7.7 billion in additional labor income to area residents in 2023. By 2033, the impact is projected to increase to 197,274 additional workers in Arizona, $18.9 billion in additional state GDP, and $12.2 billion in additional labor income.

Logically, with greater access to healthcare that would be enabled by an increase in the number of healthcare workers, the incidence and severity of chronic diseases and illnesses could be reduced, which will result in greater quality of life and greater workforce participation. However, the precise nature of the relationship between a healthcare workforce and healthy outcomes is unclear within the literature.

The economic costs of poor health are substantial. The costs fall into three categories:

- The resource costs associated with the treatment of a condition or disease, including the costs of physician's visits, tests, medications, and surgical procedures.
- The loss of output, or decline in productivity, when poor health interferes with a person's ability to work, either through absenteeism or presenteeism (people who suffer from poor health but still attend work, which frequently lowers their productivity).
- The loss of life or decline in quality of life because of a disease.

Based on nine chronic diseases or illnesses — arthritis, asthma, cancer, diabetes, heart disease, hypertension, mental disorders, migraines, and respiratory disorders — direct medical treatment costs an average of $5,582 per case per year in Arizona. Days absent per year per case average 10.6, with an annual impact per case of $2,719. Presenteeism averages 1 hour lost per day per case for an annual impact per case of $7,694.

The aggregate medical treatment cost in Arizona in 2023 is estimated to be $17 billion, The productivity cost from absenteeism and presenteeism is estimated to range between $21-and-$39 billion.

ESTIMATES OF HEALTHCARE WORKFORCE SURPLUSES AND SHORTAGES IN ARIZONA

Summary

Due to data insufficiencies, it is a challenge to determine the magnitude of healthcare worker shortages by occupation, and indeed, whether a shortage even exists. Three studies specific to Arizona are examined in this section; these analyses employ different methodologies and different data. While some correlation in the magnitude of workforce surpluses/shortages exists across the three studies, it is not as high as would be desired. In particular, little correlation exists in the projected change over the next decade in the surpluses/shortages by occupation across the three studies. As a result, it is unclear which occupations and specialties have the greatest needs.

Overall, there appears to be a shortage of healthcare workers in Arizona that will continue through the next decade. However, not all occupations have a shortage and the projected change over the next 10 years in the supply-demand balance varies by occupation. General conclusions follow.

Worker shortages appear to be most severe and are expected to worsen over the next decade in behavioral health occupations, including psychologists, counselors, and social workers. Physicians and registered nurses (RNs) are in short supply, though the situation may improve among RNs. In contrast, a surplus of physician assistants is expected, with only a small shortfall in nurse practitioners. A large shortage of occupational therapists is expected to disappear, and a shortage of physical therapists is projected to become smaller, by 2032. Disagreement exists on whether the current small shortage of dentists will become worse. A large shortfall in dental hygienists exists. In contrast to these shortages, there appears to be a small surplus of pharmacists and pharmacy technicians.

Healthcare worker shortages in Arizona are most severe outside of the Phoenix, Tucson, and Flagstaff areas. In some of the healthcare occupations, a shortfall in less-populous areas is inevitable due to the limited demand for healthcare specialties among a small and geographically dispersed population. Determining how to meet the needs of rural communities will be an important challenge over the next decade.

Introduction

There is a perceived shortage of healthcare workers in Arizona. Among the causes cited for any shortages are population growth exceeding the growth of the healthcare workforce, an aging population that boosts demand for healthcare services, increased demand apart from that caused by an aging and growing population, insufficient training and and/or educational programs for healthcare workers, and geographic maldistribution of healthcare workers. Among the possible effects of shortages of healthcare workers are longer wait times, reduced access to healthcare, overworked healthcare providers, increased turnover of workers, and a decrease in the quality of healthcare.

One method used to estimate workforce surpluses and shortages is to calculate healthcare employment per capita[1] in Arizona and compare that to the national average or to the median of the states. This per capita measure is crude, not taking into consideration variations in demand for healthcare across various populations. In particular, the demand for healthcare varies by age and is much higher for the elderly population than for younger adults.

The per capita method is cited in recent reports by the Arizona Medical Association (ArMA) and the Arizona Board of Regents (ABOR). In contrast, the Health Resources and Services Administration (HRSA), part of the U.S. Department of Health and Human Services, uses a complex microsimulation model to project supply and demand by healthcare occupation by state. While this method should be considered to be superior to the per capita method, it also has shortcomings. In particular, surpluses and shortages are available from the HRSA for Arizona for relatively few of the healthcare occupations.

Arizona Medical Association

The Healthy Arizona Workforce Coalition (HAWC) was established in 2022 by the ArMA and the Arizona Department of Health Services (ADHS); coalition members represent numerous organizations across Arizona. The main focus of the group is to develop initiatives to strengthen Arizona's healthcare workforce, especially to address the healthcare workforce shortages that are perceived to exist in the state. The coalition also is working to bolster data availability, collecting information from healthcare licensing boards. However, these data are not yet available on the organization's website (azhealthworkforce.org).

The ArMA's 2023 report "The Healthy Arizona Workforce Coalition Final Report" includes limited information on healthcare workforce shortages. The HAWC report did not attempt to estimate the magnitude of healthcare workforce shortages, but did cite a few statistics produced by other organizations.

One way of looking at healthcare workforce shortages is to use the federal government's designations of Health Professional Shortage Area (HPSA) and Medically Underserved Area (MUA). HPSAs are defined in terms of primary, dental, and mental health providers. MUAs are specific to primary care. The ADHS used these designations in its March 2021 report " Arizona Primary Care Needs Assessment." Most of Arizona is designated as being in a MUA. The exceptions are the Flagstaff area and sections of the Phoenix and Tucson areas that are affluent and/or have a high percentage of senior citizens. The ADHS report cited shortages of 558 primary care physicians, 381 dentists, and 178 psychiatrists.

The ArMA report predicted shortages in Arizona in 2032 of 4,679 registered nurses, 412 nurse practitioners, and 4,131 physicians. The source of these figures was not cited.

Among the other sources cited by the ArMA is the Association of American Medical Colleges (AAMC), which produces a "State Physician Workforce Data Report." This report relies on per capita workforce numbers compared to the median of all states. According to the 2021 report, Arizona's per capita figure was 4 percent below the median in the active patient care physician

[1] Per capita employment often is expressed as healthcare employment per 100,000 residents. Alternatively, healthcare employment may be expressed as a ratio to population.

category, ranking 29th among the states. The shortfall exceeded 10 percent in the active patient care primary care physician and active patient care surgeon categories; Arizona ranked 40th in each category. This report also examined undergraduate and graduate medical student enrollment on a per capita basis. Arizona was about 15 percent below average on each measure. In contrast, Arizona was above average in retention measures, based on the percentage of active physicians who received their undergraduate or graduate medical education in Arizona.

The *Nurse Journal* compares the per capita number of registered nurses (RNs) in each state to the national average. Based on the data reported in November 2023, Arizona's per capita figure was 17 percent below average, ranking 45th. To reach the U.S. average, Arizona needed another 11,800 RNs. The ArMA report also cited HRSA data; a more complete and up-to-date analysis of the HRSA data follows.

Health Resources and Services Administration

The HRSA periodically produces assessments of supply and demand for various healthcare occupations. Prior to its data release in October 2023, limited information was available by state. In the October 2023 release, a number of occupations were assessed, using a base year of 2021 with annual projections for 2022 through 2036. Demand was projected for 60 occupations, but the supply in Arizona was projected for only 25 of these occupations.

The occupations for which both supply and demand were projected include a number of physician occupations, some behavioral health occupations, a couple of oral health occupations, some therapist occupations, and a few others. Nursing occupations were not included in the October 2023 release, but according to the HRSA website "projections for nursing occupations will be published soon."

Nursing supply and demand by state was assessed twice previously by the HRSA, with figures released in 2014 and 2017. The results for Arizona were considerably inconsistent between the 2014 and 2017 releases for both occupations analyzed: registered nurses and licensed practical nurses (LPNs). The 2014 report projected a supply-demand imbalance growing significantly over time in each occupation, while the 2017 report projected a stable situation among RNs and a smaller increase in the imbalance of LPNs.

The results of the most recent run of the HRSA's model are shown in Table 1 for Arizona. The data are presented for the base year of 2021 and for 2036, the last year of the projections. The HRSA expresses the workforce balance in terms of "adequacy" — calculated as supply divided by demand. While annual data are available, a consistent trend on adequacy is forecast over the 15 years in each occupation, regardless of the direction of change.

Rather than use the adequacy measure, workforce surpluses/shortages in the remainder of this paper are expressed as a percentage of the actual or projected workforce; a negative figure indicates a shortage. Of the 25 occupations listed in Table 1, Arizona had a workforce shortage in 2021 in 17; a different set of 17 occupations are projected to have a shortage in 2036. Of the nine physicians occupations, six had a shortage in 2021, with the worst imbalance in the family medicine and general internal medicine occupations. Between 2021 and 2036, the workforce balance is projected to worsen in each of the physician occupations except emergency medicine,

In contrast, Arizona had a surplus of physician assistants in 2021 that is predicted to increase through 2036.

Workforce shortages are more extreme in the behavioral health occupations, particularly in 2036. The imbalance is expected to worsen significantly in four of the five behavioral health occupations.

In the oral health occupations, there was only a small shortage of dentists in 2021, but the shortage is predicted to worsen between 2021 and 2036. In contrast, a large shortage in 2021 in dental hygienists is expected to narrow by 2036.

TABLE 1
SUPPLY AND DEMAND IN HEALTHCARE OCCUPATIONS IN ARIZONA

	2021			2036		
Occupation	**Supply**	**Demand**	**Surpl***	**Supply**	**Demand**	**Surpl***
PHYSICIANS AND RELATED						
Anesthesiology Physicians	1,360	1,120	17	1,280	1,390	-9
Emergency Medicine Physicians	1,270	1,220	4	1,650	1,500	9
Family Medicine Physicians	2,110	2,860	-36	2,240	3,660	-63
General Internal Medicine Physicians	1,680	2,270	-35	1,950	3,030	-55
General Surgery Physicians	660	680	-3	790	860	-9
Hospital Medicine Physicians	810	890	-10	780	1,190	-53
Obstetrics & Gynecology Physicians	940	1,060	-13	820	1,230	-50
Orthopedic Surgery Physicians	640	630	2	650	760	-17
Pediatrics Physicians	1,130	1,370	-21	1,040	1,530	-47
Physician Assistants: Total	3,420	3,320	3	5,230	4,250	19
Physician Assistants: Primary Care	910	820	10	1,440	1,040	28
BEHAVIORAL HEALTH						
Addiction Counselors	2,230	2,580	-16	1,360	4,550	-235
Child, Family, School Social Workers	2,730	2,860	-5	3,310	4,870	-47
Mental Health Counselors	1,160	2,510	-116	1,460	4,400	-201
Psychologists	1,440	2,420	-68	1,130	3,930	-248
School Counselors	1,730	2,980	-72	3,590	4,550	-27
ORAL HEALTH						
Dental Hygienists	2,570	3,880	-51	3,740	4,510	-21
General Dentists	3,230	3,300	-2	2,690	3,950	-47
OTHER						
Emergency Medical Technicians	2,110	2,720	-29	3,910	3,390	13
Occupational Therapists	2,340	2,850	-22	3,790	3,620	5
Pharmacists	7,560	7,300	3	9,620	9,280	3
Pharmacy Technicians	8,670	7,630	12	10,210	9,690	5
Physical Therapists	4,940	6,060	-23	7,810	7,850	-1
Respiratory Therapists	2,990	2,700	10	3,290	3,690	-12
Speech-Language Pathologists	3,320	3,930	-18	5,330	4,610	14

* Surplus/shortage expressed as a percentage of actual/projected employment (supply).

Source: U.S. Department of Health and Human Services, Health Resources and Services Administration, https://data.hrsa.gov/topics/health-workforce/workforce-projections.

Workforce surpluses and shortages in 2021 and 2036 vary across the other seven occupations shown in Table 1. A surplus in 2021 of pharmacists and pharmacy technicians is expected to remain in 2036. Shortages in 2021 are expected to become surpluses in 2036 in the emergency medical technicians, occupational therapists, and speech-language pathologists occupations.

