Package: QDiabetes (via r-universe)

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Title Type 2 Diabetes Risk Calculator

Description Calculate the risk of developing type 2 diabetes using risk prediction algorithms derived by 'ClinRisk'.

Depends R (>= 2.10)

Imports stats

Suggests graphics, tinytest, utils

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URL https://github.com/Feakster/qdiabetes

BugReports https://github.com/Feakster/qdiabetes/issues

LazyLoad true

LazyData true

Repository https://feakster.r-universe.dev

RemoteUrl https://github.com/feakster/qdiabetes

RemoteRef HEAD

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Contents

QDiabetes-package	*Type 2 Diabetes Risk Calculator*

Description

This package calculates the risk of developing type 2 diabetes using risk prediction algorithms, which were initially derived by ClinRisk. Currently, these include QDiabetes-2013 and QDiabetes-2018, although older (and eventually more recent) versions of QDiabetes will be included in future releases.

Details

The package consistes of four risk prediction functions for use in estimating the risk of developing type 2 diabetes:

- QDR2013 - For estimating the 1–10-year risk using QDiabetes-2013.
- QDR2018A - For estimating the 10-year risk using QDiabetes-2018 (Model A).
- QDR2018B - For estimating the 10-year risk using QDiabetes-2018 (Model B).
- QDR2018C - For estimating the 10-year risk using QDiabetes-2018 (Model C).

The following variables are used by each risk prediction function present in this package:

Description	Variable	Type	QDR2013	QDR2018A	QDR2018B	QDR2018
Gender	sex	character	x	x	x	
Age	age	double	x	x	x	
Body mass index (BMI)	bmi	double	x	x	x	
Ethnicity	ethn	character	x	x	x	
Smoking status	smoke	character	x	x	x	
Deprivation	tds	double	x	x	x	
Fasting plasma glucose (FPG)	fpg	double			x	
Glycated haemoglobin (HbA1c)	hba1c	double				
Family history of diabetes	fhdm	logical	x	x	x	
History of treated hypertension	htn	logical	x	x	x	
History of cardiovascular disease	cvd	logical	x	x	x	
History of gestational Diabetes	gdm	logical		x	x	
History of polycystic ovary syndrome	pcos	logical		x	x	
History of learning difficulties	learn	logical		x	x	
History of schizophrenia or bipolar affective disorder	psy	logical		x	x	
History of corticosteroid use	ster	logical	x	x	x	
History of statin use	stat	logical		x	x	
History of use of 2nd generation antipsychotics	apsy	logical		x	x	
Survival time	surv	integer	x			

NB: height (ht) and weight (wt) may be specified in place of body mass index (bmi) in any of the above functions.

As per R's general coding sytax, factor or character values may be passed to any risk prediction function parameter where a character value is expected, so long as the factor variable label matches one of the expected character strings. Similarly, 0 or 1 many be used in place of FALSE or TRUE for any function parameter where a logical value is expected.

Disclaimer

ClinRisk do not support of endorse this code. End users should see the original C source as the 'gold standard' open source implementation. Please note that the QDiabetes R package has been created as a research tool for scientific purposes only. The QDiabetes R package has not been granted Medicines and Healthcare products Regulatory Agency (MHRA) approval as a medical device, and hence, should not be used as part of any individualised risk assessment.

Funding

This project was funded by the National Institute for Health Research (NIHR) School for Primary Care Research (SPCR) [project number: 412]. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

Note

Many of the default values used in the risk prediction functions of this package were selected to be representative of a UK population. These values are only intended to minimise the amount of typing required when using the risk prediction functions in an exploratory manner. They are unlikely to be useful in a research setting, and you would need to know the exact values to assign to all function parameters in order to make accurate risk predictions. Hence, while you can get risk preditions from the QDR2013 and QDR2018A functions through the specification of only sex, age, and bmi, you would be assuming White or missing ethnicity, non-smoking status, a Townsend deprivation score of 0, and the complete absence of any relevant medical history/conditions and concommitant drug therapies. In the case of QDR2013, you would also be assuming that a 10-year risk window is desired.

