

Controlled variables

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2025-08-13

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Introduction

```

source("Survival/utils.R")

# Setup analysis environment
analysis_setup <- setup_analysis()
paths <- analysis_setup$paths
demo <- analysis_setup$demo

flare.df <- readRDS(paste0(paths$outdir, "flares-overview.RDS"))
flare.cd.df <- subset(flare.df, diagnosis2 == "CD")
flare.uc.df <- subset(flare.df, diagnosis2 == "UC/IBDU")

```

The variables being controlled for in later cox models analyses are first investigated.

Although smoking status was originally planned to be controlled for, the **high degree of missingness** for these data and the **lack of significant associations** with time to flare has resulted in smoking status not being controlled for in later analyses.

Of the variables considered here, only sex is associated with disease flare.

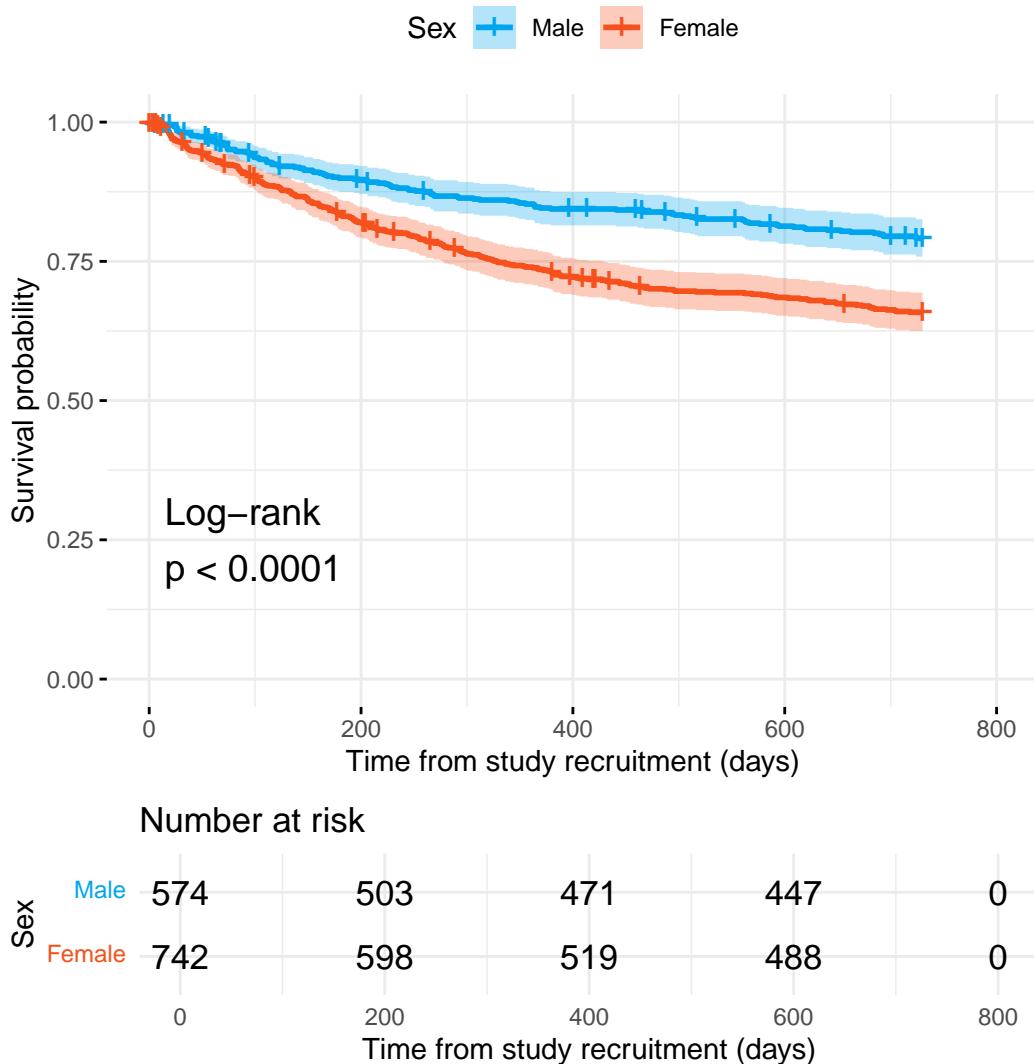
Sex

Crohn's disease

Patient-reported flare

```
generate_survival_plot(
  data = flare.cd.df,
  formula = Surv(softflare_time, softflare) ~ Sex,
  legend_title = "Sex",
  legend_labs = c("Male", "Female"),
  palette = c("#00A6ED", "#F6511D"),
  xlab = "Time from study recruitment (days)",
  title = "Time to clinical flare",
  break_time_by = 200,
  plot_path = "plots/cd/soft-flare/controlled/sex"
)
```

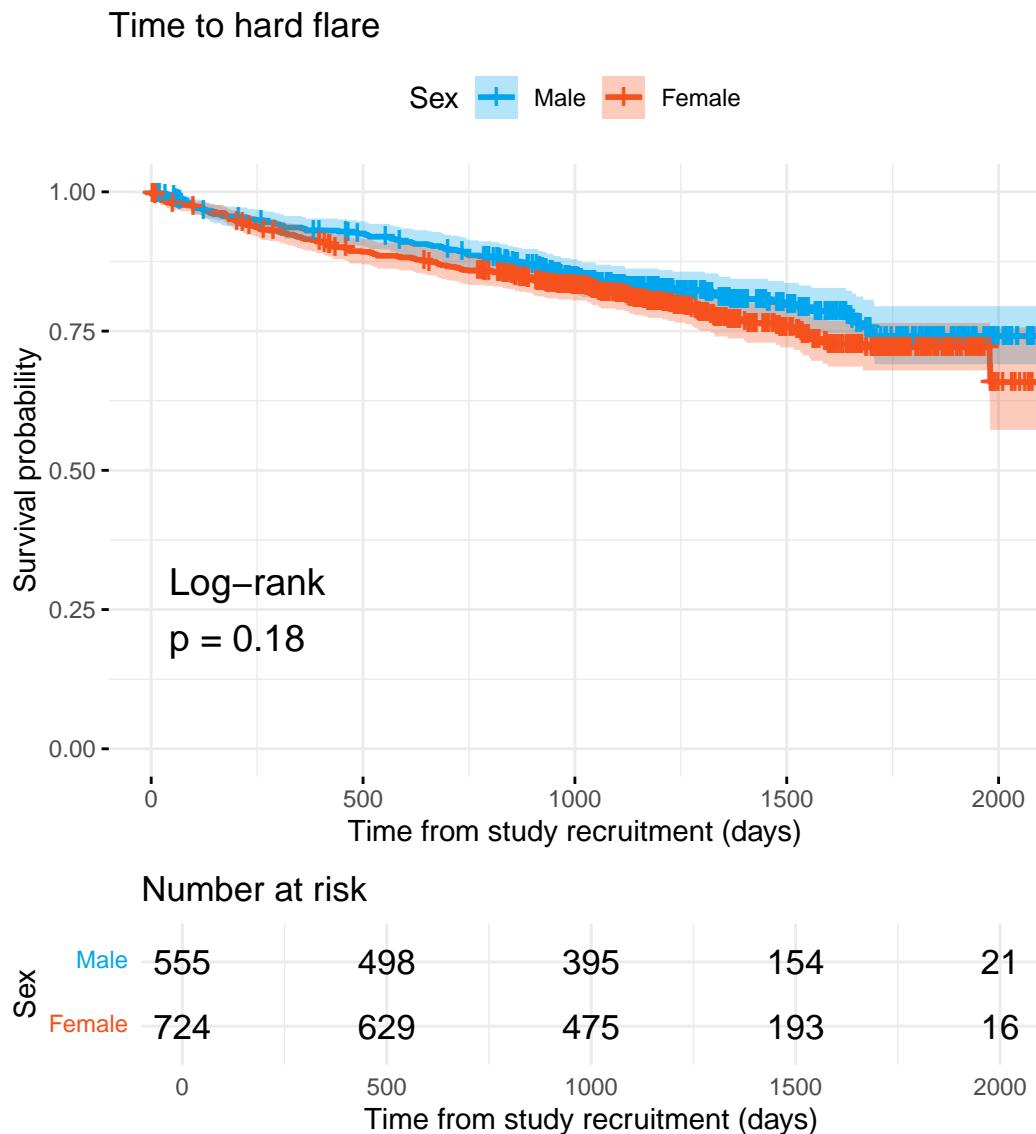
Time to clinical flare



Hard flare

```
generate_survival_plot(  
  data = flare.cd.df,  
  formula = Surv(hardflare_time, hardflare) ~ Sex,  
  legend_title = "Sex",  
  legend_labs = c("Male", "Female"),  
  palette = c("#00A6ED", "#F6511D"),  
  xlab = "Time from study recruitment (days)",
```

```
    title = "Time to hard flare",
    break_time_by = 500,
    plot_path = "plots/cd/hard-flare/controlled/sex"
)
```

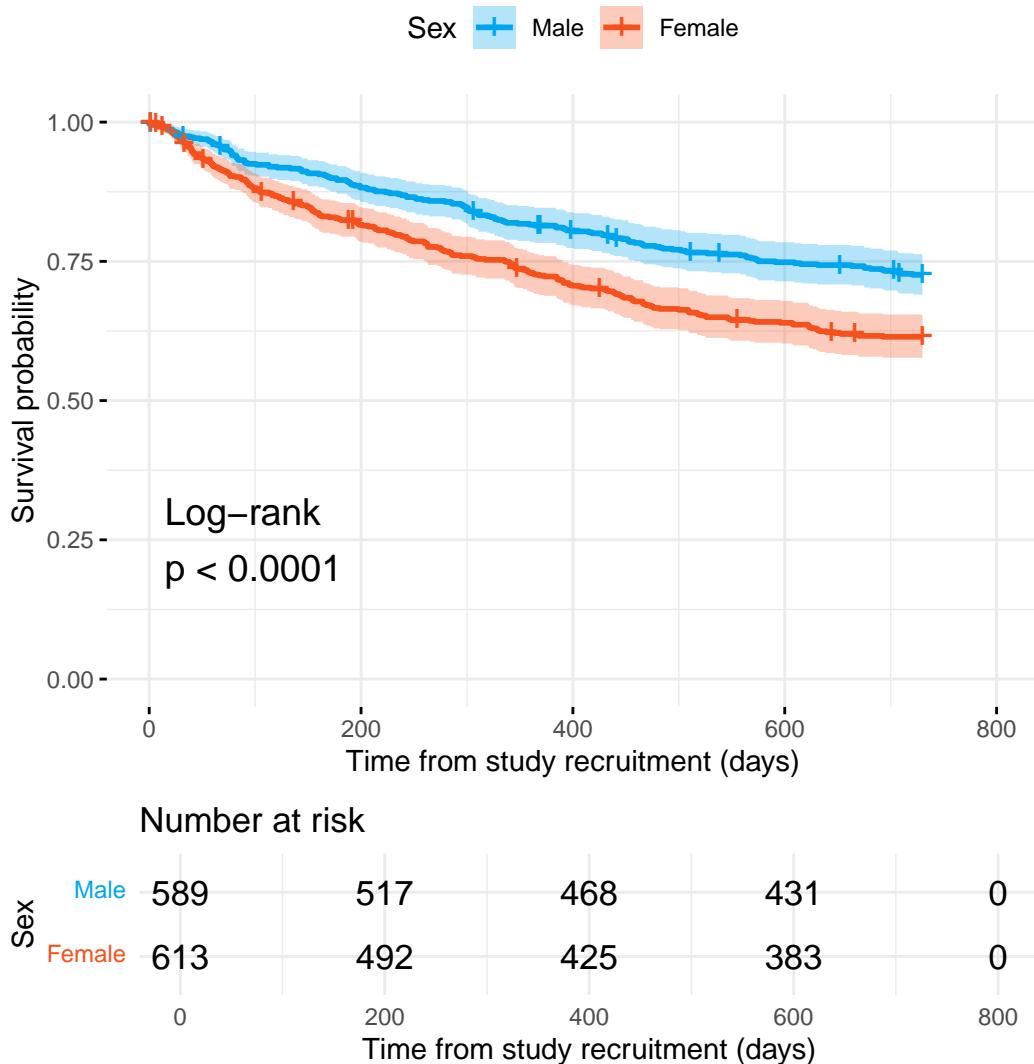


Ulcerative colitis

Patient-reported flare

```
generate_survival_plot(
  data = flare.uc.df,
  formula = Surv(softflare_time, softflare) ~ Sex,
  legend_title = "Sex",
  legend_labs = c("Male", "Female"),
  palette = c("#00A6ED", "#F6511D"),
  xlab = "Time from study recruitment (days)",
  title = "Time to clinical flare",
  break_time_by = 200,
  plot_path = "plots/uc/soft-flare/controlled/sex"
)
```

