Package 'medAdherence'

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Title Medication Adherence: Commonly Used Definitions

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adherence-package *Medication Adherence: Commonly Used Definitions*

Description

Adherence is defined as "the extent to which a person's behavior coincides with medical or health advice", which is very important, for both clinical researchers and physicians, to identify the treatment effect of a specific medication(s).

A variety of measures have been developed to calculate the medication adherence. Definitions and methods to address adherence differ greatly in public literature. Choosing which definition should be determined by overall study goals. This package provides the functions to calculate medication adherence based on commonly used definitions.

Details

Package:	medAdherence
Type:	Package
Version:	1.03
Date:	2012-04-12
License:	GPL-2
LazyLoad:	yes

Author(s)

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References

Haynes RB, Taylor DW, Sachett DL, eds. *Compliance in health care*. Baltimore: John Hopkins University Press, 1979

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos, id=ptid, rxDate=rxDay, daySupply=supplies)
```

medCMA *Continuous measure of Medication Availability*

Description

medCMA function calculates the Continuous measure of Medication Acquisition.

Continuous measure of **M**edication **A**cquisition (**CMA**) was calculated by the days' supplies of medication throughout the study period divided by the number of days from the first dispensation date up to the patient's participation completion (study end).

Usage

```
medCMA(df=data,followUpDays=365, digits=2)
```

Arguments

df	a dataframe created by postData funtion
followUpDays	days of follow up. 365 is the default, 12 month follow up
digits	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Steiner, JG and Prochazka, AV. The Assessment of Refill Compliance Using Pharmacy Records: Methods, Validity, and Applications. *Journal of Clinical Epidemiology* 1997;50:105-116

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
postdt <-postRxData(predt)
medCMA(postdt)
```

medCMG *Continuous measure of Medication Gaps*

Description

medCMG function calculates the Continuous measure of Medication Gaps. This is **non-adherence rate**. The higher CMG, the lower adherence rate.

Continuous measure of **M**edication **G**aps (**CMG**) was estimated by total number of days in treatment gaps (days for which a drug was unavailable) divided by the duration of the time period of interest.

The formula is: (Total Days in Study - Total Days' Supply)/(Total Days in Study) x 100. If numerator is negative, it will be set to '0'.

Usage

```
medCMG(df=data,followUpDays=365, digits=2)
```

Arguments

df	a dataframe created by preData funtion
followUpDays	days of total study period. 365 is the default, 12 month follow up.
digits	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Steiner, JF and Prochazka, AV The Assessment of Refill Compliance Using Pharmacy Records: Methods, Validity, and Application *Journal of Clinical Epidemiology* 1997;50:105-116

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
medCMG(predt)
```

`medCMOS` *Continuous Multiple interval measure of Over-Supply*

Description

`medCMOS` function calculates the Continuous Multiple interval measure of Over-Supply

Usage

```
medCMOS(df=data,followUpDays=365, digits=2)
```

Arguments

`df`	a dataframe created by `preData` funtion
`followUpDays`	days of follow up. 365 is the default, 12 month follow up
`digits`	round to decimals. Default is 2

Details

Continuous **M**ultiple interval measure of **O**ver-**S**upply (**CMOS**) was calculated concurrently with CMG. The description of both calculations are as follows:

From the first prescription refill to the next prescription refill, a patient can accumulate a surplus or a deficit by either coming to pick up their medicaiton too early (which would show up as a surplus) or too late (which is considered to be a deficit). Future deficits and surpluses are accumulated based on existing deficits and surpluses.

If a person continuously has deficits or surpluses for each prescription refill period, the deficits or surpluses are always accumulated into accumulated deficits or surplus categories, respectively. An old surplus can cancel out a new deficit. If the accumulated surplus is more than the new deficit, the remaining surplus remains an accumulated surplus. If there is an accumulated surplus that precedes a new deficit , but less than the new deficit, the remaining deficit goes to the accumulated gap category.

At the end of the observation period, the accumulated gap is divided by the total days between the first and last prescription to get the CMG value for each patient. Similarly, the accumulated surplus is divided by the total days between the first and last presciption to get the measure of surplus for each patient.

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Morningstar, BA, Sketris IS, et al. Variation in Pharmacy Prescription Refill Adherence Measures by Type of Oral Antihyperglycaemic Drug Therapy in Seniors in Nova Scotia, Canada *Journal of Clinical Pharmacy and Therapeutics* 2002;27:213-220

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
postdt <- postRxData(predt)
medCMOS(postdt)
```

`medCR` *Compliance Rate*

Description

`medCR` function calculates the compiance rate.

