



Medical School and Interstate Balance of Trade Among Direct Patient Care Physicians in North Dakota

This topic brief is Number 32 and provides supplementary information to a series of fact sheets regarding health workforce and North Dakota.

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This North Dakota workforce topic brief explores the balance of trade and migration into and out of North Dakota with regard to direct patient care physicians and the state location of their graduation medical schools at one point in time – 2015. Direct patient care physicians are defined as those who have regular medical care contact with patients in clinics, hospitals, and other facilities. Physicians who predominately teach, conduct research, are administrators, or see patients while completing their residencies are not included.

The medical school graduation states of the physicians who practiced in North Dakota in 2015 are examined, as well as the practice locations of University of North Dakota School of Medicine & Health Sciences (UND SMHS) physician graduates. The medical specialties of UND SMHS graduates and of physicians who practiced in North Dakota are examined, as are their geographic locations. For the purposes of this brief, family physicians, general internists, and general pediatricians are considered primary care (generalist) physicians. All other physician specialties are considered specialists.

Direct Patient Care Practicing Medical School Graduates

After graduation from the UND SMHS and completing one or more in-state and/or out-of-state residencies, graduates will most often start practicing medicine in North Dakota or elsewhere. Likewise, not all physicians currently practicing in North Dakota will have received their medical degree within the state, but rather, some moved from other states and from other countries where they graduated from medical school to North Dakota to practice.

State of Medical School Graduation for Practicing North Dakota Direct Patient Care Physicians in 2015

There were 1164 direct patient care physicians practicing in North Dakota in 2015. It is important to note, however, that this number only includes physicians who graduated medical school in the United States and four from Puerto Rico. Unless otherwise noted, this Topic Brief does not include data regarding 50 direct patient care physicians who practiced in North Dakota who received their medical degrees in Canada and 400 International Medical Graduates (IMGs) who practiced in North Dakota but received their medical degrees outside the United States. Canadian and other international medical school graduates are grouped together for this brief and denoted as IMGs. There were 450 IMGs who practiced as direct patient care physicians in North Dakota during 2015. IMGs are not included in analyses in this brief until the section entitled “Practice Specialties of Direct Patient Care Practicing Physicians.”

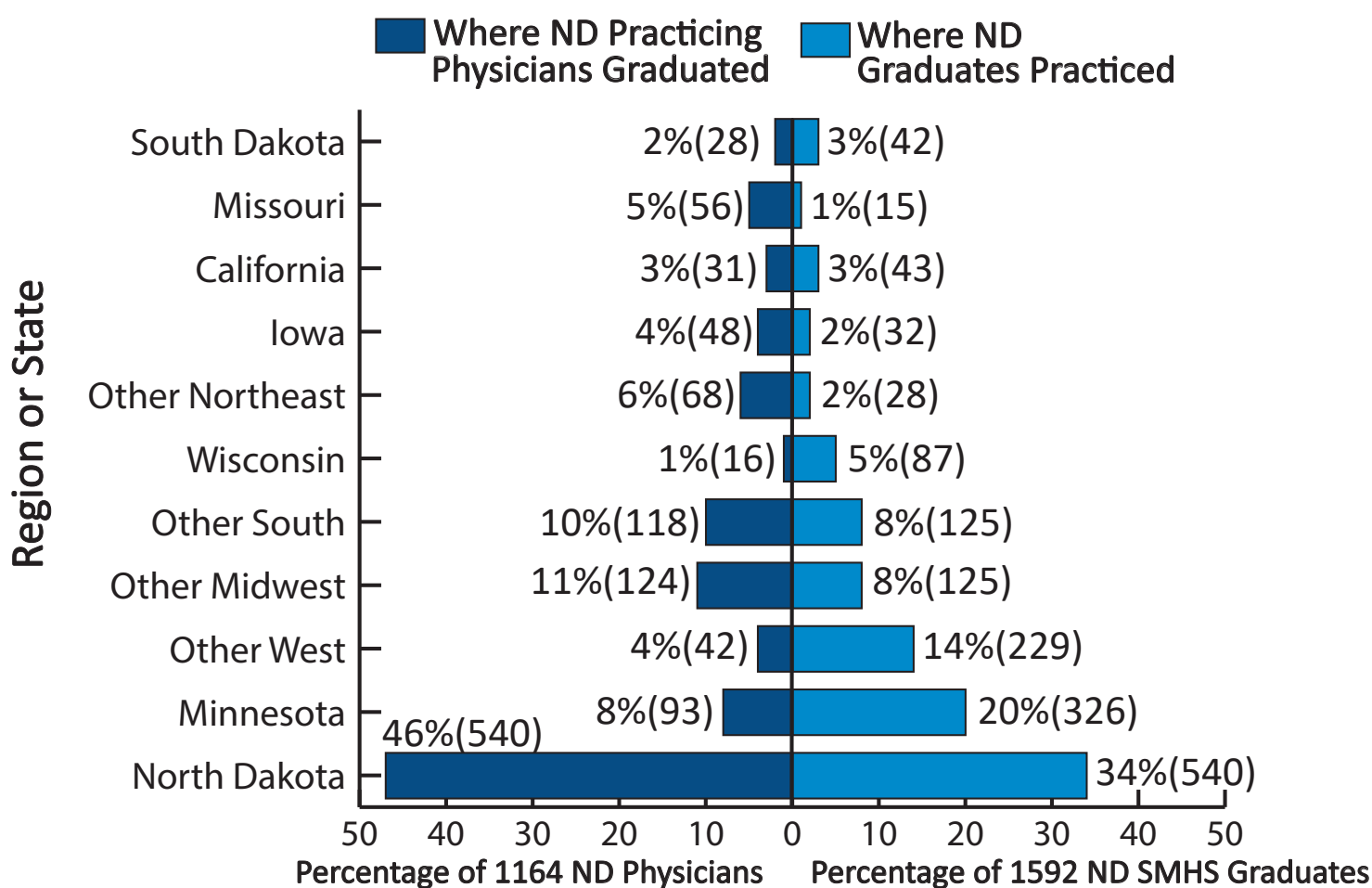
Figure 1 can be thought of as two figures. The left side shows the medical school graduation state origins of physicians who practiced in North Dakota and the right side shows where North Dakota’s medical school graduates were practicing in 2015.

Of the direct patient care physicians who practiced in North Dakota, 46.4 percent (540) completed their medical degrees in North Dakota, while 53.6 percent received their degrees from other states. Nearly a third (31.4%, 365) of direct patient care physicians who practiced in North Dakota graduated from medical schools in Midwest states (all regional states except North Dakota). The three states that provided the most direct patient care physicians to North Dakota were Minnesota (93), Missouri (56), and Iowa (48). The South regions’ medical schools graduated 118 physicians who were practicing in North Dakota.

As shown on the left side of Figure 1:

- 46.4 percent (540) graduated from North Dakota
- 31.4 percent (365) graduated from other Midwestern states (including Iowa, Minnesota, Missouri, South Dakota, and Wisconsin)
- 10.1 percent (118) graduated from Southern states
- 8.0 percent (93) graduated from Minnesota
- 5.8 percent (68) graduated from Northeastern states
- 4.8 percent (56) graduated from Missouri
- 4.1 percent (48) graduated from Iowa
- 3.6 percent (42) graduated from other Western states, not including California
- 2.7 percent (31) graduated from California
- 2.4 percent (28) graduated from South Dakota

Figure 1. Where 1164 North Dakota Direct Patient Care Physicians Graduated from U.S. Medical Schools and Where 1592 Graduates of the University of North Dakota School of Medicine & Health Sciences (UND SMHS) Practiced Medicine During 2015*



*A more detailed state by state version of these data (left side of Table 1) is shown in Table 2. A more detailed state by state version of these data (right side of Figure 1) is shown in Table 3. Figure 1 does not include North Dakota IMG data.

2015 State of Practice of UND SMHS Direct Patient Care Physician Graduates

In addition to examining where practicing North Dakotan physicians received their medical degrees, it is also important to understand where UND SMHS physician graduates were practicing. There were 1593 North Dakota physician graduates who practiced direct patient care throughout the United States. Because one physician did not report his 2015 practice location, the total number included in this report is 1592.

Of all the direct patient care UND SMHS physician graduates, 33.9 percent (540) were practicing within North Dakota. Of the 66.1 percent of North Dakota physician graduates practicing out-of-state, states/regions with the most graduates were: Minnesota (20%, 326), Western states (including California (17%, 272)), South region states (8%, 125), and so forth as shown in the right side of Figure 1. The number of UND SMHS physician graduates that were practicing out of the U.S. is unknown.