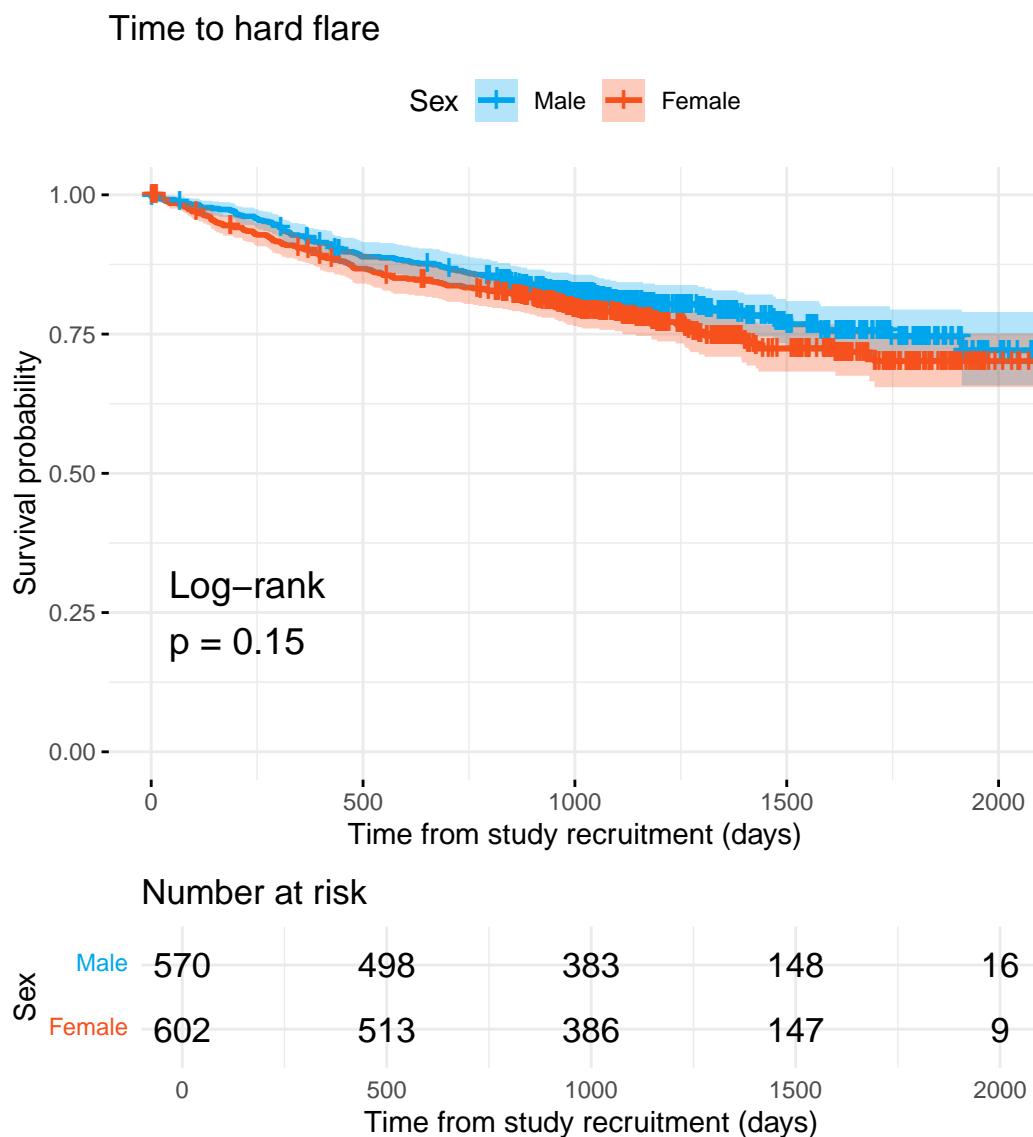
Time to clinical flare



Hard flare

```
generate_survival_plot(  
  data = flare.uc.df,  
  formula = Surv(hardflare_time, hardflare) ~ Sex,  
  legend_title = "Sex",  
  legend_labs = c("Male", "Female"),  
  palette = c("#00A6ED", "#F6511D"),  
  xlab = "Time from study recruitment (days)",
```

```
    title = "Time to hard flare",
    break_time_by = 500,
    plot_path = "plots/uc/hard-flare/controlled/sex"
)
```



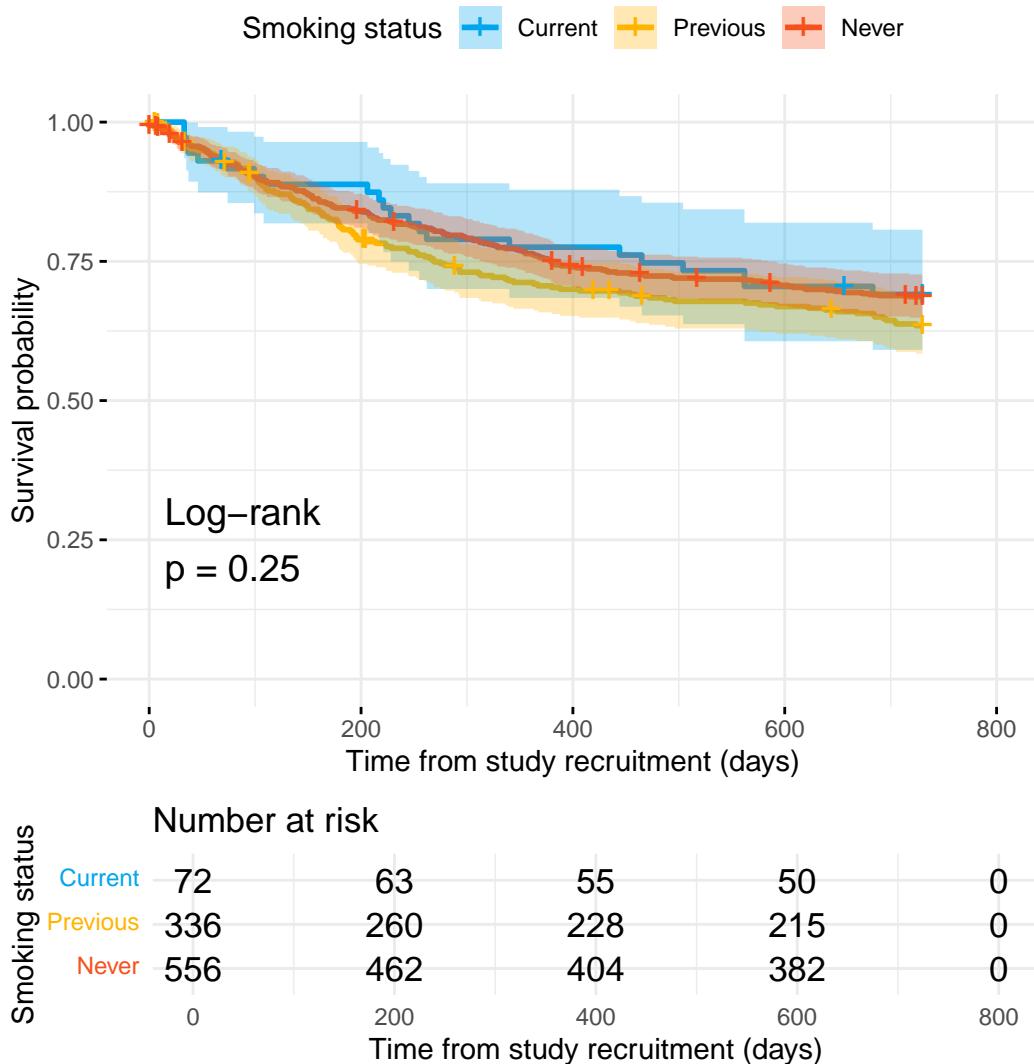
Smoking status

Crohn's disease

Patient-reported flare

```
generate_survival_plot(
  data = flare.cd.df,
  formula = Surv(softflare_time, softflare) ~ Smoke,
  legend_title = "Smoking status",
  legend_labs = c("Current", "Previous", "Never"),
  palette = c("#00A6ED", "#FFB400", "#F6511D"),
  xlab = "Time from study recruitment (days)",
  title = "Time to clinical flare",
  break_time_by = 200,
  plot_path = "plots/cd/soft-flare/controlled/smoke"
)
```

Time to clinical flare



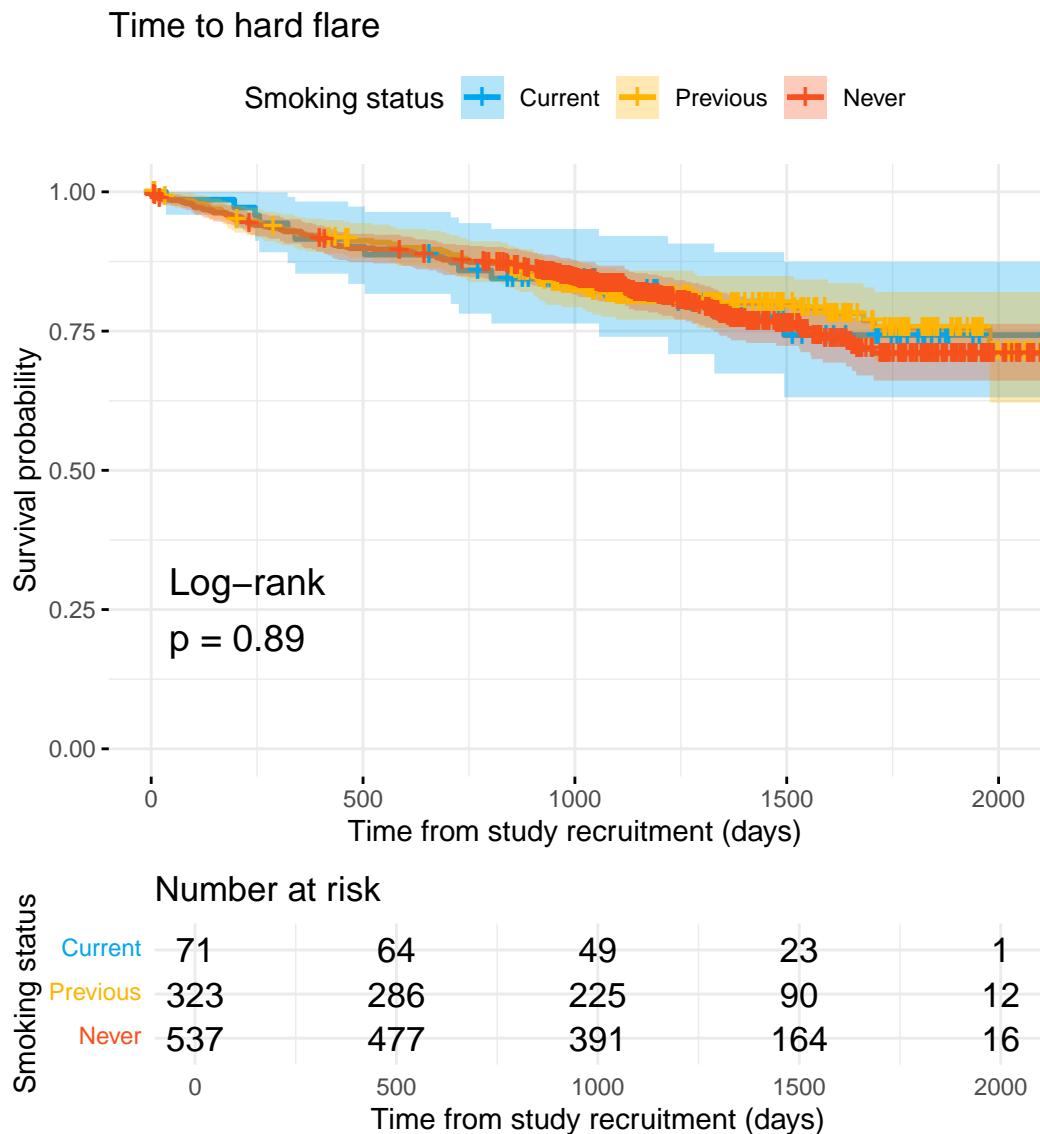
Hard flare

```
generate_survival_plot(
  data = flare.cd.df,
  formula = Surv(hardflare_time, hardflare) ~ Smoke,
  legend_title = "Smoking status",
  legend_labs = c("Current", "Previous", "Never"),
  palette = c("#00A6ED", "#FFB400", "#F6511D"),
  xlab = "Time from study recruitment (days)",
```

```

    title = "Time to hard flare",
    break_time_by = 500,
    plot_path = "plots/cd/hard-flare/controlled/smoke"
)

```

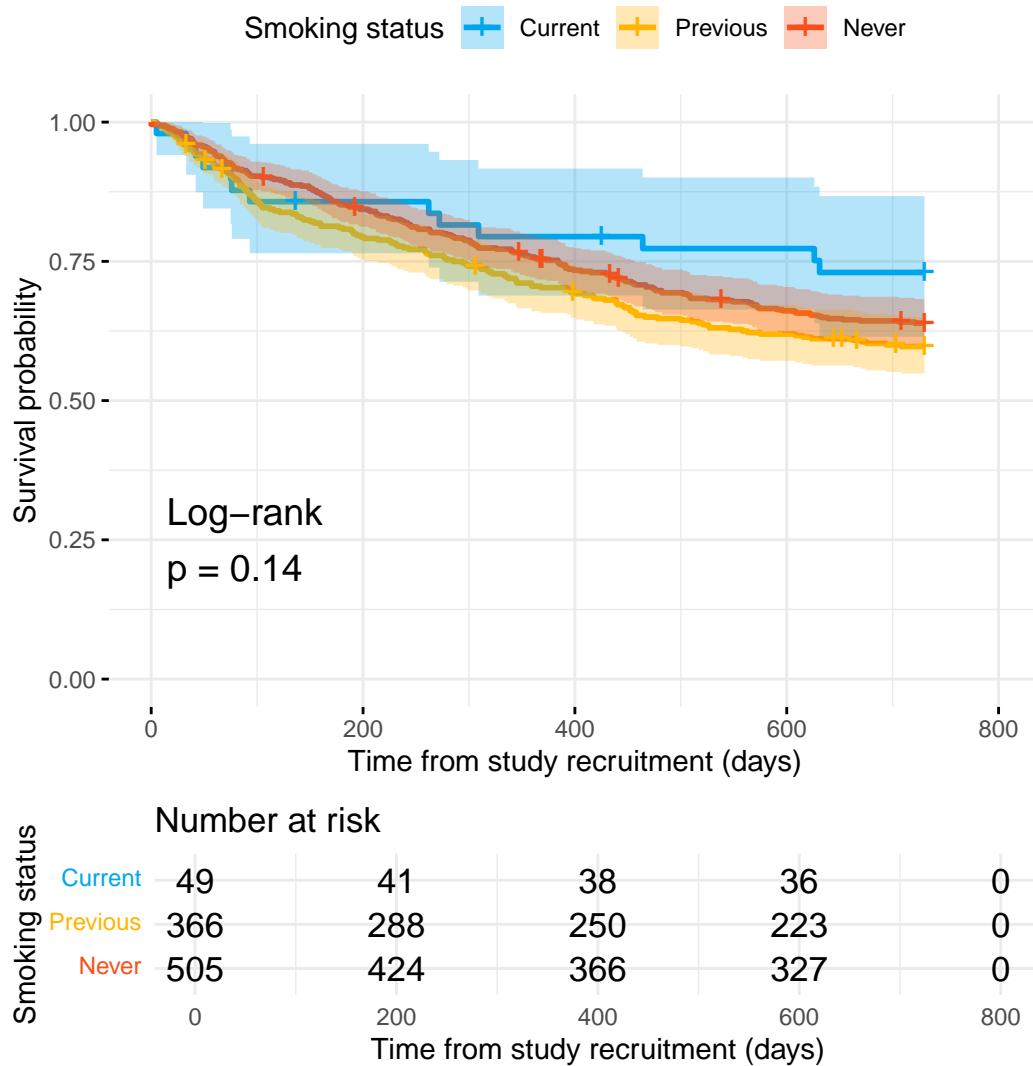


Ulcerative colitis

Patient-reported flare

```
generate_survival_plot(
  data = flare.uc.df,
  formula = Surv(softflare_time, softflare) ~ Smoke,
  legend_title = "Smoking status",
  legend_labs = c("Current", "Previous", "Never"),
  palette = c("#00A6ED", "#FFB400", "#F6511D"),
  xlab = "Time from study recruitment (days)",
  title = "Time to clinical flare",
  break_time_by = 200,
  plot_path = "plots/uc/soft-flare/controlled/smoke"
)
```

