

# Empirical Hazard Rates

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M.C.Jones(1993) showed that the Dirac function can be used to define an empirical density function with the property that its definite integral up to  $x$  equals the empirical distribution function evaluated at  $x$ ,and he showed that,although not directly computable, the empirical density can be used to construct a boundary aware density estimator. In this paper we use the Dirac function to define an empirical hazard rate whose integral equals the Aalen-Nelson cumulative hazard estimator,and we use it to construct a simple boundary aware hazard rate estimator in the case of censored data.Our approach is based on a local polynomial approximation to the empirical hazard rate and also provides estimators of the derivatives of the hazard rate.Rates of convergence of the root mean squared error at boundary and non-boundary points are established and show that the hazard rate estimator is boundary adaptive and that under smoothness conditions the rate of convergence can be made arbitrary close to root  $n$ . Joint asymptotic normality of the estimators of the hazard rate and its derivatives is established.A data driven bandwidth selection procedure is introduced and is illustrated on the Stanford heart transplant data.We use Monte Carlo methods to show that the proposed estimator compares favorably with the Muller-Wang estimator.This is joint work with Jiancheng Jiang.