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Modeling the dynamics of breast cancer through controlling the side effects of treatment

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Breast cancer is known as a type of malignancy which started from the breast tissue. World-wide, it is the utmost common source of death in women. The main plans in the fight against breast malignancy include radiotherapy, chemotherapy, hormone therapy, and immunotherapy and gene therapy. This work wishes to explore the effects of combined therapy (radiotherapy and chemotherapy) as a technique to cure breast malignancy and dissimilar cures tactics are integrated into the model. Furthermore, the model is fitted to data on patients with breast cancer in Tanzania. The study determines new treatment strategies and finally the results show that when acceptable quantity of chemotherapy and radiotherapy with a low decay rate are used, the drug will be meaningfully more effective in fighting the illness. Although chemotherapy and radiotherapy are effective ways for treating breast cancer, their effectiveness may be lessened to the immune-resistant cells and they may have major side effects due to the damage of normal cells during the treatment. As a result, this work models an optimal chemo-radiotherapy treatment strategy that decreases the amount of cancerous cells while safeguarding that the total harmfulness is below an acceptable limit. The study investigates the existence and stability of the equilibrium points, analytically and numerically. Simulation results of the suggested optimal model are presented and in addition, the incremental cost-effectiveness analysis method is used to determine the most cost-effective strategy. The study determines new treatment strategies and finally the results show that the control measure implementing chemotherapy and radiotherapy treatment is the most efficient and cost-effective. The study recommends that, stakeholders should be more careful on the amount of doses administered that cures the disease and helps to minimize devastating effects related to treatment.