Best versus the Rest : Comparing Hospitals *Graphically*

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Introduction

Aims

- In assessing and improving **Quality in Healthcare**, we often compare numbers of events, e.g., falls or deaths, across hospitals and/or wards, using a variety of statistical methods, including **graphical ones**[1-7].
- To apply two statistical methods to compare mortality data between hospitals.

Methodology

- **Publicly-available** summary mortality data of **acute stroke patients** (between 1995-1997) from five anonymous UK hospitals were included in this analysis[2-3].
- Method 1/ **Chi-square**[7] (overall test)
- Method 2/ **Funnel plot**[1-2,4-6], compares each hospital to overall mean of these five hospitals, using 95% and 99.7% 'control limits' above and below the mean.

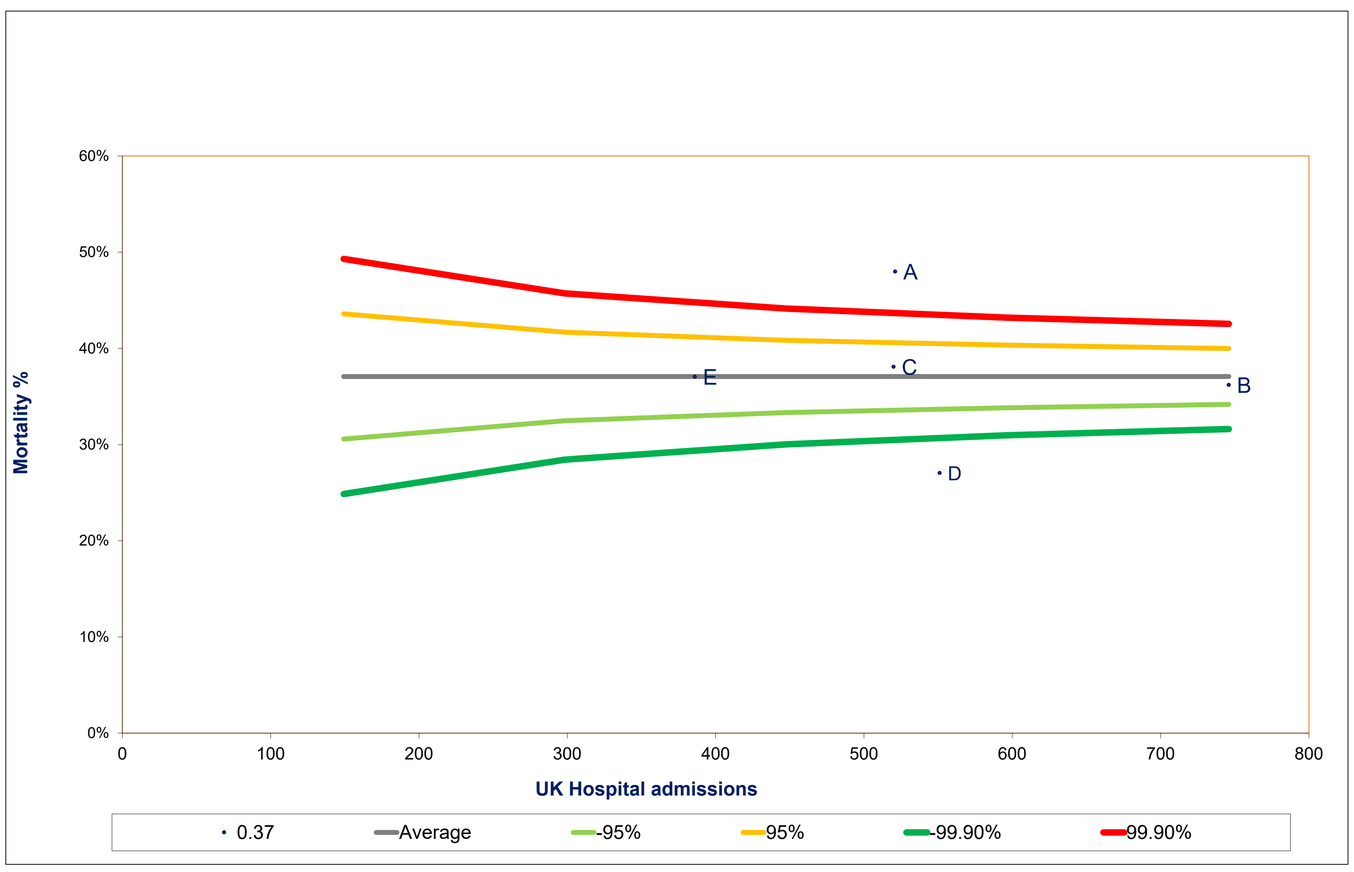
Results and Discussion

Chi-square test

UK Hospital	A	B	C	D	E	Total
Died	250	276	198	149	143	1016
Admissions	521	746	520	551	386	2724
Mortality %	48.0	37.0	38.1	27.0	37.0	37.3

Overall, mortality significantly differs across the 5 hospitals, chi-square (df = 4) = 50.3, $p < 0.001$

Funnel Plot



Hospitals **ordered** by admissions. Fewer admissions = less precise / wider control limits, chart looks like a ***'funnel'*** on its side

Hospital **A** is ***above*** the upper 99.7% control limit*, Hospital **D** is ***below*** the lower 99.7% limit*

- 99.7% = three standard deviations from average/mean of the five hospitals
- 95.0% = two standard deviations from average/mean of the five hospitals

Conclusions

Both methods reach the same conclusions regarding mortality. While **chi-square** is a widely-used method for overall comparisons, **funnel plots** allow visual comparison of individual hospitals with the overall mean. The latter technique takes hospital size into account and can readily be applied to risk-adjusted data[6]. **Therefore, funnel plots should be used more often in comparative studies in healthcare.**

Method 1/ ***IBM SPSS 29*** Method 2/ ***QI Macros for Excel 2023***

References: [1]https://fingertips.phe.org.uk/profile/guidance/supporting-information/PH-methods [2]https://www.perceptualedge.com/articles/visual_business_intelligence/variation_and_its_discontents.pdf [3]Weir N, Dennis MS (2001) ***Stroke***, 32; 1415-1421. [4]Mohammed MA, Holder R (2012). ***BMJ Quality & Safety***, 21, 529-532. [5]Spiegelhalter D (2005). ***Statistics in Medicine***, 24, 1185-1202. [6]Hoogevorst LA et al (2023). ***J Shoulder and Elbow Surgery***, 32, 59-67. [7]Sielkas A (2021). ***PloS one***, 16, e0256267.