Research Article

The Return on Investment of Orthopaedic Fellowship Training: A Ten-year Update

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Abstract

Background: Over 90% of graduating orthopaedic residents now pursue fellowship training, and only 15% of practicing orthopaedic surgeons now characterize themselves as generalists. Fellowship training has significant financial effects due to both opportunity cost of that year of training and changes in compensation throughout one's career. The purpose of this study was to estimate the financial return on investment by pursuing additional training in an orthopaedic fellowship versus general practice.

Methods: Using described techniques of financial analysis, net present value (NPV), internal rate of return (IRR), and break-even point were estimated over the average working career length of an orthopaedic surgeon. Compensation data were drawn from the American Medical Group Association physician compensation surveys. Seven fellowships were studied and referenced to a career in general orthopaedic practice.

Results: Fellowship training in spine surgery yields the highest return on investment with a break-even point of 5 years. Adult reconstruction has a positive NPV and IRR, but when corrected for number of hours worked per week offers no productivity advantage to general practice. Sports medicine and trauma offer neutral returns, but when corrected for work hours, NPV and IRR both become negative. Hand, pediatrics, and foot and ankle never break even following the loss of compensation realized during fellowship year.

Discussion: The recent trend across all medical specialties has been for increased fellowship training and subspecialization. There are numerous reasons to pursue fellowship training, both personal and financial. This study presents an updated estimate of the financial impact of fellowship training in orthopaedics. This analysis demonstrates that selecting different fellowships can generate positive, negative, or neutral financial returns. This study has the potential to influence residents' decisions to pursue general practice versus fellowship training and identifies economic drivers, which may lead to preferential pursuit of certain subspecialties.

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In 1999, Goldner et al[1] published an article titled, "Is the orthopedic generalist moving toward extinction?" Their question stemmed from concern due to the rapidly growing trend of subspecialization within orthopaedics. At the time, 33% of practicing orthopaedic surgeons characterized themselves as generalists, which already represented a decline from

44% in 1990.[2] Today, this trend has continued, with only 15% of practicing orthopaedic surgeons in the United States characterizing themselves as generalists.[3] Furthermore, Mannava et al[4] recently showed that from 1984 to 2014, the percentage of advertised general orthopaedic job openings decreased from 95% to 32%, whereas job openings requiring fellowship training increased from 5% to 68%. Not surprisingly, over 90% of orthopaedic residents now pursue fellowship training.[5]

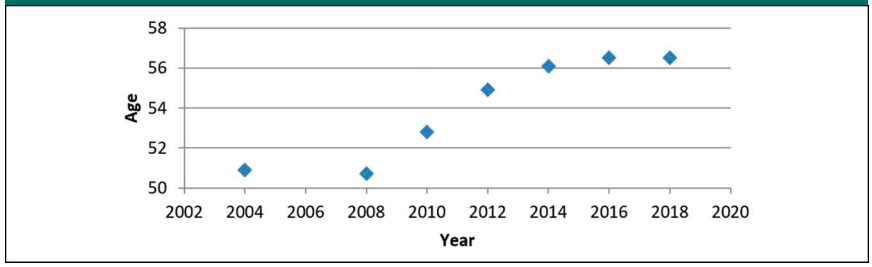
A decade ago, Gaskill et al[6] were the first to publish on the estimated financial implications of orthopaedic fellowship training. Their results were generated from survey data of practicing orthopaedic surgeons compiled in the 2006 American Academy of Orthopaedic Surgeons (AAOS) census. These data were used to estimate the net present value (NPV) and internal rate of return (IRR) of pursuing an orthopaedic fellowship. They found that although some subspecialties (such as spine and hand) generated a positive NPV, others (such as pediatrics and foot and ankle) resulted in a negative NPV when taking into account the changes in compensation and opportunity cost of delaying subspecialty pay during fellowship training.

