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# TOPICS IN TRAINING

## The Financial Impact of Orthopaedic Fellowship Training

By Trevor Gaskill, MD, Chad Cook, PT, PhD, MBA, James Nunley, MD, and R. Chad Mather, MD

**Background:** Previous reports have compared the expected financial return of a medical education with those expected in other professions. However, we know of no published report estimating the financial return of orthopaedic training. The purpose of this study was to estimate the financial incentives that may influence the decision to invest an additional year of training in each of the major orthopaedic fellowships.

**Methods:** With survey data from the American Academy of Orthopaedic Surgeons and using standard financial techniques, we calculated the estimated return on investment of an additional year of orthopaedic training over a working lifetime. The net present value, internal rate of return, and the break-even point were estimated. Eight fellowships were examined and compared with general orthopaedic practice.

**Results:** Investment in an orthopaedic fellowship yields variable returns. Adult spine, shoulder and elbow, sports medicine, hand, and adult arthroplasty may yield positive returns. Trauma yields a neutral return, while pediatrics and foot and ankle have negative net present values. On the basis of mean reported incomes, the break-even point was two years for spine, seven years for hand, eight years for shoulder and elbow, twelve years for adult arthroplasty, thirteen years for sports medicine, and twenty-seven years for trauma. Fellowship-trained pediatric and foot and ankle surgeons did not break even following the initial investment. When working hours were controlled for, the returns for adult arthroplasty and trauma became negative.

**Conclusions:** The financial return of an orthopaedic fellowship varies on the basis of the specialty chosen. While reasons to pursue fellowship training vary widely, and many are not financial, there are positive and negative financial incentives. Therefore, the decision to pursue fellowship training is best if it is not made on the basis of financial incentives. This information may assist policy makers in analyzing medical education economics to ensure the training of orthopaedic surgeons in all specialties and subspecialties.

Since 1984, the median tuition and fees for medical school have increased 165% and 312% for private and public medical schools, respectively<sup>1</sup>. Consequently, the mean indebtedness of medical students has increased from \$86,000 to \$120,000 for public medical school graduates and from \$120,000 to \$160,000 for private medical school graduates between 2001 and 2006<sup>2</sup>. Graduates now carry 4.5 times the

educational debt of those graduating only two decades prior, and the debt may be in excess of \$350,000<sup>1</sup>. Considering forecasted decreases in Medicare fee schedules<sup>3</sup> and greater managed-care penetration<sup>4</sup>, the financial implications of practicing medicine are becoming increasingly important.

Fellowship training in orthopaedic surgery is becoming more prevalent.

A recent survey published by the American Academy of Orthopaedic Surgeons (AAOS) found that 56% of orthopaedic surgeons completed fellowship training<sup>5</sup>. Between 1990 and 2006, the proportion of practicing orthopaedic generalists decreased from 44.2% to 28.7%<sup>5</sup>. While the decision to pursue fellowship training is undoubtedly multifactorial, the growing educational debt, and the perceived expected

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ability to repay it, may increasingly influence the decision to pursue fellowship training in lieu of general orthopaedic practice.

Published reports have suggested that the return on a medical education is decreasing and is poorer for primary care medicine compared with procedure-based specialties, business, law, or dentistry<sup>1,2,6-8</sup>. To our knowledge, the financial impact of orthopaedic fellowship training has not been described. An understanding of the differences in financial incentives to complete fellowship training in certain subspecialties is important to ensure that we continue to train appropriate numbers of all specialties.

Using standard techniques, we estimated the financial return of fellowship training in adult arthroplasty, adult spine, foot and ankle, hand, pediatrics, sports medicine, trauma, and shoulder and elbow surgery. These financial returns were then compared with that of pursuing a general orthopaedic career.

