# *Editorial Commentary:* Machine Learning Can Indicate Hip Arthroscopy Procedures, Predict Postoperative Improvement, and Estimate Costs

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**Abstract:** Complex statistical approaches are increasingly being used in the orthopaedic literature, and this is especially true in the field of sports medicine. Tools such as machine learning provide the opportunity to analyze certain research areas that would often require the complex assessment of large amounts of data. Generally, decision making is multifactorial and based upon experience, personal capabilities, available utilities, and literature. Given the difficulty associated with determining the optimal patient treatment, many studies have moved toward more complex statistical approaches to create algorithms that take large amounts of data and distill it into a formula that may guide surgeons to better patient outcomes while estimating and even optimizing costs. In the future, this clinical and economic information will play an important role in patient management.

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"What is best for my patient?" The answer for this question is quite complicated. Generally, decision making is multifactorial and is based upon experience, personal capabilities, available utilities, and literature. Given the difficulty associated with determining the optimal patient treatment, many studies have moved toward more complex statistical approaches to create algorithms that take large amounts of data and distill it into a formula that may guide surgeons toward achieving better patient outcomes. Some questions that previous studies have attempted to answer are "Can we determine whether a patient needs a labral reconstruction based on preoperative radiographic measures alone?"[1] or "Can we predict whether a patient will have a clinically significant improvement in their hip function following a hip arthroscopy?"[2] Studies such as these offer insight into how statistics can be leveraged to improve decision making for patient treatment. In the study, "Duration of Care and Operative Time Are the Primary Drivers of Total Charges After Ambulatory Hip Arthroscopy: A Machine Learning Analysis"[3] by Lu, Lavoie-Gagne, Forlenza, Pareek, Kunze, Forsythe, Levy, and Krych, they show that this type of analysis extends beyond predicting procedures or postoperative improvement and lends itself well to estimating costs. Specifically, the authors developed a machine learning algorithm that predicts total charges following hip arthroscopy. A total of 5,121 patients were included, and their gradient-boosted ensemble model managed to predict total charges following hip arthroscopy. The authors found both modifiable and nonmodifiable drivers associated with high charges such as total hours in facility ($<12$ or $>15$), longer procedure time, labral repair, age $<30$, Elixhauser comorbidity index $\geq 1$, African-American race, residence in extreme urban and rural areas, and higher household and neighborhood income. These findings raise interesting questions. For example, why does the cost of the same procedure vary between a wealthy 25-year-old African-American male and a low-income 35-year-old Caucasian female? Or perhaps, how does a surgeon go about weighing the pros and cons of a procedure such as a labral repair when it may cost significantly more but yield much better long-term function for the patient?

These questions may be at the core of what may come next in this area of research. As Lu et al. discussed, costs cannot be analyzed in isolation. Future studies must work to incorporate more information, so that we can add context to the costs of surgery and hopefully

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optimize both costs and outcomes for patients. Overall, studies such as this one are the first step in the right direction because they take the mass amounts of data that are currently available and condense it into more distinct relationships between specific variables and costs. However, moving forward, we need to assess why certain factors increase cost and if they do, if they are justifiable, because only then will we be able to take actionable measures that improve health care expenses for patients. Because at the end of the day, we can apply many different statistical analyses to the wealth of data that currently exists, but we must ensure that the studies we do account for patient outcomes and health equity.

## References

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