



# A Deep Neural Network Model of the Residency Rank Order List with and without Step 1 Scores

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## Abstract

Concerns have been raised in the academic community about the impact of the USMLE changing the Step 1 exam to pass/fail. This study used a deep neural network (DNN) to model this year's rank order list at our program and determine the effect of disregarding the Step 1 scores. Correlation with and without the Step 1 scores was very high suggesting that once an applicant has reached the interview and ranking stage, Step 1 did not have a high impact on the rank order.

**Keywords:** USMLE Step 1; Residency; Match Rank Order; Deep neural network

## Background

The United States Medical Licensing Examination (USMLE) Step exams are designed to assess a physician's abilities to apply knowledge, concepts, and principles important to the provision of patient care [1]. As such, they are used by state medical boards in deciding the disposition of license applications.

These standardized tests have also often been used as part of the resident selection process. The USMLE, and others, have been concerned about the over reliance of programs on tests not intended for this purpose. The USMLE has then recently announced that they will be changing the reporting of Step 1 scores to Pass/Fail.

The question is then whether this will affect the rank order for residency applicants.

## Methods

The resident selection committee for Internal Medicine at East Tennessee State University met as usual and selected a rank order for the residents for the incoming class of 2020. This procedure was unchanged from prior years. Information available to the ranking committee included Step 1 and Step 2 scores, interview scores (compiled from the interviews with categories such as fit, academic abilities, letters of reference, etc),

scale (from the interviews, range from rank Top 10% to Do Not Rank), sex, medical school, and graduation date. For students who had taken both Comlex and USLME exams, only the USMLE results were considered. For those who only took the Comlex, conversion to a comparable USMLE score was performed [2]. Approximately 1 month later the announcement was made that Step 1 will be moving to Pass/Fail.

A deep neural network was created to model the rank order list. Categorical items such as sex or medical school location were converted to a series of attributes through one hot encoding. This model was trained on the actual rank order list. Using this model a rank order was created that was close to the original. This model was then used to create a rank order eliminating the effect of Step 1 by changing the value of each applicant's step 1 score to the mean. The results were then compared to the predicted rank list using step 1 scores.

A separate multiple linear regression was performed to estimate the impact of each feature (attribute) on the rank order.

## Results

The neural network was trained on the current list and reached a mean accuracy error of 4. Comparing the match order lists with and without Step 1 scores yielded a correlation coefficient of 0.983 with a p value of  $1.64 \times 10^{-85}$ , showing a very high degree of correlation between the lists with and without Step 1.

The linear regression showed the top four attributes by impact on the rank order were Scale (estimated rank by interviewers), Interview Score, Step 2 score, and Graduation Year (preference given to more recent graduates). Step 1 score had the lowest independent impact of any of the 15 attributes.

## Conclusion

Based on the model results, it appears that USMLE Step 1 scores do not have a significant effect on the rank order of applicants to our Internal Medicine categorical residency program. Other factors appear to have a greater impact.

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## Limitations

Limitations to this study are numerous. The model applies to a single year in a single Internal Medicine program. Before a person can be ranked, they must be interviewed, and the decision to interview likely includes Step 1 scores. Interviewers also are aware of Step 1 scores and this may influence the Interview Score and Scale scores.

## References

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