## Materials and Methods

### Data Source

Two data sources were used to obtain specialty and age-specific data on income and duty hours. Fellowship incomes were obtained from the Association of American Medical Colleges 2006 annual house staff survey<sup>9</sup>. This survey provides the average stipend nationally for persons training in post-graduate year (PGY)-6. For income generated by practicing orthopaedic surgeons, we used survey data compiled by the AAOS<sup>5,10</sup>. The survey data include full-time orthopaedic surgeons practicing general orthopaedics as well as those who report practicing in one of eight different subspecialties. The included subspecialties were adult arthroplasty, adult spine, pediatrics, foot and ankle, hand, shoulder and elbow, sports medicine, and trauma. Orthopaedic oncology was excluded because reliable salary estimates are not available. In some circumstances, those reporting a specialty practice may not

have completed fellowship training. In this situation, expected gross returns associated with specialty practice would be similar but no associated opportunity cost is accrued. Therefore, calculations in this analysis would not be applicable.

The salary figures represent income generated by direct patient care only. These are mean, age-specific values after expenses and before taxes. No ancillary income is included. The survey data are generated from six nonresident AAOS membership categories including board-certified nonmembers. By including nonmembers, the AAOS intended to create a survey group representative of the practicing orthopaedic surgeon population in the United States. The survey was conducted in 2006, and the response rate was 76%. Income averages were obtained for the following age groups: below the age of forty, forty to forty-nine, fifty to fifty-nine, and sixty to sixty-five years. We reviewed two

TABLE I Age and Specialty-Specific Annual Net Income in 2006 Dollars with the Number of Respondents\*

Subspecialty	Age				Mean Weekly Duty Hours
	Under 40 Yr	40 to 49 Yr	50 to 59 Yr	60 to 65 Yr	
Generalist	\$404,500	\$411,900	\$347,500	\$277,700	60.58
No. in subspecialty (n = 1799)	178	528	702	391	
Adult arthroplasty	\$444,700	\$455,800	\$412,600	\$309,000	65.01
No. in subspecialty (n = 2800)	316	946	1046	492	
Adult spine	\$612,300	\$574,400	\$461,600	\$325,000	65.01
No. in subspecialty (n = 911)	99	336	321	155	
Foot and ankle	\$430,700	\$429,500	\$363,500	\$276,000	63.38
No. in subspecialty (n = 1170)	164	381	408	217	
Hand	\$466,600	\$453,500	\$398,900	\$324,900	60.74
No. in subspecialty (n = 1444)	204	533	485	222	
Pediatrics	\$381,300	\$373,700	\$359,400	\$314,400	63.66
No. in subspecialty (n = 666)	70	229	242	125	
Sports medicine	\$433,200	\$467,500	\$426,300	\$324,800	62.29
No. in subspecialty (n = 3037)	526	1242	953	316	
Trauma	\$429,300	\$433,800	\$375,300	\$292,400	67.95
No. in subspecialty (n = 1824)	257	674	605	288	
Shoulder and elbow	\$463,600	\$476,500	\$417,700	\$316,000	65.5
No. in subspecialty (n = 2522)	401	945	822	354	

\*Data are from the American Academy of Orthopaedic Surgeons: AAOS Orthopaedic Practice in the U.S. 2005-2006<sup>10</sup>.

