Entry of Medical School Graduates Into Family Medicine Residencies: 2016–2017
Stanley M. Kozakowski, MD; Alexandra Travis; Julie P. Marcinek, DO; Ashley Bentley, MBA; Gerald T. Fetter Jr, MSHA

BACKGROUND AND OBJECTIVES: This annual report is an expansion on previous reports in this series that provides further evidence that the current medical school system is failing, collectively, to produce the primary care workforce that is needed to achieve optimal health in the United States. Inclusion of data on the performance of DO-granting and international medical schools, creates a more complete and complex picture of the contribution of all medical school types to the primary care workforce that should allow stakeholders to set goals, identify institutions with models from which to learn, and develop strategies for continuous improvement. US MD graduates made up 49% of the entering first-year class of family medicine residencies accredited by the Accreditation Council for Graduate Medical Education (ACGME), a percentage that is not statistically changed from the 11-year average of 46%. Over the same time, the percentage of DO graduates in the entering class has been increasing at an annual rate of 1%, while the percentage of international graduates has been decreasing in a reciprocal manner. Production of family medicine graduates has varied widely between and within medical school types. The number of graduates entering family medicine programs accredited by the ACGME underrepresents the overall family medicine output by US medical schools since up to a third of DO graduates have historically entered residencies accredited only by the American Osteopathic Association. While marked differences between public and private continue among US MD-granting medical schools, the percentages are nearly equal between public and private for DO-granting medical schools, with a slightly higher percentage for private schools.

Methods
The authors used the same methodology as has been reported in previous articles in this series to conduct an annual online census to identify all residents in ACGME-accredited family medicine residency programs. They also used the most recent data from the LCME Annual Medical School Questionnaire, Part II, and the American Association of Colleges of Osteopathic Medicine (AACOM) Fast Facts About Osteopathic Medical Education. Data is combined for US MD-granting and DO-granting medical schools for analysis where possible.

From the Medical Education Division, American Academy of Family Physicians, Leawood, KS (Dr Kozakowski, Ms Travis, Ms Bentley, and Mr Fetter); and the Robert Graham Center, Washington, DC (Dr Marcinek).
International medical schools are considered separately for some of the analysis because of data limitations. Rank order lists for US MD-granting and DO-granting medical schools, based on the last 3 years’ average percentage of graduates who became family medicine residents, were created using the AAFP census data from 2014-2016. Percentages of graduates from July 2015 to June 2016 who entered ACGME-accredited family medicine residency programs as PGY-1 residents were calculated and organized by state for both MD- and DO-granting medical schools based upon the total number of graduates and the number entering ACGME-accredited family medicine programs. States were also ranked by the absolute number of medical school graduates entering family medicine during the same period.

Analysis
Descriptive analysis and ordinary least squares (OLS) regression were utilized to assess the relationship between the year and each of the types of medical school and graduates for the entering classes between 2006-2007 and 2015-2016. Significance was defined at the .05 level, and analyses were conducted using IBM SPSS 24 Base Edition (IBM, New York, NY).

The residency census was granted an exemption from the AAFP Institutional Review Board.

Results
All ACGME-accredited family medicine residency programs completed the annual AAFP online census to achieve a 100% response rate.

Composition of Entering Class by Type of Medical School
In 2016, 3,658 medical school graduates matriculated into ACGME-accredited family medicine residency programs as first-year residents. US MD graduates compose 49% of the entering first year resident class, a percentage that is not statistically significant when compared with the 11 year mean of 46%. The percentage of DO graduates and international graduates in the first-year class has changed in a nearly reciprocal fashion over the last decade. DO graduates have increased approximately 1% per year ($P=0.038$) from 14% in 2006 to 21% in 2016, while international graduates have had a reciprocal annual 1.4% decrease ($P=0.038$) from 38% in 2006 to 31% in 2016 (Figure 1).

Categorically, MD- and DO-granting medical schools had different rates in the production of graduates selecting family medicine (Table 1). There are four times as many MD-granting medical schools as DO-granting medical schools. Although there are fewer total graduates, the DO-granting medical schools’ rate of graduates entering family medicine is nearly 60% greater than that of US MD-granting medical schools (15.1% vs 9.6%). It is important to qualify that DO graduates also enter AOA-only accredited residency programs, and those graduates are not included in this analysis. Data is unavailable for all the international medical schools making a similar comparison impossible.

