Acute Leukemia Report

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Introduction

Methods

Terminating Event and Time

Our team was tasked with identifying associations and trends in survival times with two separate terminating events. In directives 1-5, where our objectives revolved around disease free survival time, our team identified *deltadfs* as the terminating event of interest. This terminating event is a binary indicator of death or relapse of disease among our patient sample. In directives 6-7, the research question shifted to the developmental risk of acute graft-versus-host disease (aGVHD) in our patient sample, and thus, the binary indicator of aGVHD onset *deltaa* was chosen as our terminating event.

Approaching the data with the research question of disease free survival time in mind, our team decided to classify *tdfs*, the time in days until death, relapse, or censoring, as the time argument when analyzing directives 1-5. The research question of directives 6 and 7 handles the time until onset of acute graft-versus-host disease, and thus *ta*, the time in days until onset of aGVHD was used as the time argument in the respective survival objects.

Significance and Family-wise Error

Given our fairly low clinical sample size of $n = 137$ patients, our tests of significance will have lower power of detecting true differences in groups if they exist. Based on this and observations of significance from Thiese, Ronna, and Ott (Thiese et al. 2016), we deliberately set our significance level to an unconservative $\alpha = .1$. This large significance level allows us to account for our small sample size, in addition, it will allowing us to correct for the family-wise error we will encounter through multiple testing without over-correcting with a practically unrejectable p-value. We chose to correct for family-wise error through a Bonferroni correction. In directives 2 and 3, we run 8 log-rank hypothesis tests of significance. Thus, our family-wise error adjusted significance level of rejection will be $\frac{.1}{8} = .0125$.

Test Statistics

To test the survival time and onset time differences between groups, we will be using the log-rank test as an *a priori* choice of statistic based on what we believe are appropriate scientific considerations.

We don't believe there to be any basis on which to weigh early terminations more heavily, thus we do not see the Gehan-Breslow generalized Wilcoxon statistic as appropriate. Additionally, we expect to see proportional hazards among our disease and FAB groups because why would we learn those methods all quarter and not get a data set where we can utilize those skills. Thus, the log-rank test statistic will be used as our method of nonparametric testing of equal survivorship between groups.

Results and Discussion

Descriptive Statistics

When attempting to **estimate the disease-free survival time for patients enrolled in this study**, we first plotted *(figure 1)* the non-parametric Kaplan-Meier estimator in an attempt to gain knowledge of the underlying shape of our data. The curve made us hopeful to use a parametric estimator. We began with a Weibull and generalized gamma estimate, which we plotted *(figure 2)* in conjunction with the Kaplan-Meier to eye-test it's effectiveness at modeling the data. Using a likelihood ratio test, we can empirically answer if the Weibull is an appropriate simplication of the generalized gamma, in which case we will use the Weibull's parameter estimates.

The LRT test statistic can be computed as $2 \times (1114.92 - 1114.36) \quad 1.12$

Proportional Hazards

Limitations

References

Thiese MS, Ronna B, Ott U. P value interpretations and considerations. J Thorac Dis. 2016 Sep;8(9):E928-E931. doi: 10.21037/jtd.2016.08.16. PMID: 27747028; PMCID: PMC5059270.

