

# Package ‘YPPE’

May 7, 2026

**Title** Yang and Prentice Model with Piecewise Exponential Baseline Distribution

**Version** 1.0.1

**Description** Semiparametric modeling of lifetime data with crossing survival curves via Yang and Prentice model with piecewise exponential baseline distribution. Details about the model can be found in Demarqui and Mayrink (2019) <[doi:10.48550/arXiv.1910.02406](https://doi.org/10.48550/arXiv.1910.02406)>. Model fitting carried out via likelihood-based and Bayesian approaches. The package also provides point and interval estimation for the crossing survival times.

**License** GPL (>= 2)

**URL** <https://github.com/fndemarqui/YPPE>

**BugReports** <https://github.com/fndemarqui/YPPE/issues>

**Encoding** UTF-8

**LazyData** true

**Biarch** true

**Depends** R (>= 3.4.0), survival

**Imports** methods, MASS, Formula, Rcpp (>= 0.12.0), rstan (>= 2.18.1), rstantools (>= 2.0.0)

**LinkingTo** BH (>= 1.66.0), Rcpp (>= 0.12.0), RcppEigen (>= 0.3.3.3.0), rstan (>= 2.18.1), StanHeaders (>= 2.18.0)

**SystemRequirements** GNU make

**RoxygenNote** 7.0.2

**Suggests** testthat

**NeedsCompilation** yes

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**Repository** CRAN

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YPPE-package

*The 'YPPE' package.*

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## Description

Semiparametric modeling of lifetime data with crossing survival curves via Yang and Prentice model with piecewise exponential baseline distribution curves. Details about the model can be found in Demarqui and Mayrink (2019) <arXiv:1910.02406>. Model fitting carried out via likelihood-based and Bayesian approaches. The package also provides point and interval estimation for the crossing survival times.

## References

- Demarqui, F. N. and Mayrink, V. D. (2019). A fully likelihood-based approach to model survival data with crossing survival curves. <arXiv:1910.02406>
- Stan Development Team (2019). RStan: the R interface to Stan. R package version 2.19.2. <https://mc-stan.org>
- Yang, S. and Prentice, R. L. (2005). Semiparametric analysis of short-term and long-term hazard ratios with two-sample survival data. *Biometrika* 92, 1-17.

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coef	<i>Generic S3 method coef</i>
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**Description**

Generic S3 method coef

**Usage**

```
coef(object, ...)
```

**Arguments**

object	a fitted model object
...	further arguments passed to or from other methods.

**Value**

the estimated regression coefficients

---

coef.yype	<i>Estimated regression coefficients</i>
-----------	--

---

**Description**

Estimated regression coefficients

**Usage**

```
## S3 method for class 'yype'  
coef(object, ...)
```

**Arguments**

object	an object of the class yype
...	further arguments passed to or from other methods

**Value**

the estimated regression coefficients

confint                      *Generic S3 method confint*

---

**Description**

Generic S3 method confint

**Usage**

```
confint(object, ...)
```

**Arguments**

object                      a fitted model object  
...                          further arguments passed to or from other methods.

**Value**

the estimated regression coefficients

---

confint.yype                      *Confidence intervals for the regression coefficients*

---

**Description**

Confidence intervals for the regression coefficients

**Usage**

```
## S3 method for class 'yype'  
confint(object, level = 0.95, ...)
```

**Arguments**

object                      an object of the class yype  
level                        the confidence level required  
...                          further arguments passed to or from other methods

**Value**

100(1-alpha) confidence intervals for the regression coefficients

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crossTime	<i>Generic S3 method crossTime</i>
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**Description**

Generic S3 method crossTime

**Usage**

```
crossTime(object, ...)
```

**Arguments**

object	a fitted model object
...	further arguments passed to or from other methods.

**Value**

the crossing survival time

---

crossTime.yype	<i>Computes the crossing survival times</i>
----------------	---

---

**Description**

Computes the crossing survival times

**Usage**

```
## S3 method for class 'yype'
crossTime(object, newdata1, newdata2, conf.level = 0.95, nboot = 4000, ...)
```

**Arguments**

object	an object of class yype
newdata1	a data frame containing the first set of explanatory variables
newdata2	a data frame containing the second set of explanatory variables
conf.level	level of the confidence/credible intervals
nboot	number of bootstrap samples (default nboot=4000); ignored if approach="bayes".
...	further arguments passed to or from other methods.