Several important changes have occurred since their 2009 study, warranting reinvestigation. From 2003 to 2013, the percentage of orthopaedic residents pursuing fellowship training increased from 76% to 90%.[5] During this time, fellowship stipends have increased, and compensation to generalists and subspecialists has changed.[2,7,8] In addition, the cost of becoming an orthopaedic surgeon in the United States has increased drastically. From 1984 to 2018, the median indebtedness of a medical student graduating from a public university increased from $22,000 to $190,000.[9,10] Normalized to inflation, this represents an increase of 349%.[11] Several studies have investigated the economic burden that this places on the graduating physician and its effects on specialty choice.[12-14]

We also think that Gaskill et al[6] assumed too short of a working career length (29 years) than is typical for the average orthopaedic surgeon. It has previously been reported that the average orthopaedic surgeon retires at age 66 years.[15] In 2006, AAOS data showed only 12% of surgeons retiring fully before age 65 years and 46% of emeritus members working into their 70s.[2] Correspondingly, the average age of a practicing orthopaedic surgeon in the United States has also increased during this time, from 50.9 in 2004 to 56.5 in 2018[3,16] (Figure 1). For these reasons, we feel that an average age of residency graduation at 31 years and retirement at 65 years, for a working career length of 34 years, remains a conservative but more appropriate estimate for this analysis.

Thus, the objective of the current study was to provide an updated estimate of the NPV and IRR of pursuing each of the orthopaedic fellowships over an average career length. These were compared with the returns of a career in general orthopaedic practice to better inform the financial implications of orthopaedic fellowship training.

Figure 1



Graph showing the average age of practicing orthopaedic surgeons in the United States, compiled from American Academy of Orthopaedic Surgeon census data from years 2004 to 2018.[2,3,16]

Methods

Data Sources

Compensation data were collected from the 2018 American Medical Group Association (AMGA) Compensation and Productivity Survey and is summarized in Table 1.[8] This report is generated from self-reported compensation data collected nationally for all medical specialties, including general orthopaedic practice and adult reconstruction, hand, sports medicine, trauma, orthopaedic oncology, pediatrics, and foot and ankle. Data on shoulder and elbow are not collected in this survey and therefore could not be analyzed. Orthopaedic oncology was excluded from analysis because of a low respondent rate of only 12 surgeons. In Gaskill et al's analysis, compensation data were drawn from the 2006 AAOS census.[2,6] Unfortunately, more recent AAOS censuses have not included detailed compensation data in their reports and so could not be used in this investigation.

Financial Analysis

NPV and IRR were calculated as described in previous studies.[6,17-20] In finance, the NPV is the summation of all future cash flows (CFs) of an investment minus the initial cost of that investment. In orthopaedic training, this investment cost (IC) is realized as an initial loss of income during the

Table 1

Compensation Data Compiled From the 2018 AMGA Compensation and Productivity Survey[8] With Number of Respondents for Each Orthopaedic Specialty

Specialty	Respondents	Mean Compensation (in 2018 $)
General	1,178	586,345
Adult reconstruction	95	675,000
Spine	104	775,889
Foot and ankle	62	486,398
Hand	178	600,000
Pediatrics	86	569,283
Sports medicine	167	620,719
Trauma	88	648,575
Oncology	12	552,793

AMGA = American Medical Group Association

period of fellowship training. CF used in NPV calculations is discounted, reflecting the time value of money, meaning that a dollar today can be used to generate a return on investment and therefore is more valuable than a dollar later in a career. In keeping with previous studies, a 5% discount rate was selected. Thus, the formula for NPV can be written as follows:[6]

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

where i is the discount rate and n is the number of periods in the analysis. A period of 34 years was selected for reasons previously discussed. IRR is a discount rate, which makes the NPV of all future CFs for a proposition equal to zero. It is calculated by an iterative process through a function available with most financial calculators and can be expressed by the following formula:

$$0 = \mathrm{NPV} = \sum_{j=0}^{n} \frac{\mathrm{CF}_j}{(1+\mathrm{IRR})^j}$$

The break-even point for each specialty (Y) was also calculated, defined as the point in time in which the IC equals the net return, and can be written as[6]:

$$\mathrm{NPY(Y)} = 0$$

In this analysis, the IC is defined as the income that would have otherwise been earned by a graduating resident entering directly into general practice, minus the salary paid during the fellowship training year. This can be written as:

$$\mathrm{IC} = \mathrm{GC} - \mathrm{FC}$$

where IC = investment cost, GC = mean generalist compensation, and FC = mean PGY6 fellow compensation. The American Association of Medical Colleges and AMGA report the mean PGY6 fellow and generalist compensations to be $68,032 and $633,572, respectively. Therefore, an IC of $565,540 was calculated.