A summary of workforce imbalances is provided in Table 2. Of the 25 occupations for which both supply and demand data are available, 11 had a shortage in 2021 that is expected to worsen going forward. In three occupations, the shortage in 2021 is projected to narrow. In three others,

TABLE 2
SUMMARY OF SUPPLY AND DEMAND IN HEALTHCARE OCCUPATIONS IN ARIZONA

	Surplus/Shortage*		
Occupation	**2021**	**2036**	**Change**
SURPLUS IN 2021, WIDENING BY 2036			
Emergency Medicine Physicians	4	9	5
Physician Assistants: Total	3	19	16
Physician Assistants: Primary Care	10	28	18
SURPLUS IN 2021, STEADY IN 2036			
Pharmacists	3	3	0
SURPLUS IN 2021, NARROWING BY 2036			
Pharmacy Technicians	12	5	-7
SURPLUS IN 2021, SHORTAGE IN 2036			
Anesthesiology Physicians	17	-9	-26
Respiratory Therapists	10	-12	-22
Orthopedic Surgery Physicians	2	-17	-19
SHORTAGE IN 2021, SURPLUS IN 2036			
Speech-Language Pathologists	-18	14	32
Occupational Therapists	-22	5	27
Emergency Medical Technicians	-29	13	42
SHORTAGE IN 2021, NARROWING BY 2036			
Physical Therapists	-23	-1	22
Dental Hygienists	-51	-21	30
School Counselors	-72	-27	45
SHORTAGE IN 2021, WIDENING BY 2036			
General Dentists	-2	-47	-45
General Surgery Physicians	-3	-9	-6
Child, Family, and School Social Workers	-5	-47	-42
Hospital Medicine Physicians	-10	-53	-43
Obstetrics & Gynecology Physicians	-13	-50	-37
Addiction Counselors	-16	-235	-219
Pediatrics Physicians	-21	-47	-26
General Internal Medicine Physicians	-35	-55	-20
Family Medicine Physicians	-36	-63	-27
Psychologists	-68	-248	-160
Mental Health Counselors	-116	-201	-85

* Surplus/shortage expressed as a percentage of actual/projected employment (supply).

Source: U.S. Department of Health and Human Services, Health Resources and Services Administration, https://data.hrsa.gov/topics/health-workforce/workforce-projections.

a shortage in 2021 is expected to become a surplus by 2036. A surplus was present in eight occupations in 2021, but in three of these, a shortage is projected to develop by 2036.

Arizona Board of Regents

In 2022, the Arizona Board of Regents (ABOR) released a "Health Care Gap Analysis Report." The analysis began with an estimate of the national and Arizona workforce in selected healthcare occupations in 2022, using figures from the HRSA. The worker-to-population ratios were calculated; from the comparison of the Arizona to national ratios, an estimate of the workforce surplus or shortage in 2022 was calculated.

In order to project the surplus or shortage in 2032, the projected change in the number of jobs in each occupation was collected from Lightcast (https://lightcast.io/) — a private-sector company that provides a variety of labor force indicators for various geographies within the United States. (Lightcast's data are proprietary, available only to subscribers.) The projected change was added to the surplus or shortage in 2022. This figure was compared to the projected number of degree completions between 2022 and 2032, adjusted by a retention factor, which accounts for graduates not entering employment within Arizona. The result is an estimate of the surplus or shortage in 2032.

The ABOR calculated a surplus/shortage in 2022 for only 15 occupations; 2032 projections are provided for 20 occupations. The analysis indicated that 87 percent of the healthcare occupations had a workforce shortage in 2022 and that 70 percent would have a shortage in 2032. However, the magnitude of the workforce imbalance was predicted to improve in just over half of the occupations between 2022 and 2032. The results from the ABOR study are included in a succeeding section that compares estimates of surpluses/shortages from various studies.

A More Detailed Look at the Healthcare Workforce in Arizona and in Its Counties

In this section, healthcare employment estimates and projections made by Lightcast by occupation and by industry are examined for the United States, Arizona, and each Arizona county. Per capita healthcare employment from 2001 through 2034 is calculated using population estimates and projections from the U.S. Census Bureau for the United States and from the Arizona Office of Economic Opportunity (OEO) for Arizona and its counties. The per capita figures for Arizona and its counties are compared to the national average in order to estimate healthcare workforce surpluses and shortages. As noted earlier, the per capita measure is crude.

State Data

Surpluses and shortages in Arizona in the 100 healthcare occupations defined in the Standard Occupational Classification are shown in Table 3. The figures are expressed in two ways: a numerical surplus/shortage and the surplus/shortage as a percentage of actual/projected employment. The surpluses and shortages are displayed for two years — the most recent year of 2023 and the projection 10 tears in the future (2033).

The annual surpluses and shortages from 2001 through 2034 expressed as a percentage of employment are displayed in Chart 1 for selected occupations with substantial employment in 2023; the six-digit numbers displayed on the graphs are the codes from the Standard Occupational Classification.

TABLE 3
OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

	Number		Percentage	
Occupation	**2023**	**2033**	**2023**	**2033**
HEALTHCARE TOTAL	-48,119	-91,370	-12	-19
Medical and Health Services Managers	-1,431	-2,727	-14	-19
Epidemiologists	21	-1	8	0
Medical Scientists, Except Epidemiologists	-1,398	-1,859	-100	-106
Industrial-Organizational Psychologists	-29	-37	-66	-80
Clinical and Counseling Psychologists	-711	-870	-75	-67
School Psychologists	-283	-481	-26	-42
Psychologists, All Other	4	-52	0	-2
Marriage and Family Therapists	-1,000	-1,241	-125	-107
Rehabilitation Counselors	-34	-211	-2	-10
Subs Abuse, Behavioral Disorder, Mental Health Counselors	645	494	7	4
Counselors, All Other	-542	-735	-47	-49
Child, Family, and School Social Workers	87	-638	1	-7
Healthcare Social Workers	-821	-1,268	-24	-30
Mental Health and Substance Abuse Social Workers	461	438	14	11
Social Workers, All Other	244	88	12	4
Chiropractors	-48	-192	-4	-13
Dentists, General	-938	-1,182	-38	-40
Oral and Maxillofacial Surgeons	331	352	72	70
Orthodontists	-59	-68	-48	-46
Prosthodontists	-7	-10	-110	-119
Dentists, All Other Specialists	-27	-42	-19	-27
Dietitians and Nutritionists	-216	-362	-14	-19
Optometrists	226	265	17	16
Pharmacists	372	68	5	1
Physician Assistants	152	-53	4	-1
Podiatrists	14	14	4	4
Occupational Therapists	-546	-939	-20	-28
Physical Therapists	-729	-1,432	-15	-23
Radiation Therapists	10	-12	2	-3
Recreational Therapists	-184	-209	-89	-82
Respiratory Therapists	66	-188	2	-5
Speech-Language Pathologists	-359	-965	-10	-21
Exercise Physiologists	-17	-37	-6	-12
Therapists, All Other	-137	-188	-12	-12
Registered Nurses	-12,965	-19,999	-22	-29
Nurse Anesthetists	-732	-868	-172	-146
Nurse Midwives	-56	-74	-39	-43
Nurse Practitioners	514	237	7	2
Audiologists	129	108	27	20

(continued)

TABLE 3 (continued)
OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

	Number		Percentage	
Occupation	**2023**	**2033**	**2023**	**2033**
Anesthesiologists	611	618	39	35
Cardiologists	-197	-228	-85	-81
Dermatologists	37	27	11	7
Emergency Medicine Physicians	-582	-661	-326	-272
Family Medicine Physicians	2,087	2,082	45	41
General Internal Medicine Physicians	99	14	5	1
Neurologists	-171	-191	-136	-117
Obstetricians and Gynecologists	-60	-94	-12	-17
Pediatricians, General	316	279	27	22
Physicians, Pathologists	-191	-214	-109	-93
Psychiatrists	-264	-321	-60	-59
Radiologists	-250	-295	-46	-46
Physicians, All Other	-673	-1,170	-9	-14
Ophthalmologists, Except Pediatric	-143	-158	-79	-69
Orthopedic Surgeons, Except Pediatric	-187	-207	-62	-56
Pediatric Surgeons	10	8	29	24
Surgeons, All Other	-413	-467	-153	-139
Acupuncturists	-66	-78	-19	-18
Dental Hygienists	-156	-484	-3	-8
Healthcare Diagnosing or Treating Practitioners, Other	-403	-496	-75	-77
Clinical Laboratory Technologists and Technicians	735	678	8	7
Cardiovascular Technologists and Technicians	-52	-142	-4	-10
Diagnostic Medical Sonographers	-139	-278	-8	-12
Nuclear Medicine Technologists	-68	-94	-19	-23
Radiologic Technologists and Technicians	-915	-1,299	-22	-26
Magnetic Resonance Imaging Technologists	-132	-180	-16	-18
Medical Dosimetrists	-25	-33	-37	-41
Emergency Medical Technicians	-858	-1,237	-29	-35
Paramedics	-127	-358	-5	-13
Dietetic Technicians	142	123	22	17
Pharmacy Technicians	1,302	1,216	11	9
Psychiatric Technicians	4,857	5,345	66	62
Surgical Technologists	-111	-355	-5	-13
Ophthalmic Medical Technicians	998	1,051	39	35
Licensed Practical and Licensed Vocational Nurses	-7,906	-9,410	-110	-103
Medical Records Specialists	-174	-567	-4	-11
Opticians, Dispensing	38	-7	2	0
Orthotists and Prosthetists	-100	-117	-77	-65
Hearing Aid Specialists	-151	-184	-117	-102
Health Technologists and Technicians, All Other	-818	-1,236	-27	-34
Health Information Technologists, Medical Registrars	-73	-167	-9	-16

(continued)

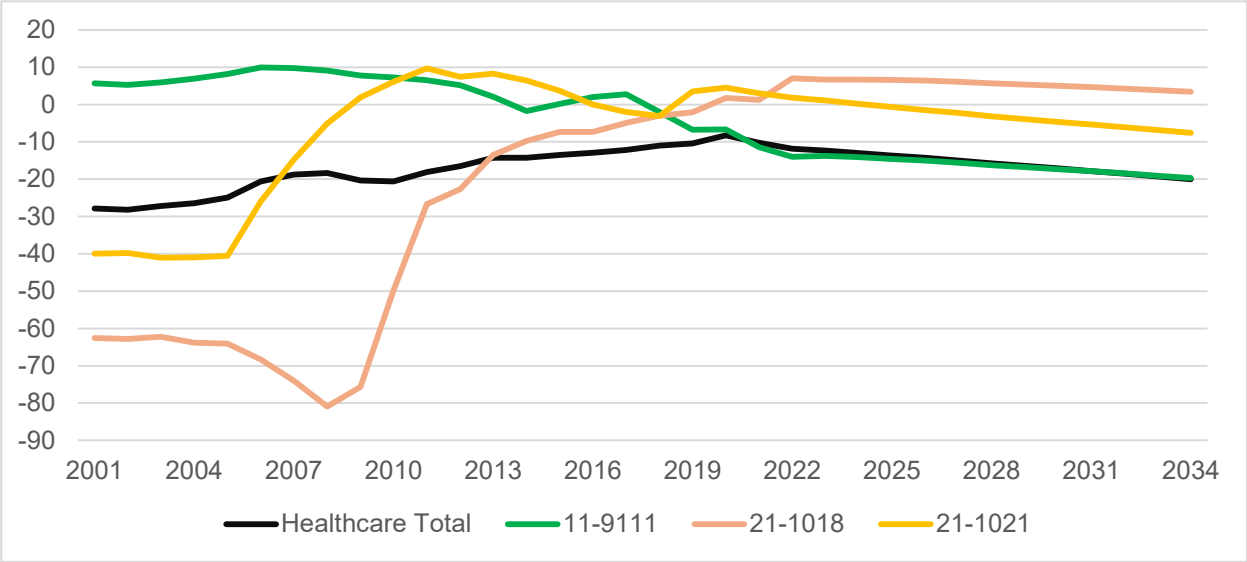
TABLE 3 (continued)
OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

	Number		Percentage	
Occupation	**2023**	**2033**	**2023**	**2033**
Athletic Trainers	115	63	12	5
Genetic Counselors	-28	-39	-46	-46
Surgical Assistants	-135	-180	-38	-43
Healthcare Practitioners and Technical Workers, Other	-300	-379	-37	-38
Home Health and Personal Care Aides	-16,183	-34,247	-21	-35
Nursing Assistants	-12,868	-15,557	-69	-70
Orderlies	-240	-351	-28	-36
Psychiatric Aides	-647	-703	-457	-324
Occupational Therapy Assistants	146	39	12	3
Occupational Therapy Aides	63	61	40	34
Physical Therapist Assistants	-763	-1,200	-48	-55
Physical Therapist Aides	45	-86	4	-7
Massage Therapists	934	807	20	14
Dental Assistants	750	273	8	2
Medical Assistants	2,689	1,803	13	7
Medical Equipment Preparers	-202	-335	-15	-22
Medical Transcriptionists	1,440	1,234	55	48
Pharmacy Aides	-397	-419	-68	-61
Phlebotomists	974	1,441	23	26
Healthcare Support Workers, All Other	654	568	20	15