Author(s)

Benjamin G. Feakins <benjamin.feakins@ndph.ox.ac.uk>

References

Hippisley-Cox, J., Coupland, C., Robson, J., Sheikh, A. and Brindle, P. (2009). Predicting risk of type 2 diabetes in England and Wales: prospective derivation and validation of QDScore. *BMJ* **338**, b880. doi:10.1136/bmj.b880

Hippisley-Cox, J. and Coupland, C. (2017). Development and validation of QDiabetes-2018 risk prediction algorithm to estimate future risk of type 2 diabetes: cohort study. *BMJ* **359**, j5019. doi:10.1136/bmj.j5019

See Also

getTDS - For looking up Townsend deprivation scores from UK postcodes.

dat_qdr - QDiabetes sample dataset.

Examples

```
### Simple usage
## QDiabetes-2013
QDR2013(sex = "Female", age = 76, ht = 1.65, wt = 70)
QDR2013(sex = "Male", age = seq(25, 80, 5), bmi = 40, ethn = "Other", tds = 5)
## QDiabetes-2018
# Model A
QDR2018A(sex = "Female", age = 76, ht = 1.65, wt = 70)
QDR2018A(sex = "Male", age = seq(25, 80, 5), bmi = 40, ethn = "Other", tds = 5)
# Model B (inc. FPG)
QDR2018B(sex = "Female", age = 76, ht = 1.65, wt = 70, fpg = 4)
QDR2018B(sex = "Male", age = 55, bmi = 40, fpg = 2:6, ethn = "BlackCaribbean")
# Model C (inc. HbA1c)
QDR2018C(sex = "Female", age = 76, ht = 1.65, wt = 70, hba1c = 25)
QDR2018C(sex = "Male", age = 55, bmi = 40, hba1c = seq(15, 40, 5), ethn = "Chinese")

### Using postcodes to estimate Townsend deprivation scores
## QDiabetes-2013
QDR2013(sex = "Male", age = 65, bmi = 40, tds = getTDS("OX3 7LF"))
QDR2013(sex = "Female", age = 60, bmi = 35, tds = getTDS(c("OX2 6NW", "OX2 6GG")))
## QDiabetes-2018
# Model A
QDR2018A(sex = "Male", age = 65, bmi = 40, tds = getTDS("OX3 7LF"))
QDR2018A(sex = "Female", age = 60, bmi = 35, tds = getTDS(c("OX2 6NW", "OX2 6GG")))
# Model B (inc. FPG)
QDR2018B(sex = "Male", age = 65, bmi = 40, fpg = 6, tds = getTDS("OX3 7LF"))
QDR2018B(sex = "Female", age = 60, bmi = 35, fpg = 6, tds = getTDS(c("OX2 6NW", "OX2 6GG")))
# Model C (inc. HbA1c)
QDR2018C(sex = "Male", age = 65, bmi = 40, hba1c = 42, tds = getTDS("OX3 7LF"))
QDR2018C(sex = "Female", age = 60, bmi = 35, hba1c = 42, tds = getTDS(c("OX2 6NW", "OX2 6GG")))
```

---

dat_qdr   *QDiabetes Sample Dataset*

Description

A simulated sample dataset for exploring the use of the QDR2013, QDR2018A, QDR2018B and QDR2018C type 2 diabetes risk prediction functions of this package.

Usage

```
data("dat_qdr")
```

Format

A data frame with 50 observations on the following 21 variables:

sex A factor vector of genders. Possible values: "Female" or "Male".

age An integer vector of ages (years).

bmi A double vector ofbody-mass indexes (kg/m^2).

ht A double vector of heights (m).

wt A double vector of weights (kg).

fpg A double vector of fasting plasma glucose test results (mmol/L).

hba1c A double vector of glycated haemoglobin test results (mmol/mol).

ethn A factor vector of ethnicities. Possible values:

- "WhiteNA" (White or not stated)
- "Indian" (Indian)
- "Pakistani" (Pakistani)
- "Bangladeshi" (Bangladeshi)
- "OtherAsian" (Other Asian)
- "BlackCaribbean" (Black Caribbean)
- "BlackAfrican" (Black African)
- "Chinese" (Chinese)
- "Other" (Other ethnic group).

smoke A factor vector of smoking statuses. Possible values:

- "Non" (Non-smoker)
- "Ex" (Ex-smoker)
- "Light" (Light smoker - less than 10 cigarettes per day)
- "Moderate" (Moderate smoker - 10 to 19 cigarettes per day)
- "Heavy" (Heavy smoker - 20 or more cigarettes per day).

