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Implementation of a fast triage score for patients arriving to a low resource hospital in Uganda

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ABSTRACT

Background: The Kitovu Fast Triage (KFT) score predicts imminent mortality from mental status, gait and either respiratory rate or oxygen status. As some non-life-threatening conditions require immediate attention, the South African Triage System (SATS) assigns arbitrary rankings of urgency for specific patient presentations.
Aim: Establish the feasibility of determining and then comparing the KFT score and explicitly defined SATS urgency rankings.
Methods: A computerized proforma used standardized methods of assessing and measuring mental status and gait, and respiratory rate and collected explicitly defined clinical presentations and SATS urgency rankings on 4,842 patients at the time of their arrival to the hospital.
Results: 75 % of patients were awake and able to count the months backwards from December to September. Respiratory rates measured by a computer application had no clustering of values or digit preference; however, oximetry failed in 14 % of patients, making the score based on respiratory rate the most practical in our setting. Determining the SATS acuity ranking and both KFT scores usually took <90 s; the commonest complaints were pain, dyspnoea, and fever, which often occurred together; overall 3574 (73.8 %) patients had at least one of these symptoms as did 96.4 % of those with the highest KFT score based on respiratory rate. 12 % of patients with the lowest KFT score based on respiratory rate had one or more very urgent SATS rankings, 52 % of whom had non-severe chest pain. Only 5.7 % of patients complaining of fever had a temperature >38 °C.
Conclusion: Whilst the KFT score based on respiratory rate could be rapidly determined in all patients, it identified some patients as low acuity who had very urgent SATS rankings. However, most of these patients had non-severe chest pain, which may not be a very urgent presentation in our setting as ischaemic heart disease remains uncommon in sub-Saharan Africa.

African relevance

- In a low resource setting it is feasible to triage patients by mobility, mental status, and either respiratory rate or oxygen saturation. However, before patients are kept waiting, attention must be paid to the severity of their pain, dyspnoea, and bleeding.
- For adult triage, respiratory rate counting by a smartphone application was quicker, easier, and more reliable and available in sub-Saharan Africa than oximetry.
- The commonest presenting symptoms in this sub-Saharan patient cohort were pain, dyspnoea, and fever, which often occurred together.
- Although the South African Triage System recommends that all chest pains receive very urgent attention, this may not be appropriate in areas where this presenting complaint is common, and the prevalence of ischaemic heart disease is still low.

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Introduction

The purpose of triage is to rapidly discriminate patients who need immediate attention from those who can wait to be seen. How long any patient waits to be seen will depend on how many other patients are presenting at the same time. Therefore, even in well-resourced hospitals in high income countries, the treatment of severely ill emergency patients may be delayed when there is overcrowding, and the hospital is too busy.

As part of an ongoing quality improvement project, our group used inpatient data to derive and validate the Kitovu Fast Triage (KFT) score, which awards one point for altered mental status, one point for impaired mobility, and one point for either a low oxygen saturation (i.e., <94 %) or an increased respiratory rate (i.e., >23 breaths per minute). A detailed description of the KFT is provided in our original derivation and internal validation study, in which we found in-hospital mortality increased from 1 % or less for patients awarded zero points to ≥35 % for those awarded the maximum of 3 points [1]. In a study of 8278 ED patients in Switzerland only one out of 5543 patients with zero KFT points died within 24 h and only 1.9 % died within a year [2]. However, some non-life-threatening conditions, such as severe pain, require immediate attention. To address this concern, the South African Triage System (SATS) assigns arbitrary urgency rankings to 39 patient presentations [3]. We have previously reported that none of 6926 patients with a KFT score of zero were rated by SATS as urgent, very urgent, or emergent presentations [4]. However, in that study SATS rankings were determined from chart information recorded by nursing staff, some of which was in free text, which was retrospectively reviewed to ensure the description of each SATS ranking was correct. As the assessments of symptoms such as pain, fever and breathlessness were not explicitly defined, urgency ranking may have been inconsistent and prone to subjective interpretation and bias.