Consideration was given to include in this analysis the extra cost of carrying student loans an additional year during fellowship training. However, the interest gained during this time was determined to be relatively insignificant compared with the magnitude of compensation earned over an orthopaedic surgeon's career and was therefore ignored. This finding is also in keeping with Gaskill et al.[6]

Last, the 2018 AAOS census reported a statistically significant difference in the number of hours worked per week by a generalist versus a specialist (47.88 versus 54.22 hours per week, respectively) ($P < 0.01$).[3] It is possible that differences in compensation can be explained solely by differences in work hours. Gaskill et al[6] accounted for this in their analysis and applied a correction in their final NPV analysis to account for these differences.[6] Based on the updated census data, we do not suspect that these patterns have changed and so also applied a correction value derived from AAOS census data to account for average number of hours worked per week in each specialty. These correction values were calculated as follows:

$$\text{Correction Ratio (x)} = \frac{\text{Average Specialist Weekly Work Hours (unique to speciality)}}{\text{Average Generalist Weekly Work Hours}}$$

These are tabulated in Table 2 and were applied in the following manner[6]:

$$\frac{\mathrm{NPV\ (Y)}}{\mathrm{x}} = \text{Work hours adjusted NPV}$$

Sensitivity Analysis

The discount rate is meant to reflect a reasonable rate of return one could expect from an alternative investment to accommodate for the time value of money. To assess whether varying

the discount rate over a series of reasonable alternatives affected results, NPV was calculated using discount rates of 5%, 7.5%, and 10%.

Results

NPV of each orthopaedic fellowship with upper and lower 95% confidence intervals is shown in Figure 2. Spine and adult reconstruction demonstrate positive NPVs, whereas pediatrics and foot and ankle demonstrate negative NPVs. Hand, sports medicine, and trauma have NPVs, which are only marginally different from general practice, with 95% confidence intervals overlapping zero, indicating a net neutral investment over the period analyzed.

Figure 3 demonstrates the NPV of each orthopaedic fellowship calculated using discount rates of 5%, 7.5%, and 10% relative to general orthopaedic practice ($0.00 NPV for reference). As would be predicted, the NPV of each specialty decreased as higher discount rates were assumed. Sports medicine decreased from positive to negative NPV when discount rates of >5% were assumed.

Figure 4 depicts the cumulative NPV for each orthopaedic fellowship over the average career length of 34 years. The point at which NPV crosses zero represents the break-even point for that specialty. Spine has the shortest break-even point of 5 years, followed by adult reconstruction and sports medicine at 10 and 26 years, respectively. Trauma, hand, pediatrics, and foot and ankle do not reach NPV of zero during this period. IRR was estimated for each specialty and was the highest in spine (38%), followed by adult reconstruction (15%), sports medicine (6%), and trauma (4%). Hand, pediatrics, and foot and ankle all had negative IRRs. Trauma had a negative NPV but positive IRR, reflecting that the IRR is smaller than the discount rate assumed during the NPV calculation.

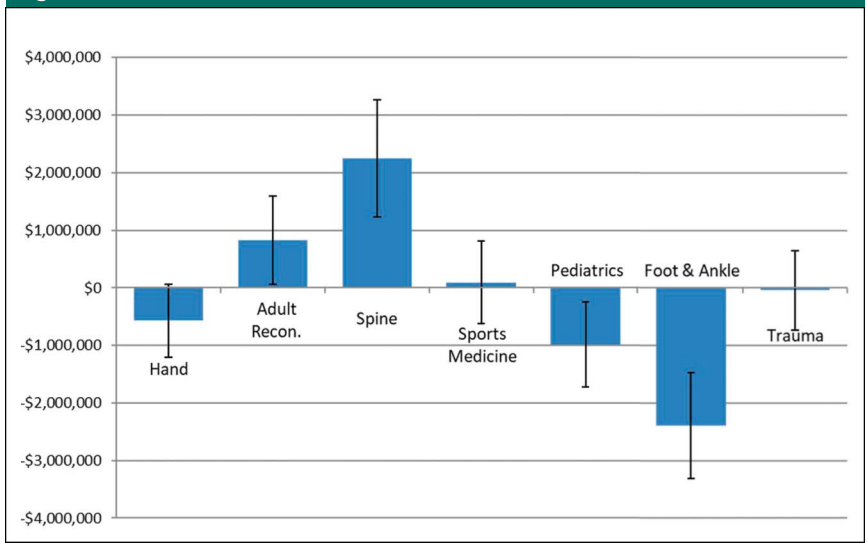
Table 2

Correction Ratios Used to Normalize Data and Account for Differences in Number of Hours Worked per Week in Each Specialty

Specialty	Correction Ratio (x)
General	1.000
Adult reconstruction	1.073
Spine	1.073
Foot and ankle	1.046
Hand	1.003
Pediatrics	1.051
Sports medicine	1.028
Trauma	1.122

See text for method of calculation.

