NBER WORKING PAPER SERIES

THE COST OF PRIMARY CARE DOCTORS

Sherry A. Glied
Ashwin Prabhu
Norman H. Edelman

Working Paper 14568
http://www.nber.org/papers/w14568

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2008

We thank Peter Muennig and participants at the NBER Frontiers in Health Policy Research conference, held in June 2008, for useful insights. All views expressed herein are solely those of the authors, and not necessarily those of the National Bureau of Economic Researchic Research.

The Cost of Primary Care Doctors
Sherry A. Glied, Ashwin Prabhu, and Norman H. Edelman
NBER Working Paper No. 14568
December 2008
JEL No. I18,J24,J44

ABSTRACT

This study uses a human capital model to estimate the societal cost of producing a physician service. Physician human capital consists of the underlying human capital (productivity) of those who become physicians and the job-specific investments (physician training) added to this underlying capital. The value of physicians' underlying human capital is estimated by forecasting an age-earnings profile for doctors based on the characteristics in youth of NLSY cohort participants who subsequently became doctors. Published estimates are used to measure the total cost (wherever paid) of investments in physician training. These data are combined to compute the societal cost per primary care physician visit. The estimated societal cost per primary care physician visit is much higher than the average co-payment per primary care service and generally higher than the current Medicare compensation rate per service unit The private return to primary care physician training is relatively low, in the range of 7-9%. At current levels of supply, the marginal social costs of primary care visits appear to be equal to or greater than marginal social benefits.

Sherry A. Glied
Mailman School of Public Health
Columbia University
Department of Health Policy and Management
600 West 168th Street, Room 610
New York, NY 10032
and NBER
sag1@columbia.edu

Ashwin Prabhu
Health Policy & Management
Columbia University
600 West 168th Street 6th Floor
New York, NY 10032
agp2014@columbia.edu

Norman H. Edelman
Stony Brook University
Graduate Program in Public Health
Department of Preventive Medicine
Stony Brook, New York, 11794-8036
and Columbia University
norman.edelman@stonybrook.edu

A spate of recent studies has drawn attention to looming shortages of physicians, and particularly of primary care doctors. Cooper et al. (2002) estimate that by 2025 the US will experience a shortage of 200,000 physicians. Colwin et al. (2008) predict a shortage of between 35,000 and 44,000 primary care physicians by 2025. In response to these predictions of shortage, health workforce planners have been calling for an infusion of public funds into the education and training of physicians and medical educators have begun to take steps to expand physician supply (Iglehart, 2008).

The market for physician services in the United States is distorted on both the demand side and the supply side. Very few consumers of physician services pay the full cost of their visits. The vast majority are covered by health insurance and subject to modest copayments. Some of the remainder receive publicly subsidized services. Thus, the demand for physician visits need not reflect the willingness to pay for these services.

The supply of physician services is also distorted. The number of available physicians and their distribution across specialties is constrained by the availability of residency positions in US hospitals and, for US medical students, by the number of slots available in US medical schools. Conversely, substantial government subsidies to undergraduate and graduate medical education may artificially expand the supply of training slots and the supply of physicians. Thus, the price physicians charge for their services need not reflect the social opportunity cost of producing these services.

The existence of these supply and demand distortions suggests that neither the observed market price for physicians' services nor the equilibrium quantity of services provided is necessarily (or even likely to be) socially optimal. These distortions in the market for physician services are further exacerbated by licensure-associated restrictions on the nature of medical training and on the scope of practice of alternative providers. These regulatory restrictions on the availability of lower cost alternatives to customary physician services further limit the extent to which the market-derived price and quantity of physician services can be assumed to be optimal.

The distortions throughout the physician service market, together with the extensive public role in subsidizing undergraduate and graduate medical education and the publicly-sanctioned role of physician organizations and medical colleges in determining the number of available slots in medical school, mean that formal workforce planning continues to be important in this market. Prior efforts at workforce planning have had, at best, mixed success in correctly anticipating how many physicians ought to be produced (Snyderman, Sheldon, and Bischoff, 2002).

This paper offers a novel approach to workforce planning in the physician market. Rather than projecting the future demand for physician services, we use a human capital model to assess the societal cost of producing a physician service. The social planner will choose a quantity of physicians such the societal cost of producing a physician service is equal to the (societal) benefit of such a visit. The human capital approach also provides direct estimates of the degree to which physicians earn rents.

We compute estimates of the opportunity cost and direct cost of developing and deploying primary care physician human capital. Our estimates suggest that the marginal cost of a primary care physician visit is between $51 and $77 and the marginal cost of a primary care physician-provided Medicare relative value unit (RVU) of work is between $37-$50. These estimated costs are substantially higher than the average co-payment for a physician visit and generally above the price of a Medicare RVU or the full price of the marginal primary care service. At current levels of supply, the marginal social costs of primary care visits appear to be equal to or greater than marginal social benefits. We estimate that the private return to primary care practice is between 7-9%. These estimates suggest that substantial increases in primary care physician supply are unlikely to be socially beneficial. Moreover, at current fee levels, such increases are unlikely to occur. Alternative, lower cost, strategies are needed for supplying primary care services.

History of Workforce Planning

The supply of new physicians in the United States is determined by the number of students who complete medical residency programs. New medical residents may be graduates of American medical schools or graduates of foreign medical schools. All must complete a residency before they may practice medicine in the United States.

The number and size of medical schools and the number of funded residency slots in the United States have varied over time with workforce projections. Planners in the 1960s, responding in part to the introduction of the Medicare program, anticipated an enormous increase in the demand for doctors. This expectation led to substantial federal support for the establishment of new medical schools and a doubling of the national medical school class size (Salsberg and Forte, 2002). The full effect of these increases was not realized until 1980.

By 1980, the introduction of managed care had led to a re-evaluation of the demand for medical services. Two influential studies (Graduate Medical Education Advisory committee, 1981 and Council on Graduate Medical Education, 1992) argued that there was likely to be a surplus of physicians. In response, federal support for the development of new medical schools ceased, and the Association of American Medical Schools [AAMC] advised its members to refrain from expansion (AAMC 2006). Congress ceased providing general funding to undergraduate medical education (Blumenthal, 2004). The total M.D. class remained constant for the next 25 years.

