

Refined Taylor series expansion-based prediction of the overall survival for non-small cell lung cancer patients of clinical stage IIIA-N2 after various treatments : Taiwan population-based study of 2655 cases from 2010 to 2017



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Purpose :

The overall survival prediction for non-small cell lung carcinoma (NSCLC) patients of clinical IIIA-N2 stage undergone various treatments was investigated through a refined Taylor series expansion algorithm. The model was created according to a population-based study in Taiwan. The proposed prediction algorithm is based on the well-known hit and target model adopted for analyzing the cell death from the microscopic viewpoint. It also implies the application of the Taylor series expansion to the population-based survey dataset.

Materials and Methods :

In the proposed algorithm, the basic degradation of a patient's health is represented via a specific function comprising a single exponential term $\exp(-\alpha t)$. The refined algorithm successfully predicted NSCLC IIIA-N2 patients' overall survival rate. A total of 127301 patients were collected from 2010 to 2017. Then, 2655 patients were recognized as effective events and classified into eight classes according to various medical treatments, namely surgical operation, radiotherapy, and chemotherapy.

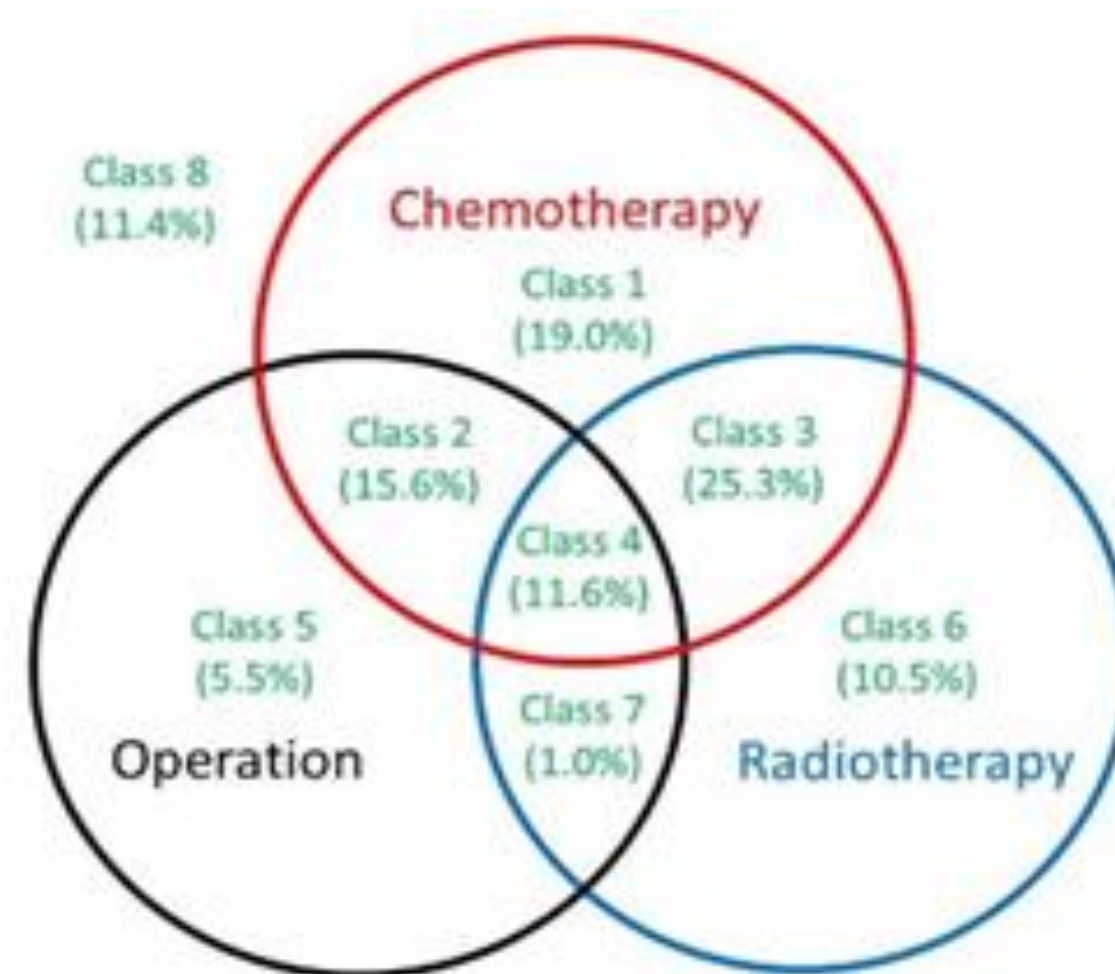


Fig. 1. NSCLC IIIA-N2 patients classified into eight classes and categorized by three major medical treatments: surgical operation, chemotherapy, and radiotherapy as well.

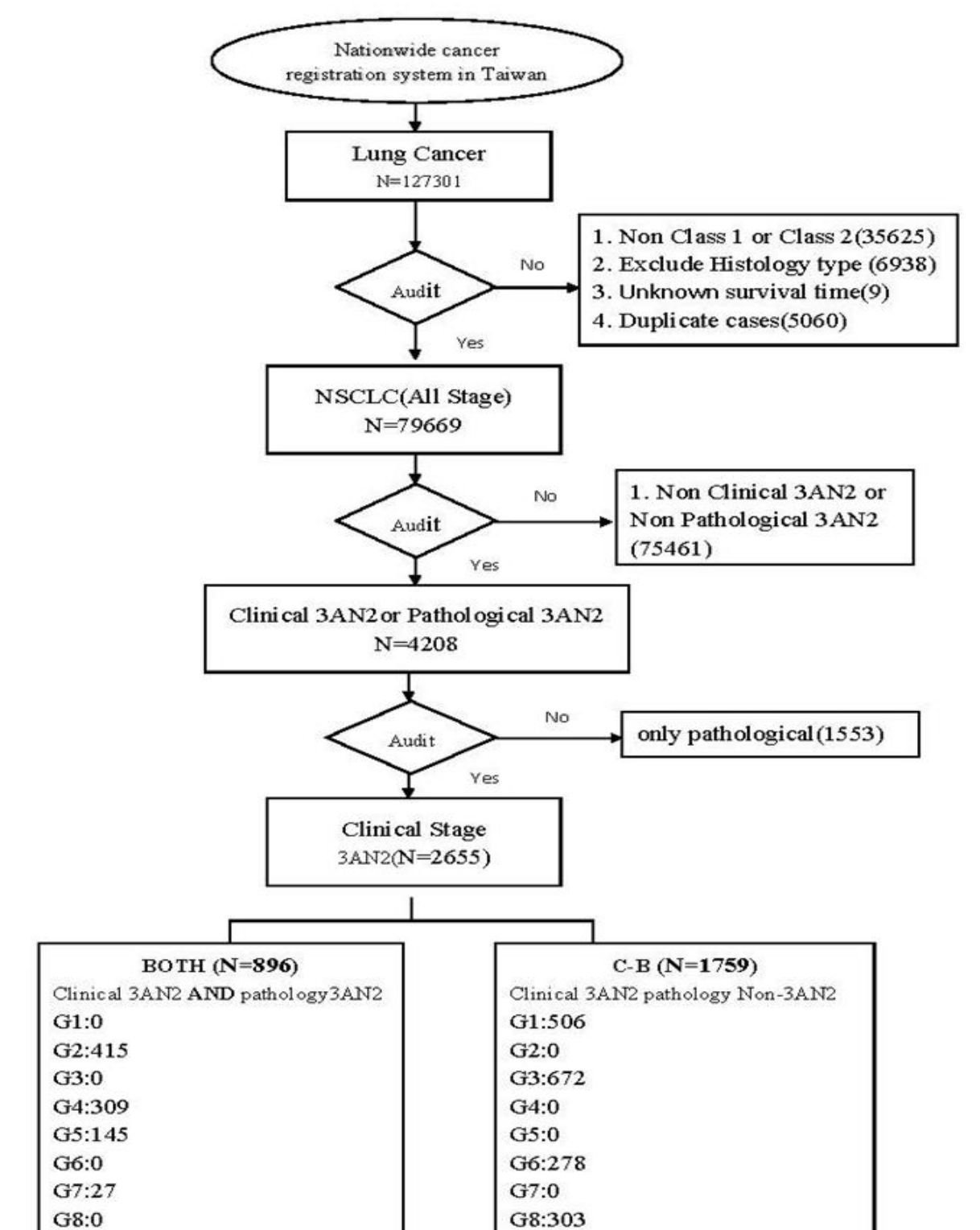


Fig. 2. The flowchart of sorting the data collected from 2010 to 2017 in Taiwan.

Results :

The breakdown of the overall survival of NSCLC IIIA-N2 patients in Taiwan by eight classes corresponding to specific treatments and their combinations. The refined algorithm correctly foreseen the overall survival with the lethal frequency prediction. For each class of patients, the average life was evaluated, according to Taylor's expansion algorithm, and the average derived life range spread from 3.51 to 7.81 years. An index of life gain with specific treatment was defined according to the Taguchi optimization analysis. The life gains provided by the surgical operation, chemotherapy, and radiotherapy were 2.74, 1.18, and 0.48 years.

