

Use of Image Processing to minimize ICU transfer delays in Sri Lanka

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Abstract— The delay encountered when transferring a critical patient from a hospital ward to an Intensive Care Unit (ICU) is one of the ongoing problems encountered in the Sri Lankan health sector. ICU transfer delays have a significant impact on a critical patient's condition as it often increases mortality. There are several factors that cause ICU transfer delays. This paper discusses ICU transfer delays, the problems associated with delays and the use of Image Processing to minimize delays. Additionally, a review of similar applications and identification of theories, tools and techniques relevant to the area of study has been assembled.

Keywords—ICU, delays, transfers, patient mortality, image processing.

I. INTRODUCTION

A. A brief history of ICUs

Critical care medicine has been built on the foundation that patients with severe illnesses are better managed when they are kept together in a separate location looked after by a dedicated team of healthcare givers. The earliest recorded instance of critical care medicine was in 1854 when Florence Nightingale separated the critically wounded soldiers of the Crimean war into a separate area in the hospital, resulting in a reduction of mortality from 40% to 2% [1]

The early ICUs were staffed by physicians who primarily specialized in anesthesiology or internal medicine. Majority of these ICU units were open and the patients were managed by their primary admitting physicians. However, as ICUs evolved it was realized that ICU patients had similar complications and that in closed units all patients could be managed by a team of specially qualified intensive care physicians and nurses [2]. This concept resulted in better care and better outcomes for patients.[3]

In Sri Lanka, the first ICU was established in 1968 at the General Hospital Colombo [4]. At present there are over 100 government funded ICUs in the island

with the highest number seen in Colombo with 32 units, while Kandy comes in second with 13 units Fig.1

Table 4.03: The distribution of selected ICU factors/characteristics by ICU category

Authority	Critical care unit		Functioning Beds		Ventilators		Admissions (September 2011)		Deaths (September 2011)	
	No.	%	No.	%	No.	%	No.	%	No.	%
General ICU	40	41.7%	189	38.3%	201	43.7%	1198	38.1%	221	43.6%
Medical ICU	12	12.5%	66	13.4%	62	13.5%	384	12.2%	108	21.3%
Surgery ICU	11	11.5%	63	12.8%	68	14.8%	443	14.1%	82	12.2%
Neurosurgery ICU	6	6.2%	29	5.9%	21	4.6%	101	3.2%	25	4.9%
Paediatric ICU	4	4.2%	16	3.2%	10	2.2%	87	2.8%	9	1.8%
Obstetric ICU	2	2.1%	6	1.2%	4	0.9%	53	1.7%	1	0.2%
Coronary Care Unit	2	2.1%	15	3.0%	2	0.4%	179	5.7%	15	3.0%
Intensive CCU	1	1.0%	9	1.8%	1	0.2%	100	3.2%	6	1.2%
Oncology ICU	3	3.1%	14	2.8%	11	2.4%	79	2.5%	7	1.4%
HDU	2	2.1%	16	3.2%	4	0.9%	92	2.9%	1	0.2%
Cardiothoracic ICU	5	5.2%	29	5.9%	36	7.8%	211	6.7%	8	1.6%
Accident Service ICU	2	2.1%	9	1.8%	9	2.0%	52	1.7%	12	2.4%
Neurology ICU	1	1.0%	6	1.2%	5	1.1%	17	0.5%	5	1.0%
Neurotrauma ICU	4	4.2%	22	4.5%	21	4.6%	105	3.3%	27	5.3%
Cardiac ICU	1	1.0%	5	1.0%	5	1.1%	43	1.4%	0	0.0%
Missing	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	96	100%	494	100%	460	100%	3144	100%	507	100.0%

(Fig.1. Distribution of ICUs in Sri Lanka-National Intensive Care Surveillance -2012)

ICUs can be categorized into types based on the specialty they provide as not all ICUs are suited for each medical requirement. Although Sri Lanka occupies these different ICU types the numbers found in specialty units are drastically low (National Intensive Care Surveillance,2012). There are only a very limited number of ICUs available for certain categories such as Cardiac and Neurology. Therefore, it is understood that these limited resources must be used in an optimum manner to bring about the best outcomes.

B. Overview of Delays in ICU Transfers

At present a problem encountered in the healthcare industry is the delay taken to transfer critically conditioned patients into intensive care units. When the number of patients in need of ICU beds exceed the number of available beds, the critically ill patient will not be receiving the required specialty care and will be forced into the circumstance of waiting for ICU bed availability [5].

It can be said that delays in ICUs occur frequently as ICU beds are often a limited resource, that does not