

Specificity of the Ambulatory Simplified Acute Physiologic Score

—Experience of the Emergency Department of the Omar Bongo On-Dimba Army Training Hospital

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Abstract

Introduction: Mortality is a frequent phenomenon in emergency department and a major public health concern. The use of mortality prognostic scores such as Ambulatory Simplified Acute Physiologic Score (ASAPS) remains a possibility to improve patient management in order to reduce mortality. Therefore, we proposed to conduct a study on patients admitted to our emergency department, in order to assess the ASAPS accuracy in our context.

Patients and Method: This is a cohort, prospective, monocentric, descriptive and analytical study, during 4 months period in 2020. The study framework was in the Army Training Hospital Omar Bongo Ondimba (ATHOBO). We included all patients admitted in emergency room for at least 24 hours for a medical disease. The main purpose was to determine the ASAPS specificity in (ATHOBO) emergency department using the pivotal value of 8 points to do so. **Results:** During the study period, there were 3425 visits to emergency department among which we included 593 patients in the study. The patients' average age was 47.37 ± 19.14 years. The sex ratio (M/W) was 1.16. The main reason for consultation was the flu-like syndrome in 15.18 % of cases. The admitted patients' average ASAPS was 3.9 ± 3.22 . The global mortality was 17.54%. For an ASAPS key value at 8, the specificity was 90.2% and the sensibility was 43.3%. Regarding the most seriously ill patients admitted in vital emergency reception room, the average ASAPS was 7 ± 2.9 . The vital emergency reception room mortality was 37.16%. **Conclusion:** ASAPS is a nonspe-

cific severity index, only based on clinical criteria. Our study showed a good ASAPS specificity and a good correlation between mortality and the score. However, this score has a bad sensibility due to the medical history and minimal blood test absence.

Keywords

ASAPS, Mortality, Emergency Department, Vital Emergency Reception Room

1. Introduction

Emergency and intensive care units are at the forefront of a hospital's healthcare system. The legally defined mission of emergency departments is "to receive, without selection, 24 hours a day, every day of the year, any person presenting in an emergency situation and to provide care, particularly in cases of distress and life-threatening emergencies" [1].

According to the World Health Organization, mortality in emergency departments in low- and middle-income countries averaged 1.8% in 2015 [2]. In France, a study in 2018 described mortality rates between 0.15 and 0.18% among emergency room visits [3]. It is in low-income countries such as those in Africa that the probability of death is higher and life expectancy lower [4]. Studies found a mortality rate of 0.6% in Emergency Departments (ED) in Morocco and 2.6% in those of Cameroon [5] [6]. In Gabon, a study conducted in the ED of the Omar Bongo Ondimba and Akanda Army Training Hospitals in 2019 found a mortality rate of 1.3% [7]. In our context, where mortality remains high, the question of the use of prognostic scores remains a possibility to improve the quality of patient care. Several prognostic scores have been created to predict this mortality and identify patients requiring more attention very early on. These scores meet required standards: simplicity, speed, relevance and low cost and classify patients into homogeneous groups of probability of hospital mortality, without taking into account the diagnosis [8]. Several scores have been tested in this regard, such as the Sequential Organ Failure Assessment (SOFA), and/or the Simplified Severity Index II (SSI II) [9] [10]. However, these scores are difficult to apply in our developing countries. For example, the IGSII score includes criteria justifying unusual examinations in sub-Saharan emergency departments, in particular arterial blood gas analysis. Then the SOFA score was essentially defined for septic patients. Even if its applicability can be extended to organ failure, a score focusing on patients attending emergency departments could be more appropriate.

Very similar to the Modified Early Warning Score (MEWS), The Ambulatory Simplified Acute Physiologic Score (ASAPS) is a simplified severity index, usable in emergency rooms. It takes into account only clinical variables: age, pulse, blood pressure, respiratory rate, body temperature, and the Glasgow Coma Scale (GCS)

score [9] [11]. This score can be easily calculated within the first few minutes of patient care. A study in France by J.R. Le Gall in 1990 demonstrated, for a pivotal value of an IGSA score equal to 8, a specificity of 90%. A score below 8 was then correlated with a survival rate of 94% [12]. It is used in routine practice in emergency medicine and is one of the best indicators of activity in an emergency department [13].