Tables and Figures

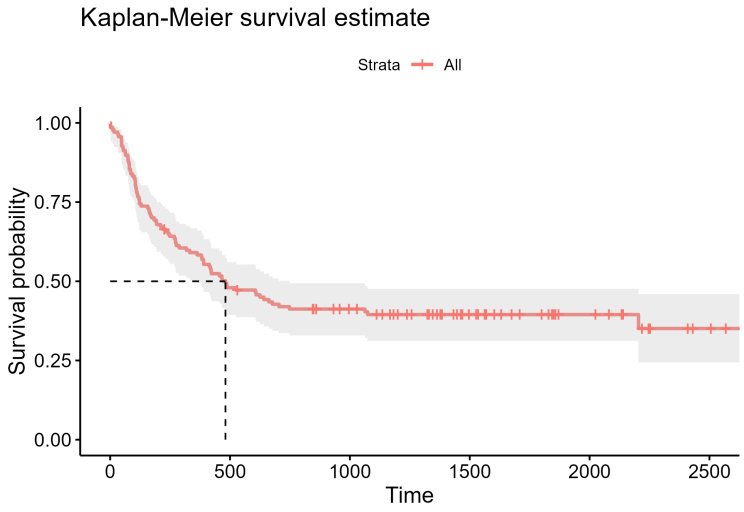

Figure 1: Kaplan-Meier Estimate, Disease Free Survival Time

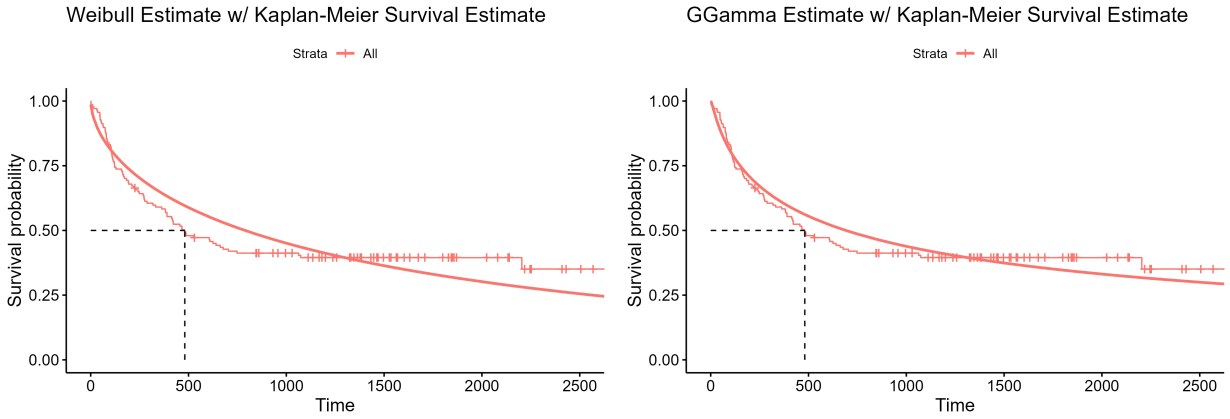

Figure 2: Weibull and GGamma Estimates, Disease Free Survival Time

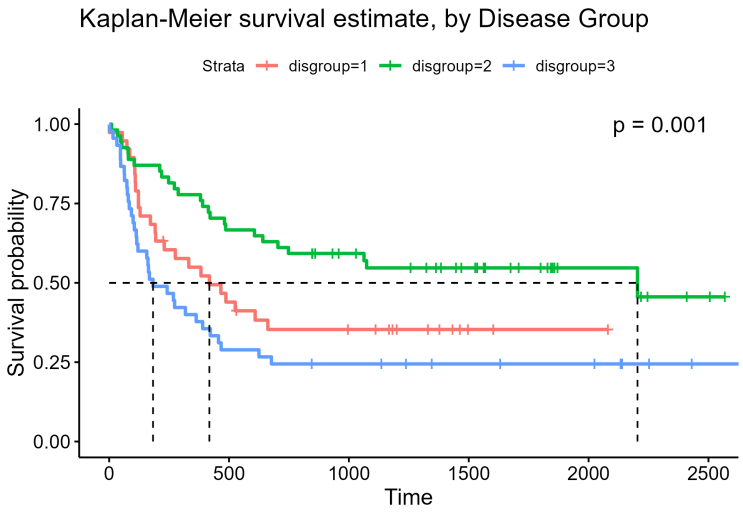

Figure 3: Kaplan-Meier Estimate, Disease Free Survival Time

Table 1: Call: s_bmt ~ disgroup Chisq = 13.803722 on 2 degrees of freedom, p = 0.001006

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
disgroup=1	38	24	21.85	0.2112	0.2893
disgroup=2	54	25	39.97	5.604	11.01
disgroup=3	45	34	21.18	7.756	10.53