The purpose of this study was to establish the feasibility of determining and then comparing the KFT score and SATS urgency rankings using a computerized proforma, which forced the patients' mental status, mobility, oxygen saturation, respiratory rate, presenting symptoms and signs to be explicitly defined and ensured that each record was complete and generated contemporaneously with the arrival of the patient to hospital.

Methods

Setting

This prospective observational study was part of an ongoing audit process and performed in the combined emergency (ED) and outpatient department (OPD) of Kitovu Hospital, which has 248 beds (50 medical and 35 surgical) and is located near Masaka, Uganda, 140 km from the capital city of Kampala. It is a private not-for-profit (PNFP) hospital, accredited by the Uganda Catholic Medical Bureau.

Most emergency medical care is provided by recently qualified doctors (i.e., within 3 years of graduation) assisted by clinical officers (i.e., non-physician clinicians). The ED and OPD, which care for all patients attending the hospital except those attending the obstetric department, are located beside each other, sharing a common entrance. The ED is open 24 h a day, and the OPD from 9 am to 5 pm. During the day the combined departments are staffed by at least two clinical officers and a doctor, and at night one doctor is first on-call and supported by two others who are second and third on-call.

Participants and study process

Participants were all non-pregnant patients who presented between 31 August 2022 and July 4 2023, between 9 am and 5 pm when the OPD and ED are most busy [5]. The nurse on duty, stationed at the hospital entrance, used a bespoke audit computer program (Supplemental Figure 1), which captured each patients' mental status, mobility, oxygen saturation, respiratory rate, presenting symptoms and signs at the time of hospital arrival. The computer program recorded the time taken to enter patient data, which could not be recorded until it was complete. The data fields of the program varied according to what had already been entered; for example, patients with a stable independent gait could not be in coma or those in coma answer questions. After all the required data was entered, it was linked to hospital's electronic medical records system (*Medicaudit Uganda Ltd)* and stored on the hospital's IT server.

Mobility on presentation was defined as a 'stable' independent gait, 'needing help', or arriving by 'stretcher'. Patients 'needing help' included all those who were unsteady on their feet, needed a walking stick or other aid to steady themselves, or other help to walk. However, it did not include those with a leg injury, who were stable using crutches and able to move independently. Mental status was defined on a continuum from 'not breathing' (i.e., either a cardiac or respiratory arrest), to 'fitting', 'coma', 'drowsy', or 'awake'. For patients who were awake the ability to answer questions was determined by the ability to count the months of the years backwards from December to July [6]; 'can answer questions' was defined as counting back correctly to September.

Respiratory rates were counted by the *RRate* app [7], which calculates the respiratory rate within 16.2 SD 8.1 s from the interval between taps on a smartphone screen [8]. Oxygen saturation and heart rate were measured by the Acc U Rate CMS 500D finger oximeter (CMS Mobility, Stafford, USA), which required 30 to 60 s to provide a stable reading [9]. Patient temperatures were measured from February 21st, 2023 using the FDIR-V22 non-Contact Infrared Thermometer (Famidoc Technology Co., Ltd. Dongguan, P.R.China). Pyrexia was defined as a temperature >38 °C, based on the UK National Early Warning Score (NEWS) criteria [10].

Pain was assessed subjectively and objectively. Mild pain could be ignored by patients; moderate pain could be ignored except when aggravated by certain circumstances; severe pain caused severe distress and could not be ignored in any circumstances. As there is no single word in the Ganda language that captures breathlessness, it was determined by two questions: 'Does your breathing require more work" and "Is your breathing uncomfortable" [11]. Objective signs of dyspnoea were audible adventitious breath sounds (e.g., wheezing etc.), the use of accessory muscles, and inability to complete a single sentence in one breath. All patients complaining of fever were asked about 'fatigue', 'anorexia', 'headache', 'muscular aches', 'feeling hot', 'feeling cold', and 'rigors' [12].

