探討台灣外傷系統之設計-資料探勘分析法於健康資料庫之應用

Explore the Design of a Trauma System in Taiwan－The application of data mining to existing health databanks

中文摘要

背景：台灣地區每年因事故傷害死亡之人數達上萬人，且高居第四或第五大死亡原因。因衛生署中央健康保險局之資料，每年外傷病患之醫療申報費用共達 147 億，平均每天花費四仟萬元。本研究之主要方向爲探討台灣地區嚴重外傷病患之重要死亡影響因子，並藉由決定樹分類法(decision tree classifier)以及邏輯迴歸分析法(logistic regression analysis)來探尋院前轉送、外傷嚴重度、醫療費用與治療結果間之相互關係。期望能提出有效的策略來改善現有外傷醫療，以及建立外傷系統。

方法：民國 89 年 7 月 1 日至 90 年 12 月 31 日間，經由中央健康保險局之重大外傷病患之資料與長庚林口醫學中心之外傷登錄資料結合。共收集 550 位重大外傷病患，其平均外傷嚴重度指數(Injury Severity Score, ISS)爲 21.6 ± 0.3。男女比爲 3.4 比 1，平均年齡爲 41.5 ± 0.9 歲。急診檢傷分類第一級爲 242 人，第二級爲 245 人，第三級爲 63 人。平均住院日數爲 25.2 ± 1.2 天，範圍爲 1 至 227 天。死亡人數共 87 人，死亡率爲 15.8%。至第三級照護外傷中心之前，到院延遲時間，依 1 與 4 小時，分爲立即(immediately)，早期(early)與晚期(late)三種型態。依到院前各級醫療院所之治療紀錄，分爲直接(direct)，間接(indirect)與延遲(delayed)轉送三種型態。數值均以 mean ± SEM，以 t 檢定來檢驗連續變數，並以卡方檢定來檢驗級距變數。並採用商用資料探勘軟體 Index Miner 中之 C4.5 分類法，以及 SPSS 10.0 之邏輯迴歸分析模式來分析，其有意義值定爲 $p< 0.05$。

結果：本研究使用兩種以上分析法均能有效完成危險因子之分析。其中外傷嚴重度指數達 25 分或以上最具意義，且與改良式外傷指數(Revised Trauma Score, RTS)同時出現於兩種分析法中。年齡 55 歲或以上，簡易外傷指數(Abbreviated Injury Score, AIS)於頭部、腹部與體表傷害達 5 分，以及間接或延遲轉診等各種因子，均能有意義地使嚴重外傷病患死亡率提高。直接轉送死亡率最低達 12.3%。如果 550 位嚴重外傷病患均能直接轉送至第三級照護之外傷中心，將可節省 13%住院日數，以及 15%醫療費用。

結論：本研究爲國內首次結合健保申報資料與外傷登錄來分析外傷死亡影響因子。兩種分析法其功能爲互補，且分析結果也與其他的研究報告吻合。結合以上兩種資料，針對病患之死活，本研究對外傷嚴重度與醫療費用，均提出有意義建議，應可提供政府作爲外傷醫療政策改善的參考。並且十分清楚地得到嚴重外傷病患，應避免間接與延遲轉送；而應於受傷後最短時間內抵達三級醫療之外傷中心，以降低死亡率。因此我們建議台灣應建立完整的外傷醫療系統，以期能有效

降低外傷死亡率與醫療資源浪費。

英文摘要

Background: In Taiwan, injury remains a major disease with ten-thousand trauma death annularly. The injured patients consumed NT$ 14.7 billion per year, or an average of NT$ 40 million per day in Taiwan. The primary interest of this study was to identify the most significant influencing factors on mortality of patients with severe injury, and through the decision tree classifier and logistic regression analysis to identify the relationships between the pre-hospital transfer, injury severity, medical expenditures; and their outcomes. Then a recommendation to identify the most efficient strategies for organizing the delivery of acute trauma care was made, and the design of trauma system can be suggested.

Methods: From July 1, 2000 to December 31, 2001, using the merged data from the BNHI and the Linkou CGMH, 550 major trauma patients with a mean ISS of 21.6 ± 0.3 were studied. The blunt forces have caused more than 95% of injuries in our major trauma patients. The male to female ratio was 3.4 to 1, and the mean age was 41.5 ± 0.9 years. The category of ED triage of those severe injured patients was III in 63, II in 245, and I in 242. The mean length of hospital stay was 25.2 ± 1.2 days, ranged from 1 to 227 days. The overall mortality rate was 15.8% (87/550). The time lag prior to arrival at a definitive trauma institute was categorized into three types, as immediate (<1hour), early (1-4 hours), and late (> 4 hours) transfer after injury. The prior utilization of medical facility was also categorized as direct, indirect, and delayed types of transfer. Data was expressed as mean ± SEM. Student's t-test was used to compare the continuous variables, and the Chi-square test was used to compare the categorical variables. The influencing factors on trauma mortality were studied by two methods: (1) a C4.5 decision tree classifier from a commercial data mining tool, Index Miner, (2) forward stepwise logistic regression model performed by using the SPSS statistical package (Release 10.0, SPSS Inc., Chicago, IL). Statistical significance was considered at $p < 0.05$.

Results: This research shows that the decision tree and logistic regression are both effective for the factor analysis. The ISS 25 or greater were found most significant, and then followed by the RTS over both analytic methods. Patients with a age of 55 or greater (OR=3.3), a head injury with an AIS score of 5 (OR=13.1), an abdominal injury with an AIS score of 5 (OR=26.2), an external injury with an AIS score of 5 (OR=66.9), an indirect transfer (OR=3.7), and a delayed transfer (OR=2.9), would significantly encounter a worsening prognosis after sustaining a severe trauma. Patients with similar injury severity received the direct, indirect, and delayed transfer and resulted in 12.3%, 19.5%, and 14.7% mortality rate, respectively. If all

the major trauma patients were directly transferred to the tertiary trauma care center, 13% of hospitalization days and 15% medical expenditures could be saved. Conclusion: This study is the first to use the data of medical claims and trauma registry to analyze the factors affecting trauma outcomes in Taiwan. These two analytic methods are complementary and reasonable models for outcome prediction for this study. Linking trauma registries with medical claims data provides much significant information about injury severity, outcome, and medical expenditures to this study. This data linkage offers the opportunity for improving our trauma care, provides data for government for further policy making.

This study distinctly shows that only the avoidance of the indirect and delayed transfer and transfers the patients to the appropriate tertiary trauma center in the shortest time can decrease the mortality after injury. We conclude that implementation of an organized system of trauma care can result in a measurable decrease in trauma mortality and effective utilization of the medical resources.