Forgiven But Not Relieved: US Physician Workforce Consequences of Changes to Public Service Loan Forgiveness

Supplementary Appendix

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Study Methodology:

We sought to determine the intended participation in Public Service Loan Forgiveness by physician specialty and estimate the total cost of physician participation in the Public Service Loan Forgiveness program to the federal government.

Intended loan forgiveness program participation by specialty

We estimated intended Public Service Loan Forgiveness program participation by intended specialty using data from the Association of American Medical Colleges Medical Student Graduation Questionnaire. Data on intended loan forgiveness program participation were available from 2010 to 2014. De-identified individual-level data were used for the analysis. Only data for those individuals responding to both intended loan forgiveness program participation and intended specialty were used (n = 55,905). The data used for the analysis represent approximately 80% of medical graduates in the sample. Graduates were assigned to one of three categories: primary care eligible specialties, medical specialties, or surgical specialties, based on their indication of specialty choice at the time of graduation.

Primary care eligible specialties were defined as those individuals indicating an intended career in family medicine, pediatrics, general internal medicine, medicine-pediatrics, or preventive medicine. This definition is consistent with that of the US Health Services and Resources Administration.[S1] Other medical specialties were defined as allergy/immunology, dermatology, emergency medicine, medical genetics, neurology, pathology, physical medicine and rehabilitation, psychiatry, radiology,

radiation oncology, or hospice and palliative medicine. Surgical specialties were defined as anesthesiology, colon and rectal surgery, neurological surgery, obstetrics and gynecology, ophthalmology, orthopedics, otolaryngology, plastic surgery, general surgery, thoracic surgery, or urology. These assignments are consistent with that used by the AAMC in recent studies.[S2] We additionally display the intended participation for PSLF by select specialties from 2010 to 2014 in Supplementary Table 2.

Sensitivity Analysis

Given that historical match rates have found only 25% of internal medicine graduates pursue primary care,[S3] we have conducted a sensitivity analysis, which randomly assigns those going into internal medicine to primary care or other specialties. For those indicating general internal medicine or medicine-pediatrics, we randomly assigned to primary care or medical specialty with a 25%/75% probability, respectively, (using Bernoulli trials) to reflect the proportion of internal medicine residents who have historically pursued primary care. This stochastic assignment was then repeated 1,000 times to produce confidence intervals around the resultant estimate. The results can be seen in Supplementary Figure 3.

Statistical Analysis

We used a chi-squared test to determine differences in PSLF intended use across specialties with the significance level set a priori at $P<0.05$. The statistical analysis was conducted using STATA version 13.0 (StataCorp LP, College Station, TX).

