Original communications

Financial returns on specialty training for surgeons

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Background. *Because of recent changes in physician reimbursement and managed care penetration, we wanted to examine the financial returns that medical students might anticipate when considering different careers.*

Methods. *We used standard financial techniques to calculate the return on educational investment for 5 surgical specialties (general surgery, otolaryngology, ophthalmology, orthopedic surgery, and urology) and primary care medicine between 1992 and 1998.*

Results. *The annual yield on specialty training fell for all specialties examined, from an average of 15% to 3% for primary care specialties, and from an average of 36% to 19% for surgical specialties. The difference in the average future hourly income between a given specialty and general practice decreased for all surgical specialties (for general surgery, from $12.03 in 1992 to $9.89 in 1998; otolaryngology, from $21.37 to $5.56; ophthalmology, from $14.12 to $7.15; orthopedic surgery, from $21.16 to $18.91), except urology (from $13.81 in 1992 to $14.84 in 1998). Returns became negative for primary care medicine, dropping from $1.72 to –$1.21.*

Conclusion. *Efforts to create a "level playing field" within medicine have resulted in decreased returns on educational investment across all specialties. Financial returns and the incentives they create should be carefully considered as part of health care reform. (Surgery 2002;132:795-802.)*

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WE PREVIOUSLY EXAMINED the 1990[1] and 1997[2] educational costs and incomes of physicians and other professionals and found that students could expect a poorer financial return on their educational investment when they chose a career in primary care medicine than when they chose a procedure-based specialty, business, the law, or dentistry.

During that period, efforts to reduce the disparity between the incomes of primary care and procedure-based physicians were implemented,[3] the number of practicing physicians per population has increased,[4] and managed care penetration has doubled.[5] We were interested in how these changes might affect the financial returns that medical students entering a surgical specialty might anticipate. By using the same sources of data and analytic techniques, we determined the return on additional specialty training that fourth-year medical students might expect by pursuing a career in general surgery, otolaryngology, ophthalmology, orthopedic surgery, or urology, and compared those with returns that might be expected from a primary care career, between 1992 and 1998.

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METHODS

We examined two measures of the financial return on additional training that could be expected by a fourth-year medical student contemplating a career in general surgery, otolaryngology, ophthalmology, orthopedic surgery, or urology. We

Table I. Age and specialty specific annual income, annual opportunity cost, hours worked annually, and annual cash flow per hour, in 1998

Age (y)	*27-29*	*30-31*	*32-35*	*36-45*	*46-55*	*56-65*
Annual income ($)						
General surgery	35,739	39,784	173,827	278,087	254,438	232,905
Otolaryngology	35,739	39,784	146,500	234,368	214,437	196,289
Ophthalmology	35,739	92,868	146,781	234,819	214,849	196,667
Orthopedics	35,739	129,528	220,102	352,116	322,171	294,906
Urology	35,739	129,528	201,085	321,693	294,335	269,426
Primary care	35,739	124,906	124,906	145,194	159,203	158,402
Annual opportunity cost ($)	108,817	146,173	146,173	133,219	159,142	67,969
Debt repayment ($)	9,767	9,767	9,767	6,837	0	0
Hours worked annually						
General surgery	2,882	2,882	2,882	2,859	2,804	2,715
Otolaryngology	2,722	2,722	2,722	2,701	2,649	2,565
Ophthalmology	2,457	2,457	2,457	2,437	2,390	2,315
Orthopedics	2,909	2,909	2,909	2,886	2,830	2,741
Urology	3,079	3,079	3,079	3,055	2,996	2,901
Primary care	2,633	2,633	2,633	2,671	2,719	2,642
Annual cash flow per hour ($)						
General surgery	(25.36)	(36.92)	9.60	50.67	33.99	60.75
Otolaryngology	(26.84)	(39.08)	0.12	37.45	20.88	50.03
Ophthalmology	(29.75)	(21.70)	0.25	41.68	23.31	55.60
Orthopedics	(25.12)	(5.72)	25.41	75.84	57.60	82.80
Urology	(23.73)	(5.41)	17.83	61.69	45.12	69.44
Primary care	(28.00)	(8.28)	(8.28)	4.31	0.11	34.35

More detail is given for earlier years to demonstrate the early differences in income levels associated with residency training.

used an established method of evaluating the financial return on an educational investment and accounting for differences in number of hours worked in each specialty.[1,2,6,7] Hours-adjusted net present value is the current value of an expected stream of cash flow per hour at a predetermined rate of interest, the discount rate; hours-adjusted internal rate of return is the annual interest rate that equalizes the negative and positive cash flows on an investment by weighting them according to when they occur, accounting for differences in numbers of hours worked. (See Glossary for term definitions).