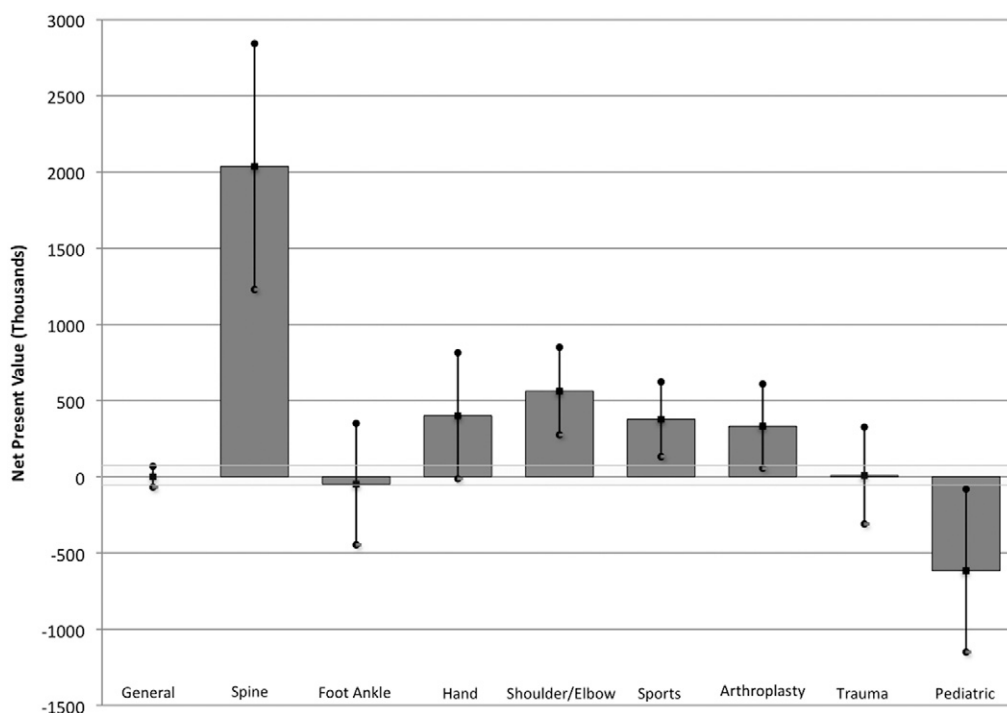


Fig. 1

Net present value (in thousands) of each subspecialty. Upper and lower 95% confidence intervals are indicated by I-bars. General orthopaedic practice is defined as equal to \$0.00 net present value for comparative purposes. The light gray bar indicates the 95% confidence interval for general practice for comparative purposes.

other reputable sources for income information, the Medical Group Management Association salary survey and the American Medical Association, but we elected to use the AAOS survey data because the number of survey respondents was substantially greater than those in the other sources. Therefore, we believe the AAOS data provide the most robust income estimates available.

### Financial Calculations

We used standard techniques of financial analysis used in previous studies<sup>11</sup> to estimate the return of the educational investment required to complete various orthopaedic subspecialty fellowships. Two measures for estimating the return on investment, i.e., the net present value and the internal rate of return, were used. The net present value (NPV) is the value of the future net cash flows of an investment minus the initial investment. It is estimated from the annual cash flow of investment returns (CF), which is the after-expense annual income (Y) minus the opportunity costs. Because a dollar

today is worth more than a dollar in the future, cash flows must be discounted. We chose 5% as our interest (discount) rate. The formula for net present value used in this study is as follows<sup>11</sup>:

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

The internal rate of return on the educational investment is the annual interest rate at which the sum of the present values in a series of expected cash flows equals zero. Individuals and businesses use these measures to evaluate potential investment opportunities. If positive, the investment will yield a return and is considered financially sound. Multiple investment opportunities can be compared with use of these measures, which allow businesses to choose the option with the highest internal rate of return or net present value<sup>11</sup>.

$$\sum_{j=0}^n \frac{Y_j}{(1+r)^{j+1}} = \sum_{j=0}^n \frac{X_j}{(1+r)^{j+1}}$$

The break-even point was also calculated for each fellowship investment. It is defined as the year when the opportunity cost and the returns of the fellowship investment become equal. In other words, there is no net loss or gain. It is also defined as the point in time when the net present value equals 0.

$$NPV(Y) = 0$$

We also examined the estimated net present value of the educational investment per hour worked over a working lifetime. This is a measure of the efficiency of a specialty, and it reflects the effect of fellowship training on productivity. The average weekly duty hours (excluding call) for each specialty were used to calculate an hour-adjusted net present value of the additional year of fellowship training. This was based on a sixty-hour week, forty-eight-week work year, and the predefined twenty-nine-year working career. Age group-specific duty hours for