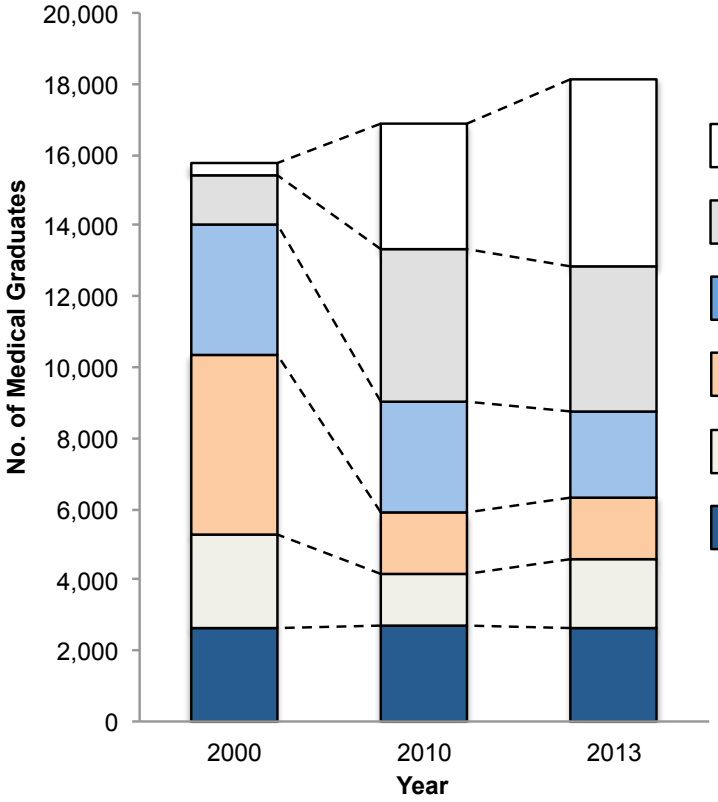
AAMC survey question validation

Since the survey question is largely untested, we sought to determine the validity of the survey question regarding choice of loan forgiveness program by comparing the proportion responding in the affirmative to intent to use National Health Survey Corp loan forgiveness within the Association of American Medical Colleges Medical Student Graduation Questionnaire to the proportion of medical students who actually applied to the National Health Service Corp. In 2014, 7.6% of AAMC survey respondents indicated intent to use National Health Service Corp loan forgiveness, whereas 6.5% of 2014 graduates actually applied to the program.

Cost estimation of Public Service Loan Forgiveness for US medical graduates

We used the average loan forgiveness amount after 10 years of public service under PSLF assuming a Pay As You Earn income driven repayment plan (See Supplementary Table 1) for physicians as estimated by the Association of American Medical Colleges.[S4] Total cost estimations were generated using the average individual estimated cost of forgiveness and the number of medical graduates reporting intended Public Service Loan Forgiveness participation within the sample. The 80% sample from the Association of American Medical Colleges Medical Student Graduation Questionnaire was used to make projections in order to generate a conservative estimate on cost. Given the payout for 2014 graduates would not occur until 10 years post-graduation, cost was adjusted using a discount rate of 6%,[S5] and reported in net present value dollars to provide a better comparison to current loan forgiveness programs (e.g., National Health Service Corp).

Supplementary Figure 1. Number of Medical School Graduates by Educational Debt Level, 2000-2013*



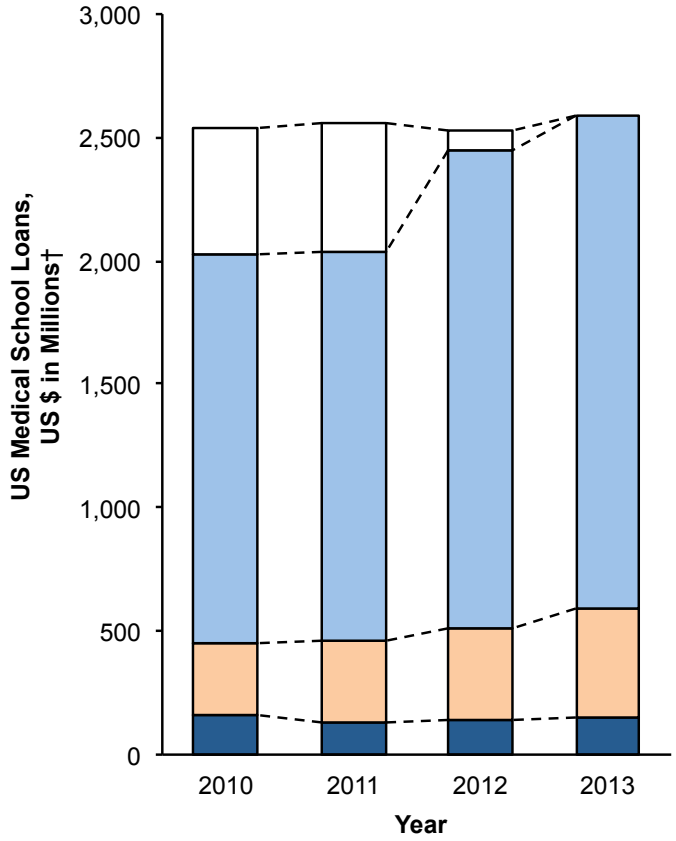
Debt	No. of Medical Graduates (%) † 2000	2010	2013	CAGR,‡ % 2000-2013
$200,001 or more	299 (2)	3,552 (21)	5,309 (29)	24.8
$150,001 to $200,000	1,433 (9)	4,243 (25)	4,077 (23)	8.4
$100,000 to $150,000	3,670 (23)	3,182 (19)	2,410 (13)	-3.2
$50,001 to $100,000	5,103 (32)	1,734 (10)	1,758 (10)	-7.9
$1 to $50,000	2,630 (17)	1,431 (9)	1,957 (11)	-2.2
No Debt	2,614 (17)	2,711 (16)	2,627 (15)	0.04
Overall	15,749	16,836	18,120	1.1

