Variability in the American Society of Anesthesiologists Physical Status Classification Scale

Capt Wendy L. Aronson, CRNA, MSN, NC, USAF
Anchorage, Alaska

Maura S. McAuliffe, CRNA, PhD, FAAN
Greenville, North Carolina

Ken Miller, RN, PhD, FAAN
Albuquerque, New Mexico

The American Society of Anesthesiologists (ASA) Physical Status (PS) Classification is used worldwide by anesthesia providers as an assessment of the preoperative physical health of patients. This score also has been used in policy-making, performance evaluation, resource allocation, and reimbursement of anesthesia services and frequently is cited in clinical research. The purpose of this study was to assess interrater reliability and describe sources of variability among anesthesia providers in assigning ASA PS scores.

A questionnaire with 10 hypothetical patient scenarios was given to 70 anesthesia providers who were asked to assign ASA PS scores in each scenario and to provide rationale for their decisions. The data were summarized and stratified according to nurse anesthetist or anesthesiologist and military or nonmilitary anesthesia providers. We hypothesized there would be no difference between any of the anesthesia provider groups in assignment of ASA PS scores.

A lack of interrater reliability in assigning ASA PS scores was demonstrated. There were no significant differences between the anesthesia provider groups. There was no correlation between ASA PS scoring and years practicing or any of the other demographic variables. Several sources of variability were identified: smoking, pregnancy, nature of the surgery, potential difficult airway, and acute injury.

Key words: ASA physical status, assessment, classification, physical status, preoperative physical status.

Assessment of general physical status is integral to the preoperative evaluation of patients. Anesthesia providers worldwide routinely stratify patients according to disease severity and overall health using the American Society of Anesthesiologists (ASA) Physical Status (PS) Classification (Table 1).[1] The original intent of this classification, developed in 1941 by a group of American anesthesiologists,[2] was to collect and compare anesthesia statistical data. However, as the classification became widely used, many anesthesia providers began, without scientific-based evidence, to associate the ASA PS score with a risk assessment of anesthesia and surgery.[3]

Although it was not designed to identify individual anesthetic or surgical risk, many clinical studies suggest the ASA PS classification correlates with morbidity and mortality attributable to anesthesia and surgery, suggesting it may be useful in predicting patient outcomes. Tiret et al[4] reported the rate of perioperative complications to be related closely to physical status (ASA class I = 0.4/1,000; classes IV and V = 9.6/1,000), with emergency surgeries having even greater correlation (1/1,000 in class I increasing to 26.5/1,000 in classes IV and V). Other researchers demonstrated no correlation between patient ASA PS scores and patient outcomes. Goldstein and Keats[5] reported the classification was not a sensitive predictor of anesthetic mortality because 41% of anesthetic-related deaths occurred in ASA PS II or III patients. Little[6] suggested the ASA PS classification may work well when applied to large populations since gradations are smoothed out with large numbers, but that

Table 1. Revised ASA Physical Status Classification (1961)

I	A normal healthy patient
II	A patient with mild systemic disease
III	A patient with severe systemic disease that limits activity, but is not incapacitating
IV	A patient with an incapacitating systemic disease that is a constant threat to life
V	A moribund patient not expected to survive 24 hours with or without operation
E	In the event of an emergency operation, an E is placed after the Roman numeral

(Adapted from American Society of Anesthesiologists.[1])

the system may be unreliable when applied to individual patients. This hypothesis, however, has not been demonstrated in the literature.

The ASA PS classification was used in practice from 1941 to 1978 without published investigation into its reliability and validity. Three subsequent studies[3,7,8] reported inconsistencies among anesthesiologists in assigning ASA PS scores to hypothetical patients. In 1978, Owens et al[2] demonstrated a lack of uniformity among anesthesiologists in assigning patient ASA scores, concluding the ASA PS classification lacks scientific precision and calling for its revision in 1979.[9] More than 2 decades later, this revision has yet to be accomplished.

In 1995, Haynes and Lawler[7] conducted a study of the consistency of ASA PS score allocation by anesthesiologists. Participants in this study were asked to assign ASA PS scores in 10 hypothetical patient scenarios. There was no complete agreement between providers in assignment of ASA PS scores in any of the scenarios. In 9 of 10 scenarios, the range of ASA PS scores assigned was spread over at least 3 categories. It was concluded that the ASA PS classification was used inconsistently and lacked scientific precision, with anesthesia providers being warned not to use the classification as the sole indicator of preoperative physical status. The authors also expressed concern about the accuracy of ASA PS classification data, use of the data to justify allocation of resources, and the practice of quantifying anesthesia provider clinical performance based in part on patient ASA PS scores.

A third study[8] hypothesized that in a small, homogenous country such as Finland, there would be less variation in the assignment of ASA PS scores than in large, heterogeneous countries such as the United States. Despite the similar ethnic and cultural backgrounds of Finnish patients and anesthesia providers, wide variations in assignment of ASA PS scores was demonstrated. Anesthesia providers were cautioned to keep this variation in mind when using ASA PS scores for scientific and statistical purposes. These studies suggest the ASA PS classification may be unreliable when used to evaluate individual patients. The question, therefore, is: "What, if any, identifiable variables contribute to this lack of reliability?"