postcode A character vector of UK postcodes.

tds A double vector of Townsend deprivation scores.

fhdm A logical vector indicating family history of diabetes.

htn A logical vector indicating history of hypertension.

cvd A logical vector indicating history of cardiovascular disease.

gdm A logical vector indicating history of gestational diabetes.

pcos A logical vector indicating history of polycystic ovary syndrome.

learn A logical vector indicating history of learning difficulties.

psy A logical vector indicating history of shizophrenia or bipolar affective disorder.

ster A logical vector indicating history of corticosteroid use.

stat A logical vector indicating history of statin use.

apsy A logical vector indicating history of 2nd generation antipsychotic use.

Details

A simulated dataset containing the characteristics of 50 subjects (one per row). No relationships have been simulated between variables. The dataset contains no values or combinations of values that would result in warnings or errors from any of the risk prediction functions in this package. It exists purely to allow for testing and exploration of these functions.

Author(s)

Benjamin G. Feakins <benjamin.feakins@ndph.ox.ac.uk>

Source

The dataset is simulated, except for the postcode and tds variables, which are key-value pairs randomly drawn from an Office for National Statistics dataset. For more information on this dataset, see the documentation for the getTDS function.

- Contains OS data (C) Crown copyright and database right 2020
- Contains Royal Mail data (C) Royal Mail copyright and database right 2020
- Source: Office for National Statistics licensed under the Open Government Licence v.3.0

Examples

```
data(dat_qdr)
str(dat_qdr)
```

---

getTDS   *Lookup Townsend Deprivation Scores from UK Postcodes*

Description

Convenient function to look up Townsend deprivation scores using UK postcodes, postcode prefixes, postcode suffixes or a regular expression.

Usage

```
getTDS(postcode, type = "full", squash = ifelse(type != "regex", FALSE, TRUE))
```

Arguments

postcode   A vector of UK postcodes, postcode prefixes, postcode suffixes, or a regular expression.

type   A character string indicating the term provided in the postcode parameter. Possible values are:

- "full" — a full five–seven character postcode.
- "prefix" — a two–four character postcode prefix.
- "suffix" — a three character postcode suffix.
- "regex" — a regular expression, allowing any nature of postcode match.

squash   a logical parameter indicating whether the scores returned should be aggregated into a single median value.

Details

getTDS is a lookup function that queries a dataset of postcodes and Townsend deprivation scores. This dataset was created by joining a dataset of postcodes to a dataset of Townsend deprivation scores, via output area codes. Both data sets are made available by the Office for National Statistics under the Open Government License. The postcode dataset was last updated in February 2019, while the dataset of Townsend deprivation scores uses values obtained from the 2011 UK census (matching the Townsend deprivation score dates used by ClinRisk in the derivation of the QDiabetes-2018 algorithms).

Value

Townsend Deprivation Score.

Where type is not set to "regex", the length and nature of the value returned are governed by the type and squash parameters:

- When squash is set to FALSE (the default value) an output vector will be returned that is of equal length to the input vector. When squash is set to TRUE a numeric output of length one will be returned, comprising the median Townsend deprivation score from all matched postcodes.

- As each postcode is only associated with a single output area, when type is set to "full" and squash is set to FALSE the Townsend deprivation scores returned will be the exact values associated with each linked output area.

- As each postcode prefix or suffix may be associated with multiple output areas, when squash is set to FALSE and type is set to "prefix" or "suffix" the median Townsend deprivation score per prefix/suffix will be returned.

Note

PO Box codes have no associated Townsend deprivation scores and will not work as function inputs. No Northern Ireland postcodes are present in the database searched by getTDS as their use is governed by a separate, more restrictive license.

- Contains OS data (C) Crown copyright and database right 2020
- Contains Royal Mail data (C) Royal Mail copyright and database right 2020
- Source: Office for National Statistics licensed under the Open Government Licence v.3.0

Author(s)

Benjamin G. Feakins <benjamin.feakins@ndph.ox.ac.uk>

Source

UK Postcode-to-output-area data were obtained here from the Office for National Statistics.

Output-area-to-Townsend-deprivation-scores data were obtained here from the Office for National Statistics.

