Family Medicine Graduate Proximity to Their Site of Training:

Policy Options for Improving the Distribution of Primary Care Access

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BACKGROUND AND OBJECTIVES: The US Graduate Medical Education (GME) system is failing to produce primary care physicians in sufficient quantity or in locations where they are most needed. Decentralization of GME training has been suggested by several federal advisory boards as a means of reversing primary care maldistribution, but supporting evidence is in need of updating. We assessed the geographic relationship between family medicine GME training sites and graduate practice location.

METHODS: Using the 2012 American Medical Association Masterfile and American Academy of Family Physicians membership file, we obtained the percentage of family physicians in direct patient care located within 5, 25, 75, and 100 miles and within the state of their family medicine residency program (FMRP). We also analyzed the effect of time on family physician distance from training site.

RESULTS: More than half of family physicians practice within 100 miles of their FMRP (55%) and within the same state (57%). State retention varies from 15% to 75%; the District of Columbia only retains 15% of family physician graduates, while Texas and California retain 75%. A higher percentage of recent graduates stay within 100 miles of their FMRP (63%), but this relationship degrades over time to about 51%.

CONCLUSIONS: The majority of practicing family physicians remained proximal to their GME training site and within state. This suggests that decentralized training may be a part of the solution to uneven distribution among primary care physicians. State and federal policy-makers should prioritize funding training in or near areas with poor access to primary care services.

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Despite a $15 billion annual federal and state investment in graduate medical education (GME), a physician shortage is on the horizon.[1] The Association of American Medical Colleges predicted that by 2025 the nation would need an additional 124,400 physicians of all specialty types.[2] However, the number of GME-funded training positions was capped by the 1997 Balanced Budget Act, and from 1997 to 2008, only 7,869 new resident positions were created, mainly to train specialists by teaching hospitals.[3] Moreover, the physician shortage is particularly acute among primary care physicians (PCPs) due to the Affordable Care Act and a declining production of primary care from US GME teaching hospitals.[4] Recent projections estimate that the growth in the overall US population, the aging of the US population, and insurance expansion through various provisions of the Patient Protection and Affordable Care Act (ACA) will create a need for 35,000 to 52,000 more PCPs by 2025.[5,6]

Equally important is the uneven geographic distribution of primary care physicians between urban and rural areas. Most states and primary care service areas have shortages because physicians most often practice in urban areas. There are on average 68 PCPs per 100,000 residents in rural areas, compared to 84 per 100,000 in urban areas.[7] According to the Agency for Healthcare Research and Quality, 89.9% of general internal medicine physicians,

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77.6% of pediatricians, and 91% of all physicians practice in urban areas.[8,9] Of all the adult primary care physician specialties, family physicians are more likely to populate rural areas, with 77.5% in urban areas, 11.1% in large rural areas, 7.2% in small rural areas, and 4.2% in isolated rural areas.[7,10]

Many factors have been shown to influence the ultimate location of physician practice, including family factors, birth location, training exposures, and even the location of training itself.[11,12] As evidenced by significant public investment in regional expansion of medical schools, some policymakers and planners believe the location of training is an effective remedy to the unequal distribution of physicians in their states or regions. Evidence supporting this assumption, however, is scarce. A small number of studies have examined the relationship between training location and practice location upon graduation. In a 1995 study, Seifer and colleagues found that 51% of all physicians practiced in the state from which they completed their residency. They also found that generalist physicians were more likely than specialists to remain in the same state as their residency.[12] Another study of family physicians practicing in the state of Virginia found that physicians with the highest likelihood of practicing in Virginia were those who attended medical school and completed residency training in Virginia.[13] They also found that of physicians who had only one previous "contact" with Virginia, only 6% were practicing in Virginia, compared to 49% of physicians who completed residency training in Virginia.[13] A more recent study of graduates of a single family medicine residency program in Hawaii found that 73% of graduates remained in practice in Hawaii after graduation.[11]

Internationally, a UK study of medical school graduates found that 59% were practicing in their region of training, while the deans of Australia's medical schools have established a Medical Student Outcomes Database that will allow them to prospectively track these issues.[14,15] All of these studies, however, are either dated, international, single-state, or regional; we found no recent national study of regional retention post-GME on a national scale, at a time when GME reform weighs heavily on the minds of federal policymakers. No prior studies have examined retention in terms of distance from training sites, nor have any examined retention across all states over time.