Residency programs receive subsidies from the Medicare program, and from many state Medicaid programs and other state government programs. In the mid-1990s, the expectations of a future physician surplus led the major medical and medical education societies to call for a reduction in the number of federally funded residency positions to one closer to that of the number of graduating medical students (Dunn, Miller, and Richter, 1998). This goal was realized through the cap on Medicare residency funding established under the 1997 Balanced Budget Act.

Current estimates of future shortages of physicians are based largely on a new econometric forecast model developed by Cooper, Getzen et al. (2002). This model predicts the future demand for physicians based on both demographic factors and income. The model incorporates a substantial income elasticity of demand for physician services and, thus, projects an increased demand for physician services in an era of economic growth. In response to these new predictions of physician supply shortages, the AAMC has called for a thirty percent increase in medical class size and the number of students admitted to US medical schools has increased for the first time since 1982. The AAMC is also calling for a substantial infusion of public funds into the expansion of physician supply, through an increase in Medicare funding for residency (graduate medical education) programs (Iglehart, 2008).

.

A Human Capital Approach to Workforce Planning

A physician service is produced through physician labor and human capital, combined with other labor and capital goods (office space, office staff, stethoscopes, nursing staff, etc.). The average cost of a physician service is the total cost of the physician's human capital and of all the other labor and capital goods used over the physician's career, divided by the number of patient-valued services delivered by the physician throughout his career.

Physician human capital consists of the inherent ability of those who become physicians, combined with the cost of the education and training they receive (high school, college, undergraduate medical school, and a residency program). The basic human capital earnings equation states:

$$(1)\quad \sum_{t=R}^{T} \frac{Y_1 - Y_0}{(1+i)^t} = \sum_{t=0}^{S} \frac{(s+Y_0)}{(1+i)^t} + \sum_{t=S}^{R} \frac{(r+Y_0)}{(1+i)^t}$$

Where Yo is the opportunity cost of physician time in the best alternative career; Y_1 is the level of earnings of physicians after they have been trained; T are years of worklife; S are the number of years of undergraduate medical education at a direct cost of s each; R are years of residency (graduate medical education) at a direct cost of r each and i is the discount rate.

If we assume that Y_0 and Y_1 are constant over the worklife, and that doctors and non-doctors work the same number of years, this implies that:

$$(2)\quad \sum_{t=R}^{T}\frac{Y_1}{(1+i)^t}=\sum_{t=0}^{S}\frac{s}{(1+i)^t}+\sum_{t=S}^{R}\frac{r}{(1+i)^t}+\sum_{i=0}^{T}\frac{Y_0}{(1+i)^t}$$

This implies that the average cost of a physician visit (C) can be expressed as:

$$(3)\quad C=\frac{\left(\sum_{t=0}^{S}\frac{s}{(1+i)^t}+\sum_{t=S}^{R}\frac{r}{(1+i)^t}+\sum_{i=0}^{T}\frac{Y_0}{(1+i)^t}\right)}{V}$$

where V is the number of visits a physician produced over a physician's worklife.

Many of the inputs into physician services – particularly education and training -- are fixed. Over their employed lifetimes, we expect physicians to choose the scale at which they operate – that is, hours worked – to minimize average cost. At the most efficient scale, the marginal cost of an additional service should be equal to the average cost of services. From an optimal societal investment perspective, then, the average cost of services provided by a given physician (which, in equilibrium, should equal marginal cost) should equal the marginal value of services generated by that physician.

Regulation, licensure, and other institutional impediments have largely fixed the attributes of physicians and the training they receive. We assume that neither the average opportunity costs of prospective physicians nor the per-physician cost of physician training vary with the number of physicians over the policy-relevant range[1].

Most medical services appear to exhibit diminishing marginal benefit. Increasing the number of physicians produced will allow services of lower benefit to be added to the mix of services, bringing down the average valuation. Conversely, reducing the number of physicians available will raise the average value of those services produced. Thus, the

[1] There are currently about 2.4 applicants for each position in US medical schools.

social planner equates the costs and benefits of physicians' services by changing the number of physicians produced.

Based on this set-up, we can estimate the value of Y1, by constructing estimates of Yo and finding estimates of the other parameters from the literature. Using published sources to estimate s, r, S, R, and V, we can estimate the societal cost of producing a physician service.

Measuring Opportunity Cost

The largest element in the cost of physician services is the opportunity cost of physician time. Physician productivity in medical service delivery must be sufficient to offset the opportunity cost of time while practicing and the opportunity cost of time spent in earlier training.

We calculate the opportunity cost of physician practice by estimating what the earnings of future physicians would have been had they chosen an alternate profession. To do this, we rely on the fact that the demand for admission to medical school exceeds the supply of medical school positions. Entry into medical school is rationed primarily by applicant test scores and grades. Students who are good at standardized tests and get good grades are most likely to get into medical school. In 2008, for example, the average matriculant at an American medical school had an MCAT score of about 30.8 (the 80th percentile) and an average total GPA of 3.65. Medical school matriculants had high GPAs in both their science and non-science courses, suggesting that they were good all-around students, as well as strong in biological and physical sciences. [AAMC: Facts Table 17]

Unfortunately, only students who hope to attend medical school take MCAT tests, and medical school aspirants also take different classes in college than do other students. To estimate opportunity costs, we would like to have a measure of aptitude and achievement before students differentiate themselves according to future occupational choice. We do this by using data collected in high school to forecast the 'alternative profession' earnings of high school students who went on to become doctors using information on those who completed college but chose careers other than medicine.

We conduct these analyses using the 1979 National Longitudinal Survey of Youth (NLSY79). The NLSY79 is a nationally representative survey of 12,686 men and women, which contains extensive information about the characteristics of sampled youth in their late teens (ages 14-22). The survey tracked these youth annually through 1994 and biennially since then. The NLSY79 collects an extensive array of information, including family socioeconomic characteristics, respondent background, occupational information, and annual income. The study also contains information about respondent aptitudes and achievements measured before they made choices about future occupations. The aptitude and achievement measures we use are the Armed Forces Qualification Test (AFQT) and High School GPA. The AFQT is a measure of trainability and is a major criterion for armed forces enlistment. The AFQT score is derived from select sections of the Armed Services Vocational Aptitude Battery (ASVAB), using a methodology developed by the U.S. Department of Defense. Of the entire sample, a total of 11, 914 youths (94%) completed the AFQT test. We compute high school GPAs from data gathered during a High School Transcript Survey conducted as part of the NLSY79 during 1980-1983. Transcript information was collected for respondents who were 17 years of age or older (at the time of the survey) and who had finished or were expected to finish high school in the US. Credits and final grades were collected for up to 64 courses, across all 4 years of high school. We used this information to compute a high school GPA. Of the NLSY79 sample, 8,778 (70%) of respondents provided complete transcript information. We compare future physicians to other college completers (since both physicians and non-physicians make comparable investments in college-level education). We also limit the sample to men who work full time (35 hours a week or more), since we will use data on physicians who are full time labor force participants.

