

# Package ‘qif’

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**Title** Quadratic Inference Function

**Version** 1.5

**Date** 2019-7-2

**Depends** R (>= 3.5.0)

**Description** Developed to perform the estimation and inference for regression coefficient parameters in longitudinal marginal models using the method of quadratic inference functions. Like generalized estimating equations, this method is also a quasi-likelihood inference method. It has been showed that the method gives consistent estimators of the regression coefficients even if the correlation structure is misspecified, and it is more efficient than GEE when the correlation structure is misspecified. Based on Qu, A., Lindsay, B.G. and Li, B. (2000) <doi:10.1093/biomet/87.4.823>.

**Imports** MASS

**License** GPL-2

**Encoding** UTF-8

**LazyData** true

**BugReports** <https://github.com/umich-biostatistics/qif/issues>

**RoxygenNote** 6.1.1

**NeedsCompilation** yes

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 epil

*Seizure Counts for Epileptics*


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### Description

The data set consists of seizure counts for 59 individuals with epilepsy. Counts were recorded for four two-week periods (8 weeks total). Age is the only covariate.

### Usage

epil

### Format

A `data.frame` with 236 rows and 9 variables (columns):

**y** the count for the 2-week period.

**trt** treatment, "placebo" or "progabide".

**base** the counts in the baseline 8-week period.

**age** subject's age, in years.

**V4** 0/1 indicator variable of period 4.

**subject** subject number, 1 to 59.

**period** period, 1 to 4.

**lbase** log-counts for the baseline period, centred to have zero mean.

**lage** log-ages, centred to have zero mean.

### Source

Thall, P. F. and Vail, S. C. (1990) Some covariance models for longitudinal count data with overdispersion. *Biometrics* 46, 657–671.

### References

Venables, W. N. and Ripley, B. D. (2002) *Modern Applied Statistics with S*. Fourth Edition. Springer.

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 exacerb

*MS data*


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**Description**

MS data

**Usage**

exacerb

**Format**An object of class `data.frame` with 765 rows and 14 columns.**Source**

Thal

**References**

Venab

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 print.qif

*Print Function for qif Object*


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**Description**Print a `qif` model object.**Usage**

```
## S3 method for class 'qif'
print(x, digits = NULL, quote = FALSE, prefix = "",
      ...)
```

**Arguments**

<code>x</code>	the <code>qif</code> model object.
<code>digits</code>	number of digits to print.
<code>quote</code>	logical, indicating whether or not strings should be printed with surrounding quotes.
<code>prefix</code>	string, only "" is implemented.
<code>...</code>	further arguments passed to or from other methods.

**Value**

The invisible object from the arguments.

**Author(s)**

Zhichang Jiang, Alberta Health Services, and Peter X.K. Song, University of Michigan.

**See Also**

`print qif`

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`print.summary.qif` *Print the Summary of qif Object*

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**Description**

Prints the summary of a `qif` object.

**Usage**

```
## S3 method for class 'summary.qif'  
print(x, digits = NULL, quote = FALSE,  
      prefix = "", ...)
```

**Arguments**

<code>x</code>	the <code>qif</code> model object.
<code>digits</code>	number of digits to print.
<code>quote</code>	logical, indicating whether or not strings should be printed with surrounding quotes.
<code>prefix</code>	string, only "" is implemented.
<code>...</code>	further arguments passed to or from other methods.

**Value**

The invisible object from the arguments.

The invisible object from the arguments.

**Author(s)**

Zhichang Jiang, Alberta Health Services, and Peter X.K. Song, University of Michigan.

**See Also**

`summary qif`

qif

*Function to Solve a Quadratic Inference Function Model***Description**

Produces an object of class "qif" which is a Quadratic Inference Function fit of the balanced longitudinal data.

**Usage**

```
qif(formula = formula(data), id = id, data = parent.frame(),
    b = NULL, tol = 1e-08, maxiter = 1000, family = gaussian,
    corstr = "independence", invfun = "finv")
```