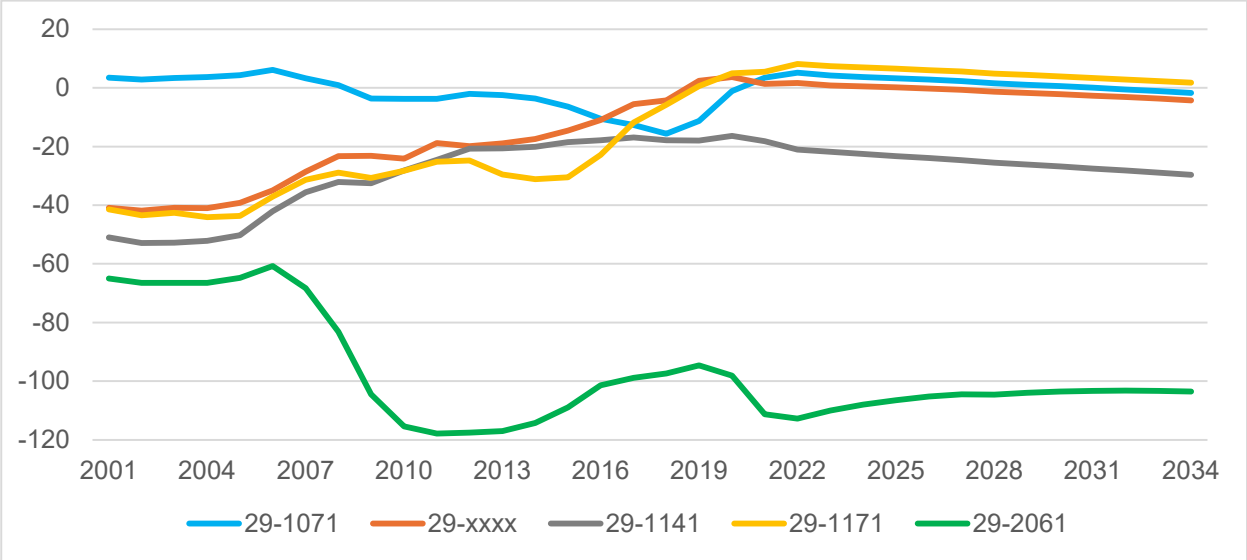
Note: The percentage surplus/shortage is calculated as the numeric surplus/shortage divided by actual/projected employment.

Source: Calculated from U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona).

CHART 1
ANNUAL OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA EXPRESSED AS A PERCENTAGE OF ACTUAL/PROJECTED EMPLOYMENT



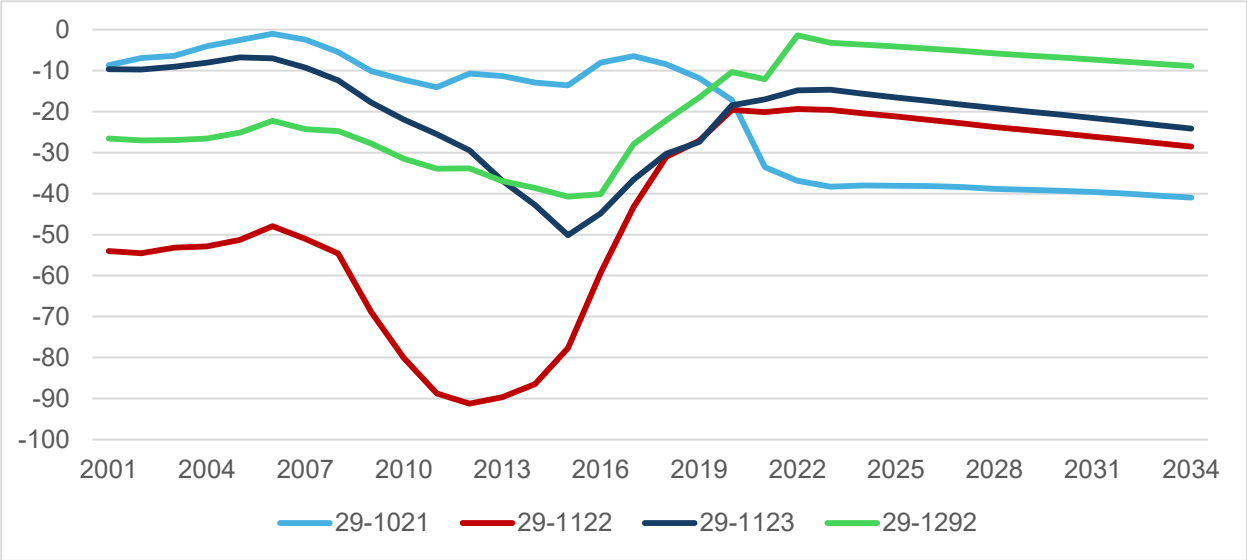
11-9111: Medical and Health Services Managers
21-1018: Substance Abuse, Behavioral Disorder, and Mental Health Counselors
21-1021: Child, Family, and School Social Workers



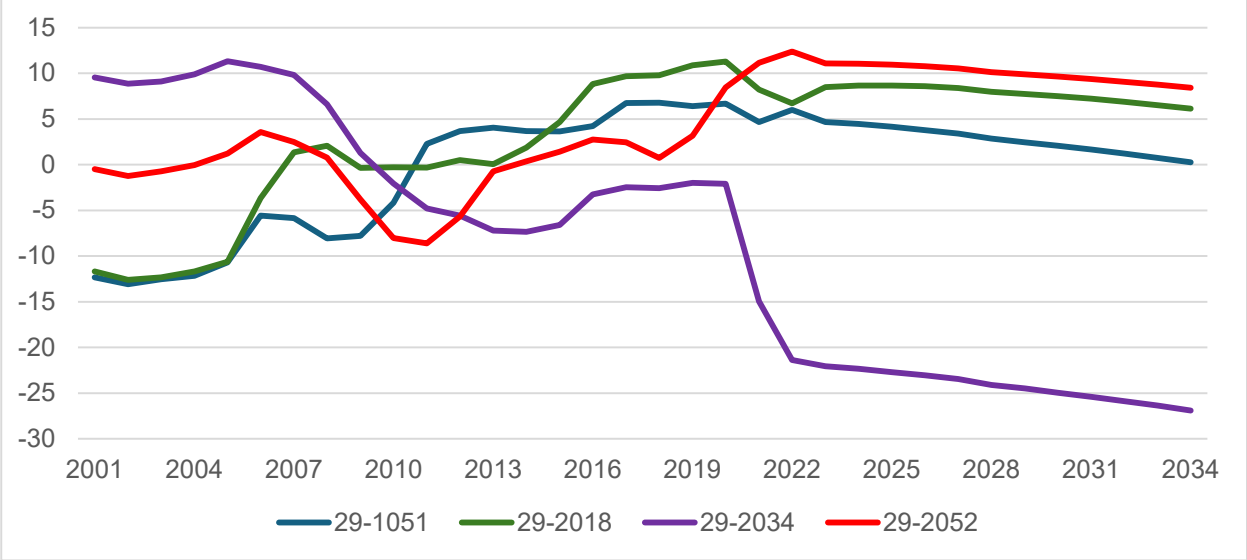
29-1071: Physician Assistants
29-xxxx: Sum of 16 Physician Occupations
29-1141: Registered Nurses
29-1171: Nurse Practitioners
29-2061: Licensed Practical and Licensed Vocational Nurses

(continued)

CHART 1 (continued)
ANNUAL OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA
EXPRESSED AS A PERCENTAGE OF ACTUAL/PROJECTED EMPLOYMENT



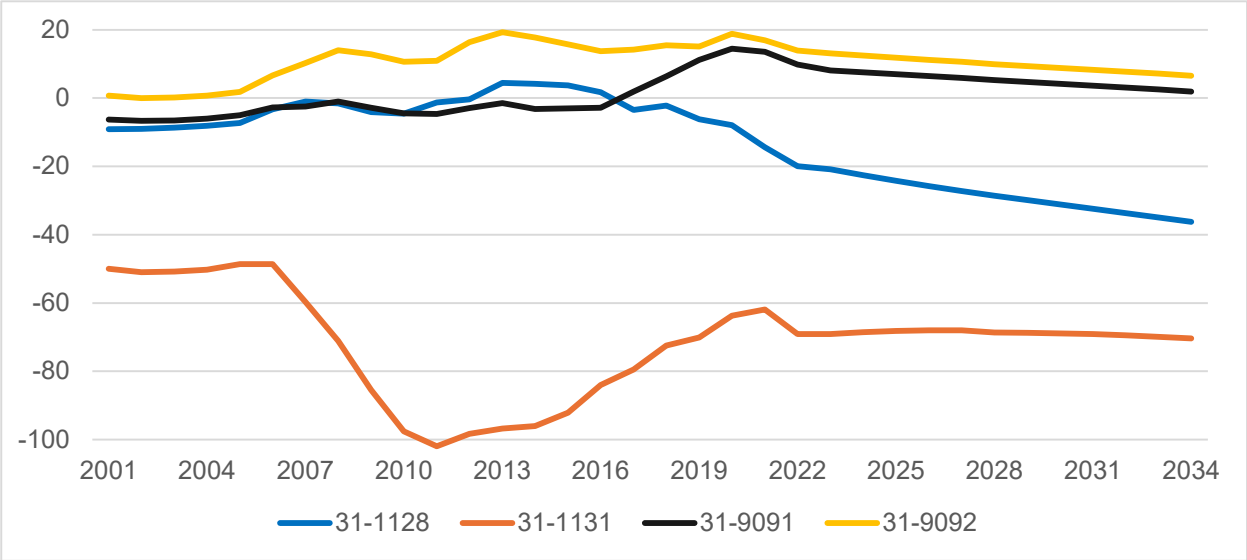
29-1021: Dentists, General
29-1122: Occupational Therapists
29-1123: Physical Therapists
29-1292: Dental Hygienists



29-1051: Pharmacists
29-2018: Clinical Laboratory Technologists and Technicians
29-2034: Radiologic Technologists and Technicians
29-2052: Pharmacy Technicians

(continued)

CHART 1 (continued)
ANNUAL OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA EXPRESSED AS A PERCENTAGE OF ACTUAL/PROJECTED EMPLOYMENT



31-1128: Home Health and Personal Care Aides
31-1131: Nursing Assistants
31-9091: Dental Assistants
31-9092: Medical Assistants

Source: Calculated from U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona).

Based on the Lightcast employment data and the simplistic per capita method of determining workforce surpluses/shortages, Arizona had an overall occupational healthcare shortage in 2023 that is forecast to worsen by 2033 (see Table 3). As seen in Chart 1, the overall shortage narrowed from 2002 until 2020, then expanded somewhat and is forecast to widen a little more through 2034.

As seen in Chart 1, no consistent pattern in the magnitude of workforce surpluses/shortages was present from 2001 through 2023 across the healthcare occupations, but imbalances are expected to worsen between 2023 and 2034 in most occupations. In some occupations, such as general dentists, the magnitude of the shortfall has increased over time, but in other occupations, such as dental hygienists, the magnitude of the shortfall has decreased. In some occupations, such as radiologic technicians, a surplus has turned into a deficit, but in several occupations, including pharmacists and pharmacy technicians, a shortage has become a surplus.

Based on the percentage surpluses/shortages shown in Table 3, per capita employment in Arizona in 2023 was higher than the national average in 37 percent of the occupations; the figure is projected to drop to 30 percent in 2033. Among those occupations employing at least 50,000 individuals nationally, Arizona's per capita employment in 2023 was well above the U.S. average

in some of the healthcare technicians and healthcare support occupations, including psychiatric technicians, medical transcriptionists, ophthalmic medical technicians, phlebotomists, and massage therapists. In contrast, Arizona was above average in few of the healthcare practitioners and other medical professional occupations.

Arizona's per capita employment was well below the U.S. average in some of the sizable healthcare technicians and healthcare support occupations, including nursing assistants, physical therapist assistants, emergency medical technicians, radiologic technicians, and home health aides. Arizona also was considerably below average in many of the professional occupations, including marriage and family therapists, psychologists, healthcare social workers, registered nurses, licensed practical nurses, physical therapists, occupational therapists, and dentists.

The occupational data are conceptually superior for this analysis since they are targeted to those actually working in a healthcare occupation. In contrast, the healthcare industrial data include workers from occupations other than healthcare, such as clerks and accountants, while some individuals working in a healthcare occupation are counted in other industries. For example, nurses employed in a factory are counted as part of the manufacturing sector. However, the quality of the raw industrial data is better than that of the occupational data. Thus, results for the 30 healthcare industries defined in the North American Industry Classification System are shown in Table 4. As with the occupational data, industrial healthcare employment per capita in Arizona was below the national average in 2023 and is predicted to be further below average in 2033. However, the magnitude of the shortages is considerably less based on the industrial data than the occupational data.

