



Original Contribution

San Francisco Syncope Rule, Osservatorio Epidemiologico sulla Sincope nel Lazio risk score, and clinical judgment in the assessment of short-term outcome of syncope[☆]

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Abstract

Objective: The study aimed to compare the efficacy of the Osservatorio Epidemiologico sulla Sincope nel Lazio (OESIL) risk score, San Francisco Syncope Rule, and clinical judgment in assessing the short-term prognosis of syncope.

Methods: We studied 488 patients consecutively seen for syncope at the emergency department of 2 general hospitals between January and July 2004. Sensitivity, specificity, predictive values, and likelihood ratios for short-term (within 10 days) severe outcomes were computed for each decision rule and clinical judgment. Severe outcomes comprised death, major therapeutic procedures, and early readmission to hospital.

Results: Clinical judgment had a sensitivity of 77%, a specificity of 69%, and would have admitted less patients (34%, $P < .05$ vs decision rules). The OESIL risk score was characterized by a sensitivity of 88% and a specificity of 60% (admission 43%). San Francisco Syncope Rule sensitivity was 81% and specificity was 63% (admission 40%). According to both clinical rules, no discharged patient would have died. With combined OESIL risk score and clinical judgment, the probability of adverse events was 0.7% for patients with both *low risk scores*, whereas that for both *high risk scores* was roughly 16%.

Conclusion: Because of a relatively low sensitivity, both risk scores were partially lacking in recognizing patients with short-term high-risk syncope. However, the application of the decision rules

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would have identified all patients who subsequently died, and OESIL risk score and clinical judgment combined seem to improve the decision-making process concerning the identification of high-risk patients who deserve admission.

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1. Introduction

Several factors account for the high rate of hospital admission in patients with syncope. First, diseases inducing syncope are difficult to address in the emergency setting because of time constraints and lack of available diagnostic tools. Second, there is concern about potentially fatal ventricular arrhythmia and sudden death based on the finding that cardiac syncope is characterized by a mortality rate of up to 30% [1-7]. Third, in most of the cases, patient hospital admission or discharge from the emergency department (ED) is based only on the physician's own clinical experience and no specific admission/discharge protocol is followed a priori.

A few prognostic scores have been developed to provide emergency physicians with accurate guidelines for hospital admission [8-11]. Among them, the Osservatorio Epidemiologico sulla Sincope nel Lazio (OESIL) [10] risk score is largely used in the emergency setting in Europe. However, it was obtained from mortality and morbidity at 12 months after the sentinel event, like the large majority of the studies aimed at evaluating the prognosis of syncope [1-4,8,11-15]. Thus, the use of such a risk stratification approach in the emergency setting implies that risk factors for 1-year adverse outcomes are identical to risk factors affecting the short-term (ie, up to 10 days) clinical outcome. This assumption, however, has been recently challenged [16]. A different risk scale, that is, the San Francisco Syncope Rule (SFSR) [9], overcame this potential weakness as it was based on unfavorable outcomes within 7 days from examination at the ED. However, the SFSR was obtained in a cohort of patients with syncope at the ED of a *single* hospital [17], and the attempts to validate such a risk scale have yielded discordant results [18-20]. The SFSR and OESIL risk score were recently compared in a feasibility pilot single-center study based, however, on a limited number of patients [21].

The aim of the present study was to compare the SFSR, the OESIL risk score, and clinical judgment to assess their efficacy in recognizing patients at high risk for short-term (within 10 days) adverse events (ie, *death*, the need for *major therapeutic procedures*, and *early readmission to hospital*) after syncope. *Clinical judgment*, defined as the emergency physician's decision-making process dealing with hospital admission or discharge, was obtained from a recent observational multicenter study aimed at addressing the short-term prognosis of syncope [16].