As a permanent part of the record, ASA PS scores are available for audit and reportedly have been applied to performance evaluations, resource allocation, and the development of institutional policies.[7] In many institutions, data are collected regarding daily operative cases (type of surgery, type of anesthesia, and patient ASA PS classification) for quality assurance purposes or process improvement efforts. Similarly, most self-reported quality assurance programs include ASA PS scores as a variable of interest. In addition, nurse anesthesia residents must demonstrate proficiency in providing anesthesia care to a minimum number of patients in each ASA PS category in order to graduate and qualify for the national certification examination. Some insurance companies tie resource allocation to patient ASA PS classification in that reimbursable units for services are based in part on ASA PS scores (L.S. Broadston, healthcare practice consultant, president and chief executive officer, Broadston Consulting Services, Inc, personal communication, November 25, 1998).

In many circumstances, resource allocation with respect to type of anesthesia provider also is based on the ASA PS score for the patient. For example, in many hospitals nonanesthesia healthcare providers are permitted to provide intravenous sedation for patients who are ASA class I or II. For patients classified as ASA PS III or higher, an anesthesia provider must be present for the conscious sedation. The ASA PS classification also is tied to the development of institutional policy, federal policy, and even to scope of practice. In all 3 branches of the US military medical system and in US federal hospitals, nurse anesthetists can provide anesthesia without the presence of an anesthesiologist for patients with certain ASA PS classifications and not for those in higher classes. For example, in the Air Force, nurse anesthetists can provide anesthesia independently to ASA class I and II patients but must consult with a physician for patients with an ASA class III or higher.[10] Assignment of ASA PS classification to patients is central to these government-wide policies, directly affecting scope of practice and patient care. Finally, the ASA PS score of subjects is cited as a variable in most clinically based anesthesia research, as well as in many other areas of medical research.

Several gaps in the published research are apparent. For instance, nurse anesthetists, who constitute a large portion of anesthesia providers throughout the world and who administer anesthesia in more than 100 countries,[11,12] have not participated in previous studies of this classification. Likewise, no study has been published regarding use of this scale comparing military and nonmilitary providers. We hypothesized there would be no difference in the assigning ASA PS scores between any of the anesthesia provider groups. Finally, despite the recognition of continued inconsistencies in use of the classification, no studies were found identifying the possible sources of variability between providers when assigning ASA PS scores.

Our objective was to identify sources of variability

in the application of the ASA PS classification. The research questions were as follows: (1) Are the assignment of ASA PS scores consistent among anesthesia providers (nurse anesthetist or anesthesiologist and military or nonmilitary)? (2) What are the possible sources of variability among anesthesia providers in their assignment of ASA PS scores?

Materials and methods

In this descriptive study, anesthesia provider assignment of ASA PS scores in 10 hypothetical case scenarios was evaluated. ASA PS scores and the rationale for each score were documented. Demographic data and participant answers to several general questions about the classification also were collected. Sample size for this study was determined by the method described by Kraemer and Thiemann.[13] To achieve 80% power using a 2-tailed test and an α of .05, 83 subjects were determined to be needed for an expected critical effect size of 0.03. The sample consisted of both military and nonmilitary Certified Registered Nurse Anesthetists (CRNAs) and anesthesiologists from 4 hospitals in the greater Washington, DC area and 1 hospital in Ohio. Participant anonymity and privacy were assured. Approval was obtained from institutional review boards at each involved institution.

Eight scenarios used in this investigation were adapted from the Haynes and Lawler study,[7] while 2 scenarios (8 and 9) were created to reflect 2 additional health issues related to the ASA PS classification: pregnancy and smoking.

Demographic data collected included the following:

- Type of anesthesia provider (CRNA or anesthesiologist)
- Military status (military or nonmilitary)
- How long practicing anesthesia (number of years)

The following questions also were asked:

- Do you routinely record ASA PS scores on your patients? (yes or no)
- Do you find the ASA PS scores of patients helpful in daily practice? (helpful, somewhat helpful, or not helpful)
- Do you see the ASA PS classification as an "anesthetic risk indicator"? (yes or no)
- Do you see the ASA PS classification as a "surgical risk indicator"? (yes or no)

Results

After the collection of 70 surveys, statistical significance was demonstrated and the sample size was considered adequate. Of the 70 anesthesia providers surveyed, 39 (56%) were CRNAs, 31 (44%) were anesthesiologists, 41 (59%) of 69 were military, and 28 (41%) were nonmilitary; 1 participant did not disclose military status. Years practicing anesthesia ranged from 0.25 to 30 years (mean, 8 years; SD, 7 years; mode, 1 year). There was no correlation between ASA PS scoring and years practicing or any of the other demographic variables. No significant differences were noted between the groups of anesthesia providers.

All providers in this study reported routine assignment of ASA PS scores to their patients. All anesthesia providers identified ASA PS scores as "helpful" to "somewhat helpful" in their practice. Of the 70 providers surveyed, 62 (89%) indicated use of the ASA PS classification as an *anesthetic* risk indicator and 34 (49%) as a *surgical* risk indicator. Of the 70 respondents, 31 (45%) provided rationale for their selected ASA PS scores. The results for each case scenario are presented below (Table 2).