Compliance **R**ate (**CR**) were computed taking the ratio of the sum of days' supplies (excluding the last days' supply) to the elapsed intervals between the last dispensation date and the first dispensation date.

The formula is: (Total Days' Supply - Last Days' Supply)/(Last Dispensation Date - First Dispensation Date) x 100.

Usage

```
medCR(df=data,digits=2)
```

Arguments

`df`	a dataframe created by `preData` funtion
`digits`	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Ren XS, Kazis LE, et al. Identifying Patient and Physician Characteristics That Affect Compliance with Antihypertensive Medications. *Journal of Clinical Pharmacy and Therapeutics* 2002;27:47-56

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
medCR(predt)
```

`medCSA` *Continuous Single-interval measure of medication Availability*

Description

`medCSA` function calculates the Single-interval medication availability.

Continuous **S**ingle-interval measure of medication **A**vailability (**CSA**) was calculated by the days' supply of a medication divided by the number of days in the interval from the dispensation date up to, but not include, the next dispensation date (or the study end).

Usage

```
medCSA(df=data,digits=2)
```

Arguments

`df`	a dataframe created by `postData` funtion
`digits`	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Steiner, JG and Prochazka, AV. The Assessment of Refill Compliance Using Pharmacy Records: Methods, Validity, and Applications. *Journal of Clinical Epidemiology* 1997;50:105-116

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
postdt <-postRxData(predt)
medCSA(postdt)
```

`medDBR` *Days Between Refills adherence rate*

Description

`medDBR` function calculates the Days Between Reills adherence rate.

Days **B**etween **R**efills (**DBR**) adherence rate was estimated by comparing patients' monthly pharmacy refill records to the prescribed regimen documented in their medical records. An assumption was made that any extra doses accumulated during the study period were used as needed by the patients in order to adhere to the prescribed therapy if medication refills were not obtained on time.

The formula is: Adherence Rate = (1-(Days Between Refills - Total Days' Supply)/(Days Between Refills)) x 100.

Usage

```
medDBR(df=data,followUpDays=NA, digits=2)
```

Arguments

`df`	a dataframe created by `preData` funtion
`followUpDays`	days of follow up. If no follow up days provided, the elapsed interval from the first dispensation date to last dispensation date will be used.
`digits`	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Chisholm MA, Molly LL, et al. Comparing Renal Transplant Patients' Adherence to Free Cyclosporine and Free Tacrolimus Immunosuppressant Therapy. *Clinical Transplant* 2005;19:77-82

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
medDBR(predt)
```

`medDTMPR` *Dual Therapy Medication Possession Ratio*

Description

`medDTMPR` function calculates the Dual Therapy Medication Possession Ratio.

Dual **T**herapy **M**edication **P**ossession **R**atio (**DTMPR**) were computed taking the ratio of the sum of days' supplies (devided by 2) to the intervals elapsed between date of first prescription refill and last prescription refill plus the days' supply of last refill.

Same as MPR, the ratio alone can't be combined across patients due to different observation days (denomitor). DTMPR may exceed 100% due to early refills and/or polypharmacy. Very commonly, if DTMPR>100%, it will be truncated to 100%.

Usage

```
medDTMPR(df=data,followUpDays=NA,truncated="yes", digits=2)
```

Arguments

`df`	a dataframe created by `preData` funtion
`followUpDays`	days of follow up
`truncated`	limit MPR to 100% or not. "yes" is the default
`digits`	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Vanderpoel, DR. , Hussein, MA, et al. Adherence to a Fixed-Dose Combination of Rosiglitazone Maleate/Metformin Hydrochloride in Subjects with Type 2 Diabetes Mellitus: A Retorspective Database Analysis *Clinical Therapeutics* 2004;26:2066-2075

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
medDTMPR(predt)
```

medMPR *Medication Possession Ratio*

Description

medMPR function calculates the medication possession ratio.

Medication **P**ossession **R**atio (**MPR**) were computed taking the ratio of the sum of days' supplies to number of days in study (**important**: the first day in study is not necessary a prescription refill date).

The ratio alone can't be combined across patients due to different observation days (denomitor). MPR may exceed 100% due to early refills and/or polypharmacy. Very commonly, if MPR>100%, it will be truncated to 100%.