The purposes of our study were to: (1) assess what percentage of family physicians practice within 5, 25, 50, 75, and 100 miles of their family medicine residency program (FMRP) site, (2) determine what percentage of family physicians practice within the state from which they graduated from residency training, and (3) determine how many family physicians remain near their FMRP over time. Knowing the retention rates of FMRP graduates by distance from training site, retention within the state that they trained, and retention over time could influence how policymakers decide to distribute future GME training funding.

Methods

Physician practice location was drawn from the 2012 American Medical Association (AMA) Masterfile, and each physician was matched by medical education number to the 2012 American Academy of Family Physicians' (AAFP) membership file to identify the family physicians' residency program. This match yielded a study cohort of all family physicians who had ever graduated from a US allopathic or osteopathic medical school from 1970 through the year 2006 (64,972 family physicians). We excluded graduates of military residency training sites (2,163 family physicians), due to their obligatory mobility post-training. This historical cohort, ending at 2006, was selected to ensure that physicians had time to locate after their residency training and allow the AMA Masterfile to update their information.[16]

While the AAFP's membership file only maintains data on their members, there are other family physicians captured in the file for those that had previously been members but are no longer active members. The AMA Masterfile was used to identify the practice address, specialty, and to optimize the inclusion of physicians who practice direct patient care. Further, we utilized the AAFP's membership file as it has the actual residency training site, whereas the AMA Masterfile only lists the sponsoring institutions. This was done to more accurately calculate the distances from practice locations to programs and also to capture correct state to state matches since some sponsoring institutions are located in different states than their residency program.[16]

A total of 71,656 physicians were successfully matched in the AAFP and AMA files, 64,972 of whom graduated from medical school between 1970 and 2006 and were identified as graduating from a non-military program. The locations of the physicians and residency programs were geocoded and assigned longitude and latitude point locations based upon matching to a national address database. Locations were assigned these point identifiers based on the street address, street names, or zip code locations if the previous were unavailable. Once the longitude and latitude coordinates were assigned to the two different locations, the distance was calculated to the residency program from the physicians' practice location based upon the Vincenty formula for calculating geodesic distances along the Earth's surface.[17] While this does not account for actual transportation distances along road networks, this does give an extremely accurate straight line distance from the practice location to the residency program.

Practice distances from FMRP were summed and percent of the physicians practicing within 5, 25, 50, 75, and 100 miles of their

training site were calculated. The same was done for subsets of physicians who graduated between 2000 and 2006, 1990 and 1999, 1980 and 1989, and 1970 and 1979. Physicians practicing in the same state as their FMRP were also calculated and similarly tested for proximity degradation over time. We explored associations between retention within state of training and regional and state characteristics that might also influence proximity after training. Multivariate analysis is not typically used in state-level studies due to the small number of observations. We used SAS, Excel, and ArcGIS to conduct these analyses. This study received approval for exemption from the IRB.

Results

Nationally, 54.8% of eligible family physicians practice within 100 miles of their FMRP training location (Table 1). Nineteen percent practice within 5 miles, and 46% are practicing within 50 miles of their FMRP training location. Recent graduates are more likely (62.5% of graduates in the 2000s) than earlier graduates (51.5% of graduates in the 1980s) to practice within 100 miles of their FMRP.

