

Letters

RESEARCH LETTER

Proportion of Non-US-Born and Noncitizen Health Care Professionals in the United States in 2016

National estimates of the proportion of current health care professionals, including physicians, who are non-US-born or noncitizens are unknown. These proportions may be significant. For example, non-US-born medical graduates comprise approximately one-fifth of practicing US physicians,^{1,2} and among non-US-born medical graduates who match into residency positions in the United States, approximately 60% are not US citizens.³ Using data from

the US Census, this study estimated the proportion of non-US-born and noncitizen health care professionals in the United States in 2016.

Methods | The Harvard institutional review board waived review for this study. Analyses used data from the American Community Survey (ACS), an annual, nationally representative, US Census Bureau-administered survey of US households. The survey, which had a 94.7% response rate in 2016, is collected by mail, telephone, and personal-visit interviews and includes information on all household members.⁴

Table 1. Percentage of US Health Care Professionals Who Were Non-US-Born or Noncitizens, by Health Care Occupation, 2016^a

Health Care Occupation	No. of Health Care Professionals Surveyed, Unweighted	Health Care Professionals, Weighted % (95% CI)	
		Non-US-Born	Noncitizens ^b
Medical and health service managers	7709	14.0 (12.8-15.2)	3.4 (2.7-4.1)
Psychologists	2502	9.5 (8.0-11.0)	2.0 (1.3-2.7)
Counselors (including mental health)	9532	10.1 (9.4-10.9)	3.2 (2.7-3.7)
Chiropractors	627	10.8 (6.9-14.7)	3.0 (1.4-4.6)
Dentists	1975	23.7 (21.1-26.2)	3.9 (2.8-5.0)
Dietitians and nutritionists	1223	17.4 (14.7-20.1)	7.7 (5.7-9.6)
Optometrists	461	16.2 (11.3-21.0)	1.9 (0.9-2.9)
Pharmacists	3610	20.3 (18.8-21.7)	3.7 (2.9-4.4)
Physicians	10 607	29.1 (28.0-30.3)	6.9 (6.3-7.5)
Physician assistants	1080	12.7 (10.0-15.4)	2.6 (1.2-4.0)
Podiatrists	100	11.1 (1.9-20.2)	0.0 (0.0-0.0)
Audiologists	180	5.9 (2.3-9.4)	1.9 (0.0-4.1)
Occupational therapists, physical therapists, and other therapists ^c	9234	12.5 (11.6-13.4)	3.3 (2.9-3.8)
Veterinarians	1008	7.3 (5.4-9.3)	2.5 (1.4-3.6)
Registered nurses	36 796	16.0 (15.5-16.6)	3.3 (3.0-3.6)
Nurse anesthetists	380	8.4 (4.8-12.1)	1.6 (0.0-3.6)
Nurse practitioners and nurse midwives	1875	10.7 (9.2-12.2)	1.3 (0.8-1.8)
Health diagnosing and treating practitioners, all other	372	31.1 (25.6-36.5)	9.2 (5.6-12.8)
Health practitioner support technologists and technicians, health diagnosing and treating practitioner support technicians	6749	12.8 (11.8-13.9)	3.3 (2.7-3.9)
Licensed practical and licensed vocational nurses	10 167	15.0 (14.2-15.9)	4.0 (3.5-4.5)
Other health technologists, technicians, and health care practitioners ^d	18 825	13.1 (12.5-13.6)	3.2 (2.9-3.6)
Nursing, psychiatric, and home health aides	22 463	23.1 (22.4-23.7)	8.7 (8.2-9.2)
Occupational and physical therapy assistants and aides	1448	9.0 (7.1-10.8)	2.4 (1.5-3.3)
Dental assistants	3235	16.5 (14.9-18.0)	5.5 (4.6-6.4)
Medical assistants	5307	17.3 (16.0-18.5)	5.6 (4.8-6.3)
Other health care support occupations ^e	6657	14.7 (13.6-15.8)	5.5 (4.8-6.3)
Total	164 122	16.6 (16.4-16.8)	4.6 (4.4-4.7)

^a Based on data from the US Census Bureau's American Community Survey (ACS) in 2016. Estimates use ACS-provided replicate weights to account for the complex survey design and are nationally representative.

^b Noncitizen health care professionals were a subset of non-US-born health care professionals.

^c Other therapists include radiation therapists, recreational therapists, respiratory therapists, speech language pathologists, exercise physiologists, and other therapists.

^d Includes clinical laboratory technologists and technicians; dental hygienists; diagnostic related technologists and technicians; emergency medical technicians and paramedics; medical records and health information technicians; dispensing opticians; miscellaneous health technologists and technicians; medical, dental, and ophthalmic laboratory technicians; and other health care practitioners and technical occupations.

^e Includes massage therapists, medical transcriptionists, pharmacy aides, veterinary assistants, and laboratory animal caretakers, phlebotomists, medical equipment preparers, and other health care support workers.

Table 2. Distribution of Select US Health Care Professionals by Region of Birth, 2016^a

Region of Birth	All Health Care Professionals		Select Health Care Professionals, Weighted % (95% CI)				
	No. Surveyed, Unweighted ^b	Weighted % (95% CI)	Physicians and Surgeons	Dentists	Registered Nurses	Nursing, Psychiatric, and Home Health Aides	Pharmacists
United States or US territory	139 270	83.4 (83.1-83.6)	70.9 (69.7-72.0)	76.3 (73.7-78.8)	84.0 (83.4-84.5)	76.9 (76.2-77.5)	79.7 (78.2-81.2)
Canada	756	0.4 (0.4-0.5)	1.1 (0.9-1.4)	0.8 (0.4-1.4)	0.6 (0.5-0.7)	0.1 (0.1-0.2)	0.5 (0.3-0.7)
Africa	2094	1.7 (1.6-1.9)	2.2 (1.9-2.6)	1.4 (0.9-2.4)	1.8 (1.6-2.0)	3.4 (3.1-3.8)	2.8 (2.1-3.7)
Asia	10 247	6.4 (6.2-6.5)	17.7 (16.7-18.6)	14.1 (12.2-16.3)	7.8 (7.4-8.3)	4.4 (4.1-4.8)	12.2 (11.0-13.6)
Australia or Pacific Islands	127	0.1 (0.1-0.1)	0.1 (0.0-0.2)	0.0 (0.0-0.4)	0.1 (0.1-0.1)	0.1 (0.0-0.1)	0.1 (0.0-0.3)
Europe	3660	2.3 (2.2-2.4)	4.2 (3.7-4.7)	2.9 (2.1-4.0)	2.2 (2.0-2.4)	1.9 (1.6-2.2)	2.5 (2.0-3.2)
Mexico and Central America or Caribbean	6384	4.7 (4.6-4.8)	2.5 (2.1-3.0)	2.5 (1.7-3.6)	2.8 (2.6-3.1)	11.7 (11.2-12.2)	1.4 (1.1-1.9)
South America	1577	1.0 (1.0-1.1)	1.5 (1.2-1.8)	2.0 (1.2-3.1)	0.8 (0.6-0.9)	1.5 (1.3-1.7)	0.7 (0.4-1.1)

^a Based on data from the US Census Bureau's American Community Survey (ACS) in 2016. Estimates use ACS-provided replicate weights to account for the complex survey design and are nationally representative.

^b The numbers surveyed for all health care professionals do not sum to 164 122 because there are 7 health care professionals for whom birthplace was unknown.

Individuals in self-reported health care occupations were included (for list of occupations, see **Table 1**) based on the US census classification scheme. Non-US-born individuals were defined as those who reported not being born in the United States or US territories and noncitizens were defined as those who were non-US-born who reported not being a US citizen (noncitizens were therefore a subset of non-US-born). First, the proportions of individuals in each health care occupation category who were non-US-born or noncitizens were calculated. Then the proportion of all and selected health care professionals by region of birth was calculated. ACS-provided replicate weights and the complex survey modules in Stata (StataCorp), version 14.2, were used to account for the complex survey design of the ACS.

Results | Our sample included 164 122 health care professionals (which represented 5.2% of the 3 156 487 household members surveyed in the ACS in 2016). Of all US health care professionals, 16.6% (95% CI, 16.4%-16.8%) were non-US-born and 4.6% (95% CI, 4.4%-4.7%) were noncitizens. Non-US-born health care professionals comprised a substantial proportion of several professions: dentists (23.7%; 95% CI, 21.1%-26.2%); pharmacists (20.3%; 95% CI, 18.8%-21.7%); physicians (29.1%; 95% CI, 28.0%-30.3%); registered nurses (16.0%; 95% CI, 15.5%-16.6%); and nursing, psychiatric, and home health aides (23.1%; 95% CI, 22.4%-23.7%) (Table 1). Noncitizens were also represented considerably among dietitians and nutritionists (7.7%; 95% CI, 5.7%-9.6%); physicians (6.9%; 95% CI, 6.3%-7.5%); nursing, psychiatric, and home health aides (8.7%; 95% CI, 8.2%-9.2%); medical assistants (5.6%; 95% CI, 4.8%-6.3%); and dental assistants (5.5%; 95% CI, 4.6%-6.4%) (Table 1). The majority of health care professionals not born in the United States emigrated from Asia (6.4%; 95% CI, 6.2%-6.5%) or Central America or the Caribbean (4.7%; 95% CI, 4.6%-4.8%) (Table 2). Nursing, psychiatric, and home health aides emigrated predominantly from Central America or the Caribbean (11.7%; 95% CI, 11.2%-12.2%).