There are many reasons for UND SMHS physician graduates to practice outside North Dakota. For example, residency location, specialty selection, geographic background, financial opportunities, fiscal incentives, spousal geographic background, professional opportunities, and living amenities all played important roles in their practice location decisions.¹⁻⁵ The number of residencies and the specialty types of residencies are limited in North Dakota because of its small population and because of the high costs of new residencies. North Dakota has residencies in family practice, general internal medicine, psychiatry, general surgery, and a transitional year residency. If a UND SMHS physician graduate cannot obtain admittance to one of North Dakota's residencies, they would have to leave the state for residency training. A more important issue is that if they select a specialty where there are no North Dakota residencies, they have to leave the state for their residency training (e.g., such as for orthopedic surgery, endocrinology, cardiology, pediatrics, neurology, and others). The location of residency training is one of the most important predictors of where physicians locate their practices because of many factors including the contacts they make during their residency training and their familiarity with the location and surrounding areas. This, coupled with where they went to medical school and where they were raised, are the most important determinants of their practice site along with many other factors and circumstances.⁶⁻⁷ In addition, many specialties need large threshold patient bases that are not available within North Dakota such as for neurosurgery.

A previous fact sheet entitled Adjacent Border Analysis for Direct Patient Care Physicians⁸ utilized the 2013 AMA Masterfile data to examine UND SMHS physician graduates practicing just over the North Dakota border. The analyses show that an additional 67 direct patient care physicians practiced near the North Dakota border (in ZIP codes within 15 miles), close enough to the state that part of their patient panels were from North Dakota. The majority of these 67 physicians practiced in Minnesota (45) and the remaining physicians practiced in South Dakota (21) and Montana (1). No North Dakota medical school graduates were identified who practiced on the Manitoba, Canada side of North Dakota's northern border. Counting these physicians as serving North Dakota's population (at least in part) would increase the number of UND SMHS MD graduates who practiced in North Dakota from 540 to 607 (an increase of 12%).

Of the 1592 practicing direct patient care UND SMHS physician graduates, 540 (34%) practiced in North Dakota (not including the 67 mentioned in the preceding paragraph). The second highest state location was Minnesota, where 326 (20%) practiced, followed by other Western states at 229 (14%) (not including California's 43 (3%)). As shown on the right side of Figure 1, the practice locations of UND SMHS MD graduates include:

- 33.9 percent (540) practiced in North Dakota
- 20.5 percent (326) practiced in Minnesota
- 14.4 percent (229) practiced in other Western states (excluding California)
- 7.9 percent (125) practiced in Southern states
- 7.9 percent (125) practiced in other Midwestern states
- 5.5 percent (87) practiced in Wisconsin
- 2.7 percent (43) practiced in California
- 2.6 percent (42) practiced in South Dakota
- 2.0 percent (32) practiced in Iowa
- 1.8 percent (28) practiced in Northeastern states
- 0.9 percent (15) practiced in Missouri

Inter-State Net Balance of Medical School Production Versus Practice Location

In order to determine overall net migration trends across the states with regard to North Dakota, the number of North Dakota direct patient care physicians who graduated from each state was compared to the number of UND SMHS physician graduates who were practicing in that particular state (or region). Said differently, as a question, were there

more physicians choosing to practice in North Dakota who graduated from a particular state, compared to the locations where UND SMHS graduates practiced? At a macro-level, this can be thought of as the inter-state balance of trade per physicians in the market in terms of which states fund medical school training and which states subsequently benefit with patient care physicians providing health care to their populations. Of course, these results are not the result of trade between states but are the result of individual practice decisions based on a myriad of circumstances.

Table 1 provides information on overall net migration trends across states/regions during 2015.

- If more physicians were practicing in North Dakota from a particular state (or group of states) than there were UND SMHS graduates who practiced in that state, this indicates net migration into North Dakota (balance of trade in favor of North Dakota (+)).
- If more UND SMHS graduates were practicing in a state than there were physicians from that state practicing in North Dakota, this indicates net migration out of North Dakota (balance of trade a deficit for North Dakota (-) (i.e., favors other state)). A detailed state specific version of these data is available in Table 2.
- Overall, North Dakota had 1164 direct patient care physicians who practiced within North Dakota but had produced 1592 practicing direct patient care physicians, of which 1052 were practicing in other states (i.e., $1592 - 540 = 1052$) and 540 of whom were practicing in North Dakota. North Dakota had produced 1052 physicians that were practicing in states outside North Dakota while physicians practicing within North Dakota that received their medical degrees in other states numbered 624. Thus, North Dakota had an overall -428 ($1052 - 624 = -428$) direct patient care physician deficit per medical school graduates with other states.

At the national macro level, North Dakota was a net importer of direct patient care medical school graduate physicians (it had a 428 deficit in physician medical school graduate production). However, North Dakota's SMHS did produce 46.4 percent of the physician medical school graduates who practiced direct patient care within North Dakota, during 2015 (Table 1).

Table 1. Where North Dakota Direct Patient Care Physicians Graduated from U.S. Medical Schools and Where Graduates of UND SMHS Practiced During 2015*

Region /State	ND Practice Graduation State		UND Med School Practice State		Net ND Migration Balance
	N	%	N	%	
North Dakota	540	46.4%	540	33.9%	--
Missouri	56	4.8%	15	0.9%	+41
Other Northeast	68	5.8%	28	1.8%	+40
Iowa	48	4.2%	32	2.0%	+16
Other Midwest	124	10.7%	125	7.9%	-1
Other South	118	10.1%	125	7.9%	-7
California	31	2.7%	43	2.7%	-12
South Dakota	28	2.4%	42	2.6%	-14
Wisconsin	16	1.4%	87	5.5%	-71
Other West	42	3.6%	229	14.4%	-187
Minnesota	93	8.0%	326	20.5%	-233
Total	1164	100%	1592	100%	-428

*Table 1 does not include North Dakota IMG data.

Table 2. Where North Dakota Direct Patient Care Physicians Graduated from Medical School and Where Graduates of UND SMHS Practiced During 2015 (State-Level)*

State	ND Practice Graduation State		UND Med School Practice State		Net ND Migration Balance
	N	%	N	%	
Alabama	2	0.2%	4	0.3%	-2
Alaska**	0	0.0%	6	0.4%	-6
Arizona	4	0.3%	40	2.5%	-36
Arkansas	0	0.0%	1	0.1%	-1
California	31	2.7%	43	2.7%	-12
Colorado	11	0.9%	33	2.1%	-22
Connecticut	4	0.3%	1	0.1%	+3
District of Columbia	5	0.4%	4	0.3%	+1
Florida	6	0.5%	22	1.4%	-16
Georgia	5	0.4%	7	0.4%	-2
Hawaii	1	0.1%	5	0.3%	-4
Idaho**	0	0.0%	17	1.1%	-17
Illinois	29	2.5%	17	1.1%	+12
Indiana	5	0.4%	9	0.6%	-4
Iowa	48	4.1%	32	2.0%	+16
Kansas	14	1.2%	13	0.8%	+1
Kentucky	3	0.3%	11	0.7%	-8
Louisiana	7	0.6%	0	0.0%	+7
Maine	2	0.2%	1	0.1%	+1
Maryland	16	1.4%	4	0.3%	+12
Massachusetts	9	0.8%	5	0.3%	+4
Michigan	21	1.8%	38	2.4%	-17
Minnesota	93	8.0%	326	20.5%	-233
Mississippi	0	0.0%	2	0.1%	-2
Missouri	56	4.8%	15	0.9%	+41
Montana**	0	0.0%	45	2.8%	-45
Nebraska	34	2.9%	22	1.4%	+12
Nevada	1	0.1%	13	0.8%	-12
New Hampshire	2	0.2%	3	0.2%	-1
New Jersey	3	0.3%	1	0.1%	+2
New Mexico	5	0.4%	7	0.4%	-2
New York	20	1.7%	10	0.6%	+10
North Carolina	8	0.7%	10	0.6%	-2
North Dakota	540	46.4%	540	33.9%	--
Ohio	21	1.8%	26	1.6%	-5

State	ND Practice Graduation State		UND Med School Practice State		Net ND Migration Balance
	N	%	N	%	
Oklahoma	8	0.7%	10	0.6%	-2
Oregon	3	0.3%	15	0.9%	-12
Pennsylvania	21	1.8%	5	0.3%	+16
Puerto Rico	4	0.3%	0	0.0%	+4
Rhode Island	5	0.4%	1	0.1%	+4
South Carolina	5	0.4%	4	0.3%	+1
South Dakota	28	2.4%	42	2.6%	-14
Tennessee	6	0.5%	6	0.4%	--
Texas	30	2.6%	30	1.9%	--
Utah	8	0.7%	10	0.6%	-2
Vermont	2	0.2%	1	0.1%	+1
Virginia	12	1.0%	8	0.5%	+4
Washington**	9	0.8%	31	1.9%	-22
West Virginia	1	0.1%	2	0.1%	-1
Wisconsin	16	1.4%	87	5.5%	-71
Wyoming**	0	0.0%	7	0.4%	-7
Total	1164	100%	1592	100%	-428

*Table 2 does not include North Dakota IMG data.

**These 5 states are members of the WWAMI Regional Medical Education Program whose graduates came from the five states but whose graduation state in the AMA Masterfile was Washington, where they finally graduated. As shown, only 9 of the University of Washington's graduates practiced in North Dakota during 2015, some of whom are likely to have come from the other 4 WWAMI states.

State-Level Net Migration into North Dakota

During 2015, there were a number of states (and regions) in which there were more direct patient care medical school graduate physicians practicing in North Dakota who received their MDs from other states than North Dakota MD graduates practicing in them (net balance of trade in favor of North Dakota) (Table 1).

- There were 56 direct patient care Missouri physician graduate physicians practicing in North Dakota but only 15 North Dakota medical school physician graduates practicing in Missouri (North Dakota has a favorable net +41 physician balance).

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- Physician graduates from the Northeastern states (i.e., Connecticut, Massachusetts, Maine, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island and Vermont) have 68 physicians practicing in North Dakota but only 28 UND SMHS physician graduates practicing in them (North Dakota has a favorable net +40 physician balance).
- The similar net favorable balance for North Dakota regarding Iowa is +16 physicians (i.e., 48-32).

Figure 1 illustrates the pattern of absolute numbers of direct patient care physicians who practiced in North Dakota who graduated in other states. As can be seen, the Midwest states (adding in Iowa, Minnesota, Missouri, South Dakota, and, Wisconsin) produced 365 physicians (31% of North Dakota’s total physicians). The South region produced 10 percent and the Northeast is third with 6 percent.

Table 2 contains the detailed results for all states individually regarding the number and percentage of physicians that graduated from medical school from North Dakota’s medical school and the state where they practiced in 2015 compared to the graduation states of all the physicians that practiced in North Dakota in 2015 (detailed state specific version of Table 1). Eighteen states (counting Puerto Rico) had fewer than five physicians practicing in North Dakota, while fewer than five physicians that graduated from UND’s SMHS were practicing in 15 states. Table 2 is provided so that the reader can examine specific interstate balance of trade at the state specific level.

State-Level Net Migration Out of North Dakota

In contrast to the previous section, there were many states (and regions) in which there were fewer direct patient care physicians that practiced in North Dakota who received their medical degrees from other states than North Dakota physician graduates that practiced in them (net balance of trade unfavorable to North Dakota) (Table 1).

- There were 93 direct patient care Minnesota medical school physician graduates that practiced in North Dakota but 326 North Dakota medical school physician graduates practicing in Minnesota (North Dakota had an unfavorable net -233 physician balance).
- Medical school physician graduates from Western states (Alaska, Arizona, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming, including California’s 31) had 73 physicians that were practicing in North Dakota but 272 North Dakota medical school physician graduates practicing in them (North Dakota had an unfavorable net -199 physician balance).

- The 2015 net unfavorable balance for North Dakota regarding Wisconsin was -71 physicians (i.e., 16-87).
- There were also smaller negative net physician balances for North Dakota regarding South Dakota and the South region (Alabama, Arkansas, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, and Virginia).

As can be observed, the largest recipients of North Dakota’s physician graduates were: Minnesota (326), the Midwest region (adding in Iowa, Missouri, South Dakota, and, Wisconsin, excluding Minnesota) (301), the West region (including California) (272), and the South region (125). The corresponding percentages of total UND SMHS graduates were: 20 percent, 19 percent, 17 percent, and 8 percent.

Practice Specialties of Direct Patient Care Practicing Physicians

To add a specialty context to this discussion of North Dakota-associated direct patient care physicians, selected specialty frequencies of different physician groups are addressed. Tables 3, 4, 5, 6, and 7 display all direct patient care physicians that meet the inclusion criteria described above. All physicians included in the following five tables were direct patient care physicians during 2015. The listed physician specialties are self-reported primary specialties as reported by the AMA. In Tables 3 through Table 7, all physicians graduated from a U.S. medical school as specified. Table 8 provides information on physicians who were IMGs, including Canadian medical school graduates who were practicing in North Dakota.

Table 3: Specialties of all direct patient care physicians who graduated from U.S. medical schools who practiced medicine in North Dakota during 2015 (n=1164)

Table 4: Specialties of all direct patient care physicians who graduated from UND SMHS who practiced medicine in the U.S. during 2015 (n=1592)

Table 5: Specialties of all direct patient care physicians who graduated from the UND SMHS and practiced medicine in North Dakota during 2015 (n=540)

Table 6: Specialties of all direct patient care physicians who graduated from the UND SMHS who practiced medicine in the U.S. but did not practice in North Dakota during 2015 (n=1053)

Table 7: Specialties of all direct patient care physicians who graduated from U.S. medical schools and did not graduate from the UND SMHS during 2015 (n=624)

Table 8: Specialties of all direct patient care physician IMGs who practiced in North Dakota during 2015 (n=450)

Table 3 contains a frequency of physician specialties for all direct patient care physicians who were practicing in North Dakota (1164) regardless of their medical school state of graduation (excluding physicians who did not graduate from a U.S. medical school). The six most frequent specialties are: family practice (23.5%); general internal medicine (7.8%); general pediatrics (6.4%), general surgery (5.4%), emergency medicine (5.2%), and Obstetrics/Gynecology (5.1%). The three primary care specialties (i.e., family practice, general internal medicine, and general pediatrics) accounted for almost 38 percent of North Dakota’s direct patient care physicians. The specialties of obstetrics and gynecology and general surgery, which are sometimes considered primary care, account for an additional 10.5 percent. North Dakota’s number of different types of specialties was approximately 83 depending on how specialty aggregations are defined.

Table 3: Specialties of all direct patient care physicians who graduated from U.S. medical schools who practiced medicine in North Dakota during 2015 (n=1164)

Primary Specialty	Total	Percent
Family Practice	273	23.5%
General Internal Medicine	91	7.8%
General Pediatrics	74	6.4%
General Surgery	63	5.4%
Emergency Medicine	60	5.2%
Obstetrics & Gynecology	59	5.1%
Diagnostic Radiology	50	4.3%
Anesthesiology	43	3.7%
Orthopedic Surgery	41	3.5%
Psychiatry	34	2.9%
Ophthalmology	30	2.6%
Pathology - Anatomic/Clinical	25	2.1%
Dermatology	18	1.5%
Cardiovascular Disease	15	1.3%
Otolaryngology	15	1.3%
Neurology	13	1.1%
Child Psychiatry	12	1.0%
Neurological Surgery	12	1.0%

Table 3 continued at top of column to the right.

Primary Specialty	Total	Percent
Plastic Surgery	12	1.0%
Radiation Oncology	12	1.0%
Urological Surgery	12	1.0%
Unspecified Specialty	12	1.0%
Hematology/Oncology	11	0.9%
Gastroenterology	10	0.9%
Physical Medicine & Rehab	10	0.9%
Vascular & Interventional Radiology	8	0.7%
Allergy & Immunology	7	0.6%
Radiology	7	0.6%
Thoracic Surgery	7	0.6%
Endocrinology	6	0.5%
General Preventative Medicine	6	0.5%
Infectious Diseases	6	0.5%
Hand Surgery/Orthopedic Surgery	5	0.4%
Interventional Cardiology	5	0.4%
Neonatal-Perinatal Medicine	5	0.4%
Neuroradiology	5	0.4%
Critical Care – Pediatric	4	0.3%
Hand Surgery	4	0.3%
Nephrology	4	0.3%
Orthopedic Sports Medicine	4	0.3%
Pulmonary Disease	4	0.3%
Critical Care Medicine	3	0.3%
Colon & Rectal Surgery	3	0.3%
Forensic Pathology	3	0.3%
Hematology/Pathology	3	0.3%
Oral & Maxillofacial Surgery	3	0.3%
Pediatric Anesthesiology	3	0.3%
Pediatric Cardiology	3	0.3%
Pediatric Radiology	3	0.3%
Vascular Surgery	3	0.3%
Clinical Neurophysiology	2	0.2%
Dermatopathology	2	0.2%
IM - Cardiac Electrophysiology	2	0.2%
Occupational Medicine	2	0.2%
Oncology	2	0.2%
Pulmonary Critical Care Med	2	0.2%
Procedural Dermatology	2	0.2%
Reproductive Endocrinology	2	0.2%
Rheumatology	2	0.2%
Traumatic Surgery	2	0.2%
Adolescent Medicine - Pediatrics	1	0.1%

Table 3 continued at top of next page.

Primary Specialty	Total	Percent
Addiction Medicine	1	0.1%
Addiction Psychiatry	1	0.1%
Aerospace Medicine	1	0.1%
Anesthesiology/Pain Management	1	0.1%
Critical Care Surgery	1	0.1%
Facial Plastic Surgery	1	0.1%
Gynecology	1	0.1%
Hospice & Palliative Medicine	1	0.1%
Hand Surgery	1	0.1%
Medical Genetics	1	0.1%
Neurotology	1	0.1%
Other Specialty	1	0.1%
Orthopedic Surgery of Spine	1	0.1%
Pediatric Infectious Diseases	1	0.1%
Pediatric Surgery	1	0.1%
Pediatric Emergency Medicine	1	0.1%
Pediatric Hematology Oncology	1	0.1%
Pain Management	1	0.1%
Pain Medicine	1	0.1%
Surgical Oncology	1	0.1%
Selective Pathology	1	0.1%
Vascular Neurology	1	0.1%
Total	1164	100.0%

Table 4 is similar in form to Table 3 except that the 2015 physician specialties of all UND SMHS medical school graduates practicing direct patient care are enumerated. The six most frequent specialties were: family practice (24.8%); obstetrics and gynecology (9.3%); general internal medicine (8.3%); emergency medicine (7.5%); general pediatrics (6.7%), and general surgery (4.9%). The three primary care specialties accounted for 39.8 percent of North Dakota’s direct patient care physicians. The specialties of obstetrics and gynecology and general surgery account for an additional 14.2 percent. The most frequent six physician specialties for North Dakota are the same as for all UND SMHS graduates who were practicing, though the order is somewhat different. The pattern of specialty distribution for all of North Dakota’s direct patient care physicians and of those graduating with their medical degrees in North Dakota (regardless of whether they were practicing in North Dakota or in another state) are similar.

Table 4: Specialties of all direct patient care physicians who graduated from UND SMHS who practiced medicine in the U.S. during 2015 (n=1592)

Primary Specialty	Total	Percent
Family Practice	395	24.8%
Obstetrics & Gynecology	148	9.3%
General Internal Medicine	132	8.3%
Emergency Medicine	120	7.5%
General Pediatrics	106	6.7%
General Surgery	78	4.9%
Diagnostic Radiology	68	4.3%
Psychiatry	64	4.0%
Anesthesiology	61	3.8%
Pathology - Anatomic/Clinical	46	2.9%
Orthopedic Surgery	40	2.5%
Ophthalmology	21	1.3%
Dermatology	20	1.3%
Physical Medicine & Rehab	19	1.2%
Gastroenterology	16	1.0%
Neurology	14	0.9%
Child Psychiatry	13	0.8%
Otolaryngology	13	0.8%
Cardiovascular Disease	10	0.6%
Neuroradiology	9	0.6%
Radiation Oncology	9	0.6%
Plastic Surgery	7	0.4%
Clinical Neurophysiology	6	0.4%
Endocrinology	6	0.4%
Infectious Diseases	6	0.4%
Rheumatology	6	0.4%
Urological Surgery	6	0.4%
Vascular & Interventional Radiology	6	0.4%
Allergy & Immunology	5	0.3%
Critical Care Surgery	5	0.3%
Nephrology	5	0.3%
Oncology	5	0.3%
Pediatric Surgery	5	0.3%
Thoracic Surgery	5	0.3%
Critical Care - Pediatric	4	0.3%
Hematology/Oncology	4	0.3%
Interventional Cardiology	4	0.3%
Neonatal-Perinatal Medicine	4	0.3%

Table 4 continued at top of next page.

Primary Specialty	Total	Percent
Orthopedic Sports Medicine	4	0.3%
Pulmonary Critical Care Med	4	0.3%
Pediatric Hematology Oncology	4	0.3%
Vascular Surgery	4	0.3%
Dermatopathology	3	0.2%
General Preventative Medicine	3	0.2%
Hematology/Pathology	3	0.2%
Neurological Surgery	3	0.2%
Occupational Medicine	3	0.2%
Pediatric Anesthesiology	3	0.2%
Pediatric Radiology	3	0.2%
Adult Cardiothoracic Anesthesiology	2	0.1%
Anesthesiology/Pain Management	2	0.1%
Critical Care - Anesthesiology	2	0.1%
Colon & Rectal Surgery	2	0.1%
Gynecology	2	0.1%
Hand Surgery/Orthopedic Surgery	2	0.1%
Musculoskeletal Radiology	2	0.1%
Other Specialty	2	0.1%
Pediatric Emergency Medicine	2	0.1%
Procedural Dermatology	2	0.1%
Pulmonary Disease	2	0.1%
Geriatric Psychiatry	2	0.1%
Sleep Medicine	2	0.1%
Selective Pathology	2	0.1%
Traumatic Surgery	2	0.1%
Unspecified Specialty	2	0.1%
Adolescent Medicine - Pediatrics	1	0.1%
Aerospace Medicine	1	0.1%
Advanced Surgical Oncology	1	0.1%
Anatomic Pathology	1	0.1%
Blood Banking	1	0.1%
Critical Care Medicine	1	0.1%
Forensic Pathology	1	0.1%
Female Pelvic Medicine and Reconstructive Surgery	1	0.1%
Facial Plastic Surgery	1	0.1%
Hematology	1	0.1%
Hospitalist	1	0.1%
Hospice & Palliative Medicine	1	0.1%
IM - Cardiac Electrophysiology	1	0.1%
Maternal & Fetal Medicine	1	0.1%
Medical Genetics	1	0.1%

Table 4 continued at top of column to the right.

Primary Specialty	Total	Percent
Nuclear Medicine	1	0.1%
Neuromuscular Medicine	1	0.1%
Neuropathology	1	0.1%
Nuclear Radiology	1	0.1%
Ophthalmic Plastic and Reconstructive Surgery	1	0.1%
Orthopedic Surgery of Spine	1	0.1%
Pathology - Cytopathology	1	0.1%
Pediatric Cardiology	1	0.1%
Pediatric Endocrinology	1	0.1%
Pediatric Infectious Diseases	1	0.1%
Pediatric Emergency Medicine	1	0.1%
Pain Medicine	1	0.1%
Pediatric Rheumatology	1	0.1%
Plastic Surgery within the Head & Neck	1	0.1%
Radiology	1	0.1%
Reproductive Endocrinology	1	0.1%
Pediatric Urology	1	0.1%
Total	1592	100.0%

A comparison of Table 3 (i.e., specialties of all direct patient care physicians practicing in North Dakota regardless of their medical school graduation state) and Table 4 (i.e., specialties of all direct patient care physicians who graduated from the UND SMHS and practiced medicine in 2015) reveals that the specialty distributions are quite similar, especially regarding the most frequent top half of both frequencies. Note that many of the physicians included on the two lists are the same.

Table 5 contains a frequency of physician specialties of all the direct patient care physicians who received their medical degree from the UND SMHS and practiced in North Dakota during 2015. The six most frequent specialties are family practice (31.7%), general internal medicine (9.8%), obstetrics and gynecology (7.0%), emergency medicine (6.7%), general pediatrics (6.1%), and diagnostic radiology and general surgery tied (4.3%). The three primary care specialties accounted for 47.6 percent of North Dakota’s direct patient care physicians. The specialties of obstetrics and gynecology and general surgery, which are sometimes considered primary care, account for an additional 11.3 percent.

Table 5: Specialties of all direct patient care physicians who graduated from the UND SMHS and practiced medicine in North Dakota during 2015 (n=540)

Primary Specialty	Total	Percent
Family Practice	171	31.7%
General Internal Medicine	53	9.8%
Obstetrics & Gynecology	38	7.0%
Emergency Medicine	36	6.7%
General Pediatrics	33	6.1%
Diagnostic Radiology	23	4.3%
General Surgery	23	4.3%
Orthopedic Surgery	19	3.5%
Anesthesiology	17	3.1%
Psychiatry	16	3.0%
Pathology - Anatomic/Clinical	12	2.2%
Dermatology	8	1.5%
Neurology	8	1.5%
Ophthalmology	8	1.5%
Radiation Oncology	5	0.9%
Otolaryngology	4	0.7%
Gastroenterology	3	0.6%
Physical Medicine & Rehab	3	0.6%
Plastic Surgery	3	0.6%
Vascular & Interventional Radiology	3	0.6%
Allergy & Immunology	2	0.4%
Child Psychiatry	2	0.4%
Clinical Neurophysiology	2	0.4%
Endocrinology	2	0.4%
Hematology/Pathology	2	0.4%
Hematology/Oncology	2	0.4%
Hand Surgery/Orthopedic Surgery	2	0.4%
Interventional Cardiology	2	0.4%
Neonatal-Perinatal Medicine	2	0.4%
Neurological Surgery	2	0.4%
Orthopedic Sports Medicine	2	0.4%
Pediatric Radiology	2	0.4%
Procedural Dermatology	2	0.4%
Urological Surgery	2	0.4%
Vascular Surgery	2	0.4%
Critical Care - Pediatric	1	0.2%
Critical Care Surgery	1	0.2%
Cardiovascular Disease	1	0.2%
Dermatopathology	1	0.2%

Primary Specialty	Total	Percent
Hospice & Palliative Medicine	1	0.2%
IM - Cardiac Electrophysiology	1	0.2%
Infectious Diseases	1	0.2%
Medical Genetics	1	0.2%
Nephrology	1	0.2%
Occupational Medicine	1	0.2%
Oncology	1	0.2%
Other Specialty	1	0.2%
Pediatric Anesthesiology	1	0.2%
Pulmonary Critical Care Med	1	0.2%
Pediatric Cardiology	1	0.2%
Pediatric Surgery	1	0.2%
Pediatric Emergency Medicine	1	0.2%
Radiology	1	0.2%
Reproductive Endocrinology	1	0.2%
Rheumatology	1	0.2%
Neuroradiology	1	0.2%
Traumatic Surgery	1	0.2%
Thoracic Surgery	1	0.2%
Unspecified Specialty	1	0.2%
Total	540	100.0%

Table 6 contains a frequency of physician specialties of all the direct patient care physicians who received their MD degree at the UND SMHS and practiced outside North Dakota during 2015. The six most frequent specialties were family practice (21.4%), obstetrics and gynecology (10.4%), emergency medicine (8.0%), general internal medicine (7.5%), general pediatrics (6.9%), and general surgery (5.2%). The three primary care specialties accounted for 35.8 percent of North Dakota’s direct patient care physicians. The specialties of obstetrics and gynecology and general surgery, which are sometimes considered primary care, account for an additional 15.6 percent.

Table 5 continued at top of column to the right.

Table 6: Specialties of all direct patient care physicians who graduated from the UND SMHS who practiced medicine in the U.S. but did not practice in North Dakota during 2015 (n=1053)

Primary Specialty	Total	Percent
Family Practice	225	21.4%
Obstetrics & Gynecology	110	10.4%
Emergency Medicine	84	8.0%
General Internal Medicine	79	7.5%
General Pediatrics	73	6.9%
General Surgery	55	5.2%
Psychiatry	48	4.6%
Diagnostic Radiology	45	4.3%
Anesthesiology	44	4.2%
Pathology - Anatomic/Clinical	34	3.2%
Orthopedic Surgery	21	2.0%
Physical Medicine & Rehab	16	1.5%
Gastroenterology	13	1.2%
Ophthalmology	13	1.2%
Dermatology	12	1.1%
Child Psychiatry	11	1.0%
Cardiovascular Disease	9	0.9%
Otolaryngology	9	0.9%
Neuroradiology	8	0.8%
Neurology	6	0.6%
Infectious Diseases	5	0.5%
Rheumatology	5	0.5%
Critical Care Surgery	4	0.4%
Clinical Neurophysiology	4	0.4%
Endocrinology	4	0.4%
Nephrology	4	0.4%
Oncology	4	0.4%
Pediatric Surgery	4	0.4%
Pediatric Hematology Oncology	4	0.4%
Plastic Surgery	4	0.4%
Radiation Oncology	4	0.4%
Thoracic Surgery	4	0.4%
Urological Surgery	4	0.4%
Allergy & Immunology	3	0.3%
Critical Care - Pediatric	3	0.3%
General Preventative Medicine	3	0.3%
Pulmonary Critical Care Med.	3	0.3%

Table 6 continued at top of column to the right.

Primary Specialty	Total	Percent
Vascular & Interventional Radiology	3	0.3%
Adult Cardiothoracic Anesthesiology	2	0.2%
Anesthesiology/Pain Management	2	0.2%
Critical Care - Anesthesiology	2	0.2%
Colon & Rectal Surgery	2	0.2%
Dermatopathology	2	0.2%
Gynecology	2	0.2%
Hematology/Oncology	2	0.2%
Interventional Cardiology	2	0.2%
Musculoskeletal Radiology	2	0.2%
Neonatal-Perinatal Medicine	2	0.2%
Occupational Medicine	2	0.2%
Orthopedic Sports Medicine	2	0.2%
Pediatric Anesthesiology	2	0.2%
Pulmonary Disease	2	0.2%
Geriatric Psychiatry	2	0.2%
Sleep Medicine	2	0.2%
Selective Pathology	2	0.2%
Vascular Surgery	2	0.2%
Adolescent Medicine - Pediatrics	1	0.1%
Aerospace Medicine	1	0.1%
Advanced Surgical Oncology	1	0.1%
Anatomic Pathology	1	0.1%
Blood Banking	1	0.1%
Critical Care Medicine	1	0.1%
Forensic Pathology	1	0.1%
Female Pelvic Medicine & Reconstructive Surgery	1	0.1%
Facial Plastic Surgery	1	0.1%
Hematology/Oncology	1	0.1%
Hematology/Pathology	1	0.1%
Hospitalist	1	0.1%
Maternal & Fetal Medicine	1	0.1%
Nuclear Medicine	1	0.1%
Neuromuscular Medicine	1	0.1%
Neuropathology	1	0.1%
Nuclear Radiology	1	0.1%
Neurological Surgery	1	0.1%
Ophthalmic Plastic and Reconstructive Surgery	1	0.1%
Other Specialty	1	0.1%
Orthopedic Surgery of Spine	1	0.1%
Pathology - Cytopathology	1	0.1%

Table 6 continued at top of the next page

Table 6 continued from bottom right column of previous page

Primary Specialty	Total	Percent
Pediatric Endocrinology	1	0.1%
Pediatric Infectious Diseases	1	0.1%
Pediatric Radiology	1	0.1%
Pediatric Emergency Med - EM	1	0.1%
Pediatric Emergency Medicine	1	0.1%
Pain Medicine	1	0.1%
Pediatric Rheumatology	1	0.1%
Plastic Surgery within the Head & Neck	1	0.1%
Traumatic Surgery	1	0.1%
Pediatric Urology	1	0.1%
Unspecified Specialty	1	0.1%
Total	1053	100.0%

Table 7 contains a frequency of physician specialties for all the direct patient care physicians who did not receive their degree at the UND SMHS who practiced in North Dakota during 2015. The six most frequent specialties were family practice (16.3%), general pediatrics (6.6%), general surgery (6.4%), general internal medicine (6.1%), diagnostic radiology (4.3%), and anesthesiology (4.2%). Emergency medicine was the seventh most frequent specialty at 3.8 percent. The three primary care specialties accounted for 29.0 percent of North Dakota's direct patient care physicians. The specialties of obstetrics and gynecology and general surgery, which are sometimes considered primary care, account for an additional 9.8 percent.

Table 7: Specialties of all direct patient care physicians who graduated from U.S. medical schools and did not graduate from the UND SMHS during 2015 (n=624)

Primary Specialty	Total	Percent
Family Practice	102	16.3%
General Pediatrics	41	6.6%
General Surgery	40	6.4%
General Internal Medicine	38	6.1%
Diagnostic Radiology	27	4.3%
Anesthesiology	26	4.2%
Emergency Medicine	24	3.8%
Ophthalmology	22	3.5%
Orthopedic Surgery	22	3.5%
Obstetrics & Gynecology	21	3.4%
Psychiatry	18	2.9%
Cardiovascular Disease	14	2.2%

Table 7 continued at top of column to the right.

Primary Specialty	Total	Percent
Pathology - Anatomic/Clinical	13	2.1%
Otolaryngology	11	1.8%
Unspecified Specialty	11	1.8%
Child Psychiatry	10	1.6%
Dermatology	10	1.6%
Neurological Surgery	10	1.6%
Urological Surgery	10	1.6%
Hematology/Oncology	9	1.4%
Plastic Surgery	9	1.4%
Gastroenterology	7	1.1%
Physical Medicine & Rehab	7	1.1%
Radiation Oncology	7	1.1%
General Preventative Medicine	6	1.0%
Radiology	6	1.0%
Thoracic Surgery	6	1.0%
Allergy & Immunology	5	0.8%
Infectious Diseases	5	0.8%
Neurology	5	0.8%
Vascular & Interventional Radiology	5	0.8%
Endocrinology	4	0.6%
Hand Surgery	4	0.6%
Pulmonary Disease	4	0.6%
Neuroradiology	4	0.6%
Critical Care Medicine	3	0.5%
Critical Care - Pediatric	3	0.5%
Colon & Rectal Surgery	3	0.5%
Forensic Pathology	3	0.5%
Hand Surgery/Orthopedic Surgery	3	0.5%
Interventional Cardiology	3	0.5%
Nephrology	3	0.5%
Neonatal-Perinatal Medicine	3	0.5%
Oral & Maxillofacial Surgery	3	0.5%
Orthopedic Sports Medicine	2	0.3%
Pediatric Anesthesiology	2	0.3%
Pediatric Cardiology	2	0.3%
Adolescent Medicine - Pediatrics	1	0.2%
Addiction Medicine	1	0.2%
Addiction Psychiatry	1	0.2%
Aerospace Medicine	1	0.2%
Anesthesiology/Pain Management	1	0.2%
Dermatopathology	1	0.2%
Facial Plastic Surgery	1	0.2%
Gynecology	1	0.2%

Table 7 continued at top of the next page

Table 7 continued from bottom right column of previous page

Primary Specialty	Total	Percent
Hematology/Pathology	1	0.2%
Hand Surgery (Plastic Surgery)	1	0.2%
IM - Cardiac Electrophysiology	1	0.2%
Neurotology (Otolaryngology)	1	0.2%
Occupational Medicine	1	0.2%
Oncology	1	0.2%
Orthopedic Surgery of Spine	1	0.2%
Pulmonary Critical Care Med	1	0.2%
Pediatric Infectious Diseases	1	0.2%
Pediatric Radiology	1	0.2%
Pediatric Hematology Oncology	1	0.2%
Pain Management	1	0.2%
Pain Medicine	1	0.2%
Reproductive Endocrinology	1	0.2%
Rheumatology	1	0.2%
Surgical Oncology	1	0.2%
Selective Pathology	1	0.2%
Traumatic Surgery	1	0.2%
Vascular Neurology	1	0.2%
Vascular Surgery	1	0.2%
Total	624	100.0%

Table 8 is different from Table 3 through Table 7. Table 3 through Table 7 use the same physician inclusion criteria (i.e., physicians who graduated from medical schools within the U.S.) made up of different combinations of North Dakota’s practicing physicians (graduates the UND SMHS, other graduates of U.S. medical schools) and UND SMHS graduates who practiced in other states than North Dakota. However, Table 8 includes the specialties of direct patient physicians who practiced in North Dakota who were IMGs, including Canadian graduates.