Overall, 56.9% of family physicians practice within the state from which they graduated (Table 2). State retention varies widely from 15.3% in the District of Columbia to 74.8% in California. Other states with relatively high graduate retention rates include Minnesota at 66.7%, Louisiana at 68.0%, Montana at 68.5%, Arkansas at 68.9%, Hawaii at 72.1%, Mississippi with 74.4%, and Texas at 74.6%. States with lower retention rates include Rhode Island at 22.4%, Wyoming at 27.0%, Delaware at 36.1%, Connecticut at 36.4%, and North Dakota at 38.3%.

In general, we observed slight decreases in retention of family physicians over time (Table 3). Initially, 64% of FMRP graduates remained in state, but this drops to around 53% after about 20 years. Every state retained more of their family physician graduates in the 2000 to 2006 cohort than over the total time period except Rhode Island (total 22.4%, but 17% retention in the 2000–2006 cohort) and Hawaii (total 72.1%, but only 69.7% in the 2000–2006 cohort). Alaska and New Hampshire retained 100% of their FMRP graduates from the 1970s and 1980s, and Hawaii retained 100% of its graduates in the 1980s (Table 2). We tested the effects of including graduates of military family physician training programs in our analyses as well. Nationally, this lowered retention within 100 miles by 1.2%, and only two states changed by greater than 10% overall (Florida, Hawaii). Retention within state of training was positively correlated with increasing size, increasing number of family physicians, percentage of low income population per state, and negatively correlated with a states' population density.

The map shows the percent of the total family medicine residency graduates that practice in the same state in which they were trained and shows that there are lower retention rates among the smaller states in the northeast as well as Wyoming and North Dakota (see Figure 1). There are higher rates of retention in the southern portion of the country and in Alaska, Washington, California, Montana, Minnesota, Kentucky, Indiana, and New Hampshire.

Limitations

This paper examined family physicians only. We did not examine retention rates of internal medicine and pediatric physicians. Inevitably, some physicians found in the AAFP membership file could not be found in the AMA Masterfile and thus, were not mapped. This could be due to death, retirement, or career changes. Based on previous work with these files, we believe that they have a high fidelity with family physicians who are currently in practice. In addition, the distance from residency program graduation site to current practice location was calculated as a linear distance along the Earth's surface and thus does not represent the actual distance using road networks. Finally, the AMA Masterfile has an approximately 3-year lag time between graduating from residency and accurately updating the physician's new practice location.

Discussion

Our study finds that the majority of family physicians remain relatively close to their GME training sites. As policymakers seek ways to find primary care access solutions for underserved and shortage areas, this study suggests that the limited federal and state GME resources that are directed to training family physicians in or near underserved and shortage areas may have important returns.

The state variability in family physician retention we observed may be partly explained by the size and population density of the state under consideration. For example, the three smallest states, Rhode Island, Delaware, and Maryland, retain 22.3%, 36.1%, and 36.2% of family physician graduates, respectively. Population and GME training density, relatively small state size and the resulting proximity to other states, and natural flow within a DC to Boston "megalopolis" may explain the lower retention rates seen among Northeast and Mid-Atlantic states. The interesting exception of New Hampshire may be related to its having produced the fewest family physicians out of all states in the last 3 decades but from a program notable for placing its graduates in rural areas.

Our findings also reveal the importance of statewide retention in lieu of 100-mile distance for large Western and rural states, particularly those with demonstrated low training capacity, such as Alaska, Wyoming, Idaho, or Montana. Alaska has only one family medicine residency program, in Anchorage, which retained a better than average 63.5% of family physician graduates within the state.