* Total educational debt at graduation from medical school was taken from the AAMC medical school graduation questionnaire, 2000-2013. Data are displayed in number of medical graduates based on weights to approximate the population of medical graduates in the US in each year from the AAMC databook.[S6] Figures were not adjusted for inflation due to data reported in categories of debt by year.

† When compared to other professional training in 2011-2012, the proportion of medical graduates with educational loans was 85% (AAMC), compared to 82% for law graduates, 38% for masters in business administration graduates, and 17% for doctoral degree program graduates (from the 2011-12 National Postsecondary Student Aid Studies).[S7]

‡ CAGR (Compound annual growth rate) supposing that year A is X and year B is Y, CAGR = $(Y/X)^{\{1/(B-A)\}-1}$.

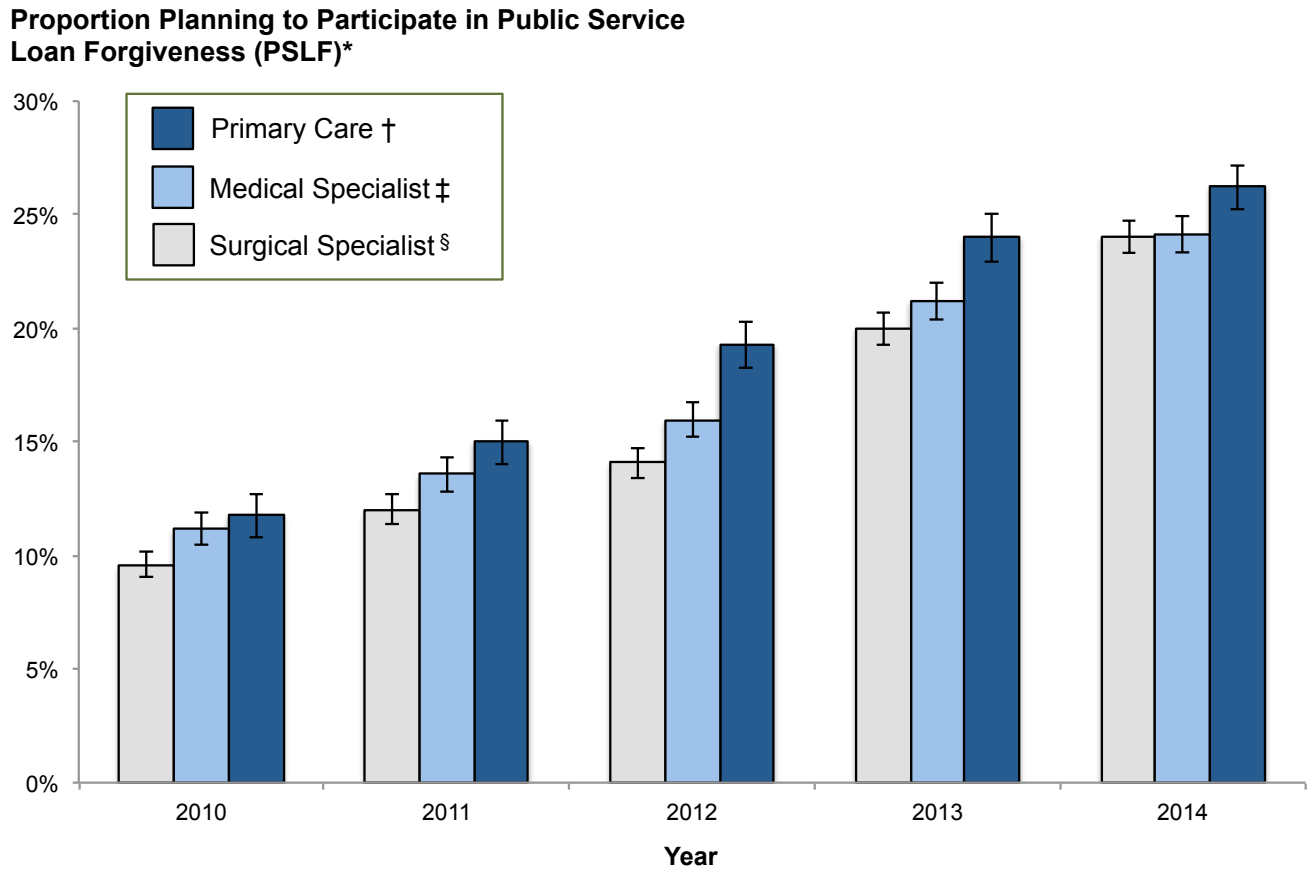
Supplementary Figure 2. US Medical School Loans by Source, 2010-2013*