The annual surpluses and shortages expressed as a percentage of employment are displayed in Chart 2 for selected industries with substantial employment in 2023; the six-digit numbers shown on the graphs are the codes from the North American Industry Classification System. The magnitude of workforce surpluses/shortages have tended to be more consistent over time by industry (see Chart 2) than by occupation (see Chart 1). There is no way of knowing whether this is real or a reflection of the better quality of the industrial data and/or the larger average employment size among 30 industries versus 100 occupations.

Using the percentage surpluses/shortages shown in Table 4, per capita employment in Arizona in 2023 was higher than the national average in 17 of the 30 industries; a surplus is projected in 15 industries in 2033. Arizona's figure in 2023 was much above the U.S. average in the following large industries: freestanding ambulatory surgical and emergency centers, residential mental health and substance abuse facilities, outpatient mental health and substance abuse centers, medical laboratories, diagnostic imaging centers, and offices of miscellaneous health practitioners. In contrast, Arizona's per capita figure was considerably below average in the following industries: nursing care facilities, other outpatient care centers, residential intellectual and developmental disability facilities, specialty hospitals, and home healthcare services.

Arizona's per capita figure was a little above average in the offices of physicians (except mental health specialties) industry, but was below average in most of the other offices of health practitioners industries and in the general hospitals industry.

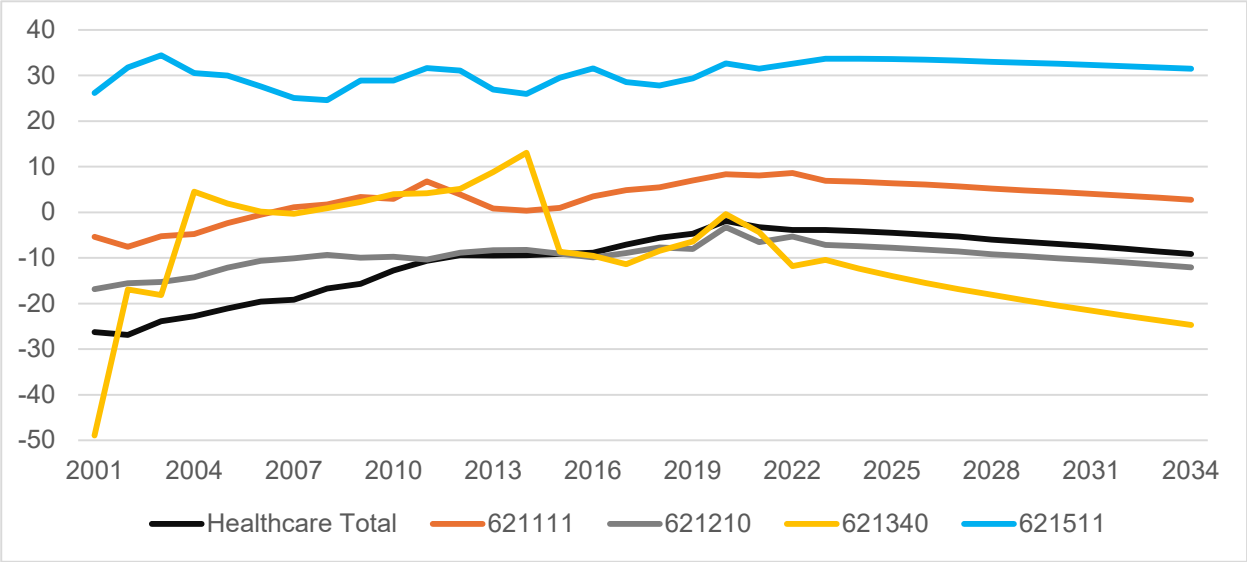
TABLE 4
INDUSTRIAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

	Number		Percentage	
Industry	**2023**	**2033**	**2023**	**2033**
HEALTHCARE TOTAL	-14,460	-38,503	-4	-9
Offices of Physicians (except Mental Health Specialists)	4,753	2,634	7	3
Offices of Physicians, Mental Health Specialists	337	791	14	22
Offices of Dentists	-1,604	-3,067	-7	-12
Offices of Chiropractors	-112	-612	-3	-15
Offices of Optometrists	-171	-178	-5	-4
Offices of Mental Health Practitioners (except Physicians)	-157	-467	-3	-6
Offices of Physical, Occupational, and Speech Therapists	-1,025	-3,063	-10	-24
Offices of Podiatrists	-110	-141	-17	-20
Offices of All Other Miscellaneous Health Practitioners	1,929	2,493	29	28
Family Planning Centers	-179	-393	-30	-52
Outpatient Mental Health and Substance Abuse Centers	4,156	4,997	37	34
HMO Medical Centers	562	-1,629	11	-33
Kidney Dialysis Centers	21	-259	1	-7
Freestanding Ambulatory Surgical and Emergency Centers	4,278	5,466	50	47
All Other Outpatient Care Centers	-2,477	-4,992	-78	-140
Medical Laboratories	2,810	3,287	34	32
Diagnostic Imaging Centers	996	1,427	33	37
Home Health Care Services	-8,706	-15,740	-31	-44
Ambulance Services	971	664	19	12
Blood and Organ Banks	687	752	25	22
All Other Miscellaneous Ambulatory Health Care Services	5,297	8,588	68	71
General Medical and Surgical Hospitals	-13,829	-24,029	-15	-22
Psychiatric and Substance Abuse Hospitals	303	356	10	9
Specialty (except Psychiatric & Substance Abuse) Hospitals	-1,568	-1,947	-38	-36
Nursing Care Facilities (Skilled Nursing Facilities)	-16,268	-18,037	-107	-106
Residential Intellectual &Developmental Disability Facilities	-3,029	-5,245	-54	-106
Residential Mental Health and Substance Abuse Facilities	3,528	5,455	39	43
Continuing Care Retirement Communities	1,499	1,797	13	12
Assisted Living Facilities for the Elderly	1,950	1,875	16	12
Other Residential Care Facilities	701	713	16	15

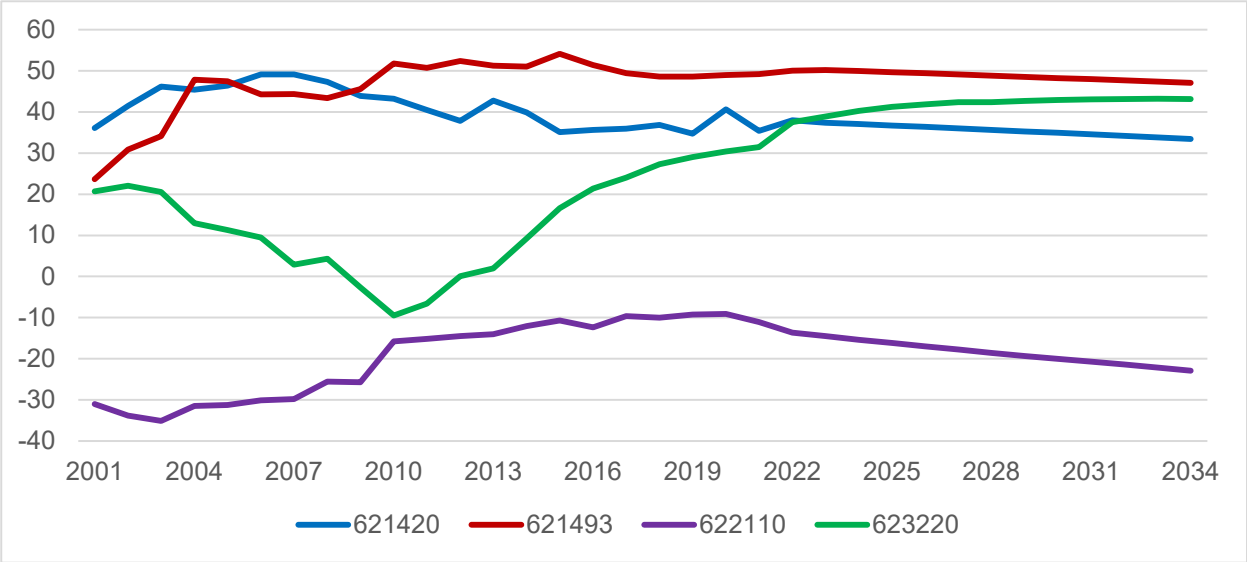
Note: The percentage surplus/shortage is calculated as the numeric surplus/shortage divided by actual/projected employment.

Source: Calculated from U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona).

CHART 2
ANNUAL INDUSTRIAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA EXPRESSED AS A PERCENTAGE OF ACTUAL/PROJECTED EMPLOYMENT



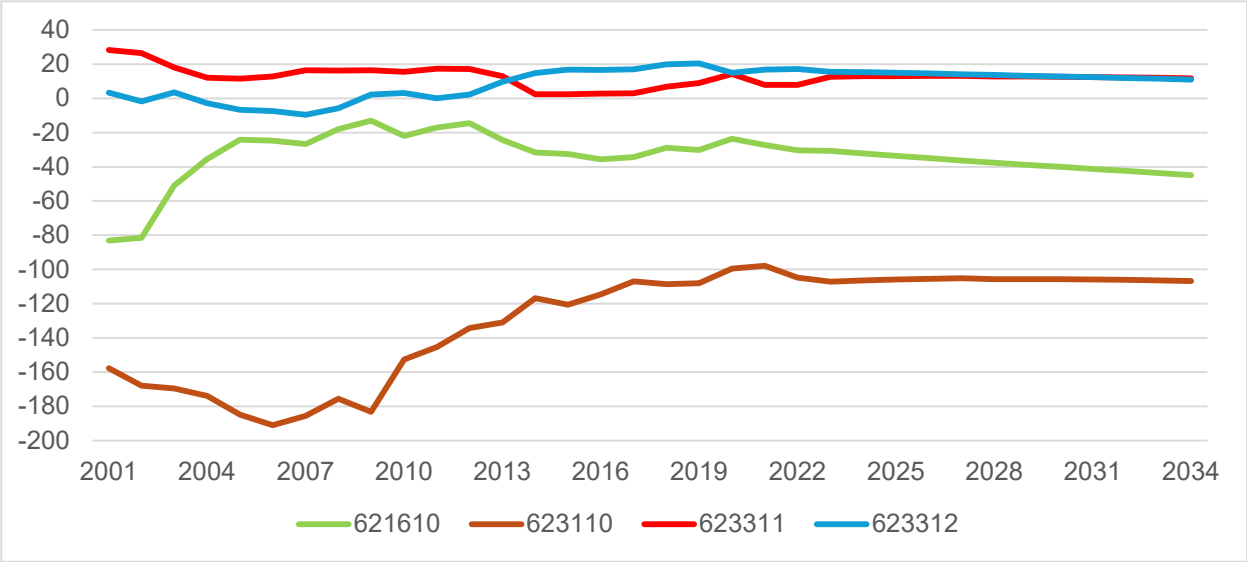
621111: Offices of Physicians
621340: Offices of Physical, Occupational and Speech Therapists, and Audiologists
621210: Offices of Dentists
621511: Medical Laboratories



621420: Outpatient Mental Health and Substance Abuse Centers
621493: Freestanding Ambulatory Surgical and Emergency Centers
622110: General Medical and Surgical Hospitals
623220: Residential Mental Health and Substance Abuse Facilities

(continued)

CHART 2 (continued)
ANNUAL INDUSTRIAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA EXPRESSED AS A PERCENTAGE OF ACTUAL/PROJECTED EMPLOYMENT



621610: Home Health Care Services
623110: Nursing Care Facilities (Skilled Nursing Facilities)
623311: Continuing Care Retirement Communities
623312: Assisted Living Facilities for the Elderly

Source: Calculated from U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona).

County Data

As noted earlier, the per capita measure to assess healthcare surpluses and shortages is crude. It is even less accurate in most of Arizona's counties, which have relatively small numbers of residents and healthcare workers. Moreover, the demographic characteristics of residents vary widely across Arizona's counties, by age and by race/ethnicity, affecting the demand for healthcare services. Further, demand for specialized healthcare services is too low in many of these counties to allow a healthcare provider to succeed financially. Thus, the county data should be examined cautiously. The low per capita figures in many healthcare occupations in many counties are not likely to be resolvable by healthcare workforce initiatives due to the low demand from a limited and geographically dispersed population.

The overall healthcare surpluses/shortages expressed as a percentage of employment are displayed by county in Table 5 based on the occupational data. The counties are listed by the 2023 value. Only Maricopa County had per capita employment greater than the U.S. average in 2023. Twelve counties had a figure at least 45 percent below average. Pinal County is at the bottom of the list since most of its residents live relatively close to medical services in Maricopa County or Pima County. Otherwise, Arizona's least-populous counties are near the bottom of the list.

