

# Software for the joint modelling of longitudinal and survival data: the **Joiner** package

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The joint modelling of longitudinal and survival data has seen a surge of interest in recent years. Wulfsohn and Tsiatis (1997) developed the methodology for a random effects joint model, and their work was built upon by Henderson et al (2000). This model considers a linear mixed effects sub-model for the longitudinal data and a Cox-based sub-model for the survival data, linking the sub-models through common random effects. A subsequent alternative approach (Diggle et al 2007) considered a fully parametric transformation model in which a transformed version of the time-to-event outcome is treated as conditionally normally distributed given the repeated measurements.

Software to accommodate joint models has, however, been outstripped by the methodological advances to the extent that the first R software emerged only recently (see package **JM**). The availability of electronically linked healthcare databases suggest that the lacunae in readily available software for joint modelling is set to become more apparent. The **Joiner** package attempts to fill some of this void, building on established separate modelling functions `coxph` and `lme` where appropriate.

The unique contribution of **Joiner** is in allowing flexibility in the form of the latent association that links the longitudinal and event time processes in the random effects model, as well as being the first package to provide functionality to fit the transformation model. Accompanying these novel joint modelling functions are several useful functions to transform, view and simulate data. The features of **Joiner** will be illustrated on both simulated and real data.

Aspects of the package have been trialled in a series of successful workshops and details of the overarching project can be found on the **Joiner** website (<http://www.liv.ac.uk/joine-r/index.htm>).

## References

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