Of the 12,686 youths sampled by these NLSY in 1979, 25 men and 18 women went on to become physicians. Figure 1 below shows the mean and interquartile ranges of test scores and GPAs of these 43 eventual physicians, compared to those who went on to graduate college and work full time. Eventual physicians have higher GPAs and AFQT scores than most other college graduates.

Table 1 provides descriptive statistics for a range of characteristics for male college graduates who worked full-time but were not physicians and for "Eventual Physicians (male)". These data suggest that, on other dimensions, as well as GPA and AFQT, doctors are drawn from those with very high expected future earnings. They are more likely to be non-Black and non-Hispanic, more likely to have grown up in an Urban setting, more likely to come from households with both parents, have fewer older siblings, and have parents with higher educational attainment, than do those who do not become doctors.

We use these data to forecast future physician's earnings in an alternative profession based on their inherent characteristics, not their subsequent investments in education and training. Thus, we include in our analyses only characteristics at birth, characteristics at age 14, family background, and aptitude and intelligence scores. We also include an interaction between AFQT scores and GPA, as we anticipate that it is those who score very highly on both measures who are most likely to be admitted to medical school. We use these data in regressions on earnings over the 1979-2004 period, including each respondent in each year that he is working full time. The dataset includes multiple observations for each respondent, reflecting earnings at different ages.

As with most surveys that ask questions about income, the NLSY79 employs top coding of high incomes to maintain the confidentiality of its respondents. This is a serious problem for our study, because both physicians and the comparison group of college-educated full time working men are likely to have high earnings. The NLSY79 uses different methods to top code data over the years. From 1979 to 1984, every response above $75,000 is truncated to $75,001; from 1985 to 1988, every response above $100,000 is truncated to $100,001; from 1989-1994, all values above $100,000 were replaced with the average of outlying values; and finally, from 1996 onwards, the top 2% of valid values were averaged and this average value replaced all the values in that top range. In our sample, the effect of top coding is more relevant in later years then in the early years. In other words, more people are ‘captured’ in the top coded section in later years then in the early years. This is to be expected, as incomes increase with age.

We employ two strategies to address this top-coding problem. First, we use the censored normal regression. To do this, we modify our data to create a truncated income variable. For the years 1979-1988, when the data are truncated at pre-specified thresholds, we maintain the existing truncation values ($threshold+1). For example, from

1985-1988, the threshold is $100,000 and all values above that are coded $100,001. For the years 1989-1994, the threshold is $100,000, but all values above this are replaced with the average of those values, not $100,001 as was the case previously. For these years, the topcoded values are all replaced with $100,001, the level at which censoring begins. Somewhat similarly, in the years 1996-2004, the top 2% of valid income values are censored, and replaced with the average of the these values. In these years, there is no fixed censoring level. We replace the censored income variables for these years with a figure that is $1 more than the 2nd highest value in the dataset (since all values equal to or greater than this fall in the top 2%, and are censored). Finally, we compute hourly wage rates using data on annual hours worked. We adjust top-coded values to reflect the top-coding in the underlying income data[2].

Table 2 reports results of four regression specifications: a regression on log hourly wages using topcoded values (to take advantage of the information in the top 2% values for 1996 forward), a regression on log annual income using topcoded values, a censored normal regression on the log of truncated hourly wages, and a censored normal regression on the log of truncated annual income,

The regressions control for: age, age square and age cube; High school GPA; AFQT Score; an Interaction between GPA and AFQT score; dummies for Black and Hispanic ethnicity; a dummy for birth in the South region of USA; dummies for whether each parent was born in the US; total years of education for each parent; dummies for

---

[2] For those individuals with the highest values (ie censored values) in each year, wage rate is constructed from income and an annual hours worked figure of 1750hrs (35hrs/week, 50 weeks or Full time Equivalent). This provides an upper estimate for the wage rate at which censoring begins (since the true wage rate will be higher, given the censoring of incomes).

residence characteristics at age 14 - whether in the South, in Urban setting, farm setting, and whether in the same town/city/county since birth; dummies for household characteristics at age 14 - whether living with both parents, living with no parents, foreign language spoken in household; number of older siblings; a dummy for whether had easy access to reading material; and finally dummies for religion in which raised (Protestant, Catholic, or other). Each regression also contains year dummies (1981-2004). We run each regression on the sample of men, who are not 'eventual doctors', who went on to graduate college and work full time (defined as 35hrs/wk for 50wks/yr, or 1750 hrs/yr).

As expected, we find that socioeconomic characteristics of youth predict their future earnings. High school achievement and ability also play an important part in future earnings. The regression coefficients suggest that a 1-standard deviation increase in high school GPA is associated with a 4% increase in hourly earnings. A 1-standard deviation increase in AFQT score is associated with an 11.3% increase in hourly earnings.

We use these regression equations to predict the annual incomes/hourly wages of the physicians in our sample at each age based on the physician sample's characteristics at the initial interview[3]. These estimates are based on a sample of full-time workers, where full-time work is defined as 35 hours a week for 50 weeks a year. Physicians, on average, work substantially longer hours (AMA Socioeconomic Monitoring Survey). The American Medical Association's Socioeconomic Monitoring Survey collects

[3] To the extent that people self-select into professions other than medicine based on attributes that increase their returns to these professions (and that are not shared by future physicians), these estimates may overstate opportunity costs.

information on physician hours of work by specialty (available through the Bureau of Healthcare Professionals)[4]. We use information on physicians' hours of work each year to compute predicted annual incomes based on the predicted hourly wages of the 'eventual doctor' sample. The use of predicted wages and actual physician hours in this context makes this estimated opportunity cost estimate analogous to a Paasche price index measure and is therefore an underestimate of the true opportunity cost (Lindsay, 1973;1976). That is, the actual wages that would be commanded by someone working as many hours as doctors do is likely greater than the estimate derived from the comparison group[5]. The predicted incomes derived from these analyses are reported in Table 3 and Figure 2. These equations predict about ¼ of the variation in income among male, full-time employed, college graduates over time. Age, high school grades, test scores, and year dummies provide most of the explanatory power in the regression. Figure 2 also includes an estimate of primary care physicians' actual incomes, from the 2004 Medical Group Management Association Physician Compensation and Productivity Survey.