TABLE 5
OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA'S COUNTIES EXPRESSED AS A PERCENTAGE OF THE ACTUAL/PROJECTED EMPLOYMENT

	2001	2023	2034
ARIZONA	-28	-12	-20
Maricopa	-23	1	-4
Pima	-3	-12	-24
Coconino	-13	-18	-23
Apache	-64	-46	-51
Yavapai	-30	-58	-85
Navajo	-96	-72	-52
Yuma	-96	-75	-89
Gila	-38	-84	-85
Mohave	-67	-86	-104
Cochise	-99	-94	-105
Graham	-96	-100	-93
Santa Cruz	-117	-147	-143
La Paz	-156	-148	-150
Greenlee	-183	-224	-135
Pinal	-247	-278	-422

Source: Calculated from U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona and counties).

A shift has occurred since 2001 in the relative geographic concentration of healthcare employment within Arizona's populous urban areas, with employment gains disproportionately occurring in Maricopa County (the heart of Metro Phoenix). In 2001, per capita healthcare employment in Pima County (Metro Tucson) was close to the national average while Maricopa County was further below average.

Among the 100 healthcare occupations, per capita employment in Maricopa County was above the state average in 92 and above the national average in 50. Coconino County (Metro Flagstaff) was above the state average in 43 and above the national average in 31 — more than in Pima County (40 above the state average and 27 above the national average). Among the other 12 counties, Yavapai County (Metro Prescott) had the largest number above average: 23 versus the state average and 20 versus the U.S. average.

In some occupations, only Maricopa County had a per capita figure greater than the state average. In most occupations, three or fewer counties had a figure greater than the state average. A summary of the counties in which per capita employment in 2023 exceeded the national average follows for selected occupations:

- Physicians: Overall, only Maricopa and Coconino counties had a per capita figure greater than the U,S. average. Four counties were above average in the family medicine occupation: Maricopa, Pima, Santa Cruz, and Yuma. No county was above average in the cardiologists, emergency medicine, and neurologists occupations, but six were above

average in the anesthesiologists and general internal medicine occupations. The physician assistants figure was above average in Maricopa and Coconino counties.

- Nurses: No county was above average in the registered nurses, licensed practical nurses, or nursing assistants occupations. In contrast, Coconino, Maricopa, and Pima counties were above average in the nurse practitioners occupation.
- Dental: Mohave County was above average in the general dentists, dental hygienists, and dental assistants occupations. Maricopa County was above average in the dental hygienists and dental assistants occupations; Graham and Navajo counties were above average in the dental assistants occupation.
- Therapists: No county was above average in the occupational therapists occupation, but Maricopa, Mohave, and Yavapai were above average in the occupational therapy assistants occupation. Coconino and Maricopa counties were above average in the physical therapists occupation, but no county was above average in the physical therapy assistants occupation. Only Maricopa County was above average in the respiratory therapists occupation.
- Mental health: Maricopa and Pima counties were above average in the mental health counselors and mental health social workers occupations, but no county was above average in the psychologists, marriage and family therapists, or healthcare social workers occupations.

Comparison of Estimated Healthcare Workforce Surpluses and Shortages in Arizona

In this section, healthcare workforce surpluses/shortages in Arizona by occupation are compared across three datasets: the HRSA, the ABOR, and the per capita figures calculated from the Lightcast employment data. (In the rest of this report, the per capita figures calculated using the Lightcast employment estimates and projections are referred to as "Lightcast," but Lightcast did not produce these figures.)

Comparisons are made for 2022 and 2032, years that are available from each of the three sources, and for the 10-year change. Table 6 includes only those occupations for which estimates are available from at least two of the three sources. Some of the occupations may be defined somewhat differently across the three sources.

Conceptually, the surpluses/shortages estimated by the HRSA should be most reliable, followed by those from the ABOR. However, estimates from each of these sources are available for only a limited number of the 100 healthcare occupations defined in the Standard Occupational Classification. An estimate of the surplus/shortage is available from both the HRSA and the ABOR for only 10 occupations. Expressing the surpluses/shortages as a percentage of the actual/projected employment, the correlations across the 10 occupations are moderate between the ABOR and the HRSA figures (see Table 7). Low correlation is present between the HRSA and the Lightcast data in 2022 and 2032, but the correlation on the change is negative. Correlations between the ABOR and the figures calculated from the Lightcast data are low.

Using all possible ABOR and HRSA pairs of occupations, the correlations are lower than those of the 10 occupations. Using all possible HRSA and Lightcast pairs of occupations excluding those of individual physician occupations, the correlations are similar to those the 10 occupations. However, including the individual physician occupations, the correlation between

TABLE 6
COMPARISON OF OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

	NUMERIC								
	2022			2032			Change		
Occupation	**ABOR**	**HRSA**	**LC**	**ABOR**	**HRSA**	**LC**	**ABOR**	**HRSA**	**LC**
Psychologists	-849	-1,100	-985	-1,121	-2,260	-1,398	-272	-1,160	-413
Marriage and Family Therapists			-978	-372		-1,219			-241
Addiction, Mental Health, School Counselors		-3,160	79	-220	-5,740	-369		-2,580	-448
Social Workers	-2,419	-230	50	-868	-1,140	-1,233	1,551	-910	-1,283
Chiropractors	13		-49	174		-178	161		-129
Dentists, General	-206	-200	-896	59	-960	-1,156	265	-760	-260
Dietitians and Nutritionists	-503		-195	-652		-348	-149		-153
Optometrists	-233		214	-293		267	-60		53
Pharmacists	289	340	476	1,247	480	109	958	140	-367
Physician Assistants	-578	150	178	1,100	700	-25	1,678	550	-203
Podiatrists			17	13		16			-1
Occupational Therapists	-871	-430	-522	-11	40	-900	860	470	-378
Physical Therapists	-988	-990	-710	-274	-220	-1,361	714	770	-651
Respiratory Therapists		250	103		-270	-162		-520	-265
Speech-Language Pathologists	-393	-460	-319	-397	500	-905	-4	960	-586
Registered Nurses	-14,291		-12,279	-4,679		-19,310	9,612		-7,031
Nurse Practitioners	-560		535	-412		288	148		-247
Audiologists			125	59		111			-14
Physicians, Total*	-3,644	-1,730	320	-4,131	-3,480	-694	-487	-1,750	-1,014
Anesthesiologists		200	614		-70	621		-270	7
Emergency Medicine Physicians		60	-575		100	-654		40	-79
Family Medicine Physicians		-830	2,116		-1,290	2,093		-460	-23
General Internal Medicine Physicians		-620	108		-950	25		-330	-83
Obstetricians and Gynecologists		-150	-55		-370	-90		-220	-35
Pediatricians, General		-240	324		-410	284		-170	-40
Surgeons		-40	-577		-160	-659		-120	-82
Dental Hygienists	-1,120	-1,280	-66	-1,296	-880	-448	-176	400	-382
Emergency Medical Technicians		-510	-933		360	-1,200		870	-367
Pharmacy Technicians		1,010	1,448		700	1,244		-310	-204
Genetic Counselors			-28	-23		-37			-9

(continued)

TABLE 6 (continued)
COMPARISON OF OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

EXPRESSED AS A PERCENTAGE OF THE ACTUAL/PROJECTED EMPLOYMENT

	2022			2032			Change		
Occupation	**ABOR**	**HRSA**	**LC**	**ABOR**	**HRSA**	**LC**	**ABOR**	**HRSA**	**LC**
Psychologists	-30	-78	-27	-33	-188	-30	-3	-110	-3
Marriage and Family Therapists			-132	-24		-107			25
Addiction, Mental Health, School Counselors		-61	1	-2	-94	-2		-33	-3
Social Workers	-34	-8	0	-10	-37	-6	24	-29	-6
Chiropractors	1		-4	-14		-12	-15		-8
Dentists, General	-6	-6	-37	1	-34	-40	7	-28	-3
Dietitians and Nutritionists	-28		-13	-30		-19	-2		-6
Optometrists	-18		17	-18		17	0		0
Pharmacists	3	4	6	13	5	1	10	1	-5
Physician Assistants	-20	4	5	27	15	-1	47	11	-6
Podiatrists			6	3		4			-2
Occupational Therapists	-35	-17	-19	0	1	-27	35	18	-8
Physical Therapists	-23	-19	-15	-5	-3	-22	18	16	-7
Respiratory Therapists		8	3		-9	-4		-17	-7
Speech-Language Pathologists	-13	-13	-9	-9	10	-20	4	23	-11
Registered Nurses	-24		-21	-8		-28	16		-7
Nurse Practitioners	-9		8	-5		3	4		-5
Audiologists			27	24		20			-7
Physicians, Total*	-20	-16	2	-19	-32	-3	1	-16	-5
Anesthesiologists		15	39		-6	35		-21	-4
Emergency Medicine Physicians		5	-334		7	-273		2	61
Family Medicine Physicians		-40	46		-59	41		-19	-5
General Internal Medicine Physicians		-37	6		-50	1		-13	-5
Obstetricians and Gynecologists		-16	-12		-45	-17		-29	-5
Pediatricians, General		-21	28		-38	22		-17	-6
Surgeons		-3	-97		-12	-90		-9	7
Dental Hygienists	-26	-48	-1	-24	-25	-8	2	23	-7
Emergency Medical Technicians		-23	-28		10	-35		33	-7
Pharmacy Technicians		12	12		7	9		-5	-3
Genetic Counselors			-49	-34		-46			3

(continued)

TABLE 6 (continued)
COMPARISON OF OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA

* The HRSA's figures do not include cardiologists, radiologists, or other physician specialists.
Notes: A blank cell indicates that the data are not available. Some of the occupations may be defined somewhat differently across the three sources.

Sources:
ABOR: Arizona Board of Regents
HRSA: U.S. Department of Health and Human Services, Health Resources and Services Administration
LC: Calculated from U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona).

TABLE 7
CORRELATIONS OF OCCUPATIONAL WORKFORCE SURPLUSES/SHORTAGES IN ARIZONA, BASED ON THE PERCENTAGE OF THE ACTUAL/PROJECTED EMPLOYMENT

	Number*	2022	2032	2022-32 Change
Occupations for Which Complete Data Are Available:	10			
ABOR and HRSA		0.48	0.69	0.39
ABOR and Lightcast		0.08	0.28	-0.21
HRSA and Lightcast		0.37	0.38	-0.72
Occupations Available From ABOR and Lightcast	15/20^	0.21	0.45	-0.17
Occupations Available From HRSA and Lightcast:				
Using Total Physicians, Not Individual Occupations	14	0.36	0.21	-0.66
Using Individual Physician Occupations, Not Total	20	-0.18	-0.15	0.01

* Number of occupations available from each source.
^ 15 for 2022 and the change, 20 for 2032.

Sources: Calculated from Arizona Board of Regents (ABOR), U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), and U.S. and Arizona employment estimates and projections from Lightcast and population estimates and projections from the U.S. Department of Commerce, Census Bureau (national) and Arizona Office of Economic Opportunity (Arizona).

the HRSA and Lightcast figures disappears — there is wide divergence between the HRSA and the Lightcast data in the surpluses/shortages in individual physician occupations.

A summary by occupation in Arizona, based on Table 6, follows:

- Physicians, Total: A shortage is estimated in 2022 and 2032 by the HRSA and the ABOR, but a supply-demand balance is indicated from the Lightcast data. The ABOR indicates a stable situation between 2022 and 2032, but the HRSA and Lightcast predict a deterioration.
- Physicians by Specialty: The results are substantially different between the HRSA and the Lightcast data. Focusing on the HRSA data, shortages existed in most specialties in 2022 and are expected to become larger by 2032. The exception is emergency medicine.
- Physician Assistants: The ABOR shows a shortage in 2022 but a surplus in 2032. The HRSA indicates a small surplus in 2022, growing by 2032. Using the Lightcast data, a small surplus in 2022 disappears by 2032.
- Registered Nurses: The ABOR and Lightcast data each indicate shortages in 2022 and 2032, but the ABOR projects the shortage will narrow while Lightcast indicates it will expand.
- Nurse Practitioners: The ABOR shows a small shortage in 2022 and 2032, but the Lightcast data indicate a small surplus in each year.
- Occupational Therapists: Each of the sources indicate a shortage in 2022. The HRSA and the ABOR predict the shortage will disappear by 2032, but the Lightcast data indicate the shortage will expand.

