Dear Editors,

Thank you for considering the manuscript *Bayesian Inference for Cox Proportional Hazard Models with Partial Likelihoods, Semi-Parametric Covariate Effects and*

*Correlated Observations,* by myself, Alex Stringer, Patrick Brown, and Jamie Stafford, for publication in Statistics in Medicine.

Time-to-event data is ubiquitous in the medical sciences, and the combination of the Cox Proportional Hazard Model (Cox PH) with inference via partial likelihood has been the dominant methodology for analysis of such data for nearly 50 years. Current state-of-the-art methodology and software (INLA) cannot be used to fit the most flexible Cox PH models using Bayesian inference, because the use of partial likelihood violates the condition imposed by INLA that observations be independent conditional on the latent variables. Current methods for Bayesian inference for the Cox PH model require the assumption that baseline hazard either has a particular parametric form or is smooth.

In this manuscript, we describe and implement a novel approximate Bayesian inference methodology for the Cox Proportional Hazard model which uses partial likelihood and hence does not require assumptions to be made about the form of the baseline hazard. Our method allows the inclusion of semi-parametric covariate effects and correlated survival times and is of broad potential use in the medical sciences. We achieve this by developing a framework which retains the flexibility and computational advantages of INLA but can accommodate models that do not satisfy its conditional independence restriction. We demonstrate the advantages of our proposed method over both INLA and frequentist methods through a simulation study and analyses of two datasets on Leukemia survival and kidney infection times.

We believe *Statistics in Medicine* is the most appropriate journal for our work because of its influence in the quantitative medical sciences, where we expect our approach to make the strongest positive impact.

With thanks,

Ziang Zhang Alex Stringer Jamie Stafford Patrick Brown

PhD Candidate PhD Candidate Professor Professor