A Novel and Dynamic Prediction Engine for Practicing Precision Medicine to Prevent Chemotherapy-Induced Nausea and Vomiting

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Abstract

Cancer remains the second major cause of death in the United States over the last decade. Chemotherapy is a core component of nearly every cancer treatment plan. Chemotherapy-Induced Nausea and Vomiting (CINV) are the two most dreadful and unpleasant side-effects of chemotherapy for cancer patients. The consequences of CINV include: (1) impaired life quality, (2) poor social life, (3) burden on economy due to loss of workdays, (4) increased healthcare cost, and (5) denial of chemotherapy due to unendurable CINV. There are three clinical guidelines (ASCO, NCCN, and MASCC/ESMO) for the management of CINV. Several patient-specific factors affect the risk of CINV. However, none of the guidelines consider those factors. Not all of patients have the similar emetic risk of CINV. Despite the improvements in CINV management, as many as two-thirds of chemotherapy patients still experience some degree of CINV. As a result, physicians use their personal experiences for CINV treatment, which leads to inconsistent managements of CINV. The overall objective of this study is to improve the prevention of CINV using precise, personalized and evidence-based antiemetic treatment before chemotherapy. Physicians receive feedback about CINV risks of patients from a CINV decision support system based on patient-specific factors. This objective was achieved by accomplishing clinical innovations through the discovery of combined relationships of various patient-specific factors for causing CINV, and informatics innovations through the development of a novel, precise and dynamic Prediction Engine for practicing precision and personalized medicine in CINV prevention. The approach presented in this thesis can be applied to any other clinical predictions.