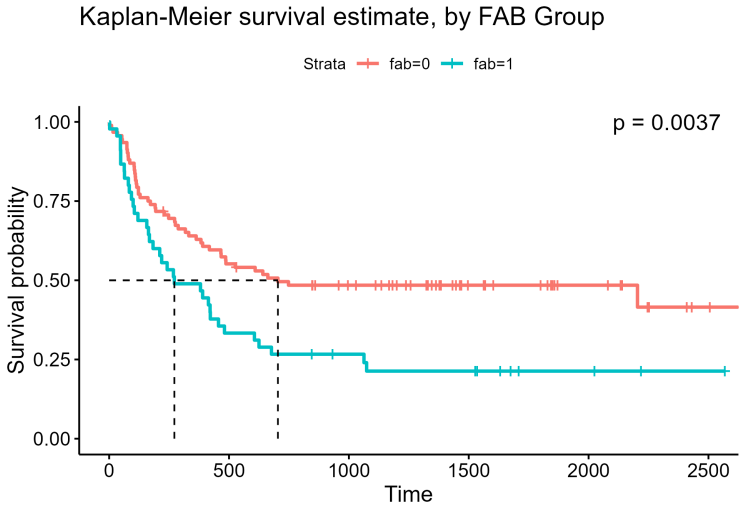

Figure 4: Kaplan-Meier Estimate, Disease Free Survival Time

Table 2: Call: s_bmt ~ fab Chisq = 8.435337 on 1 degrees of freedom, p = 0.003680

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
fab=0	92	48	59.83	2.337	8.435
fab=1	45	35	23.17	6.034	8.435

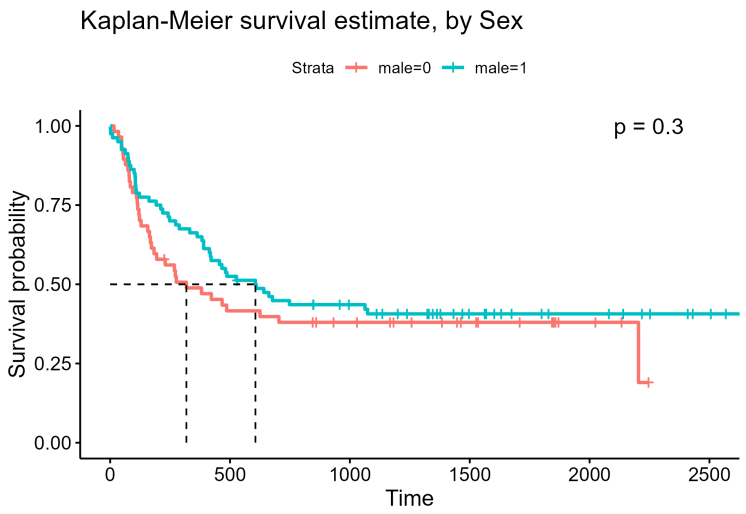

Figure 5: Kaplan-Meier Estimate, Disease Free Survival Time

Table 3: Call: s_bmt ~ male Chisq = 1.078766 on 1 degrees of freedom, p = 0.298974

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
male=0	57	36	31.42	0.6662	1.079
male=1	80	47	51.58	0.4059	1.079

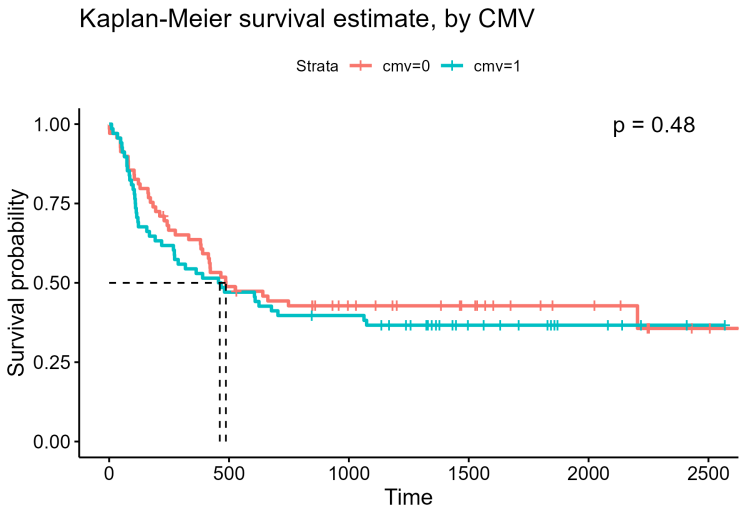

Figure 6: Kaplan-Meier Estimate, Disease Free Survival Time

Table 4: Call: s_bmt ~ cmv Chisq = 0.497423 on 1 degrees of freedom, p = 0.480635

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
cmv=0	69	40	43.2	0.2375	0.4974
cmv=1	68	43	39.8	0.2579	0.4974

Figure 7: Kaplan-Meier Estimate, Disease Free Survival Time

Table 5: Call: s_bmt ~ donormale Chisq = 0.001359 on 1 degrees of freedom, p = 0.970591

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
donormale=0	49	30	29.84	0.0008686	0.001359
donormale=1	88	53	53.16	0.0004875	0.001359

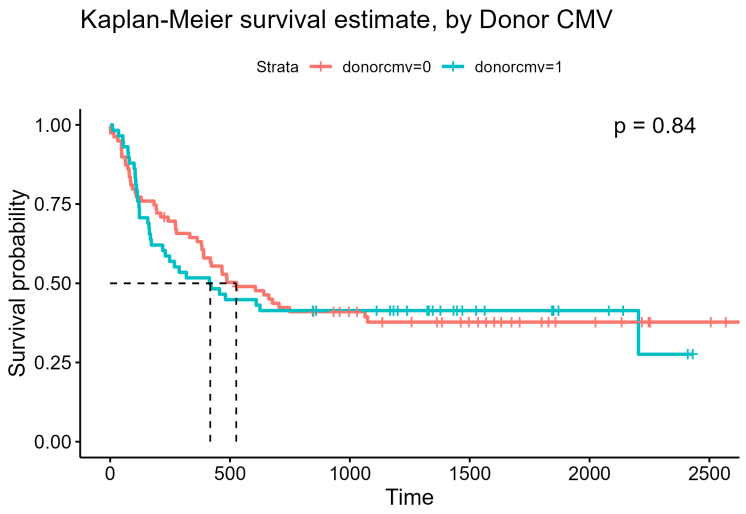

Figure 8: Kaplan-Meier Estimate, Disease Free Survival Time

Table 6: Call: s_bmt ~ donorcmv Chisq = 0.043347 on 1 degrees of freedom, p = 0.835073

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
donorcmv=0	79	48	48.93	0.01772	0.04335
donorcmv=1	58	35	34.07	0.02544	0.04335

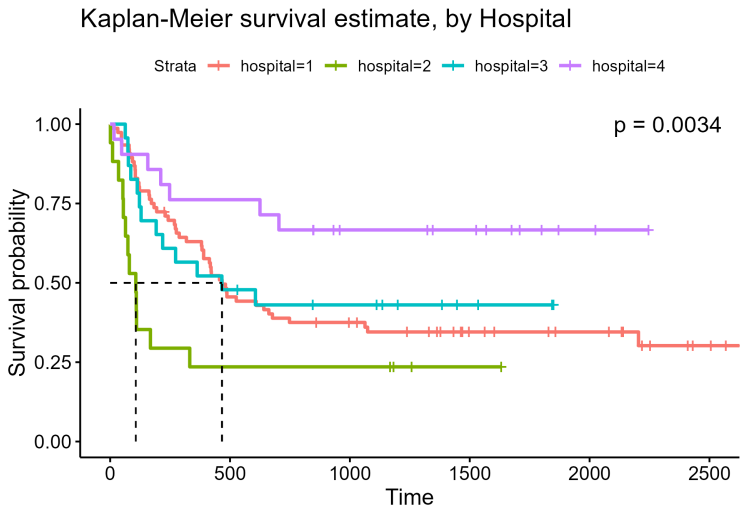

Figure 9: Kaplan-Meier Estimate, Disease Free Survival Time

Table 7: Call: s_bmt ~ hospital Chisq = 13.680494 on 3 degrees of freedom, p = 0.003374

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
hospital=1	76	50	47.71	0.1101	0.2613
hospital=2	17	13	5.905	8.524	9.258
hospital=3	23	13	13.62	0.02779	0.03339
hospital=4	21	7	15.77	4.879	6.076