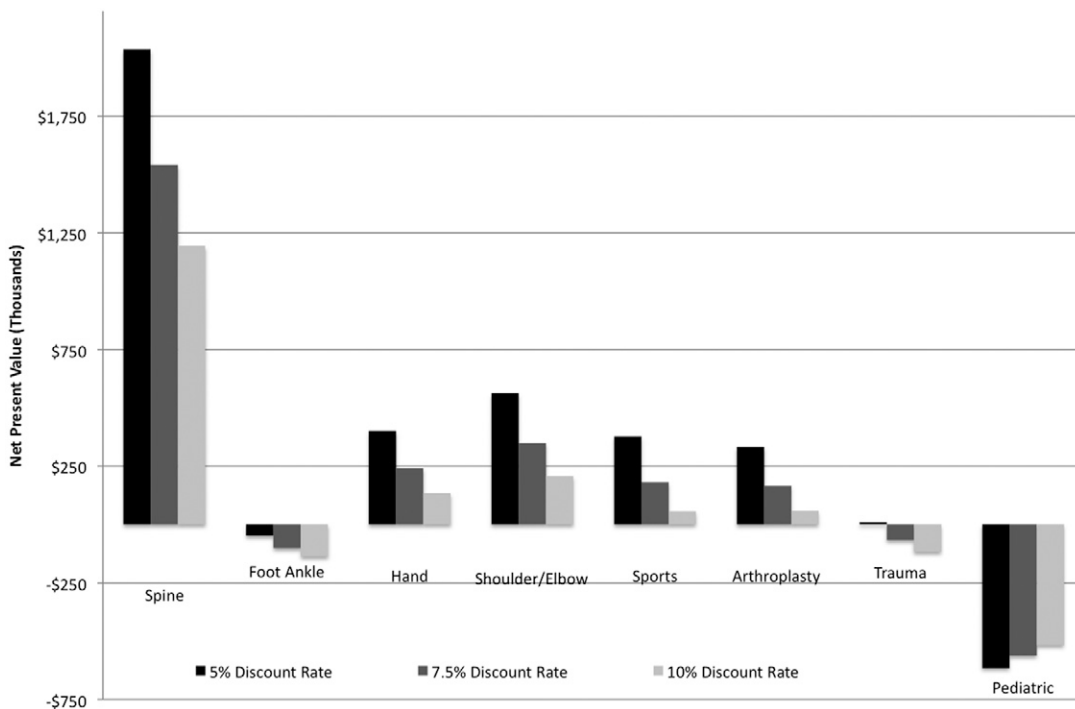


Fig. 2

Net present value (in thousands) of each subspecialty, with use of the mean income estimates at three different discount rates. General orthopaedic practice is defined as equal to \$0.00 net present value for comparative purposes.

each specialty were not available from survey data. This prevented us from calculating age-specific hour-adjusted returns.

Average weekly work hours (unique to specialty) \* 48 weeks \* (29 years) = lifetime work hours (Z)

60 weekly work hours \* 48 weeks \* (29 years) = standard lifetime work hours (X)

$\frac{NPV(Y)}{Z} = NPV \text{ per hour worked } (Q)$

$Q * X = \text{Work hours adjusted NPV}$

Calculation of the return on investment requires the determination of an opportunity cost of pursuing an orthopaedic fellowship. The opportunity cost is that income that a person could generate had he or she not completed additional orthopaedic training.

In our analysis, the opportunity cost is represented by the income earned by a general practice orthopaedic surgeon minus the fellowship stipend.

Opportunity cost

= first-year income of a general orthopaedist – fellow stipend

On the basis of the AAOS income data (Table I) and average PGY-6 fellowship stipend (\$52,654)<sup>9</sup>, an opportunity cost of \$351,846 was estimated. It is important to note that this cost is the financial investment in fellowship training. We did not include the cost of carrying educational debt or an additional year. In most cases, the incremental cost of the interest for an additional year contributes a negligible amount to the total opportunity cost.

To complete these financial calculations, several assumptions were made. On the basis of the AAOS survey estimates, the average age of retirement was fifty-nine years<sup>7</sup>. Therefore, we assume a fixed working lifetime defined as completion of an orthopaedic resi-

dency at the age of thirty-one to retirement at the age of sixty. Although the age of retirement is variable, discounting makes the contribution of the later years small. On the completion of training, we assume that physicians immediately become employed in their chosen field. This financial analysis does not reflect the investment of the entire medical education but rather the incremental investment in fellowship training. Although some studies have suggested that educational debt is associated with specialty choice, others have not confirmed these findings<sup>12-15</sup>.