![Figure 1: Percent of PGY-1 Residents in ACGME-Accredited Family Medicine Residency Programs, by Type of Medical School, 2006-2016](image-url)
The number of graduates from MD- and DO-granting medical schools produced 80% of the MD-granting and DO-granting medical schools. The number of graduates entering family medicine from 30.3% (New Mexico) to 5.0% (Puerto Rico) (see Table E at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). States were ranked by the production of all medical students entering family medicine residencies from the MD- and DO-granting schools located within the state (see Table F at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). Five states had 20% or more of all graduates enter family medicine (New Mexico, South Dakota, North Dakota, Kansas, and Arkansas). Ten states containing medical schools produce half of the graduates entering ACGME-accredited family medicine residency programs. Eight states produce more than 100 graduates each entering ACGME-accredited family medicine residency programs. Seven states (Ohio, Florida, Missouri, Kentucky, Georgia, Louisiana, and Texas) were below the national average of population to primary care physician ratio and produced fewer than the national average of MD-granting medical school graduates entering family medicine.

The percent of students graduating from MD- and DO-granting US medical schools, 10 schools produced 30 or more graduates entering family medicine in 2016 (see Table A at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). Fifty-four percent of the schools (73/136) produced 80% of the MD-granting graduates choosing family medicine while the eight lowest schools on the rank list only produced one graduate entering family medicine each. The greatest number of graduates entering family medicine residencies was from the University of Minnesota Medical School, with 45. The University of New Mexico had the highest percentage at 30.3%.

Among the MD-granting medical schools, 10 schools produced 30 or more graduates entering family medicine in 2016 (see Table A at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). Fifty-four percent of the schools (73/136) produced 80% of the MD-granting graduates choosing family medicine while the eight lowest schools on the rank list only produced one graduate entering family medicine each. The greatest number of graduates entering family medicine residencies was from the University of Minnesota Medical School, with 45. The University of New Mexico had the highest percentage at 30.3%.

All DO-granting schools with graduates in 2016 had students enter ACGME-accredited family medicine programs (see Table B at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). Twelve schools had 30 or more students enter family medicine. Twenty of the 34 schools with graduates produced 80% of the DO-granting graduates entering family medicine. Chicago College of Osteopathic Medicine, Midwestern University had the greatest absolute number of students (48), while Pacific Northwest University College of Osteopathic Medicine had the highest percentage of students (25.4%) entering family medicine.

Six international medical schools (Ross University School of Medicine, St George’s University School of Medicine, American University of the Caribbean School of Medicine, American University of Antigua College of Medicine, Saba University School of Medicine, and University of Medicine and Health Sciences, St Kitts) each produced 30 or more graduates entering family medicine and combined account for 74% of the total number of international students entering family medicine residencies (see Table C at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). The greatest number of graduates entering family medicine residencies was from Ross University School of Medicine with 216, followed by St George’s University School of Medicine with 141.

**Medical School Location**

The number of graduates from MD- and DO-granting medical schools and entry rates into family medicine residency programs were calculated by US census region and state in 2016 (see Table D at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686). The Mountain region had the highest percentage of students entering family medicine (14.8%), while the Middle Atlantic region had the lowest percentage (7.1%) among the contiguous states.

In aggregate, schools east of the Mississippi River had almost double the total number of graduates of schools west of the Mississippi, and had 506 more graduates enter family medicine than those west of the Mississippi. However, the western medical schools graduated students entering family medicine at a higher rate than schools east of the Mississippi (13.0% vs 9.7%). Overall, the average percentage of MD and DO graduates entering family medicine was 10.9%. Not every state or territory has a medical school located within its boundaries. Of those US states and territories with medical schools, the number of graduates from MD- and DO-granting schools entering family medicine residencies ranged from 191 (California) to 6 (Hawaii) with a mean of 56, median of 40, and standard deviation of 49. States and territories ranked in the rate of students entering family medicine from 30.3% (New Mexico) to 5.0% (Puerto Rico) (see Table E at http://www.stfm.org/FamilyMedicine/ Vol49Issue9/Kozakowski686).

