Appendix F. Bayesian Logistic Regression Analysis

Appendix F: Bayesian Logistic Regression Analysis

A belief elicitation exercise was conducted in 2014 to generate the Bayesian priors to be used in this analysis using the methods described by Johnson et al.[50,51] At the face-to-face CARRA meeting, 42 CARRA members were asked to describe the probability of CID at 12 months for each of the 3 CTPs for an average patient by applying 20 stickers (each representing 5% probability of inactive disease) to a laminated card marked with a horizontal axis labeled with probabilities from 0-100%, broken into bins of width 5%. The counts in each bin from the laminated cards were entered into a computer and used to construct a prior for each respondent for each CTP. A group prior was formed for each CTP by averaging all 42 individual priors; pessimistic, neutral and optimistic priors were formed by averaging the 14 respondents with the lowest, middle and highest mean prior probabilities of CID. These priors were used to generate smooth parametric prior distributions for odds ratios comparing each pair of CTPs by assuming that the elicited priors were the marginal distributions from a tri-variate distribution. This distribution was modelled with a copula, assuming a common correlation of 0.8 between the three components. Five thousand samples from the resulting distribution were generated and the odds ratios between CTPs, with Step Up as the reference, were calculated. A bivariate normal distribution was fitted to the distribution of the two log-odds-ratios and this bivariate normal was used as the joint prior for the two odds ratios in the Bayesian logistic regression model.

In the Bayesian logistic regression model with uninformative prior distributions and, for each pair of CTPs, we calculated the posterior probability that one has higher effectiveness than the other. A probability above 97.5% was considered strong evidence that the CTP was superior to its comparator. The informative priors from the belief elicitation exercises were used in a second analysis to allow interpretation of the study's findings in light of expert opinion that existed at the study's outset. Figure F1 below shows the pooled expert-derived prior distributions for the probability of CID at 12 months for each of the three CTPs. As the modes of these distributions span the range from 50% (for Step Up) to 75% for (Early Combination), values that are far above the observed percentages with CID in this study, the relevance of these priors could be questioned. However, there may be useful information in the relative odds of CID between the CTPs.

Figure F1: Separate priors for probability of CID at 12 months from elicitation exercise.

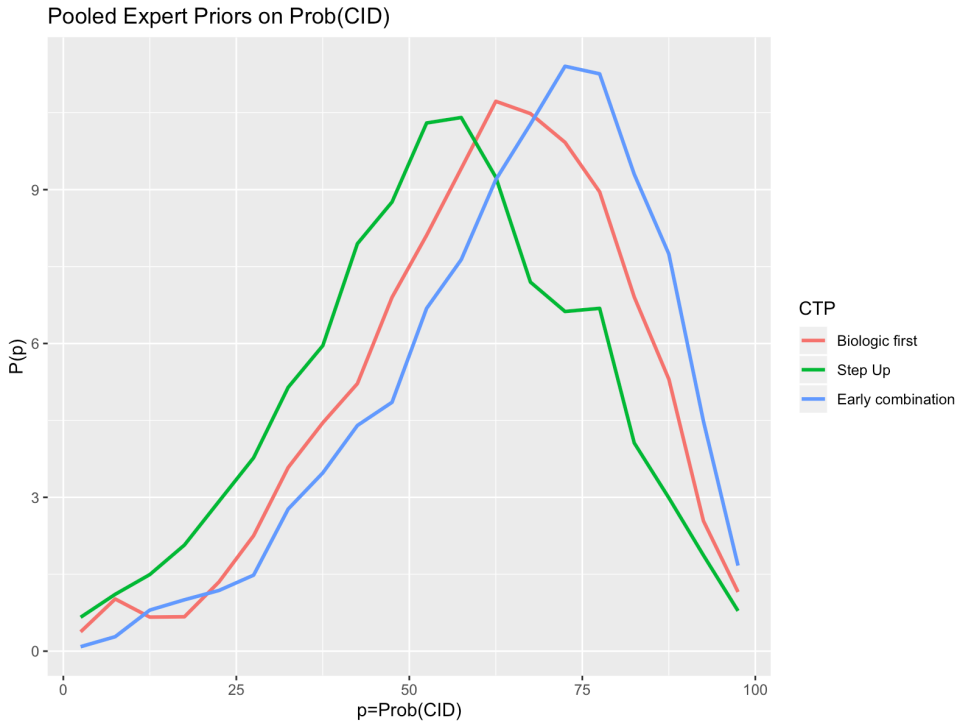

Table F1. Using imputed data: estimated odds ratios and probabilities of benefit for CID from Bayesian model using priors from CARRA elicitation exercise

	Estimated OR	2.5%	97.5%
Biologic First vs Step Up	1.10	0.49	2.11
Early Combination vs Step Up	1.40	0.78	2.34
Biologic First vs Early Combination	0.82	0.35	1.63
	Probability of superiority		
Biologic First vs Step Up	52.9%		
Early Combination vs Step Up	85.6%		
Biologic First vs Early Combination	75.3%		

Figure F2: Posterior distributions of odds ratios for CID at 12 months from Bayesian logistic regression model pooled across 30 imputed datasets.