Dear Prof Massimiliano Leigheb,
Editor-in-Chief,
World Journal of Orthopedics Date: 8 September 2023

Manuscript ID: 87059
Machine learning applications for the prediction of eLOS in geriatric hip fracture patients: A case-control study

Dear Prof. Massimiliano Leigheb,

First of all, we would like to thank you and all the reviewers for thoughtful comments and your time for reviewing our manuscript.

We have currently improved the manuscript by addressing all of reviewers' and editors' comments and indicated how their suggestions have been incorporated in the revised manuscript when it is appropriate. A point-by-point response to comments is attached below, and the changes to this revision are uploaded in supplementary files.

In addition, we engaged the services of a professional language editing company to refine our manuscript. We believe the revised version of the manuscript represents a significant improvement, and your favorable consideration would be greatly appreciated.

Sincerely yours,

Dr Yun-Feng Rui, Department of Orthopaedics, Zhongda Hospital, School of Medicine, Southeast University, Nanjing, Jiangsu, China. (On behalf of all co-authors)
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Reviewers' comments:

Reviewer: 1 Comments to the Author

I am really grateful to review this manuscript. In my opinion, this manuscript can be published once some revision is done successfully. I made one suggestion and I would like to ask your kind understanding. This study used numeric data from 763 patients, applied eight machine learning models and achieved the area under the curve of 72% with logistic regression and the support vector machine for the prediction of the length of stay for hip fracture. This study presented variable importance results as well. I would argue that this is a good achievement.

Reply: We express our gratitude to the reviewer for their meticulous review of our manuscript and for their valuable insights. In response to the feedback from multiple reviewers, we have diligently addressed all the questions and suggestions posed by them. Additionally, we have made substantial enhancements to the previous version in the revised manuscript. We sincerely appreciate the ongoing support and dedication of the reviewers in enhancing the quality of our manuscript. We firmly believe that this revised version signifies a noteworthy improvement, and we kindly request your favorable consideration.

However, it can be noted that the Shapley Additive Explanations (SHAP) summary plot is very effective to identify the direction of association between the length of stay for hip fracture and its major predictor derived from variable importance. In this context, I would like to ask the authors to derive the SHAP summary plot.

Reply: We thank the reviewer for your kind comment and positive advice. We have added SHAP summary plots for each model and modified them in the methods and results section. The corresponding amendments in the revised manuscript are as follow.

“Next, we used a Shapley Additive Interpretation (SHAP) summary plot to determine

the relationship between the eLOS and its main predictors in each model.

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Figure 3 shows the results of the SHAP analysis. We can intuitively understand the importance of features in each model and the direction of their association with the eLOS. Then, we summarized the importance of the features output by each model."

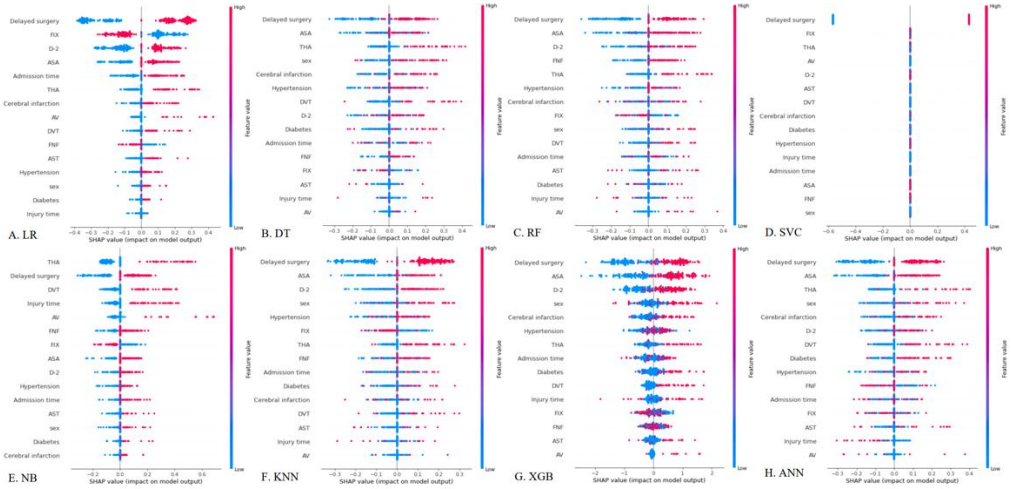

Fig 3. Shapley Additive Explanations (SHAP) summary plots of each model. A. Logistic Regression (LR). B. Decision Tree (DT). C. Random Forest (RF). D. Support Vector Classifier (SVC). E. Naïve Bayes (NB). F. K-nearest Neighbour (KNN). G. eXtreme Gradient Boosting (XGBoost). H. Artificial Neural Network (ANN).

Reviewer: 2 Comments to the Author

This manuscript is well and good at innovation and clears the clarity of the reader. It is well structured and well written. The author does a good job of presenting a highly technical and complicated process in an easy-to-understand manner.