The data in Table 3 can be used to estimate the lifetime opportunity cost of pursuing medical education. At a 4% discount rate, the lifetime earnings of a potential physician amount to between $1,685,000 and $2,222,000.

---

[4] We further adjust these hours estimates upward by 8% to reflect the fact that male physicians (our sample) work about 15% more hours than do female physicians, while the AMA figure combines hours for both groups.

[5] We repeated our analysis using a comparison group that worked more than 45 hours a week, more closely comparable to physician earnings, and found that hourly wages of this (much smaller) group were not substantially higher than those reported here.

Direct Costs of Medical Education and Training

Future primary care doctors must complete four years of medical school and approximately three years of residency (family medicine) training after college. But other college graduates also go on to further education. We use the forecast method above to determine how many years of post-college education were attained by non-physicians with similar characteristics. We find (not reported in tables) that future physicians would have attained, on average, one year of post-college education had they not gone to medical school. Thus, physicians obtain substantially more formal education and training than do their non-physician counterparts.

The estimates above provide evidence on the opportunity cost of this education and training. We now turn to estimating the direct cost of education.

The direct cost of educating a physician is most easily sorted into two categories: 1) those costs associated with medical school, and 2) those costs associated with medical residency training. The total educational resource costs associated with training students within medical schools include those associated with medical research, general scholarship, patient care, and instruction (Jones and Korn, 1997). Several studies, reviewed by Jones and Korn (1997), use cost-accounting techniques to estimate those elements of cost directly related to instruction. The mid-point of the studies examined in this review suggests that these costs amounted to about $45,000 per student per year in 1996. We inflate these costs to 2008 dollars using the overall CPI, for an estimate of $64,000. This likely leads to an underestimate in costs because medical school tuition inflation has been nearly twice as high as the CPI (Jolly, 2005). Much of this cost is covered by grants and government subsidies. Medical school tuition in private universities in 2003 averaged about $34,550 (Jolly, 2005; 2003 dollars).

Medical residency training is an on-the-job investment in general education (Newhouse and Wilensky, 2001; Marder and Hough, 1983). Investments in general education are generally paid for by workers through reduced wages. In the case of residency training, however, the relationship between earnings and the cost of education is distorted by the existence of substantial subsidies. We use two methods to compute the societal cost of medical residency training in primary care.

First, we estimate the costs of residency training based on cost-accounting studies. Franzini et al. (1999) conducted a cost-accounting study of the family practice residency program of the University of Texas. They found that the instructional costs of the program per year per resident were about $127,000 (adjusted to $2008 using the CPI). These instructional costs exceeded the value of services provided by junior residents, suggesting that if they bore the full costs of training, their earnings would have been negative. Senior residents provided services valued at about $32,000 above these instructional costs.

Second, we use estimates of the size of the Medicare subsidy, the cost of replacing residents with other workers, and the stipends paid to residents to back out the instructional cost of resident training. The Medicare subsidy per resident in 2000 averaged $73,000 (National Conference of State Legislatures, 2000), about $91,000 in $2008. Franzini et al. (1999) estimate the value of services provided by residents at about $96,000 ($2008). Alternatively, Green and Johnson (1995) estimate the cost of replacing residents with mid-level practitioners at about $151,000 ($2008) per resident.

Finally, based on the opportunity cost estimates above, the outside opportunity cost of a resident working 80 hours per week is approximately $115,000 per year. The third component of the analysis is the stipend paid to residents. In 2008, these stipends averaged $45,000 (http://mdsalaries.blogspot.com/2005/10/residency-salaries.html). We compute the instructional cost of residency training by summing the replacement cost of residents and the subsidy to residency training and subtracting the stipend. This yields an estimate of $142,000 - $197,000 per year, about 11-55% above the Franzini cost-accounting estimate.

Amortizing these Costs

The direct and indirect costs of medical education are amortized over a physician's worklife. We assume that primary care doctors work full time through age 65 (beginning regular employment on the completion of residency at age 29). We use data from the American Medical Association and the Medical Group Management Association to compute the number of visits and Medicare resource-value units produced by a full-time employed physician each year. These figures are in Table 4. Primary care doctors produce between 5000-5700 visits per year and about 4040 Medicare work RVUs per year.

Physician visits include both physician labor costs and capital costs. The non-labor costs of physician visits are calculated in computing total resource value units. Primary care practitioners average about 1.95 total RVUs (combined work and practice cost RVUs) for each work RVU. Thus, a physician must bill $1.95 for a visit to net $1 toward the cost of labor.

The Societal Cost of a Physician Visit

We combine information on opportunity costs, direct costs of education and training, productivity, and practice costs to compute the social cost per primary care physician visit or per primary care RVU. These estimates are provided in Table 5. We report results using the high and low estimates of all the components of cost. The low estimate uses the lowest opportunity cost estimate, the cost-accounting based residency estimate, and the high visit estimate, while the high estimate uses the opposite combination of assumptions. Together, these estimates suggest that the societal cost of the labor associated with primary care physicians is between $151,000 - $200,000 per year. This translates into a primary care visit cost of between $51-$77 (including both physician and facility costs) and a per work RVU cost of between $37-$50.

Comparing Cost and Value

It is difficult to ascertain the marginal value of a primary care visit. Estimates from the RAND Health Insurance Experiment suggest that the health value of the marginal visit is close to zero (Newhouse, 1993). If care is currently rationed by out-of-pocket cost, the marginal value of a privately insured visit should be close to the copa1yment rate, about $19 for privately insured patients (Kaiser Family Foundation and Health Research and Educational Trust, 2007). The Medicare program may ration care using its payment for RVUs. The current RVU payment is about $38 (http://www.cms.hhs.gov/PhysicianFeeSched/01_Overview.asp). Finally, the emergence of retail clinics which provide primary care provides a market-based estimate of value. The fees charged by these clinics average about $60 per visit (http://minuteclinic.com/en/USA/Treatment-and-Cost.aspx; http://www.sutterexpresscare.com/services/index.html. Table 6 summarizes information on the value of visits.