Scenario 1

- 19-year-old involved in a motor vehicle accident 10 hours ago
- Requires fixation of a compound fracture of the tibia
- Unconscious at the scene, in the emergency department responded to pain with incomprehensible sounds; now obeys commands and opens eyes when spoken to
- Computed tomography scan revealed large frontal contusion but no signs of intracranial hypertension
- *Author ASA PS recommendation:* IIIE

The range of ASA PS scores assigned by participants to this patient was 5 (I to VE), with 61 (87%) viewing this patient as an emergency case (E). The most common response was IIE, recorded by 24 (35%) of the providers. Three conditions (head injury, change in level of consciousness, and full stomach) were reported by participants as reasons for selecting both ASA PS II and III. Two factors unrelated to patient PS (possible neck injury and risk of doing poorly postoperatively) also were cited as contributing factors in assigning this patient's ASA PS score.

ASA PS class definitions are broad, which may have contributed to this variability. Providers also may have considered the acute physical status of the patient and planned surgical interventions when assigning the ASA PS score. According to the ASA PS classification guidelines,[1] this patient should be assigned an ASA PS score of IIIE. The definition of ASA PS III is "a patient with severe systemic disease that limits activity, but is not incapacitating."[1] Due to the extent of the patient's injuries and his initial presentation, his physical status (disease) should be viewed as severe (ASA PS III)

Table 2. Variability in the ASA physical status classification: scenario scores*

Scenario	I	IE	II	IIE	III	IIIE	IV	IVE	V	VE
1										
CRNA	0 (0)	7 (10)	3 (4)	13 (18)	**3 (4)**	12(17)	0 (0)	1 (1)	0 (0)	0 (0)
Anesthesiologist	1 (1)	6 (9)	1 (1)	11 (16)	**1 (1)**	5 (7)	0 (0)	5 (7)	0 (0)	1 (1)
Combined	1 (1)	13 (19)	4 (6)	24 (34)	**4 (6)**	17(24)	0 (0)	6 (9)	0 (0)	1 (1)
Military	0	11 (16)	1 (1)	16 (23)	**1 (1)**	9(13)	0 (0)	2 (3)	0 (0)	1 (1)
Nonmilitary	1 (1)	1 (1)	3 (4)	8 (12)	**3 (4)**	8(11)	0 (0)	4 (6)	0 (0)	0 (0)
Combined	1 (1)	12 (17)	4 (6)	24 (35)	**0**	17(25)	0 (0)	6 (9)	0 (0)	1 (1)
Haynes & Lawler[7] (case 2)	17 (18)	†	5 (5)	†	**52 (54)**	†	23 (24)	†	0 (0)	†
2										
CRNA	0 (0)	0 (0)	19 (27)	0 (0)	**20 (29)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anesthesiologist	0 (0)	0 (0)	16 (23)	0 (0)	**15 (21)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	35 (50)	0 (0)	**35 (50)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Military	0 (0)	0 (0)	22 (32)	0 (0)	**19 (27)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nonmilitary	0 (0)	0 (0)	13 (19)	0 (0)	**15 (21)**	0 (0)	0 (0)	0 0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	35 (51)	0 (0)	**34 (49)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7] (case 3)	0 (0)	†	36 (37)	†	**59 (61)**	†	2 (2)	†	0 (0)	†
3										
CRNA	0 (0)	0 (0)	0 (0)	0 (0)	**31 (44)**	0 (0)	8 (12)	0 (0)	0 (0)	0 (0)
Anesthesiologist	0 (0)	0 (0)	1 (1)	0 (0)	**27 (39)**	1 (1)	2 (3)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	1 (1)	0 (0)	**58 (83)**	1 (1)	10 (14)	0 (0)	0 (0)	0 (0)
Military	0 (0)	0 (0)	1 (1)	0 (0)	**36 (51)**	0	4 (6)	0 (0)	0 (0)	0 (0)
Nonmilitary	0 (0)	0 (0)	0 (0)	0 (0)	**22 (32)**	1 (1)	5 (7)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	1 (1)	0 (0)	**58 (84)**	1 (1)	9 (13)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7] (case 6)	0 (0)	†	14 (14)	†	**62 (64)**	†	21 (22)	†	0 (0)	†
4										
CRNA	0 (0)	0 (0)	20 (29)	0 (0)	**18 (26)**	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)
Anesthesiologist	0 (0)	0 (0)	16 (23)	0 (0)	**14 (20)**	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	36 (51)	0 (0)	**32 (46)**	0 (0)	2 (3)	0 (0)	0 (0)	0 (0)
Military	0 (0)	0 (0)	22 (32)	0 (0)	**18 (26)**	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)
Nonmilitary	0 (0)	0 (0)	14 (20)	0 (0)	**13 (19)**	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	36 (52)		**31 (45)**	0 (0)	2 (3)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7] (case 7)	0 (0)	†	31 (32)	†	**63 (65)**	†	3 (3)	†	0 (0)	†
5										
CRNA	0 (0)	0 (0)	8 (11)	0 (0)	**27 (39)**	0 (0)	4 (6)	0 (0)	0 (0)	0 (0)
Anesthesiologist	0 (0)	0 (0)	5 (7)	0 (0)	**20 (29)**	0 (0)	6 (9)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	13 (19)	0 (0)	**47 (67)**	0 (0)	10 (14)	0 (0)	0 (0)	0 (0)
Military	0 (0)	0 (0)	7 (10)	0 (0)	**29 (42)**	0 (0)	5 (7)	0 (0)	0 (0)	0 (0)
Nonmilitary	0 (0)	0	6 (9)	0 (0)	**18 (26)**	0 (0)	4 (6)	0 (0)	0 (0)	0 (0)
Combined	0 (0)	0 (0)	13 (19)	0 (0)	**47 (68)**	0 (0)	9 (13)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7] (case 8)	0 (0)	†	16 (17)	†	**57 (59)**	†	23 (24)	†	1 (1)	†
6										
CRNA	4 (6)	1 (1)	10 (14)	2 (3)	11 (16)	1 (1)	**7 (10)**	3 (4)	0 (0)	0 (0)
Anesthesiologist	1 (1)	1 (1)	7 (10)	3 (4)	8 (11)	1 (1)	**6 (9)**	4 (6)	0 (0)	0 (0)
Combined	5 (7)	2 (3)	17 (24)	5 (7)	19 (27)	2 (3)	**13 (19)**	7(10)	0 (0)	0 (0)
Military	4 (6)	2 (3)	8 (11)	4 (6)	12 (17)	0	**6 (9)**	5 (7)	0 (0)	0 (0)
Nonmilitary	1 (1)	0	9 (13)	1 (1)	7 (10)	1 (1)	**7 (10)**	2 (3)	0 (0)	0 (0)
Combined	5 (7)	2 (3)	17 (24)	5 (7)	19 (27)	1 (1)	**13 (19)**	7(10)	0 (0)	0 (0)
Haynes & Lawler[7] (case 4)	15 (15)	†	11 (11)	†	29 (30)	†	**39 (40)**	†	1 (1)	†