Figure 2



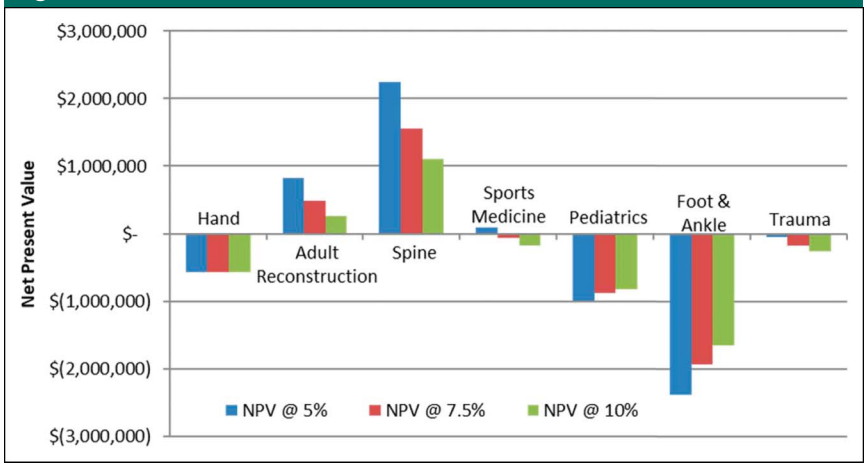
Graph showing the NPV of each orthopaedic fellowship with upper and lower 95% confidence intervals. The x-axis (zero) represents the NPV of general orthopaedic practice for comparison. Negative values indicate a worse return on investment than general practice, whereas positive values indicate a better return on investment. NPV = net present value

Work hour–adjusted NPV is presented for each specialty in Figure 5. General orthopaedic practice is again defined as equal to $0.00 NPV for comparison. After correction for work hours, the NPV of adult reconstruction drops considerably and is no different than general practice. Sports medicine drops from a positive NPV to a negative NPV, but with 95% confidence intervals still overlapping with general practice. Similarly, the estimated NPV of fellowship training in trauma drops as well such that its 95% confidence intervals no longer overlap with general practice.

Discussion

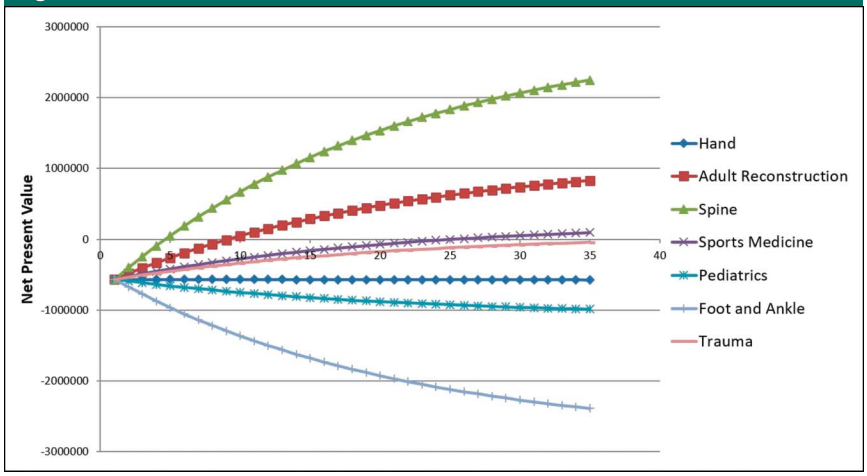
There are many considerations that enter into the decision of whether to pursue fellowship training in

Figure 3



Graph showing the NPV of each orthopaedic fellowship, as calculated using discount rates of 5%, 7.5%, and 10%, relative to the NPV of general orthopaedic practice, defined as $0.00 NPV. Note that sports medicine drops to a negative NPV as larger discount rates are assumed. NPV = net present value

Figure 4



Graph showing the cumulative NPV for each orthopaedic fellowship over time. The point at which NPV reaches zero represents the break-even point for that specialty. Note that trauma, hand, pediatrics, oncology, and foot and ankle do not reach an NPV of zero during this period. NPV = net present value

orthopaedics. These include a special interest in that chosen field, a desire to perform certain surgeries done more commonly in that field, anticipated career opportunities in that specialty, or the need to fill a void in one's surgical or clinical skillset. It would be naive to say, however, that the financial implications of choosing to pursue fellowship training ought not to be considered as well. This study presents an estimation of the financial implications of pursuing an orthopaedic fellowship. A similar analysis was performed a decade ago by Gaskill et al[6] using data from the 2006 AAOS census. Thus, this study represents a 10-year update on this important topic.