Figure 1: Percent of Family Physicians by State Who Practice in the Same State in Which They Were Trained

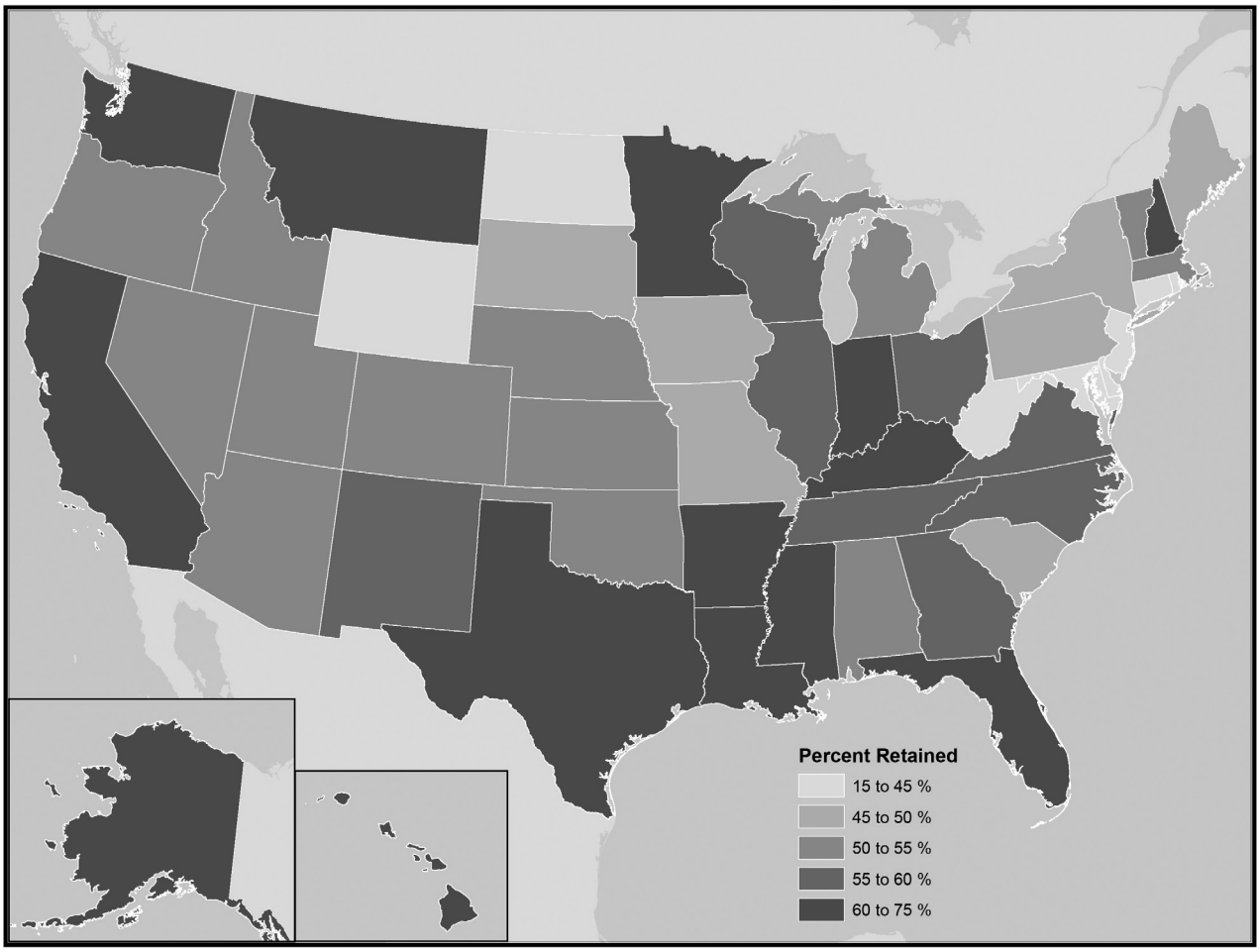

Table 1: Proportion and Total Number of Family Physicians Remaining Near Their Residency Training Site*