In general, estimates of the marginal value of the visit lie near the bottom of the estimated range of social cost. These estimates do not support the idea that there is substantial excess societal demand for primary care services relative to the cost of producing these services using primary care physicians.

Private Returns

Physicians themselves bear only a portion of the cost of medical training and education. They pay all opportunity costs, but only about ½ of medical school tuition costs, and only a small portion of training costs. We use our estimates to compute the private return on primary care education.

We estimate that the private return on primary care medical education is between 7-9%. Investments in education are relatively risky and must be made when people are quite liquidity constrained. These private returns, while substantially above the social returns, are quite low, and suggest, as experience bears out, that few physicians will choose to specialize in primary care.

Conclusions

Physicians are very costly. They are selected from the most talented students in our nation and substantial investments are made in their education and training. Economic efficiency requires assigning these valuable resources to high productivity activities. Our analyses suggest that the cost of producing the marginal primary care service using physicians likely outweighs the societal benefits of these services. Our estimates are conservative, in that they amortize the cost of education over the worklife of a physician who works full time, without career interruption, averaging over 105 visits per week, through age 65. To the extent that many physicians now work shorter hours or retire earlier, the estimated societal cost per visit would be greater.

Many primary care services currently delivered by physicians, however, can be provided by less costly personnel. An alternative to making an increased investment in primary care training would be to increase the use of complementary, lower-skilled practitioners. Practices that make greater use of lower cost practitioners, perhaps in combination with highly skilled physicians, are likely to provide higher returns on the societal investment in physician education.

References

AAMC: Facts Table 17 - MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools, 1996-2007. <http://www.aamc.org/data/facts/2007/2007mcatgpa.htm>

Blumenthal, David "New Steam from an Old Cauldron -- The Physician-Supply Debate" New England Journal of Medicine 350 (2004): 1780-1787

Colwill, Jack M.; Cultice, James M.; Kruse, Robin L. "Will Generalist Physician Supply Meet Demands Of An Increasing And Aging Population?" Health Affairs 27.3 (2008): 232-241

Cooper, R.A.; Getzen T.E.; McKee, H.J.; Laud, P. "Economic and demographic trends signal an impending physician shortage" Health Affairs 21 (2002): 140-154

Cooper, R.A. "Weighing the Evidence for Expanding Physician Supply" Annals of Internal Medicine 141 (2004): 705-714

Dunn, Marvin R., Rebecca S. Miller, Thomas H. Richter. "Graduate Medical Education, 1997-1998". JAMA. 280(9) (1998):809-812.

Franzini, Luisa; Monteiro, F. Marconi; Fowler, Grant C.; Low, M. David "A Cost Construction Model to Assess the Cost of a Family Practice Residency Program", Family Medicine 31.3 (1999): 159-70

Green, B. A.; Johnson, T "Replacing residents with midlevel practitioners: a New York City-area analysis" Health Affairs 14.2 (1995): 192-198.

Iglehart, John K. "Grassroots Activism and the Pursuit of an Expanded Physician Supply**"** N Engl J Med 358 (2008): 1741-1749

Jolly, P.. "Medical school tuition and young physicians' indebtedness." Health Affairs, 24(2) (2005): 527-535.

Jones, R. F., and Korn, D. "On the cost of educating a medical student." Acad Med, 72(3) (1997): 200-210.

Kaiser Family Foundation and Health Research and Educational Trust. "Employer Health Benefit Survey, 2007" Downloaded from http://www.kff.org/insurance/7672/upload/76723.pdf, June 27, 2008

Lindsay, Cotton M. "Real Returns to Medical Education" The Journal of Human Resources 8.3 (1973): 331-348

Lindsay, Cotton M. "More Real Returns to Medical Education" Journal of Human

Resources 11.1 (1976): 127-130

Marder, William D.; Hough, Douglas E. “Medical Residency as Investment in Human Capital” Journal of Human Resources 18.1 (1983): 49-64

Medical Group Management Association (MGMA) “Physician Compensation and Production Survey: 2005 report based on 2004 Data” John Wiley & Sons Inc., 2005.

MEDPAC “Rethinking Medicare’s Payment policies for GME and Teaching Hospitals” Washington DC, 1999

National Conference of State Legislatures “Graduate Medical Education and Public Policy: A Primer”, Washington DC, 2000

Newhouse, J. P., and the Insurance Experiment Group. “Free for All? Lessons from the RAND Health Insurance Experiment” Cambridge: Harvard University Press, 1993

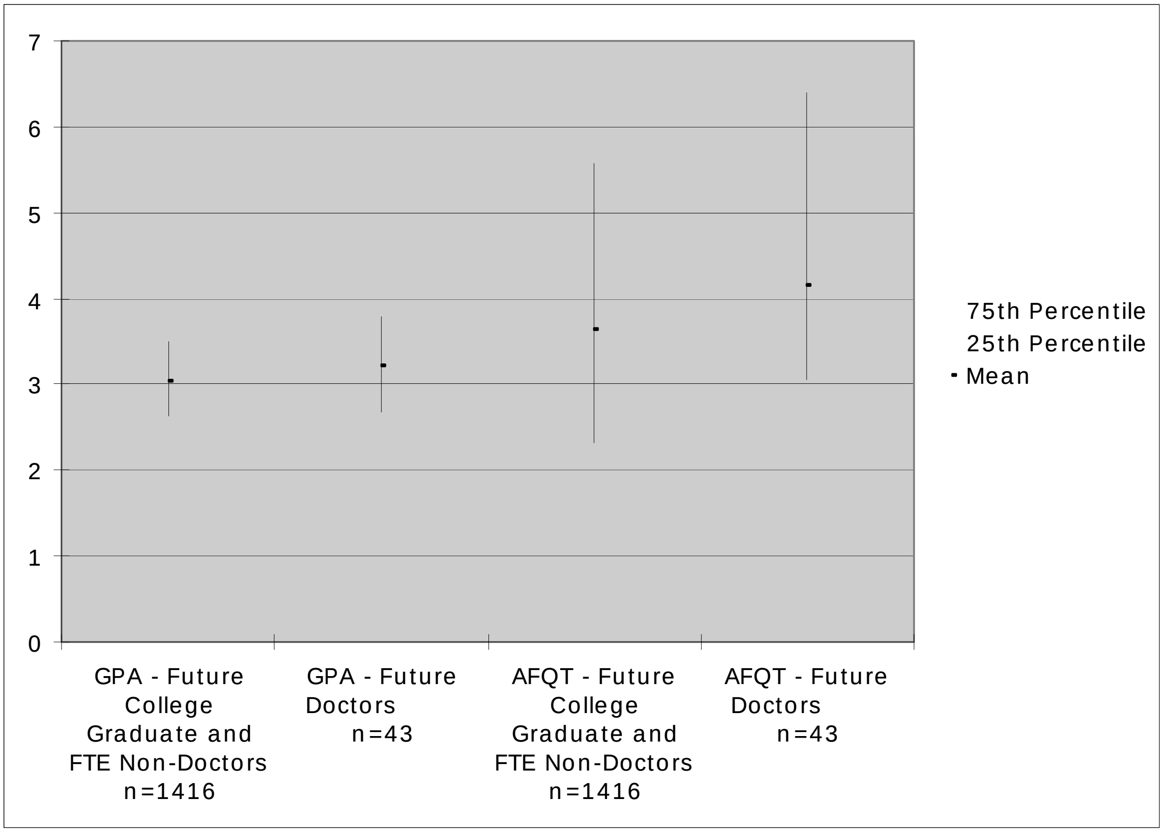
Newhouse, Joseph P.; Wilensky, Gail R. “Paying For Graduate Medical Education: The Debate Goes On” Health Affairs 20.2 (2001): 136-147.