Examples

```
## Simple usage
getTDS(postcode = "OX2 6GG")
getTDS(postcode = c("OX2 6NW", "OX3 7LF"))

## Case & white space insensitive
getTDS(postcode = c("OX37LF", "OX3 7LF", "ox37lf", "ox3 7lf"))

## Median Townsend Deprivaton Score per Postcode Prefix ##
getTDS(postcode = paste0("OX", 1:9), type = "prefix")

## Median Overall Townsend Deprivation Score for a Set of Prefixes ##
getTDS(postcode = paste0("OX", 1:9), type = "prefix", squash = TRUE)

## Median Townsend Deprivaton Score per Postcode Suffix ##
getTDS(postcode = paste0(1:9, "AA"), type = "suffix")

## Median Overall Townsend Deprivation Score for a Set of Prefixes ##
getTDS(postcode = paste0(1:9, "AA"), type = "suffix", squash = TRUE)

## Median Overall Townsend Deprivation Score for Postcodes Matching a Regular Expression ##
getTDS(postcode = "^OX37[A-Z]{2}$", type = "regex")
```

QDR2013	*QDiabetes-2013 Risk Calculator*

Description

Calculate the risk of developing type 2 diabetes, using the QDiabetes-2013 algorithm.

Usage

```
QDR2013(sex, age, bmi, ht, wt, ethn = "WhiteNA", smoke = "Non", tds = 0,
        fhdm = FALSE, htn = FALSE, cvd = FALSE, ster = FALSE, surv = 10L)
```

Arguments

sex	Gender. Must be "Male" or "Female".
age	Age, in years. Must be ≥25 and <85.
bmi	Body-mass index, in kg/m^2. Must be ≥40/2.1^2 and ≤180/1.4^2. Within this range, values >40 are set to 40, while values <20 are set to 20.
ht	Height, in m. Must be ≥1.4 and ≤2.1.
wt	Weight, in kg. Must be ≥40 and ≤180.
ethn	Ethnicity. Must be one of:

- "WhiteNA" (White or not stated)
- "Indian" (Indian)

- "Pakistani" (Pakistani)
- "Bangladeshi" (Bangladeshi)
- "OtherAsian" (Other Asian)
- "BlackCaribbean" (Black Caribbean)
- "BlackAfrican" (Black African)
- "Chinese" (Chinese)
- "Other" (Other ethnic group).

smoke   Smoking status. Must be one of:

- "Non" (Non-smoker)
- "Ex" (Ex-smoker)
- "Light" (Light smoker - less than 10 cigarettes per day)
- "Moderate" (Moderate smoker - 10 to 19 cigarettes per day)
- "Heavy" (Heavy smoker - 20 or more cigarettes per day).

tds   Townsend deprivation score. Must be $\geq$-7 and $\leq$11.

fhdm   Family history of diabetes in 1st degree relative.

htn   History of hypertension.

cvd   History of cardiovascular disease.

ster   History of use of corticosteroids.

surv   Time point at which the Kaplan-Meier cumulative survival estimate is used to calculate risk. Must be an integer value between 1 and 10.

Value

Risk (%) of type 2 diabetes.

Note

The QDiabetes R package has been created as a research tool for scientific purposes only. The QDiabetes R package has not been granted Medicines and Healthcare products Regulatory Agency (MHRA) approval as a medical device, and hence, should not be used as part of any individualised risk assessment.

Author(s)

Benjamin G. Feakins <benjamin.feakins@ndph.ox.ac.uk>

Source

https://svn.clinrisk.co.uk/opensource/qdiabetes/standard/

See Also

QDR2018A - For estimating the 10-year risk using QDiabetes-2018 (Model A).

QDR2018B - For estimating the 10-year risk using QDiabetes-2018 (Model B).

QDR2018C - For estimating the 10-year risk using QDiabetes-2018 (Model C).

Examples

```
## Simple usage
QDR2013(sex = "Female", age = 76, ht = 1.65, wt = 70)
QDR2013(sex = "Male", age = seq(25, 80, 5), bmi = 40, ethn = "Other", tds = 5)
QDR2013(sex = "Female", age = 65, bmi = 35, smoke = c("Non", "Ex", "Light"), fhdm = TRUE)

## Using postcodes to estimate Townsend deprivation scores
QDR2013(sex = "Male", age = 65, bmi = 40, tds = getTDS("OX3 7LF"))
QDR2013(sex = "Female", age = 60, bmi = 35, tds = getTDS(c("OX2 6NW", "OX2 6GG")))

## Data frame usage
data(dat_qdr)
with(dat_qdr, QDR2013(sex = sex, age = age, bmi = bmi))

## Plotting outputs
age <- seq(25, 80, 5)
risk_m <- QDR2013(sex = "Male", age = age, bmi = 40)
risk_f <- QDR2013(sex = "Female", age = age, bmi = 40)

oldpar <- par(no.readonly = TRUE)
par(cex = 0.8, cex.sub = 0.8)
plot.new()
plot.window(xlim = range(age), ylim = range(pretty(c(risk_m, risk_f))))
axis(1, at = age)
axis(2, at = pretty(c(risk_m, risk_f)))
title(
  main = "Diabetes 10-year risk with age:\nQDiabetes-2013",
  sub = expression("BMI set to"~40*kg/m^2*", other variables set to defaults"),
  xlab = "Age (years)", ylab = "Risk (%)"
)
lines(age, risk_m, type = "b", col = "navy", lwd = 1.5)
lines(age, risk_f, type = "b", col = "red3", lwd = 1.5)
legend("bottomright", legend = c("Male", "Female"), col = c("navy", "red3"), lty = 1, bty = "n")
par(oldpar)
```

QDR2018A	*QDiabetes-2018 Risk Calculator (A-Variant)*

Description

Calculate the 10-year risk of developing type 2 diabetes, using the A-variant of the QDiabetes-2018 algorithm. This variant does not use fasting plasma glucose or glycated haemoglobin A1c.

Usage

```
QDR2018A(sex, age, bmi, ht, wt, ethn = "WhiteNA", smoke = "Non", tds = 0,
         fhdm = FALSE, htn = FALSE, cvd = FALSE, gdm = FALSE, pcos = FALSE,
         learn = FALSE, psy = FALSE, ster = FALSE, stat = FALSE, apsy = FALSE)
```

Arguments

sex	Gender. Must be "Male" or "Female".
age	Age, in years. Must be $\geq$25 and <85.
bmi	Body-mass index, in kg/m^2. Must be $\geq$40/2.1^2 and $\leq$180/1.4^2. Within this range, values >40 are set to 40, while values <20 are set to 20.
ht	Height, in m. Must be $\geq$1.4 and $\leq$2.1.
wt	Weight, in kg. Must be $\geq$40 and $\leq$180.
ethn	Ethnicity. Must be one of:

- "WhiteNA" (White or not stated)
- "Indian" (Indian)
- "Pakistani" (Pakistani)
- "Bangladeshi" (Bangladeshi)
- "OtherAsian" (Other Asian)
- "BlackCaribbean" (Black Caribbean)
- "BlackAfrican" (Black African)
- "Chinese" (Chinese)
- "Other" (Other ethnic group).

smoke	Smoking status. Must be one of:

- "Non" (Non-smoker)
- "Ex" (Ex-smoker)
- "Light" (Light smoker - less than 10 cigarettes per day)
- "Moderate" (Moderate smoker - 10 to 19 cigarettes per day)
- "Heavy" (Heavy smoker - 20 or more cigarettes per day).

tds	Townsend deprivation score. Must be $\geq$-8 and $\leq$14.
fhdm	Family history of diabetes in 1st degree relative.
htn	History of hypertension.
cvd	History of cardiovascular disease.
gdm	History of gestational diabetes.
pcos	History of polycystic ovary syndrome.
learn	History of one or more conditions conveying learning difficulties.
psy	History of schizophrenia or bipolar affective disorder.
ster	History of use of corticosteroids.
stat	History of use of statins.
apsy	History of use of 2nd generation antipsychotics.

Value

Risk (%) of type 2 diabetes.

Note

The QDiabetes R package has been created as a research tool for scientific purposes only. The QDiabetes R package has not been granted Medicines and Healthcare products Regulatory Agency (MHRA) approval as a medical device, and hence, should not be used as part of any individualised risk assessment.