2. Methods

2.1. Population

This observational prospective cohort study included all consecutive subjects 18 years or older who presented at the ED of 2 general hospitals reporting syncope within the previous 48 hours. The hospitals were chosen among those participating in the Short-Term Prognosis of Syncope (STePS) study [16] because of automatic access to laboratory data required to compute the SFSR.

As already described [16], between January 23 and July 31, 2004, 2226 consecutive patients presenting in the ED were screened according to the following triaging diagnoses: syncope, loss of consciousness, presyncope, fainting, collapse, light-headedness, dizziness, falls, seizures, head injury, bone fractures.

The following *exclusion criteria* were used to ultimately determine our target population: (i) the presence of clinical conditions primarily confirmed in the ED that would have required hospital admission independently of the syncope such as myocardial infarction, acute pulmonary embolism, subarachnoid hemorrhage, stroke, cardiac arrest, sustained bradycardia (<35 beats per minute), complete atrioventricular block, sustained ventricular tachycardia; (ii) a referred head injury preceding the loss of consciousness; (iii) a referred nonspontaneous return to consciousness; (iv) nonsyncopal syndromes such as light-headedness, vertigo, coma, shock, seizure; (v) associated diseases with a prognosis less than 6 months; (vi) recent alcohol or drugs abuse; (vii) unwillingness to provide consent to participate in the study; (viii) unfeasible follow-up (foreigners, homeless).

The study was approved by the Ethical Committee on Human Research of the Coordinating Centre (Ospedale "L. Sacco"), and participants provided written consent. Oral consent was obtained in patients discharged from the ED that were interviewed by phone.

As shown in Fig. 1, 492 patients were enrolled. Four patients were lost at follow-up. The final population was composed of 488 patients. Every enrolled patient underwent a prognostic score in keeping with both the OESIL risk score and the SFSR. According to clinical judgment, patients admitted to the hospital or discharged from the ED were considered at high or low risk (see below), respectively.

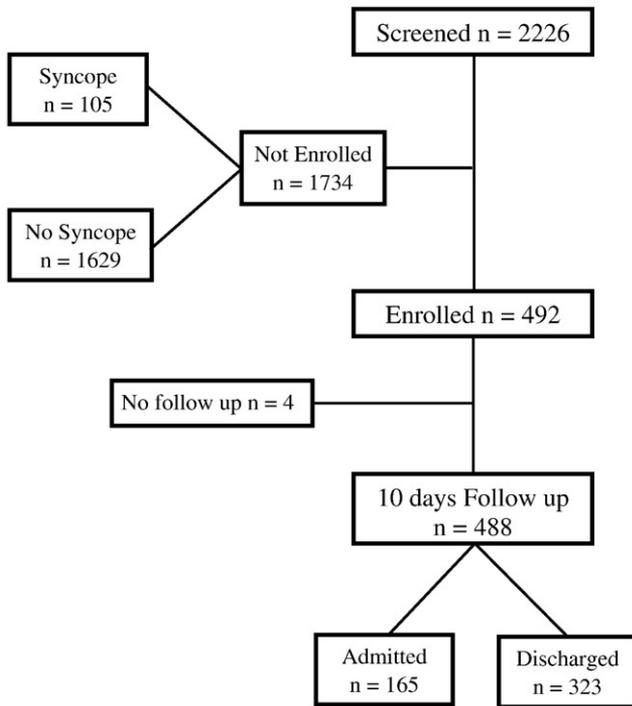


Fig. 1 Flow diagram of the screened and enrolled population.

2.2. Definitions

Syncope was defined as a transient loss of consciousness associated with the inability to maintain postural tone, followed by spontaneous recovery [5].

Severe outcomes (within 10 days) included *death*, the need for *major therapeutic procedures*, and *early (within 10 days) readmission to hospital*. We defined as *major therapeutic procedures* cardiopulmonary resuscitation (CPR), pacemaker (PM) or implantable cardioverter-defibrillator (ICD) implant, intensive care unit (ICU) admittance, and acute antiarrhythmic therapy. We considered only those procedures undertaken after the patient was hospitalized from the ED or discharged. It is worth noticing that these outcomes are “intervention related,” in contrast to those used in the OESIL risk score [10] and SFSR [9], which were “diagnosed related.” As to *early readmission to hospital*, in keeping with a previous study [9], we assumed that any patient discharged from ED after syncope and then readmitted to hospital for the same or similar symptoms was to be considered at high risk for developing a severe outcome.

