In [75]:
```
library(survival)
```

Appropriate data manipulations

In [83]:
```
dat <- read.csv("diabeticVision.csv")
dat$trt = factor(dat$trt)
dat$laser = factor(dat$laser)
dat$type = factor(dat$type)
dat$group = factor(dat$group)
dat
```

A data.frame: 394 × 11

X	id	laser	eye	age	type	trt	futime	status	risk	group
<int>	<int>	<fct>	<chr>	<int>	<fct>	<fct>	<dbl>	<int>	<int>	<fct>
1	5	argon	left	28	adult	1	46.23	0	9	2
2	5	argon	left	28	adult	0	46.23	0	9	0
3	14	argon	right	12	juvenile	1	42.50	0	8	2
4	14	argon	right	12	juvenile	0	31.30	1	6	0
5	16	xenon	right	9	juvenile	1	42.27	0	11	3
6	16	xenon	right	9	juvenile	0	42.27	0	11	1
7	25	argon	left	9	juvenile	1	20.60	0	11	2
8	25	argon	left	9	juvenile	0	20.60	0	11	0
9	29	xenon	left	13	juvenile	1	38.77	0	9	3
10	29	xenon	left	13	juvenile	0	0.30	1	10	1
11	46	xenon	right	12	juvenile	1	65.23	0	9	3
12	46	xenon	right	12	juvenile	0	54.27	1	9	1
13	49	argon	right	8	juvenile	1	63.50	0	8	2
14	49	argon	right	8	juvenile	0	10.80	1	6	0
15	56	xenon	right	12	juvenile	1	23.17	0	8	3
16	56	xenon	right	12	juvenile	0	23.17	0	9	1
17	61	argon	right	16	juvenile	1	1.47	0	9	2
18	61	argon	right	16	juvenile	0	1.47	0	10	0
19	71	argon	right	21	adult	1	58.07	0	9	2
20	71	argon	right	21	adult	0	13.83	1	9	0
21	100	argon	left	23	adult	1	46.43	1	9	2
22	100	argon	left	23	adult	0	48.53	0	9	0
23	112	argon	right	44	adult	1	44.40	0	11	2
24	112	argon	right	44	adult	0	7.90	1	12	0

X	id	laser	eye	age	type	trt	futime	status	risk	group
<int>	<int>	<fct>	<chr>	<int>	<fct>	<fct>	<dbl>	<int>	<int>	<fct>
25	120	xenon	left	47	adult	1	39.57	0	11	3
26	120	xenon	left	47	adult	0	39.57	0	6	1
27	127	xenon	right	48	adult	1	30.83	1	6	3
28	127	xenon	right	48	adult	0	38.57	1	10	1
29	133	argon	right	26	adult	1	66.27	0	10	2
30	133	argon	right	26	adult	0	14.10	1	9	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
365	1619	xenon	left	20	adult	1	74.97	0	9	3
366	1619	xenon	left	20	adult	0	61.83	1	12	1
367	1627	xenon	left	10	juvenile	1	6.57	1	10	3
368	1627	xenon	left	10	juvenile	0	66.97	0	12	1
369	1636	argon	right	16	juvenile	1	38.87	1	6	2
370	1636	argon	right	16	juvenile	0	68.30	0	6	0
371	1640	xenon	left	10	juvenile	1	42.43	1	11	3
372	1640	xenon	left	10	juvenile	0	46.63	1	9	1
373	1643	xenon	right	11	juvenile	1	67.07	0	9	3
374	1643	xenon	right	11	juvenile	0	67.07	0	9	1
375	1649	argon	right	1	juvenile	1	2.70	1	10	2
376	1649	argon	right	1	juvenile	0	2.70	0	12	0
377	1666	argon	left	17	juvenile	1	63.80	0	6	2
378	1666	argon	left	17	juvenile	0	63.80	0	8	0
379	1672	argon	left	7	juvenile	1	32.63	0	9	2
380	1672	argon	left	7	juvenile	0	32.63	0	9	0
381	1683	xenon	right	29	adult	1	62.00	0	10	3
382	1683	xenon	right	29	adult	0	62.00	0	8	1
383	1688	xenon	left	5	juvenile	1	13.10	1	11	3
384	1688	xenon	left	5	juvenile	0	54.80	0	10	1
385	1705	xenon	left	1	juvenile	1	8.00	0	8	3
386	1705	xenon	left	1	juvenile	0	8.00	0	8	1
387	1717	argon	left	22	adult	1	51.60	0	12	2
388	1717	argon	left	22	adult	0	42.33	1	11	0
389	1727	argon	right	33	adult	1	49.97	0	9	2
390	1727	argon	right	33	adult	0	2.90	1	10	0
391	1746	argon	right	3	juvenile	1	45.90	0	10	2