#### Sensitivity Analysis

The results of our analysis are dependent on both the reliability of our data sources and the assumptions made. Therefore, a sensitivity analysis was completed to determine the effect of varying disputable data points within a plausible value range. The net present value was calculated with use of the mean, upper and lower 95% confidence intervals for salary, and discount rates of 5%, 7.5%, and 10%.

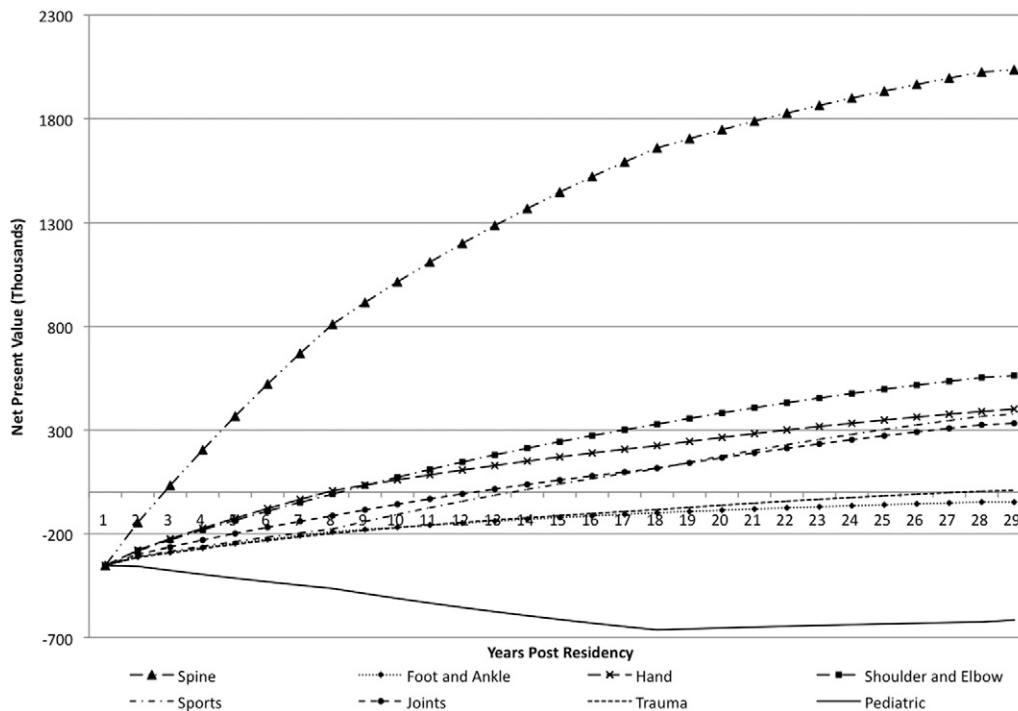


Fig. 3

Cumulative net present value (in thousands) for each subspecialty over time. The point at which each line becomes positive represents the break-even point for that specialty.

## Results

Net income by subspecialty and age group is shown in Table I. These tended to be higher in adult spine surgery and lower in pediatric orthopaedics. In each subspecialty, salaries tended to decline in the later years of practice. This trend mirrored decreases in reported weekly duty hours late in a surgeon's career. Table I also includes mean reported duty hours (excluding call) by specialty for all age groups. Orthopaedic traumatologists followed by shoulder and elbow, adult arthroplasty, and adult spine surgeons reported the highest mean weekly duty hours. The fewest mean duty hours were reported for general orthopaedics and hand surgery.