We combined and re-defined some of the original SATS AMBER presentations, which were those deemed to require very urgent attention (Supplemental Table 1). All severe injuries, including head injuries, road traffic accidents, burns, overdoses, and poisonings were combined, so that any one of them would place a patient in an AMBER category. We defined 'severe dyspnoea' as audible breath sounds and/or the inability to complete a sentence in a single breath and/or the use of the accessory muscles of breathing; 'focal neurology – acute stroke' was defined as a 'suspected stroke' and 'diabetic ketoacidosis' as 'diabetes with a respiratory rate >23 bpm'. An AMBER ranking was also awarded to any severe pain, any bleeding, and any chest pain.

Statistical methods and data analysis

Histogram inspection [13] compared the quality of respiratory rate recordings with those made on patients aged >12 years age who presented to hospital from 31st August 2021 to July 3rd, 2022. Two versions of the KFT score were calculated, both awarded one point if patients were unable to answer questions, and one point if there was not a stable, independent gait. KFTr awarded one point for respiratory rate > 23 breaths per minute (bpm), and KFTo awarded one point for an oxygen saturation < 94 %.

Data was interrogated using Microsoft Excel and Epi-Info version 6.0 (Centre for Disease Control and Prevention, USA). The C-statistic of

discrimination for hospital admission was determined by the method of Hanley and McNeil [14]. Numeric variables were compared using ANOVA and Student's *t*-test. The p-value for statistical significance was 0.05.

Ethics

Ethical approval for the study was obtained from the Scientific Committee Kitovu Hospital. The study conforms to the principles outlined in the Declaration of Helsinki.

Results

During the study 14,170 patients presented to the hospital and 1305 (9.2 %) were admitted of whom 537 (41.1 %) were medical and 768 (58.9 %) surgical patients; 57 (10.6 %) medical and 18 (2.3 %) surgical patients died while in hospital. Of these patients, 4842 (34.2 %) patients aged 44.8 SD 20.3 years (range 13–109 years) were evaluated on arrival; 153 (3.2 %) were admitted and 13 (8.5 %) died within 19 days of hospital admission (median 4, IQR 2–8 days). On average, patient evaluation took 86.4 s (median 86.4, IQR 86.4–172.8 s) and oximetry failed in 689 (14.2 %) patients; 3634 patients were able to answer questions, 3624 had a stable independent gait, and 3921 has a respiratory <=23 breaths per minute (Table 1).

Prior to the study respiratory rates were recorded on only 483 (3.8 %) of the more than 12,721 patients aged >12 years who presented to the hospital, and these were slightly but significantly faster than those measured by the RRate app during the study (21.2 SD 5.5 versus 20.4 SD 5.2, $p = 0.001$). Unlike respiratory rates recorded prior to the study, the histogram of those generated by RRate had a smooth distribution with no clustering of values or digit preference (Supplemental Figure 2).

The KFTo could only be determined in 4153 patients because of oximetry failure. The KFTr score awarded zero points to 2875 (59.4 %), one point to 975 (20.1 %), two points to 604 (12.5 %), and three points to 388 (8.0 %) patients (Supplementary Table 2), whereas the KFTo score awarded zero points to 65.1 %, one point to 18.9 %, two points to 14.4 %, and three points to 1.7 % of patients (Supplementary Table 3). Therefore, KFTr identified fewer patients with zero points (odds ratio 0.78, 95 %CI 0.72–0.86, $p < 0.0001$) and more with ≥ two points than KFTo (odds ratio 1.34, 95 %CI 1.20–1.50, $p < 0.0001$). However, the correlation coefficient between the KFTr and KFTo was 0.91, their C-statistics for admission were not statistically different (0.797 95 % CI 0.754–0.840 versus 0.788 95 % CI 0.739–0.838, p 0.79), and the overall agreement between the two scores was 80.6 % with an 89.5 % agreement for those with zero points (Table 2).

