Package ‘cpk’

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Disclaimer The authors take no responsibility for the outcome of therapy in any patient in which the techniques described in this package have been utilized.
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R topics documented:
cpk-package ................................................................. 2
ar.fn ........................................................................ 4
bc.ttc.fn ................................................................. 5
cmax.fn ................................................................. 6
Description

This package was written to teach concepts and techniques to clinicians and pharmacists for individualizing drug therapy. While the package may be used by clinicians for actual dosage regimen analysis, design, and modification, caution should be exercised when applying the techniques described in R package cpk.

Details

Package: cpk
Type: Package
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License: GPL-2

Author(s)

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References


Examples

wtkg = 181;  # kg

# Drug Disposition Parameters
thalf = 4;  # h
ke = 0.3180;  # h^-1
vd = 4.5;  # L/kg
cl = 1.43;  # L/h/kg
f = 1.00;  # dpo range: 15-64% (avg 38%), IV f = 1.

### Set TTC
ttc = 25;

### Calculate dose rate (mg/h)
dr <- dr.fn (ttc, cl, wtkg, f)

### Set dosing interval based on thalf
di = 4;  # h

### Calculate dose (if f = 1, dose IV)
dpo <- dpo.fn (dr, di)
### Calculation of Loading Dose

dpo/1000 # convert to mg

### Calculate loading dose based on cmax

cmax <- 18.93; vd <- 35;
dlCmax <- dlcmax.fn(cmax, vd)

### Calculate loading dose based on ar

dm <- 276; ar <- 2.4;
dlar <- dlar.fn(dm, ar)

# -------------------------------
# ANALYSIS
# --------------------------------

bc.ttc <- bc.ttc.fn (dr, f, cl, wtkg)

### Predict average steady-state concentration

### Accumulation ratio

ar <- ar.fn (ke, di)

css <- css.fn (f, dpo, di, cl, ar, wtkg)
css # mg/L

# Predict fluctuation about steady-state (ug/L)

cmax <- cmax.fn (f, dpo, vd, ar, wtkg)
cmin <- cmmin.fn (cmax, ke, di)

cT <- ct.fn (cmax, ke, time=0)
cT <- ct.fn (cmax, ke, time=4)

# Infusion rate
css <- 14.43; cl <- 3.2;
R0 <- R0.fn (css, cl)

---

**ar.fn**

**Accumulation ratio function**

**Description**

Calculates drug’s accumulation ratio

**Usage**

ar.fn(ke, di)

**Arguments**

- **ke**: Drug’s total elimination rate constant ke (h^-1).
- **di**: Dosing interval (h).
bc.ttc.fn

Value

Returns the calculated accumulation ratio

Author(s)

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Examples

ke <- 0.2350; di <- 4;
ar <- ar.fn(ke, di)

Description

Performs a back-calculation to get the target therapeutic concentration (TTC) based on the administered dose.

Usage

bc.ttc.fn(dr, f, cl, wtkg)

Arguments

dr dr is
f bioavailability
cl clearance rate
wtkg weight in kg average man in US (NHANES III)

Value

Returns the back-calculated TTC (ug/L).

Author(s)

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References

See cpk-package help.
Examples

```r
ttc <- 20; dr <- 2.26; cl <- 0.57; f <- 0.74; wtkg <- 86;
    dr <- dr.fn(ttc, cl, wtkg, f)
```

---

**cmax.fn**  
*Function*

**cmax function**

---

Description

Calculates cmax (peak) drug concentration in ng/mL, which is the same as ug/mL.

Usage

```r
cmax.fn(f, dpo, vd, ar, wtkg)
```

Arguments

- **f**
  - is bioavailability.
- **dpo**
  - is oral dose administered in ug.
- **vd**
  - is apparent volume of distribution in L.
- **ar**
  - is accumulation ratio.
- **wtkg**
  - is patient weight in kg.

Value

Returns cmax ug/L.

Author(s)

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References

See *cpk-package* help.

Examples

```r
f = 0.74; dpo <- 3440; vd = 2.8; ar = 2.4; wtkg=86;
cmax <- cmax.fn(f, dpo, vd, ar, wtkg)
```
**Description**

Calculates cmin (trough) drug concentration in ng/mL, which is the same as ug/mL.

**Usage**

```r
cmin.fn(cmax, ke, di)
```

**Arguments**

- `cmax` is the maximum concentration of drug (peak level).
- `ke` Drug’s total elimination rate constant.
- `di` is the dosing interval in h.

**Value**

Returns cmin ug/L.

**Author(s)**

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**References**

See `cpk-package` help.

**Examples**

```r
cmax <- 25.37; ke <- 0.1333; di <- 4;
cmin <- cmin.fn(cmax, ke, di)
```

---

**Description**

Calculates css (steady-state) drug concentration in ng/mL, which is the same as ug/mL.

**Usage**

```r
css.fn(f, dpo, di, cl, ar, wtkg)
```
ct.fn

Arguments

f is bioavailability.
dpo is oral dose administered in ug.
di is the dosing interval in h.
cl is the total clearance rate in L/kg/h.
ar is stepwise accumulation ratio.
wtkg is patient weight in kg.

Value

Returns css in mg/L and ug/L

Author(s)

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References

See cpk-package help.