Author(s)

Benjamin G. Feakins <benjamin.feakins@ndph.ox.ac.uk>

Source

https://qdiabetes.org/2018/src.php

References

Hippisley-Cox, J. and Coupland, C. (2017). Development and validation of QDiabetes-2018 risk prediction algorithm to estimate future risk of type 2 diabetes: cohort study. *BMJ* **359**, j5019. doi:10.1136/bmj.j5019

See Also

QDR2013 - For estimating the 1–10-year risk using QDiabetes-2013.

QDR2018B - For estimating the 10-year risk using QDiabetes-2018 (Model B).

QDR2018C - For estimating the 10-year risk using QDiabetes-2018 (Model C).

Examples

```
## Simple usage
QDR2018A(sex = "Female", age = 76, ht = 1.65, wt = 70)
QDR2018A(sex = "Male", age = seq(25, 80, 5), bmi = 40, ethn = "Other", tds = 5)
QDR2018A(sex = "Female", age = 65, bmi = 35, smoke = c("Non", "Ex", "Light"), fhdm = TRUE)

## Using postcodes to estimate Townsend deprivation scores
QDR2018A(sex = "Male", age = 65, bmi = 40, tds = getTDS("OX3 7LF"))
QDR2018A(sex = "Female", age = 60, bmi = 35, tds = getTDS(c("OX2 6NW", "OX2 6GG")))

## Data frame usage
data(dat_qdr)
with(dat_qdr, QDR2018A(sex = sex, age = age, bmi = bmi))

## Plotting outputs
age <- seq(25, 80, 5)
risk_m <- QDR2018A(sex = "Male", age = age, bmi = 40)
risk_f <- QDR2018A(sex = "Female", age = age, bmi = 40)

oldpar <- par(no.readonly = TRUE)
par(cex = 0.8, cex.sub = 0.8)
plot.new()
plot.window(xlim = range(age), ylim = range(pretty(c(risk_m, risk_f))))
```

```
axis(1, at = age)
axis(2, at = pretty(c(risk_m, risk_f)))
title(
  main = "Diabetes 10-year risk with age:\nQDiabetes-2018 (A-Variant)",
  sub = expression("BMI set to"~40*kg/m^2*", other variables set to defaults"),
  xlab = "Age (years)", ylab = "Risk (%)"
)
lines(age, risk_m, type = "b", col = "navy", lwd = 1.5)
lines(age, risk_f, type = "b", col = "red3", lwd = 1.5)
legend("bottomright", legend = c("Male", "Female"), col = c("navy", "red3"), lty = 1, bty = "n")
par(oldpar)
```

QDR2018B   *QDiabetes-2018 Risk Calculator (B-Variant)*

Description

Calculate the 10-year risk of developing type 2 diabetes, using the B-variant of the QDiabetes-2018 algorithm. This variant includes all risk predictors present in the A-variant, with the addition of fasting plasma glucose.

Usage

```
QDR2018B(sex, age, bmi, ht, wt, fpg, ethn = "WhiteNA", smoke = "Non", tds = 0,
         fhdm = FALSE, htn = FALSE, cvd = FALSE, gdm = FALSE, pcos = FALSE,
         learn = FALSE, psy = FALSE, ster = FALSE, stat = FALSE, apsy = FALSE)
```

Arguments

sex	Gender. Must be "Male" or "Female".
age	Age, in years. Must be $\geq$25 and <85.
bmi	Body-mass index, in kg/m^2. Must be $\geq$40/2.1^2 and $\leq$180/1.4^2. Within this range, values >40 are set to 40, while values <20 are set to 20.
ht	Height, in m. Must be $\geq$1.4 and $\leq$2.1.
wt	Weight, in kg. Must be $\geq$40 and $\leq$180.
fpg	Fasting plasma glucose level, in mmol/L. Must be $\geq$2 and <7.
ethn	Ethnicity. Must be one of:

- "WhiteNA" (White or not stated)
- "Indian" (Indian)
- "Pakistani" (Pakistani)
- "Bangladeshi" (Bangladeshi)
- "OtherAsian" (Other Asian)
- "BlackCaribbean" (Black Caribbean)
- "BlackAfrican" (Black African)
- "Chinese" (Chinese)

- "Other" (Other ethnic group).

smoke	Smoking status. Must be one of:

- "Non" (Non-smoker)
- "Ex" (Ex-smoker)
- "Light" (Light smoker - less than 10 cigarettes per day)
- "Moderate" (Moderate smoker - 10 to 19 cigarettes per day)
- "Heavy" (Heavy smoker - 20 or more cigarettes per day).