Reply: We thank reviewer for carefully reading our manuscript and raising recognition. After integrating the opinions of other reviewers, we have addressed all the reviewers' questions and suggestions, and further fully supplemented previous version in revised manuscript. Thanks for the reviewers' continued help and efforts to improve the quality of our manuscript. We believe this revised version represents a

significant improvement, and your favorable consideration would also be greatly appreciated.

1. Authors need to cross check the reference section by addressing the cited contents in the introduction and related work part.

Reply: We thank the reviewer for your kind comment and positive advice. We checked the references and revised the introduction.

"Hip fractures have become more prevalent as the global geriatric population increases [1]. They are associated with higher incidence, mortality, and disability, significantly impacting the quality of life of affected individuals [2, 3]. Prolonged length of stay (LOS) not only places a financial burden on patients but also elevates the risk of mortality and complications [4]. Enhanced recovery after surgery (ERAS) refers to the integration of perioperative concepts using evidence-based medicine tools to reduce surgical stress and complications, shorten hospital stays, lower financial costs, and hasten postoperative recovery [5-7]. Based on this concept, Andrew et al. developed a logistic regression model to identify risk factors for extended length of stay (eLOS), offering new insights for optimizing treatment for hip fracture patients [8]. However, traditional statistical methods suffer from poor performance and lack of features.

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In recent times, ML has shown superior predictive performance compared to traditional methods and has found extensive application in clinical data processing and predictive modelling [10, 11]. Mijwil et al. enhanced the ML-based estimation method for detecting acute appendicitis in individuals, achieving high accuracy [12]. In the context of hip fractures among geriatric individuals, Shtar et al. and Oosterhoff et al. established ML models to predict prognosis and mortality, enhancing clinician decision-making ability [13, 14]. With the establishment of a clinical database for elderly hip fracture patients and advancements in machine learning algorithms, predicting the eLOS for this patient group through machine learning has become

feasible."

2. The introduction must be an extended version of the abstract. The authors must elaborate on the points highlighted on the abstract and give supportive ideas and references.

Reply: We thank the reviewer for carefully reading our manuscript and raising effective suggestions. We have modified the background of the abstract and introduction to make them logically consistent.

"Background: Geriatric hip fractures are one of the most common fractures in elderly individuals, and prolonged hospital stays increase the risk of death and complications. Machine learning (ML) has become prevalent in clinical data processing and predictive models. This study aims to develop ML models for predicting extended length of stay (eLOS) among geriatric patients with hip fractures and to identify the associated risk factors.

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With the establishment of a clinical database for elderly hip fracture patients and advancements in machine learning algorithms, predicting the eLOS for this patient group through machine learning has become feasible."

3. The conclusions in this manuscript are primitive. Rewrite your conclusions.

Reply: We thank the reviewer for carefully reading our manuscript and raising effective suggestions. The conclusion has been revised for brevity and clarity.

"In conclusion, we have effectively developed a highly accurate machine learning model for eLOS prediction in hip fracture patients. Notably, delayed surgery, elevated D-dimer levels, ASA classification, surgical type, and sex were significantly associated with the eLOS. By applying machine learning in clinical practice, we can optimize the diagnosis and treatment of elderly hip fracture patients, guide clinicians in decision-making, and allocate medical resources more efficiently."

4. References aren't formatted according to rules. Additional References: The following articles could be useful:

Has the Future Started? The Current Growth of Artificial Intelligence, Machine Learning, and Deep Learning. https://doi.org/10.52866/ijcsm.2022.01.01.013

A diagnostic testing for people with appendicitis using machine learning techniques. https://doi.org/10.1007/s11042-022-11939-8

Reply: We express our gratitude to the reviewer for their thoughtful comments and valuable recommendations. In accordance with the journal's guidelines, we have made adjustments to the reference format and incorporated the suggested references.

"1. Veronese N, Maggi S. Epidemiology and social costs of hip fracture. Injury 2018; 49: 1458-1460 [PMID: 29699731 DOI: 10.1016/j.injury.2018.04.015]

2. Aasvang EK, Luna IE, Kehlet H. Challenges in postdischarge function and recovery: the case of fast-track hip and knee arthroplasty. Br J Anaesth 2015; 115: 861-866 [PMID: 26209853 DOI: 10.1093/bja/aev257]

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11. Karan Aggarwal, Maad M. Mijwil, Sonia, Abdel-Hameed Al-Mistarehi, Safwan Alomari, Murat Gök, et al. Abdulrhman. Has the Future Started? The Current Growth of Artificial Intelligence, Machine Learning, and Deep Learning. Iraqi Journal for Computer Science and Mathematics 2022: 115-123 [DOI: 10.52866/ijcsm.2022.01.01.013]

12. Mijwil MM, Aggarwal K. A diagnostic testing for people with appendicitis using machine learning techniques. Multimed Tools Appl 2022; 81: 7011-7023 [PMID: PMC8785023 DOI: 10.1007/s11042-022-11939-8]"