Electrocardiogram (ECG) was defined as abnormal in the presence of any of the following: (i) atrial fibrillation or tachycardia; (ii) sinus pause of 2 seconds or more; (iii) sinus bradycardia with heart rate ranging between 35 and 45 beats per minute; (iv) conduction disorders (ie, bundle-branch block, second-degree Mobitz I atrioventricular block); (v) ECG signs of previous myocardial infarction

or ventricular hypertrophy; (vi) multiple premature ventricular beats. The ECG was analyzed by the cardiologist on duty who was unaware of the study and blinded to the 2 risk scores and to clinical judgment. It can be pointed out that our definition of normal vs abnormal ECG was in keeping with the OESIL risk score but did not take into account only *ECG changes* as SFSR did. Indeed, we considered as abnormal any *ECG alteration*, independently of the onset time.

Severe outcomes were calculated between day 0 and day 10 from the index event.

We defined as *clinical judgment* the decision-making process dealing with hospital admission or discharge applied by the emergency physicians of the STePS study [16]. With the latter being an observational study, decisions on possible hospital admission or discharge were based only on the physician’s knowledge of appropriate guidelines on syncope [5,22] and on his/her clinical experience. More specifically, all patients underwent an accurate history, complete physical examination, hemodynamic and respiratory parameters assessment, hematocrit evaluation, and a 12-lead resting ECG. In selected cases, other laboratory tests, carotid sinus massage, chest x-ray, ECG continuous monitoring, cardiac ultrasounds, and chest computed tomographic (CT) scan were performed. For ethical reasons the admission/discharge procedure could obviously not be randomized. Physicians in charge of the patients were unaware of the present study.

2.2.1. Osservatorio Epidemiologico sulla Sincope nel Lazio risk score

The OESIL risk score [10] is based on the presence of 4 risk factors that are abnormal ECG, a previous history of cardiovascular diseases, absence of prodromal symptoms, and age greater than 65 years. Each risk factor counts as one. In keeping with the OESIL study, we considered as low risk patients characterized by a score up to 1. Subjects with a score of 2 or higher were assumed to be at intermediate or high risk (ie, admitted to the hospital).

2.2.2. San Francisco Syncope Rule

According to the SFSR [9], high-risk patients are those having at least one of the following risk factors: a history of congestive heart failure, hematocrit lower than 30%, abnormal ECG, a complaint of shortness of breath, and systolic blood pressure values lower than 90 mm Hg.

2.2.3. Clinical judgment

Admitted patients were classified as high risk, whereas discharged individuals were assumed to be at low risk, in keeping with the judgment of the emergency physician. It has to be pointed out that because of the observational nature of the present study, no defined protocol was followed *a priori* by the emergency physician.

Patients who left the ED against medical advice were considered as admitted.

2.3. Study end points

The aim of the present study was to assess the efficacy of the OESIL risk score, SFSR, and clinical judgment in recognizing patients at high risk for short-term (within 10 days) adverse events after syncope. This goal was accomplished by comparing the sensitivity, specificity, positive and negative likelihood ratios, and positive and negative predictive values of each of the 2 clinical scores and of clinical judgment.

2.4. Outcome measures

Severe outcomes comprised death, major therapeutic procedures, and early (within 10 days) readmission to the hospital.

2.5. Data collection and follow-up

Six participating physicians obtained the ED reports to perform the initial screening. Furthermore, they promptly evaluated all the admitted patients in the different wards. As to the discharged subjects, they were either directly evaluated before discharge or surveyed within 2 days by phone and subsequently within 10 days from the target event, using a 10-item questionnaire. The questionnaire took into account syncope recurrence, readmission for syncope, the need for major therapeutic procedures, and death. It has to be highlighted that admission/discharge decision in the ED was taken uniquely by the emergency physician on duty who was blinded to the protocol.

If patients were not reachable or unable to talk, their relatives or general practitioners were interviewed. All data on patient's clinical history, presenting symptoms, physical examination findings, laboratory test results, and subsequent follow-up related to the index event were collected by a physician of the coordinating center and stored in a prospectively designed database.

2.6. Statistical analysis

Descriptive statistics for continuous (age) and categorical variables were used for baseline characteristics of enrolled patients. Differences were evaluated by Student *t* test, χ^2 test, Fisher exact test, and McNemar test, whenever appropriate. Multivariate logistic regression was used to compare the 2 risk scores and clinical judgment in respect to the observed events. $P < .05$ (2-tailed) was considered significant.

K statistics was used to evaluate the concordance between the OESIL prognostic scale, SFSR, and clinical judgment. For each risk score and clinical judgment, the sensitivity, specificity, predictive values, and likelihood ratios were calculated.

The following formula provided the number of patients who needed to be admitted to prevent one adverse event according to the different risk scores:

$$\begin{aligned} & (\text{admitted Pt}_{\text{dr}} - \text{admitted PT}_{\text{CJ}}) \\ & \times (\text{Events}_{\text{rs}} - \text{Events}_{\text{CJ}})^{-1} \end{aligned}$$

admitted Pt_{dr} indicates the number of patients admitted by the decision rule; admitted PT_{CJ} , the number of patients admitted by clinical judgment; $\text{Events}_{\text{rs}}$, the number of events found in patients admitted according to the decision rule; $\text{Events}_{\text{CJ}}$, the number of events in the patients admitted by clinical judgment.

3. Results

Of the 492 patients who fulfilled inclusion criteria, 4 were lost at follow-up. The demographic features and clinical characteristics of the remaining 488 patients who met inclusion criteria are summarized in Table 1.

Severe outcomes occurred in 26 patients (5.3%). Death, major therapeutic procedures, and readmission were 5, 19, and 2, respectively. *Major therapeutic procedures* included PM ($n = 13$) and ICD ($n = 1$) implants, CPR ($n = 2$), ICU admission ($n = 1$), and antiarrhythmic therapy ($n = 2$).

Of the 488 patients who came to the ED for syncope, 165 (34%) were admitted (Table 2). Twenty admitted patients had adverse events.

Table 1 Demographic and clinical features of the population studied (N = 488)

Age \pm SD	59 \pm 22	
Sex		
Female	270	55%
Male	218	45%
Comorbidities		
Hypertension	183	38%
Structural heart disease	125	26%
Heart failure	22	5%
Ventricular arrhythmias	8	2%
Cerebrovascular disease	66	14%
Neurologic disease	51	10%
Diabetes mellitus	46	9%
COPD	33	7%
Cancer	40	8%
Index syncope history		
Supine/sitting	116	24%
Upright posture	364	74%
During exercise	8	2%
First episode	215	44%
Trauma	115	24%
Abnormal ECG at presentation	167	34%
Absence of prodromal symptoms	127	26%

COPD, chronic obstructive pulmonary disease.

Table 2 Comparison of the effectiveness of clinical judgment, OESIL risk score, and SFSR in recognizing patients at high risk for short-term adverse events after syncope using McNemar test

	Clinical judgment	OESIL	SFSR	<i>P</i>		
				Clinical judgment/OESIL	SFSR/OESIL	Clinical judgment/SFSR
Sensitivity (95% CI)	0.77 (0.56-0.91)	0.88 (0.70-0.98)	0.81 (0.61-0.93)	.25	.62	1
Specificity (95% CI)	0.69 (0.64-0.73)	0.59 (0.55-0.64)	0.63 (0.58-0.67)	.001	.16	.02
Positive LR (95% CI)	2.45 (1.91-3.15)	2.19 (1.83-2.61)	2.16 (1.73-2.69)	ns	ns	ns
Negative LR (95% CI)	0.34 (0.17-0.68)	0.19 (0.07-0.56)	0.31 (0.14-0.68)	ns	ns	ns
Positive predictive value (95% CI)	0.12 (0.07-0.17)	0.11 (0.07-0.15)	0.11 (0.06-0.15)	ns	ns	ns
Negative predictive value (95% CI)	0.98 (0.97-1)	0.99 (0.98-1)	0.98 (0.97-1)	ns	ns	ns
% of admission (95% CI)	34 (30-38)	43 (35-51)	40 (32-48)	.002	.087	.015

LR indicates likelihood ratio; CI, confidence interval; ns, nonsignificant.

According to the OESIL risk score, 210 patients (43%) would have been admitted (Table 2). Three discharged patients would have had a serious outcome. No discharged patients would have died.

In keeping with the SFSR, 194 patients (40%) would have been admitted (Table 2). None of the discharged patients would have died. Five discharged patients would have had a serious outcome.

The performances of the clinical judgment, OESIL risk score, and SFSR in predicting patients with short-term serious outcomes are compared in Table 2. Sensitivity of the OESIL risk score was higher than those of SFSR and clinical judgment, albeit not significantly (Table 2).

The clinical judgment was more specific than the OESIL risk score and SFSR (Table 2). Accordingly, the percentage of admission was significantly lower for the clinical judgment than for OESIL risk score and SFSR (Table 2). Indeed, to avoid sending home one patient with a serious outcome, the OESIL risk score would have admitted 15 and SFSR 29 more patients compared with the clinical judgment.

Table 3 shows the adverse events in high- and low-risk patients according to the 2 risk scores and to the clinical judgment.

To assess whether risk scores and clinical judgment identify patients with the same risk profile, we evaluated

concordance between the different risk scores and the clinical judgment. Concordance between the SFSR and OESIL risk score was moderate ($K = 0.62$). Concordance between clinical judgment and OESIL was 0.39 and between clinical judgment and SFSR was 0.36, thus markedly lower.

To evaluate whether the decision-making process might improve, we combined each risk score with clinical judgment. It is worth noticing that SFSR and clinical judgment together would have improved the sensitivity to 92%, leading, however, to an increase of admission (admission, 52%). Clinical judgment and OESIL risk score combined would have resulted in the same sensitivity of the single OESIL risk score and in an enhancement of admissions (admission 53%). Therefore, this approach does not provide further advantage.

To better evaluate the risk scores and clinical judgment relationships, we used a multivariate logistic regression considering the 2 risk scores and the clinical judgment as predictors and the events as dependent variables. The SFSR was not associated to a significant increased risk of major events ($P < .22$), thus suggesting its relative uselessness compared to the OESIL and clinical judgment. Conversely, OESIL and clinical judgment were characterized by a significant higher risk of adverse events ($P < .04$ and $P < .01$, respectively). In particular, the probability of developing an adverse event for patients with combined OESIL and

Table 3 Distribution of adverse events between high- and low-risk patients according to the OESIL risk score, the SFSR, and the clinical judgment

		Death	Antiarrhythmic therapy	PM	Readmission	Other	Total
OESIL	Low risk	0	1	0	2	0	3
	High risk	5	1	13	0	4	23
SFSR	Low risk	0	0	3	2	0	5
	High risk	5	2	10	0	4	21
Clinical judgment	Low risk	2	2	0	2	0	6
	High risk	3	0	13	0	4	20

High risk refers to a score of 2 or higher for OESIL, to the presence of at least one of the components of the rule for SFSR, and to the hospital admission for clinical judgment. PM indicates pacemaker placement. "Other" indicates ICU admission (n = 1), CPR (n = 2), and ICD implant (n = 1) (see text).

clinical judgment *low risk scores* was 0.7%, the probability for OESIL low risk score and clinical judgment high risk was 2.8%, the probability for OESIL high risk score and clinical judgment low risk was 4.6%, whereas the probability of a serious outcome for patients characterized by a *high risk profile* according to OESIL and clinical Judgment together was roughly 16%.