Table 2 continues on page 269.

Table 2 continued from page 268.

Scenario	I	IE	II	IIE	III	IIIE	IV	IVE	V	VE
7										
CRNA	0 (0)	0 (0)	**34 (49)**	0 (0)	5 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anesthesiologist	1 (1)	0 (0)	**26 (37)**	0 (0)	4 (6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	1 (1)	0 (0)	**60 (86)**	0 (0)	9 (13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Military	0 (0)	0 (0)	**34 (49)**	0 (0)	7 (10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nonmilitary	1 (1)	0 (0)	**25 (36)**	0 (0)	2 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	1 (1)	0 (0)	**59 (86)**	0 (0)	9 (13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7] (case 10)	1 (1)	†	**80 (83)**	†	16 (17)	†	0 (0)	†	0 (0)	†
8										
CRNA	9 (13)	0 (0)	**30 (43)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 0)
Anesthesiologist	11 (16)	0 (0)	**20 (29)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	20 (29)	0 (0)	**50 (71)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Military	8 (11)	0 (0)	**33 (47)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nonmilitary	11 (16)	0 (0)	**17 (24)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	19 (28)	0 (0)	**50 (73)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7]	†	†	†	†	†	†	†	†	†	†
9										
CRNA	8 (11)	3 (4)	**19 (27)**	9 (13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anesthesiologist	5 (7)	3 (4)	**12 (17)**	11 (16)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	13 (19)	6 (9)	**31 (44)**	20 (29)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Military	7 (10)	4 (6)	**16 (23)**	14 (20)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nonmilitary	6 (9)	2 (3)	**15 (22)**	5 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	13 (19)	6 (9)	**31 (45)**	19 (28)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7]	†	†	†	†	†	†	†	†	†	†
10										
CRNA	**30 (43)**	0 (0)	8 (11)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anesthesiologist	**27 (36)**	0 (0)	6 (9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	**55 (79)**	0 (0)	14 (20)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Military	**33 (48)**	0 (0)	7 (10)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nonmilitary	**21 (30)**	0 (0)	7 (10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Combined	**54 (78)**	0 (0)	14 (20)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Haynes & Lawler[7] (case 9)	**85 (88)**	†	7 (7)	†	5 (5)	†	†	†	†	†

* Data are given as number (percentage).

† Information not reported in Haynes and Lawler study.[7]

Note: Bolded numbers show most common participant response. Of the 70 Certified Registered Nurse Anesthetists (CRNAs) and anesthesiologist participants, 1 provider did not disclose military status, therefore the number 69 was used for military vs nonmilitary numbers.

rather than mild (ASA PS II) while not incapacitating or a constant threat to life (ASA PS IV). Several participants in this study disagreed with this rationale and indicated the patient should be classified as IE because he was healthy before the accident.

This scenario presents a dilemma. Should acute injury be considered a "disease" state and influence preoperative assignment of ASA PS scores? Some providers believe it should because the PS of a patient can be changed by injury and not just by "disease." Others argue that PS refers to the disease state of the patient unrelated to injury. Dixon[14] noted that some anesthesia providers do not consider acute physiological or pathological processes in their assessment of previously healthy patients when assigning ASA PS scores. He argues that inconsistencies among anesthesia providers in assignment of ASA PS scores might be lessened if more attention were given to acute disease at the time of anesthesia. This dilemma illustrates 2 inherent problems with the ASA PS classification: subjectivity and broad guidelines.

