



Comparison of American Society of Anesthesiology (ASA) Physical Status Assignment Among Clinicians and a Novel NLP Enhanced Scoring Tool

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BACKGROUND

Initially developed for statistical comparison of patient populations, the American Society of Anesthesiologists (ASA) Physical Status (PS) score system has evolved to be used for numerous purposes including billing, risk assessment, research, practice management, and staffing models. In recent years, the ASA has published guidance updates to help reduce discordance and improve accuracy. Mayo Clinic has developed a software tool integrated into our electronic medical record (EMR) that aims to further improve ASA PS scoring concordance and accuracy.

OBJECTIVES

The objective of this study was to evaluate concordance between the ASA PS scoring tool, provider selected ASA score, and independent evaluators.

METHODS

This retrospective study was deemed exempt by our institutional review board. Anesthesia records from 150 randomly selected patients who were 18 years of age or older, consented to use of their clinical data, and had surgical procedures at Mayo Clinic between January 1, 2022, and December 31, 2023 were retrospectively analyzed to evaluate concordance. ASA PS scores were generated from 4 sources for each patient: the score assigned by the anesthesiologist caring for the patient on the day of surgery, the software tool embedded into our EMR, and separately, both a junior anesthesiologist and senior anesthesiologist not involved in the patient's care who assigned a score after reviewing the patient's chart and utilizing the examples and definitions provided by ASA. Concordance was then evaluated between assigned scores using weighted kappa and signed rank p-value scores to measure variability and statistical significance.

ASA Score - required

Click here to view calculated ASA score recommendation

ASA: ☐ 1 ☐ 2 ☐ 3 ☒ 4 ☐ 5 ☐ 6

☐ Emergent

1 - normal healthy patient

2 - patient with mild systemic disease

3 - patient with severe systemic disease; substantive functional limitations

4 - patient with severe systemic disease that is a constant threat to life

5 - moribund patient not expected to survive without operation

6 - declared brain dead patient; organ harvest

ASA Physical Status Scoring Tool

Recommended a minimum ASA score of 4

4 Evidence for ASA score 4

- CIRCULATORY (Recent CVD)

Found evidence of cerebrovascular disease within past 90 days

- 06/21/2024 ICD10 (I26.73) - Personal History Of Transient Ischemic Attack And Cerebral Infarction Without Residual Deficits

3 Evidence for ASA score 3

- NERVOUS (Neuro. affecting movement)
- CIRCULATORY (CAD, CHF, PVD)
- RESPIRATORY (OSA)

Found evidence of congestive heart failure

- 06/23/2024 ICD10 (I50.9) - Failure Heart (HCC)

Found evidence of coronary artery disease

- 06/21/2024 ICD10 (I25.118) - Atherosclerotic heart disease of native coronary artery with other forms of angina pectoris (HCC)

Found evidence of obstructive sleep apnea within last 365 days

- 06/21/2024 ICD10 (G47.33) - Obstructive sleep apnea (adult) (pediatric)

Found evidence of peripheral vascular disease within past 365 days

- 06/21/2024 ICD10 (I71.811) - Abdominal aortic aneurysm (HCC)

Found evidence of neurological disorders affecting movement

- 08/04/2023 ICD10 (G08) - Intracranial and intraspinal phlebitis and thrombophlebitis (HCC)

2 Evidence for ASA score 2

- CIRCULATORY (Deficiency anaemia, Hypertension uncomp., LBBB)

? Evidence for ASA score ?

- OTHER (Other evidence not associated with an ASA score)

Figure 1. Images of ASA score selection in EMR and the ASA PS scoring tool

- There continues to be significant variability and discordance in ASA scores
- “Day of” providers had the greatest variability compared to the junior reviewer, senior reviewer, and a software tool

Possible sources of bias/discordance:

- Reviewers knew score assignments were part of a study.
- Reviewers consistently access ASA guidelines and example .
- “Day of” providers likely were not able to review EMR as thoroughly as reviews.
- Large academic centers likely have patients with greater co-morbid conditions.

Our hope is that continued validation of an EMR integrated software tool will be able to provide a more accurate and consistent score assignment in the future. The tool underscored several patients. Upon further investigation, this was often attributed to ICD-10's or other objective data points that were not yet fully integrated into the tool. With continued development, iterations, and future machine learning activity, we anticipate our tool, or some other version being developed elsewhere, will allow for improvement in accuracy of ASA PS assignment.

RESULTS

Software tool	“Day of” Anesthesiologist					Senior Reviewer					Junior Reviewer				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
I	5	2	1	1	0	3	4	1	1	0	3	4	1	1	0
II	2	24	3	0	0	1	20	7	1	0	1	21	6	1	0
III	2	34	61	7	1	1	5	92	6	1	1	16	80	7	1
IV	0	0	2	5	0	0	0	1	6	0	0	0	1	6	0
V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concordance	63% (95/150)					81% (121/150)					73% (110/150)				
Weighted Kappa (95% CI)	0.44 (0.32, 0.56)					0.61 (0.49, 0.73)					0.52 (0.40, 0.65)				
Signed Rank p-value	0.004					0.013					0.484				

Figure 2. ASA status assignment agreement of the software tool with “day of” anesthesiologist, senior anesthesia reviewer, and junior anesthesia reviewer. Green indicate the software tool assigned an ASA PS rating higher than the provider or reviewer and red indicate software generated scores that were lower than the reviewer.

“Day of” Provider vs Senior Reviewer (SR)

Day of Anesthesia Provider	SR				
	1	2	3	4	5
1	5	3	1	0	0
2	0	24	36	0	0
3	0	2	63	2	0
4	0	0	1	12	0
5	0	0	0	0	1

Concordance: 70% (105/150)
Weighted Kappa: 0.59 (0.48, 0.70)
Signed Rank test: p<0.001

Junior Reviewer (JR) vs Senior Reviewer (SR)

	SR				
JR	1	2	3	4	5
1	4	1	0	0	0
2	1	27	13	0	0
3	0	1	87	0	0
4	0	0	1	14	0
5	0	0	0	0	1

Concordance: 89% (133/150)
Weighted Kappa: 0.83 (0.75, 0.91)
Signed Rank test: p=0.013

Figure 3. ASA assignment concordance between “Day of” provider and senior reviewer (Right), and ASA assignment concordance between junior reviewer and senior reviewer (Left).

DISCUSSION

CONCLUSIONS

ASA PS scoring has been found to have significant variability and discordance between anesthesia providers. Previous attempts with utilizing educational resources such as the published ASA PS examples has resulted in some improvement. Software that scans a patient's medical record and objectively assigns an ASA PS based on ASA examples, provider input, and continued development of machine learning capabilities may continue to improve accuracy and concordance. This improvement would benefits aspects that use ASA PS score. Further investigation into educational, informative, and technological aids for ASA PS scoring continues to be necessary to increase accuracy and concordance of ASA PS scoring and their implications on medical practices.

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