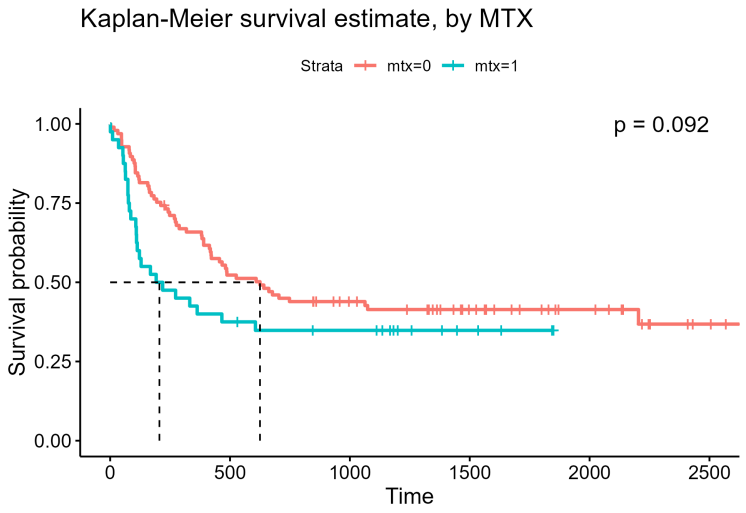

Figure 10: Kaplan-Meier Estimate, Disease Free Survival Time

Table 8: Call: s_bmt ~ mtx Chisq = 2.838053 on 1 degrees of freedom, p = 0.092056

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
mtx=0	97	57	63.48	0.6614	2.838
mtx=1	40	26	19.52	2.151	2.838