Rein, M.F.; Randolph, W.J.; Short, J.G.; Coolidge, K.G.; Coates, M.L.; Carey, R.M. “Defining the cost of educating undergraduate medical students at the University of Virginia.” Academic Medicine 72.3 (1997): 218-227

Salsberg, Edward S.; Forte, Gaetano J. “Trends in the Physician Workforce, 1980–2000.” Health Affairs, September/October 21(5) (2002): 165-173.

Snyderman, Ralph; Sheldon George F.; Bischoff, Theresa A. “Gauging Supply And Demand: The Challenging Quest To Predict The Future Physician Workforce” Health Affairs 21.1 (2002): 167-168

Figure 1: GPA and AFQT Scores of Future Physicians and Other College Graduates



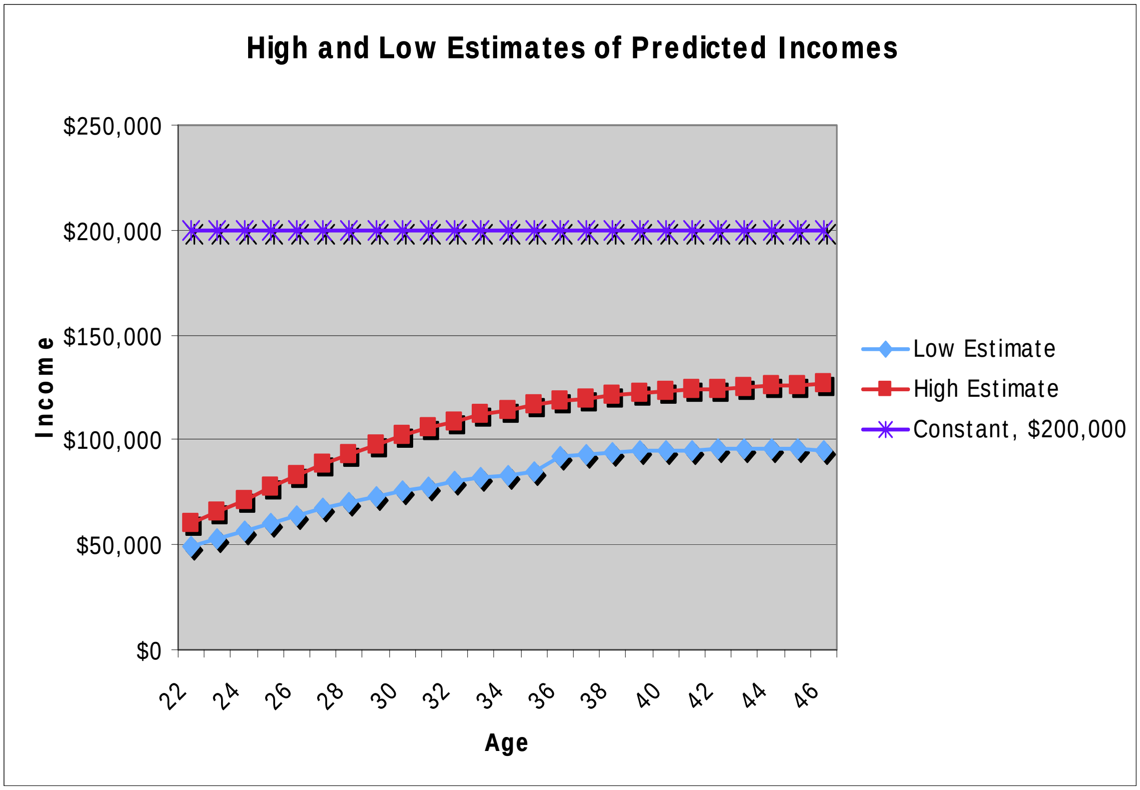
Source: National Longitudinal Survey of Youth, 1979 Cohort

GPA was calculated from a Transcript Survey administered as part of the NLSY in the years 1980-83. Full transcript surveys were available for 8,778 of the 12,686 people in the original survey sample

AFQT scored were determined from a battery of ASVAB tests, administered to the entire NLSY 79 cohort. Conversion from ASVAB scores to AFQT scores follows a 1989 Department of Defense Methodology, as explained in the NLSY

This chart displays results for only those who have valid scores for both the GPA and the AFQT.