This score could therefore prove useful in the practice of emergency departments in our country. But what about its specificity in our context where the quality of care and technical platform remain inferior? We therefore proposed to conduct a study among patients admitted to the HIAOBO emergency department, in order to evaluate the reliability of the IGSA score in our context.

2. Patients and Method

This was a prospective, single-center, descriptive, and analytical cohort study conducted on all patients admitted to the ATHOBO Emergency Department (ED) from November 1, 2019, to February 29, 2020, a period of 4 months.

The ATHOBO emergency department (ED) received a total of 12,849 patients during the 2019 calendar year.

This study took place over a total of 4 months, from November 1, 2019, to February 29, 2020. The study population consisted of all patients received in the ATHOBO (ED) during the study period.

2.1. Inclusion Criteria

The sample included all patients hospitalized in the HIAOBO emergency department for a minimum of 24 hours for a medical condition. The calculation was made upon admission by the reception and orientation nurse before admission to the department, or in the structure's resuscitation airlock, with a capacity of 6 beds, equipped like intensive care beds. A multiparameter monitor took the basic parameters of patients presenting to the HIAOBO emergency department and the constitution of the medical file provided information on age and Glasgow Coma Scale.

Due to its simplicity and the mandatory nature of the inclusion of score parameters in the emergency room medical records, the three triage nurses at the facility did not receive specific training in calculating the score. It was established within 48 hours of admission by a single investigator, trained for.

We did not include in the sample:

- Patients who arrived deceased
- Patients under 15 years of age
- Patients hospitalized for traumatic illness
- Patients admitted for serious burns
- Patients or relatives who did not agree to participate in the study

2.2. Data Collection and Work Procedure

A data collection form was created and completed for all patients hospitalized in

- the emergency department upon admission to collect the following parameters:
- Population characteristics (name, age, sex)
 - Reason for consultation
 - Date of admission
 - Possible admission to the resuscitation room
 - Vital parameters upon admission (Glasgow Coma Scale, blood pressure, heart rate, respiratory rate, temperature)
 - The **ASAPS** calculated from the score table (**Table 1**) [11]

Table 1. Ambulatory simplified acute physiologic score according to le gall.

Point	Age	Pulse	Systolic Arterial Pressure	Temperature	Respiratory Rate	GLASGOW Coma Scale
4		≥180	≥190	≥41	>50	
3		140 - 179		39 - 40.9	35 - 49	
2		110 - 139	150 - 189			
1				38.5 - 39	25 - 34	
0	<45 ans	70 - 109	80 - 149	36 - 38.4	12 - 25	13 - 15
1	45 - 55 ans			34 - 35.9	10 - 11	10 - 12
2	56 - 69 ans	55 - 69	55 - 79	32 - 33.9	6 - 9	7 - 9
3	69 - 75 ans	40 - 54		30 - 31.9	Mechanical ventilation	4 - 6
4	>75 ans	<40	<55	<30	<6	3

The pivotal value for the ASAP Score at 8 was chosen according to the work of J.R. Le Gall in his study in France of 1990, and in the study of Dia *et al.*, in Senegal in 2015, who chose the same pivotal value [13].

Other parameters were collected upon discharge or, if applicable, after death, including the date of discharge, date of death (if applicable) and the length of hospitalization in days. The comparison between actual mortality and predicted mortality was made by calculating the observed lethality of patients according to the ASAP score, compared to the maximum lethality assumed by their score [12].

2.3. Data Analysis

The data were transcribed into a digital database using Microsoft Excel 2013 software and statistically processed using Epi Info version 7.2.3. We used an ASAPS of 8 as the benchmark value, and the data set allowed us to determine:

- True positives (TP): Patients who died with an IGSA score ≥ 8
- True negatives (TN): Patients who survived with an IGSA score < 8
- False positives (FP): Patients who survived with an IGSA score ≥ 8
- False negatives (FN): Patients who died with an IGSA score < 8

From these values, we were able to calculate the various performance indices,

namely:

- Sensitivity (SE): $TP/(TP + FN)$
- Specificity (SP): $TN/(TN + TP)$
- Positive predictive value (PPV): $TP/(TP + TP)$
- Negative predictive value (NPV): $TN/(TN + FN)$

Sensitivity, specificity, positive predictive value, and negative predictive value were expressed as a percentage (%).

2.4. Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki. A free and informed consent form was completed and signed by the patients or a family representative.