Therefore, OESIL risk score and clinical judgment combined seem to improve the decision-making process concerning the identification of high-risk patients who deserve admission. Conversely, adding OESIL risk score and clinical judgment does not provide further advantage compared to the simple OESIL as far as the sensitivity is concerned.

4. Discussion

In the emergency setting, cardiologists and emergency physicians are asked to promptly distinguish syncope that will develop major adverse events in the short-term period from the large majority of low-risk syncope. Risk stratification strategies, based on clinical risk scores [8-10], have been proposed to help emergency physician decision making, particularly whenever the cause of syncope still remains undetermined after patient's first evaluation in the ED [5].

The results of the present study indicate that clinical judgment did not accomplish this aim because of its low sensitivity and the failure to recognize 2 patients who died after having been discharged from ED.

However, either the OESIL risk score [10] or the SFSR [9] still were not characterized by an adequate sensitivity to properly identify patients with syncope that can be safely sent home from the ED, although their sensitivity was higher compared to the clinical judgment. Indeed, according to the OESIL risk score and SFSR, 12% and 19% of syncope patients with potential serious outcome would have been discharged, respectively. In keeping with recent findings [16], the probability of developing a serious adverse event for a patient presenting to ED for syncope is about 6% [16]. Giving the rules negative likelihood ratios, the use of OESIL risk score would reduce the risk to 1%, whereas SFSR would reduce the risk of severe outcomes to 1.9%.

Thus, from the clinical standpoint, decision rules themselves do not seem to entirely resolve the problem of the risk stratification of patients with syncope. Nonetheless, it is noteworthy that application of either of the rules lead to some broad clinical benefit because they both enabled to identify all patients who subsequently died.

Moreover, to better evaluate the risk scores and clinical judgment relationships, we used a multivariate logistic regression considering the 2 risk scores and the clinical judgment as predictors and the events as dependent variables. The results of the present study indicated that SFSR was relatively ineffective compared to the OESIL and clinical judgment. Conversely, OESIL risk score and clinical

judgment combined seem to improve the decision-making process concerning the identification of high-risk patients who deserve admission.

It has to be pointed out that our study is characterized by a composite end point, that is, we considered as *severe outcomes* death, early readmission, and those major therapeutic procedures that might have saved the life of the patient. This approach represents a shift from *diagnosed related* end points, used in previous studies [9,17-20], to *outcome-related* end points used in the present investigation. We consider this a peculiar feature of our investigation because these interventions are likely to be reasonable surrogate markers for the identification of patients who may potentially benefit from hospitalization, whereas a diagnosed-based approach is limited by the difficulty of taking into account all the possible causes of syncope. In addition, in the present study, we excluded patients with clinical conditions primarily confirmed in the ED that would have required hospital admission independently of syncope, such as myocardial infarction, pulmonary embolism, stroke, cardiac arrest, sustained bradycardia, and others, in contrast to previous studies [9,17-20]. We considered this approach appropriate to the goal of assessing the risk scales' capability to identify syncope patients with severe outcomes that were otherwise occult in the ED.

The OESIL risk score and SFSR were characterized by comparable sensitivity and specificity in the short term, although the former prognostic scale was obtained from 1 year follow-up mortality [10], whereas the SFSR [9] was based on the onset of adverse events within 7 days after syncope. However, it has to be pointed out that both scales share risk factors that are related, either directly or indirectly, to a cardiac etiology of syncope such as an abnormal ECG, a history of cardiovascular disease or congestive heart failure, and the absence of prodromal symptoms [9,10]. The crucial role of cardiac abnormalities in worsening syncope prognosis has been long recognized [1-7,12]. Furthermore, a possible relation with a common cardiac etiology of syncope seems to characterize either short-term and 1-year risk factors [16], although in a recent study they have been found to be different [16]. We hypothesize that, regardless of the duration of the follow-up which the 2 risk scales are based on, such a common potential capability to identify a cardiac syncope might account for the similar performance of OESIL risk score and SFSR shortly after syncope.