Time to clinical flare



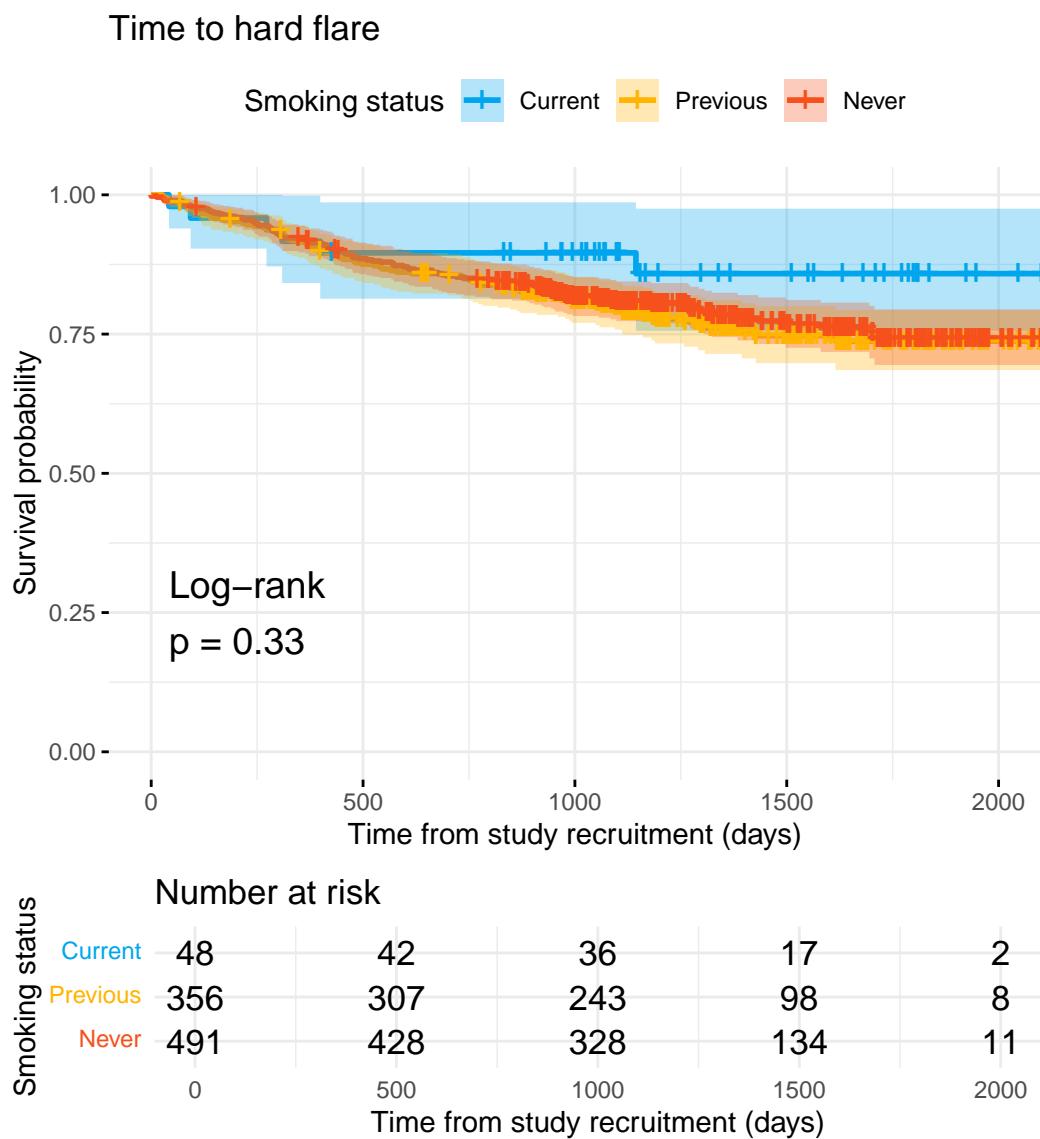
```
#### Hard flare
```

```
generate_survival_plot(
  data = flare.uc.df,
  formula = Surv(hardflare_time, hardflare) ~ Smoke,
  legend_title = "Smoking status",
  legend_labs = c("Current", "Previous", "Never"),
  palette = c("#00A6ED", "#FFB400", "#F6511D"),
  xlab = "Time from study recruitment (days)",
```

```

    title = "Time to hard flare",
    break_time_by = 500,
    plot_path = "plots/uc/hard-flare/controlled/smoke"
)

```



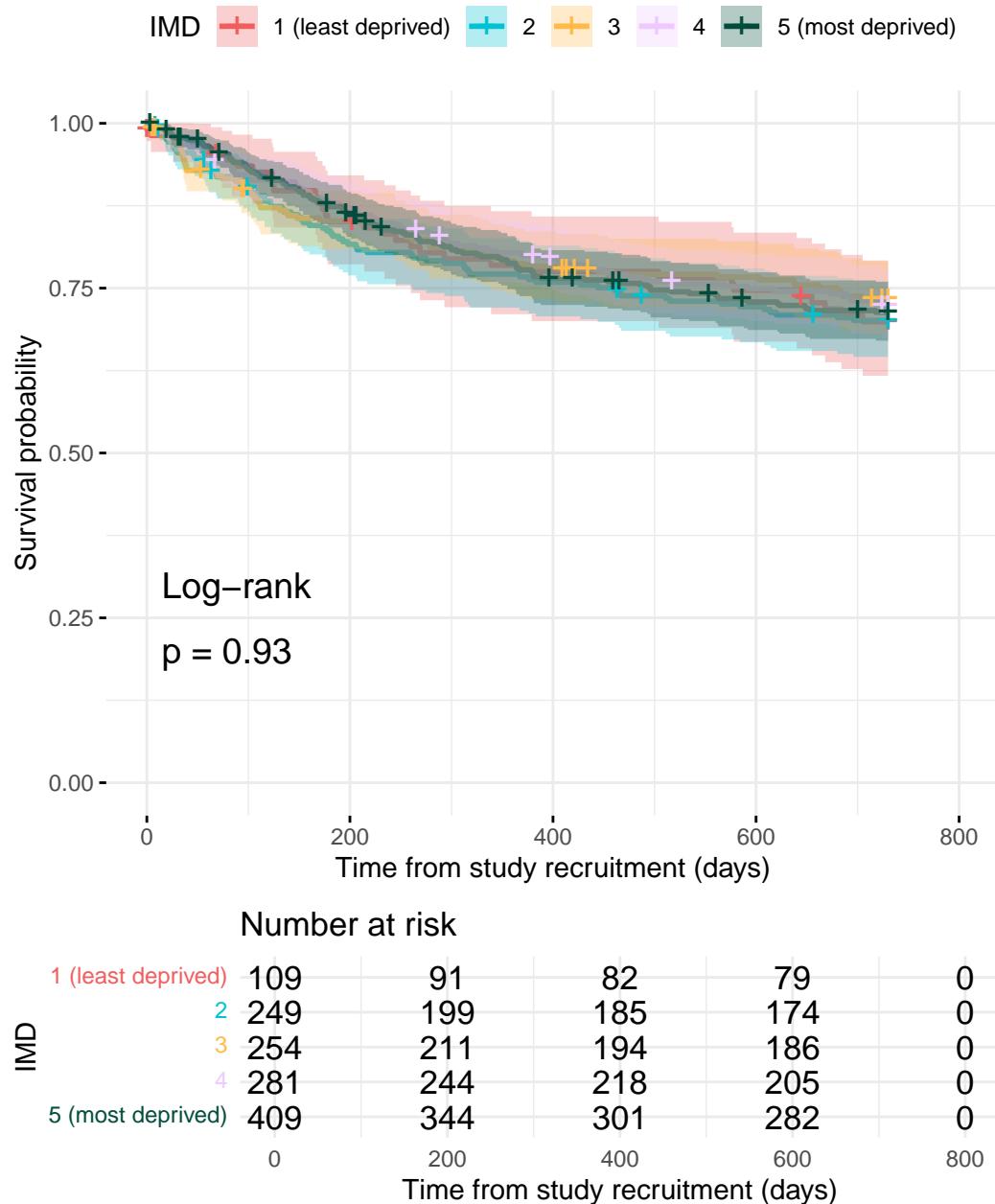
Social deprivation

Crohn's disease

Patient-reported flare

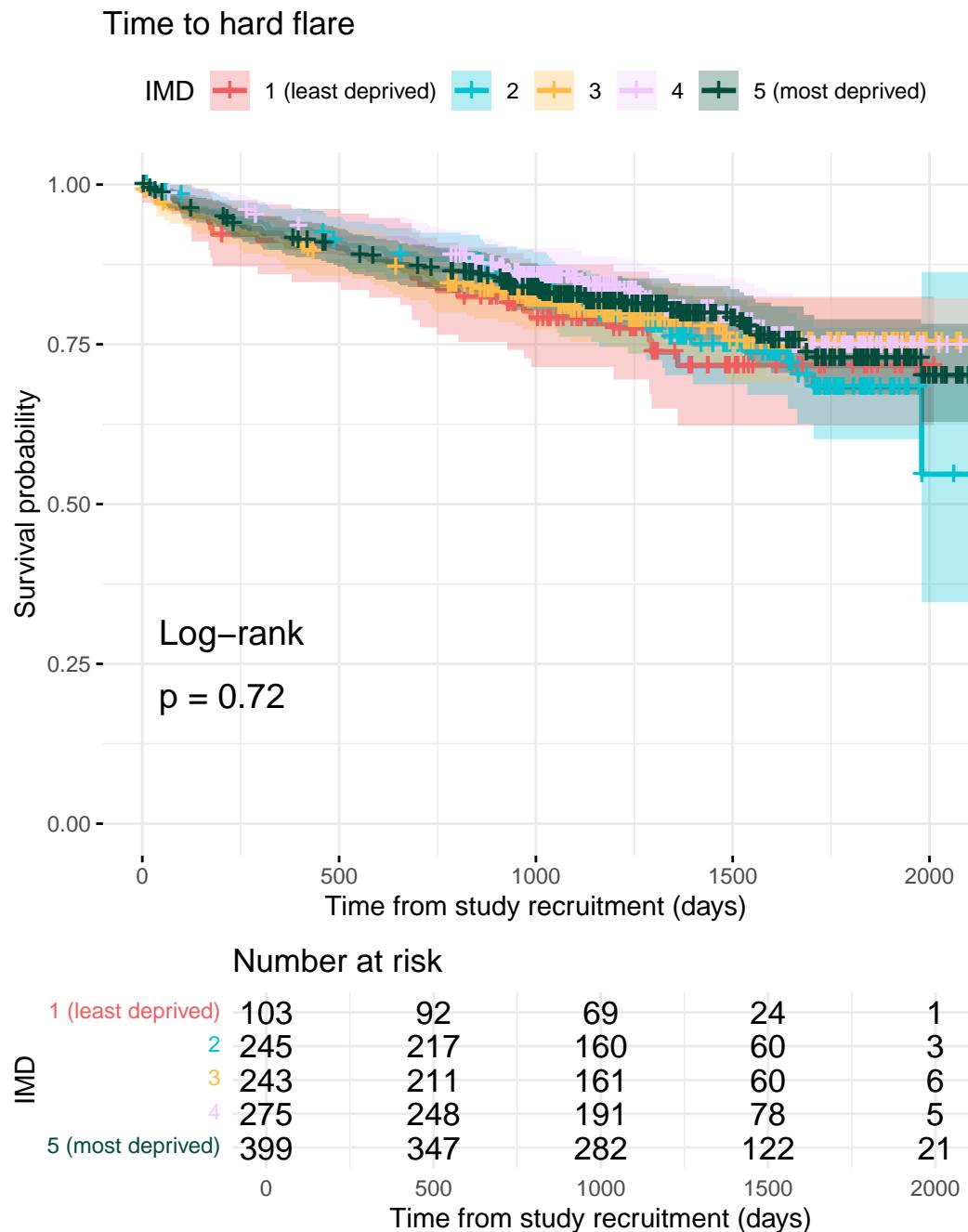
```
generate_survival_plot(
  data = flare.cd.df,
  formula = Surv(softflare_time, softflare) ~ IMD,
  legend_title = "IMD",
  legend_labs = c("1 (least deprived)", "2", "3", "4", "5 (most deprived)"),
  palette = c("#F05D5E", "#00C2D1", "#FFBA49", "#EDC9FF", "#034C3C"),
  xlab = "Time from study recruitment (days)",
  title = "Time to clinical flare",
  break_time_by = 200,
  plot_path = "plots/cd/soft-flare/controlled/imd"
)
```

Time to clinical flare



Hard flare

```
generate_survival_plot(
  data = flare.cd.df,
  formula = Surv(hardflare_time, hardflare) ~ IMD,
  legend_title = "IMD",
  legend_labs = c("1 (least deprived)", "2", "3", "4", "5 (most deprived)"),
  palette = c("#F05D5E", "#00C2D1", "#FFBA49", "#EDC9FF", "#034C3C"),
  xlab = "Time from study recruitment (days)",
  title = "Time to hard flare",
  break_time_by = 500,
  plot_path = "plots/cd/hard-flare/controlled/imd"
)
```