The commonest presenting complaints were pain in 3307 (68.3 %) patients, fever in 1321 (27.3 %) patients, and dyspnoea in 819 (16.9 %) patients. These three complains often occurred together (Fig. 1); overall 3574 (73.8 %) patients had at least one of them as did nearly all (96.4 %)

Table 2
Comparison of the Kitovu Fast Triage Score based on respiratory rate (KFTr) with the KFT score based on oxygen saturation (KFTo).

	KFT score based on oxygen saturation. (KFTo)				
KFT score based on respiratory rate.(KFTr)	0 points	1 point	2 points	3 points	Total
0 points	**2418**	54	0	0	2472
1 point	284	**562**	12	0	858
2 points	0	167	**319**	21	507
3 points	0	0	266	**50**	316
Total	***2702***	***783***	***597***	***71***	***4153***
Agreement	*89.50 %*	*64.10 %*	*53.40 %*	*70.40 %*	*80.60 %*

Table 1
Summary of the characteristics, including South African Triage System (SATS) very urgent AMBER rankings, of all patients according to the Kitovu Fast Triage score based on respiratory rate (KFTr). More detailed results on both versions of the KFT score are provided in Supplemental Tables 2 and 3; *n* = number of patient presentations; bpm = beats of breaths per minute; GI = gastrointestinal.