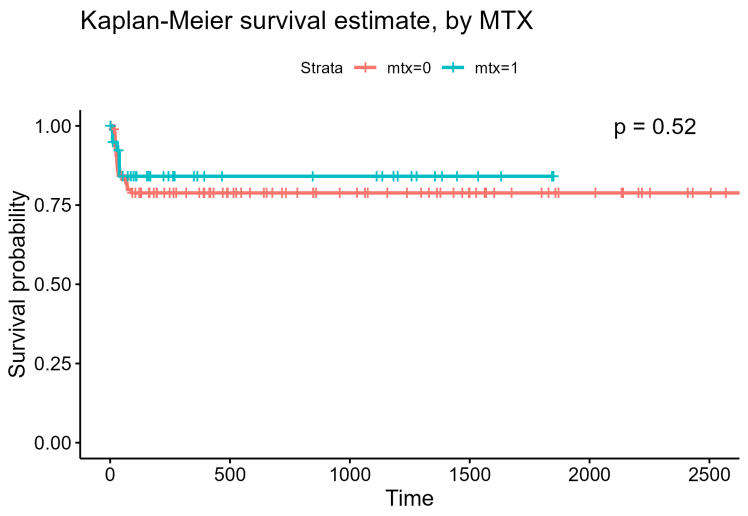

Figure 11: Kaplan-Meier Estimate, Disease Free Survival Time

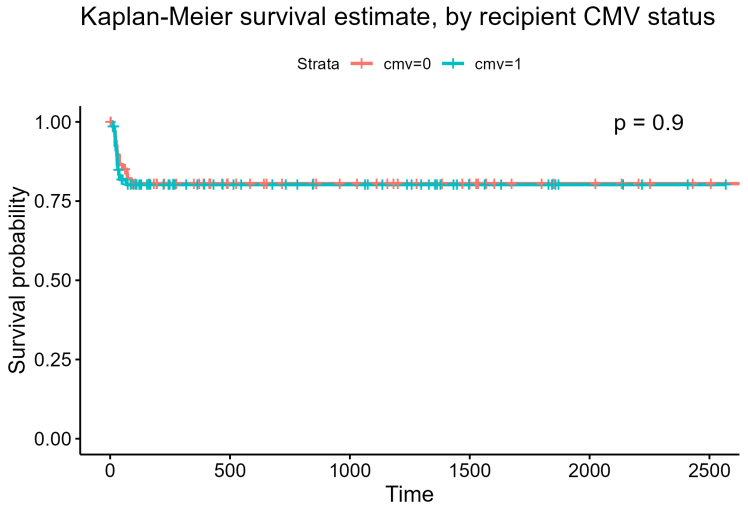

Figure 12: Kaplan-Meier Estimate, Disease Free Survival Time

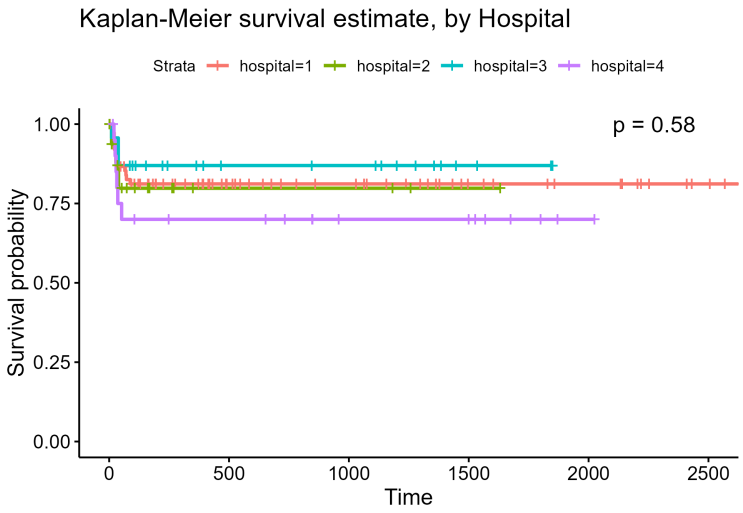

Figure 13: Kaplan-Meier Estimate, Disease Free Survival Time

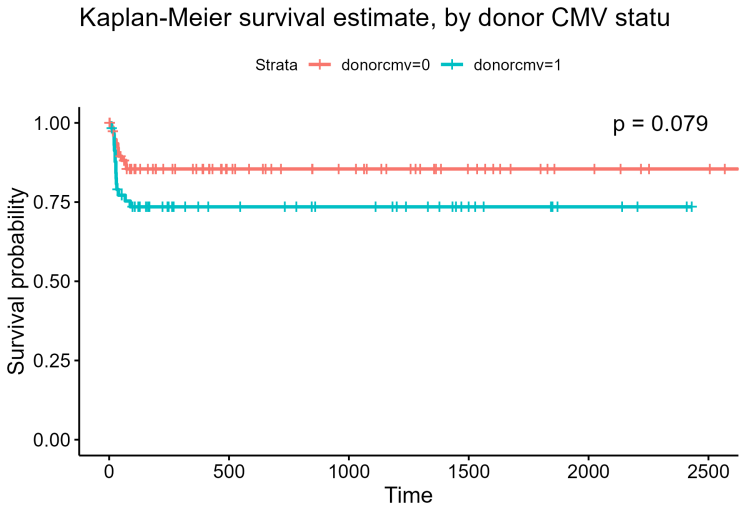

Figure 14: Kaplan-Meier Estimate, Disease Free Survival Time

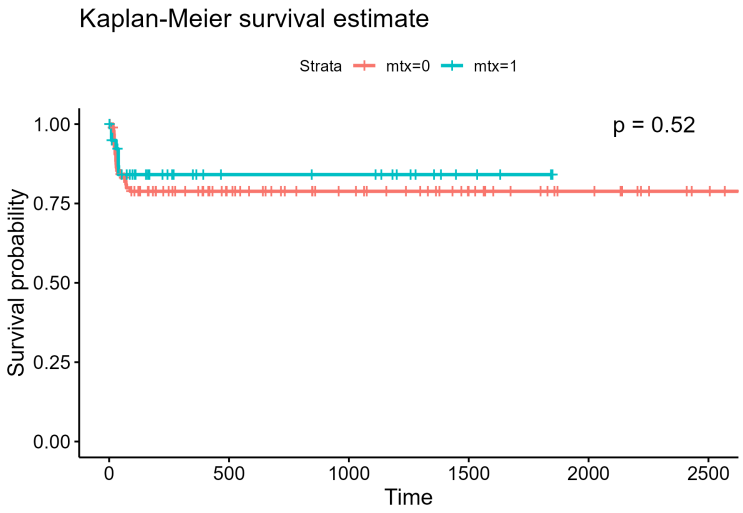

Figure 15: Kaplan-Meier Estimate, Disease Free Survival Time