The Efficacy of Determining Abnormal Financial Indicators by Using Control Charts in a Hospital

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Introduction
With the rapid advancements in information technology, hospital cost accounting department has been implemented. Cost, revenue, and cost information are collected and analyzed each month in the hospital. These time-series data is collected and stored in the hospital's information system.

Therefore, the use of information statistics modules can efficiently and quickly pick up the specific targets, and we will make an exception analysis and review. This is an important issue in the hospital's financial management.

Objective
Our research is to implement an information module to reduce tedious and subjective detection work, and the module uses (1) detecting abnormal financial accounts, (2) summarizing monthly financial reports, and (3) determining cost-effectiveness by using the system's dynamic method.

Methods
To determine the cost of the last period (the period) whether the department's costs were significantly above or below expectation, and shows the past 13 months' data as (2)≥2.0. Using Excel's XnR/Visual Basic for Applications, we programmed an Excel XmR detection to automatically (1) report the time-series database report, (2) detect the outliers, and (3) archive the information drawings (Tables 1).

The detection of outliers is using the XmR average as the centerline (CL) of control chart, and control the upper limit (Upper Control Limit, UCL) and control line of the lower limit (Lower Control Limit, LCL) are identified on the difference between up and down standard deviations from the centerline. The outlier can quickly be detected by the data control chart as (2)≥2.5 and p<0.5.

Normal regression analysis is taken by each cost, department contribution and department revenue, and the correlation coefficient among each cost, department contribution, and department revenue is gotten. And it will be a reference for the department cost analysis. When the department contribution correlation coefficient is very small (r=0.60), it indicates that many (or large amounts) of the costs and revenue are canceled out in synchronized movements (Figure 1).

Results and Conclusion
The Excel VBA module is established by the control chart, the financial statements of 29 main hospital departments is analyzed by 3 standard deviations. The ratio of abnormal outlier is about 15 % per month. And by the chi-square distribution, the P-value of outlier is 0.22. The bubble chart illustrates the structure differences among these departments.

The simulation shows the system can save the cost of over US 2.5 million as using 10 weeks. The simulation shows the use of manual work load will be greater than the present system, and the speed is slower than the system. This model need 7 persons per week, day by manual operation, but just need 911 person per week day by using the system. The simulation also show the system can pick out abnormal number of an accurate positive rate of more than 70%. We suggest that the use Excel employees are familiar with its excellent to generate summarized financial reports monthly and avoid abnormal accounts with the criterion of (2)≥2.0 from thousand and million collection items of a hospital. The application of control chart for summarizing financial reports is recommended to hospital managers for improvements in selection and cost-effectiveness evaluation.