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ABSTRACT. Recent research on Leukemia cancer cells shows that the search for more effective cancer treatments are necessary. Beyond traditional treatments, such as radiotherapy and chemotherapy, combination therapies should be introduced. The importance of further understanding the efficacy of combination therapies has proven to be critical and through mathematical modeling, the optimal dosages and treatment strategies can be clearly defined. To begin, we summarize the potential benefits of radiotherapies, immunotherapies, and chemotherapies. Afterward, we analyze the combination of a chemotherapy and a radiotherapy, modeling in terms of numerical simulation of the system and modifying the necessary and sufficient conditions to ensure a decrease in the rate of infected cells. Utilizing differential equations that are modeled based on certain parameters, we were able to conclude the proficient treatment routines for the combination therapies. Through our analysis, we will have a better understanding of specific dosages and times between treatment installations that prove to be optimal, and understanding which combination of therapies will be most efficient. Through our adjusted parameters and model of infected cancer cells, a conclusion is made regarding a reasonable treatment strategy that can be implemented when two therapies are combined suitably.