- Physical Therapists: Each of the sources indicate a shortage in 2022 and 2032, but the HRSA and the ABOR predict the shortage will narrow during the 10 years while the Lightcast data indicate it will expand.
- Speech-Language Pathologists: Each of the sources indicate a shortage in 2022, but the HRSA indicates this will become a surplus by 2032 while a deficit persists according to the other sources.
- Audiologists: The limited data suggest a surplus in 2022 and 2032.
- Pharmacists: Each source indicates a small surplus in both 2022 and 2032. The surplus will expand according to the ABOR but narrow using the Lightcast data.
- Pharmacy Technicians. Each of the two available sources indicate a surplus in 2022 that will narrow somewhat by 2032.
- Optometrists: Steady conditions are predicted by the ABOR and Lightcast data, but the ABOR shows a shortage while the Lightcast data indicate a surplus.
- Chiropractors: A decline is predicted by the ABOR and Lightcast data, but the ABOR shows a supply-demand balance in 2022 while the Lightcast data indicate a shortage.
- Podiatrists: The limited data suggest a small surplus in 2022 and 2032.
- Dentists, General: The HRSA and the ABOR indicate a small shortfall in 2022, but the shortfall is larger based on Lightcast's data. Between 2022 and 2032, the ABOR predicts improvement, the HRSA a worsening of the shortage, and the Lightcast data suggest nearly steady conditions.
- Dental Hygienists: The ABOR and HRSA show significant shortfalls in 2022 while the Lightcast data indicate a balance. Each source indicates a shortage in 2032.
- Genetic Counselors: The limited data suggest a shortage in 2022 and 2032.
- Dieticians and Nutritionists: The ABOR and Lightcast data indicate a shortage in 2022 that becomes slightly larger in 2032.
- Emergency Medical Technicians: A shortfall in 2022 is indicated by the HRSA and the Lightcast data. The HRSA predicts this will turn into a surplus by 2032, while the Lightcast data indicate the shortage will become somewhat larger.
- Respiratory Therapists: The HRSA and the Lightcast data show a small surplus in 2022 becoming a small deficit in 2032.
- Psychologists: A significant shortage in 2022 is indicated by each source. The HRSA predicts the shortage will become considerably larger by 2032, while the other sources suggest little change in magnitude.
- Counselors: The ABOR and the Lightcast data indicate a balance in 2022 and 2032 in substance abuse, behavioral disorder, mental health, and rehabilitation counselors. The HRSA category includes addiction, mental health, and school counselors, with shortages in each of the three subcategories in 2022 and 2032.
- Marriage and Family Therapists: The limited data suggest large shortages in 2022 and 2032.
- Social Workers: The ABOR and the Lightcast data include substance abuse, mental health, and health care social workers. The ABOR indicates a large shortfall in 2022 that will narrow by 2032, while the Lightcast data indicate a balance in 2022 but a small deficit in 2032. The only data available from the HRSA are for child, family, and school social workers.

ECONOMIC IMPACT OF HEALTHCARE EMPLOYMENT IN ARIZONA

This section estimates the economic impact of eliminating healthcare worker shortages in all occupations in Arizona, in 2023 and 2033. The shortages, based largely on Lightcast employment estimates and projections, are displayed in Table 3. Shortage calculations are obtained by comparing Arizona per capita figures with comparable national norms. The economic impact of eliminating these shortages was calculated using the IMPLAN software.

Economic impact analysis is an effective way of demonstrating the total contribution that additional workers in certain industries, a new company, or proposed project will make to the state's economy. It encompasses three types of impact:

- Direct impacts: The jobs, labor income, and state gross domestic product (GDP) contributions generated by the healthcare employees themselves.
- Indirect impacts: The jobs, labor income, and state GDP contributions supported by the employers of the healthcare workers through their local supply-chain purchases.
- Induced impacts: The jobs, labor income, and state GDP supported by the local spending of the healthcare employees.

As the monies associated with supplier purchases and employee spending circulates through the economy, the impact of the initial job creation is "multiplied." Hence, indirect and induced impacts are also called multiplier effects.

Estimates of multiplier effects are made using an "input-output" model — a system of linear equations which describes the interindustry relationships in an economy. The input-output model used in this report is an Arizona-specific version of IMPLAN, a model used widely by researchers throughout the United States. The latest available IMPLAN model was used, based on 2022 data.

The most accurate workforce shortages are measured by the occupational data, but IMPLAN's structure is based on 546 industries. To convert occupational employment to industrial employment, the U.S. Bureau of Labor Statistics' crosswalk of standard occupational codes (SOC) to codes from the North American Industry Classification System (NAICS) is used.[2] Then, the North American Industry Classification System codes are mapped to IMPLAN codes following a scheme made available by IMPLAN.

Economic impacts are measured in terms of three variables: gross domestic product, labor income, and employment:

- State Gross Domestic Product (State GDP): This is synonymous with value added and consistent with national GDP. State GDP represents the dollar value of all goods and services produced for final demand in Arizona. It excludes the value of intermediate goods and services purchased as inputs to final production. It can also be defined as the sum of employee compensation (wages, salaries, and benefits, including employer contributions to health insurance and retirement pensions), proprietors' income, property income, and indirect business taxes.

[2] The crosswalk is available at https://www.bls.gov/oes/tables.htm, under "National industry-specific and by ownership"

- Employment: This is the number of full- and part-time jobs; it includes both wage and salary workers and the self-employed.
- Labor Income: This refers to all forms of employment income, including the wages, salaries, and benefits of employees, and any incomes earned by the self-employed.

Tables 8 and 9 show the economic impact of eliminating healthcare workforce shortages in Arizona in 2023 and 2033, respectively. In 2023, the direct employment shortages amount to 70,437 healthcare jobs, which are associated with direct labor income of $4.3 billion and direct state GDP of $6.1 billion. Eliminating these shortages will also produce additional multiplier effects: 23,652 indirect jobs in all sectors of the Arizona economy, $2.5 billion in state GDP, and $1.6 billion in labor income. Induced effects are estimated at 31,037 additional jobs, $3.5 billion in state GDP, and $1.8 billion in labor income accruing to Arizona residents.

The total effects are substantial, resulting in a total of 125,126 additional workers in Arizona, $12.0 billion in additional state GDP, and $7.8 billion in additional labor income to area residents in 2023. The state GDP effects represent 2.3 percent of Arizona's 2023 GDP,[3] and the employment effects represent 3.6 percent of Arizona's employment.[4]

TABLE 8
ECONOMIC IMPACT OF ELIMINATING HEALTHCARE WORKFORCE SHORTAGES IN ARIZONA, 2023

	State GDP*	Employment	Labor Income*
Total Economic Impact	$11,934	125,126	$7,731
Direct Effects	6,035	70,437	4,320
Indirect Effects	2,449	23,652	1,593
Induced Effects	3,450	31,037	1,818

* In millions of 2023 dollars

Source: Calculated by authors using IMPLAN, State of Arizona, latest version based on 2022 data.

TABLE 9
ECONOMIC IMPACT OF ELIMINATING HEALTHCARE WORKFORCE SHORTAGES IN ARIZONA, 2033

	State GDP*	Employment	Labor Income*
Total Economic Impact	$18,901	197,274	$12,210
Direct Effects	9,613	111,164	6,839
Indirect Effects	3,840	37,095	2,499
Induced Effects	5,448	49,015	2,872

* In millions of 2023 dollars

Source: Calculated by authors using IMPLAN, State of Arizona, latest version based on 2022 data.

[3] Arizona's total 2023 GDP of $508 billion was sourced from the U.S. Bureau of Economic Analysis (BEA).
[4] Lightcast's 2023 employment estimate of 3,512,457 for Arizona was used to calculate this percentage.

The employment multiplier — calculated as the increase represented by jobs created through multiplier effects compared to direct jobs — is 1.8, meaning that every direct healthcare job will create an additional 0.8 jobs in various sectors of the Arizona economy.

In 2033, the direct employment shortages amount to 111,164 healthcare jobs, which are associated with direct labor income of $6.9 billion and direct state GDP of $9.6 billion. Eliminating these shortages will also produce the following multiplier effects: 37,095 indirect jobs in all sectors of the Arizona economy, $3.9 billion in state GDP, and $2.5 billion in labor income. Induced effects are estimated at 49,015 additional jobs, $5.5 billion in state GDP and $2.9 billion in labor income accruing to Arizona residents.

The total effects are again substantial, resulting in a total of 197,274 additional workers in Arizona, $19.0 billion in additional state GDP, and $12.3 billion in additional labor income to Arizona residents in 2033.

Healthcare has been one of Arizona's fastest-growing industries in recent years and if recent trends prevail, the sector will be an important contributor to Arizona's economy going forward. The analysis reveals that continuing efforts to meet the needs of this growing sector will yield significant economic benefits. This will likely require increased opportunities for Arizona workers to acquire the skills needed to succeed in the occupations the sector demands.

SOCIOECONOMIC BENEFITS OF HEALTHCARE: ESTIMATING THE DIRECT MEDICAL COSTS AND PRODUCTIVITY LOSSES OF ILL-HEALTH

The primary objective of this section is to explore the economic costs of ill health. It is very difficult to estimate the social return on investment (SROI) associated with a larger healthcare workforce in the state. Logically, with greater access to healthcare, the incidence and severity of chronic diseases and illnesses could be reduced, which will result in greater quality of life and greater workforce participation. However, the precise nature of the relationship between a healthcare workforce and healthy outcomes is unclear within the literature.

Direct Medical Costs and Production Losses

In June 2009, the Seidman Institute in association with the Morrison Institute proposed a means of measuring the economic cost of poor health as part of a detailed analysis of healthcare in Arizona.[5] This approach was based on three categories of economic costs associated with poor health:

- The resource costs associated with the treatment of a condition or disease, including the costs of physician's visits, tests, medications, and surgical procedures.
- The loss of output, or decline in productivity, when poor health interferes with a person's ability to work, either through absenteeism or presenteeism.[6]
- The loss of life or decline in quality of life because of a disease.

Resource or Treatment Costs

Persons suffering from an illness or disease generate several costs associated with the diagnosis, management, and treatment of their condition. Examples include the cost of physician visits, medication for the management of a disease, psychiatric appointments, surgery, and/or regular blood work to monitor changes. A 2019 analysis by the Partnership to Fight Chronic Disease estimated that treatment of the seven most common chronic diseases, coupled with productivity losses, will cost the U.S. economy $2 trillion annually by 2030.[7] That is equivalent to $8,600 per person. The same analysis also estimated that reductions in unhealthy behaviors could save 1,100,000 lives per year.[8] In Arizona, the Partnership to Fight Chronic Disease also estimates that 24,500 lives could be saved annually through better prevention and treatment of chronic diseases.[9]

The total cost of treating a disease is dependent on two key components: the cost per case and the incidence of that disease in the population. For example, the number of U.S. residents suffering

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[5] See "Truth and Consequences: Gambling, Shifting, and Hoping in Arizona Health Care," https://prism.lib.asu.edu/system/files/c6/TruthConsequences.pdf.

[6] Presenteeism refers to people who suffer from poor health but still attend work, which frequently lowers their productivity.

[7] Partnership to Fight Chronic Disease, (2019). "What is the Impact of Chronic Disease on America?," https://www.fightchronicdisease.org/sites/default/files/pfcd_blocks/PFCD_US.FactSheet_FINAL1%20%282%29.pdf .

[8] Prior to COVID-19, there were fewer than 3 million deaths per year in the United States.

[9] Partnership to Fight Chronic Disease, "What is the Impact of Chronic Disease on Arizona?," https://www.fightchronicdisease.org/sites/default/files/download/PFCD_AZ.FactSheet_FINAL1_0.pdf.

from asthma in 2016 was 30 percent more than the number suffering from coronary heart disease and 2.5 times more than those who had a stroke.[10]

Table 10 estimates the direct medical costs for a range of chronic diseases in the United States in 2016, collated by the Milken Institute. Approximately $1.1 trillion was estimated to be directly spent on treating these diseases in 2016. This represented 5.8 percent of U.S. gross domestic product at that time. The chronic disease with the highest treatment costs was diabetes ($189.6 billion). Other categories with high treatment costs were Alzheimer's disease ($185.9 billion), osteoarthritis ($115.5 billion), gallbladder disease ($79.4 billion), and dyslipidemia ($74.9 billion).[11]

TABLE 10
AVERAGE TREATMENT COSTS FOR CHRONIC DISEASES IN THE UNITED STATES, 2016

Condition	Total Direct Cost in Millions	Cost Per Individual With Condition
Alzheimer's or Vascular Dementia	$185,917	$33,084
Asthma	40,201	1,844
Breast Cancer	23,086	6,291
Chronic Back Pain	66,239	2,098
Colorectal Cancer	18,479	13,723
Congestive Heart Failure	28,281	4,287
Coronary Heart Disease	72,497	4,329
Diabetes Type 2	189,618	7,109
Dyslipidemia	74,887	791
End Stage Renal Disease	5,107	7,285
Endometrial Cancer	3,472	4,781
Esophageal Adenocarcinoma	1,963	42,167
Gallbladder Cancer	52	5,219
Gallbladder Disease	79,415	3,912
Gastric Cardia Adenocarcinoma	4,038	42,167
Hypertension	66,257	843
Liver Cancer	348	5,219
Lung Cancer	14,448	27,404
Osteoarthritis	115,523	2,074
Ovarian Cancer	6,702	30,181
Pancreatic Cancer	537	8,308
Prostate Cancer	17,659	5,724
Renal Cancer	7,770	16,080
Stroke	52,338	5,951
TOTAL	1,074,832	3,300

Source: Milken Institute: Waters, H., and Graf, M. "The Cost of Chronic Disease in the U.S.," August 2018, https://milkeninstitute.org/report/costs-chronic-disease-us.

[10] Waters, H., and Graf, M. "The Cost of Chronic Disease in the U.S.," The Milken Institute, August 2018, https://milkeninstitute.org/report/costs-chronic-disease-us.
[11] Dyslipidemia is a cholesterol imbalance which increases the chance of clogged arteries (atherosclerosis) and heart attacks, stroke, or other circulatory concerns.

In Arizona, according to the Milken Institute, the direct medical cost of the chronic diseases listed in Table 10 was $23.4 billion in 2016, representing approximately 7.5 percent of the state's GDP in that year of $313.1 billion. The direct cost of medical treatments per capita in Arizona was $3,341 in 2016 — 1.2 percent greater than Milken's national average of $3,300 per capita.

Productivity Losses

Workforce productivity losses occur due to absenteeism and presenteeism.

Absenteeism refers to the economic costs associated with workdays that are lost through illness. Mattke et.al. (2007) offered a comprehensive review of the instruments used to measure health-related productivity loss and its costs from 1995 to 2005.[12] Absenteeism costs include lost wages and other forms of compensation, premium pay for temporary help, premium pay for overtime work, and any losses associated with substandard production.

Presenteeism refers to employees who attend work but are unable to function at a normal level because of their illness or disease. Common afflictions which give rise to significant presenteeism costs include depression, arthritis, and lower back pain. The principal difficulty in estimating the costs of presenteeism is finding a valid way to measure the decline in worker productivity.

A 2011 Gallup study estimated the annual economic cost of health-related absenteeism for full-time U.S. workers at $153 billion.[13] Equating to $209 billion in 2023 dollars, Gallup suggests an economic loss of $341 per missed day of work per person.[14] This excludes the absenteeism of part-time workers, and the economic cost of presenteeism for all workers.

The National Institute for Occupational Safety and Health (NIOSH) collates monthly data at a state and national level summarizing the amount of health-related absenteeism among full-time workers during the flu season.[15] This is based on a sample of full-time workers confirming how many hours they actually worked, and the reason for any absence. NIOSH estimates that 2.224 percent of Arizona's full-time workers were absent for a health-related reason during the 2023-24 flu season.

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[12] Mattke, S., Balakrishnan, A., Bergamo, G., and Newberry, S.J., (2011). "A Review of Methods to Measure Health-Related Productivity Loss," *American Journal of Managed Care*, Vol. 13 (4), pages 211-217, https://www.ajmc.com/view/apr07-2472p211-217.

[13] Witters, D., and Agrawal, S., (2011). "Unhealthy U.S. Workers Absenteeism Costs $153 Billion," Gallup, October 17, 2011, https://news.gallup.com/poll/150026/unhealthy-workers-absenteeism-costs-153-billion.aspx.

[14] Witters, D., and Agrawal, S., (2023). "Poor Wellbeing Linked to Formation of New Chronic Conditions," Gallup, October 24, 2013, https://news.gallup.com/poll/512750/poor-wellbeing-linked-formation-new-chronic-conditions.aspx.

[15] Health-related absenteeism encompasses absences due to illness, injury, or other medical reason. Full-time workers are assumed to work 35 hours or more per week. NIOSH's data are available at: https://www.cdc.gov/niosh/topics/absences/default.html#past.

One credible estimate of the costs of absenteeism and presenteeism for several chronic conditions was provided by the MEDSTAT Group at Cornell University.[16] Their costs, shown in Table 11, were based on two assumptions: an average hourly wage of $23.15 (in 2001 dollars), and an average working year of 240 days.

Looking first at the costs of absenteeism, MEDSTAT estimated that people suffering from mental disorders missed on average 25.6 days of work per year at an annual cost of $4,741 per case. People with cancer missed an average of 16.9 days of work per year at a cost of $3,133 per case. Employees with hypertension missed on average 0.9 days of work a year at a cost of $170 per case.

MEDSTAT also provided estimated ranges of hours lost per day and annual dollar impacts per case for presenteeism. The lowest figure for each chronic condition represented their low estimate. The upper figure represented their average estimate.

TABLE 11
ESTIMATING THE INDIVIDUAL COSTS OF ABSENTEEISM AND PRESENTEEISM FOR CHRONIC DISEASES IN THE UNITED STATES

	Absenteeism		Presenteeism			
	Days Absent Per Year Per Case	Annual Impact Per Case*	Hours Lost Per Day Per Case		Annual Impact Per Case*	
			Low	Average	Low	Average
Arthritis	5.9	$1,089	0.5	0.9	$2,778	$5,000
Asthma	12.0	2,221	0.6	0.9	3,334	5,000
Cancer	16.9	3,133	0.2	0.7	1,111	3,889
Diabetes	2.0	365	0.2	0.9	1,111	5,000
Heart Disease	6.8	1,257	0.0	0.5	0	2,778
Hypertension	0.9	170	0.0	0.6	0	3,334
Mental Disorder	25.6	4,741	0.7	1.2	3,889	6,667
Migraine	10.7	1,988	0.7	1.6	3,889	8,890
Respiratory Disorders	14.7	$2,727	1.0	1.4	5,556	7,778

* In 2001 dollars

Source: The MEDSTAT Group: Goetzel, R.Z., Long, S.R., Ozminkowski, R.J., Hawkins, K., Wang, S., and Lynch, W., (2004). “Health, Absence, Disability, and Presenteeism Cost Estimates of Certain Physical and Mental Health Conditions Affecting U.S. Employees,” *Journal of Occupational and Environmental Medicine*, Vol. 46(4): 398-412, https://journals.lww.com/joem/abstract/2004/04000/health,_absence,_disability,_and_presenteeism_cost.13.aspx.

[16] Goetzel, R.Z., Long, S.R., Ozminkowski, R.J., Hawkins, K., Wang, S., and Lynch, W., (2004). “Health, Absence, Disability, and Presenteeism Cost Estimates of Certain Physical and Mental Health Conditions Affecting U.S. Employees,” *Journal of Occupational and Environmental Medicine*, Vol. 46(4): 398-412, https://journals.lww.com/joem/abstract/2004/04000/health,_absence,_disability,_and_presenteeism_cost.13.aspx.

MEDSTAT's lower bound costs of presenteeism were significantly greater than the costs of absenteeism for five of the nine chronic diseases listed. Their average costs of presenteeism were significantly greater than the costs of absenteeism for all nine chronic diseases listed. Individuals suffering from hypertension, for example, missed only one full day of work per year and lost a maximum of 0.6 hours per day in diminished productivity. However, the annual dollar impact of presenteeism for hypertension was considerably higher — that is, up to $3,334 per case compared to an absenteeism cost of only $170 per case.

It is important to note that MEDSTAT's cost estimates were exclusively for the loss of individual productivity. If an individual suffering from a chronic disease worked in a team, they could also affect the productivity of their colleagues. The extent to which this productivity loss extends to other people is dependent on the nature of the work. For some occupations, such as waiters, fast-food cooks, and nonresidential construction workers, MEDSTAT suggested that the spillover effects were negligible. However, team effects were more important for professions such as paralegals, mechanical engineers who work in groups, and motor vehicle salesmen, increasing the estimated cost of absence multiplier by 1.5-to-2 times. A 2005 study at Dow Corning, for example, estimated a mean absence multiplier of 1.61 for 35 types of job, and a median of 1.28.[17]

Mortality and Lower Quality of Life

For many people, the most important consequence of poor health is that it may reduce life expectancy and lower the quality of those years remaining. Life and quality of life are difficult to value. Nevertheless, economists and healthcare professionals have developed a quality-adjusted life year (QALY) system that can be used to make tough decisions involving the rationing of scarce health care resources, or the setting of reasonable standards in safety regulations.

A QALY is a number between 0 and 1, where 0 indicates death and 1 is a state of perfect health. Three different methods have been used to assign value to QALY for a person in a given state of health:

- One method involves a time trade off, where respondents choose between remaining in a state of less than perfect health for a certain period of time, compared to living in perfect health for a shorter period.
- A second method uses a visual analogue scale, where respondents rate different health alternatives ranging from 0 (death) to 100 (perfect health).
- A third method, called the standard gamble, presents a person with the possibility of undergoing a medical procedure that will either restore him to perfect health or result in his death. The probabilities of the two outcomes are adjusted until the person is indifferent between choosing the procedure and remaining in his current condition. The probability of a complete recovery can be used to define QALY.

Aside from the quality issue, the value of a life also needs to be measured. The approach frequently used to assign a monetary value to a year of life is to identify how much money

[17] Nicholson, S., Pauly, M.V., Polsky, D., Baase, C.M., Billotti, G.M., Ozminkowski, R.J., Berger, M.L., and Sharda, C.E., (2005). "How to Present the Business Case for Healthcare Quality to Employers," *Applied Health Economics & Health Policy*, Vol. 4 (4): 209-281, https://link.springer.com/article/10.2165/00148365-200504040-00003

people are willing to spend to reduce their chances of dying. For example, when airbags were an optional extra in car purchases, the market price was $300. For the marginal buyer, the value of the additional safety provided by the airbag was therefore perceived to be $300. The chance that an airbag would save the life of a driver was 1 in 10,000. Multiplying 10,000 by the cost of one air bag establishes a value for a statistical life of at least $3 million.

Most economists offer a range when estimating the statistical value of a life. In July 2020, the Federal Emergency Management Agency (FEMA) estimated the value of a statistical life at $7.5 million per person.[18] In 2021, the Department of Transportation estimated the value of a life at $12.5 million using 2022 as the base year.[19] Based on an average assumption of 42 working years, the value of another year of life could therefore range between $178,600 and $297,600.[20]

Estimating The SROI Associated With Enhanced Health Care Options

The Milken Institute's medical treatment costs per patient and MEDSTAT's estimates of absenteeism and presenteeism are updated to 2023 dollars in Table 12. The BEA's GDP implicit price deflator is used to update Milken's direct costs per patient in 2016 dollars to 2023 dollars. For the absenteeism and presenteeism costs, Seidman used an average hourly wage of $32.06 for Arizona in 2023.[21] MEDSTAT's insights on the days absent per year, and hours lost per day, are assumed to remain constant.

Table 12 suggests that on average the direct medial costs for a patient suffering from one of the nine chronic diseases or illnesses listed is $5,582. This person will be absent on average for 10.6 days a year at an average cost of $2,719. Their cost of presenteeism additionally cost on average $3,078 to $7,694 per year. This sums to an annual average economic loss of $11,379-to-$15,995 per patient (or case) for the nine chronic diseases or illnesses listed in Table 12. That is, $5,582 direct medical costs and $5,797-to-$10,413 indirect costs per patient (or case).

Table 13 presents estimates from the Centers for Disease Control and Prevention (CDC) of the prevalence of several chronic diseases among U.S. adults in 2022. Assuming prevalence percentage rates equally apply to Arizona adults ages 18 to 64 and applying them to the MEDSTAT per case costs in Table 12, Seidman conservatively estimates direct medical costs of $17.1 billion and productivity losses through absenteeism and presenteeism of $21.1-to-$38.1 billion in 2022. This is a conservative estimate as it does not consider every possible aspect of any chronic disease listed. For example, the heart attack prevalence data in Table 13 is used as a

[18] FEMA, (2020). "FEMA Benefit-Cost Analysis (BCA) Toolkit 6.0 Release Notes," July 2020, https://www.fema.gov/sites/default/files/2020-08/fema_bca_toolkit_release-notes-july-2020.pdf.
[19] Department of Transportation, (2021). "Departmental Guidance on Valuation of a Statistical Life in Economic Analysis," March 2021, https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis.
[20] Henricks argues that the average working life of a college graduate is 42 years. For anyone who starts working at 18, it is 46 years. Source: Henricks, M., (2024). "You Have To Work This Many Years Before You Retire," Finance Yahoo! Smart Asset, April 8, 2024, https://finance.yahoo.com/news/many-years-retire-130034309.html.
[21] This is based on BLS' average weekly wage in all industries and for all establishment sizes in Arizona during the first three quarters of 2023. Seidman has summed the average weekly wage for the first three quarters (which are preliminary) and divided by 40, to arrive at an hourly wage.

proxy for heart disease, whereas the CDC also lists prevalence rates for coronary disease and angina, albeit without explaining the extent to which the three categories overlap.