We assumed a fixed working lifetime, defined as medical school graduation at age 27 to retirement at age 65. Although some choose to work longer, discounting makes the contribution of the final years trivial to the analysis. We used the minimum postgraduate training periods required for board eligibility for each specialty[8] and assumed that residencies are completed without interruption. Because information on the number of hours worked by residents is not available, we conservatively assumed that residents work the same number of hours as the youngest group of attending physicians in their specialty (to examine the influence of this assumption on our results, we repeated the analysis, assuming that residents work 25% more hours than that group). On completion of specialty training, we also assumed that physicians immediately become employed in their chosen specialty. We also assume that each career path was associated with the average educational indebtedness of graduating medical students, for each year examined, as published by the American Association of Medical Colleges (AAMC).[9] Although some studies have suggested that educational debt is associated with specialty choice,[10,11] others have not confirmed those findings.[12] We assumed that educational debt was repaid over 15 years, at a fixed annual interest rate of 8%, beginning at completion of the first year of residency for all groups examined, including general practice physicians. Therefore, in this model, for each year examined, all specialty groups experienced the same level of educational indebtedness and the same debt repayment schedule.

To obtain specialty and age-specific information on incomes and hours worked, we used 2 data sources. For residency training years, we used median, postgraduate year-specific house staff stipends in Council of Teaching Hospitals and Health Systems (COTH) hospitals, as published by the AAMC.[9] For income and hours worked after

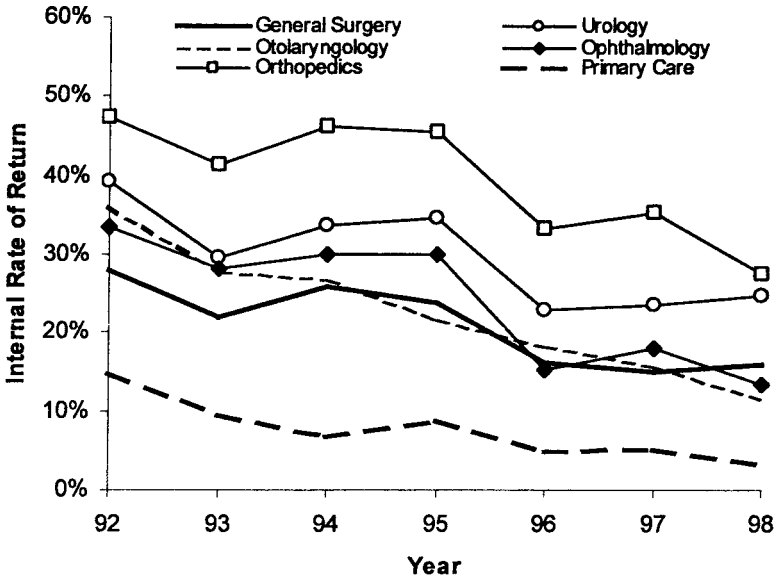

Fig 1. The hours-adjusted internal rate of return on additional training for 5 surgical specialties and primary care medicine.

completion of residency programs, we used existing data compiled by the American Medical Association (AMA) in their socioeconomic monitoring system (SMS), an annual survey of individual physician level data on a broad variety of characteristics.[13-20] The survey is conducted by telephone and is designed to provide representative information on the population of all nonfederal physicians who spend the greatest proportion of their time in patient care activities. SMS surveys are administered annually to a random sample of a subset of the AMA Masterfile. The AMA Masterfile contains current and historical information on every doctor of medicine in the United States, including both members and nonmembers of the AMA. The subset from which the random sample is taken is limited to nonfederal, patient care physicians and excludes doctors of osteopathy, graduates of foreign medical schools who are only temporarily licensed to practice in the United States, inactive physicians, physicians who were sampled in SMS surveys during the last five years, physicians listed as "do not contact" in the Masterfile, physicians not practicing in the United States, and unlicensed physicians. After the initial sample selection is made, physicians who spend fewer than 20 hours per week caring for patients and physicians who cannot be located by telephone are excluded.