Scenario 2

- 66-year-old is admitted for anterior resection of rectal carcinoma
- Smoked 2 to 3 packs cigarettes per day for 50 years; productive cough for 15 years
- Two courses of antibiotics during last 6 months for chest infection; sputum now clear

- Breathless with 1 flight of stairs; plays full round of golf twice a week
- Physical examination: chest clear
- No cardiovascular disease signs or symptoms; does not take regular medications
- Hemoglobin = 13.6 g/dL; blood urea nitrogen (BUN) and electrolyte levels normal; chest x-ray shows slightly hyperinflated lung fields; electrocardiogram (ECG), normal; forced expiratory volume in 1 second (FEV_1), 2.31, and forced vital capacity (FVC), 3.51
- *Author ASA PS recommendation:* III

The range of ASA PS scores for this scenario was 2 (II and III). Smoking, chronic obstructive pulmonary disease, and decreased activity were provided as rationale for assigning both ASA II and III, which suggests that providers view these variables differently when assigning ASA PS scores. The type of surgery also was listed as contributing to the ASA PS score. This patient has severe systemic disease limiting his activity (unable to climb stairs). It is debatable whether this should be considered incapacitating. In the ASA PS classification guidelines,[1] "incapacitating" is not defined clearly and, thus, is subject to individual interpretation. This patient could, therefore, be classified as an ASA PS of II, III, or IV, depending on the anesthesia provider's interpretation of incapacitating. There also was a lack of agreement among providers about the activity level of this patient (breathless walking 1 flight of stairs). Once again, the guidelines about activity level are vague, lending to individual interpretation. Despite the ambiguity surrounding this scenario, this patient demonstrates severe systemic disease that limits his activity but is not necessarily incapacitating (able to play a full round of golf) and should, therefore, be assigned an ASA PS score of III.

Scenario 3

- 72-year-old is admitted for elective repair of abdominal aortic aneurysm
- History of a myocardial infarction 2 years ago; stable angina for the last 5 years, treated with nifedipine and sublingual nitroglycerin (uses once per week)
- Physical examination: systolic murmur loudest over the aortic area; blood pressure, 170/80 mm Hg
- ECG, Q waves in leads II, III, and aVF, with borderline left ventricular hypertrophy; chest x-ray and full blood cell count normal; BUN, 30 mg/dL; creatinine, 2.0 mg/dL; electrolyte levels normal
- *Author ASA PS recommendation:* III

The range of ASA PS scores assigned by participants to this patient was 3 (II, III, and IV). The majority of anesthesia providers (58 [84%]) assigned this patient an ASA PS score of III. Once again, several conditions (hypertension, history of myocardial infarction, abdominal aortic aneurysm, nature of the surgery, and aortic stenosis) were reported as rationale by participants for their assignment of both ASA PS II and III scores. Because this patient has severe systemic disease, inferred by his use of sublingual nitroglycerin (limited activity), he should be assigned an ASA PS III. A variable unrelated to physical status (nature of the surgery) was reported as rationale by several providers. This demonstrates how providers may incorrectly consider the "nature of the surgery" as part of the patient's physical status when assigning ASA PS scores.

Scenario 4

- 69-year-old, 80 kg, admitted for transurethral prostatectomy
- Smoked all his adult life; decreasing exercise tolerance, shortness of breath walking on incline, symptomatic relief with ipratropium (Atrovent) and prophylactic beclomethasone (Beconase); small amount clear sputum daily
- Physical examination: slight intercostal retractions and scattered expiratory rhonchi
- FEV_1 = 2.21; FVC = 3.91; complete blood cell count, BUN and electrolyte levels, ECG, and chest x-ray normal
- *Author ASA PS recommendation:* III

The range of assigned ASA PS scores for this patient was 3 (II, III, and IV), with providers nearly equally split between ASA PS II 37 (51%) and III 31 (45%). Once again, 2 conditions (pulmonary disease and smoking) were cited by participants as rationale for assigning this patient an ASA PS score of II or III. According to the guidelines,[1] an ASA PS III patient has severe systemic disease, limiting but not incapacitating activity. Only 8 providers recognized this patient's limited but not incapacitating activity level, evidenced by shortness of breath when walking on an incline. This places the patient in ASA PS category III.

Scenario 5

- 61-year-old with esophageal carcinoma, diet restricted to liquids, scheduled for esophagectomy (upper abdominal incision and right-sided thoracotomy)
- History of angina for 1 year; no symptoms after treated with atenolol; when became unable to swallow tablets, anginal symptoms returned with exercise
- ECG, chest x-ray, liver function test results, and BUN and electrolyte levels normal; hemoglobin =

10.1 g/dL with microcytic picture; FEV_1 and FVC, 90% of predicted for age and weight (before onset of dysphagia)

- *Author ASA PS recommendation:* III

The range of assigned ASA PS scores in this scenario was 3 (II, III, and IV), with the majority of participants assigning an ASA PS score of III (47 [68%]). Several conditions (angina, coronary artery disease, and esophageal cancer) were cited as rationale for assigned ASA PS classes, with nature of the surgery also mentioned. According to the ASA PS guidelines,[1] this patient should be assigned an ASA PS score of III due to severe systemic disease (heart disease and cancer) that limits activity (unable to eat, angina, limited activity) without necessarily being incapacitating. Again, it is debatable as to what constitutes incapacitating.