The confidentiality of the patient data was ensured by identifying each patient with an anonymity number assigned in ascending order according to the chronology of inclusion.

3. Results

During the study period from November 1, 2019, to February 29, 2020, the ATH-OBO Emergency Department (ED) received a total of 3425 patients, 2773 of whom were treated as outpatients. Thus, we recorded 803 hospitalizations, both medical and surgical. Ultimately, 593 patients, or 74% of all hospitalizations, were included in our study, as shown in **Figure 1** below.

Table 2 illustrates the distribution of consultations, hospitalizations and patients ultimately included in our study for each month of the study period.

Table 2. Summary of emergency department visits per month.

Months	Consultations	Hospitalizations	Patients included
November 2019	825	210	129
Décember 2019	868	197	140
January 2020	854	204	169
February 2020	878	192	155
Total	3425	803	593

3.1. Descriptive Study

Patient ages ranged from 15 to 94 years, with a mean age of 47.37 ± 19.14 years, with a median of 45 years and a predominance in the 45 - 75 age group. Male patients were the most numerous, with a distribution of 53.63%, representing a sex ratio (M/F) of 1.16.

• Main Reasons for Consultation

The most common main reason for consultation was influenza-like illness (15.18%), and in 13.83% of cases, patients consulted for altered levels of consciousness. **Figure 1** describes the main reasons for consultation for the patients

included in our study.

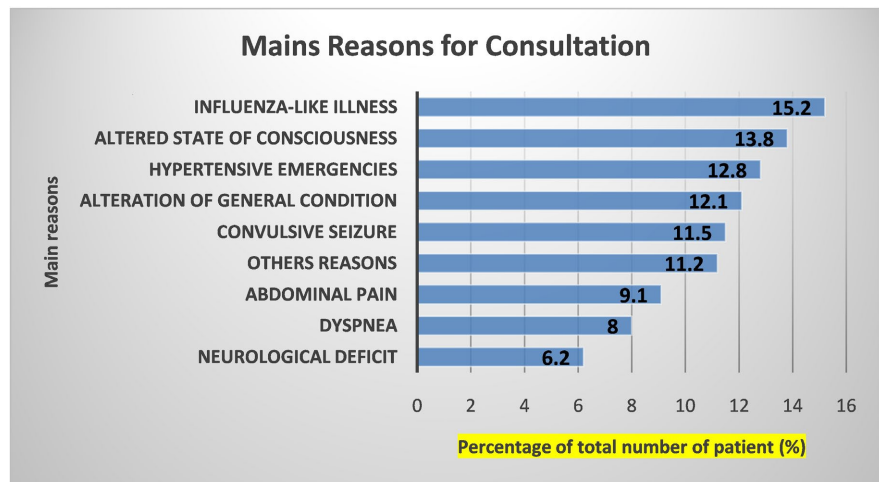
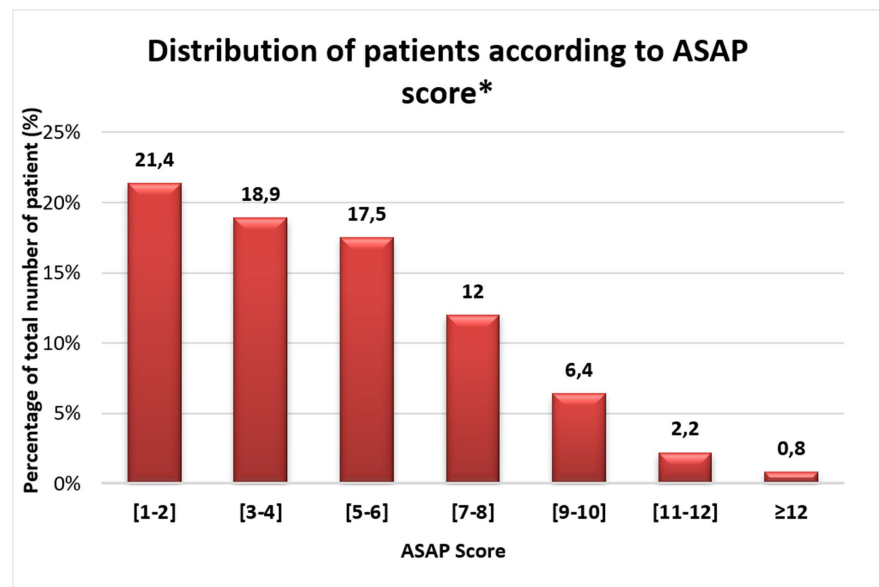


Figure 1. Main reason for consultation.

