



Service Priorities and Programmes Electronic Presentations

Convention ID: 1179

Submitting author: Dr King Chung Kenny Chan

Post title: Consultant, Tuen Mun Hospital, NULL

How Many More ICU Beds We May Need? – A Statistical Answer Using Resampling

Chan KC(1), Chan CH, Shum HP(2), Kwan WM(1), Yan WW(2)

(1) Department of Anaesthesia and Intensive Care, Tuen Mun Hospital, HKSAR (2) Department of Intensive Care, Pamela Youde Nethersole Eastern Hospital, HKSAR

Keywords:

Intensive Care

Service Planning

Introduction

Planning for ICU-bed provision, with a statistical confidence level, required the average number of critically-ill patients, their average ICU length of stay (LOS), and the fluctuation/variance of these two parameters. The actual ICU bed occupancy would under-estimate the variance, as ICU could never exceed its full capacity. With an under-estimate, the predicted ICU bed requirement would be inaccurate, with a tendency of under estimation.

Objectives

Estimate the bed requirement to cover 97.5% of time, by resampling of admission/discharge entries in 2014, for the two busiest ICUs in HK (~1600 admissions/year each)

Methodology

We assumed that the chance of an ICU admission was roughly identical in a period of four weeks before and after a certain date. Based on this assumption, a computer simulation of ICU admissions was performed as if the year 2014 happened again. In brief, we pooled patients admitted on a particular date in 2014, and those admitted on the same day of week in the previous four and subsequent four weeks. Then patients were randomly selected from the pool to simulate ICU admission on that particular date. A mechanism (not described here) was in place to handle the public holidays. The hourly ICU occupancy was calculated using the actual ICU LOS of the selected patient. Re-sampling for the whole year was repeated 200 times to provide the estimates required.

Result

The actual medians of ICU occupancy were 82% and 77%. They were close to that obtained using resampling (77% and 77%). As predicted, the distributions of the actual occupancy were skewed to left, indicating a negative bias on the variance estimates. The observed standard deviations of the two ICUs' occupancy were 11.5% and 8.6% respectively. After resampling, the distributions became more symmetrical, and had higher standard deviations of 18.9% and 16.9% (both $p=0.000$).

The 97.5 percentile occupancy in reality were 95% and 92%, while that from resampling were significantly higher at 118% and 112% (both $P=0.000$). This corresponded to three or four additional ICU beds in each ICU. In conclusion, using a simple and conservative assumption, resampling could provide valuable insight for ICU bed planning.