Loan Source	US Medical School Loans, US $ in Millions† 2010	2011	2012	2013
Federal Direct Subsidized Loans‡	520.4	521.3	80.1	0.0
Federal Direct Unsubsidized Loans‡	1,571.5	1,573.7	1,929.6	1,999.7
Federal Direct Grad PLUS Loans‡	292.5	337.1	372.5	436.3
All other loans				
Federal Perkins Loans	31.2	34.6	41.0	48.9
Primary Care Loan	9.1	8.3	7.8	5.9
Loans for Disadvantaged Students	19.3	8.6	10.2	13.0
Federal Stafford or FFELP loans	25.2	0.0	0.0	0.0
State-Funded Loans	5.3	5.5	5.8	6.3
Private Loan Programs	8.9	14.3	18.6	18.0
Other loans	59.5	57.9	60.4	59.4
Total Loans	**2,543.0**	**2,561.3**	**2,525.9**	**2,587.5**

* Aggregate data on loans were obtained from the AAMC Databook from 2000-2013.[S6]
† Dollar amounts were adjusted to 2013 dollars using the US consumer price index from the Bureau of Labor Statistics.
‡ Federal Direct Loans (including subsidized, unsubsidized, and Grad PLUS loans) are those eligible for forgiveness under the Public Service Loan Forgiveness Program. All other loans may be become eligible depending on consolidation.

Supplementary Figure 3. Sensitivity Analysis of Planned Public Service Loan Forgiveness Participation by Specialty, 2010-2014



* Data are from the AAMC Graduation Questionnaire, 2010-2014. For those indicating general internal medicine or medicine/pediatrics, we stochastically assigned 25% of observations within each year using a uniform distribution to primary care in accordance with the proportion reporting the choice of general internal medicine from match results. Error bars represent 95% confidence intervals.
† Primary care includes family medicine, pediatrics, and a 25% random sample of internal medicine and internal medicine/pediatrics.
‡ Medical specialties include allergy/immunology, dermatology, emergency medicine, medical genetics, neurology, pathology, physical medicine and rehabilitation, preventive medicine, psychiatry, radiology, radiation oncology, hospice and palliative medicine, and a 75% random sample of internal medicine and internal medicine/pediatrics.
§ Surgical specialties include anesthesiology, colon and rectal surgery, general surgery, neurological surgery, obstetrics and gynecology, ophthalmology, orthopedics, otolaryngology, plastic surgery, thoracic surgery, and urology.