TABLE 12
CURRENT ESTIMATES OF THE COSTS OF MEDICAL TREATMENT, INDIVIDUAL ABSENTEEISM AND INDIVIDUAL PRESENTEEISM FOR SELECT CHRONIC DISEASES OR ILLNESSES IN ARIZONA

	Medical Treatment	Absenteeism		Presenteeism			
				Hours Lost Per Day Per Case		Annual Impact Per Case^	
	Direct Cost *^	Days Absent*	Impact *^	Low	Average	Low	Average
Arthritis	$2,581	5.9	$1,513	0.5	0.9	$3,847	$6,925
Asthma	2,295	12.0	3,078	0.6	0.9	4,617	6,925
Cancer	9,530	16.9	4,335	0.2	0.7	1,539	5,386
Diabetes	8,848	2.0	513	0.2	0.9	1,539	6,925
Heart Disease	5,388	6.8	1,744	0.0	0.5	0	3,847
Hypertension	1,049	0.9	231	0.0	0.6	0	4,617
Mental Disorder	2,846[22]	25.6	6,566	0.7	1.2	5,386	9,233
Migraine	8,500[23]	10.7	2,744	0.7	1.6	5,386	12,311
Respiratory Disorders[24]	9,205[25]	14.7	3,771	1.0	1.4	7,694	10,772
AVERAGE	5,582	10.6	2,719	0.4	1.0	3,078	7,694

* Per year per case
^ In 2023 dollars

Source: Authors' calculations.

[22] This is based on a 2022 study by Soni, which estimated that medical spending in the U.S. to treat 44 million adults with mental disorders totaled $106.5 billion in 2019. Source: Soni, A., (2022). "Healthcare Expenditures for Treatment of Mental Disorders: Estimates for Adults Ages 18 and Older, U.S. Civilian Noninstitutionalized Population," 2019. Agency for Health Care Research and Quality, Statistical Brief #539, February 2022, https://meps.ahrq.gov/data_files/publications/st539/stat539.pdf.

[23] This is the lower bound estimate provided by the Migraine Relief Center. The number is available at: https://www.themigrainereliefcenter.com/costs-of-migraines/#:~:text=Detailing%20the%20costs%20migraine%20sufferers,may%20spend%20%242%2C000%20a%20year.

[24] For the purpose of this study, this encompasses chronic obstructive pulmonary disease, lower and upper respiratory tract infections, interstitial lung disease and sarcoidosis, and pneumoconiosis. It does not include asthma or trachea, bronchus, and lung cancers.

[25] This is an approximation based on direct medical costs in 2016 sourced from Duan et. al (2023), and the percentage prevalence of respiratory disease in the U.S. in 2017 sourced from GBD Chronic Respiratory Disease Collaborators (2020). Seidman assumes that the percentage rate of prevalence is the same in 2016 and applies this to a U.S. Census Bureau population estimate of 324,367,742 in 2016 to arrive at a per patient cost, which is then adjusted to 2023 dollars. Sources: Duan, K.I., Birger, M., Au, D.H., Spece, L.J., Feemster, L.C., Dieleman, J.L., (2023). "Health Care Spending on Respiratory Diseases in the United States, 1996-2016," *American Journal of Respiratory and Critical Care Medicine*, January 15; 2023, Vol. 207(2):183-192, https://www.atsjournals.org/doi/full/10.1164/rccm.202202-0294OC and GBD Chronic Respiratory Disease Collaborators,(2020). "Prevalence and Attributable Health Burden of Chronic Respiratory Diseases, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study," 2017, *Lancet Respiratory Medicine*, 2020, Vol. 8(6):585-596, https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30105-3/fulltext.

TABLE 13
PREVALENCE OF SELECT CHRONIC DISEASES IN THE UNITED STATES, 2022

	Adult Prevalence	95 Percent Confidence Interval	
		Low	High
Arthritis	21.6%	21.0%	22.2%
Current Asthma	8.7	8.3	9.2
Cancer	9.6	9.2	9.9
Diabetes	9.6	9.2	10.0
Heart Attack/Myocardial Infarction	3.0	2.7	3.2
Diagnosed Hypertension	27.2	26.5	27.8
Counseled by a Mental Health Professional	12.6	12.2	13.1
COPD, Emphysema, or Chronic Bronchitis	4.6	4.3	4.9

Note: Data for migraines was not provided by the CDC.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, Interactive Summary Health Statistics for Adults, https://wwwn.cdc.gov/NHISDataQueryTool/SHS_adult/index.html.

Using the Arizona Office of Economic Opportunities medium series population projections for 2023 and 2033, Seidman conservatively estimates direct medical costs of $17.3 billion and productivity losses of $21.4-to-$38.6 billion in 2023 for the eight chronic diseases. Seidman also conservatively estimates direct medical costs of $19.5 billion and productivity losses of $24.1-to-$43.5 billion in 2033 for the eight chronic diseases listed. All amounts are expressed in 2023 dollars.

The CDC also estimates that 18.2 percent of adults nationwide missed six or more workdays in 2022 due to illness, injury, or disability. Applying this to Lightcast's Arizona's projected total employment in 2023 and 2033 in conjunction with Gallup's economic loss of $341 per missed day of work per person,[26] Seidman conservatively estimates annual productivity losses of:

- $1.3 billion in 2023 (range of $1.26 to $1.36 billion).
- $1.5 billion in 2033 (range of $1.42 to $1.53 billion).

The ranges for both years reflect the CDC's 95 percent confidence interval of 17.5 percent and 18.9 percent. The productivity losses are conservative estimates as they assume only six days absence.

Table 14 summarizes the age-adjusted death rates per 100,000 members of the Arizona population and total number of deaths within the state, 2019 through 2021. It is standard practice for mortality statistics to attribute every death to a single underlying condition or cause, even though in reality there could be multiple contributory conditions or causes. This underlying cause is selected by a physician from up to 20 causes or conditions for the death certificate, and is defined as "…the disease or injury that initiated the chain of events leading directly to death."[27]

[26] This is significantly less than the average loss of $547-to-$982 for MEDSTAT's absenteeism and presenteeism for chronic diseases, but appears logical given the inclusion of nonchronic diseases within the calculation.

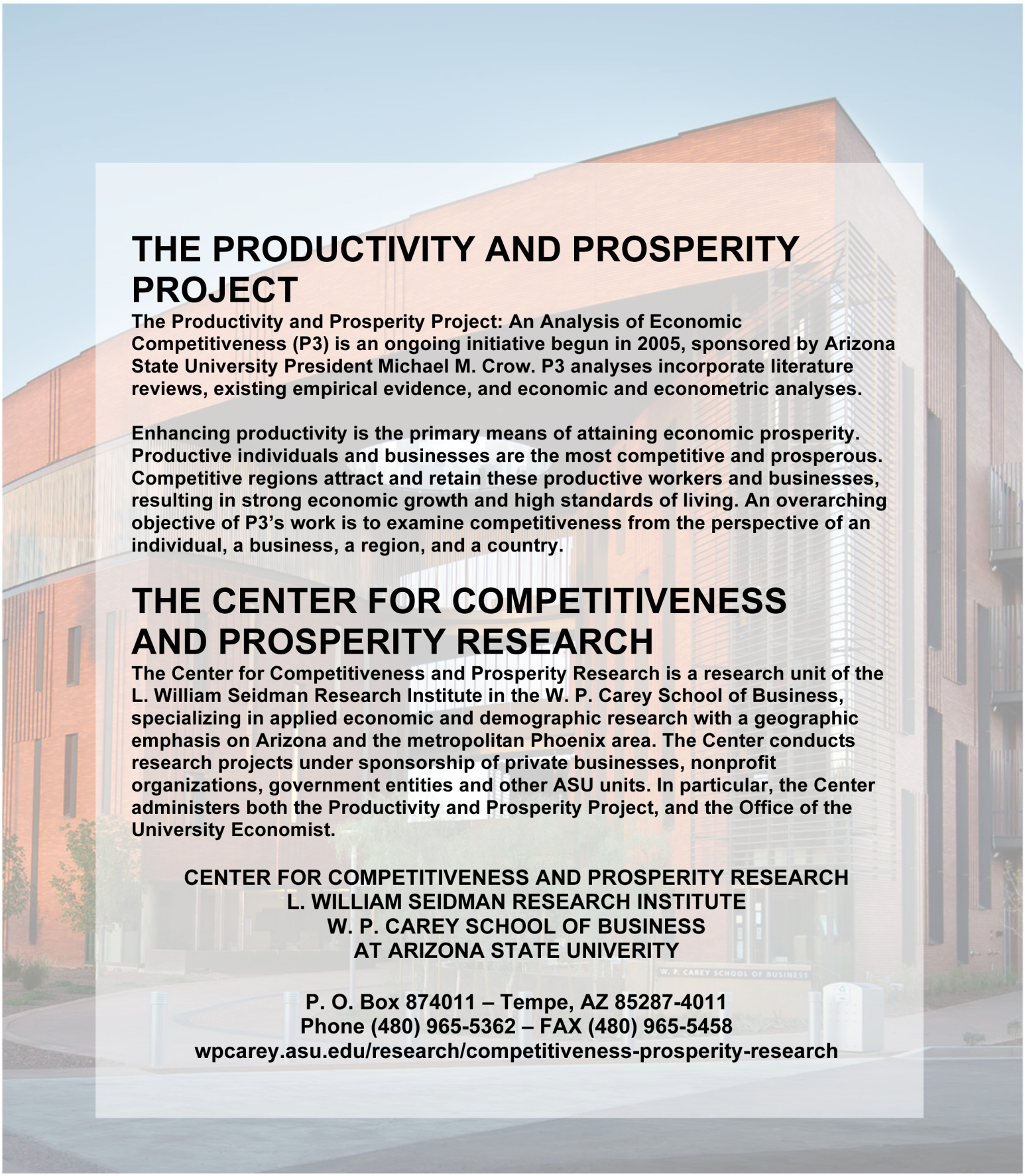
[27] Arizona Health Status and Vital Statistics 2020, https://pub.azdhs.gov/health-stats/report/ahs/ahs2020/pdf/text2b.pdf.

Logically, with an enhanced healthcare worker to patient ratio, the impacts of chronic disease could potentially be mitigated, thereby prolonging life and/or reducing the death rates However, Seidman has been unable to find a reliable and valid way to measure this.

TABLE 14
AGE-ADJUSTED DEATH RATES AND NUMBER OF DEATHS FROM SELECT CHRONIC DISEASES IN ARIZONA

	Age-Adjusted Death Rate Per 100,000			Number of Deaths		
	2019	**2020**	**2021**	**2019**	**2020**	**2021**
Heart	134.0	144.8	158.3	12,587	14,196	14,550
Cancer	131.1	127.7	134.7	12,503	12,676	12,813
Chronic Lower Respiratory Disease	38.1	36.6	36.7	3,685	3,696	3,518
Stroke	30.2	32.7	36.1	2,851	3,227	3,329
Alzheimer's Disease	32.3	32.7	30.5	3,047	3,238	2,754
Diabetes	23.4	26.5	27.3	2,173	2,566	2,559
Chronic Liver Disease	14.5	16.8	21.5	1,217	1,431	1,773
Suicide	18.7	17.6	19.5	1,419	1,363	1,475

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, https://www.cdc.gov/nchs/pressroom/states/arizona/az.htm.



THE PRODUCTIVITY AND PROSPERITY PROJECT

The Productivity and Prosperity Project: An Analysis of Economic Competitiveness (P3) is an ongoing initiative begun in 2005, sponsored by Arizona State University President Michael M. Crow. P3 analyses incorporate literature reviews, existing empirical evidence, and economic and econometric analyses.

Enhancing productivity is the primary means of attaining economic prosperity. Productive individuals and businesses are the most competitive and prosperous. Competitive regions attract and retain these productive workers and businesses, resulting in strong economic growth and high standards of living. An overarching objective of P3's work is to examine competitiveness from the perspective of an individual, a business, a region, and a country.

THE CENTER FOR COMPETITIVENESS AND PROSPERITY RESEARCH

The Center for Competitiveness and Prosperity Research is a research unit of the L. William Seidman Research Institute in the W. P. Carey School of Business, specializing in applied economic and demographic research with a geographic emphasis on Arizona and the metropolitan Phoenix area. The Center conducts research projects under sponsorship of private businesses, nonprofit organizations, government entities and other ASU units. In particular, the Center administers both the Productivity and Prosperity Project, and the Office of the University Economist.

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