

U.S. Immigration Policy and American Medical Research: The Scientific Contributions of Foreign Medical Graduates

Dhruv Khullar, MD, MPP; Daniel M. Blumenthal, MD, MBA; Andrew R. Olenski, BS; and Anupam B. Jena, MD, PhD

Recently proposed changes to U.S. immigration policy, such as President Donald J. Trump's executive order suspending the entry of persons from several Muslim-majority countries and stricter regulations on work visas, have raised moral, legal, and geopolitical questions for the United States. They also have engendered clinical and biomedical research concerns for the U.S. medical community.

Policies that threaten the long-standing ability of foreign medical graduates (FMGs) to train and practice in the United States have prompted heightened recognition of the important role these physicians play in the U.S. health care system. Foreign medical graduates make up nearly a quarter of the physician workforce and disproportionately practice in underserved areas as well as in specialties with practitioner shortages (1). More than half of internal medicine residency positions are filled by FMGs, and patients cared for by FMGs have mortality rates similar to, if not lower than, those cared for by U.S. graduates (2, 3). Some states and hospitals rely heavily on physicians in the H-1B visa program, which the Trump administration recently proposed revamping (4).

Although much of the recent discussion within the medical community has focused on the clinical effect of FMGs, scientists at large have raised concerns about the potential effect of more restrictive immigration policies on scientific research in the United States. Leading scientific and academic organizations have urged President Trump to rescind the recent executive order, citing concerns about attracting international research talent and maintaining America's scientific leadership on the global stage (5).

We sought to examine the scientific contributions of FMGs to the U.S. biomedical research enterprise. The free exchange of expertise and ideas, as well as a diversity of backgrounds and experiences, generally is considered vital for scientific progress. However, few studies have rigorously evaluated the contributions of FMGs to research scholarship, innovation, and mentorship.

To assess the effect of FMGs on research, we analyzed data from Doximity, a cross-sectional database of all U.S. physicians (6). Doximity assembles information on physicians from several sources, including the National Plan and Provider Enumeration System, state licensing boards, specialty societies, collaborating medical schools and hospitals, and self-registered physicians. As of 7 July 2015, the date to which our data are current, 24% of U.S. physicians were registered

members (although the database includes information on all physicians, not just registered members). In addition to information on medical school, residency, and fellowship training, Doximity includes the following information for each physician, using linkage based on name: number of publications in PubMed, number of National Institutes of Health (NIH) grants for which the physician was a principal investigator (from the NIH RePORT [Research Portfolio Online Reporting Tools] database), number of registered clinical trials for which the physician was a principal or subinvestigator (from ClinicalTrials.gov), and faculty rank for physicians with U.S. medical school appointments (from the Association of American Medical Colleges faculty roster database). Foreign medical graduates were defined as physicians who graduated from a non-U.S. medical school, including U.S. citizens educated abroad. The dataset's accuracy was validated previously through a manual audit of a randomly selected physician cohort (6).

Among 778 781 physicians practicing in the United States in 2015, 164 111 (21.1%) were FMGs and 614 670 (78.9%) were domestic medical graduates.

We found that FMGs play a substantial role in clinical teaching, mentorship, and biomedical research (Table). Among 82 737 U.S. academic physicians, 15 075 (18.3%) were FMGs. Of the 18 653 full professors, 2808 (15.1%) completed medical school in other countries, with physicians educated in Asia, western Europe, the Middle East, and Latin America and the Caribbean most highly represented.

Foreign medical graduates account for a considerable share of biomedical research scholarship. They were responsible for 18.0% of all publications, 18.5% of first-authored publications, and 16.5% of last-authored publications. Foreign medical graduates led 12.5% of NIH grants (1526 of 12 155), despite being ineligible for certain NIH awards, and led 18.5% of clinical trials (2276 of 12 324). By traditional research metrics, then, FMGs contribute substantially to the generation, publication, and application of biomedical research in the United States.

The value of a culturally and ethnically diverse physician-investigator workforce extends beyond scholarly publications and research grants to many benefits not captured by our data. Physicians educated abroad provide unique perspectives that trigger conversations we otherwise may not have. They serve as mentors to students, residents, and young investigators, and their presence and their work send a signal that medical science is ultimately about truth, progress, and reducing

Table. Scientific Contributions of Foreign Medical Graduates*

Variable	All Professors in the United States	Full Professors in the United States	All Publications†	All NIH Grants‡	All Clinical Trials‡
Overall	18.3	15.1	18.0	12.5	18.5
Region of medical school training					
Asia	7.2	4.3	5.5	2.5	6.9
Latin America and the Caribbean	2.5	1.8	2.5	1.3	2.2
Western Europe	2.4	2.9	3.2	3.5	2.9
Middle East	1.8	1.5	1.9	1.2	2.0
Africa	1.3	1.2	1.4	1.0	1.2
North America (excluding the United States)	1.2	1.7	1.8	2.2	1.9
Other	1.9	1.7	1.7	0.8	1.4

NIH = National Institutes of Health.