3.2. Aalytical Study

- **ASAP Score**

The mean IGSA score for all hospitalized patients was 3.9 ± 3.22 , with a range of 0 to 19 and a median of 3. Figure 2 shows the distribution of patients according to their IGSA score.



*: Number of patients / percentage of patients presenting the cumulative score.

Figure 2. Distribution of patients according to IGSA score.

- **Mortality as a Function of ASAP Score**

The overall mortality rate was 17.54%. It increased with the ASAP score. Figure 3 illustrates the distribution of mortality observed in the study and predicted mor-

tality as a function of the ASAP score (Figure 3).

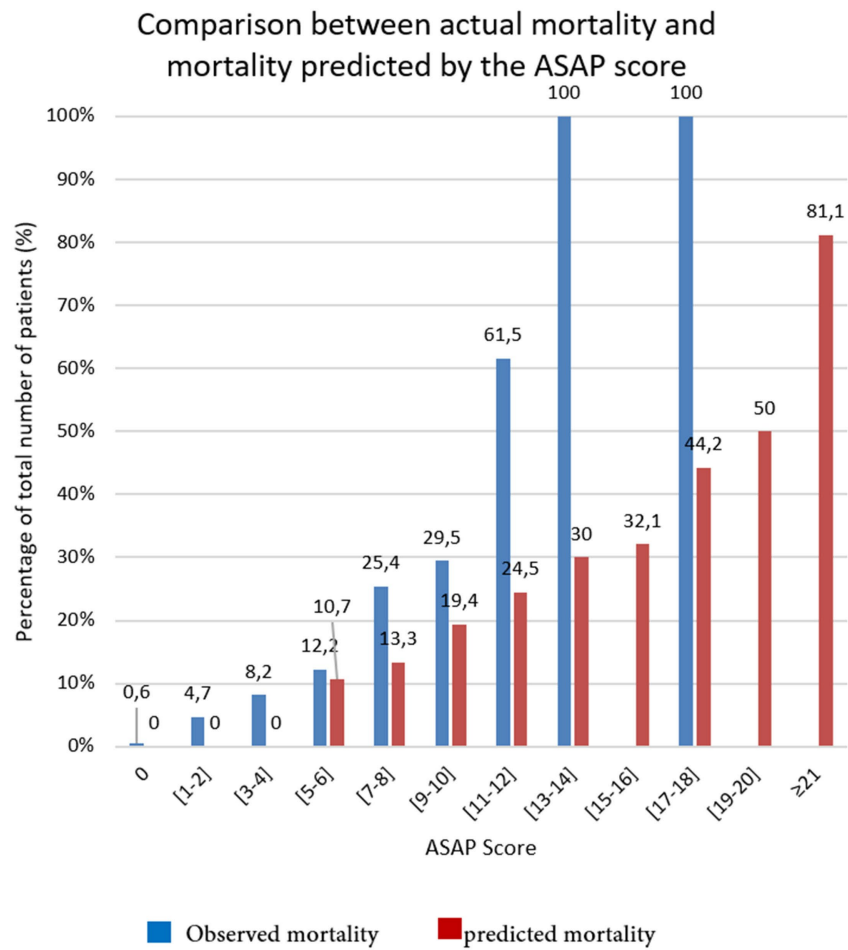


Figure 3. Comparison between actual mortality and mortality predicted by the ASAP score.

• **ASAP Score Performance Indicators**

For a benchmark ASAP score of 8, data analysis showed that the proportion of false positives was 48, or 8.10%, and that of false negatives was 59, or 9.95%. Table 3 summarizes the proportions of true positives, true negatives, false positives, and false negatives.

Table 3. Contingency table.

	Deaths	Survival
IGSA ≥ 8	45 TP	48 FP
IGSA < 8	59 FN	441 TN

*TP: True Positive; FP: False Positive; FN: False Negative; TN: True Negative.

After calculating the various performance indices, we found a sensitivity of 43.3% for the ASAP score and a specificity of 90.2%. Table 4 shows the various performance indicators of the ASAP score found in our study.