Scenario 6

- 42-year-old previously healthy man with subarachnoid hemorrhage 36 hours ago; continues to complain of severe headache, but level of consciousness not impaired
- Neurological examination shows a right-sided oculomotor nerve palsy
- Cerebral angiography identified anterior communicating artery aneurysm, with no evidence of arterial spasm
- Now will undergo craniotomy and clipping of the aneurysm
- *Author ASA PS recommendation:* IV

The range of assigned ASA PS scores for this patient was 4 (I-IV). The most common responses were ASA PS II, III, and IV. Five providers assigned an ASA PS score of I, commenting that the patient was previously "healthy." The most frequently cited rationale for ASA PS scores of II, III, and IV was "aneurysm/subarachnoid hemorrhage." Other variables considered included change in level of consciousness, life-threatening surgery, and increased morbidity and mortality associated with subarachnoid hemorrhage. Some would argue that because this patient no longer had an altered level of consciousness and was experiencing only a headache and mild oculomotor palsy, his disease state is mild and, thus, warrants an ASA PS score of II. Others would argue that a cerebral aneurysm, like an abdominal aneurysm, is a constant threat to life, warranting an ASA PS score of IV. Still others view the disease as activity limiting but not incapacitating (ASA PS III). The variability of provider responses to this scenario demonstrates the lack of clear and objective guidelines associated with the ASA PS classification. In addition, one would have to consider the knowledge base of the provider in relation to the pathophysiology of cerebral aneurysms as part of this variability. It is well documented in the neurosurgery literature that approximately one third of patients with cerebral aneurysms die, one third are debilitated to some degree, and one third return to a normal state.[15] Considering this, one would be inclined to assign an ASA PS score of IV to this patient, particularly when bleeding has already occurred and the patient demonstrates a neurological deficit. Assignment of an ASA PS score of IV is best in this patient scenario, although it is subject to debate using the current classification with its broadly defined terms.

Scenario 7

- 57-year-old with type 1 (insulin-dependent) diabetes is admitted for right knee replacement because of osteoarthritis related to injury 20 years ago; no significant arthritis in other joints; otherwise healthy with blood glucose normally around 150 mg/dL
- History and physical examination unremarkable; no cardiovascular or ophthalmic abnormalities
- Creatinine = 2.0 mg/dL; results of all other routine laboratory tests normal
- *Author ASA PS recommendation:* II

This scenario demonstrated the least variability in provider assignment of ASA PS scores with 86% agreement (60/70) on ASA PS II; however, the range was still 3 (I, II, and III). The patient has systemic disease (diabetes mellitus) that is well controlled (consistently near-normal blood glucose levels). With the exception of possible renal insufficiency, there are no other systemic manifestations of the disease, and the patient is otherwise in good health. This patient should be assigned an ASA II due to the presence of mild systemic disease that has no affect on activity level.

Scenario 8

- 23-year-old woman (60 kg) admitted for left knee arthroscopy
- Smoked 1 pack per day for 3 years
- No significant health history except left knee injury 2 months ago
- Exercise tolerance before the accident, running 3 miles 3 times per week
- Physical examination: unremarkable; human chorionic gonadotropin, negative
- *Author ASA PS recommendation:* II

This scenario was developed to explore the influence of patient smoking history on anesthesia provider assignment of ASA PS scores. Of the 70 anesthesia providers, 50 (71%) assigned this patient an ASA PS score of II. Five providers cited smoking history as the

rationale for assigning a PS score of ASA I, while 17 cited smoking as the rationale for an ASA PS score of II.

The influence of smoking on provider assignment of ASA PS scores has been described in the literature as an issue of asymptomatic versus symptomatic patient presentation.[16] Some providers assign an ASA PS score of I for asymptomatic smokers, arguing that smoking is not a disease despite its link to physiological changes in nearly every body system. Asymptomatic smokers have increased closing volumes consistent with small airway disease[17] and abnormalities in mucociliary transport.[18] Even passive smoking is associated with a decline in the FEV_1. Smoking is the leading cause of chronic bronchitis and emphysema (chronic obstructive pulmonary disease), causing bronchial wall thickening, mucous gland hyperplasia, muscle hypertrophy, and chronic inflammation.[19] In addition to the pulmonary effects, smokers develop cardiovascular changes including accelerated coronary arthrosclerosis and coronary artery disease, increased incidence of vasoconstriction and vasospasm, and increased heart rate, blood pressure, and cardiac output due to sympathetic stimulation and release of catecholamines. Smoking at any age doubles the risk of hypertension and other cardiovascular diseases.[20] Smoking acutely impairs glucose tolerance and causes insulin insensitivity, which has been linked to type 2 (non–insulin-dependent) diabetes mellitus.[21] Finally, there is an increase in postoperative morbidity in smokers.[22] Considering all these factors, even asymptomatic smoking should be considered a mild systemic disease, justifying an ASA PS score of II.