**Value**

the crossing survival time

**Examples**

```

# ML approach:
library(YPPE)
mle <- yppe(Surv(time, status)~arm, data=ipass, approach="mle")
summary(mle)
newdata1 <- data.frame(arm=0)
newdata2 <- data.frame(arm=1)
tcross <- crossTime(mle, newdata1, newdata2)
tcross
ekm <- survfit(Surv(time, status)~arm, data=ipass)
newdata <- data.frame(arm=0:1)
St <- survfit(mle, newdata)
time <- sort(ipass$time)
plot(ekm, col=1:2)
lines(time, St[[1]])
lines(time, St[[2]], col=2)
abline(v=tcross, col="blue")

# Bayesian approach:
bayes <- yppe(Surv(time, status)~arm, data=ipass, approach="bayes")
summary(bayes)
newdata1 <- data.frame(arm=0)
newdata2 <- data.frame(arm=1)
tcross <- crossTime(bayes, newdata1, newdata2)
tcross
ekm <- survfit(Surv(time, status)~arm, data=ipass)
newdata <- data.frame(arm=0:1)
St <- survfit(bayes, newdata)
time <- sort(ipass$time)
plot(ekm, col=1:2)
lines(time, St[[1]])
lines(time, St[[2]], col=2)
abline(v=tcross, col="blue")

```

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gastric

*Gastric cancer data set*


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**Description**

Data set from a clinical trial conducted by the Gastrointestinal Tumor Study Group (GTSG) in 1982. The data set refers to the survival times of patients with locally nonresectable gastric cancer. Patients were either treated with chemotherapy combined with radiation or chemotherapy alone.

**Format**

A data frame with 90 rows and 3 variables:

- time: survival times (in days)

- status: failure indicator (1 - failure; 0 - otherwise)
- trt: treatments (1 - chemotherapy + radiation; 0 - chemotherapy alone)

**Author(s)**

Fabio N. Demarqui <fndemarqui@est.ufmg.br>

**References**

Gastrointestinal Tumor Study Group. (1982) A Comparison of Combination Chemotherapy and Combined Modality Therapy for Locally Advanced Gastric Carcinoma. *Cancer* 49:1771-7.

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ipass

*IRESSA Pan-Asia Study (IPASS) data set*

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**Description**

Reconstructed IPASS clinical trial data reported in Argyropoulos and Unruh (2015). Although reconstructed, this data set preserves all features exhibited in references with full access to the observations from this clinical trial. The data base is related to the period of March 2006 to April 2008. The main purpose of the study is to compare the drug gefitinib against carboplatin/paclitaxel doublet chemotherapy as first line treatment, in terms of progression free survival (in months), to be applied to selected non-small-cell lung cancer (NSCLC) patients.

**Format**

A data frame with 1217 rows and 3 variables:

- time: progression free survival (in months)
- status: failure indicator (1 - failure; 0 - otherwise)
- arm: (1 - gefitinib; 0 - carboplatin/paclitaxel doublet chemotherapy)

**Author(s)**

Fabio N. Demarqui <fndemarqui@est.ufmg.br>

**References**

Argyropoulos, C. and Unruh, M. L. (2015). Analysis of time to event outcomes in randomized controlled trials by generalized additive models. *PLOS One* 10, 1-33.

print.summary.yype      *Print the summary.yype output*

---

**Description**

Print the summary.yype output

**Usage**

```
## S3 method for class 'summary.yype'  
print(x, ...)
```

**Arguments**

x                      an object of the class summary.yype.  
...                     further arguments passed to or from other methods.

**Value**

a summary of the fitted model.

---

summary.yype              *Summary for the yype model*

---

**Description**

Summary for the yype model

**Usage**

```
## S3 method for class 'yype'  
summary(object, ...)
```

**Arguments**

object                  an object of the class 'yype'.  
...                      further arguments passed to or from other methods.

---

survfit	<i>Generic S3 method survfit</i>
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---

**Description**

Generic S3 method survfit

**Usage**

```
survfit(object, ...)
```

**Arguments**

object	a fitted model object
...	further arguments passed to or from other methods.

