

# Using Artificial Intelligence to Mitigate the Side-Effects of Chemotherapy Drugs in Patients at Risk of Heart Failure

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## Abstract

**Background:** Cancer ranks as the second leading cause of death in the United States. Currently, the mortality rate among cancer patients surpasses the rate of successful treatments, a discrepancy significantly attributed to the adverse effects of chemotherapy drugs, notably their cardiotoxicity and hepatotoxicity, alongside the delayed diagnosis of cancer. With the aid of artificial intelligence, researchers have now distinguished cancer patients who, when exposed to chemotherapy drugs, exhibit an elevated risk of heart failure compared with other patients. This advancement marks a significant stride toward enhancing cancer treatment efficacy.

**Method:** This investigation utilized electronic patient records from the California Health Center. It is imperative to note that eligibility requires an initial cancer diagnosis followed by a subsequent diagnosis of heart failure. The dataset spans from 2011 to 2017, encompassing 143,199 cancer patients. Identification of heart failure cases employed the 9<sup>th</sup> and 10<sup>th</sup> editions of the International Classification of Diseases (ICD), while cancer diagnoses were ascertained using matrix codes and the RXnorm for pharmacological classifications. To augment the study's precision, four machine-learning algorithms and two encoding strategies were implemented.

**Results:** The screening process, grounded on specified criteria, identified 1,958 cases and 15,488 controls from the 143,199 patients. The chemotherapy agents most frequently administered were methotrexate (in 1,486 patients), cyclophosphamide (in 1,371 patients), and carboplatin (in 1,275 patients).

**Conclusion:** This study employed four machine learning algorithms to forecast the likelihood of heart failure in cancer patients. Among the 143,199 evaluated patients, we identified 1,958 cases and 15,488 controls. Methotrexate, cyclophosphamide, and carboplatin emerged as the chemotherapy drugs most commonly associated with a heightened risk of heart failure in comparison with control group patients. Furthermore, the analysis revealed that conditions such as high blood pressure during stress, atrial fibrillation, dyspnea, and hyperlipidemia intensify the risk of heart failure.

**Keywords:** Drug toxicity, Heart failure, Cancer, Artificial intelligence

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