* Values are percentages.

† Those indexed in PubMed as of December 2015.

‡ Based on grants in which the principal investigator listed in the NIH Research Portfolio Online Reporting Tools database or the trial investigator listed on ClinicalTrials.gov was a foreign medical graduate.

human suffering—regardless of the background of patients or investigators.

Although FMGs have important clinical and research roles in the United States, their presence is not without controversy. Large numbers of FMG applicants in the National Resident Matching Program may contribute to U.S. graduates going unmatched, especially as the number of domestic graduates increases. A recent Canadian study found that FMGs are disciplined at higher rates than North American graduates, although we are unaware of similar findings in the United States (7). Perhaps most concerning is the phenomenon of “brain drain,” by which doctors leave developing countries to practice in the United States, leading to physician shortages in low-income nations contending with endemic diseases (8). This loss likely is offset only partially by any “brain gain”: clinical and educational connections between the United States and developing countries as well as remittances sent home to family and communities (9).

Our analysis has limitations. Although the accuracy of the Doximity database has been validated, we cannot rule out inaccuracies due to matching errors, although these should be unrelated to FMG status. Because the dataset is cross-sectional, we also cannot assess changes in the numbers of FMGs practicing in the United States or their relative contributions over time.

Physicians educated abroad but working in the United States play a critical role in promoting and maintaining America's biomedical competitiveness. Our findings suggest that they account for nearly a fifth of U.S. biomedical research scholarship. By hampering the ability of FMGs to learn from and contribute to the academic medical community in the United States, we risk worsening the health of patients, weakening our position as a global leader in medical innovation, and compromising our aspirational commitment to the ideals that spur scientific progress: collaboration, understanding, and the free exchange of ideas.

From Weill Cornell Medical College and Columbia University, New York, New York; Massachusetts General Hospital and

Harvard Medical School, Boston, Massachusetts; and National Bureau of Economic Research, Cambridge, Massachusetts.

Grant Support: Dr. Jena was supported by the Office of the Director, NIH (NIH Early Independence Award, grant 1DP5OD017897-01). Dr. Blumenthal is supported by the John S. LaDue Memorial Fellowship at Harvard Medical School.

Disclosures: Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M17-1304.

Requests for Single Reprints: Anupam B. Jena, MD, PhD, Department of Health Care Policy, Harvard Medical School, 180 Longwood Avenue, Boston, MA 02115; e-mail, jena@hcp.med.harvard.edu.

Current author addresses and author contributions are available at Annals.org.

Ann Intern Med. 2017;167:584-586. doi:10.7326/M17-1304

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Current Author Addresses: Dr. Khullar: Weill Cornell Medical Center, 402 East 67th Street, New York, NY 10065.

Dr. Blumenthal: Cardiology Division, Massachusetts General Hospital, 55 Fruit Street, Yawkey Building, Suite 5B, Boston, MA 02114.

Mr. Olenski: Department of Economics, Columbia University, 420 West 118th Street, New York, NY 10027.

Dr. Jena: Department of Health Care Policy, Harvard Medical School, 180 Longwood Avenue, Boston, MA 02115.

Author Contributions: Conception and design: D. Khullar, D.M. Blumenthal, A.B. Jena.

Analysis and interpretation of the data: D. Khullar, D.M. Blumenthal, A.R. Olenski, A.B. Jena.

Drafting of the article: D. Khullar, D.M. Blumenthal, A.B. Jena.

Critical revision for important intellectual content: D. Khullar, D.M. Blumenthal, A.R. Olenski, A.B. Jena.

Final approval of the article: D. Khullar, D.M. Blumenthal, A.R. Olenski, A.B. Jena.

Provision of study materials or patients: D.M. Blumenthal.

Statistical expertise: A.R. Olenski, A.B. Jena.

Obtaining of funding: A.B. Jena.

Administrative, technical, or logistic support: A.R. Olenski, A.B. Jena.

Collection and assembly of data: D.M. Blumenthal, A.B. Jena.