**Table 1: Number and Percentage of US Medical School Graduates Entering ACGME-Accredited Family Medicine Residency Programs as PGY-1 Residents by MD/DO Medical School, 2016**

<table>
<thead>
<tr>
<th>Programs</th>
<th>Number of Graduates July 2015 to June 2016</th>
<th>First-year Family Medicine Residents Number</th>
<th>First-year Family Medicine Residents Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>US MD-granting (136)</td>
<td>19,036</td>
<td>1,833</td>
<td>9.6%</td>
</tr>
<tr>
<td>DO-granting (34)</td>
<td>5,472</td>
<td>827</td>
<td>15.1%</td>
</tr>
<tr>
<td>TOTAL (170)</td>
<td>24,508</td>
<td>2,660</td>
<td>10.9%</td>
</tr>
</tbody>
</table>

2 American Association of Colleges of Osteopathic Medicine, Office of Research and Information Services.
3 American Academy of Family Physicians, Annual Survey of Medical Schools.
medical schools who remain in state for residency varies from 0% in the District of Columbia and New Hampshire to 78.0% in California (mean 42.9%, median 36.9%, SD=16.7%) (see Table G at http://www.stfm.org/FamilyMedicine/Vol49Issue9/Kozakowski686).

Medical School Structure
Fifty-four percent (92/170) of US medical schools are publicly owned (see Table H at http://www.stfm.org/FamilyMedicine/Vol49Issue9/Kozakowski686). In aggregate, public schools had a slightly higher percentage of their graduates matriculate into family medicine residency programs in comparison to private schools (11.4% vs 10.2%). Most DO-granting medical schools are privately owned and produce more than twice the percentage of graduates entering ACGME-accredited family medicine residency programs than privately-owned US MD-producing medical schools. Ninety-three percent (126/136) of MD-granting medical schools have departments or divisions of family medicine (see Table I at http://www.stfm.org/FamilyMedicine/Vol49Issue9/Kozakowski686). Those schools produce more than four times the rate of students entering family medicine in comparison to the eight schools that do not have a department or division. Two schools without family medicine departments have divisions of family medicine and have a rate of twice as many graduates enter family medicine as those that have a center of family medicine or lack any family medicine structure. The numbers and percentages of DO-granting and international medical schools that have departments of family medicine is unknown.

Three-Year Averages
The authors have expanded the annual tradition of creating a rank order list of the top 20 MD-granting medical schools based upon 3-year rolling average of family medicine graduation rates by adding a rank order list of DO-granting medical schools (Table 2). Three-year rolling average graduation rates have not been tracked in the past for the international medical schools.

Table 2: Rankings of Top 20 US MD-Granting and DO-Granting Medical Schools Based on 3-Year Average Graduation Rates of PGY-1 Residents Entering ACGME-Accredited Family Medicine Residency Programs as PGY-1 Residents, 2016

<table>
<thead>
<tr>
<th>US MD-Granting Medical School</th>
<th>Percent</th>
<th>DO-Granting Medical School</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Mexico, University of</td>
<td>20.7%</td>
<td>Des Moines University, College of Osteopathic Medicine, Des Moines DMU-COM</td>
<td>28.0%</td>
</tr>
<tr>
<td>East Carolina University</td>
<td>19.6%</td>
<td>Western University College of Osteopathic Medicine of the Pacific, Pomona WUHS/COMP</td>
<td>23.4%</td>
</tr>
<tr>
<td>Minnesota, University of</td>
<td>18.9%</td>
<td>Chicago College of Osteopathic Medicine, Midwestern University, Downers Grove CCOM/MWU</td>
<td>23.1%</td>
</tr>
<tr>
<td>Kansas, University of</td>
<td>18.9%</td>
<td>Touro University College of Osteopathic Medicine, Vallejo TUCOM-CA</td>
<td>23.0%</td>
</tr>
<tr>
<td>South Carolina, University of (Greenville)</td>
<td>18.4%</td>
<td>University of North Texas Health Science Center, College of Osteopathic Medicine, Fort Worth UNT/THSC/TCOM</td>
<td>21.7%</td>
</tr>
<tr>
<td>Arkansas, University of</td>
<td>18.1%</td>
<td>Pacific Northwest University College of Osteopathic Medicine, Yakima PNWU-COM</td>
<td>21.6%</td>
</tr>
<tr>
<td>South Dakota, University of</td>
<td>17.8%</td>
<td>A.T. Still University - School of Osteopathic Medicine in Arizona ATSU-SOMA</td>
<td>20.7%</td>
</tr>
<tr>
<td>Texas Tech University (Lubbock)</td>
<td>17.7%</td>
<td>William Carey University College of Osteopathic Medicine, Hattiesburg WCU-COM</td>
<td>20.2%</td>
</tr>
</tbody>
</table>

