

BINARY RESPONSE MODELS FOR OUTCOME OF PROSTATE CANCER SURGICAL OPERATIONS AMONG MALE NIGERIANS

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ABSTRACT

The goal of this study is to predict how the death of male prostate cancer patients subjected to surgical operation is associated with their prostate specific antigen (*PSA*), *age*, *grade* and *stage* of prostate cancer, and thereby determine the relationship between the likelihood of survival from the disease and other risk factors, using the most parsimonious model. Three logistic regression models were fitted to the outcome of prostate cancer surgical operation data. Model 1 fits all the four predictors, model 2 is a reduced model involving *PSA*, *age* and *grade* as predictors, and is nested in model 1, while model 3 involves *PSA*, *age*, *grade* and interaction term of *age***PSA*. Model 1 gives a deviance value of 144.02 on 116 d.f ($p=0.0399$), model 2 yields a deviance of 145.27 on 119 d.f ($p=0.0511$), while model 3 gives deviance of 0.7293 on 115 d.f ($p=0.7293$). Model 3 appeared to have fitted the data well but none of the predictors including the interaction term is significant in predicting the status patients to undergo surgical operation. The focus is therefore on model 2 for interpretation, which is moderately reasonable and revealed some of the predictors as significant. In fact, the AIC value for model 2 clearly revealed the model as the most parsimonious, compared to the other two models. The results of model 2 revealed that *PSA* and *age* were the two significantly important predictors to the model specification. Surprisingly *grade* made no significant contribution to the model in the presence of other predictors. The results also showed that for a unit increase in *PSA* of patients, the odds of dying from the surgical operation increases by 0.4783 with other variables fixed. Also, the older prostate cancer male patients have higher possibility of dying from the surgical operation of prostate cancer removal compared with the younger males. The odds of dying from prostate cancer surgical operation therefore increased with *PSA* and *age* of patients, so that the two predictors are critical to the survival of patients subjected to surgical operation. Few observations were identified as outliers from the residual plots, but they did not cause much perturbation in the model parameters on omission. Diagnostic evaluation of the model therefore revealed no major problem in the model. The area under the ROC for the three models ranges between 0.77 and 0.79, giving acceptable discrimination of the models. There was an indication of slight overdispersion in the data but does not call for concern. The proposed logistic models are useful in predicting the outcome of surgical operation of male prostate cancer patients; and could be used to generalize for other male Nigerians since genetics and environment have effect on the disease.

KEYWORDS: Prostate-Cancer, Logistic Regression Model, Effect Modifier, Residual Deviance; Receiver Operating Characteristic (ROC) Curve, Akaike Information Criterion