The expected net present value of additional fellowship training over a working lifetime in each of eight subspecialties is illustrated with upper and lower 95% confidence intervals (Fig. 1), and at three different discount rates (Fig. 2). General orthopaedic practice was defined as equal to \$0.00 net present value for comparative purposes. The largest estimated return on fel-

lowship training was experienced in adult spine. Fellowship training in this area yielded an estimated 34.2% increase in net present value over a working lifetime compared with general orthopaedic practice. Lesser returns were seen in shoulder and elbow (9.4%), sports medicine (6.3%), hand (6.7%), adult arthroplasty (5.6%), and trauma (0.14%). Pediatrics and foot and ankle fellowship training estimates resulted in a negative net present value (90% and 99%, respectively) compared with general practice. The net present value decreased for all specialties at higher discount rates and became negative for orthopaedic trauma above a 5% discount rate.

Figure 3 illustrates the estimates of cumulative net present value and break-even point for each fellowship type with use of mean income estimates. The initial opportunity cost of fellowship training in adult spine surgery was recouped within the second year of practice. The break-even point was longer for hand surgery (seven years), shoulder and elbow (eight years), adult arthroplasty

(twelve years), sports medicine (thirteen years), and trauma (twenty-seven years). On the basis of mean income estimates under our assumptions, fellowship-trained pediatric and foot and ankle surgeons would never break even following the initial investment.

The estimates for internal rate of return were positive for fellowship training in all areas with the exception of pediatric specialization. The largest internal rate of return (58.5%) was again associated with training in adult spine surgery. The estimated internal rates of return for shoulder and elbow, hand, adult arthroplasty, sports medicine, trauma, and foot and ankle were 17.2%, 15.5%, 12.0%, 11.6%, 5.2%, and 3.4%, respectively. Foot and ankle exhibits a positive net present value and a negative internal rate of return because the internal rate of return for foot and ankle is smaller than the discount rate used in the net present value calculations.

The duty-hour-adjusted lifetime net present value for each subspecialty is illustrated, with use of mean income

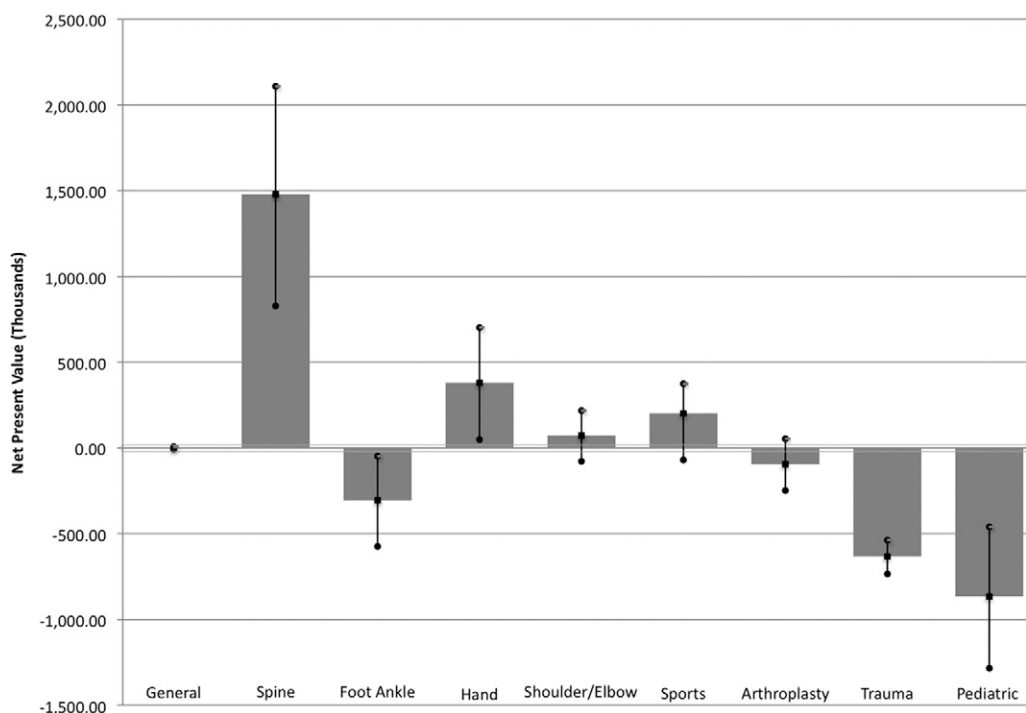


Fig. 4

Cumulative duty-hour-adjusted net present value (in thousands). Upper and lower 95% confidence intervals are indicated by I-bars. General orthopaedic practice is defined as equal to \$0.00 net present value for comparative purposes. The light gray bar indicates the 95% confidence interval for general practice.