Table 4. ASAP score performance indicators.

Sensitivity	43.3%
Specificity	90.2%
PPV	48.4%
NPV	88.2%

*PPV: Positive Predictive Value; NPV: Negative Predictive Value.

4. Discussion

The ASAP Score is a non-specific severity index for emergency departments, based solely on clinical criteria, which allows patients to be stratified into groups of comparable severity, without regard to diagnosis. We considered the use of this score in a hospital setting to be advantageous given that it includes only clinical values, and therefore no laboratory values, in our working conditions where resources are sometimes limited. Furthermore, these values are accessible at any time. The aim of this study was therefore to assess the reliability of this score in our context.

4.1. Limitations

The single-center nature of our study and the short duration of the study (4 months) are significant limitations. Other limitations include the exclusion of patients with certain traumatic and/or surgical conditions (severe burns, etc.).

Despite this, the prospective nature of our study and the large cohort allow us to draw some conclusions.

4.2. Descriptive Study

- Age

In our series, the population was relatively young, with a mean age of 47.37 ± 19.14 years. We found a predominance in the age group between 45 and 75 years. These results corroborate those found by Tchoua *et al.* [14], who found a mean age of 42 ± 15.3 years in 1999 at the Jeanne Ebori Foundation in Libreville. Dia *et al.* [13] found a mean age of 46.7 ± 19.4 years in Senegal in 2009.

In developed countries, a higher mean age is found. Le Conte *et al.* found a mean age of 73 years in ED admissions in France in 2005 [15].

This difference could be related to life expectancy, which is higher in Western countries. Also, the pioneering study on the ASAP score [11] was conducted in a Western country with a higher average age than in our setting.

Since advanced age is a characteristic that influences the ASAP score and therefore patient prognosis, we would therefore expect mortality in our setting, where patients are younger, to be lower than in Western countries.

- Sex

Male patients were the most numerous, with a sex ratio (M/F) of 1.16. Tchoua *et al.* and Dia *et al.* made the same observation, also finding a male predominance,

with a sex ratio of 1.82 and 1.77, respectively [13] [14]. The same was true for Coplan *et al.* in their study in Turkey, where the sex ratio favored men at 1.12 [16]. There appears to be a male predominance in emergency room hospitalizations. It is true that women's hormonal systems, particularly estrogen, play a protective role against cardiovascular disease, and some studies claim that they have a better immune system, which ages less quickly than men's [17].

- Reasons for Consultation

The reasons for consultation were dominated by flu-like symptoms (15.18%) and altered state of consciousness (13.83%). These results are similar to those of Mbengono *et al.*, who found altered state of consciousness and fever as the leading reasons for consultation in their 2015 series in Cameroon [6]. In France, Berard *et al.* described 44% of respiratory disorders and 41% of altered state of consciousness [3]. The high frequency of infectious pathologies in our context, particularly the fact that Gabon and Cameroon are malaria-endemic areas, could explain this difference. These results also show the modification of the landscape of EDs, where, despite the persistence of infectious endemic areas, we are witnessing a resurgence of cardiovascular pathologies with neurological symptoms (stroke, etc.).

4.3. Analytical Study

- ASAP Score

For all patients hospitalized in the emergency department and included in our study, the mean ASAP score was 3.9 ± 3.22 , with a range between 0 and 19. Dia *et al.* [13] found a mean IGSA score of 6.3 ± 3.6 in their series in Senegal, with a range between 0 and 18.

This difference is related to the fact that Dia *et al.*'s study took place in the intensive care unit of the infectious diseases department of the FANN National and University Hospital in Dakar, which therefore admitted more critically ill patients than the patients included in our study. If we consider our most critically ill patients, those admitted to the resuscitation room, the mean ASAP score increases to 6.6 ± 2.9 , close to the score reported by Dia *et al.* Including patients admitted for traumatic conditions in our study would certainly have increased this score.

- Mortality as a Function of IGSA Score

In our series, the overall mortality of hospitalized patients was 17.54%, and the higher the ASAP score, the greater the increase in mortality. In their series, Dia *et al.* found an overall mortality of 48.3%, and this also increased with the ASAP score [13]. This difference in mortality is explained, as mentioned above, by the fact that this study was conducted in an intensive care unit, and the patients were therefore more critically ill.

It is regularly suggested that the ratio of observed mortality to predicted mortality based on a score such as the ASAP could be an indicator of the performance of emergency and intensive care units [18]. Regardless of the ASAP score in our study, the observed mortality was higher than the predicted mortality. It was 61% versus 24.5% for predicted mortality when the ASAP score was between 11 and

12, and it was 100% versus 30% for predicted mortality when the ASAP score was greater than or equal to 13. In their study in Senegal, Dia *et al.* found a mortality of 81% for an ASAP score between 11 and 12 and, as in our study, a mortality of 100% from a score equal to or greater than 13. Menthonex *et al.*, on the other hand, in a study in the pre-hospital sector in France (SAMU of Grenoble), found a mortality of 50% for an ASAP score between 11 and 12 and a mortality of 100% from an IGSA score ≥ 17 [19].

Very few studies have dealt with the application of the ASAP score to patients admitted to the emergency department. However, all the studies found showed that observed mortality was higher than predicted mortality, regardless of the ASAP score [13] [16]. Mortality in sub-Saharan Africa is higher than that found in France for ASAP scores < 17 . From an ASAP score of 17, all studies showed 100% mortality. These results could suggest that the performance of healthcare facilities in sub-Saharan Africa is poor.

However, we believe that they primarily reflect the gap in terms of quality of care between the country where this score was established and our own. They indicate that our healthcare facilities must improve the quality of patient care, given that patients are on average younger than in Western countries, and therefore have a supposedly higher survival rate.

- ASAP Score Performance Indicators

Determining the specificity of the ASAP score for the ATHOBO's ED was the primary objective of our study. All studies identified assumed an ASAP score of 8 as the baseline value. The specificity of the IGSA score for the ATHOBO's ED was 90.2%, while the sensitivity was 43.3%. Dia *et al.* found a specificity of 84%, while the sensitivity was 38% [13], and for Le Gall *et al.*, the specificity of the ASAP score was 90% and the sensitivity was 56% [11].

The specificity of a test is its ability to detect true negatives. Concerning our study, the aim was therefore to determine the capacity of the ASAP score to detect patients who survive with an ASAP score < 8 . All studies agree that the ASAP score is a score with good specificity for predicting patient mortality for a pivotal value of 8 [11]-[13]. However, its low sensitivity and its low PPV do not make it a good predictive score for mortality in our context. Some authors believe that the addition of a minimalist biological assessment as well as the taking into account of the patients' history by the score could increase its sensitivity [13].

The use of prognostic scores is a possibility for improving the quality of patient care in emergency departments, where mortality remains high. The ASAP is a non-specific severity index, based solely on clinical criteria. It is a simple and inexpensive method that allows patients to be classified into groups of comparable severity and mortality, in the absence of laboratory tests. Therefore, our main objective was to determine the specificity of this score, used in our context.

Our study demonstrated good specificity of the ASAP score applied to patients admitted to the ATHOBO's emergency department during the study period. There was a good correlation between mortality and the ASAP score, both for all

patients admitted to the emergency department and for the most critically ill patients admitted to the resuscitation room. However, the poor sensitivity of this score can be explained by the underestimation of the severity of certain patients, due to the failure to take into account their history and the absence of a minimalist biological assessment.

5. Conclusions

The use of prognostic scores is a possibility for improving the quality of patient care in emergency departments, where mortality remains high. The ASAPS is a non-specific severity index, based solely on clinical criteria.

It is a simple and inexpensive method that allows patients to be classified into groups of comparable severity and mortality, in the absence of laboratory tests. Therefore, our main objective was to determine the specificity of this score, used in our context.

Our study demonstrated good specificity of the ASAP score applied to patients admitted to the ATHOBO emergency department during the study period. There was a good correlation between mortality and the ASAP score, both for all patients admitted to the emergency department and for the most critically ill patients admitted to the resuscitation room. However, the poor sensitivity of this score can be explained by the underestimation of the severity of certain patients, due to the failure to take into account their history and the absence of a minimalist biological assessment. Furthermore, the age criterion could be reassessed given the relatively younger sub-Saharan population.

Readapted to the sub-Saharan context, the ASAP score could then be quickly integrated into routine emergency department practice, and its support would allow for improved triage of patients presenting to emergency departments. Further multicenter studies could then definitively establish the contribution of this score to the categorization of emergency department patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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