Scenario 9

- 25-year-old (65 in and 80 kg) gravida 1 para 0 is admitted in active labor, dilated to 5 cm, and requests labor epidural
- Pregnancy uneventful; hematocrit = 38%; hemoglobin = 12.4 g/dL; electrolyte levels normal
- History and physical examination findings, normal full-term pregnancy
- *Author ASA PS recommendation:* II

This scenario was developed to explore the influence of patient pregnancy on anesthesia provider assignment of ASA PS scores. The range of scores for this patient was 2 (I and II); one third of the providers considered this patient an emergency case. Normal alterations in physiology were cited as the rationale for assignment of both ASA PS I and II scores. Participants also mentioned "full stomach" as a contributing factor. Some providers favor an ASA PS score of II for pregnant patients due to the physiological changes of pregnancy. Others argue that pregnancy is not a disease state and these patients, who are otherwise healthy, should be classified as ASA PS I. There also is disagreement as to whether pregnant patients should be considered as emergency cases for elective procedures such as a labor epidural.

Physiological changes that occur during pregnancy are well documented. Nearly all body systems are affected by pregnancy (respiratory, cardiovascular, renal, hepatic, gastrointestinal, and hematological). There is an increase in oxygen consumption and minute ventilation and a decrease in functional residual capacity, which places the parturient at greater risk for rapid desaturation. In addition, closing volumes exceed functional residual capacity, making the parturient prone to atelectasis and hypoxemia. Capillary engorgement of respiratory mucosa predisposes the patient to trauma, bleeding, and obstruction. Blood volume and cardiac output increase. There is decreased renal perfusion and glomerular filtration with a decreased threshold for glucose and amino acid filtration. Liver enzyme levels increase in the midst of dilutional decreases in the levels of albumin and pseudocholinesterase. An increased progesterone level inhibits the release of cholecystokinin, which decreases emptying of the gallbladder, altering bile metabolism and placing the parturient at risk for cholelithiasis. The parturient demonstrates a state of hypercoagulability (increased levels of fibrinogen and factors VII, VIII, and X), as well as dilutional thrombocytopenia. Finally, metabolism is affected as evidenced by a relative insulin resistance and hyperactive thyroid.[23] Considering these physiological changes, pregnancy should be considered a "mild systemic disease," warranting assignment of an ASA PS score of II.

Scenario 10

- 26-year-old is admitted for bilateral tubal reanastamosis
- History and physical examination and review of systems unremarkable; excellent health; small mouth with protruding upper incisors, small chin, restricted mouth opening
- Past injury to face, no bony injury but some temporomandibular joint dysfunction
- Has never received general anesthesia
- *Author ASA PS recommendation:* I

The range of assigned ASA PS scores in this scenario was 3 (I, II, and III). Of the providers, 54 (78%) assigned this patient an ASA PS score of I. The possibility of a difficult airway, which is unrelated to the ASA PS classification, was cited by some as rationale for assigning both ASA PS scores of I and II. According to the ASA PS guidelines,[1] physical status should

be assessed without regard to potential anesthetic risks such as a difficult airway. This scenario demonstrates that providers do not follow ASA PS guidelines when considering potential anesthetic risks in their assignment of ASA PS scores.

Discussion

This study was limited by 2 factors: (1) Only interrater reliability was tested. (2) A paper-and-pencil questionnaire was used so providers were not able to ask further questions or examine the patient. Findings from this study are consistent with those from previous studies[3,6,7] regarding variability among anesthesia providers in their assignment of ASA PS scores. No significant statistical differences were noted between CRNAs and anesthesiologists or between military and nonmilitary anesthesia providers in the assignment of ASA PS scores. There was no correlation between ASA PS scores and years practicing or any of the other demographic variables. Interrater reliability in the assignment of ASA PS scores was not demonstrated in any of the 10 scenarios. The overall range of scores assigned to the various scenarios was 2 to 5, with only 2 scenarios having a range of 2, and none having total agreement. These findings demonstrate a lack of interrater reliability among anesthesia providers in assigning individual patients an ASA PS class.

Sources of variability in assigning ASA PS scores identified in this study include nature of the surgery, potential difficult airway, history of smoking, acute injury, and pregnancy. In addition, anesthesia providers used the same rationale (smoking, pregnancy, heart disease, lung disease) to assign *different* ASA PS scores. Participants in this study reported using the ASA PS classification as an indicator of anesthetic risk (62 providers [88%]) and surgical risk (34 providers [49%]). The original intent of the classification was for the collection and comparison of anesthesia statistical data. Many anesthesia providers have, without evidence, associated the ASA PS classification with risk assessment.

The results of this study raise several questions. What are the anesthesia provider's perceptions about the meaning of this measurement, and how might this influence the provider's assignment of ASA PS scores? Do the planned surgical interventions influence the provider's assignments of scores? Do economic (resource allocation) and political (policy determination) considerations for which this score is used influence decision making? Education of anesthesia providers related to use of the ASA PS classification also should be questioned. Is there an inherent "opinion" factor in this classification related to its broad definitions that may leave assignment of ASA PS scores open to individual interpretation?