estimates, in Figure 4. General orthopaedic practice is defined as equal to \$0.00 net present value for comparative purposes. Controlling for duty hours changes the estimated net present value of the various subspecialties considerably. Only spine and hand surgery seem to exhibit a clear productivity advantage compared with general practice. The estimated net present value of a shoulder and elbow fellowship decreases considerably but, along with sports medicine, remains positive. The estimated net present values of adult arthroplasty and trauma become negative, while those of pediatrics and foot and ankle show little change. Adult spine continues to show the largest hour-adjusted lifetime net present value return on fellowship training.

### Discussion

Financially speaking, an investment can be considered acceptable if the estimated internal rate of return and net present value are greater than zero. Under our idealized assumptions and mean reported incomes, fellowships in adult

spine, sports medicine, hand, adult arthroplasty, shoulder and elbow, and trauma may be acceptable financial investments. In contrast, specialties exhibiting an internal rate of return of <5% (our smallest discount rate) or a negative net present value may be considered poor financial investments under these same assumptions. Foot and ankle and pediatric training appear to fit this definition. Furthermore, returns associated with each fellowship are not equal. For example, adult spine is estimated to have a greater net present value and an early break-even point, whereas an orthopaedic traumatologist spends nearly an entire working lifetime to pay off the investment of a fellowship. Pediatric and foot and ankle-trained surgeons never recoup the opportunity cost of the additional training.

The reasons for these disparities are unclear. For all fellowship subspecialties, salaries tended to be higher in private practice than in academic practice<sup>5,16</sup>. The ability to better control efficiency, overhead, payer mix, and increased income from nonclinical en-

ties contributes to this finding. In addition, the proportion of academic and private-practice orthopaedic surgeons in each subspecialty category is variable. Smaller academic salaries, compared with private practice incomes, may partially explain the negative estimated returns in subspecialties with a high proportion of academic clinicians. Reimbursement structure likely has an impact as well. For example, adult spine has less bundling of procedures than other specialties, which perhaps contributes to higher returns.

It is interesting to consider why most fellowships yield a positive net present value on training. Surgeon fees are equivalent for a given procedure regardless of whether fellowship training has been completed. Therefore, more relative value units must be billed for the fellowship-trained surgeon to obtain a higher salary than a generalist performing the same procedure. Some argue that fellowship training accomplishes this by improving surgeon efficiency. In other words, a more efficient, fellowship-trained surgeon would bill more relative

value units per duty hour. If similar collection rates were assumed, this would improve earnings per duty hour. We estimated this by calculating the hour-adjusted lifetime net present value for each fellowship (Fig. 4). These calculations demonstrate that hour-adjusted earnings vary considerably between many of the subspecialties and general orthopaedic surgery. Only fellowships in hand and adult spine appear to offer a productivity advantage compared with general orthopaedic practice. Conversely, shoulder and elbow, adult arthroplasty, and trauma yield a positive net present value but appear to offer no productivity advantage. An explanation for this may be that specialty training allows access to more patients and cases, leading to more hours worked, which increases the associated net present value.

In our analysis, the estimated break-even point illustrates how many years a person must practice in his or her given specialty before the fellowship investment can be paid off. While we assumed a working lifetime from the age of thirty-one to sixty years, many surgeons do not practice for this number of years. Those entering orthopaedic surgery later in life or planning to retire earlier can look at the break-even point as an effective measure of whether completing a fellowship makes financial sense. With use of mean reported income, most fellowships can attain the break-even point within ten years. It is difficult to draw firm conclusions, however, because current standards of practice are likely to change over this time frame.