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Discussion
This annual report is an expansion on previous reports in this series that serve as a barometer for advocates, policy makers, and other stakeholders who recognize the need for a robust primary care workforce and seek data and analysis that can be used to gauge their own performance. In expanding the report to include data on the performance of DO-granting and international medical schools, a more complete picture of the contribution of all medical school types and their contribution to the primary care workforce should allow stakeholders to set goals, identify institutions with models from which to learn, and develop strategies for continuous improvement.

Understanding top performing schools and programs may be a step toward bolstering the primary care workforce. Rank order lists by medical school type allow comparisons as to the overall contribution of schools to the family medicine workforce. This allows recognition of top performing schools, competition between schools to increase their family medicine production, and a starting point for the creation of a continuous learning and action network to help advance the work being done across schools to adopt programs, policies, and procedures that result in increased production of students choosing family medicine.

The differences in the production between types of medical schools, medical school structure, location, and individual schools may serve as a tool to develop best practices for states and institutions to improve their impact on the nation’s primary care workforce.

The authors have previously reported on the marked difference in

<table>
<thead>
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<th>Percent</th>
<th>DO-Granting Medical School</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Nevada, University of</td>
<td>17.7%</td>
<td>Lake Erie College of Osteopathic Medicine, Erie LECOM</td>
<td>17.6%</td>
</tr>
<tr>
<td>Oregon Health &amp; Sciences University</td>
<td>17.0%</td>
<td>Michigan State University College of Osteopathic Medicine, East Lansing MSUCOM</td>
<td>17.2%</td>
</tr>
<tr>
<td>North Dakota, University of</td>
<td>16.4%</td>
<td>Rocky Vista University College of Osteopathic Medicine, Parker RVUCOM</td>
<td>16.6%</td>
</tr>
<tr>
<td>Washington, University of</td>
<td>16.3%</td>
<td>University of Pikeville - Kentucky College of Osteopathic Medicine, Pikeville UP-KYCOM</td>
<td>15.9%</td>
</tr>
<tr>
<td>Oklahoma, University of</td>
<td>16.2%</td>
<td>A.T. Still University - Kirksville College of Osteopathic Medicine ATSU-KCOM</td>
<td>15.5%</td>
</tr>
<tr>
<td>Uniformed Services University</td>
<td>15.7%</td>
<td>Ohio University Heritage College of Osteopathic Medicine, Athens OUCHCOM Athens</td>
<td>15.2%</td>
</tr>
<tr>
<td>Michigan State University</td>
<td>15.2%</td>
<td>Philadelphia College of Osteopathic Medicine, Philadelphia PCOM</td>
<td>15.0%</td>
</tr>
<tr>
<td>Florida State University</td>
<td>15.2%</td>
<td>Lincoln Memorial University Debusk College of Osteopathic Medicine LMU-DCOM</td>
<td>14.6%</td>
</tr>
<tr>
<td>Loma Linda University</td>
<td>14.9%</td>
<td>Western University College of Osteopathic Medicine of the Pacific, Lebanon WUHS/COMP-NW</td>
<td>14.5%</td>
</tr>
<tr>
<td>Iowa, University of</td>
<td>14.9%</td>
<td>Edward Via College of Osteopathic Medicine - Carolinas Campus, Spartanburg VCOM-CC</td>
<td>14.1%</td>
</tr>
<tr>
<td>Nebraska, University of</td>
<td>13.9%</td>
<td>Edward Via Virginia College of Osteopathic Medicine, Virginia Campus VCOM-VC</td>
<td>13.8%</td>
</tr>
<tr>
<td>Meharry Medical College</td>
<td>13.8%</td>
<td>University of New England College of Osteopathic Medicine, Biddeford UNECOM</td>
<td>13.5%</td>
</tr>
</tbody>
</table>

Source: American Academy of Family Physicians
family medicine output based upon the governance structure of US MD-granting medical schools (public vs private). While the differences persist between public and private among US MD-granting medical schools, the percentages are nearly equal between public and private for DO-granting medical schools, with a slightly higher percentage for private schools. The reasons for these differences of public vs private between US MD-granting and DO-granting medical schools are not understood and will require additional study. Such a study could lead to potential strategies to increase the production of family physicians at private US MD-granting medical schools. The administrative structure of medical schools by the presence of a department of family medicine or other administrative structure is unpublished for DO-granting and international medical schools. US MD-granting medical schools with departments of family medicine continue to produce graduates entering family medicine at much higher rates than all other administrative structures.