Figure 2: High and Low Estimates of Predicted Earnings



Source: See Table 3

Table 1 – Sociodomegraphic statistics of NLSY and Sample

Sociodemographic characteristics	*All (non-docs)*	*Men (non-docs)*	*Regression Sample**	*Eventual Physicians (Male)*
Observations, n =	5759	2749	648	25
Sex				
Male	47.73%	100.00%	100.00%	100.00%
	[0.007]	[0.000]	[0.000]	[0.000]
Female	52.27%	0.00%	0.00%	0.00%
	[0.007]	[0.000]	[0.000]	[0.000]
Race				
Hispanic	11.79%	11.17%	7.10%	12.00%
	[0.004]	[0.006]	[0.010]	[0.066]
Black	21.03%	20.92%	14.04%	4.00%
	[0.005]	[0.008]	[0.014]	[0.040]
non-Hispanic, non-Black	67.18%	67.92%	78.86%	84.00%
	[0.006]	[0.009]	[0.016]	[0.075]
Test Scores				
High School GPA	2.528	2.407	2.982	3.394
	[0.009]	[0.013]	[0.024]	[0.128]
AFQT	0.739	0.828	4.175	5.110
	[0.046]	[0.070]	[0.090]	[0.504]
Birth Region				
non-South	64.25%	65.70%	71.14%	52.00%
	[0.006]	[0.009]	[0.018]	[0.102]
South	35.75%	34.30%	28.86%	48.00%
	[0.006]	[0.009]	[0.018]	[0.102]
Residence characteristics at age 14				
non-South	65.18%	66.21%	70.52%	52.00%
	[0.006]	[0.009]	[0.018]	[0.102]
South	34.82%	33.79%	29.48%	48.00%
	[0.006]	[0.009]	[0.018]	[0.102]

Urban	76.65%	76.68%	82.10%	96.00%
	[0.006]	[0.008]	[0.015]	[0.040]
Rural (non farm)	17.45%	17.32%	12.04%	0.00%
	[0.005]	[0.007]	[0.013]	[0.000]
Farm	5.90%	6.00%	5.86%	4.00%
	[0.003]	[0.005]	[0.009]	[0.040]
Same city/town/county as birth	48.05%	48.42%	43.36%	32.00%
	[0.007]	[0.010]	[0.019]	[0.095]
Household characteristics at age 14				
with both Parents	77.62%	77.88%	84.88%	88.00%
	[0.005]	[0.008]	[0.014]	[0.066]
with single Parent	20.49%	20.41%	13.89%	12.00%
	[0.005]	[0.008]	[0.014]	[0.066]
with non-Parents	1.89%	1.71%	1.23%	0.00%
	[0.002]	[0.002]	[0.004]	[0.000]
Number of older siblings	2.13	2.10	1.61	1.20
	[0.028]	[0.039]	[0.064]	[0.265]
Parent characteristics				
Father born in US	95.52%	96.03%	96.14%	88.00%
	[0.003]	[0.004]	[0.008]	[0.066]
Mother born in US	94.96%	94.80%	94.44%	88.00%
	[0.003]	[0.004]	[0.009]	[0.066]
Father's years of education (avg)	11.29	11.40	13.72	14.92
	[0.050]	[0.071]	[0.140]	[0.822]
Mother's years of education (avg)	11.36	11.45	13.07	14.40
	[0.037]	[0.054]	[0.103]	[0.632]
Religion Raised in				
Catholic	32.92%	32.27%	31.94%	8.00%
	[0.006]	[0.009]	[0.018]	[0.055]
Protestant	51.57%	51.51%	52.93%	60.00%
	[0.007]	[0.010]	[0.020]	[0.100]
Other (non-Catholic, non-Protestant)	15.51%	16.22%	15.12%	32.00%
	[0.005]	[0.007]	[0.014]	[0.095]
Other				

Foreign lang. spoken during childhood	15.51%	14.73%	10.34%	24.00%
	[0.005]	[0.007]	[0.012]	[0.087]
Reading material - easy access at age 14	87.52%	88.43%	95.83%	92.00%
	[0.004]	[0.006]	[0.008]	[0.055]

Standard Errors in Brackets

* The ‘Regression Sample’ consists of Men, who are not ‘Eventual Physicians’ who are College Graduates and Full Time Equivalent (FTE) workers. FTE is defined as 35hrs/wk for 50wks/yr i.e. 1750 hrs/yr

Source: NLSY 1979 Cohort

Table 2 – Impact of Characteristics measured at 17 on Subsequent Earnings (FTE college educated males)

Independent Variables	*Log Wage*	*Log Annual Income*	*Log Wage, Censored*	*Log Annual Income, Censored*
Age	0.30	0.41	0.30	0.458
	[0.126]*	[0.129]**	[0.116]**	[0.108]**
Age Squared	-0.01	-0.01	-0.01	-0.011
	[0.004]	[0.004]*	[0.003]*	[0.003]**
Age Cubed	0.00005	0.00007	0.00005	0.00009
	[0.00004]	[0.00004]*	[0.00003]	[0.00003]**
GPA	-0.06	-0.03	-0.06	-0.025
	[0.047]	[0.048]	[0.023]*	[0.022]
AFQT	-0.04	-0.02	-0.04	-0.02
	[0.026]	[0.027]	[0.012]**	[0.011]
Interaction - GPA and AFQT	0.03	0.02	0.03	0.022
	[0.009]**	[0.010]*	[0.004]**	[0.004]**
Race: Black	0.08	0.09	0.08	0.082
	[0.054]	[0.060]	[0.021]**	[0.019]**
Race: Hispanic	-0.07	-0.08	-0.06	-0.048
	[0.079]	[0.085]	[0.030]	[0.028]
Birth Region: the South (USA)	0.06	0.09	0.05	0.058
	[0.075]	[0.082]	[0.028]	[0.026]*
Mother born in US	-0.25	-0.22	-0.24	-0.188
	[0.116]*	[0.120]	[0.034]**	[0.032]**
Father born in US	-0.04	-0.053	-0.02	-0.044
	[0.130]	[0.139]	[0.042]	[0.039]
Mother's years of education	0.01	0.01	0.01	0.006
	[0.008]	[0.008]	[0.003]*	[0.003]*
Father's years of education	0.00	0.00	0.00	-0.002
	[0.006]	[0.007]	[0.002]	[0.002]
Residence at age 14: the South	-0.13	-0.13	-0.12	-0.101
	[0.073]	[0.079]	[0.027]**	[0.026]**
Residence type at age 14: Urban	0.00	0.01	-0.01	-0.004
	[0.047]	[0.052]	[0.018]	[0.017]
Residence type at age 14: on Farm	-0.10	-0.08	-0.11	-0.087
	[0.084]	[0.085]	[0.031]**	[0.029]**
Residence at age 14: Same as birth	0.00	-0.01	0.00	-0.002
	[0.036]	[0.038]	[0.013]	[0.012]
Living with both Parents @ 14	0.055	0.03	0.05	0.019
	[0.053]	[0.057]	[0.020]**	[0.018]