Examples

f <- 0.74; dpo <- 3440; di <- 4; cl <- 0.37; ar <- 1.4; wtkg <- 86;
css <- css.fn(f, dpo, di, cl, ar, wtkg)

ct.fn  ct function

Description

Predicts drug concentration at specified time (default time=0 h) [ng/mL].

Usage

cf.fn(cmax, ke, time=0)

Arguments

cmax is the maximum concentration (cmax).
ke is the first-order elimination rate constant (ke).
time is the time on the clearance curve for which a drug concentration is desired.

Value

Returns the concentration at specified time.
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References
See cpk-package help.

Examples
```r
msc <- 15; ke <- 0.1333; time <- 4;
ct <- ct.fn(cmax, ke, time=0)
```

---

**di.fn**

**di function**

Description
Calculates a drug's dosing interval.

Usage
```r
di.fn(msc, mec, ke)
```

Arguments
- **msc**: Drug's maximum safe concentration or Cmax (peak) concentration.
- **mec**: Drug's minimum effective concentration or Cmin (trough) concentration.
- **ke**: Drug's total elimination rate constant.

Value
Returns the dosing interval (h).

Author(s)
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References
See cpk-package help.

Examples
```r
msc <- 50; mec <- 20; ke <- 0.2078;
di <- di.fn(msc, mec, ke)
```
dlar.fn

Description
Calculates a drug’s loading dose based on its accumulation ratio

Usage
dlar.fn(dm, ar)

Arguments
- dm: Drug’s maintenance dose.
- ar: Drug’s accumulation ratio.

Value
Returns the calculated loading dose

Author(s)
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Examples
dm <- .276; ar <- 2.4;
dlar <- dlar.fn(dm, ar)

dlcmax.fn

Description
Calculates a drug’s loading dose based on its cmax

Usage
dlcmax.fn(cmax, vd)

Arguments
- cmax: Drug’s maximum concentration (cmax).
- vd: Drug’s apparent volume of distribution (vd).
**dm.fn**

**Value**

Returns the calculated loading dose

**Author(s)**

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**Examples**

```r
cmax <- 18.93; vd <- 35;
dlcmx <- dlcmx.fn(cmax, vd)
```

---

**Description**

Calculates drug’s maintenance dose.

**Usage**

```r
dm.fn(dr, di)
```

**Arguments**

- `dr` is the dose rate.
- `di` is the dosing interval, which can be either computed or assigned (e.g., `di <- 4`)

**Value**

Returns the maintenance dose.

**Author(s)**

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**References**

See **cpk-package** help.

**Examples**

```r
dr <- 1.42; di <- 4;
dm <- dm.fn(dr, di)
```
dpo.fn  

*dpo function*

**Description**

Calculates the oral dose of drug to give.

**Usage**

```r
dpo.fn(dr, di)
```

**Arguments**

- `dr`: is the dose rate in mg/h.
- `di`: is the dosing interval in h.

**Value**

Returns oral dose administered in ug.

**Author(s)**

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**References**

See *cpk-package* help.

**Examples**

```r
dr <- 0.86; di <- 4;
dpo <- dpo.fn(dr, di)
```

---

dr.fn  

*dr function*

**Description**

Calculates dose rate (mg/h).

**Usage**

```r
dr.fn(ttc, cl, wtkg, f)
```
**Arguments**

- **ttc**: target therapeutic concentration.
- **cl**: clearance rate.
- **wtkg**: patient's weight in kilograms.
- **f**: bioavailability.

**Value**

Returns the dose rate.

---

**Author(s)**

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**References**

See `cpk-package` help.

**Examples**

ttc <- 32.74; cl <- 0.59; wtkg <- 86; f <- 0.74;
dr <- dr.fn(ttc, cl, wtkg, f)

---

**Description**

Predicts drug infusion rate [ug/h].

**Usage**

```
R0.fn(css, cl)
```

**Arguments**

- **css**: is the steady-state concentration.
- **cl**: is the clearance rate.

**Value**

Returns the infusion rate.
**Author(s)**

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**References**

See *cpk-package* help.

**Examples**

```r
msc <- 50; mec <- 20;
ttc <- ttc.fn(msc, mec)
```

---

**Description**

Calculates a drug’s target therapeutic concentration (ttc) based on its msc or cmax and mec or cmin in ng/mL, which is the same as ug/mL.

**Usage**

```
ttc.fn(msc, mec)
```

**Arguments**

- `msc`: maximum safe concentration or cmax
- `mec`: minimum effective concentration of cmin

**Value**

Returns target therapeutic concentration (ttc).

**Author(s)**

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**References**

See *cpk-package* help.

**Examples**

```r
msc <- 14.43; cl <- 3.2;
R0 <- R0.fn(css, cl)
```
Index

*Topic cpk package
  cpk-package, 2

ar.fn, 4
bc.ttc.fn, 5
cmax.fn, 6
cmin.fn, 7
cpk (cpk-package), 2
cpk-package, 2
css.fn, 7
cf.fn, 8
di.fn, 9
dlar.fn, 10
dlcmax.fn, 10
dm.fn, 11
dpo.fn, 12
dr.fn, 12
RØ.fn, 13
ttc.fn, 14