Table 8 contains a frequency of physician specialties of all the direct patient care IMGs who practiced in North Dakota during 2015 (n=450), which represented 27.9 percent of North Dakota’s practicing direct patient care physicians. The six most frequent IMG specialties were family practice (19.3%), general internal medicine (16.9%), anesthesiology (6.2%), psychiatry (5.1%), nephrology (3.3%), and general pediatrics (3.3%). The three primary care specialties accounted for 39.5 percent of North Dakota’s direct patient care physicians. The specialties of obstetrics and gynecology (0.9%) and general surgery (2.7%), account for an additional 3.6 percent. Of all the physician groups examined in Table 3 through Table 8, IMGs had the fewest number of different specialty types (i.e., 55) and by far the highest percentage of general internal physicians (i.e., 16.9%).

Table 8: Specialties of all direct patient care physician IMGs who practiced in North Dakota during 2015 (n=450)

Primary Specialty	Total	Percent
Family Practice	87	19.3%
General Internal Medicine	76	16.9%
Anesthesiology	28	6.2%
Psychiatry	23	5.1%
Nephrology	15	3.3%
General Pediatrics	15	3.3%
Hematology/Oncology	13	2.9%
Cardiovascular Disease	12	2.7%
General Surgery	12	2.7%
Infectious Diseases	12	2.7%
Gastroenterology	10	2.2%
Critical Care Medicine	9	2.0%
Interventional Cardiology	9	2.0%
Pulmonary Critical Care Med	9	2.0%
Unspecified Specialty	8	1.8%
Child Psychiatry	7	1.6%
Emergency Medicine	7	1.6%
Neurology	7	1.6%
Orthopedic Surgery	7	1.6%
Endocrinology	6	1.3%
Neonatal-Perinatal Medicine	6	1.3%
Rheumatology	6	1.3%
Pathology - Anatomic/Clinical	5	1.1%
Urological Surgery	5	1.1%
Obstetrics & Gynecology	4	0.9%
Oncology	4	0.9%
Otolaryngology	4	0.9%
Physical Medicine & Rehab	4	0.9%
Allergy & Immunology	3	0.7%
Neurological Surgery	3	0.7%
Plastic Surgery	3	0.7%
Critical Care Surgery	2	0.4%
Child Neurology	2	0.4%
Clinical Neurophysiology	2	0.4%
Hematology/Oncology	2	0.4%
IM - Cardiac Electrophysiology	2	0.4%
Ophthalmology	2	0.4%
Sleep Medicine	2	0.4%
Allergy & Immun/Diag Lab	1	0.2%
Anatomic Pathology	1	0.2%

Table 8 continued at top of the next page

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Primary Specialty	Total	Percent
Critical Care - Pediatric	1	0.2%
Diagnostic Radiology	1	0.2%
Endovascular Surgical Neuroradiology	1	0.2%
Hematology/Pathology	1	0.2%
Orthopedic Pediatric Surgery	1	0.2%
Other Specialty	1	0.2%
Orthopedic Sports Medicine	1	0.2%
Pediatric Hematology Oncology	1	0.2%
Pain Medicine	1	0.2%
Pulmonary Disease	1	0.2%
Neuroradiology	1	0.2%
Radiation Oncology	1	0.2%
Thoracic Surgery	1	0.2%
Vascular & Interventional Radiology	1	0.2%
Vascular Surgery	1	0.2%
Total	450	100.0%

There is a myriad of comparisons between Table 3 through Table 8 that can be made. For example, for Table 3 through Table 7 (U.S. medical school graduates only), the percentage in primary care ranges from a low of 29.0 percent (North Dakota’s non-UND SMHS physicians) to a high of 47.6 percent (North Dakota’s UND SMHS physicians). For the UND SMHS graduates that practiced in other states, only 35.8 percent practiced in the primary care specialties. The lengthy formats of Table 3 through Table 8 are provided so that readers can examine their own specialty-related questions. The inclusion of Table 8 data provides readers the ability to examine North Dakota’s total 2015 active direct patient care physicians (n=1614).

Final examples of using comparisons of information in Table 3 through Table 8 are provided in Table 9. Table 9 illustrates specialty information from Table 3 (all U.S. medical school graduates who practiced in North Dakota other than UND SMHS graduates), Table 5 (all UND SMHS medical school graduates who practiced in North Dakota), and Table 8 (IMGs who practiced in North Dakota). Among other things, Table 9 provides North Dakota specialty information on the most frequent direct patient care physician specialties for U.S. graduate physicians (i.e., 24 most frequent specialties and the aggregated remainder), the North Dakota percentage of each specialty represented by UND SMHS medical school graduates, and separately for IMGs.

Table 9: North Dakota direct patient care (DPC) physicians by specialty for UND SMHS medical school graduates, other non-North Dakota U.S. Medical School graduates, and IMGs during 2015

	A	B	C	D	E	F	G
	U.S. Grads Practicing DPC in ND	SMHS Grads Practicing DPC in ND	SMHS % of U.S. Grads Practicing DPC in ND	IMGs Practicing DPC in ND	All Physicians Practicing DPC in ND	IMG % of All Physicians Practicing DPC in ND	SMHS % of All Physicians Practicing DPC in ND
Physician Specialty (Most Frequent 1-10)							
Family Practice	273	171	62.6	87	360	24.2	47.5
General Internal Medicine	91	53	58.2	76	167	45.5	31.7
General Pediatrics	74	33	44.6	15	89	16.9	37.1
General Surgery	63	23	36.5	12	75	16.0	30.7
Emergency Medicine	60	36	60.0	7	67	10.4	53.7
Obstetrics & Gynecology	59	38	64.4	4	63	6.3	60.3
Diagnostic Radiology	50	23	46.0	1	51	2.0	45.1
Anesthesiology	43	17	39.5	28	71	39.4	23.9
Orthopedic Surgery	41	19	46.3	7	48	14.6	39.6
Psychiatry	34	16	47.1	23	57	40.4	28.1
Physician Specialty (Most Frequent 11-24)							
Ophthalmology	30	8	26.7	2	32	6.3	25.0
Pathology (Anatomic/Clinic)	25	12	48.0	5	30	16.7	40.0
Dermatology	18	8	44.4	0	18	0.0	44.4
Cardiovascular Disease	15	1	6.7	12	27	44.4	3.7
Otolaryngology	15	4	26.7	4	19	21.1	21.1
Neurology	13	8	61.5	7	20	35.0	40.0
Child Psychiatry	12	2	16.7	7	19	36.8	10.5
Neurological Surgery	12	2	16.7	3	15	20.0	13.3
Plastic Surgery	12	3	25.0	3	15	20.0	20.0
Radiation Oncology	12	5	41.7	1	13	7.7	38.5
Urological Surgery	12	2	16.7	5	17	29.4	11.8
Hematology/Oncology	11	2	18.2	13	24	54.2	8.3
Gastroenterology	10	3	30.0	10	20	50.0	15.0
Physical Medicine/Rehab	10	3	30.0	4	14	28.6	21.4
All Other Specialties	169	48	28.4	114	283	40.3	17.0
Grand Total	1164	540	46.4	450	1614	27.9	33.5

Table 9 Column Notes

- A Total U.S. medical school graduate DPC physicians practicing in North Dakota, including UND SMHS graduates
- B UND SMHS medical school graduate DPC physicians practicing in North Dakota
- C Percent of total U.S. medical school DPC practicing physicians in North Dakota who graduated from UND SMHS ((B/A)*100)
- D IMGs DPC practicing physicians in North Dakota
- E Total DPC practicing physicians in North Dakota (i.e., UND SMHS, other U.S., medical school graduates, and IMGs) (A+D)
- F Percent total DPC practicing physicians in North Dakota who were IMGs ((D/E)*100)
- G Percent total DPC practicing physicians in North Dakota who were UND SMHS graduates ((B/E)*100)

In Table 9's right four columns, IMGs are added to the mix. For instance, for family physicians, UND SMHS graduates made up 62.6 percent of North Dakota's direct patient care U.S. medical school graduates, while they represented 47.5 percent of the family physicians when IMGs are included in the calculations. These specialty-specific types of percentages are illustrated in Figure 2 for North Dakota's 10 most frequent physician specialties. The 10 most frequent North Dakota specialties are illustrated by the percentage of UND SMHS medical school graduates (red bars), other non-North Dakota U.S. medical school graduates (blue bars), and IMGs (green bars).

Across the three physician groups and the 10 most frequent specialties, the majority (greater than 50%) of a specialty's physicians only occurred in four instances by one of the three physician groups: twice by UND SMHS physicians (obstetrics/gynecology (60.3%) and emergency medicine (53.7%)) and twice by other non-North Dakota U.S. medical school graduates (general surgery (53.3%) and diagnostic radiology (52.9%)).