Supplementary Table 1. Federal Loan Repayment Programs[S8]

Repayment Plan	Eligible Loans*	Payment Term	Payment Calculation	Eligible for PSLF	Comments
Standard Repayment	Direct and FFEL	10 years, no forgiveness	Fixed annual payments based on repaying total amount borrowed and accumulated interested in 10 years	Yes	Default plan in place if the borrower selects no other repayment plan
Extended Repayment	Direct and FFEL	25 years, no forgiveness	Fixed annual payments based on repaying total amount borrowed and accumulated interest in 25 years	No	Must reapply for program annually
Income Contingent Repayment	Direct only	25 years, then forgiveness	Payments based on 20% of monthly discretionary income, no repayment cap	Yes	Must be a new borrower on or after 7/1/2014 and have partial financial hardship§
Income Based Repayment† (prior to 7/1/2014)	Direct and FFEL	25 years, then forgiveness	Payments based on a cap of 15% of monthly discretionary income‡	Yes	Must have partial financial hardship; Must provide annual income verification
Pay As You Earn†	Direct only	20 years, then forgiveness	Payments capped at 10% of monthly discretionary income and based on family size and household AGI‡	Yes	Must be a new borrower on or after 10/1/2007 and must have received a loan disbursement on or after 10/1/2011; Must have partial financial hardship and provide annual income verification

Abbreviations: FFEL = Federal Family Education Loans; PSLF = Public Service Loan Forgiveness

* Federal Family Education Loans (FFEL) include Stafford Loans, Unsubsidized Stafford Loans, Federal PLUS Loans and Federal Consolidation Loans. After the Health Care and Education reconciliation Act of 2010, no new FFEL Program Loans. The US Department of Education disperses education loans through the William D. Ford Federal Direct Loan Program.

† Monthly payments do not have to exceed the monthly payments calculated under the standard repayment plan. A recently introduced Revised Pay As You Earn (REPAYE) program was introduced which removes this clause.

‡ Discretionary income is adjusted gross income minus 150% of the household poverty line. Adjusted gross income is total income minus any deductions.

§ Partial financial hardship is when annual amount due on loans, as calculated under the standard repayment plan, exceeds 15% of borrower's discretionary income.

Supplementary Table 2. US Medical Graduates Planning to Use Public Service Loan Forgiveness by Specialty,* 2010-2014

Specialties	Measure	2010	2011	2012	2013	2014	CAGR† (%)
Internal Medicine	No. of Graduates	202	256	289	388	488	24.7
	Percent	12%	15%	17%	24%	27%	
Pediatrics	No. of Graduates	135	181	215	261	338	25.8
	Percent	13%	17%	22%	26%	29%	
Emergency Medicine	No. of Graduates	102	104	173	157	195	17.6
	Percent	11%	11%	19%	17%	21%	
Obstetrics & Gynecology	No. of Graduates	96	112	106	126	193	19.1
	Percent	13%	17%	17%	20%	29%	
General Surgery	No. of Graduates	103	89	110	154	188	16.2
	Percent	14%	15%	18%	25%	29%	
Family Medicine	No. of Graduates	57	75	94	124	168	31.0
	Percent	9%	12%	16%	20%	22%	
Anesthesia	No. of Graduates	73	84	91	140	143	18.3
	Percent	8%	11%	11%	20%	21%	
Radiology	No. of Graduates	61	75	81	91	112	16.4
	Percent	8%	12%	14%	18%	24%	
Psychiatry	No. of Graduates	59	83	69	85	96	12.9
	Percent	11%	19%	17%	22%	25%	
Orthopedics	No. of Graduates	44	52	61	70	92	20.2
	Percent	7%	9%	11%	15%	19%	
Neurology	No. of Graduates	36	37	44	62	69	17.7
	Percent	14%	13%	17%	26%	27%	
Other Medical Specialties	No. of Graduates	63	74	86	118	135	21.0
	Percent	9%	10%	11%	20%	21%	
Other Surgical Specialties	No. of Graduates	88	99	143	175	199	22.6
	Percent	8%	10%	14%	20%	22%	
Total	No. of Graduates	1119	1321	1562	1951	2416	21.2
	Percent	11%	13%	16%	21%	25%	

Abbreviations: CAGR = Compound Annual Growth Rate

* Specialties were selected for individual display if the specialty had at least 1,000 medical graduates within the 5-year sample. The remaining specialties were categorized as other medical or other surgical.

† CAGR (Compound annual growth rate) supposing that year A is X and year B is Y, CAGR = $(Y/X)^{\{1/(B-A)\}-1}$.

Supplementary References

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