

# Cost of Orthopaedic Surgeon Time is \$7.75 Dollars per Minute

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**Objectives:** The purpose of this study is to establish a consensus in the estimation of orthopedic surgeon cost-per-minute based on currently published literature.

**Design:** Literature review.

**Main Outcome Measurement:** Orthopedic surgeon cost per unit time

**Results and Conclusions:** Google Scholar search produced 73 articles regarding (“orthopaedic surgeon” OR “orthopedic surgeon”) (“cost per minute” OR “cost per episode”) from which 10 novel estimates for orthopedic surgeon cost-per-minute were obtained. The mean of these estimates was \$7.75±\$4.72. The methodology was relatively consistent using surgeon salary and time spent to establish cost-per-minute.

**Level of Evidence:** IV; Review

**Keywords:** Business, management, human resources, cost, value, efficiency.

(*J Ortho Business 2023; Volume 3, Issue 1: Pages 12-14*)

## INTRODUCTION

What must be considered when estimating the cost of healthcare? An accurate cost estimate is important at all levels of medicine, from patients and providers to insurers and local and national governments.<sup>1,2</sup> Some fields may be less difficult to estimate cost, for example for an office visit plus the cost of medications. However, in fields that are largely procedural based, such as orthopaedics, it may be difficult to estimate due to the many components that influence the final cost, such as location or level of the hospital facility.<sup>3</sup> One of the largest cost variables is operating room time, which can change dramatically based on individual anatomy, pathology, and complications that may arise during an operation.<sup>4</sup> The cost of operating room time can be further broken down into its different components.<sup>5</sup> These include, but are not limited to, professional fees such as anesthesia and surgeon fees, radiology, blood bank, lab, and orthopaedic implants.<sup>6</sup> Time-driven activity-based costing is a recent development allowing us to accurately break down complex environments, such as

an operating room, into its many components and assign costs based on time.<sup>7</sup> This method could be used to accurately predict the final cost of any procedure if there is a known standard reference.

A standard surgeon fee is not currently found in the literature. The surgeon cost may vary by specialty, training, location, or healthcare system. Additionally, the price may be influenced by what type of procedure is done.<sup>8</sup> A standard reference would benefit healthcare by creating a reliable number to be used in estimating overall costs. This study focuses on surgeon fees and seeks to establish a standardized reference for orthopaedic surgeon cost-per-minute.

## METHODS

This is a systematic review, performed following the established PRISMA guidelines for methodology and reporting. A literature search was performed in Google Scholar for (“orthopaedic surgeon” OR “orthopedic surgeon”) (“cost per minute” OR “cost per episode”) from 2010 until 2022. All article titles were reviewed by authors, and either discarded or selected for further review. Abstracts of selected articles were reviewed and those that had novel estimates for orthopaedic surgeon cost-per-minute were included. The methods of the remaining articles were scrutinized to determine if they included an estimate of surgeon cost-per-minute or if one could be determined given the information that was presented in the article. Where applicable, a single number was extracted to calculate the mean cost per minute. The fiscal year was used for the cost estimate when available, and the publication year was used when it was not. All figures were adjusted for inflation to 2022 dollars. For data that was gathered over multiple years, we adjusted for inflation of both the beginning year and the ending year. The averages of the two estimates were then reported.

**Table 1:** All estimates of Orthopaedic Surgeon cost per unit time found in the literature

Author	Year	Orthopaedic Surgeon Cost/Min	Orthopaedic Surgeon Cost/Min adjusted for Inflation	Median Adjusted Cost/Min
Koehler DM et al <sup>7</sup>	2016	\$12.29	\$15.17	\$15.17
Koolmees D et al <sup>9</sup>	2018-2019	\$6.19	7.30-7.17	\$7.24
Ang WW et al <sup>10</sup>	2015	\$2.72	\$3.41	\$3.41
Koolmees DS et al <sup>5</sup>	2018	\$14.25	\$16.70	\$16.70
O'Gorman PM et al <sup>11</sup>	2013	\$2.91	\$3.70	\$3.70
Fang CJ et al <sup>12</sup>	2018-19	\$6.36	7.50-7.37	\$7.44
Balakrishnan R <sup>13</sup>	2018	\$6.53	\$7.70	\$7.70
Berger J et al <sup>14</sup>	2012	\$2.49	\$3.21	\$3.21
Assmann G et al <sup>8</sup>	2009-2014	\$4.37	6.03-5.66	\$5.85
Assmann G et al <sup>8</sup>	2009-2014	\$4.10	5.47-5.13	\$5.30
Mean		\$6.22		\$7.75

## RESULTS

A literature search generated a total of 73 results. Excluded articles included 57 because they did not include estimates nor means of estimating surgeon cost-per-minute, five because they were not available without subscriptions, one because it was not specific to orthopaedic surgeons, and one because it was not available in English. There were 9 articles included which yielded a total of 10 estimates. Of the articles included all gave estimates that were within the specified parameters. Additionally, one of these articles included 2 separate estimates depending on if the procedure was septic vs aseptic.

Figure 2 shows a box-and-whisker plot of 10 estimates for surgeon cost. The data exhibits a mean of \$7.75, a median of \$6.55, a positive skew, and no outliers.



The mean cost-per-minute adjusted to 2022 dollars from all 10 estimates was \$7.75 per minute of surgeon time with a standard deviation of \$4.72. The median cost was \$6.55

with an interquartile range of \$3.63-\$9.57 (figure 2). There were no outliers to the data set with a maximum value of 1.9 standard deviations above the mean. The maximum value was \$16.70, and the minimum value was \$3.21.

## DISCUSSION

In this systematic literature review study, 10 estimates of orthopaedic surgeon cost-per-minute were identified with a mean value of \$7.75. These estimates came from 9 articles with topics varying from an operating room's general cost to specific procedural costs. While these studies were not directly investigating surgeon costs, it was found and reported as a contributing portion of the whole cost. The need for an established, known surgeon cost is evident even within these articles, as these researchers had an additional step of independently identifying the cost of the surgeon.

There is relative consistency found within the estimates identified in this review. This may be explained in part by the similar method used in calculation by the various researchers. For all but the greatest values, the researchers calculated surgeon cost by dividing the salary by minutes worked. The cost reported by Koehler et al. also included salary, fringe benefits, bonuses, administrative support, travel, and malpractice insurance. Thus, we would expect them to report a higher cost per minute. Koolmees et al. did not report a cost-per-minute within their article, however, they reported

the total cost and time for a rotator cuff repair and a percentage breakdown including physician cost. Thus, we see that changes in the methods produce variability, but remain within 2 standard deviations of estimates using other methods.

Developing standard and reproducible surgeon cost measurements and methods warrants further research.

Knowing this cost will help in creating accurate estimates for procedural cost, patient billing, and satisfaction.

## CONCLUSION

In conclusion, the mean cost for one minute of orthopaedic surgeon time estimated in the literature is \$7.75. For most articles, this was estimated by dividing the surgeon's salary by the minutes of operating. Further research is warranted to develop precision, reproducibility, and clarification of the methods for estimation of orthopaedic surgeon cost per minute.

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