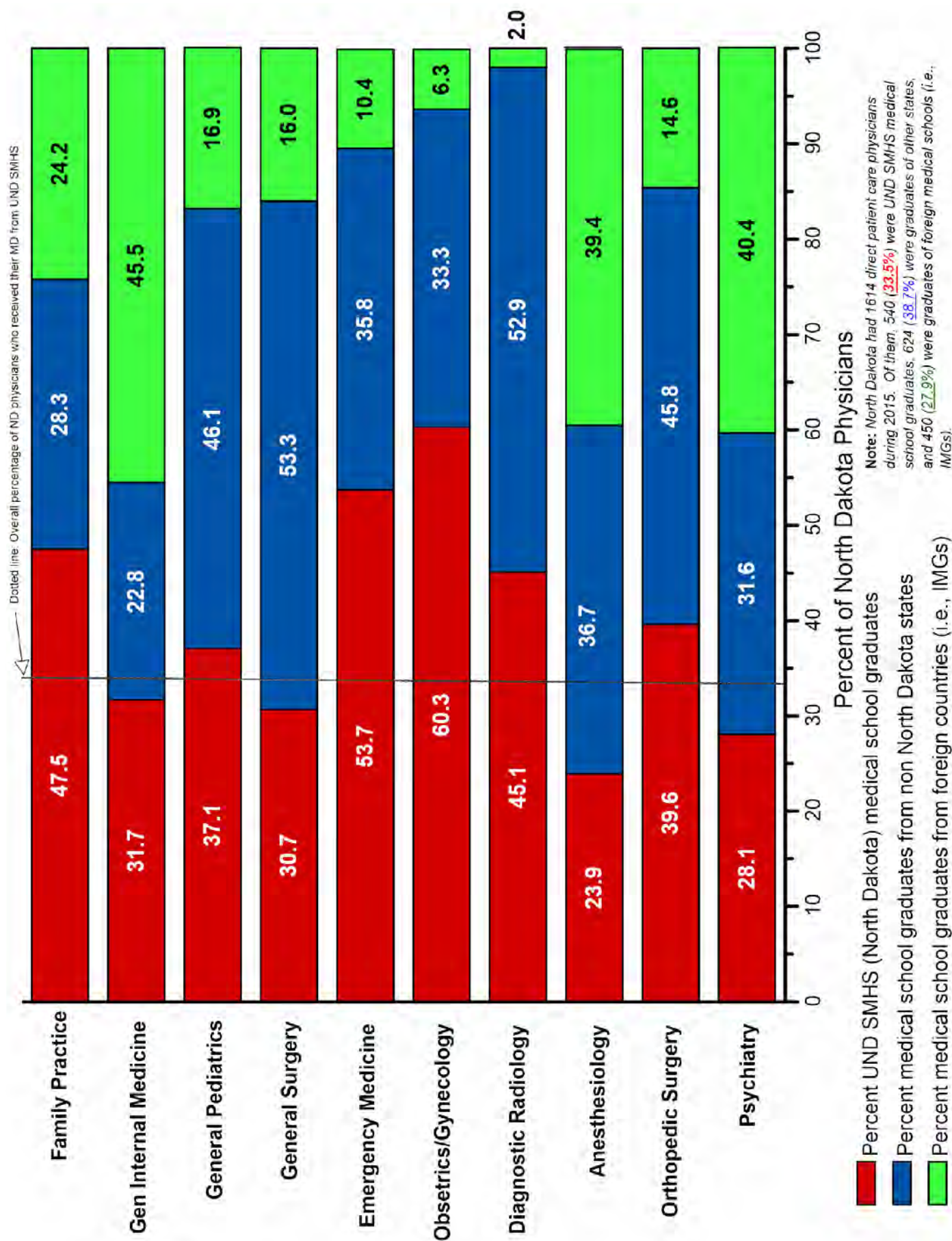
UND SMHS graduates had the highest percentage for obstetrics/gynecology physicians (60.3%), followed by emergency medicine physicians (53.7%), family physicians (47.5%), and diagnostic radiologists (45.1%). The UND SMHS graduates accounted their lowest percentage for anesthesiologists (23.9%). Non-North Dakota U.S. medical school graduates had their highest percentages for general surgery (53.3%), diagnostic radiology (52.9%), general pediatrics (46.1%), and orthopedic surgery (45.8%). Their lowest percentages were for general internal medicine (22.8%) and family practice (28.3%). IMGs had their highest percentages for general internal medicine (45.5%), psychiatry (40.4%), and anesthesiology (39.4%). Their lowest percentage was for diagnostic radiology at only 2.0 percent.

As expected when IMGs were added to the denominators (Table 9), the UND SMHS graduates' percentages of all North Dakota's direct patient care physicians for the 10 most frequent physician specialties dropped.

The North Dakota numbers of physicians by specialties drop appreciably for the 11 through 24 most frequent specialties in Table 9, so caution must be exercised when making observations when the physician counts drop below 30. Of interest in the second 12 most frequent specialties is that of the cardiovascular disease physicians, where only 3.7 percent were UND SMHS graduates, 51.9 percent were non-North Dakota U.S. medical school graduates, and 44.4 percent were IMGs.

The bottom physician category of Table 9 titled "All Other Specialties" contains 17.5 percent (283/1614) of all of North Dakota's direct patient care physicians during 2015. Of the 283, non-North Dakota U.S. medical school graduates accounted for 42.8 percent, IMGs accounted for 40.3 percent, and UND SMHS medical school graduates accounted for just 17.0 percent. The comparable overall percentages of the state's 1614 direct patient care physicians were 38.7 percent (624), 27.9 percent (450), and 33.5 percent (540). Thus, IMGs were disproportionately overrepresented in the "All Other Specialties" category (i.e., least frequent North Dakota specialties). IMGs represented 27.9 percent (450) of all of North Dakota's direct patient care physicians but represented 40.3 percent of the "All Other Specialties" category." UND SMHS graduates represented 33.5 percent (540) of all North Dakota's direct patient care physicians but represented a lower 17.0 percent of the "All Other Specialties" category (i.e., they were disproportionately underrepresented in the category). The parallel percentages for the 624 non-North Dakota U.S. medical school graduate physicians were 38.5 percent and 42.8 percent.

Figure 2: Percentage of North Dakota Direct Patient Care Physicians Who Graduated From UND SMHS, Other States, and Foreign Countries by Most Frequent Specialties: 2015



Among other things, there is enough information provided in Table 9 that a table like Table 3 (all U.S. medical school graduates by specialty) can be created that includes all of North Dakota’s direct patient care physicians including IMGs. There are many other tables of interest that can be constructed.

An aspect of specialty supply that is relevant to this discussion relates to the relative supply of different specialty types per population within North Dakota in comparison with the U.S. Such comparisons only make sense for the most numerous specialties. As with Figure 2, only the most frequent 10 North Dakota specialties are examined. Comparisons for less frequent specialties are not meaningful because of the small numbers of physicians. In Table 10, the most frequent North Dakota direct patient care practicing physicians are displayed for North Dakota and the U.S. Table 10 provides the approximate physician rates per 100,000 population for each of the specialties. In addition, the rightmost column displays the percentage difference between North Dakota’s rate in comparison with the U.S rate.

Note that the AMA physician data utilized in Table 10 are not the same as those utilized throughout the rest of this policy brief. Physician data obtained from the AMA for direct patient care physicians practicing in North Dakota and physicians who received their medical school degrees from SMHS were utilized elsewhere in this brief. However, because the AMA Physician Masterfile for all U.S. physicians was cost prohibitive, results of AMA produced tables were used for Table 10.⁹ The physician selection type does not match the rest of this Topic brief but is good enough to provide an overview of how North Dakota compares with the U.S.

As can be observed from Table 10, North Dakota has substantially more physicians per population for the specialties of family practice and general surgery (56.0 versus 31.3 and 15.7 versus 12.1; 79% and 30% more) than does the U.S. This makes sense because North Dakota is considerably more rural than the nation at large (i.e., North Dakota is nearly 50% rural). However, North Dakota has significantly fewer physicians per 100,000 population than the U.S for the specialties of: general pediatrics (62% fewer), anesthesia (37% fewer), obstetrics/gynecology (OB/GYN) (33% fewer), and general internal medicine (19% fewer).

Across all specialties, North Dakota has 28 percent fewer physicians than the U.S. These figures are not adjusted for factors such as age and sex. For instance, OB/GYNs could more appropriately have their rate per 100,000 population denominator adjusted for the relevant female population and general pediatricians could have their denominator adjusted for the relevant young population.