In financial terms, an investment can be considered advantageous if either the NPV or IRR is greater than zero. Without correction for differences in the number of work hours per year, spine, adult reconstruction, and sports medicine meet these criteria. Conversely, investments with negative NPV or IRR of less than the assumed discount rate can be considered disadvantageous. Fellowship training in hand, pediatrics, and foot and ankle meet these criteria. Another way to examine these findings is in terms of work years required before reaching the financial break-even point of each specialty. This value reflects how many years one would need to practice in their specialty before surpassing the IC incurred with fellowship training. Spine has the shortest break-even point of 5 years. This finding can be contrasted to sports medicine, in which one works nearly the entire length of their career before breaking even at 26 years. In Figure 4, trauma can be seen approaching the y-axis, but only passes the break-even point if the career length is extended to 44 years. Assuming graduation from fellowship at age 32 years, this means an orthopaedic trauma surgeon must work to age 76 years before recovering the upfront ICs of their fellowship training. Under the assumptions made during this analysis, hand, pediatrics, and foot and ankle do not ever recover these costs.

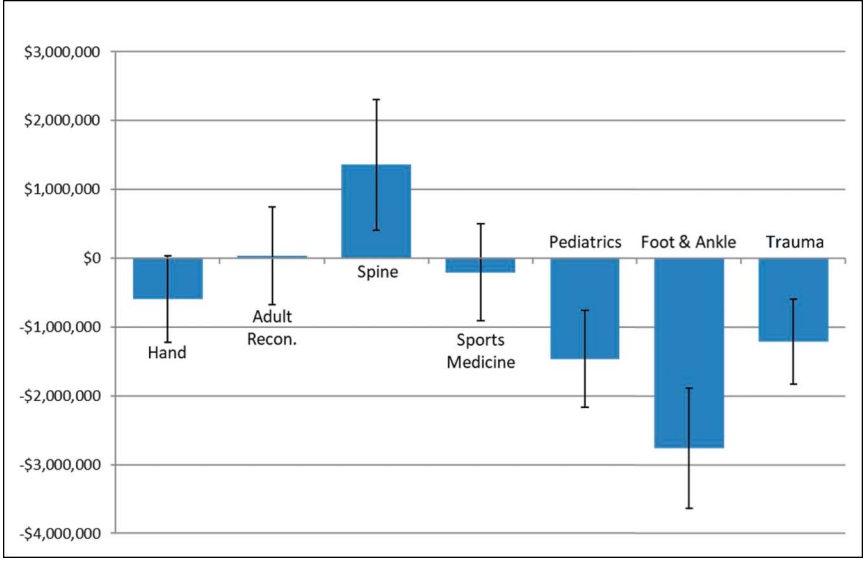
It has been noted that different specialties tend to have variations in the number of hours worked per week.[2,3,16] Surgeons who work more hours presumably would have more opportunities to generate higher incomes. When NPV is normalized to work hours, only spine surgery continues to demonstrate a positive NPV and thus confers some productivity advantage per hours worked over the general orthopaedic surgeon. Taking work hours into account, the NPV of adult

reconstruction becomes no different from general orthopaedics and thus represents a net neutral investment over the average length working career. With work hours normalized, pursuing sports medicine and trauma become financially disadvantageous.

Several comparisons can be made with Gaskill et al[6] financial analysis. Spine continues to be highly compensated and offers the best positive financial return for fellowship training. Adult reconstruction also remains advantageous, although to a lesser extent than was seen previously. Similarly, trauma fellowship training continues to produce slightly higher mean compensation, but a trauma surgeon would spend their entire working career (or longer) to recoup the loss of income incurred during their fellowship training. This finding is relevant to the older resident, who enters orthopaedic training later in life and has a shorter than average career length. A notable difference can be seen in hand surgery, as previously this represented the second highest paying specialty, but now generates a negative NPV.

Reasons for these changes are multifactorial. The economic principle of supply and demand may explain some of these changes. As surgeons preferentially enter one specialty, they increase the number of providers in that specialty and the number of patient's available to treat per surgeon is decreased, leading to decreased compensation. This scenario could be the case for hand surgery, which previously was noted to be highly compensated. Other causes for these differences could include changes in insurance reimbursement, a push toward bundling of procedural payments, evolving indications and contraindications to various procedures, and an aging patient cohort with changing demands.