	% (n) Within 100 Miles	% (n) Within 75 Miles	% (n) Within 50 Miles	% (n) Within 25 Miles	% (n) Within 5 Miles
Total n=64,972	54.9% (35,638)	50.7% (32,958)	45.7% (29,675)	37.9% (24,631)	19.1% (12,429)
2000–2006 n=12,751	62.5% (7,965)	59.2% (7,546)	54.4% (6,932)	46.7% (5,956)	27.5% (3,510)
1990–1999 n=23,386	54.9% (12,846)	50.8% (11,875)	45.7% (10,692)	38.3% (8,946)	18.6% (4,345)
1980–1989 n=19,912	51.5% (10,256)	47.1% (9,372)	42.0% (8,362)	34.3% (6,820)	15.9% (3,162)
1970–1979 n=8,927	51.2% (4,571)	46.9% (4,189)	41.3% (3,688)	33.7% (3,009)	15.8% (1,412)

* 64,972 qualifying family physicians in study

We examined retention by decade of graduation to gain an understanding of differences by generations of graduates and, perhaps, a decline in retention over time. A higher number of recent family physician graduates stay close to their training site, some of which may be explained by the limitations of the AMA Masterfile, which has an approximately 3-year lag time between graduating from residency and accurately updating the physician's new practice location, as mentioned above.[18] Given our use of a 2012 file, we reported

Table 2: Total Number and Proportion of Family Physicians Practicing in the Same State as Their Family Medicine Residency, by Graduation Year*

State	Total # of Graduates	% Remained in State	% in State 2000–2006	% in State 1990–1999	% in State 1980–1989	% in State 1970–1979
AK	74	63.5	66.0	52.4	100.0	100.0
AL	1,090	52.2	61.3	53.8	44.2	51.9
AR	912	68.9	72.9	69.2	66.0	65.1
AZ	906	51.7	66.9	54.9	43.3	44.1
CA	6,161	74.8	85.2	75.5	70.6	69.4
CO	1,441	50.7	59.2	50.1	45.8	49.5
CT	511	36.4	42.5	32.7	39.1	32.0
DC	213	15.3	33.3	15.9	11.1	18.2
DE	313	36.1	40.0	37.9	34.9	31.3
FL	1,928	65.5	72.9	64.4	63.8	61.0
GA	1,398	59.8	67.4	63.2	55.7	47.0
HI	68	72.1	69.7	75.8	100.0	—
IA	1,351	46.3	50.5	51.8	43.6	38.9
ID	266	51.5	52.9	47.7	58.1	47.8
IL	3,326	55.6	64.2	54.8	51.7	53.0
IN	1,924	64.6	66.8	62.5	66.7	62.6
KS	818	52.5	63.9	49.5	49.6	53.1
KY	836	60.8	71.0	59.6	58.6	57.3
LA	808	68.0	73.8	65.8	63.9	70.0
MA	669	53.8	61.0	56.3	45.6	45.3
MD	698	44.2	48.2	40.8	44.7	46.0
ME	565	47.3	49.0	47.8	42.5	54.4
MI	2,773	54.8	59.1	56.7	52.5	50.0
MN	1,330	66.7	71.8	69.1	54.2	67.2
MO	1,000	48.6	65.0	45.8	42.9	40.2
MS	353	74.4	85.5	73.1	67.8	82.6
MT	54	68.5	75.8	60.0	—	—
NC	1,975	55.5	64.5	55.4	50.7	54.0
ND	405	38.3	44.4	40.5	35.4	30.0
NE	944	51.0	56.0	47.9	54.4	46.8
NH	62	62.9	66.7	56.7	100.0	100.0
NJ	1,594	39.8	43.4	41.2	35.7	42.7
NM	365	56.2	57.0	56.5	50.0	64.3
NV	164	51.8	54.8	57.5	35.3	50.0
NY	3,738	47.7	51.9	45.9	48.0	47.0
OH	3,058	57.4	60.5	61.0	52.2	55.5
OK	870	51.2	57.7	50.5	46.3	49.5
OR	366	53.1	64.2	46.9	49.3	48.9

(continued on next page)