X	id	laser	eye	age	type	trt	futime	status	risk	group
<int>	<int>	<fct>	<chr>	<int>	<fct>	<fct>	<dbl>	<int>	<int>	<fct>
392	1746	argon	right	3	juvenile	0	1.43	1	10	0
393	1749	argon	right	32	adult	1	41.93	0	9	2
394	1749	argon	right	32	adult	0	41.93	0	9	0

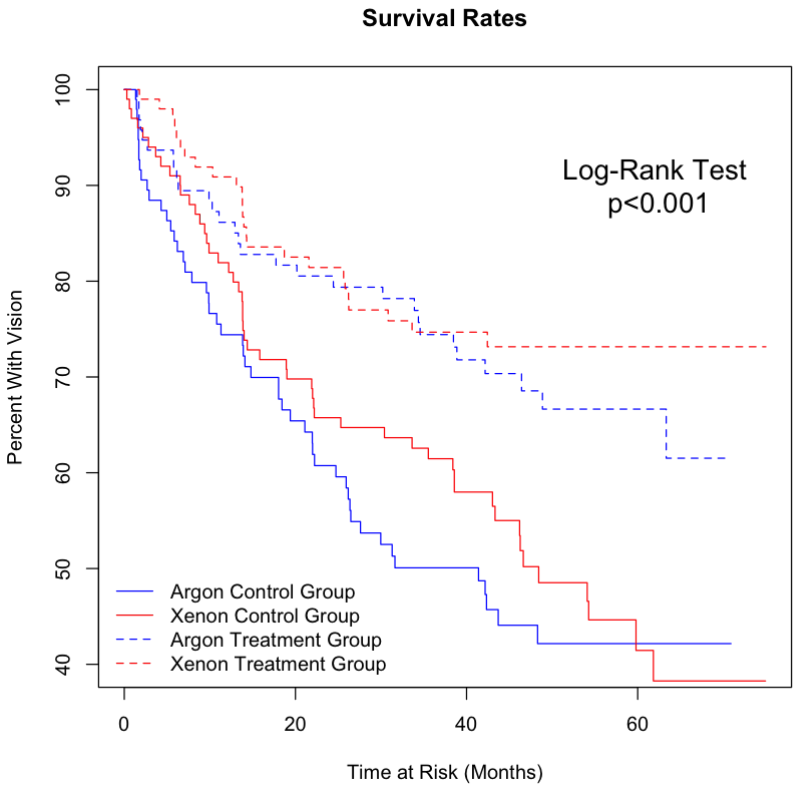
In [28]:
```
levels(dat$group)
```

'0' · '1' · '2' · '3'

Kaplan-Meier Curves and Log Rank

In [76]:
```
survobj <- with(dat, Surv(futime, status))

# ph$compas <- cut(ph$decile_score, breaks=c(0,3,6,10))
fitc <- survfit(survobj~group, data=dat)
plot(fitc, xlab="Time at Risk (Months)",
   ylab="Percent With Vision", yscale=100, ylim=c(1, 0.4),
   main="Survival Rates",
   col = c('blue', 'red', 'blue', 'red'),
   lty = c('solid', 'solid', 'dashed', 'dashed')
)
legend_text = c('Argon Control Group', 'Xenon Control Group', 'Argon Treatment G
legend('bottomleft', legend=legend_text, bty='n',
       col=c('blue', 'red', 'blue', 'red'), lty=c('solid', 'solid', 'dashed', 'd
text(62, 0.9, 'Log-Rank Test\n p<0.001', cex=1.4)
```



In [6]:
```
dat$group = relevel(dat$group, ref="2")
```

In [77]:
```
finalfit(dat, "Surv(futime, status)", c("trt*laser", "age", "risk", "frailty(id)
```