From these data sources, we were able to obtain specialty-specific data on the mean after expenses and before taxes annual income and the mean number of hours worked per week in professional activities, and mean number of weeks worked per year for each specialty examined. Although age-specific data were available for primary care specialties and general surgery, they were not available for surgical specialties. To generate age-specific estimates (<36 years old, 36-45 years old, 46-55 years old, and 56-65 years old) for otolaryngology, ophthalmology, orthopedic surgery, or urology, we first calculated the ratio of the overall specialty average for each measure to the overall general surgery average. We then applied that specialty-specific ratio to age-specific data for general surgery. To create an aggregate primary care medicine comparison group, we weighted data from general internal medicine, family practice, and pediatrics by the proportion of practicing physicians in each primary care specialty in 1995.[5] We multiplied the mean number of hours worked per week by the mean number of weeks worked per year to calculate the annual number of hours worked for each specialty for each year examined.

The financial techniques used require the application of a common opportunity cost across all comparison groups. The opportunity cost is that income which a person could have generated had he not pursued additional medical specialty training; in this analysis, the opportunity cost is represented by the age-specific income earned and hours worked by a general practice physician. Because the minimum training for state licensure in is one year of postgraduate work, we assumed that the general practice physician completed one year of postgraduate internship and then entered

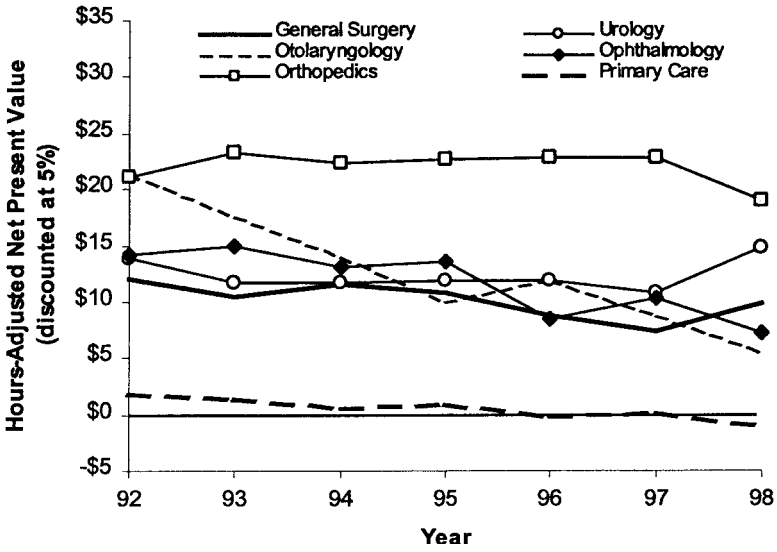

Fig 2. The hours-adjusted net present value of additional educational training for 5 surgical specialties and primary care medicine, discounted at 5%, between 1992 and 1998.

practice. Opportunity costs were the same for all specialties across all ages. Because published AMA survey results did not disaggregate general practice physicians from family practice physicians during this period, a special analysis of the SMS was required to obtained disaggregated data on these two specialties during this period. As an example, age- and specialty-specific data on income, hours worked, educational debt repayment, opportunity costs, and cash flows per hour for 1998 are shown in Table I.

We limited our analysis to the period from 1992 to 1998 for three reasons. First, although distant analyses of returns on educational investment are interesting from an historical perspective, we wanted to conduct analyses pertinent to medical students who are approaching graduation. Second, across the nation managed care penetration doubled during the period examined,[21] an increase that was captured in the SMS survey by higher proportions of physicians who reported participation in health maintenance organizations, managed care contracts, and capitated payment mechanisms.[13-20] Because a doubling in the level of managed care penetration was estimated to reduce physicians' annual earnings by 7% to 11% and hourly earnings by 6% to 9%,[22] we expected to find a significant drop in real annual earnings and hourly earnings. Finally, the period chosen follows the 1992 implementation of the Medicare Fee Schedule, which was expected to increase the annual income for family practitioners by 30% and that for general internists by 7%, while decreasing the annual income for surgeons by 7%.[3,23]

RESULTS

Over the seven year period, the hours-adjusted internal rate of return on specialty training declined for every specialty examined (Fig 1). For comparative purposes, general practice would have an internal rate of return of zero percent for all years examined. General surgery, orthopedics, and urology had parallel results, dropping from an hours-adjusted internal rate of return of 28% for general surgery, 47% for orthopedics, and 39% for urology in 1992 to 16% for general surgery, 27% for orthopedics, and 25% for urology in 1998. Otolaryngology and ophthalmology showed more precipitous declines, from 36% for otolaryngology and 34% for ophthalmology in 1992 to 11% to 13%, respectively, in 1998. On a percentage basis, primary care had the greatest decline, from 15% to 3% over the period examined.

Fig 2 shows the hours-adjusted net present value of additional medical specialty training for five surgical specialties and primary care, discounted at 5% (to reflect the reduction in the value of future income compared with present income). For comparative purposes, general practice would have an hours-adjusted net present value equal to $0.00 for each year examined. Again, on a percentage basis, general surgery and orthopedics had parallel results. The hours-adjusted net present value figures for general surgery dropped from $12.03 per hour in 1992 to $9.89 per hour in 1998; that for orthopedics dropped from $21.16 to $18.91. The hours-adjusted net present value of additional specialty train-

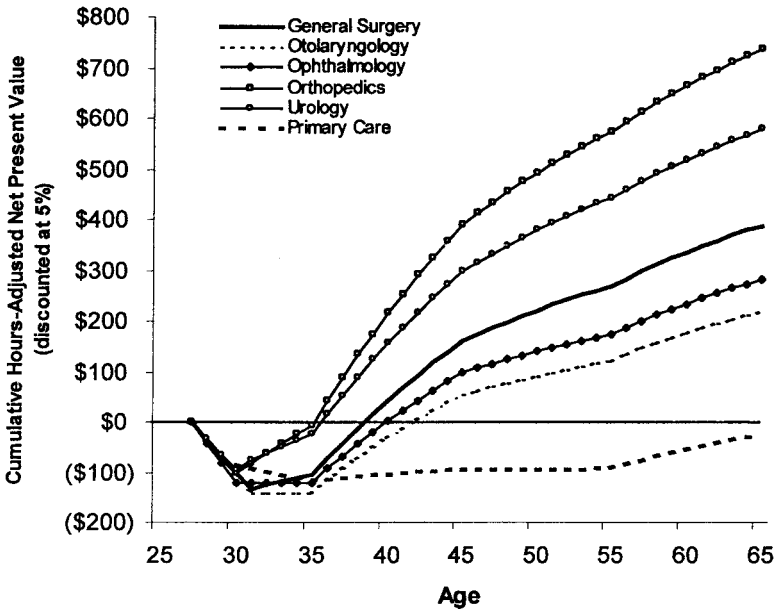

Fig 3. The cumulative hours-adjusted net present value of additional educational training for 5 surgical specialties and primary care medicine, discounted at 5%, for 1998.

ing in ophthalmology declined 49% from $14.12 to $7.15; that for training in otolaryngology dropped 74% from $21.37 to $5.56. Although the net present value figure for training in urology increased slightly from $13.81 to $14.84, that for training in primary care became negative, dropping from $1.72 in 1992 to –$1.21 in 1998. In other words, over the last seven years, entering primary care in lieu of general practice has changed from being a financial advantage to a disadvantage. In 1998, a student who chose to complete a three year residency training program in one of the primary care specialties examined instead of entering general practice after one year of postgraduate training could anticipate an average, discounted cost of $1.21 per hour worked over the next 38 years as a result of that decision.

Fig 3 shows the cumulative hours-adjusted net present value of additional training for the 6 specialties, discounted at 5%, for 1998. At any particular age, this figure reflects the current cumulative value of the additional training per hour worked. The figure gives insight into the timing and velocity of discounted, hours-adjusted cash flows with respect to the opportunity cost. During the residency years, because of the lower incomes of residents in comparison to general practice, all specialties decline. At the end of residency training, because of a larger annual income relative to that for general practice, the cumulative hours-adjusted net present value of additional training increases rapidly for all surgical specialties, albeit much faster for orthopedics and urology than for general surgery, ophthalmology, and otolaryngology. When compared with a career in general practice, primary care specialties never recapture the initial investment in additional training, although they begin to over the last 10 years of the working lifetime.

Table II shows the ramifications of increasing the hours worked by residents on the hours-adjusted net present value. By using this assumption, the net present value figures declined for all specialties, on a percentage basis somewhat more so for residencies with longer training periods. The rank order of specialties does not change in any year.

DISCUSSION

We used standard financial techniques to examine financial returns on specialty training for 6 clinical career paths that a fourth-year medical student might pursue. We found that financial returns on additional specialty training are much greater for surgical specialties than for primary care medicine, but have been declining for all specialties examined in recent years. We also discovered that the decision to enter a primary care career over general practice changed from being a financial asset to being a financial liability during the period examined.

These findings should be somewhat disconcerting to policymakers. The income shift from procedure-based specialties to primary care specialties expected as a result of the Medicare Fee

Table II. The impact of assuming that residents work 25% more hours than young attending physicians on the hours-adjusted net present value of additional educational training for 5 surgical specialties and primary care medicine discounted at 5%, between 1992 and 1998

Original analysis	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
General surgery	$12.03	$10.47	$11.55	$10.70	$8.75	$7.43	$9.89
Otolaryngology	$21.37	$17.48	$13.96	$10.04	$11.84	$8.81	$5.56
Ophthalmology	$14.12	$14.93	$13.12	$13.50	$8.40	$10.29	$7.15
Orthopedics	$21.16	$23.28	$22.36	$22.59	$22.74	$22.87	$18.91
Urology	$13.81	$11.65	$11.64	$11.77	$11.76	$10.68	$14.84
Primary care	$1.72	$1.29	$0.53	$0.82	($0.15)	$0.03	($1.21)
Assuming that residents work 25% more than young attending physicians							
General surgery	$11.68	$10.14	$11.20	$10.38	$8.49	$7.21	$9.58
Otolaryngology	$20.74	$16.93	$13.54	$9.74	$11.48	$8.55	$5.38
Ophthalmology	$13.78	$14.56	$12.80	$13.17	$8.20	$10.04	$6.97
Orthopedics	$20.65	$22.70	$21.82	$22.04	$22.19	$22.33	$18.42
Urology	$13.48	$11.36	$11.36	$11.49	$11.47	$10.43	$14.46
Primary care	$1.69	$1.27	$0.52	$0.80	($0.15)	$0.03	($1.19)
The impact of the assumption on the hours-adjusted net present value figures							
General surgery	97.0%	96.9%	97.0%	97.0%	97.0%	97.1%	96.8%
Otolaryngology	97.0%	96.9%	97.0%	97.0%	97.0%	97.1%	96.8%
Ophthalmology	97.6%	97.5%	97.6%	97.6%	97.6%	97.6%	97.4%
Orthopedics	97.6%	97.5%	97.6%	97.6%	97.6%	97.6%	97.4%
Urology	97.6%	97.5%	97.6%	97.6%	97.6%	97.6%	97.4%
Primary care	98.3%	98.3%	98.1%	98.2%	98.1%	95.1%	98.3%

Schedule[3,23] did not have a positive impact on the financial attractiveness of primary care specialties, from the perspective of an investment in educational training. It is unlikely that medical students, who may perform an informal analysis similar to ours, would be more encouraged to enter primary care over surgical specialties in 1992 than in 1998.

Although all surgical specialties except urology, showed substantial decreases in educational returns on investment over the period examined, the returns that students entering these specialties are still substantial. However, should the trends continue, it may be more difficult to attract bright students into surgical fields. With worsening returns, the significant time and initial financial commitments to the pursuit of a surgical career may be particularly difficult for socioeconomically challenged students. This should be concerning to policymakers, if medicine continues to try to match the cultural diversity of providers to that of patients across specialty groups.

There are several limitations to our approach. First, our results are dependent on the data available, and in particular on the accuracy of self-reported income, hours, and specialty data. However, the consistency of results over time suggests that they are generalizable. Second, the returns are those that could be expected by a fourth-year student today, given current costs and incomes. To the extent these data change over time, so will estimates of return. Nevertheless, we believe current data are the most relevant for students who are now considering career paths. Third, to the extent that students' level of educational debt varies from the mean, so will their returns on additional medical specialty training, although an individual's level of debt would not change the relative ranking of returns on specialty training. Fourth, our analysis cannot account for any variation in the risk associated with particular career paths. If physicians practicing procedure-based medicine encounter much greater scrutiny or much lower incomes in the future, then high returns associated with those specialties might be justifiable. Similarly, if one career path precludes an ability to work until age 65, then high returns associated with those shorter duration specialties might be justified. Fifth, our representation of the opportunity cost—the general practice physician—may be a dubious career path for most medical students. Because of increasing quality improvement, accreditation, and regulatory efforts, general practice may be a career of the past. Regardless, the relative ranking of the career paths examined would still stand if a career in pediatrics replaced our example of an opportunity cost.

Finally, our analysis ignores other factors that play a role in the choice of profession. The return on educational investment is not the sole motivation to choose one profession over another: in-

tellectual stimulation, lifestyle, and prestige undoubtedly have a role in career decisions.[6] The very long training periods associated with surgical subspecialties may dissuade students from entering those fields, despite anticipated high lifetime returns on that investment. But policymakers would be remiss if they ignored the powerful influence of the up-front costs of professional training and students' concern about their ability to repay the debt they incur. The direct and indirect costs of additional medical training are very real to students, as are the lost opportunities to earn income elsewhere. Many students may make an informal calculation of return using near term costs and future ability to repay debt. Such a calculation strongly favors medical careers with high incomes.

Market forces are pervasive. Economic incentives designed to encourage medical students to choose primary care careers do not seem to have had much of an impact with the use of this type of analysis. Our examination of the returns on different educational career paths indicates that primary care physicians continue to be underpaid relative to procedure-based physicians. These returns and the incentives they produce should be carefully considered as part of health care reform.

GLOSSARY OF FINANCIAL TERMS AND MEASURES

Cash flow: The flow of money to or from an individual (or firm). In this analysis, annual cash flow (CF) is defined as after expense income (Y) minus opportunity costs (O) minus educational costs (E) as defined in the following equation:

$$CF = Y - O - E$$

Cash flow per hour: Cash flow divided by number of hours worked.

In this case, because the opportunity cost pathway includes the same educational costs over the same period, educational costs have no impact on the analysis.

Opportunity cost: The value of available alternatives that must be forgone in order to achieve a particular goal. In this analysis, it is the forgone value of starting work immediately after one year of residency as a licensed general practitioner.

Discount rate: The discount rate reflects the increased value of receiving a dollar today in comparison to a year in the future because today's dollar can be invested to produce an immediate return. Discounting is a method of evaluating financial alternatives with different income patterns and is a standard feature of financial and economic analyses.

Net present value: Today's worth of an expected cash flow pattern at a predetermined rate of interest — the discount rate. It is calculated as the sum of the annual CF, over a number of periods (j, from 0 to the n th period), discounted at a particular assumed rate of alternative investment (i), to the present period as shown in the following equation:

$$NPV(Y) = \sum_{j=0}^{n} \frac{CF_j}{(1+i)j+1}$$

Because of its influence on net present value, the discount rate can be varied to reflect a range of reasonable possibilities.

Hours-adjusted net present value: The net present value of the cash flow divided by the number of hours worked.

Average hours-adjusted net present value: Cumulative net present value of cash flows divided by the total number of hours worked over the years examined (Fig 2).

Cumulative hours-adjusted net present value: The sum of annual hours-adjusted net present value from the completion of high school to a specified age (Fig 3).

Internal rate of return: The annual interest rate that equalizes the negative and positive cash flows on an investment over its duration by weighting them according to when they occur. It is calculated as the interest rate (r) at which the sum of the present values of a series of expected incomes (Yj, $j = 0$ to n) is equal to the costs ($Xj = Ej + Oj$, $j = 0$ to n) required to produce them as demonstrated in the following equation:

$$\sum_{j=0}^{n} \frac{Yj}{(1+r)j+1} = \sum_{j=0}^{n} \frac{Xj}{(1+r)\,j+1}$$

In the present analysis, as with most examples, negative cash flows occur in earlier periods and positive cash flows occur later.

Hours-adjusted internal rate of return: The annual return on the educational investment over the working lifetime calculated on incomes and costs divided by hours worked in their production (Fig 1).

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