Table 2: Continued

State	Total # of Graduates	% Remained in State	% in State 2000–2006	% in State 1990–1999	% in State 1980–1989	% in State 1970–1979
PA	3,724	47.0	50.9	40.8	49.1	53.1
PR	357	60.3	63.0	59.7	58.8	66.0
RI	325	22.4	17.0	28.2	20.6	15.2
SC	1,845	47.5	50.9	45.1	46.4	50.7
SD	311	46.2	55.4	49.5	36.6	46.0
TN	1,234	56.1	59.9	55.6	55.1	56.2
TX	4,678	74.6	79.6	75.3	72.4	70.9
UT	572	52.7	63.2	58.4	42.7	40.5
VA	1,990	55.3	67.7	53.9	50.1	55.5
VT	137	50.4	51.4	42.9	54.3	61.1
WA	1,547	61.2	63.0	58.7	62.5	65.3
WI	1,839	56.3	60.8	58.2	50.3	58.7
WV	771	42.2	57.8	42.3	34.8	37.2
WY	315	27.0	36.2	35.5	16.9	15.0
TOTAL	64,972	56.9	64.0	57.1	53.4	54.4

Table 3: Region and Correlation Results

Region	% Retained in State
Northeast	45.4
South	56.2
Midwest	59.9
West	63.4
Bivariate Correlation With Retention	**R**
State size	0.37
Number of family physicians in state	0.40
Percent of population in state < 200% FPL	0.31
State population density	-0.48

only on graduates from 2009 or earlier. Even so, differences in retention between recent graduates and that from other decades was limited, perhaps even lower than some might expect, further evidence of the importance of training site location for both short-term and long-term solutions to shortage areas.

Interpretations of earlier findings among other researchers vary considerably even though they are similar in the overall retention estimates. Siefer and colleagues found that 51% remained within the state of residency training and concluded that the market for physicians is national and that state-level policies would not be very effective at changing the distribution of physicians.[11] Owen and colleagues conclude the opposite, suggesting that increasing residency slots in Virginia would be an effective way to increase the number of family physicians practicing in Virginia.[12]

Our study offers a limited perspective for planners and policymakers. Some planners or FMRPs may be seeking to place graduates into a non-concentric area, which is how our measure of distance was applied. For example, the Mountain Area Health Education Center program in Asheville, NC, has a goal of placing graduates in the western 18 counties in the state, which are 35 miles to the East and over 115 miles to the West (the lead author of this paper is the director of that program). Our methods could be adapted to test other measures of dispersion or to consider other outcomes such as serving in impoverished or provider shortage areas, placement of graduates in areas that would otherwise be shortage areas, or within safety net sites such as community health centers. In addition, further exploration of the additional factors that contribute to a program's local or state-level retention, as well as the degree to which a graduate's "retention" was the product of nature versus nurture, is needed.

Policy makers at the state and federal level can take action to remedy the extremely uneven distribution of primary care physicians by

expanding residency programs in states and geographic regions that are experiencing an inadequate supply of physicians. Such proposals from federal advisory bodies, including the Institute of Medicine[19] and the Council on Graduate Medical Education,[1] have been made repeatedly. Existing GME funds could be redirected, or other funds at the state level could be redirected to create new family medicine residency training slots. Given that funding for outpatient training programs has been jeopardized recently[20] and that states will need to rapidly increase access in shortage areas due to the ACA,[21] the time to act is now.