Living with non-parents @ 14	0.01	0.02	-0.04	-0.028
	[0.142]	[0.125]	[0.062]	[0.058]
Number of Older Siblings	0.00	0.00	0.001	-0.003
	[0.010]	[0.011]	[0.004]	[0.004]
Foreign language spoken	-0.10	-0.11	-0.10	-0.105
	[0.078]	[0.082]	[0.027]**	[0.025]**
Access to Reading material @14	0.10	0.15	0.09	0.137
	[0.083]	[0.084]	[0.036]*	[0.033]**
Household Religion: Protestant	-0.06	-0.09	-0.05	-0.07
	[0.039]	[0.040]*	[0.015]**	[0.014]**
Household Religion: Other	-0.06	-0.09	-0.07	-0.096
	[0.057]	[0.060]	[0.020]**	[0.019]**
Constant	-1.09	5.23	-1.05	4.752
	[1.374]	[1.383]**	[1.278]	[1.191]**
Observations	5929	5929	5929	5929
R-squared	0.23	0.25		
Pseudo R-squared for cnreg			0.1746	0.2161

Standard Errors in Brackets
* significant at 5%; ** significant at 1%

Source: NLSY 1979 cohort.

Sample consists of Males who are future College Graduates, Full Time Equivalent Workers, and Non-Doctors

Year dummies (1981 – 2004) were included in the regression, but are not reported here.

All incomes were CPI inflated to 2008 figures

Table 3 – Predicted Incomes in Alternative Careers of Future Physicians

	Predicted Incomes			
Age	Regression on Log Wage	Regression on Log Annual Income	Censored Normal regression on Log Wage	Censored Normal regression on Log Annual Income
22	$49,776	$59,893	$49,436	$59,017
23	$53,672	$65,772	$53,219	$64,961
24	$57,494	$71,601	$56,918	$70,813
25	$61,204	$77,305	$60,496	$76,489
26	$64,765	$82,815	$63,920	$81,911
27	$68,145	$88,067	$67,159	$87,013
28	$71,316	$93,007	$70,189	$91,740
29	$74,254	$97,591	$72,991	$96,050
30	$76,942	$101,787	$75,550	$99,918
31	$79,368	$105,574	$77,856	$103,331
32	$81,524	$108,944	$79,908	$106,289
33	$83,410	$111,898	$81,706	$108,808
34	$85,029	$114,448	$83,256	$110,912
35	$86,388	$116,616	$84,570	$112,637
36	$94,142	$118,431	$92,164	$114,026
37	$95,090	$119,930	$93,118	$115,128
38	$95,809	$121,155	$93,874	$115,998
39	$96,322	$122,151	$94,456	$116,693
40	$96,653	$122,968	$94,890	$117,274
41	$96,829	$123,657	$95,203	$117,804
42	$96,876	$124,273	$95,423	$118,345
43	$96,824	$124,870	$95,579	$118,963
44	$96,701	$125,505	$95,701	$119,724
45	$96,534	$126,234	$95,818	$120,696
46	$95,659	$127,117	$95,271	$121,950

Source: In the NLSY 1979 cohort, 25 males eventually become doctors. Predictions are made using the regression estimation equations described in Table 2. Variables controlled for are: Age, Age Square and Age Cube; High school GPA; AFQT Score; an Interaction between GPA and AFQT score; dummies for Black and Hispanic ethnicity; a dummy for birth in the South region of USA (as specified in the NLSY); dummies for whether each parent was born in the US; total years of education for each parent; dummies for residence characteristics at age 14 - whether in the South, in Urban setting, farm setting, and whether in the same town/city/county since birth; dummies for household characteristics at age 14 - whether living with both parents, living with no parents, foreign language spoken in household; number of older siblings; a dummy for whether had easy access to reading material; and dummies for household religion, whether Catholic, or Other (non-Catholic, non-Protestant). Additionally, each regression contains year dummies from 1981-2004.

Table 4 – Measures of Physician productivity

Weekly visits

Specialty	Avg Weekly Visits*	Annual Weeks worked** (median)	Annual Visits
G/F Practice	122	47	5734
Internal Medicine: General	105	48	5040

*Source: AMA Physician Socioeconomic Statistics, 1999
** Source: 2004 MGMA Physician Compensation and Productivity Survey

Medicare Resource Value Units

Specialty	Work RVUs (mean)	Compensation per Work RVU* (mean)	Total RVUs (mean)	Compensation per Total RVU* (mean)
Family Practice w/o OB	4047	41.27	7897	22.35
Internal Medicine: General	4036	44.36	7599	25.43

Source: 2004 MGMA Physician Compensation and Productivity Survey
*Compensation per Work and Total RVU figures are in 2004 Dollars

Compensation

Specialty	Compensation (mean)	Compensation (median)	Male Compensation (median)
Family Practice w/o OB	193,396	177,421	187,801
Internal Medicine: General	204,393	189,258	199,618

Source: 2004 MGMA Physician Compensation and Productivity Survey
Compensation figures are CPI inflated from 2004 to 2008 Dollars

Table 5: The Social Cost of a Primary Care Visit or RVU

Discount rate	4%
Opportunity cost – lifetime earnings	• Low estimate – log hourly wages censored; Lifetime discounted income = $1,685,000 • High estimate – log annual income using actual values; Lifetime discounted income = $2,222,000
Medical School direct cost	• $64,000 (no earnings) per year for 3 years
Residency direct cost	• Low estimate based on cost-accounting: $127,000 per year with $16,000 earnings per year for 3 years • High estimate: $197,000 per year with no earnings per year for 3 years
Practice costs	• 0.95 per unit of labor cost
Visits per year	• Low estimate 5743 • High estimate 5040
RVUs per year	• 4040

Societal cost of Primary Care Physician Services			
	Per Practitioner Year	Per Visit	Per Work RVU
Low	$151,000	$51	$37
High	$200,000	$77	$50

Table 6: Measures of Value of Primary Care

	Value per Unit
Medicare RVU conversion factor	$38 http://www.cms.hhs.gov/PhysicianFeeSched/01_Overview.asp
Average copayment for a physician visit	$19 Kaiser HRET survey, 2007
Annual compensation of a primary care practitioner	$200,000 MGMA Physician Compensation Survey, 2005 Figure is CPI adjusted to $2008
Per Visit charge of retail clinics	Minute clinic -- $59 http://minuteclinic.com/en/USA/Treatment-and-Cost.aspx Sutter Express Care -- $63 http://www.sutterexpresscare.com/services/index.html