Usage

```
medMPR(df=data,followUpDays=NA,truncated="yes", digits=2)
```

Arguments

df	a dataframe created by preData funtion
followUpDays	days of follow up
truncated	limit MPR to 100% or not. "yes" is the default
digits	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Skaer TL, Sclar DA, et al. Effect of Pharmaceutical Formulation for Diltiazem on Health Care Expenditures fo Hypertension *Clinical Therapeutics* 1993;15:905-911

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
medMPR(predt)
```

`medMPRm` *Medication Possession Ratio(modified)*

Description

`medMPRm` function calculates the medication possession ratio,modified.

Medication **P**ossession **R**atio, **m**odified (**MPRm**) were computed taking the ratio of the sum of days' supplies to the intervals elapsed between date of first prescription refill and last prescription refill plus the days' supply of last refill.

Same as MPR, the ratio alone can't be combined across patients due to different observation days (denomitor). MPRm may exceed 100% due to early refills and/or polypharmacy. Very commonly, if MPRm>100%, it will be truncated to 100%.

Usage

```
medMPRm(df=data,followUpDays=NA,truncated="yes", digits=2)
```

Arguments

`df`	a dataframe created by `preData` funtion
`followUpDays`	days of follow up
`truncated`	limit MPR to 100% or not. "yes" is the default
`digits`	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Vanderpoel, DR. , Hussein, MA, et al. Adherence to a Fixed-Dose Combination of Rosiglitazone Maleate/Metformin Hydrochloride in Subjects with Type 2 Diabetes Mellitus: A Retorspective Database Analysis *Clinical Therapeutics* 2004;26:2066-2075

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
medMPRm(predt)
```

medPDC *Proportion of Days Covered*

Description

medPDC function calculates the proportion of days covered.

Proportion of **D**ays **C**overed (**PDC**) was calculated by the nubmer of days with supply in study (no matter how many medications were taken on the day) divided by total number of days in study. The maximum of PDC is 100%.

Usage

```
medPDC(df=data,followUpDays=365, digits=2)
```

Arguments

df	a dataframe created by postData funtion
followUpDays	days of follow up. 365 is the default, 12 month follow up
digits	round to decimals. Default is 2

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

References

Benner JS, Glynn RJ, et al. Long-term Persisitence in Use of Statin Therapy in Elderly Patients *the Journal of the American Medical Association* 2002;288:455-461

Hess, LM, Raebel, MA, et al. Measurement of Adherence in Pharmacy Administrative Databases: A Proposal for Statndard Definitions and Preferred Measures *The Annals of Pharmacotherapy* 2006;40:1280-1288

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
postdt <-postRxData(predt)
medPDC(postdt)
```

postRxData *Second Data Preparation*

Description

postRxData function further prepares the data for medical adherence calculation.

Usage

```
postRxData(df=data)
```

Arguments

df	a dataframe created by preData funtion

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
postRxData(predt)
```

preRxData *First Data Preparation*

Description

preRxData function prepares the data for medical adherence calculation.

Usage

```
preRxData(df=data,id=NULL,rxDate=NULL,daySupply=NULL,followUpDays=365)
```

Arguments

df	a dataframe. Patient id (id), prescription refill date (rxDate), days supply (DaySupply) are required variables
id	a variable to identify patients
rxDate	numeric variable name. Medication dispensation date
daySupply	numeric varable name. Prescription days' supply
followUpDays	a scalar. 365 days is the default, 12 month follow up

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

Examples

```
cmos <- rxExampledt()
preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
```

`rxEampledt` *Sample Dataset Creation*

Description

A sample dataset with 3 patients, 4 variables,14 records will be created by this function.

Usage

```
rxExampledt()
```

Format

A data frame with 14 observations on the following 4 variables will be created.

`ptid` a numeric vector

`rxdate` a character vector, prescription refill date

`supplies` a numeric vector

`rxDay` a numeric vector, prescription refill date

Examples

```
cmos <- rxExampledt()
cmos
```

rxGaps *rxGaps*

Description

rxGaps function calculate the gaps between the date of dispensation plus days supplies and the next dispensation date.

Usage

```
rxGaps(df=data,gap=NA)
```

Arguments

df	a dataframe. a object that rxGaps funtion created
gap	how to deal with negative gap. Negative gap is kept if any scalar is previded. Otherwise, negative gap is considered as '0', which is the default.

Author(s)

Xiangyang Ye, Pharmacotherapy Outcomes Research Center, University of Utah

Examples

```
cmos <- rxExampledt()
predt <- preRxData(df=cmos,id=ptid,rxDate=rxDay,daySupply=supplies)
postdt <-postRxData(predt)
rxGaps(postdt)
```

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