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References

1. Council on Graduate Medical Education. Improving value in graduate medical education. Report No. 21. Rockville, MD: Council on Graduate Medical Education, Aug 2013.
2. Dill M, Salsberg E. AAMC complexities of physician demand through 2025, 2008. 2008 [cited Aug 23, 2013]. Available from: http://www.innovationlabs.com/pa_future/1/background_docs/AAMC%20Complexities%20of%20physician%20demand,%202008.pdf.
3. Salsberg E, Rockey PH, Rivers KL, Brotherton SE, Jackson GR. US residency training before and after the 1997 Balanced Budget Act. JAMA 2008;300(10):1174-80.
4. Chen C, Petterson S, Phillips RL, Mullan F, Bazemore A, O'Donnell SD. Toward graduate medical education (GME) accountability: measuring the outcomes of GME institutions. Acad Med 2013 Sep;88(9):1.
5. Petterson SM, Liaw WR, Phillips RL, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010-2025. Ann Fam Med 2012 Nov 12;10(6):503-9.
6. Colwill JM, Cultice JM, Kruse RL. Will generalist physician supply meet demands of an increasing and aging population? Health Aff (Millwood) 2008;27(3):w232–w241.
7. Petterson SM, Phillips RL Jr, Bazemore AW, Koinis G. Unequal distribution of the US primary care workforce. Am Fam Physician 2013 June 1;87(11):Online.
8. Primary care workforce facts and stats no. 1: the number of practicing primary care physicians in the United States [Internet]. Report No: AHRQ Pub. No. 12-P001-2-EF. Rockville, MD: Agency for Healthcare Research and Quality, 2011 Oct. Available from: http://www.ahrq.gov/research/findings/factsheets/primary/pcwork1/pcwork1.pdf.
9. Primary care workforce facts and stats no. 2: the number of nurse practitioners and physician assistants practicing primary care in the United States [Internet]. Report No: AHRQ Pub. No. 12-P001-3-EF. Rockville, MD: Agency for Healthcare Research and Quality, 2011 Oct. Available from: http://www.ahrq.gov/research/findings/factsheets/primary/pcwork2/pcwork2.pdf.
10. Primary care workforce facts and stats no. 3 [Internet]. Rockville, MD: Agency for Healthcare Research and Quality, 2012 [cited Aug 25, 2013]. Available from: http://www.ahrq.gov/research/findings/factsheets/primary/pcwork3/index.html.
11. Hixon AL, Buenconsejo-Lum LE, Racsa CP. GIS residency footprinting: analyzing the impact of family medicine graduate medical education in Hawaii. Hawaii J Med Public Health 2012;71(4 Suppl 1):31.
12. Seifer SD, Vranizan K, Grumbach K. Graduate medical education and physician practice location. JAMA 1995;274(9):685-91.
13. Owen JA, Hayden GF, Bowman RC. Influence of places of birth, medical education, and residency training on the eventual practice locations of family physicians: recent experience in Virginia. South Med J 2005;98(6):674-5.
14. Goldacre M, Davidson J, Maisonneuve J, Lambert T. Locations of doctors' home before medical school, postgraduate training and career post: UK cohort study. J R Soc Med 2013 Mar 4;(106):96-104.
15. Cook G. Contextualizing GP shortage: a spatial audit of Australian GP residency training location [Internet]. North American Primary Cary Research Group, 2012 Dec 4. Available from: https://www.napcrg.org/Conferences/AnnualMeeting/MeetingAbstracts/2012AnnualMeeting?m=6&s=7828
16. Chen C, Petterson S, Phillips RL, Mullan F, Bazemore A, O'Donnell SD. Toward graduate medical education (GME) accountability: measuring the outcomes of GME institutions. Acad Med 2013 Sep;88(9):1.
17. Vincenty T. Direct and inverse solutions of geodesics on the ellipsoid with application of nested equations. Surv Rev 1975;23(176):88-93.
18. Petterson S, Burke M, Phillips R, Teevan B. Accounting for graduate medical education production of primary care physicians and general surgeons: timing of measurement matters. Acad Med 2011;86(5):605-8.
19. Insitute of Medicine. Primary care physicians: financing their graduate medical education in ambulatory settings. Insitute of Medicine, 1989.
20. Association of American Medical Colleges. AAMC letter to President Obama [Internet]. 2011 [cited Oct 18, 2013]. Available from: https://www.aamc.org/download/253354/data/obama_letter.pdf.
21. Shortage of primary care physicians exacerbated under Obamacare. Newsmax [Internet]. Jun 22, 2013 [cited 2013 Oct 18]. Available from: http://www.newsmax.com/US/Shortage-of-Primary-Care-Physicians-Exacerbated-Under-Obamacare/2013/06/22/id/511355.