KFTr	ZERO points (%)		ONE point (%)		TWO points (%)		THREE points (%)		Total (%)	
n	2875		975		604		388		4842	
Oximeter failure	403	*(14.0 %)*	117	*(12.0 %*	97	*16.1 %*	72	*18.6 %*	689	*14.2 %*
Age (years)	40.5 SD 17.0		46.3 SD 21.1		56.3 SD 23.8		55.5 SD 23.5		48.8 SD 20.3	
Respiratory rate (bpm)	18.4 SD 2.5		21.5 SD 5.4		22.3 SD 6.0		32.8 SD 9.5		20.6 SD 6.1	
Admitted	22	*(0.8 %)*	23	*(2.4 %)*	55	*(9.1 %)*	53	*(13.7 %)*	153	*(3.2 %)*
Male sex	1109	*(38.6 %)*	372	*(38.2 %)*	253	*(41.9 %)*	143	*(36.9 %)*	1877	*(38.8 %)*
Died in hospital	1	*(0.0 %*	2	*(0.2 %)*	5	*(0.8 %)*	5	*(1.3 %)*	13	*(0.3 %)*
KFTr components										
Respiratory rate >23 bpm	0	*(0.0 %)*	336	*(34.6 %)*	197	*(32.6 %)*	388	*(100.0 %)*	921	*(19.0 %)*
Able to answer questions	2875	*(100.0 %)*	653	*(67.0 %)*	106	*(17.5 %)*	0	*(0.0 %)*	3634	*(75.1 %)*
Fitting or coma	0	*(0.0 %)*	0	*(0.0 %)*	14	*(2.3 %)*	16	*(4.1 %)*	30	*(0.6 %)*
Stable independent gait	2875	*(100.0 %*	658	*(67.5 %)*	91	*(15.1 %)*	0	*(0.0 %)*	3624	*(74.8 %)*
Symptoms and Signs										
Pain as a presenting complaint	1803	*(62.7 %*	697	*(71.5 %)*	489	*(81.0 %)*	318	*(82.0 %)*	3307	*(68.3 %)*
Symptoms of fever	590	*(20.5 %*	269	*(27.6 %)*	257	*(42.5 %)*	205	*(52.8 %)*	1321	*(27.3 %)*
Subjective or objective dyspnoea	157	*(5.5 %)*	214	*(21.9 %)*	153	*(25.3 %)*	295	*(76.0 %)*	819	*(16.9 %)*
Diabetes	140	*(4.9 %)*	64	*(6.5 %)*	52	*(8.6 %)*	25	*(6.4 %)*	281	*(5.8 %)*
Diabetes with a respiratory rate <=23 bpm	140	*(4.9 %)*	42	*(4.3 %)*	41	*(6.8 %)*	0	*(0.0 %)*	223	*(4.6 %)*
Suspected fracture	0	*(0.0 %)*	4	*(0.4 %)*	32	*(5.3 %)*	11	*(2.8 %)*	47	*(1.0 %)*
Vomiting	93	*(3.2 %)*	60	*(6.2 %)*	92	*(15.2 %)*	86	*(22.2 %)*	331	*(6.8 %)*
Any other complaint	898	*(31.2 %)*	198	*(20.3 %)*	31	*(5.1 %)*	6	*(1.5 %)*	1133	*(23.4 %)*
SATS very urgent AMBER rankings										
Objective dyspnoea	43	*(1.5 %)*	137	*(14.1 %)*	116	*(19.2 %)*	280	*(72.2 %)*	576	*(11.9 %)*
Severe pain	60	*(2.1 %)*	121	*(12.4 %)*	198	*(32.8 %)*	191	*(49.2 %)*	570	*(11.8 %)*
*Non-severe chest pain only **	177	*(6.2 %)*	60	*(6.2 %)*	19	*(3.1 %)*	6	*(1.5 %)*	262	*(5.4 %)*
Bleeding from any site	56	*(1.9 %)*	21	*(2.2 %)*	53	*(8.8 %)*	37	*(9.5 %)*	167	*(3.4 %)*
All severe injuries, burns and poisoning	1	*(0.03 %)*	8	*(0.8 %)*	40	*(6.6 %)*	17	*(4.4 %)*	66	*(1.4 %)*
Diabetes with a respiratory rate >23 bpm	0	*(0.0 %)*	22	*(2.3 %)*	11	*(1.8 %)*	25	*(6.4 %)*	58	*(1.2 %)*
Suspected stroke	0	*(0.0 %)*	0	*(0.0 %)*	27	*(4.5 %)*	24	*(6.2 %)*	51	*(1.1 %)*
Pleurisy – pain on breathing	7	*(0.2 %)*	4	*(9.4 %)*	4	*(0.7 %)*	2	*(0.5 %)*	17	*(0.4 %)*
Any SATS AMBER condition	339	*(11.8 %)*	331	*(33.9 %)*	347	*(57.5 %)*	336	*(86.6 %)*	1353	*(27.9 %*
Admitted to hospital	8	*(0.3 %)*	9	*(0.9 %)*	39	*(6.5 %)*	47	*(12.1 %)*	103	*(2.1 %)*

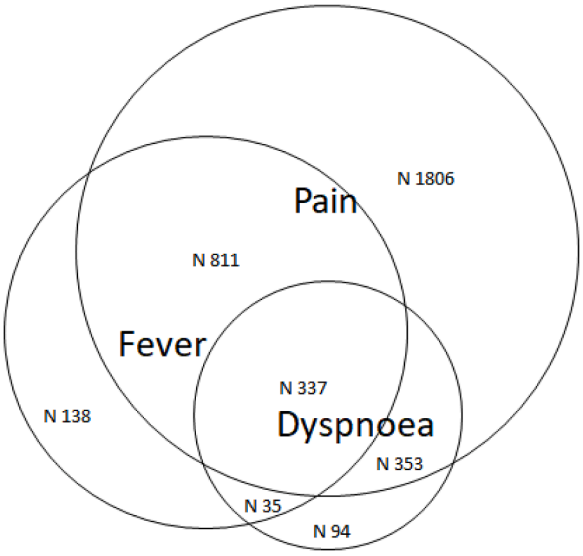

Fig. 1. A Venn diagram of the relationship between pain, fever, and dyspnoea, the three commonest presenting complaints. *N* = patient number.

of the patients with the highest acuity (i.e., three KFTr points); 1.7 % patients with zero points had all three, increasing to 37.6 % of patients with three points.

Nearly one in five (17.2 %) patients with pain complained of severe pain, ranging from 2.1 % for those with zero KFTr points to 49.2 % for those with three points. The abdomen was the most frequent site of pain, accounting for 61.0 % of all pains complained of by patients with a KFTr score of zero, 18.8 % with a score of one, 11.8 % with a score of two, and 8.4 % of those with a score of three. Most patients complaining of dyspnoea (70.4 %) had at least one objective sign (i.e., audible breath sounds, inability to complete a sentence, or use of accessory muscles), which ranged from 1.5 % for patients with zero KFTr points to 72 % for those with 3 points. The commonest symptoms reported by patients complaining of fever were fatigue (87.5 %), anorexia (64.3 %), and headache (58.3 %); 801 patients (60.8 %) complained of feeling hot or cold or rigors (Supplemental Tables 2 and 3).

For the 2081 patients on whom it was measured, a temperature >38 °C was observed in only 36 (5.7 %) of 632 patients complaining of fever, six (0.4 %) of the 1449 patients not complaining of fever, and in none of the 292 patients who complained of feeling cold. However, the frequency of a temperature >38 °C increased as the KFTr score increased for every other symptom of fever apart from feeling cold, reaching more than 28 % for patients with three KFTr points who complained of feeling hot (Fig. 2).

No patients died within 24 h of admission and only three patients with a KFTr score below 2 points died; one patient with a score of zero died intra-operatively, two patients with a score of one died, one 14 days after admission from alcoholic liver disease and the other 19 days after admission from liver cancer. The only SATS emergency (RED flag) presentations were three patients with fits. However, out of the entire study population of 4842 patients, 1353 (27.9 %) had at least one AMBER condition, 339 (25.1 %) of these patients scored zero KFTr points and these patients made up 11.8 % of all zero-point patients (Table 1). However, only 8 (2.3 %) of these patients were admitted to hospital and one died two days after admission during surgery for a rapidly expanding goitre. For patients with a KFTr score of zero the commonest AMBER complaint was non-severe chest pain with no other AMBER complaint, none of whom died in hospital (Fig. 3). KFTo produced similar results, except that more patients with objective dyspnoea and diabetes with an increased respiratory rate scored zero points (Supplemental Table 4 and Supplemental Figure 3).

Discussion

We found that in our setting it is feasible to use of the KFTr to rapidly discriminate patients who need immediate attention from those who can wait to be seen. However, before patients are kept waiting, attention must be paid to the severity of their pain, dyspnoea, and any bleeding. Oxygen saturation measurement failed in 14 % of patients, whereas respiratory rate measurement by the RRate app was quicker, easier, and more reliable. The commonest patient symptoms were pain, dyspnoea, and fever, which often occurred together. Although only 5.7 % of

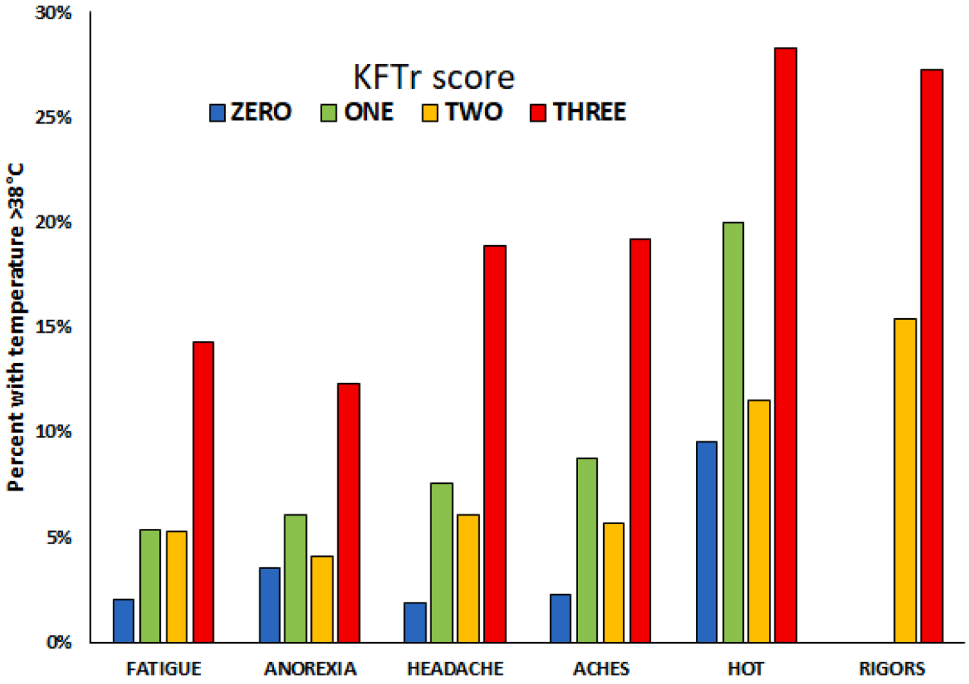

Fig. 2. The relationship between pyrexia (i.e., temperature >38 °C) and the symptoms of fever. 'Feeling cold' was not included, as no patients with this symptom had pyrexia. KFTr = Kitovu Fast Triage score based on respiratory rate.

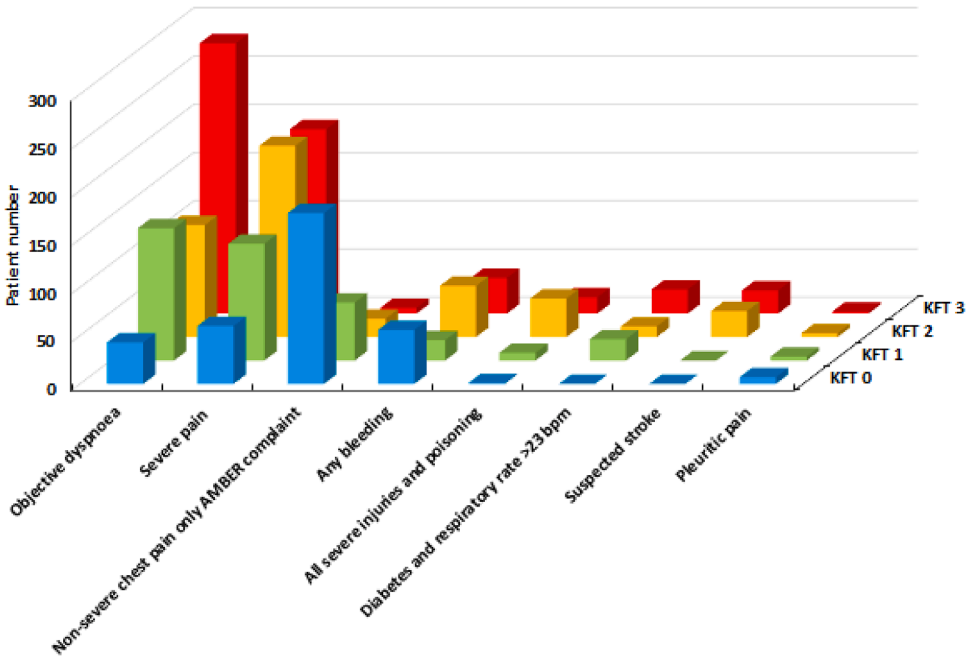

Fig. 3. SATS very urgent AMBER complaints by Kitovu Fast Triage Score based on respiratory rate (KFTr). The commonest AMBER complaint for patients with KFTr zero points was non-severe chest pain with no other AMBER complaint; bpm = breaths per minute.

patients with fever had pyrexia (i.e., a temperature >38 °C), the frequency of pyrexia increased as the KFTr score increased.

Although the performance of both the KFTo and KFTr were comparable, the difficulty obtaining oximetry made the KFTr score more practical. Although it is possible that other oximeters might have a lower failure rate [9], respiratory rate detected more patients with objective dyspnoea and may help detect metabolic acidosis. The RRate app was selected for its speed and ease of use compared with other breath counters [15] and for its established accuracy in adults in our setting [8]. Despite its importance, respiratory rate has consistently been found to be the least frequently measured and accurately recorded vital sign. Estimation and digit preference, lack of understanding and knowledge, and not valuing its clinical significance are common [16]. The histogram of the relatively small number of respiratory rates recorded prior to this study showed an irregular distribution with clustering of rates and digit preference, which suggests that there was patient selection and that some values were estimated rather than measured or were otherwise biased [13]. The Month of the Year Backwards Test has been proposed as a fast method to rule it out inattention and delirium [17], and we found it to be an easy, rapid, practical, and objective method of assessing mental status.

In our previously reported study, of the 6926 presenting patients ranked for urgency by SATS, none of the 5430 (78.4 %) patients with a KFTo score of zero were rated as urgent, very urgent, or emergent presentations [4]. In contrast, this study found that 11.8 % of patients with a KFTr score of zero had a SATS AMBER presentation, and these patients represented 25.1 % of all AMBER flag presentations. This may be explained by our consistent and explicit definitions of severe pain and dyspnoea. However, 52.2 % of very urgent AMBER presentations with a KFTr score of zero were non-severe chest pain with no other AMBER complaint, which accounted for 67.6 % of all those with non-severe chest pain, whereas only 2.3 % had a KFTr score of three. Despite claims that its prevalence is increasing, ischaemic heart disease is still uncommon in sub-Saharan Africa [18]. Local Ugandan medical opinion considers that the most likely cause of non-severe chest pain is gastritis or indigestion, and a study in Tanzania found that very few patients considered chest pain to be an emergency or associated it with heart disease [19]. Therefore, it is questionable if non-severe chest pain should be considered a very urgent AMBER ranking in our setting.

Previously we found that between 23rd November 2020 and 30th March 2021, 58.0 % of patients with two KFT points and 87.4 % of patients with three points were admitted to hospital, compared to only 9.1 % of patients with two points and 13.7 % of those with three points in this study. There is no clear explanation for this decline in admissions, except that hospital attendances dropped dramatically during the study period probably because of economic hardship experienced throughout Uganda towards the end of the COVID-19 pandemic, and many high acuity patients in this study refused hospital admission for financial reasons.

Limitations

This study was performed in a single centre and there was no follow-up of patients after hospital discharge, many of whom may have died. We only analysed patient presentations and did not analyse separately patients who attended repeatedly. As the study was based on information that could be easily obtained from patients when they first presented to hospital, the amount and detail of information collected was limited. Although the KFT score has been externally validated in Switzerland [2], it has not yet been validated elsewhere in sub-Saharan Africa. Therefore, it may not be applicable to all clinical settings. As several SATS urgency ranking presentations were not observed during the study (Supplemental Table 1), some special populations in need of time critical treatment, such as penetrating injuries, were not included and might possibly be missed by the KFT score.

Conclusion

In a low resource setting the KFT assessment of mobility, mental status, and respiratory rate combined with patients' presenting complaint could be a rapid, practical first part of the triage process. Most patients with very urgent SATS rankings and a low KFT score had non-severe chest pain, which may not need urgent attention in our setting as ischaemic heart disease is still uncommon.

Dissemination of results

Results from this and previous studies were shared with doctors and nurses working on our hospital, and they were encouraged to continue to make constructive criticisms and suggestions on how to further implement our findings to improve the delivery of care.

Authors' contributions

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: JV, IN, and JN contributed 60 %; JK 30 %; and HK and SN contributed 5 % each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

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Declaration of competing interest

John Kellett is a founder and major shareholder of Tapa Healthcare DAC, a start-up medical software company. The other authors have no conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.afjem.2024.01.001.

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