**Value**

the crossing survival time

---

survfit.yype	<i>Survival function for the YPPE model</i>
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---

**Description**

Survival function for the YPPE model

**Usage**

```
## S3 method for class 'yype'  
survfit(object, newdata, ...)
```

**Arguments**

object	an object of the class yype
newdata	a data frame containing the set of explanatory variables.
...	further arguments passed to or from other methods.

**Value**

a list containing the estimated survival probabilities.

**Examples**

```

# ML approach:
library(YPPE)
mle <- yppe(Surv(time, status)~arm, data=ipass, approach="mle")
summary(mle)
ekm <- survfit(Surv(time, status)~arm, data=ipass)
newdata <- data.frame(arm=0:1)
St <- survfit(mle, newdata)
time <- sort(ipass$time)
plot(ekm, col=1:2)
lines(time, St[[1]])
lines(time, St[[2]], col=2)

# Bayesian approach:
bayes <- yppe(Surv(time, status)~arm, data=ipass, approach="bayes")
summary(bayes)
ekm <- survfit(Surv(time, status)~arm, data=ipass)
newdata <- data.frame(arm=0:1)
St <- survfit(bayes, newdata)
time <- sort(ipass$time)
plot(ekm, col=1:2)
lines(time, St[[1]])
lines(time, St[[2]], col=2)

```

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timeGrid

*Time grid*


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**Description**

Time grid

**Usage**

```
timeGrid(time, status, n_int = NULL)
```

**Arguments**

time	Vector of failure times
status	Vector of failure indicators
n_int	Optional. Number of intervals. If NULL, the number of intervals is set to be equal to the number of distinct observed failure times.

**Value**

Time grid.

---

vcov	<i>Generic S3 method vcov</i>
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---

**Description**

Generic S3 method vcov

**Usage**

```
vcov(object, ...)
```

**Arguments**

object	a fitted model object
...	further arguments passed to or from other methods.

**Value**

the variance-covariance matrix associated the regression coefficients.

---

vcov.yype	<i>Covariance of the regression coefficients</i>
-----------	--

---

**Description**

Covariance of the regression coefficients

**Usage**

```
## S3 method for class 'yype'
vcov(object, ...)
```

**Arguments**

object	an object of the class yype
...	further arguments passed to or from other methods.

**Value**

the variance-covariance matrix associated with the regression coefficients.

---

yppe	<i>Fits the Yang and Prentice model with baseline distribution modelled by the piecewise exponential distribution.</i>
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---

### Description

Fits the Yang and Prentice model with baseline distribution modelled by the piecewise exponential distribution.

### Usage

```
yppe(
  formula,
  data,
  n_int = NULL,
  rho = NULL,
  tau = NULL,
  hessian = TRUE,
  approach = c("mle", "bayes"),
  hyper_parms = list(h1_gamma = 0, h2_gamma = 4, mu_psi = 0, sigma_psi = 4, mu_phi = 0,
    sigma_phi = 4, mu_beta = 0, sigma_beta = 4),
  ...
)
```

### Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data	an optional data frame, list or environment (or object coercible by <code>as.data.frame</code> to a data frame) containing the variables in the model. If not found in data, the variables are taken from <code>environment(formula)</code> , typically the environment from which <code>yppe</code> is called.
n_int	number of intervals of the PE distribution. If NULL, default value (square root of n) is used.
rho	the time grid of the PE distribution. If NULL, the function <code>timeGrid</code> is used to compute rho.
tau	the maximum time of follow-up. If NULL, <code>tau = max(time)</code> , where <code>time</code> is the vector of observed survival times.
hessian	logical; If TRUE (default), the hessian matrix is returned when <code>approach="mle"</code> .
approach	approach to be used to fit the model (mle: maximum likelihood; bayes: Bayesian approach).
hyper_parms	a list containing the hyper-parameters of the prior distributions (when <code>approach = "bayes"</code> ). If not specified, default values are used.
...	Arguments passed to either <code>'rstan::optimizing'</code> or <code>'rstan::sampling'</code> .

**Value**

*yype* returns an object of class "yype" containing the fitted model.

**Examples**

```
# ML approach:
library(YPPE)
mle <- yype(Surv(time, status)~arm, data=ipass, approach="mle")
summary(mle)

# Bayesian approach:
bayes <- yype(Surv(time, status)~arm, data=ipass, approach="bayes")
summary(bayes)
```

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