tds	Townsend deprivation score. Must be $\geq$-8 and $\leq$14.
fhdm	Family history of diabetes in 1st degree relative.
htn	History of hypertension.
cvd	History of cardiovascular disease.
gdm	History of gestational diabetes.
pcos	History of polycystic ovary syndrome.
learn	History of one or more conditions conveying learning difficulties.
psy	History of schizophrenia or bipolar affective disorder.
ster	History of use of corticosteroids.
stat	History of use of statins.
apsy	History of use of 2nd generation antipsychotics.

Value

Risk (%) of type 2 diabetes.

Note

The QDiabetes R package has been created as a research tool for scientific purposes only. The QDiabetes R package has not been granted Medicines and Healthcare products Regulatory Agency (MHRA) approval as a medical device, and hence, should not be used as part of any individualised risk assessment.

Author(s)

Benjamin G. Feakins <benjamin.feakins@ndph.ox.ac.uk>

Source

References

Hippisley-Cox, J. and Coupland, C. (2017). Development and validation of QDiabetes-2018 risk prediction algorithm to estimate future risk of type 2 diabetes: cohort study. *BMJ* **359**, j5019. doi:10.1136/bmj.j5019

See Also

QDR2013 - For estimating the 1–10-year risk using QDiabetes-2013.

QDR2018A - For estimating the 10-year risk using QDiabetes-2018 (Model A).

QDR2018C - For estimating the 10-year risk using QDiabetes-2018 (Model C).

Examples

```
## Simple usage
QDR2018B(sex = "Female", age = 76, ht = 1.65, wt = 70, fpg = 4)
QDR2018B(sex = "Male", age = 55, bmi = 40, fpg = 2:6, ethn = "BlackCaribbean")
QDR2018B(sex = "Female", age = 65, bmi = 35, fpg = 5, smoke = "Ex", cvd = c(FALSE, TRUE))

## Using postcodes to estimate Townsend deprivation scores
QDR2018B(sex = "Male", age = 65, bmi = 40, fpg = 6, tds = getTDS("OX3 7LF"))
QDR2018B(sex = "Female", age = 60, bmi = 35, fpg = 6, tds = getTDS(c("OX2 6NW", "OX2 6GG")))

## Data frame usage
data(dat_qdr)
with(dat_qdr, QDR2018B(sex = sex, age = age, bmi = bmi, fpg = fpg))

## Plotting outputs
fpg <- seq(2, 6.5, length.out = 10)
risk_m <- QDR2018B(sex = "Male", age = 65, bmi = 40, fpg = fpg)
risk_f <- QDR2018B(sex = "Female", age = 65, bmi = 40, fpg = fpg)

oldpar <- par(no.readonly = TRUE)
par(cex = 0.8, cex.sub = 0.8)
plot.new()
plot.window(xlim = range(fpg), ylim = range(pretty(c(risk_m, risk_f))))
axis(1, at = fpg)
axis(2, at = pretty(c(risk_m, risk_f)))
title(
 main = "Diabetes 10-year risk with fasting plasma glucose level:\nQDiabetes-2018 (B-Variant)",
 sub = expression("Age set to 65 years, BMI set to"~40*kg/m^2*", other variables set to defaults"),
  xlab = "Fasting Plasma Glucose (mmol/L)", ylab = "Risk (%)"
)
lines(fpg, risk_m, type = "b", col = "navy", lwd = 1.5)
lines(fpg, risk_f, type = "b", col = "red3", lwd = 1.5)
legend("bottomright", legend = c("Male", "Female"), col = c("navy", "red3"), lty = 1, bty = "n")
par(oldpar)
```

QDR2018C   *QDiabetes-2018 Risk Calculator (C-Variant)*

Description

Calculate the 10-year risk of developing type 2 diabetes, using the C-variant of the QDiabetes-2018 algorithm. This variant includes all risk predictors present in the A-variant, with the addition of glycated haemoglobin A1c.