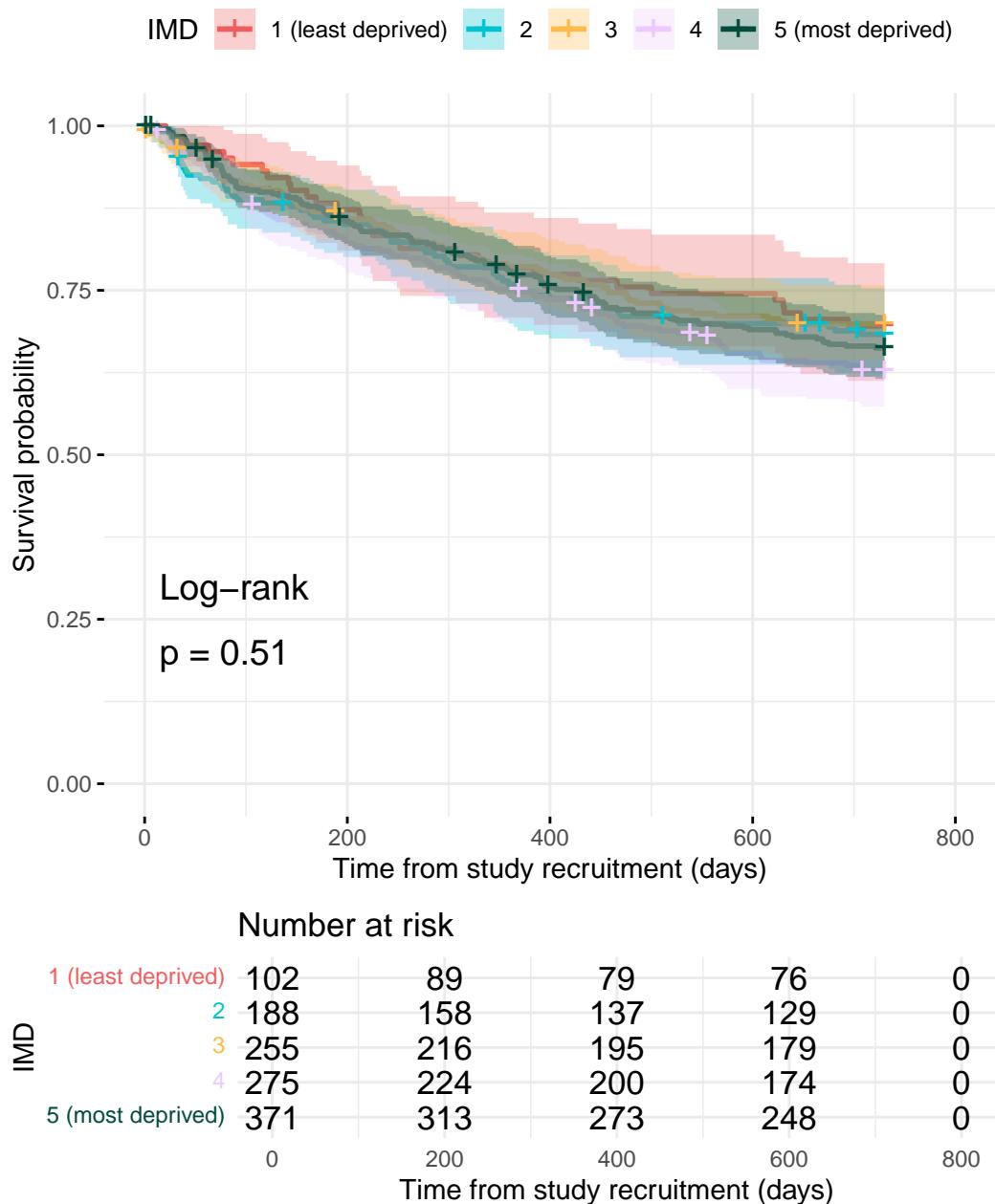


Ulcerative colitis

Patient-reported flare

```
generate_survival_plot(
  data = flare.uc.df,
  formula = Surv(softflare_time, softflare) ~ IMD,
  legend_title = "IMD",
  legend_labs = c("1 (least deprived)", "2", "3", "4", "5 (most deprived)"),
  palette = c("#F05D5E", "#00C2D1", "#FFBA49", "#EDC9FF", "#034C3C"),
  xlab = "Time from study recruitment (days)",
  title = "Time to clinical flare",
  break_time_by = 200,
  plot_path = "plots/uc/soft-flare/controlled/imd"
)
```

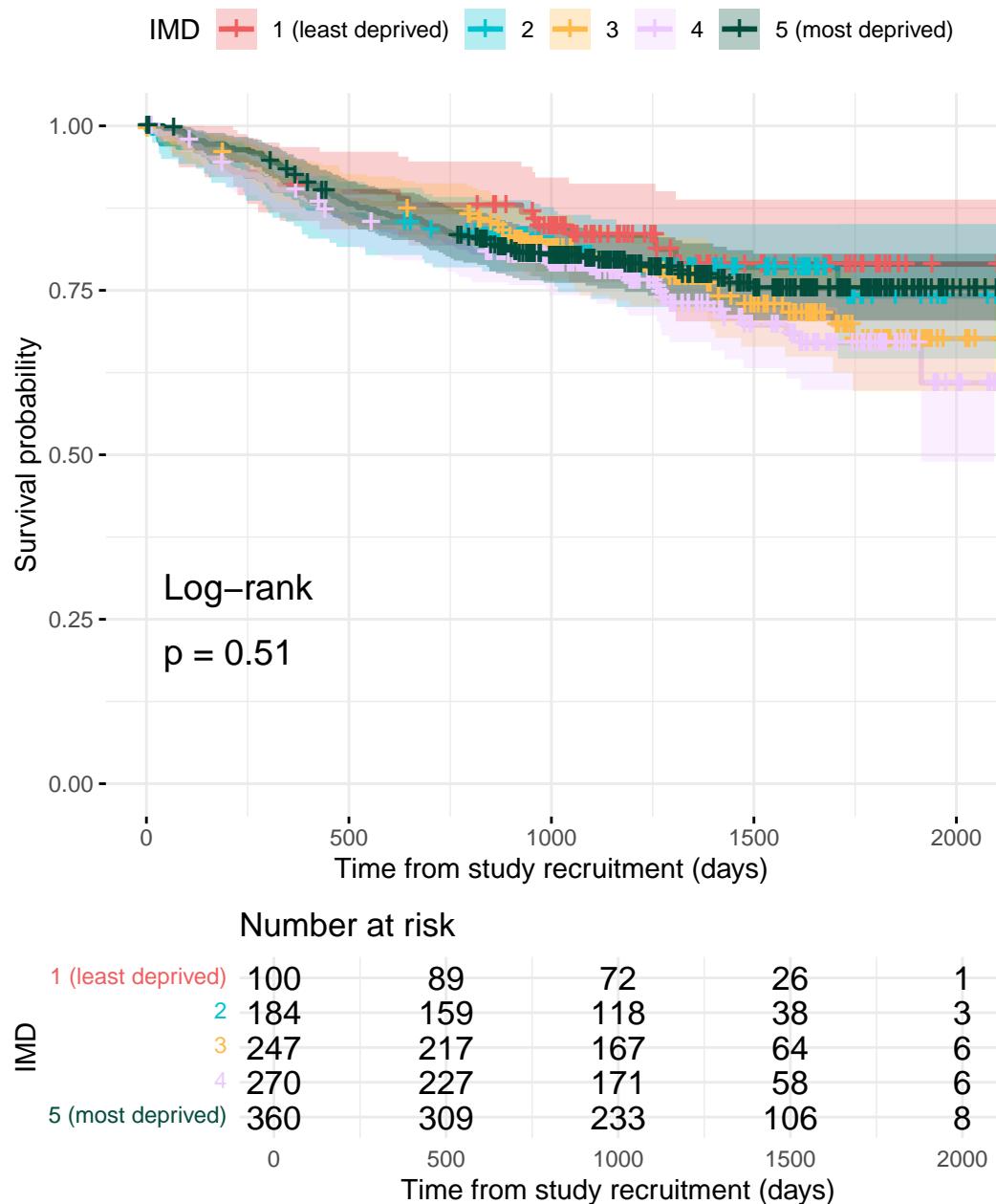
Time to clinical flare



Hard flare

```
generate_survival_plot(
  data = flare.uc.df,
  formula = Surv(hardflare_time, hardflare) ~ IMD,
  legend_title = "IMD",
  legend_labs = c("1 (least deprived)", "2", "3", "4", "5 (most deprived)"),
  palette = c("#F05D5E", "#00C2D1", "#FFBA49", "#EDC9FF", "#034C3C"),
  xlab = "Time from study recruitment (days)",
  title = "Time to hard flare",
  break_time_by = 500,
  plot_path = "plots/uc/hard-flare/controlled/imd"
)
```

Time to hard flare



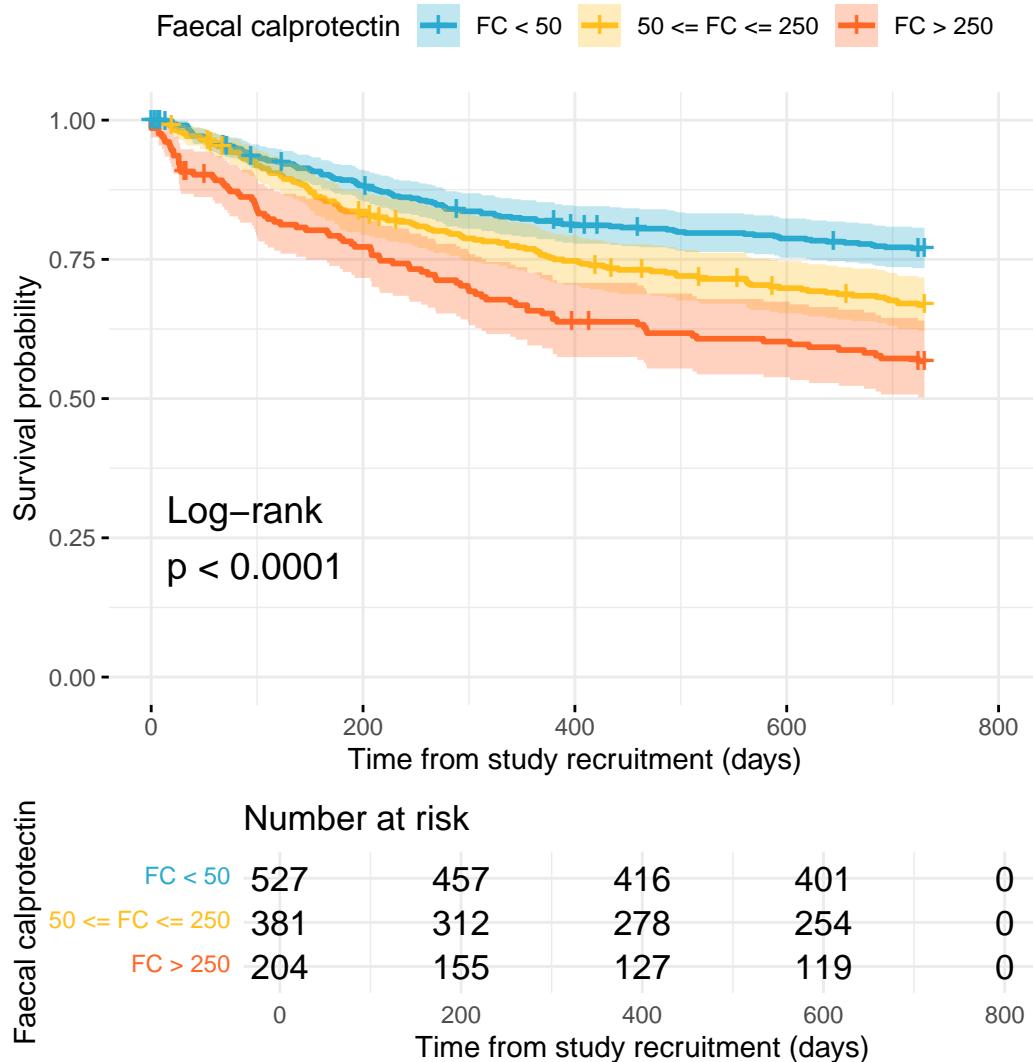
Faecal calprotectin

Crohn's disease

Patient-reported flare

```
p <- generate_survival_plot(  
  data = flare.cd.df,  
  formula = Surv(softflare_time, softflare) ~ cat,  
  legend_title = "Faecal calprotectin",  
  legend_labs = c("FC < 50", "50 < FC <= 250", "FC > 250"),  
  palette = c("#2AAACE", "#FFBF1C", "#FF6726"),  
  xlab = "Time from study recruitment (days)",  
  title = "Time to clinical flare",  
  break_time_by = 200,  
  plot_path = "plots/cd/soft-flare/controlled/fc"  
)  
  
saveRDS(p, paste0(paths$outdir, "fc-cd-soft.RDS"))  
  
print(p, newpage = FALSE)
```

Time to clinical flare



Hard flare

```
p <- generate_survival_plot(
  data = flare.cd.df,
  formula = Surv(hardflare_time, hardflare) ~ cat,
  legend_title = "Faecal calprotectin",
  legend_labs = c("FC < 50", "50 <= FC <= 250", "FC > 250"),
  palette = c("#2AAACE", "#FFBF1C", "#FF6726"),
  xlab = "Time from study recruitment (days)",
```