The SFSR and the OESIL risk score were recently compared in a feasibility pilot single-center study based, however, on a limited number of patients [21]. According to this study, the SFSR showed excellent sensitivity but with an increase in hospital admission. Similarly, the less sensitive OESIL risk score did not miss patients at high risk for severe outcomes and was also unable to reduce hospital admissions. Compared to those findings, we hypothesize that the lower sensitivity observed in the present study for both scales may be accounted for by differences in the number of subjects considered and dissimilarities in the features of that

population (all syncope were considered) compared with our study. Indeed, we did not include syncope associated with major diseases diagnosed in the ED.

Finally, we found that the concordance between the OESIL risk score and SFSR is only moderate ($K = 0.62$). This is not surprising taking into account that the 2 decision rules are based on risk factors that partially differ, thus enabling the identification of populations that are alike but not identical.

4.1. Limitations

The main limitation of the present study deals with the small number of adverse events in our population. This leads to an exceedingly large confidence intervals that in turn limit the differences noted on test characteristics.

Because of the observational nature of the present investigation, emergency physicians did not follow any defined protocol to admit/discharge patients with syncope. The diagnostic strategy and criteria for admission to the hospital reflect the individual experience of the physician in charge of the patient. Thus, the possibility that clinicians might have incorporated either the OESIL or the SFSR into his/her decision-making process (ie, the clinical judgment) could not be ruled out. This latter potential confounder is however unlikely to play a major role in affecting our results. In fact, physicians who made clinical judgment were part of the staff of the ED, did not participate directly to the present investigation, and were blinded to the aims of this study. In addition, it is noteworthy that a survey was later planned to address the overall knowledge and rate of application of the clinical rules by all the physicians who were on duty in the 2 ED that participated in the investigation. We found that only few emergency physicians knew about the OESIL risk score and SFSR. Therefore, the possibility that clinical judgment was critically influenced by the decision rules is highly unlikely.

Because of the paramount importance for the emergency physicians' discharge/admittance decision making, we decided to study only patients in whom the cause of syncope was still undetermined while at the ED. We did not consider syncope associated with major diseases diagnosed in the ED such as myocardial infarction, pulmonary embolism, and stroke. Therefore, the results of the present study should be interpreted within the limitations of this specific frame.

Finally, our definition of *abnormal ECG* was not restricted to the unique presence of *ECG changes at presentation* in the ED, as SFSR did. Indeed, we considered as abnormal any ECG alteration observed when the patient was seen in the ED, independently of the time of the onset of the abnormality. Any documented change in the ECG, if available, was obviously also taken into account. That decision was based on the fact that in the emergency setting, the possibility to rely on previous

ECG is uncommon because the large majority of patients entered the ED without previous clinical records, including the ECG. As a consequence, we did not use the SFSR in its original form. It is noteworthy that our approach could have led to an exceeding sensitivity of the SFSR. However, as above discussed, with the SFSR sensitivity being low in the present study, the overall results are not likely to be affected by these minor modifications of SFSR criteria.

5. Conclusion

The OESIL risk score and the SFSR were partially lacking in recognizing patients with short-term high-risk syncope because of a relatively low sensitivity. However, in contrast from clinical judgment, the application of the decision rules would have identified all patients who subsequently died, thus possibly resulting in some clinical benefit in the emergency setting. Moreover, OESIL risk score and clinical judgment combined seem to improve the decision-making process concerning the identification of high-risk patients who deserve admission.

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