

# Correlation of Circulating Tumor Cells with Cancer Stage

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**Background:** Circulating tumor cells (CTCs) are tumor cells that detach from the primary tumor, enter the blood stream, and can create new metastatic cases. Thus, the analysis of CTCs provides useful information for cancer diagnosis and its' development. The present study presents results of CTCs' enumeration at different stages of the disease in several types of cancer.

**Methods:** Blood samples were collected from more than 14000 patients, representing more than 60 different types of cancer. CTCs detected and isolated with Fluorescence Activated Cell Sorting (FACS), evaluated with specific biomarkers for each cancer type, and then enumeration performed with Flow Cytometry. Then, four datasets were created corresponding to four tumor stages for all cancer types. Finally, the averages of CTCs' numbers in the four datasets were estimated and modelled using linear regression.

**Results:** CTCs increase linearly with cancer stage with a correlation coefficient equal to 0.995. Particularly, the mean value of CTCs for all cancer types and for stage I was found  $3.30 \pm 1.30$ , for stage II  $4.40 \pm 1.67$ , for stage III  $5.91 \pm 2.21$  and for stage IV  $6.97 \pm 2.72$ .

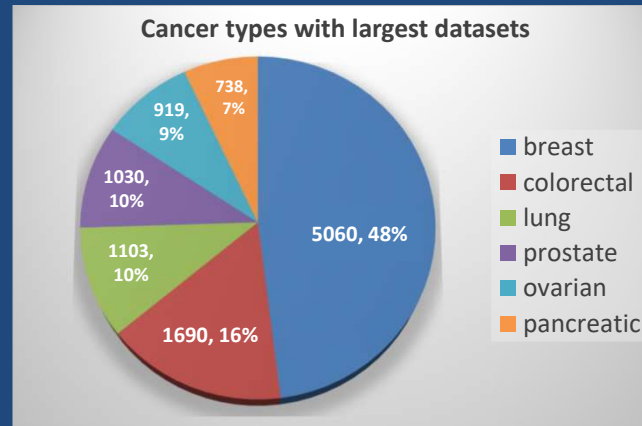


Figure 1. Pie Chart of cancer types with largest datasets. The number of patients and the respective percentage are also shown.

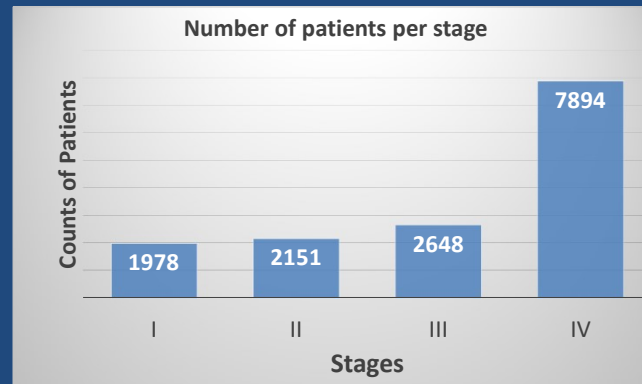


Figure 2. Distribution of patients per stage.

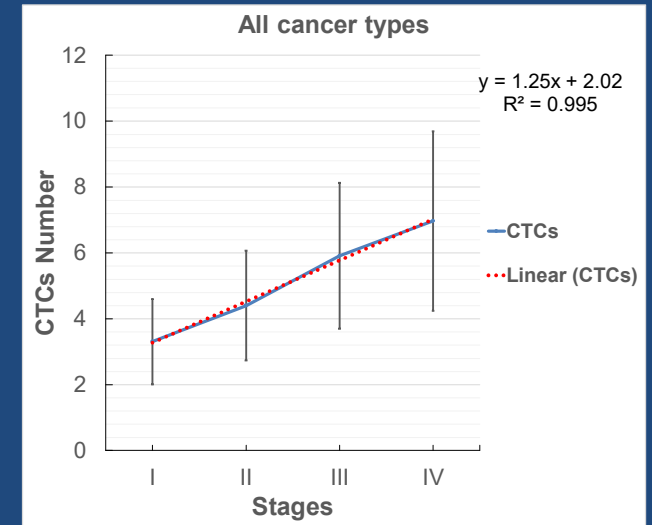


Figure 3. Linear Correlation of CTCs number with Stages.

**Conclusion:** In this study, analyzing large datasets of all cancer types, we demonstrated that CTCs' counts increase linearly with cancer stages. These results are in line with previous conclusions stating that CTCs are correlated with tumor stage and that increased CTCs indicate higher likelihood of metastasis and cancer aggressiveness. Therefore, CTC numbers can indeed be used as useful biomarkers for disease progression, treatment monitoring and prognosis.

**Selected References:**

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**Disclosure of Potential Conflicts of Interest**

None of the authors of the above study has declared any conflict of interest  
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