The impact that financial incentives have on fellowship choice cannot be ignored. Accumulated educational debt is growing more rapidly than the consumer price index<sup>1</sup>. Tuition and fees have increased dramatically, and graduating medical students carry 4.5 times the educational debt of those who graduated only two decades earlier<sup>1</sup>. Additionally, the AAOS estimated that the salaries of orthopaedic surgeons grew 2% less than inflation between 2003 and 2005<sup>10</sup>. These trends will make repayment of larger debts more

difficult and should be of concern to all medical professionals. For these reasons, most residents accumulate substantial debt and undoubtedly feel pressure to maximize available income by making sound financial decisions.

Should this trend continue, educational and specialty decision-making may become increasingly financially based. This may alter the supply and demand economics of subspecialty orthopaedic education and indirectly impact patient access to care. This foresight should prompt careful consideration when policy makers begin regulatory, fee schedule, and pay-for-performance discussions, to ensure a sufficient number of physicians are trained in all specialties and subspecialties.

There are several limitations to our study. First, these financial projections are only as accurate as the data and assumptions that are used to conduct the analysis. The AAOS survey data are self-reported. Although the AAOS makes attempts to ensure its participants are representative of the practicing population, there are no data to confirm this. Therefore, the data may not represent a true cross-section of practicing orthopaedic surgeons in the United States. Assumptions made in this analysis are based on idealized current standards of practice, and changes in these assumptions can dramatically alter the results. For example, becoming unable to complete the defined working lifetime would decrease expected returns. Therefore, these financial projections are a snapshot in time. They are relevant today, but as these data points change so will the estimates of return.

For these reasons, a sensitivity analysis was performed to determine the effect of varying disputable data points within a plausible value range. Specifically, net present value was estimated with use of upper and lower 95% confidence intervals for salary and discount rates of 5%, 7.5%, and 10%. From this analysis, it appears that spine, shoulder and elbow, and sports medicine yield a net present value greater than that for general practice (Fig. 1). However, shoulder and elbow became

comparable to, and trauma became negative compared with, general practice when duty hours are controlled. The discount rate used for net present value calculations is also debatable. However, discount rate fluctuations (Fig. 2) affect each subspecialty proportionately. In other words, discounting affects the magnitude of the estimated net present values and not disparities identified between them. Magnitude changes associated with discount rates of >5% were large enough to produce a negative net present value in trauma and improve the negative estimates of net present value in pediatrics.

Second, other cost and income factors may affect our results. For example, income estimates used in this analysis include clinical duties only. They do not include income from ancillary medical services, lectures, fringe benefits, perks, or other ventures. Geographic pay variations, practice type, payer mix, and call can also dramatically change income estimates. Furthermore, additional costs associated with fellowships including moving expenses, the interest on student loans, and fellowship interview expenses were omitted. These costs are variable and, in most cases, would not alter returns or opportunity costs substantially. Efforts to minimize these variables were made by using national salary data for calculations and excluding call in duty-hour estimates, but residents who can more accurately identify costs and future cash flows may project very different returns.

Finally, our analysis cannot account for characteristics associated with each subspecialty such as liability risk and patient outcomes. If fellowship training improves outcomes, or the risk of practicing one subspecialty is greater than others, increased financial return may be justified. It is possible that future orthopaedic surgeons may find fellowship training an integral part of pay-for-performance standards.

As stated previously by Weeks and Wallace, a salary forecast model cannot account for intangible factors such as intellectual stimulation, life-

style, and prestige<sup>17</sup>. While it is apparent that positive and negative financial incentives exist, they are based solely on the continuation of current standards of practice. Present incentives, and the relative value of some orthopaedic specialties, may evolve rapidly with changes in reimbursement guidelines, coding strategies, and other

indirect market-related forces. Therefore, fellowship selection remains a complex decision and is best not based on volatile financial incentives. Moreover, these results may alert policy makers that disparities exist and, in the face of growing educational debt, could influence the training of subspecialists.

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