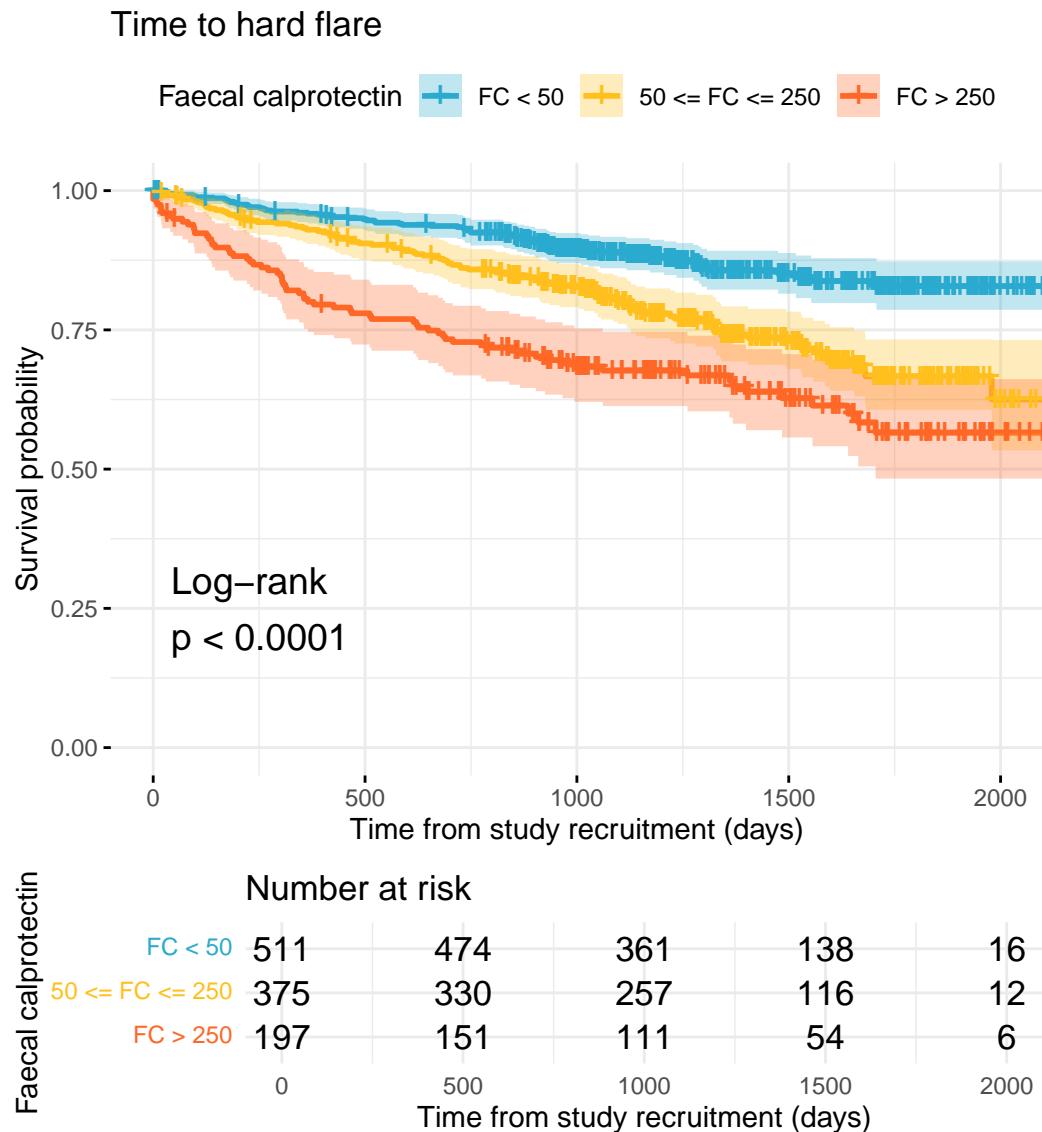
```

    title = "Time to hard flare",
    break_time_by = 500,
    plot_path = "plots/cd/hard-flare/controlled/fc"
  )

saveRDS(p, paste0(paths$outdir, "fc-cd-hard.RDS"))

print(p, newpage = FALSE)

```

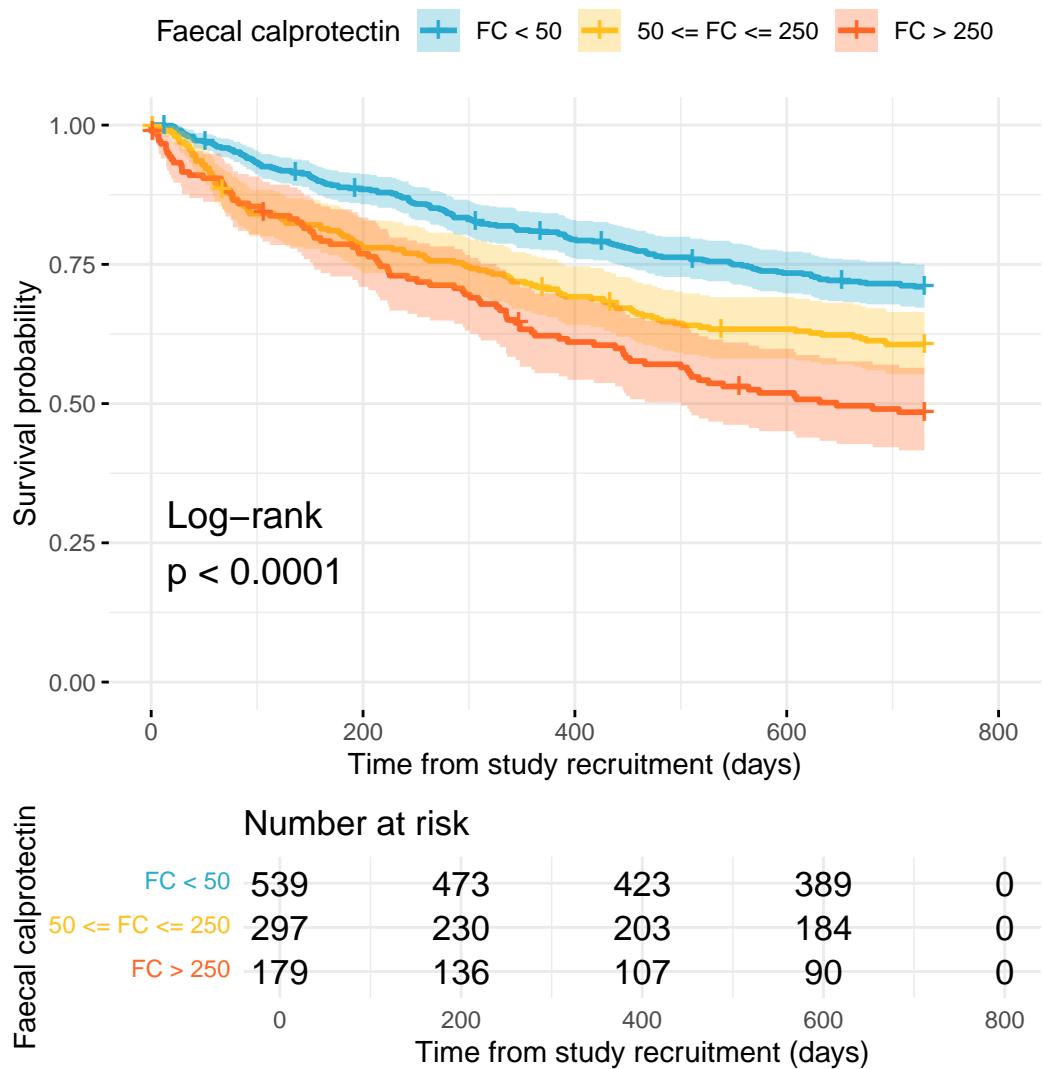


Ulcerative colitis

Patient-reported flare

```
p <- generate_survival_plot(  
  data = flare.uc.df,  
  formula = Surv(softflare_time, softflare) ~ cat,  
  legend_title = "Faecal calprotectin",  
  legend_labs = c("FC < 50", "50 < FC < 250", "FC > 250"),  
  palette = c("#2AAACE", "#FFBF1C", "#FF6726"),  
  xlab = "Time from study recruitment (days)",  
  title = "Time to clinical flare",  
  break_time_by = 200,  
  plot_path = "plots/uc/soft-flare/controlled/fc"  
)  
  
saveRDS(p, paste0(paths$outdir, "fc-uc-soft.RDS"))  
  
print(p, newpage = FALSE)
```

Time to clinical flare



Hard flare

```
p <- generate_survival_plot(
  data = flare.uc.df,
  formula = Surv(hardflare_time, hardflare) ~ cat,
  legend_title = "Faecal calprotectin",
  legend_labs = c("FC < 50", "50 <= FC <= 250", "FC > 250"),
  palette = c("#2AAACE", "#FFBF1C", "#FF6726"),
  xlab = "Time from study recruitment (days)",
```

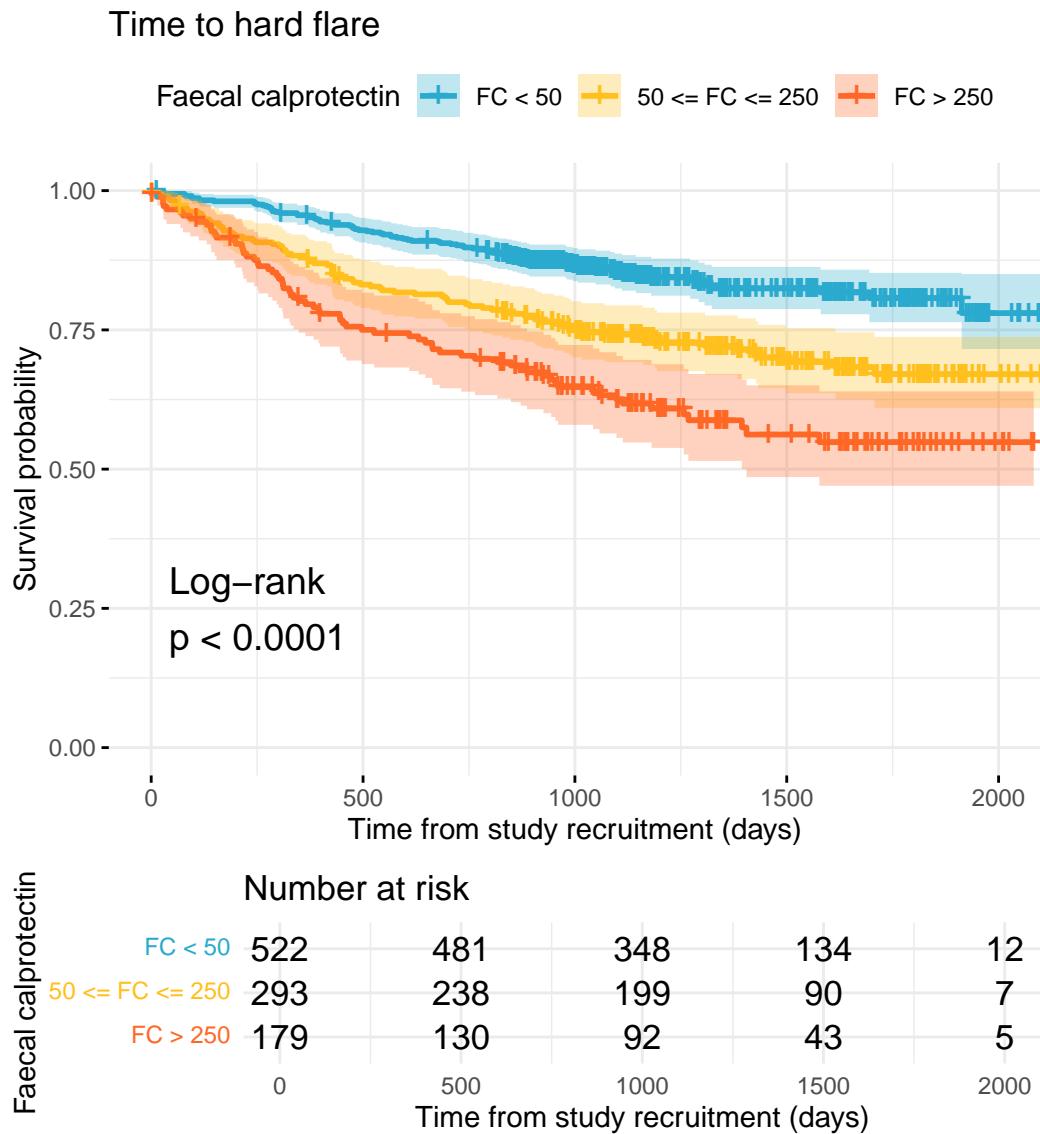
```

    title = "Time to hard flare",
    break_time_by = 500,
    plot_path = "plots/uc/hard-flare/controlled/fc"
  )

saveRDS(p, paste0(paths$outdir, "fc-uc-hard.RDS"))

print(p, newpage = FALSE)

```



Cox models

Crohn's disease

Patient-reported flare

```
fit.me <- coxph(
  Surv(softflare_time, softflare) ~
    Sex + IMD + cat + Smoke + frailty(SiteNo),
  control = coxph.control(outer.max = 20),
  data = flare.cd.df,
  model = TRUE
)

cd.clin.forest <- get_HR(
  fit.me,
  c("SmokePrevious", "SmokeNever")
)

fit.me <- coxph(
  Surv(softflare_time, softflare) ~
    Sex + IMD + cat + frailty(SiteNo),
  control = coxph.control(outer.max = 20),
  data = flare.cd.df,
  model = TRUE
)

cd.clin.forest <- rbind(
  cd.clin.forest,
  get_HR(
    fit.me,
    c(
      "SexFemale",
      paste0("IMD", seq(2, 5)),
      "catFC 50-250",
      "catFC > 250"
    )
  )
)
```

```
invisible(cox_summary(fit.me))
```

Cox model summary:

Variable	HR	Lower 95%	Upper 95%	P-value
SexFemale	1.9989	1.5753	2.5364	0.0000
IMD2	0.9364	0.5970	1.4686	0.7746
IMD3	0.8868	0.5609	1.4021	0.6074
IMD4	0.9417	0.6062	1.4631	0.7894
IMD5	0.9857	0.6443	1.5078	0.9469
catFC 50-250	1.5844	1.2278	2.0445	0.0004
catFC > 250	2.4138	1.8192	3.2028	0.0000

Diagnostics:

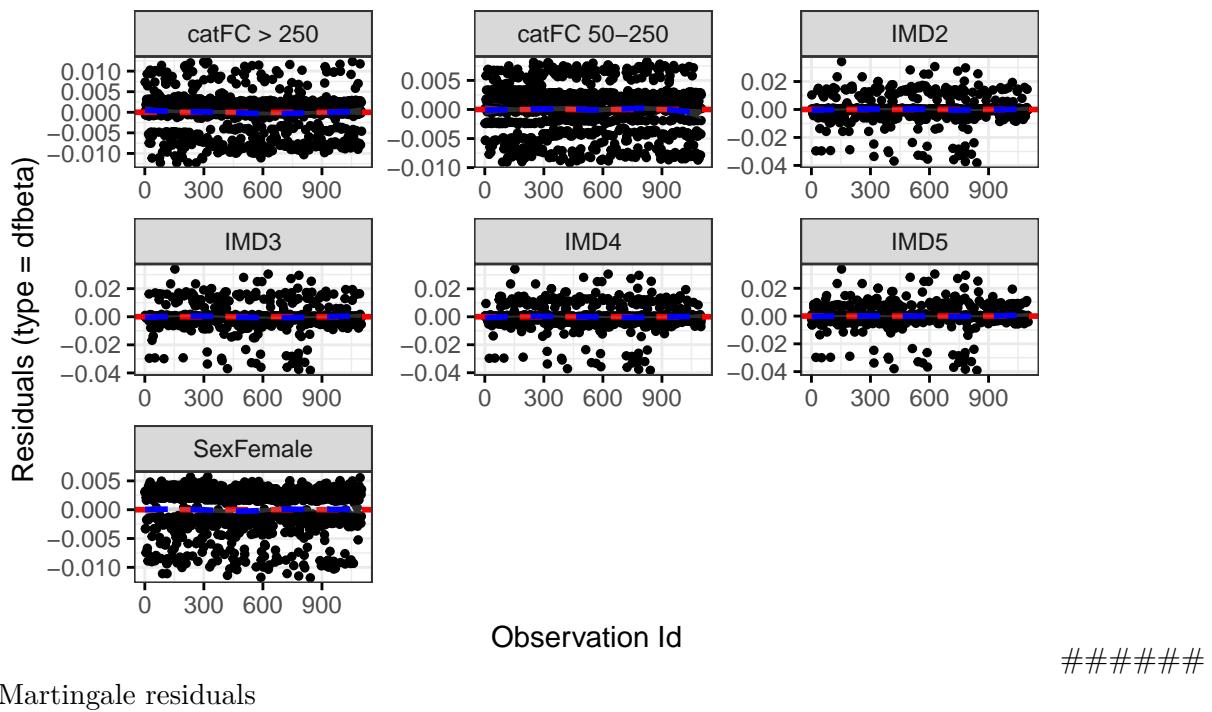
Proportional hazards assumption test

	Chi-squared statistic	DF	P-value
Sex	0.3091	0.9923	0.5750
IMD	5.8397	3.9497	0.2063
cat	2.3232	1.9815	0.3093
GLOBAL	8.4076	13.9400	0.8643

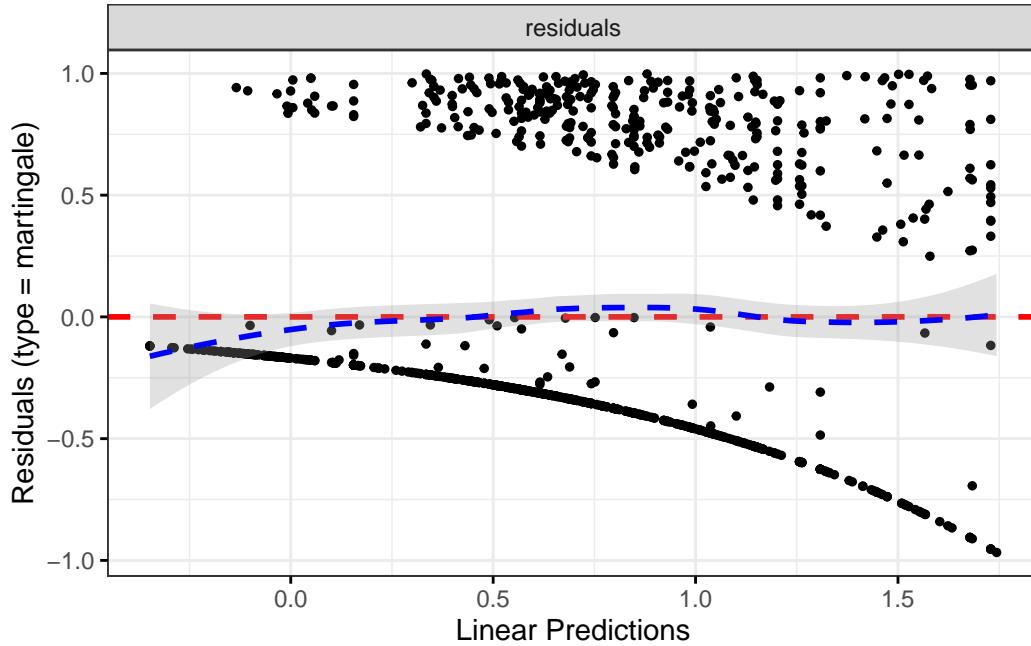
DF betas

```
Warning: `gather_()` was deprecated in tidyr 1.2.0.  
i Please use `gather()` instead.  
i The deprecated feature was likely used in the survminer package.  
Please report the issue at <https://github.com/kassambara/survminer/issues>.
```

```
`geom_smooth()` using formula = 'y ~ x'
```



```
`geom_smooth()` using formula = 'y ~ x'
```



Hard flare

```
fit.me <- coxph(  
  Surv(hardflare_time, hardflare) ~  
    Sex + IMD + cat + Smoke + frailty(SiteNo),  
  control = coxph.control(outer.max = 20),  
  data = flare.cd.df  
)  
  
cd.hard.forest <- get_HR(  
  fit.me,  
  c("SmokePrevious", "SmokeNever")  
)  
  
fit.me <- coxph(  
  Surv(hardflare_time, hardflare) ~  
    Sex + IMD + cat + frailty(SiteNo),  
  control = coxph.control(outer.max = 20),  
  data = flare.cd.df  
)  
  
cd.hard.forest <- rbind(  
  cd.hard.forest,  
  get_HR(  
    fit.me,  
    c(  
      "SexFemale",  
      paste0("IMD", seq(2, 5)),  
      "catFC > 250"  
    )  
  )  
)  
  
invisible(cox_summary(fit.me))
```

Cox model summary:

Variable	HR	Lower 95%	Upper 95%	P-value
SexFemale	1.3887	1.0579	1.8227	0.0180
IMD2	0.9220	0.5365	1.5844	0.7688

Variable	HR	Lower 95%	Upper 95%	P-value
IMD3	0.9675	0.5566	1.6817	0.9068
IMD4	0.8950	0.5222	1.5338	0.6864
IMD5	0.9035	0.5370	1.5199	0.7021
catFC 50-250	2.0217	1.4730	2.7750	0.0000
catFC > 250	3.3366	2.3693	4.6989	0.0000

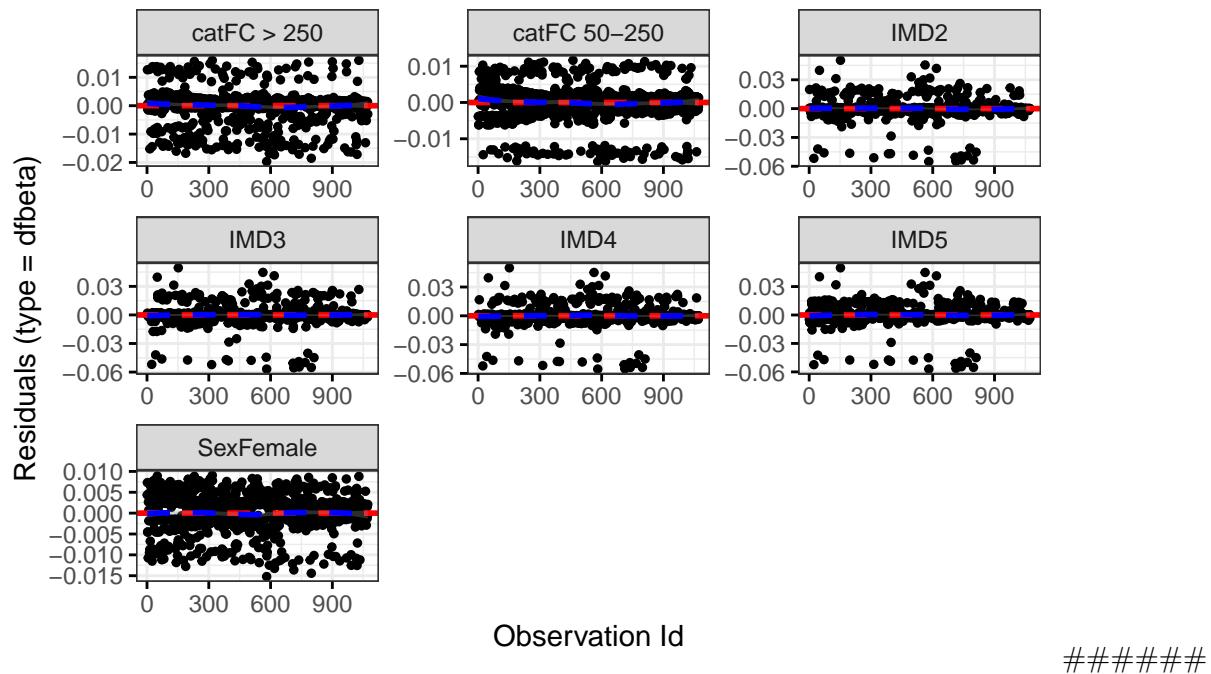
Diagnostics:

Proportional hazards assumption test

	Chi-squared statistic	DF	P-value
Sex	0.2571	0.9863	0.6064
IMD	4.2174	3.9407	0.3689
cat	8.8712	1.9847	0.0116
GLOBAL	13.9394	19.6668	0.8190

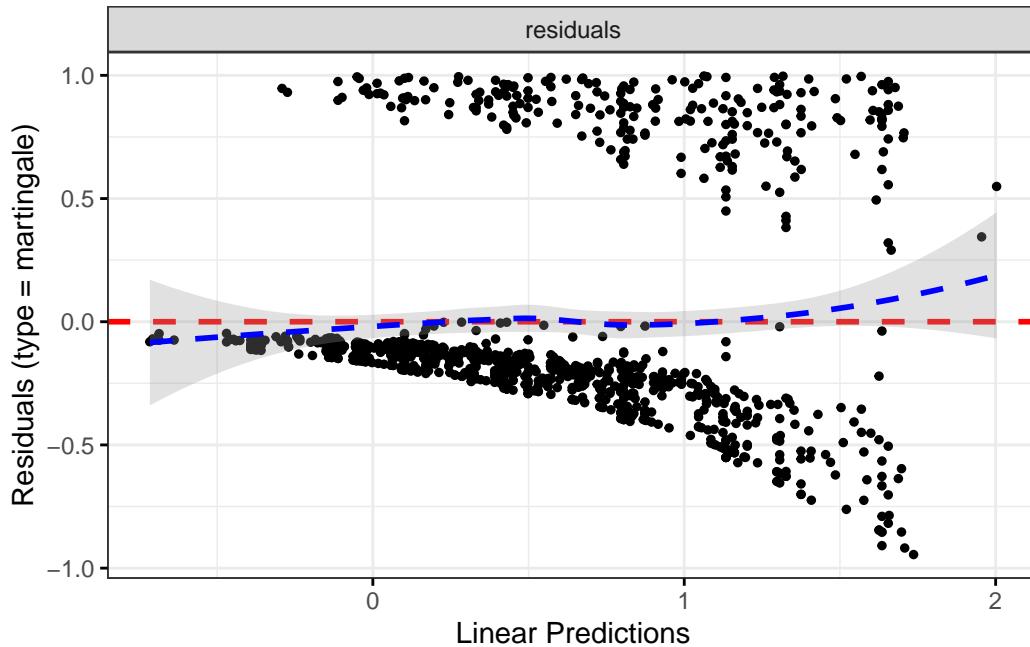
DF betas

`geom_smooth()` using formula = 'y ~ x'



Martingale residuals

```
`geom_smooth()` using formula = 'y ~ x'
```



Ulcerative colitis

Patient-reported flare

```
fit.me <- coxph(  
  Surv(softflare_time, softflare) ~  
    Sex + IMD + cat + Smoke + frailty(SiteNo),  
  control = coxph.control(outer.max = 20),  
  data = flare.uc.df  
)  
  
uc.clin.forest <- get_HR(  
  fit.me,  
  c("SmokePrevious", "SmokeNever")  
)
```

```

fit.me <- coxph(
  Surv(softflare_time, softflare) ~
    Sex + IMD + cat + frailty(SiteNo),
  control = coxph.control(outer.max = 20),
  data = flare.uc.df
)

uc.clin.forest <- rbind(
  uc.clin.forest,
  get_HR(
    fit.me,
    c(
      "SexFemale",
      paste0("IMD", seq(2, 5)),
      "catFC > 250"
    )
  )
)

invisible(cox_summary(fit.me))

```

Cox model summary:

Variable	HR	Lower 95%	Upper 95%	P-value
SexFemale	1.5438	1.2475	1.9104	0.0001
IMD2	1.2433	0.7856	1.9678	0.3525
IMD3	1.1010	0.7025	1.7255	0.6748
IMD4	1.4420	0.9388	2.2151	0.0946
IMD5	1.1988	0.7858	1.8290	0.4002
catFC 50-250	1.5688	1.2269	2.0058	0.0003
catFC > 250	2.1447	1.6433	2.7991	0.0000

Diagnostics:

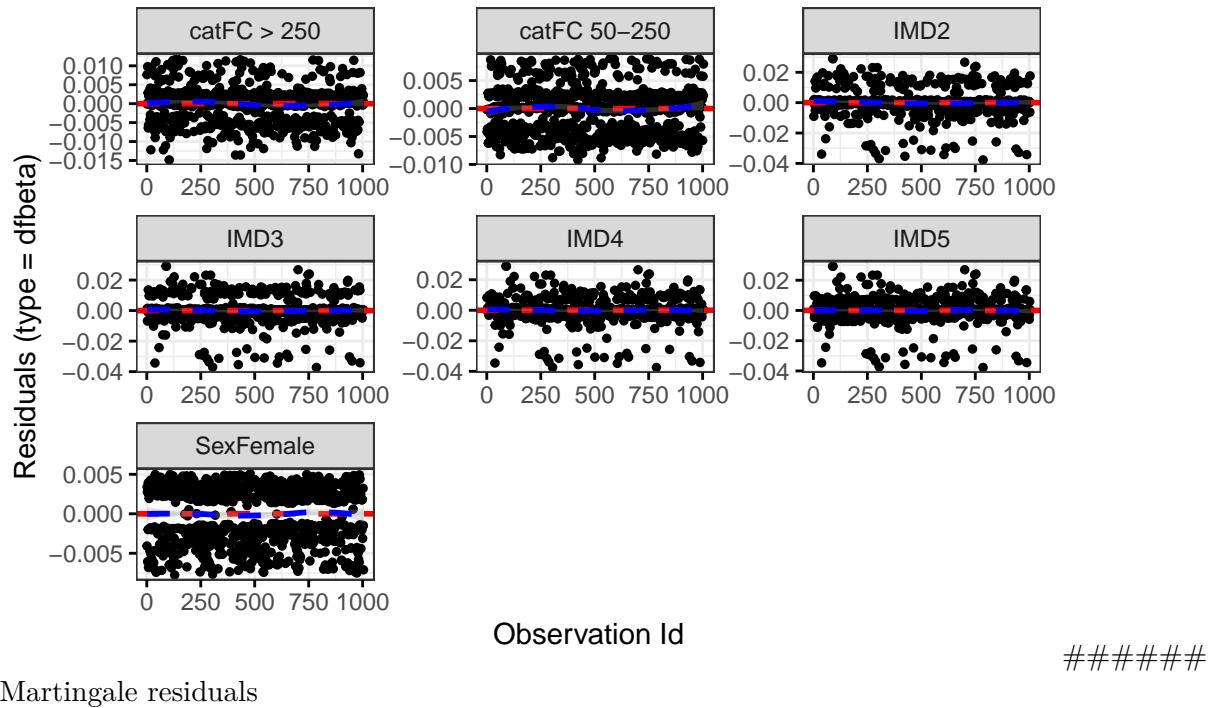
Proportional hazards assumption test

	Chi-squared statistic	DF	P-value
Sex	1.3013	0.9907	0.2514
IMD	4.0189	3.9418	0.3949

	Chi-squared statistic	DF	P-value
cat	5.7453	1.9706	0.0550
GLOBAL	11.3236	18.7016	0.9037

DF betas

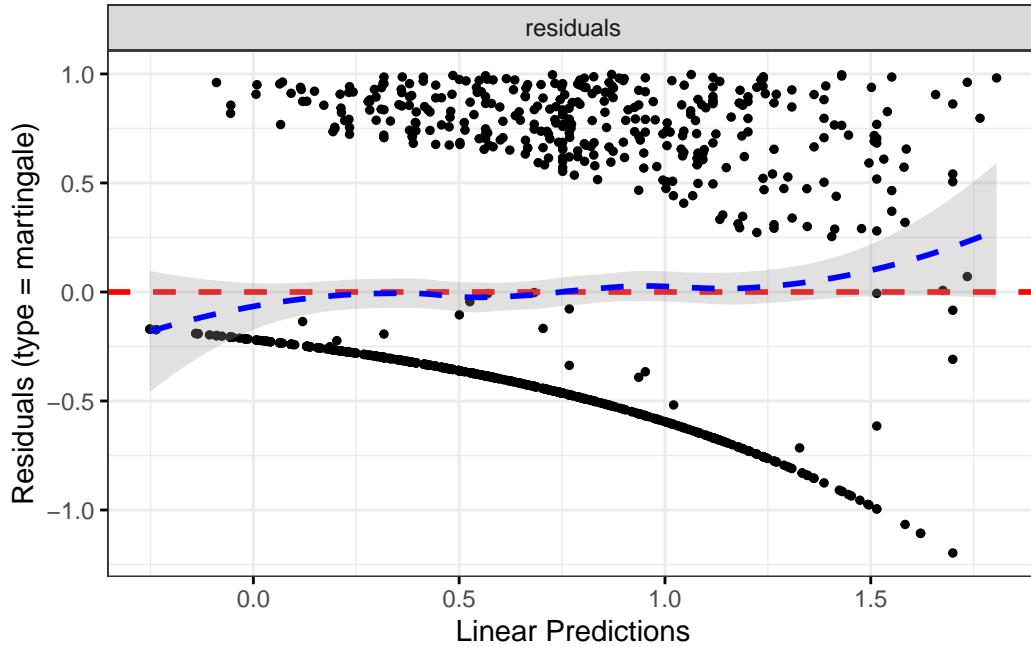
```
`geom_smooth()` using formula = 'y ~ x'
```



#####

Martingale residuals

```
`geom_smooth()` using formula = 'y ~ x'
```



Hard flare

```

fit.me <- coxph(
  Surv(hardflare_time, hardflare) ~
    Sex + IMD + cat + Smoke + frailty(SiteNo),
  control = coxph.control(outer.max = 20),
  data = flare.uc.df
)

uc.hard.forest <- get_HR(
  fit.me,
  c("SmokePrevious", "SmokeNever")
)

fit.me <- coxph(
  Surv(hardflare_time, hardflare) ~
    Sex + IMD + cat + frailty(SiteNo),
  control = coxph.control(outer.max = 20),
  data = flare.uc.df
)

```

```

uc.hard.forest <- rbind(
  uc.hard.forest,
  get_HR(
    fit.me,
    c(
      "SexFemale",
      paste0("IMD", seq(2, 5)),
      "catFC 50-250",
      "catFC > 250"
    )
  )
)

invisible(cox_summary(fit.me))

```

Cox model summary:

Variable	HR	Lower 95%	Upper 95%	P-value
SexFemale	1.3259	1.0208	1.7221	0.0345
IMD2	1.4092	0.7861	2.5260	0.2494
IMD3	1.3774	0.7835	2.4213	0.2659
IMD4	1.7484	1.0130	3.0174	0.0448
IMD5	1.2989	0.7566	2.2298	0.3430
catFC 50-250	2.0322	1.4885	2.7744	0.0000
catFC > 250	3.2203	2.3245	4.4614	0.0000

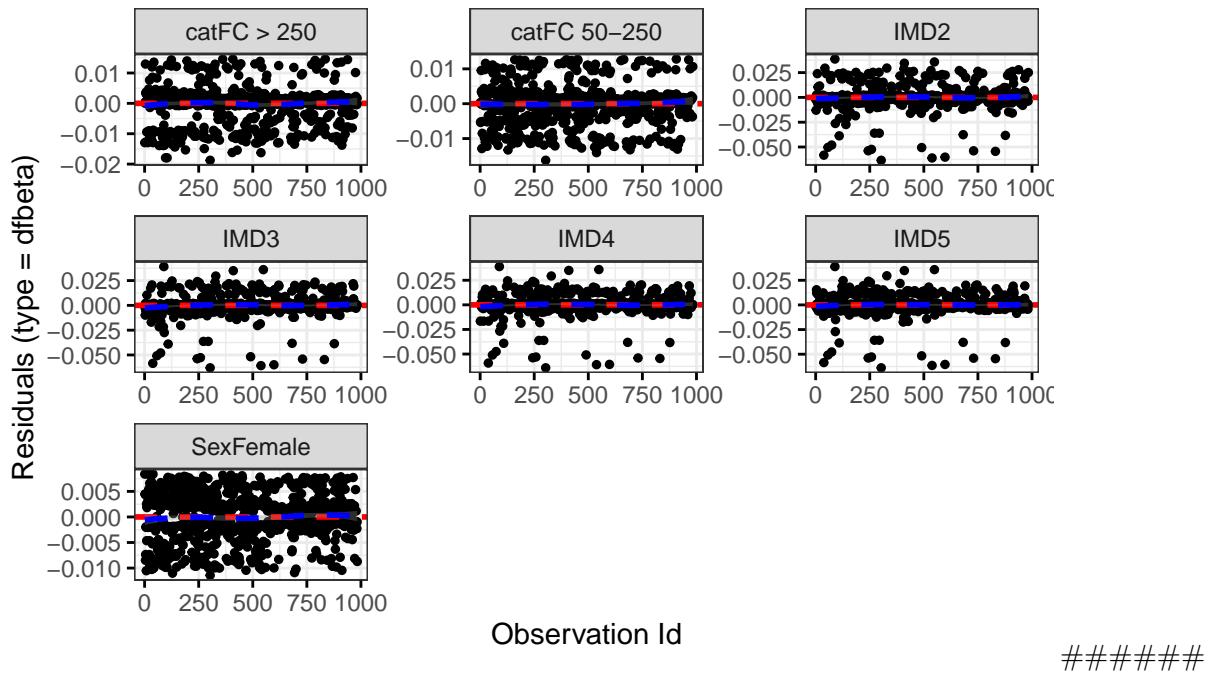
Diagnostics:

Proportional hazards assumption test

	Chi-squared statistic	DF	P-value
Sex	0.1461	0.9849	0.6962
IMD	2.6145	3.9368	0.6145
cat	4.3647	1.9671	0.1096
GLOBAL	7.4355	23.5846	0.9994

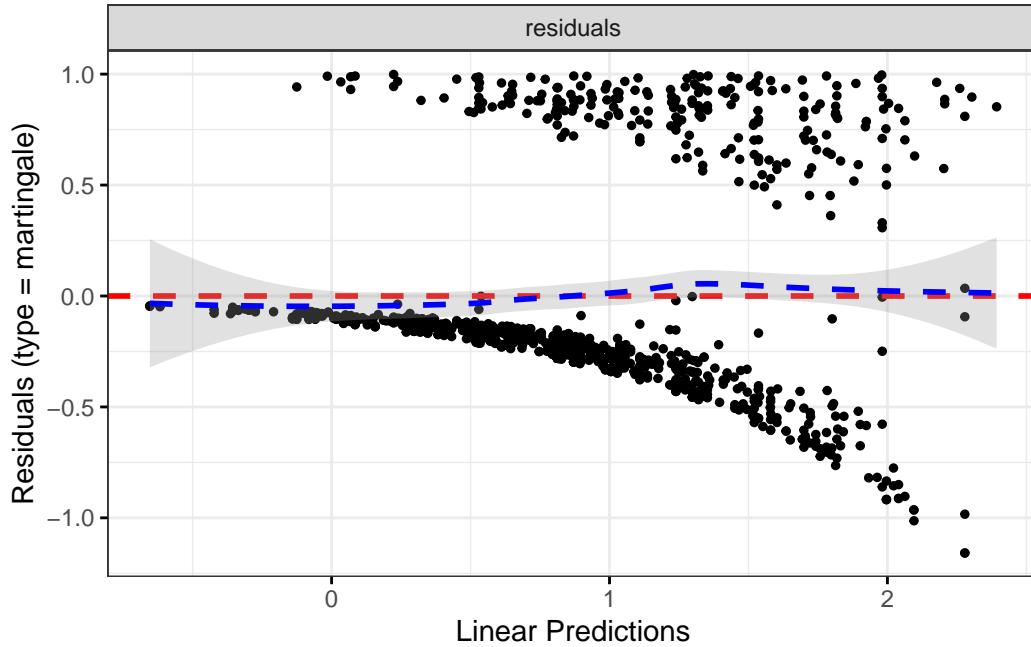
DF betas

```
`geom_smooth()` using formula = 'y ~ x'
```



Martingale residuals

```
`geom_smooth()` using formula = 'y ~ x'
```



Across IBD

Patient-reported flare

```

fit.me <- coxph(
  Surv(softflare_time, softflare) ~
    Sex + IMD + cat + frailty(SiteNo),
  control = coxph.control(outer.max = 20),
  data = flare.df
)

invisible(cox_summary(fit.me))

```

Cox model summary:

Variable	HR	Lower 95%	Upper 95%	P-value
SexFemale	1.7183	1.4676	2.0119	0.0000
IMD2	1.0417	0.7555	1.4364	0.8032
IMD3	0.9689	0.7027	1.3360	0.8474
IMD4	1.1549	0.8490	1.5712	0.3590
IMD5	1.0554	0.7814	1.4255	0.7252

Variable	HR	Lower 95%	Upper 95%	P-value
catFC 50-250	1.5194	1.2743	1.8117	0.0000
catFC > 250	2.2203	1.8303	2.6934	0.0000

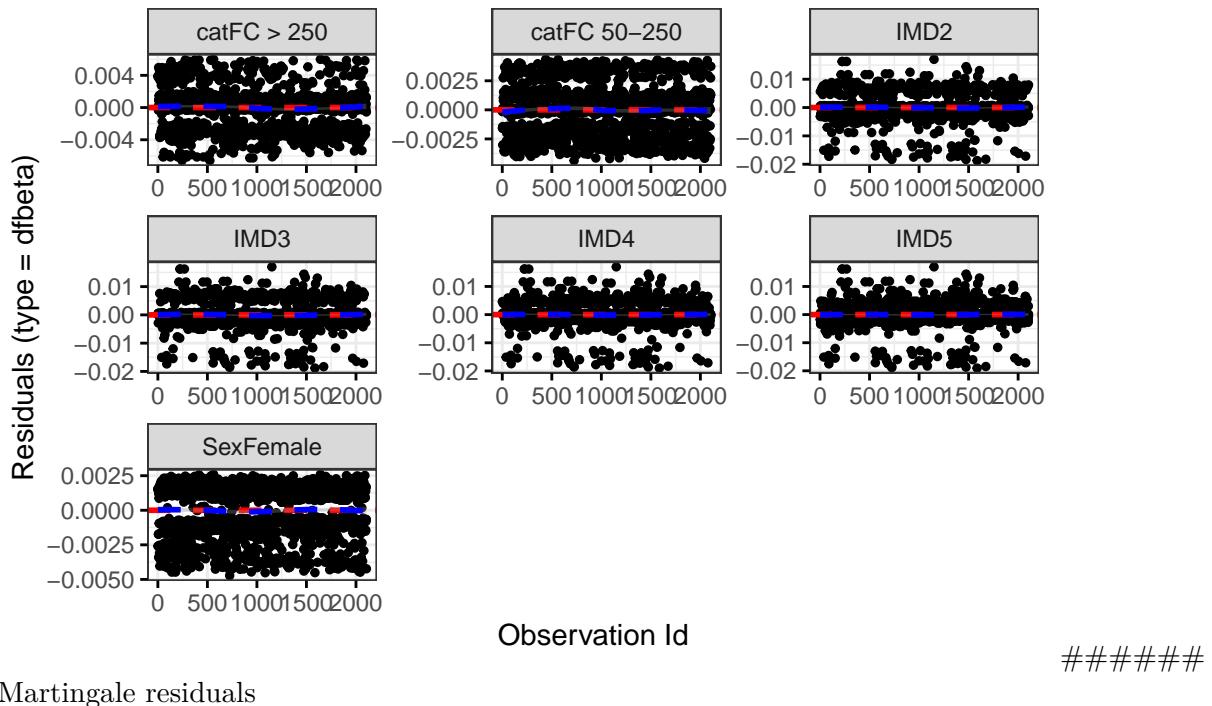
Diagnostics:

Proportional hazards assumption test

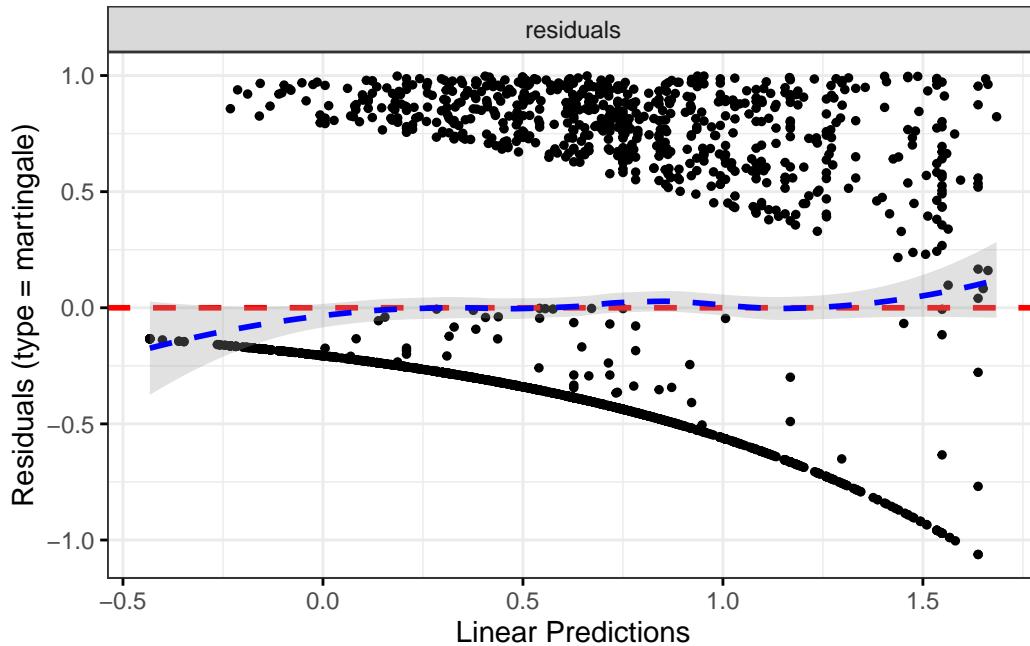
	Chi-squared statistic	DF	P-value
Sex	1.9368	0.9936	0.1627
IMD	8.9273	3.9484	0.0609
cat	1.1234	1.9824	0.5659
GLOBAL	12.1742	22.3691	0.9594

DF betas

```
`geom_smooth()` using formula = 'y ~ x'
```



```
`geom_smooth()` using formula = 'y ~ x'
```



Hard flare

```
fit.me <- coxph(  
  Surv(hardflare_time, hardflare) ~  
    Sex + IMD + cat + frailty(SiteNo),  
  control = coxph.control(outer.max = 20),  
  data = flare.df  
)  
  
invisible(cox_summary(fit.me))
```

Cox model summary:

Variable	HR	Lower 95%	Upper 95%	P-value
SexFemale	1.3310	1.1037	1.6051	0.0028
IMD2	1.1029	0.7416	1.6402	0.6286
IMD3	1.1157	0.7525	1.6542	0.5858
IMD4	1.2392	0.8452	1.8169	0.2720
IMD5	1.0508	0.7220	1.5293	0.7959

Variable	HR	Lower 95%	Upper 95%	P-value
catFC 50-250	1.9760	1.5846	2.4641	0.0000
catFC > 250	3.2506	2.5702	4.1112	0.0000

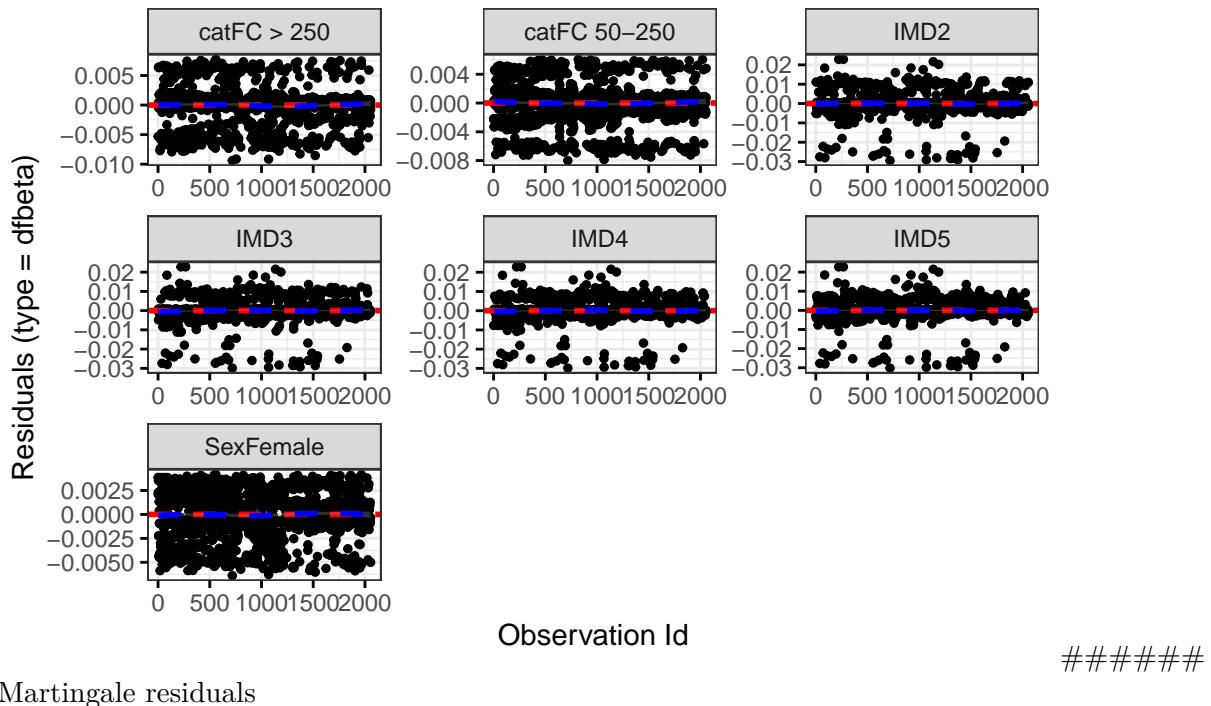
Diagnostics:

Proportional hazards assumption test

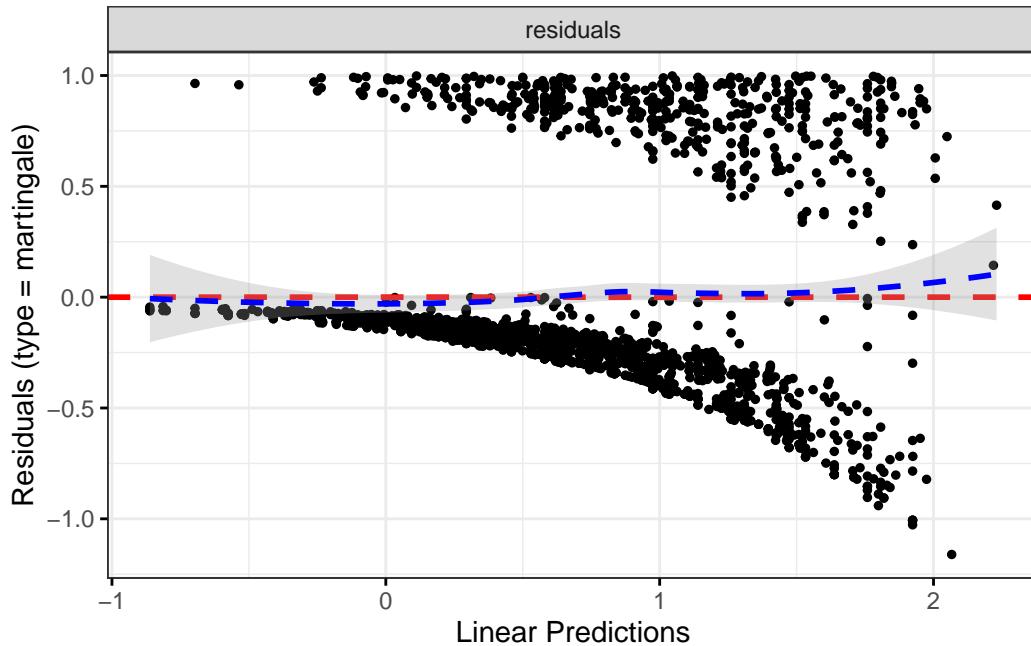
	Chi-squared statistic	DF	P-value
Sex	0.2285	0.9928	0.6297
IMD	0.8488	3.9546	0.9289
cat	8.4343	1.9867	0.0145
GLOBAL	9.9289	29.8504	0.9998

DF betas

```
`geom_smooth()` using formula = 'y ~ x'
```



```
`geom_smooth()` using formula = 'y ~ x'
```



```
saveRDS(flare.df, paste0(paths$outdir, "flares-controlled.RDS"))
saveRDS(flare.cd.df, paste0(paths$outdir, "flares-controlled-cd.RDS"))
saveRDS(flare.uc.df, paste0(paths$outdir, "flares-controlled-uc.RDS"))

saveRDS(cd.clin.forest, paste0(paths$outdir, "cd-clin-controlled.RDS"))
saveRDS(cd.hard.forest, paste0(paths$outdir, "cd-hard-controlled.RDS"))
saveRDS(uc.clin.forest, paste0(paths$outdir, "uc-clin-controlled.RDS"))
saveRDS(uc.hard.forest, paste0(paths$outdir, "uc-hard-controlled.RDS"))
```

Reproduction and reproducibility

Session info

R version 4.4.0 (2024-04-24)

Platform: aarch64-unknown-linux-gnu

locale: LC_CTYPE=en_US.UTF-8, LC_NUMERIC=C, LC_TIME=en_US.UTF-8,
LC_COLLATE=en_US.UTF-8, LC_MONETARY=en_US.UTF-8, LC_MESSAGES=en_US.UTF-8,
LC_PAPER=en_US.UTF-8, LC_NAME=C, LC_ADDRESS=C, LC_TELEPHONE=C,
LC_MEASUREMENT=en_US.UTF-8 and LC_IDENTIFICATION=C

attached base packages: *stats, graphics, grDevices, utils, datasets, methods* and *base*

other attached packages: *gtsummary(v.1.7.2), DescTools(v.0.99.54), finalfit(v.1.0.7), coxme(v.2.2-20), bdsmatrix(v.1.3-7), pander(v.0.6.5), survminer(v.0.4.9), ggpubr(v.0.6.0), survival(v.3.5-8), datefixR(v.1.6.1), lubridate(v.1.9.3), forcats(v.1.0.0), stringr(v.1.5.1), dplyr(v.1.1.4), purrr(v.1.0.2), readr(v.2.1.5), tidyR(v.1.3.1), tibble(v.3.2.1), ggplot2(v.3.5.1), tidyverse(v.2.0.0) and readxl(v.1.4.3)*

loaded via a namespace (and not attached): *gridExtra(v.2.3), gld(v.2.6.6), rlang(v.1.1.3), magrittr(v.2.0.3), e1071(v.1.7-14), compiler(v.4.4.0), mgcv(v.1.9-1), vctrs(v.0.6.5), pkgconfig(v.2.0.3), shape(v.1.4.6.1), fastmap(v.1.2.0), backports(v.1.5.0), labeling(v.0.4.3), KMsurv(v.0.1-5), utf8(v.1.2.4), rmarkdown(v.2.27), markdown(v.1.12), tzdb(v.0.4.0), nloptr(v.2.0.3), xfun(v.0.44), glmnet(v.4.1-8), jomo(v.2.7-6), jsonlite(v.1.8.8), pan(v.1.9), broom(v.1.0.6), R6(v.2.5.1), stringi(v.1.8.4), car(v.3.1-2), boot(v.1.3-30), rpart(v.4.1.23), cellranger(v.1.1.0), Rcpp(v.1.0.12), iterators(v.1.0.14), knitr(v.1.47), zoo(v.1.8-12), Matrix(v.1.7-0), splines(v.4.4.0), nnet(v.7.3-19), timechange(v.0.3.0), tidyselect(v.1.2.1), rstudioapi(v.0.16.0), abind(v.1.4-5), yaml(v.2.3.8), ggtext(v.0.1.2), codetools(v.0.2-20), lattice(v.0.22-6), withr(v.3.0.0), evaluate(v.0.23), proxy(v.0.4-27), xml2(v.1.3.6), survMisc(v.0.5.6), pillar(v.1.9.0), carData(v.3.0-5), mice(v.3.16.0), foreach(v.1.5.2), generics(v.0.1.3), hms(v.1.1.3), commonmark(v.1.9.1), munsell(v.0.5.1), scales(v.1.3.0), rootSolve(v.1.8.2.4), minqa(v.1.2.7), xtable(v.1.8-4), class(v.7.3-22), glue(v.1.7.0), lmom(v.3.0), tools(v.4.4.0), data.table(v.1.15.4), lme4(v.1.1-35.3), ggsignif(v.0.6.4), Exact(v.3.2), mvtnorm(v.1.2-5), grid(v.4.4.0), colorspace(v.2.1-0), nlme(v.3.1-164), cli(v.3.6.2), km.ci(v.0.5-6), fansi(v.1.0.6), expm(v.0.999-9), broom.helpers(v.1.15.0), gt(v.0.10.1), gtable(v.0.3.5), rstatix(v.0.7.2), digest(v.0.6.35), farver(v.2.1.2), htmltools(v.0.5.8.1), lifecycle(v.1.0.4), httr(v.1.4.7), mitml(v.0.4-5), gridtext(v.0.1.5) and MASS(v.7.3-60.2)*

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