A concern is that medical school growth has not been matched by growth of primary care residency programs. The extent of this discrepancy may currently be masked by a seeming increase in the number of residency programs that is partially due to conversion of primary care residency spots from AOA to ACGME programs. To achieve the triple aim of health care—better health, better health care, and reducing per capita costs of health care, the Council on Graduate Medical Education’s 20th report, “Advancing Primary Care,” recommended that policies should be implemented that raise the percentage of primary care physicians in the physician workforce to a minimum of 40%. The most recent estimates from 2008 indicate that primary care physicians represented 35% of the US physician workforce in direct patient care, a rate that is declining. A major overhaul of the graduate medical education system (GME) is required to address the mismatch between the health needs of the population and the specialty make-up of the physician workforce. To achieve accountability and transparency, GME reform must include a nonpartisan oversight group to: (1) develop a strategic plan for Medicare GME funding; (2) research and develop policies regarding the sufficiency, geographic distribution, and specialty configuration of the physician workforce; (3) collect data; and (4) provide accountability to the public.

There has also been displacement of international medical graduates (IMGs) entering family medicine programs by DO graduates, rather than growth of overall positions. IMGs currently represent approximately one fourth of the practicing physician workforce, disproportionately serve socioeconomically disadvantaged populations, and are more likely to be practicing one of the primary care specialties. Foreign-born IMGs increase the diversity of the US workforce. Some studies suggest that IMGs are more likely to practice in rural areas than DO graduates, however other studies indicate that IMGs are no more likely than graduates from US MD- and DO-granting medical schools to practice in rural underserved areas. The impact of the displacement of non-US citizen IMGs by DO students in ACGME programs is unknown and deserves future research.

Comparisons between programs should be taken with caution. The DO-granting medical school list is qualitatively different than the US MD-granting list. Whereas the US MD-granting list includes all graduates who enter family medicine residency programs, the list for the DO-granting schools captured in the AAFP census of ACGME-accredited programs underrepresents the total production of family physicians by DO-granting schools. The authors hope to access data on the 35% of DO graduates in AOA-only accredited programs and incorporate these residents in future reports. A single accreditation system for all US GME after July 1, 2020 will also allow the AAFP annual residency census to capture data from all US family medicine residency programs.

There are several limitations to this report. ACGME-accredited family medicine residency programs represent the largest, but not the only pathway into the family medicine workforce. This report creates a snapshot of only those residents who entered an ACGME-accredited family medicine residency programs at the start of the traditional academic year. Off-cycle residents or those who may have a gap of more than 1 year between medical school graduation and the start of residency are not included in this study. Most international graduates entering ACGME-accredited programs come from only a handful of medical schools. The lack of readily available data on the total number of graduates per year for international medical schools impedes the calculation of percentages of graduates entering family medicine.

Conclusions

Building the physician workforce to achieve optimal health for the United States will require having the optimal numbers and specialty mix of physicians, diverse to match the populations being served, and practicing in the right geographic locations. This study provides further evidence that the current medical school system is failing, collectively, to produce the primary care workforce needed to achieve optimal health. Important differences emerge as this report broadens the scope of previous reports in this series to now include expanded information on DO-granting and international medical schools. These differences require further study on the part of all stakeholders to explore the differences, create communities to identify and model successful strategies, and advocate for change.
ACKNOWLEDGEMENTS: The authors would like to acknowledge William Venable, MBA, MPA, for his assistance with statistical analysis.

CORRESPONDING AUTHOR: Address correspondence to Dr Kozakowski, American Academy of Family Physicians, Medical Education Division, 11400 Tomahawk Creek Parkway, 800-274-2237, ext: 6700, Fax: 913-906-6289, skozakowski@aafp.org.

References