Correlated Probit Model for Multiple Side Effects in Cancer Radiotherapy

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In the period from 2006 to the beginning of 2008 121 women with cervical or endometrial cancer were followed at Medical Academy - Sofia. Normal tissue is affected as a result of radiation treatment. This leads to different types of normal tissue reactions. In this work we focused on early (starting from the first day of radiotherapy to 3 months after it) skin and early urogenital normal tissue reactions. We were interested in the strength of association between both types of tissue reactions on the one hand and associations between them and genetic factors on the other hand. We used univariate and multivariate statistical models to assess the effects of predictor variables on normal tissue reactions: a separate probit model for each type of reactions and a joint correlated probit model for both type of reactions. We established that there was a relationship between skin reactions and polymorphism XRCC3 codon 241 ($C > T$) and that skin and urogenital reactions were weakly statistically associated. For fitting the correlated probit model we proposed an extension of the EM algorithm. For the implementation of the algorithm we created functions in the free software environment for statistical computing and graphics **R**. We present a simulation study to confirm the reliability of the presented algorithm.