Geographic Locations of Direct Patient Care Practicing Physicians

Table 11 provides the percentage and number of direct patient care physicians who practiced in four geographic types of areas: Urban, Large Rural, Small Rural, and Isolated Small Rural using the Rural-Urban Commuting Area (RUCA) taxonomy’s 21 codes as aggregated most often. The RUCA codes (ZIP Version 3.1) are based on the Census Bureau’s definition of Urbanized Areas and Urban Places by population coupled with work commuting flows.¹⁰

Table 10: 2013 U.S. and North Dakota Physicians Per 100,000 Population and Percent Difference*

	U.S.	North Dakota	Percentage Difference North Dakota (compared to U.S.)
Family Practice	31.3	56.0	+79%
General Internal Medicine	54.4	44.3	-19%
General Pediatrics	37.5	14.3	-62%
General Surgery	12.1	15.7	+30%
Emergency Medicine	11.4	9.0	-21%
Obstetrics/ Gynecology	13.9	9.3	-33%
Diagnostic Radiology	8.4	7.3	-13%
Anesthesia	14.2	8.9	-37%
Orthopedic Surgery	8.2	8.4	+2%
Psychiatry	12.7	11.0	-13%

**These data on total U.S. physicians are from a different AMA source and do not exactly match the AMA data from the rest of this topic brief. Unlike the data employed in the rest of this brief, some additional physicians are included in the table (e.g., residents in training, federal physicians, and physicians not in direct patient care). However, the rates and percentage differences should be close to those obtained if matched better with the rest of the brief. The North Dakota and U.S. data within this table exactly matches.*

***The 10 listed specialties accounted for approximately 55 percent of all physicians who practiced in the U.S. and 65 percent of all physicians who practiced in North Dakota.*

Table 11: North Dakota direct patient care physicians by geographic rural/urban categories for six groupings of physicians during 2015

	Physician Group	RUCA Category							
		Isolated Small Rural		Small Rural		Large Rural		Urban	
		Percent	# of Physicians	Percent	# of Physicians	Percent	# of Physicians	Percent	# of Physicians
A	Direct Patient Care Physicians Who Were Practicing in North Dakota (Table 3, n=1164)	4.8	56	3.4	40	15.4	179	76.4	889
B	Direct Patient Care Physicians Who Graduated Medical School in North Dakota (Table 4, n=1593)	2.6	41	5.2	83	13.1	208	79.1	1260
C	Direct Care Physicians Who Graduated Medical School in North Dakota and Practiced in North Dakota (Table 5, n=540)	5.0	27	1.9	10	13.7	74	79.4	429
D	Direct Care Physicians Who Graduated Medical School in North Dakota and Did Not Practice in North Dakota (Table 6, n=1053)	1.3	14	6.9	73	12.7	134	79.0	832
E	Direct Patient Care Physicians Who Practiced in North Dakota and Who Did Not Graduate from Medical School in North Dakota (Table 7, n=624)	4.6	29	4.8	30	16.8	105	73.7	460
F	IMGs and Canadian Direct Patient Care Physicians Who Practiced in North Dakota (Table 8, n=450)	4.4	20	2.7	12	15.6	70	77.3	348

In Table 11, the North Dakota number of 2015 direct patient care physicians and percentages by geography area type are shown for Table 3 through Table 8 individually (i.e. designated as A through F). Table 3 through Table 7 only include U.S. medical school graduates and Table 8 includes only IMGs.

As seen from examination of the Table 11's subsections (A through F summarize the geographic locations of their respective physician groups from Table 3 through Table 8), physician geographic distributions are generally similar to one another.

The overall North Dakota U.S. medical school graduates' distribution percentages from Table 11 Section A as follows: Isolated Small Rural, 5 percent; Small Rural, 3 percent; Large Rural, 15 percent; and Urban, 76 percent; The North Dakota population is distributed as follows: Isolated Small Rural, 22

percent; Small Rural, 6 percent; Large Rural, 21 percent; and Urban, 51 percent. Clearly rural areas have lower percentages of physicians than of population across all three rural categories.

Family physicians were more likely to have practiced in North Dakota's rural areas than other specialties (not tabled). Over half (51%) of North Dakota's population lives in Urban locations, while over three-quarters (76%) of the direct patient care physicians practice there.

Summary

This topic brief deals with the medical school interstate balance of trade for direct patient care physicians in North Dakota. Balance of trade in this macro context means the net contribution of medical schools to the provision of patient care

as it relates to North Dakota and how it relates to the practice locations of UND SMHS physician graduates. The data presented are from 2015 and are not longitudinal. These data do not explain why the findings are as described. The decisions that lead to physician practice location are multifaceted and complicated. Such factors as residency location, specialty, local lifestyle amenities, geographic background, spousal geographic background, practice opportunities, fiscal remuneration and so forth lead to the observed findings. Nevertheless, these state-level findings do describe the interstate balance of one state's output and input related to physician practice state and medical school graduation state. They are important in their own right. For instance, knowing that there is a -233 difference favoring Minnesota over North Dakota per the exchange of practicing MD graduates has significant policy, financial, and educational importance. The phrase "balance of trade" is a metaphor that is often employed in economics regarding nations and commodity trade. It is used here to denote the degree of balance in state specific medical school MD production and subsequent practicing state. It in no way is meant to signify physicians are a commodity. The training residency background of physicians is an important factor in their practice location.

There are four themes explored in this brief: 1) where direct patient care physicians practicing in North Dakota graduated from medical school, 2) where MD graduates of North Dakota's medical school (UND SMHS) currently practice, 3) how the macro balance of physician location factors has played out to North Dakota's advantage and disadvantage regarding other states, and 4) how physician specialty varies by location of physician medical school training. The rural and urban locations of different groups of physicians is briefly addressed but the findings were not unexpected or remarkable.

Some of the more salient findings discussed in this topic brief are as follows (order does not imply importance and unless otherwise noted in the following bulleted observations, the 450 IMG North Dakota direct patient care physician are not included).

- Related to direct patient care physicians in 2015, North Dakota was a large importer of U.S. medical school graduates (54%, 624).
- Nearly half (46%, 540) of North Dakota's direct patient care physicians graduated from the UND SMHS.
- Nearly a third (31%, 365) of North Dakota's direct patient care physicians graduated from medical schools in Midwest states (all Midwest states included except North Dakota).
- The three states that contributed the most practicing direct patient care physicians to North Dakota were Minnesota (93), Missouri (56), and Iowa (48).

- A third (34%, 540) of the UND SMHS physician graduates practiced within North Dakota.
- Three hundred twenty-six UND SMHS medical school graduates practiced in Minnesota and 93 Minnesota medical school graduates practiced in North Dakota. This was the largest North Dakota unfavorable balance of medical school graduates (i.e., negative balance of trade for North Dakota of -233 direct patient care physicians). The second largest North Dakota negative balance was with Wisconsin at -71. North Dakota's two largest positive differentials in physician flows were with Missouri (+41) and Iowa (+16).
- The balance between the practice locations of UND SMHS physician graduates and those of Midwest states (not including Minnesota) was nearly in balance at 301 versus 272.
- The balance between the practice locations of UND SMHS physician graduates and those of Western states (including California was significantly out of balance at 73 versus 272 (-187, difference unfavorable to North Dakota).
- The state not counting North Dakota with the most UND SMHS physician graduates who practiced as direct patient care physicians was Minnesota with 326 followed by Wisconsin with 87 and Montana with 45.
- The states with the most practicing medical school graduates who practiced as direct patient care physicians in North Dakota were: Minnesota (93) followed by Missouri (56), and Iowa (48).
- For the 3 states contiguous with North Dakota, the exchange figures are as follows (their graduates practiced in North Dakota/ UND SMHS graduates practiced in their state/balance of trade): Minnesota 93/327/-233; Montana 0/45/-45; and South Dakota 42/28/+14. See note at bottom of Table 2 (i.e., **) for explanation of zero for their graduates who practiced in North Dakota.
- The overall North Dakota versus other interstate balance of practicing medical school graduates in 2015 was an unfavorable deficit of -428. If North Dakota IMGs are included in the calculations the deficit grows to -878 (-428 -450 = -878).
- The specialty mix of North Dakota's direct patient care physicians varied greatly depending on their medical school graduation group (i.e., UND SMHS, other U.S. medical schools not including North Dakota, and IMGs).
- Of the 1614 total direct patient care physicians who practiced in North Dakota 540 (34%) received their medical degree at the UND SMHS, 450 (28%) were IMGs, and 624 (39%) were medical school graduates from U.S. states other than North Dakota.

- The six most frequent physician specialties practicing in North Dakota during 2015 were: 1) family practice, 2) general internal medicine, 3) general pediatrics, 4) general surgery, 5) emergency medicine, and 6) obstetrics/ gynecology). These specialties accounted for over half (53%) of North Dakota's direct patient care physicians.
- IMGs (40%) and non-North Dakota U.S. medical school graduates (43%) were much more likely to have practiced in the less common specialties than UND SMHS graduates (17%). See Table 9.
- During 2015, UND SMHS graduates accounted for 60 percent of North Dakota direct patient care physicians who practiced obstetrics/ gynecology, 54 percent who practiced emergency medicine, 48 percent who practiced family practice, 45 percent who practiced diagnostic radiology, 40 percent who practiced orthopedic surgery, and 32 percent who practiced general pediatrics.
- Compared to the U.S., during 2012, North Dakota had substantially more physicians per population for the specialties of family practice and general surgery (79% and 30% more) and significantly fewer for the specialties of: general pediatrics, anesthesia, obstetrics/gynecology, and general internal medicine (62%, 37%, 33%, and 19% fewer).

Total physician sums differ slightly between fact sheets and topic briefs because of a few missing data items.

Data are from the 2015 American Medical Association Physician Masterfile.

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