Figure 5



Graph showing the NPV of each orthopaedic fellowship corrected for hours worked with upper and lower 95% confidence intervals. The x-axis (zero) represents the NPV of general orthopaedic practice for comparison. Negative values indicate a worse return on investment than general practice, whereas positive values indicate a better return on investment. NPV = net present value

Census data show that the average age of retirement for an orthopaedic surgeon in the United States is increasing.[2,3,16] Figure 1 demonstrates that from 2004 to 2018, the average age of a practicing orthopaedic surgeon increased from 50.9 to 56.5 years. This increase began sometime during 2008 to 2010 and corresponds with the Great Recession and economic volatility during this time frame. Surgeons on the verge of retirement during these years may have elected to delay retirement due to the economic uncertainty during this period. Alternatively, this may also reflect increased life expectancy and improved health status of older surgeons, now practicing later into their career. However, this trend cannot proceed indefinitely. A large portion of older orthopaedic surgeons are generalists, and as they retire, there will be increased demands on those that remain. As Sarmiento[21] recently argued, generalists will retain an important role in medicine for the foreseeable future.[21] If orthopaedic surgeons do not fill that role, other practitioners will.

This study has limitations. As with all financial estimations, the conclusions are only as reliable as the data used in the analysis. The 2018 AMGA Compensation and Productivity Survey included responses from 1,958 orthopaedic surgeons and is the industry standard. It is used nationally in contract negotiation and establishment of fair payments to physicians. However, it is limited in that compensation data are drawn from self-reported income based on a relatively small sample set of the overall practicing orthopaedic surgeon cohort. In the previous analysis by Gaskill et al, compensation data were drawn from AAOS census data, which had a larger sample size of 10,436.[2] Differences in sampling size, data collection tools, and reporting methods between the AAOS census and AMGA survey potentially introduce error and bias, which

should be taken into account when interpreting the results of this study.

Second, our analysis did not include the student loan interest, which would accrue during the fellowship year, as it has a relatively small effect compared with the magnitude of compensation accrued over a working orthopaedic surgeon's lifetime.

Furthermore, there are numerous variables that can affect a surgeon's earnings. These include geographic variations, academic versus private practice models, leadership positions, or research positions, which compete with clinic and operative time. The data used in this investigation also did not include ancillary income, which for both fellows and attendings can represent a significant contribution to total compensation. For fellows, ancillary income may be in the form of moonlighting or call stipends, which are becoming more common. Sources of ancillary income available to an attending include shared practice ownership, relationships with industry, paid teaching or educational arrangements, serving as expert witness, and numerous others. In many of these examples, possessing fellowship training may open additional opportunities for ancillary income, which are otherwise not available to a generalist. In all of these examples, any alteration of income away from the mean reported incomes used in this analysis can alter NPV estimations significantly. Using trauma surgery as an example, the addition of $25,000 per year in ancillary income changes the breakeven point from 44 to 10 years. Thus, comparatively small changes in overall compensation can have relatively large changes in the NPV estimations.

An upfront IC of $565,540 was assumed in this analysis. This value is based on the mean compensation of all practicing general orthopaedic surgeons and includes surgeons at all stages of their careers. It should be noted that the average starting salary of a first-year general orthopaedic surgeon may be lower than this. Several attempts were made to determine the average true starting salary of a generalist during the writing of this article. Unfortunately, these values are not part of AMGA, Medical Group Management Association, AAOS, or Becker reports. Merritt Hawkins (a physician recruiting firm) has recently published a report on the average advertised first-year recruiting incentive offered to an orthopaedic surgeon ($536,000).[22] The issue with this value is that it is simply the average compensation package offered. It does not reflect the actual income received by the surgeon after contract negotiation and productivity bonuses. Thus, we would expect the true starting salary from a first-year generalist to be slightly higher than the advertised recruiting incentive and may approach that value used in this analysis ($633,572).

Last, the conclusions of this study are time sensitive and assume that insurance reimbursements will remain the same in the future. This could change with introduction of a single payor system or other insurance overhauls. As time progresses, these estimations will become less accurate.

In conclusion, there are many reasons to pursue an orthopaedic fellowship. It is incumbent that the financial implications of doing so be explored fully. This decision should largely be based on an interest in the field or to fill a gap in training. This analysis provides updated estimates of NPV and IRR of these training options and demonstrates that most often, fellowship training is financially disadvantageous. This finding has important implications for those weighing the decision to pursue fellowship training.

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