**Arguments**

formula	a formula expression as for other regression models, of the form <code>response ~ predictors</code> . See the documentation of <code>lm</code> and <code>formula</code> for details.
id	a vector which identifies the clusters. The length of <code>id</code> should be the same as the number of observations. Data are assumed to be sorted so that observations on a cluster are contiguous rows for all entities in the formula.
data	an optional data frame in which to interpret the variables occurring in the <code>formula</code> , along with the <code>id</code> variables.
b	an initial estimate for the parameters.
tol	the tolerance used in the fitting algorithm.
maxiter	the maximum number of iterations.
family	a family object: a list of functions and expressions for defining canonical link and variance functions. Families supported in <code>qif</code> are <code>gaussian</code> , <code>binomial</code> , <code>poisson</code> , and <code>gamma</code> ; see the <code>glm</code> and <code>formula</code> documentation. Some links are not currently available: <code>probit</code> link for binomial family and <code>log</code> link for gamma family.
corstr	a character string specifying the correlation structure. The following are permitted: <code>"independence"</code> , <code>"exchangeable"</code> , <code>"AR-1"</code> and <code>"unstructured"</code> .
invfun	a character string specifying the matrix inverse function. The following are permitted: <code>"finv"</code> and <code>"ginv"</code> .

**Details**

`qif` provides two options of computing matrix inverses. The default is from Fortran math library, and the other one is generalized inverse `"ginv"` given in R package `MASS`. You can call option `"ginv"` through argument `"invfun"` in `"qif()"`.

**Value**

A list containing:

- `title`: name of qif
- `version`: the current version of qif
- `model`: analysis model for link function, variance function and correlation structure
- `terms`: analysis model for link function, variance function and correlation structure
- `iteration`: the number of iterations
- `coefficients`: beta estimates value
- `linear.predictors`: linear predictor value
- `fitted.value`: fitted value of y
- `x`: the predicted matrix
- `y`: the response
- `residuals`:  $y - \mu$
- `pearson.resi`: pearson residuals
- `scale`: the scale of fitted model
- `family`: the type of distribution
- `id`: model fitted value
- `max.id`: max number of each steps
- `xnames`: the values are X name of qif
- `statistics`: The qif statistics
- `Xnames`: the name X matrix in qif
- `parameter`: parameter estimates
- `covariance`: Covariance of coefficients

**Note**

This R package is created by transplanting a SAS macro QIF developed originally by Peter Song and Zhichang Jiang (2006). This is version 1.5 of this user documentation file, revised 2019-07-02.

**Author(s)**

Zhichang Jiang, Alberta Health Services, and Peter X.K. Song, University of Michigan.

**References**

- Qu A, Lindsay BG, Li B. Improving generalized estimating equations using quadratic inference functions. *Biometrika* 2000, 87 823-836.
- Qu A, Song P X-K. Assessing robustness of generalised estimating equations and quadratic inference functions. *Biometrika* 2004, 91 447-459.
- Qu A, Lindsay BG. Building adaptive estimating equations when inverse of covariance estimation is difficult. *J. Roy. Statist. Soc. B* 2003, 65, 127-142.

**See Also**

glm, lm, formula.

**Examples**

```
## Marginal log-linear model for the epileptic seizures count data
## (Diggle et al., 2002, Analysis of Longitudinal Data, 2nd Ed., Oxford Press).

# Read in the epilepsy data set:
data(epil)

# Fit the QIF model:
fit <- qif(y ~ base + trt + lage + V4, id=subject, data=epil,
          family=poisson, corstr="AR-1")

# Alternately, use ginv() from package MASS
fit <- qif(y ~ base + trt + lage + V4, id=subject, data=epil,
          family=poisson, corstr="AR-1", invfun = "ginv")

# Print summary of QIF fit:
summary(fit)

## Second example: MS study
data(exacerb)

qif_BIN_IND<-qif(exacerbation ~ treatment + time + duration + time2, id=id,
                data=exacerb, family=binomial, corstr="independence")
qif_BIN_AR1<-qif(exacerbation ~ treatment + time + duration + time2, id=id,
                data=exacerb, family=binomial, corstr="AR-1")
qif_BIN_CS<-qif(exacerbation ~ treatment + time + duration + time2, id=id,
                data=exacerb, family=binomial, corstr="exchangeable")
qif_BIN_UN<-qif(exacerbation ~ treatment + time + duration + time2, id=id,
                data=exacerb, family=binomial, corstr="unstructured")

summary(qif_BIN_CS)

qif_BIN_CS$statistics

qif_BIN_CS$covariance
```

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summary.qif

*Summary of a qif Object*


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**Description**

Produce a summary of a `qif` object.

**Usage**

```
## S3 method for class 'qif'  
summary(object, correlation = TRUE, ...)
```

**Arguments**

`object`            an object for which a summary is desired.  
`correlation`      binary, include correlation.  
`...`             additional arguments to be passed to `summary`.

**Value**

The `summary.qif` object.

**Author(s)**

Zhichang Jiang, Alberta Health Services, and Peter X.K. Song, University of Michigan.

**See Also**

`qif`