Conclusion :

The surgical operation was the most beneficial treatment, which is in concert with recommendations of European experts. A similar finding was also reflected in four out of eight classes, which included the surgical operation in the treatment plans of most Taiwanese hospitals..

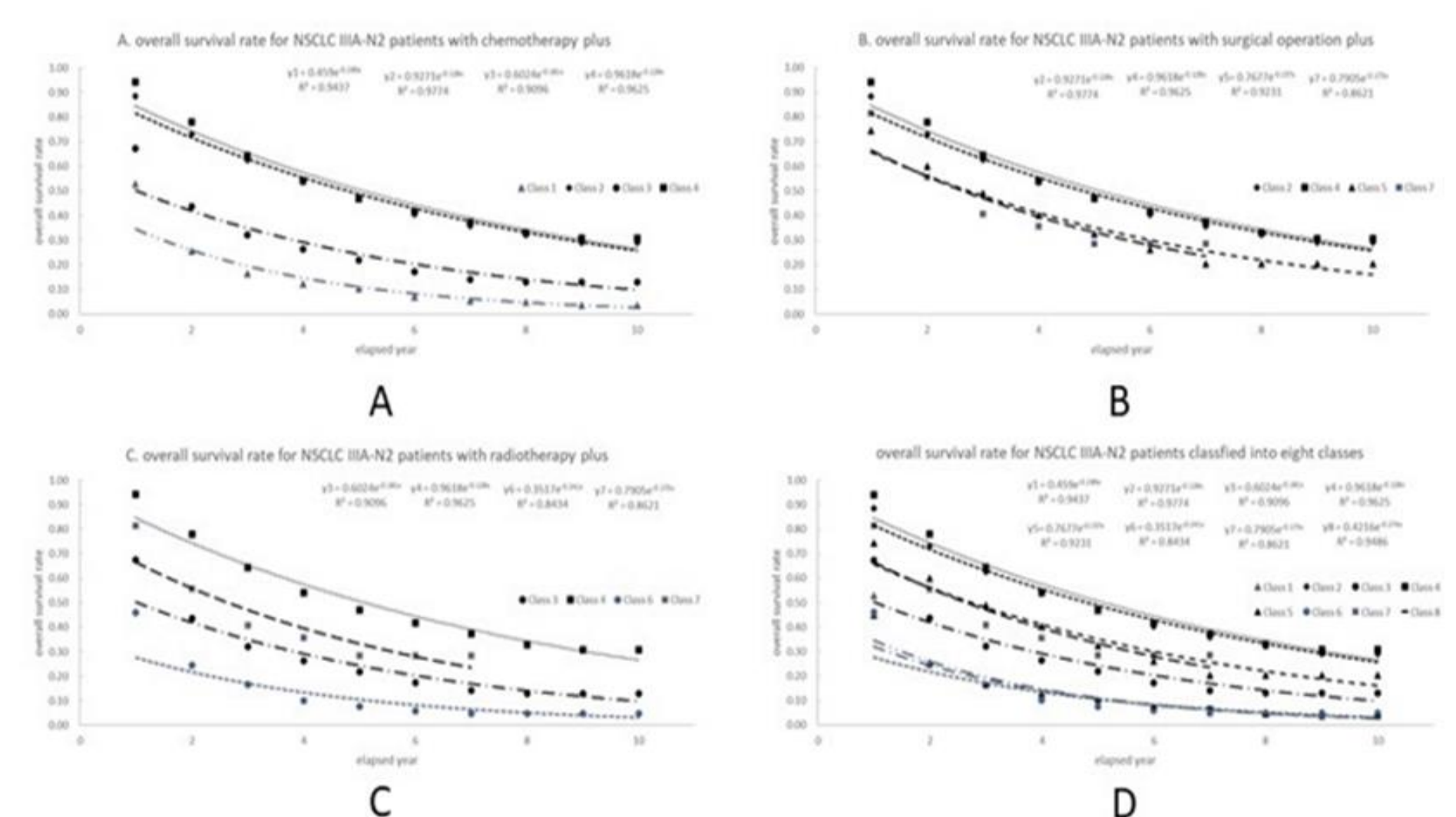


Fig. 3. (A) classes with chemotherapy plus, (B) classes with surgical operation plus, (C) classes with radiotherapy plus, and (D) all eight classes in this work.