Discussion | In a nationally representative sample, non-US-born individuals and noncitizens comprised a significant proportion of many health care professions in 2016. These proportions were notable not only among physicians, on which previously conducted studies have focused,¹ but also among the majority of other health care occupations that are important for patient care. As the US population ages, there will be an increased need for many health care professionals, particularly those who provide personal care like home health care aides, a large proportion of whom are currently non-US-born. Limitations of this study include reliance on survey-reported occupation, the possibility of underreporting of non-citizenship by certain subgroups, which has been documented previously with the ACS, and lack of detailed physician specialty information.⁵

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Association Between the Liaison Committee on Medical Education's Diversity Standards and Changes in Percentage of Medical Student Sex, Race, and Ethnicity

To improve diversity in undergraduate medical education, in 2009, the Liaison Committee on Medical Education (LCME) introduced 2 diversity accreditation standards mandating US allopathic medical schools to engage in systematic efforts to attract and retain students from diverse backgrounds and develop programs, such as pipeline and academic enrichment programs, to broaden diversity among qualified applicants.¹ These standards characterized diversity broadly, including but not limited to sex, race/ethnicity, and socioeconomic status. Because individual medical schools undergo accreditation review at least every 8 years, the LCME would have evaluated all schools for adherence by 2017. This observational study examined the change in US medical school matriculant sex, race, and ethnicity after the implementation of the LCME diversity accreditation standards.

Methods | This study was deemed exempt by the Yale University Institutional Review Board. We used Association of American Medical Colleges data that documented the number of matriculants by self-reported sex, race, and ethnicity, based on fixed categories consistent with the US Census, for all US LCME-accredited medical schools from 2002 through 2017. Historically black medical schools, schools in Puerto Rico, and schools not present throughout the entire study period were excluded (n = 30). School data were aggregated,

and the percentages of female, black, Hispanic, Asian, and white medical students were calculated for each year. Native American and Hawaiian students were not included in the analysis because of small numbers.

We used interrupted time series analysis² to evaluate the relationship between the implementation of the LCME diversity accreditation standards and the annual percentage of female, black, Hispanic, Asian, and white matriculants. Models were corrected to account for serially autocorrelated observations. A linear regression was performed assuming linear trends. Analyses were performed to account for a 1-, 2-, and 3-year postimplementation period. Because the length of the postimplementation period did not change significance for most results, we present results beginning in 2012, 3 years after the implementation of the diversity accreditation standards. Analyses were performed using Stata (StataCorp), version 14. Statistical significance was defined as a 2-sided $P < .05$.

Results | The final sample included 120 medical schools, with the number of matriculants increasing from 15 976 in 2002 to 18 853 in 2017. In 2002, 49.0% of matriculants identified as female, 6.8% as black, 5.4% as Hispanic, 20.8% as Asian, and 67.9% as white. By 2017, 50.4% of matriculants identified as female, 7.3% as black, 8.9% as Hispanic, 24.6% as Asian, and 58.9% as white.

From 2002 to 2009, before the implementation of the LCME diversity accreditation standards, the percentage of female and black matriculants decreased annually, while the percentage of Hispanic and Asian matriculants increased (Figure). There was no significant annual change in the percentage of white matriculants during that time.

After the implementation of LCME diversity accreditation standards (2012-2017), the annual trend in the percentage of female and black matriculants reversed, increasing significantly relative to the trend from 2002 to 2009, while the annual trend in the percentage of Hispanic matriculants continued to increase (Figure). There was no significant difference in the annual trend in the percentage of Asian matriculants between 2012 to 2017 and 2002 to 2009. However, the overall percentage of white matriculants decreased by 4.2% in 2012 (95% CI, -0.44% to -8.0%; $P = .03$), the first postimplementation year. After 2012, there was no significant change in the annual trend of white matriculants.

Discussion | An association was observed between the implementation of the LCME diversity accreditation standards and increasing percentages of female, black, and Hispanic matriculants in US medical schools. Because this study was observational, causality cannot be demonstrated and there may be variables unaccounted for that were responsible for the change in matriculant demographics. Nevertheless, the authors are unaware of other national policies associated with medical school matriculant diversity during the study period. The number of pipeline programs and the use of holistic review by admissions committees may have increased after the implementation of the LCME diversity accreditation standards, which could account for some of the study's findings. While the results are promising, disparities in physician workforce diversity persist.³