The ASA PS classification lacks reliability, making assignment of ASA PS scores to individual patients more a matter of opinion than of the application of objective scientific method. The majority of anesthesia providers (62 [89%]) see the ASA PS classification as an *anesthetic* risk indicator, which may be an indication of a desire for such a tool. This classification, in its present form, should not be used for administrative or public policy determination, for reimbursement, or for any other purpose. We recommend the ASA PS classification be revised (or replaced) by a multidisciplinary task force into an objective and reliable instrument. Clear guidelines related to use of the scale ultimately would result in information that can be clearly communicated and understood by anesthesia providers and others who would cite this score as a variable in research, reimbursement for services, and policy determination.

REFERENCES

1. American Society of Anesthesiologists. New classification of physical status [editorial]. *Anesthesiology.* 1963;24:111.
2. Saklad M. Grading of patients for surgical procedures. *Anesthesiology.* 1941;2:281-284.
3. Owens WD, Felts JA, Spitznagel EL Jr. ASA physical status classifications: a study of consistency of rating. *Anesthesiology.* 1978;49:239-243.
4. Tiret L, Hatton F, Desmonts JM, Vourc'h G. Prediction of outcome of anaesthesia in patients over 40 years: a multifactorial risk index. *Stat Med.* 1988;7:947-954.
5. Goldstein A Jr, Keats AS. The risk of anesthesia. *Anesthesiology.* 1970;33:130-143.
6. Little JP. Consistency of ASA grading [letter]. *Anaesthesia.* 1995;50:658-659.
7. Haynes SR, Lawler PGP. An assessment of the consistency of ASA physical status classification allocation. *Anaesthesia.* 1995;50:195-199.
8. Ranta S, Hynynen, M, Tammisto T. A survey of the ASA physical status classification: significant variation in allocation among Finnish anaesthesiologists. *Acta Anaesthesiol Scand.* 1997;41:629-632.
9. Owens WD, Felts JA, Spitznagel EL Jr. Tally of ASA classification responses [letter]. *Anesthesiology.* 1979;51:181.
10. Air Force Instruction (AFI) 44-102. 1 July 1998. Patient care and management of clinical services. 1998:20-21.
11. McAuliffe MS, Henry B. Countries where anesthesia is administered by nurses. *AANA J.* 1996;64:469-479.
12. McAuliffe MS, Henry B. Survey of nurse anesthesia practice, education, and regulation in 96 countries. *AANA J.* 1998;66:273-286.
13. Kraemer HC, Thiemann S. *How Many Subjects? Statistical Power Analysis in Research.* Newbury Park, Calif: Sage Publications, Inc; 1987.
14. Dixon J. Consistency of the ASA classification [letter]. *Anaesthesia.* 1995;50:826.
15. Kassel NF, Tomer JC, Haley EC, et al. The international cooperative study on the timing of aneurysm surgery, part I: overall management results. *J Neurosurg.* 1990;73:16-36.
16. Bayes J. Asymptomatic smokers: ASA I or II [letter]? *Anesthesiology.* 1982;56:76.

17. McCarthy DS, Spencer R, Greene R, Milic-Emili J. Measurement of "closing volumes" as a simple and sensitive test for early detection of small airway disease. *Am J Med.* 1972;52:747-753.
18. Lourenco RV, Klimek MF, Borwiski CJ. Deposition and clearance of 2 micron particles in the tracheobronchial tree of normal subjects: smokers and nonsmokers. *J Clin Invest.* 1971;50:1411-1420.
19. McCance KL, Huether SE. *Pathophysiology: The Biological Basis for Disease in Adults and Children.* 2nd ed. St Louis, Mo: Mosby Year Book, Inc; 1994:1165-1168.
20. Zhu BQ, Parmley WW. Hemodynamic and vascular effects of active and passive smoking. *Am Heart J.* 1995;130:1270-1275.
21. Frati AC, Iniestra F, Ariza CR. Acute effects of cigarette smoking on glucose tolerance and other cardiovascular risk factors. *Diabetes Care.* 1996;19:112-118.
22. Laszlo G, Archer CG, Darrel JH, Dawson JM, Fletcher CM. The diagnosis and prophylaxis of pulmonary complications of surgical operations. *Br J Surg.* 1973;60:129-134.
23. Hughes SC, Levinson GS, Rosen M. *Shnider and Levinson's Anesthesia for Obstetrics.* 4th ed. Baltimore, Md: Lippincott Williams & Wilkins; 2002.

AUTHORS

Capt Wendy L. Aronson, CRNA, MSN, NC, USAF, is a staff nurse anesthetist, Elmendorf Air Force Base, Anchorage, Alaska. Research for this article was conducted while she was a graduate student at Uniformed Services University of the Health Sciences Graduate School of Nursing Nurse Anesthesia Program, Silver Spring, Md.

Maura S. McAuliffe, CRNA, PhD, FAAN, is program director, East Carolina University School of Nursing, Nurse Anesthesia Program, Greenville, NC.

Ken Miller, RN, PhD, FAAN, is associate dean, Research and Clinical Scholarship, University of New Mexico, Albuquerque, NM.

DISCLAIMER

The opinions expressed in this article are solely those of the authors and do not necessarily represent the official views of the US Government, the Department of Defense, or the US Air Force.