

## Introduction

- Clinician burnout has been attributed to EMR design in several studies (Shanafelt 2016)
- Standard workflow in the EMR requires the clinician to navigate separate sections of a chart, retrieve and filter clinical data, and then use working memory to transcribe this information into a clinically relevant encounter note
- High number of mental tasks necessary for this process
- Reducing cognitive workload during EMR use could result in improved clinical outcomes
- This study aims to measure the impact of cognitive workload between differing EMR user interfaces

## Methods

1. Subjects included 18 Internal Medicine residents randomly selected to perform a history on a simulated patient.
2. Subjects document their clinical encounter using a standard and enhanced office note template
3. After completion of each note, the subject completes a NASA-TLX questionnaire. The NASA-TLX score is a validated tool that measures cognitive workload, from a minimal workload score of 1 to a maximal workload of 100. Its use has been studied in a variety of settings as "diver sea aircraft certification, operating rooms, nuclear power plant control rooms, simulated combat, and website design
4. The results were analyzed for significance using a paired t-test for within subjects design.

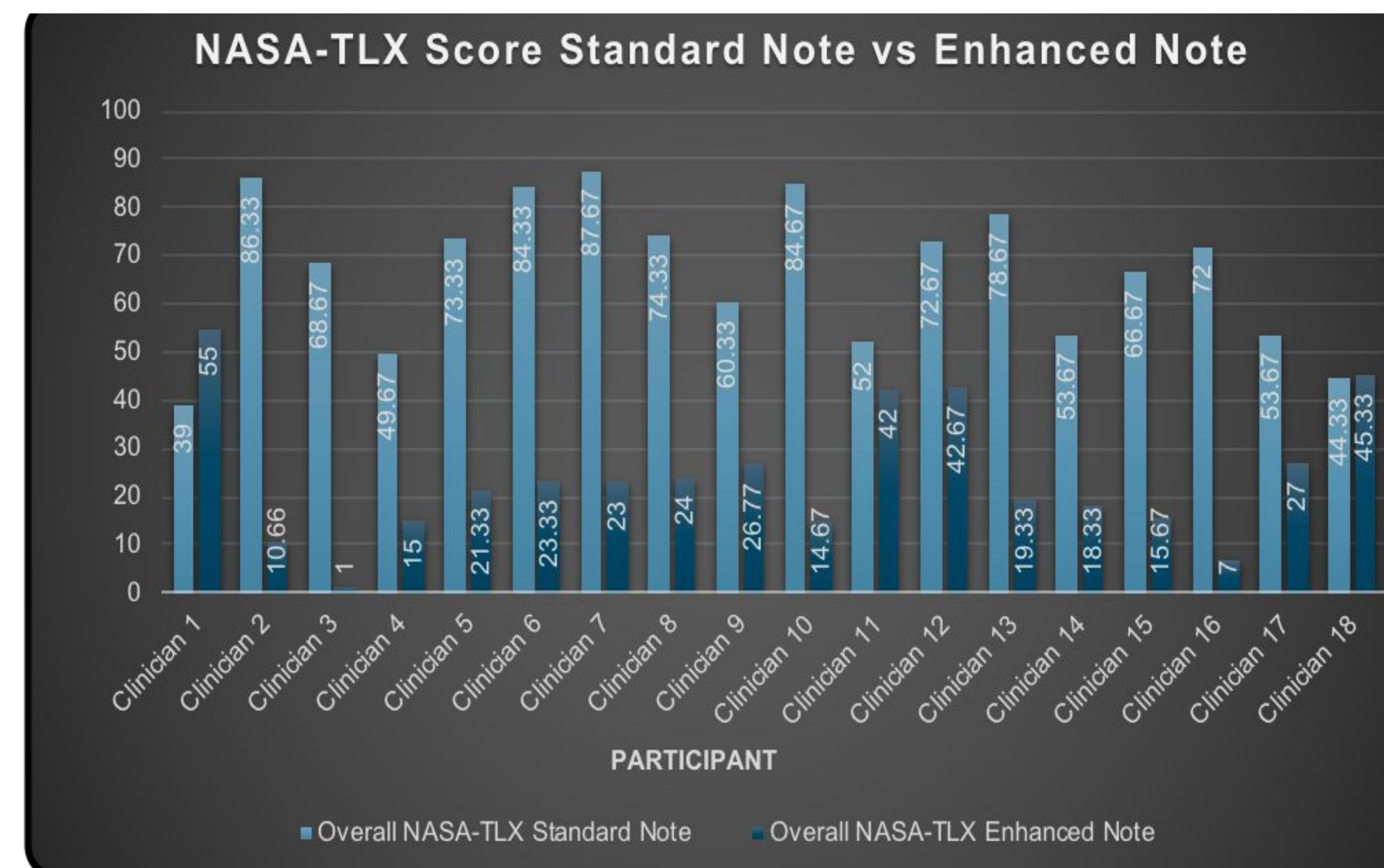
## Results

There were significant differences in the Nasa TLX scores for the standard note (M= 67, SD=14.8) versus the enhanced note (M=24, SD=13.75)  $t(5)= (2.82)$ ,  $p = <.05$ . These results suggest that altering the display of information in an EMR can meaningfully reduce the cognitive burden associated with caring for patients

**Table 1. Clinical performance differences using the standard office note vs. enhanced office note.**

Clinical Performance N=18 Physicians	Standard Office Template N=54 diagnoses	Enhance Office Template N=54 diagnoses
Missed Dx n (%)	18 (33)	8 (15)
Accurate Dx n (%)	36 (67)	46 (85)

Results indicate a significant improvement in clinical diagnosis using the enhanced note template group with an accuracy rate of 85% (46/54) versus the standard note template with an accuracy rate of 67% (36/54)



### Enhanced Note Health Concept Example

**Diabetes Management**

History

Calibri 10 B I U

Order Name	ItemName	Value
Hemoglobin A1C.	Hgb A1C.	9.0

Eye exam at external facility  Yes  No

## What is in our office note template?

The standard note template is based on a SOAP note format. Embedded in this format are structured data, including a problem list, allergies, results, medications, and orders. The structured section provide all values related to the field. In the enhanced note design, we added sections for common primary care health concepts that incorporates routine health screening and chronic disease management. We displayed the name of the concept, i.e. Diabetes Management or Colonoscopy, and then map relevant data from results or prior text regarding the health concept into the corresponding fields. In the output, clinicians will see filtered results under the appropriate clinical concept heading.

## Discussion

- This study shows that reducing cognitive workload is possible using current commercially available electronic medical records
- By refocusing the design of the office note to display relevant information on the problem list, we show a statistically significant reduction on cognitive burden for the clinician.
- EMR designers and policy makers can use cognitive workload to measure effective EMR user interfaces
- Study showed a statistically significant improvement on clinical performance in concordance with other studies that have demonstrated that clinical performance can be improved by different EMR displays (Ahmed 2011)
- Future research is necessary on the role of cognitive workload in clinician burnout related to EMR design.

## References

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2. Ahmed Adil, Chandra Subhash, Herasevich Vitaly, Gajic, Ognjen, Pickering Brian W. The effect of two different electronic health record user interfaces on intensive care provider task load, errors of cognition, and performance. *Critical Care Medicine.* 2011 Jul;39(7):1626-1634
3. Hart, S. G. (2006). NASA-Task Load Index (NASA-TLX); 20 Years Later. *Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting*, 904-908. Santa Monica: HFES