A data.frame.ff: 9 × 5

	Dependent: Surv(futime, status)		all	HR (univariable)	HR (multivariable)
	<chr>	<chr>	<chr>	<chr>	<chr>
8	trt	0	197 (50.0)	-	-
9		1	197 (50.0)	-	-
3	laser	argon	194 (49.2)	-	-
4		xenon	200 (50.8)	0.85 (0.57-1.25, p=0.412)	0.75 (0.46-1.22, p=0.247)
1	age	Mean (SD)	20.8 (14.8)	1.00 (0.99-1.01, p=0.604)	1.01 (0.99-1.02, p=0.358)
5	risk	Mean (SD)	9.7 (1.5)	1.16 (1.04-1.29, p=0.009)	1.19 (1.03-1.36, p=0.014)
2	frailty(id)			-	-
6	NA	NA	NA	0.47 (0.30-0.74, p=0.001)	0.38 (0.24-0.62, p<0.001)
7	trt:laserxenon	Interaction	NA	0.95 (0.49-1.83, p=0.869)	1.07 (0.54-2.11, p=0.854)

In [21]:
```
finalfit(dat, "Surv(futime, status)", c("risk"))
```

A data.frame.ff: 1 × 5

	Dependent: Surv(futime, status)		all	HR (univariable)	HR (multivariable)
	<chr>	<chr>	<chr>	<chr>	<chr>
1	risk	Mean (SD)	9.7 (1.5)	1.16 (1.04-1.29, p=0.009)	1.16 (1.04-1.29, p=0.009)

Interpret coefficients of Interaction Term

In [84]:
```
summary(coxph(survobj~trt*laser + age + risk + frailty(id), data=dat))
```

```
Call:
coxph(formula = survobj ~ trt * laser + age + risk + frailty(id),
    data = dat)

  n= 394, number of events= 155

                coef      se(coef) se2      Chisq  DF    p
```

```
trt1            -0.954928 0.243161 0.238255  15.42  1.0 8.6e-05
laserxenon      -0.291249 0.251438 0.204767   1.34  1.0 2.5e-01
age              0.006777 0.007375 0.005625   0.84  1.0 3.6e-01
risk             0.169901 0.069378 0.059500   6.00  1.0 1.4e-02
frailty(id)                                 107.86 79.5 1.9e-02
trt1:laserxenon  0.064234 0.348640 0.342208   0.03  1.0 8.5e-01

                exp(coef) exp(-coef) lower .95 upper .95
trt1               0.3848     2.5985    0.2389    0.6198
laserxenon         0.7473     1.3381    0.4565    1.2233
age                1.0068     0.9932    0.9924    1.0215
risk               1.1852     0.8437    1.0345    1.3578
trt1:laserxenon    1.0663     0.9378    0.5384    2.1118

Iterations: 6 outer, 31 Newton-Raphson
     Variance of random effect= 0.7990444   I-likelihood = -846.8
Degrees of freedom for terms=  1.0  0.7  0.6  0.7 79.5  1.0
Concordance= 0.838  (se = 0.016 )
Likelihood ratio test= 202  on 83.4 df,   p=8e-12
```

Model without Interaction Term

In [79]:

```
summary(coxph(survobj~group + age + risk + frailty(id), data=dat))
```

```
Call:
coxph(formula = survobj ~ group + age + risk + frailty(id), data = dat)

  n= 394, number of events= 155

            coef      se(coef) se2      Chisq  DF   p
group1      -0.291249 0.251438 0.204767   1.34  1.0 2.5e-01
group2      -0.954928 0.243161 0.238255  15.42  1.0 8.6e-05
group3      -1.181943 0.288699 0.250297  16.76  1.0 4.2e-05
age          0.006777 0.007375 0.005625   0.84  1.0 3.6e-01
risk         0.169901 0.069378 0.059500   6.00  1.0 1.4e-02
frailty(id)                             107.86 79.5 1.9e-02

       exp(coef) exp(-coef) lower .95 upper .95
group1    0.7473     1.3381    0.4565    1.2233
group2    0.3848     2.5985    0.2389    0.6198
group3    0.3067     3.2607    0.1742    0.5400
age       1.0068     0.9932    0.9924    1.0215
risk      1.1852     0.8437    1.0345    1.3578

Iterations: 6 outer, 31 Newton-Raphson
     Variance of random effect= 0.7990444   I-likelihood = -846.8
Degrees of freedom for terms=  2.5  0.6  0.7 79.5
Concordance= 0.838  (se = 0.016 )
Likelihood ratio test= 202  on 83.32 df,   p=7e-12
```

In [14]:

```
library(finalfit)
# install.packages("finalfit")
```

In [ ]: