



## Original Article

# The mortality of acutely ill medical patients for up to 60 days after admission to a resource poor hospital in sub-Saharan Africa compared with patients of similar illness severity admitted to a Danish Regional Teaching Hospital – An exploratory observational study



Barbara Nabayigga<sup>a</sup>, John Kellett<sup>b,\*</sup>, Mikkel Brabrand<sup>c</sup>, Martin Otyek Opio<sup>d</sup>

<sup>a</sup> Medical Wards, St. Joseph's Kitovu Health Care Complex, Masaka, Uganda

<sup>b</sup> Thunder Bay Regional Health Sciences Center, 980 Oliver Road, Thunder Bay ON P7S 7A5, ON, Canada

<sup>c</sup> Department of Medicine, Sydvestjysk Sygehus, Esbjerg, Denmark

<sup>d</sup> St. Joseph's Kitovu Health Care Complex, Masaka, Uganda

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## ABSTRACT

**Background:** The outcomes of patients with the same severity of illness in the developed and developing countries have not been compared. Illness severity can now be measured anywhere by the National Early Warning Score (NEWS).

**Methods:** An exploratory observational study that compared the 7, 30 and 60 days mortality of 195 Ugandan and 588 Danish acutely ill medical patients that had a NEWS >6 at the time of their admission to the hospital. The association of vital sign changes, alertness and mobility at admission on subsequent outcome was explored.

**Results:** More Kitovu (34.4%) than Danish patients (22.1%) died within 60 days of admission (OR 1.85, 95% CI 1.27–2.71,  $p$  0.001). However, the survival of non-comatose patients admitted without severely deranged vital signs or who were able to stand without help was identical in both cohorts (Chi square 0.32,  $p$  0.57): these patients made up 50% of all Ugandan and 60% of all Danish patients. In contrast the survival curves of patients admitted in a coma were widely divergent within a week of hospital admission and remained so for a further 60 days (Chi square 10.29,  $p$  0.001).

**Conclusion:** This small hypothesis generating observational study with huge selection and treatment bias found no survival difference at 60 days after admission to resource rich and resource poor hospitals for patients without severely deranged vital signs or who were able to stand without help.

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## 1. Introduction

Hospital outcome comparison studies are frustrated by a number of factors, which include variation in patient populations, case-mix variation, hospital admission criteria, treatment given prior to or during the admission process, as well as the selection process for different facilities within the hospital such as intensive care, coronary care, etc [1]. Several predictive and prognostic scoring systems, such as APACHE, SAPS, etc, have been developed [2]. However, their use requires time as well as laboratory and other resources. Therefore, it is usually only practical and affordable to apply them to a small proportion of hospital admissions. None of these scores are suitable for use in a resource-poor hospital in a developing country. As a result up until now there have been no studies that directly compare the outcomes of patients with the same severity of illness admitted to hospitals in the developed and developing countries.

We have previously reported that the 30 day in-hospital mortalities of Ugandan and Canadian patients with low values of an early warning score were identical and that Ugandan patients with a high score had lower in-hospital mortality than Canadian patients [3]. The weakness of this study was lack of patient follow-up after discharge: many Ugandan patients with a high score left hospital early because they could not afford to stay longer and probably many of them died shortly after their discharge. The external validation of the National Early Warning Score (NEWS) [4] and its closely related fore bearer ViEWS in several different clinical settings, including the developing world [5–11], now provide a cheap reliable universal tool for assessing severity of illness that can be accurately calculated on a computer spreadsheet anywhere. In this exploratory observational study we compare the 7, 30 and 60 days mortality of Ugandan and Danish acutely ill medical patients that had a NEWS >6 at the time of their admission to hospital. This unfunded study was only possible because in Denmark the deaths of every citizen are recorded in the Danish Person Registry. We could only get ethical approval to use the vital signs and mobility data collected for a previously reported study [12]. Other patient data was not made

\* Corresponding author. Tel.: +1 807 684 6030; fax: +1 807 684 5894.  
E-mail address: [jkkellett@eircom.net](mailto:jkkellett@eircom.net) (J. Kellett).

available to us. It could, therefore, only explore the possible influence of vital sign changes, alertness and mobility on the subsequent outcomes of both patient cohorts.

**2. Methods**

This unfunded exploratory hypothesis-generating observational study compared the mortality up to 60 days after admission to hospital of Ugandan and Danish patients who had a NEWS >6 when admitted to hospital. It also explored the possible influence of vital sign changes, alertness and mobility on subsequent outcome. Danish data had already been collected as part of another study [12] and was, therefore, retrospective. Ugandan patient data was collected prospectively. The two patient populations, therefore, are entirely different and the only certain common attribute they had in common was a NEWS >6 on admission to hospital.

St. Joseph’s Kitovu Health Care Complex has 220 beds and is located near Masaka, Uganda, 140 km from the capital city of Kampala. Together with the 330 bed Masaka Regional Referral Government Hospital, it serves Masaka Municipality (population of 79,200) and Masaka District with a rural population of 804,300. The hospital has no intensive care unit and the medical ward has 46 beds. Mechanical ventilation, invasive monitoring and renal replacement therapy are not available. The main reasons for admission are malaria, respiratory tract infections including community acquired pneumonia and tuberculosis, diarrhea, HIV/AIDS, as well as heart failure, diabetes and hypertension. The ward is staffed by one consultant physician, one doctor in training and three fully qualified nurses during the day from Monday to Friday, and by one fully qualified nurse and two student nurses at nights and at the weekend.

From 18th November 2013 to 16th December 2014 the NEWS of all acutely ill patients over 12 years of age admitted to the hospital’s medical ward was calculated by the principal investigator using an Excel spreadsheet. Provided either the patient or their relative(s) could be contacted either directly (i.e. lived locally) or by mobile phone, all patients with a score >6 were entered into the study. The patient’s age, vital signs, oxygen saturation, use of supplemental oxygen, mental status, ability to stand with or without help, length of stay and clinical status at 7 days, 30 and 60 days after admission were recorded.

The Hospital of South West Jutland is a 450-bed regional teaching hospital with all subspecialties of internal medicine present and a 12-bed intensive care unit. The Acute Medical Unit receives all adult medical patients (age 15 and older) admitted from general practitioners, outpatient clinics, ambulance services or emergency departments. The hospital serves a population of approximately 220,000. Denmark has a free universal health care for all residents. The Acute Medical Unit is staffed by two consultants, a senior physician in training and two junior physicians around the clock. All patients admitted through the Acute Medical Unit from October 2008 through February 2009 and February through May 2010 had their admission vital signs and their ability to stand without help determined by a registered nurse [12]: 588 (13%) of the 4480 patients admitted had a NEWS >6. After discharge the survival status of these 588 patients was extracted from the Danish Person Registry in which all Danes are followed-up [13]. The study was approved by the Danish Data Protection Agency.

The prospectively collected data from Kitovu patients was compared with the retrospective Danish data. Patients were not taken off oxygen if they were already on it to measure oxygen saturation. Coma was defined as not being aroused by voice [14]. Being unable to stand without help was defined as an inability to get into bed without assistance. All calculations were performed using Epi-Info version 6.0 (Center for Disease Control and Prevention, USA) or OASIS Online Application for the Survival Analysis software available at <http://sbi.postech.ac.kr/oasis/surv/> [15]. The *p* value for statistical significance was 0.05 and was tested using Student’s *t*-test and Chi square analysis that applied Yates continuity correction. Kaplan–Meier survival curves were compared by the log-rank test, and censoring was used to account for

missing data. The ethical approval of the study granted by the Ethics Committee Kitovu Hospital and waived by the Regional Ethics Committee for Southern Denmark as approval of observational register studies is not required by Danish law.

**3. Results**

Only patients with a NEWS >6 on admission were included in this study. During the study period 200 patients with a NEWS >6 were admitted to Kitovu Hospital. The final study population was 195 as five patients were lost to follow-up (four were discharged within 2 days and one after 5 days). None of the 588 Danish patients admitted with a NEWS >6 were lost to follow-up. No data was missing on any of the patients in either cohort.

Forty Kitovu and two Danish patients were HIV + ve. Fewer Kitovu (42.6%) than Danish (51.7%) patients were of male gender (odds ratio 0.69, 95% CI 0.49–0.97, *p* 0.03). The proportion of patients admitted in a coma was the same in both cohorts – 8% of Kitovu and 7% of Danish patients (*p* 0.92). More Kitovu (72.3%) than Danish (62.4%) patients were unable to stand without help (odd ratio 1.57, 95% CI 1.09–2.28, *p* 0.02). Fewer Kitovu (18.5%) than Danish (61.9%) patients were given supplemental oxygen (odd ratio 0.14, 95% CI 0.09–0.21, *p* < 0.00001).

The age distribution of patients in the two cohorts was markedly different: half of the Kitovu patients were under 46 years of age compared with only 51 (9%) of Danes. The length of hospital stay of both cohorts was the same. The mean blood pressure, breathing rates, temperatures and oxygen saturations of the two patient cohorts were statistically different (Table 1). Although the mean NEWS of both cohorts was the same there were considerable differences in how the scores were

**Table 1**  
Comparison of continuous variables in Danish and Kitovu patients: NEWS = National Early Warning Score, AbEWS = abbreviated National Early Warning Score, calculated without including points for altered mental status, bpm = beats or breaths per minute, mmHg = millimeters of mercury.

	Kitovu (n 195)	Denmark (n 588)	<i>p</i>
Age (years)	47.2 SD 23.3	69.4 SD 15.3	<0.00001
Median	46	72	
Quartile	25–70	62–80	
Range	12–96	16–107	
Heart rate (bpm)	108 SD 19	105 SD 24	0.11
Median	108	104	
Quartile	96–120	91–119	
Range	52–152	35–213	
Systolic blood pressure (mmHg)	109 SD 33	129 SD 30	<0.00001
Median	104	128	
Quartile	92–122	107–146	
Range	0–228	49–250	
Breathing rate (bpm)	32.1 SD 8.4	26.5 SD 7.4	<0.00001
Median	28	26	
Quartile	28–36	22–31	
Range	16–66	5–56	
Temperature (°C)	36.7 SD 1.5	37.3 SD 1.3	<0.00001
Median	36.6	37.2	
Quartile	35.8–37.8	36.5–38.3	
Range	32.0–40.0	33.4–40.5	
Oxygen saturation (%)	90.9 SD 10.7	89.5 SD 7.3	0.04
Median	93	91	
Quartile	90–97	88–94	
Range	0–99	51–100	
NEWS	8.71 SD 1.86	8.77 SD 1.88	0.70
Median	8.0	8.0	
Quartile	7.0–10.0	7.0–10.0	
Range	7.0–15.0	7.0–16.0	
AbEWS	8.22 SD 1.72	8.06 SD 1.94	0.31
Median	8.0	8.0	
Quartile	7.0–9.0	7.0–9.0	
Range	4.0–14.0	4.0–14.0	
Length of hospital stay (days)	4.9 SD 3.8	4.6 SD 9.5	0.67
Median	4	2	
Quartile	3–6	1–6	
Range	0–31	0–389	

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