Usage

```
QDR2018C(sex, age, bmi, ht, wt, hba1c, ethn = "WhiteNA", smoke = "Non", tds = 0,
         fhdm = FALSE, htn = FALSE, cvd = FALSE, gdm = FALSE, pcos = FALSE,
         learn = FALSE, psy = FALSE, ster = FALSE, stat = FALSE, apsy = FALSE)
```

Arguments

sex	Gender. Must be "Male" or "Female".
age	Age, in years. Must be $\geq$25 and <85.
bmi	Body-mass index, in kg/m^2. Must be $\geq$40/2.1^2 and $\leq$180/1.4^2. Within this range, values >40 are set to 40, while values <20 are set to 20.
ht	Height, in m. Must be $\geq$1.4 and $\leq$2.1.
wt	Weight, in kg. Must be $\geq$40 and $\leq$180.
hba1c	Glycated haemoglobin A1c level, in mmol/mol. Must be $\geq$15 and <48.
ethn	Ethnicity. Must be one of:

- "WhiteNA" (White or not stated)
- "Indian" (Indian)
- "Pakistani" (Pakistani)
- "Bangladeshi" (Bangladeshi)
- "OtherAsian" (Other Asian)
- "BlackCaribbean" (Black Caribbean)
- "BlackAfrican" (Black African)
- "Chinese" (Chinese)
- "Other" (Other ethnic group).

smoke	Smoking status. Must be one of:

- "Non" (Non-smoker)
- "Ex" (Ex-smoker)
- "Light" (Light smoker - less than 10 cigarettes per day)
- "Moderate" (Moderate smoker - 10 to 19 cigarettes per day)
- "Heavy" (Heavy smoker - 20 or more cigarettes per day).

tds	Townsend deprivation score. Must be $\geq$-8 and $\leq$14.
fhdm	Family history of diabetes in 1st degree relative.
htn	History of hypertension.
cvd	History of cardiovascular disease.
gdm	History of gestational diabetes.
pcos	History of polycystic ovary syndrome.
learn	History of one or more conditions conveying learning difficulties.
psy	History of schizophrenia or bipolar affective disorder.
ster	History of use of corticosteroids.
stat	History of use of statins.
apsy	History of use of 2nd generation antipsychotics.

Value

Risk (%) of type 2 diabetes.

Note

The QDiabetes R package has been created as a research tool for scientific purposes only. The QDiabetes R package has not been granted Medicines and Healthcare products Regulatory Agency (MHRA) approval as a medical device, and hence, should not be used as part of any individualised risk assessment.

Author(s)

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Source

https://qdiabetes.org/2018/src.php

References

Hippisley-Cox, J. and Coupland, C. (2017). Development and validation of QDiabetes-2018 risk prediction algorithm to estimate future risk of type 2 diabetes: cohort study. *BMJ* **359**, j5019. doi:10.1136/bmj.j5019

See Also

QDR2013 - For estimating the 1–10-year risk using QDiabetes-2013.

QDR2018A - For estimating the 10-year risk using QDiabetes-2018 (Model A).

QDR2018B - For estimating the 10-year risk using QDiabetes-2018 (Model B).

Examples

```
## Simple usage
QDR2018C(sex = "Female", age = 76, ht = 1.65, wt = 70, hba1c = 25)
QDR2018C(sex = "Male", age = 55, bmi = 40, hba1c = seq(15, 40, 5), ethn = "Chinese")
QDR2018C(sex = "Female", age = 65, bmi = 35, hba1c = 30, smoke = "Ex", fhdm = c(FALSE, TRUE))

## Using postcodes to estimate Townsend deprivation scores
QDR2018C(sex = "Male", age = 65, bmi = 40, hba1c = 42, tds = getTDS("OX3 7LF"))
QDR2018C(sex = "Female", age = 60, bmi = 35, hba1c = 42, tds = getTDS(c("OX2 6NW", "OX2 6GG")))

## Data frame usage
data(dat_qdr)
with(dat_qdr, QDR2018C(sex = sex, age = age, bmi = bmi, hba1c = hba1c))

## Plotting outputs
hba1c <- seq(15, 42, length.out = 10)
risk_m <- QDR2018C(sex = "Male", age = 65, bmi = 40, hba1c = hba1c)
risk_f <- QDR2018C(sex = "Female", age = 65, bmi = 40, hba1c = hba1c)
```

```
oldpar <- par(no.readonly = TRUE)
par(cex = 0.8, cex.sub = 0.8)
plot.new()
plot.window(xlim = range(hba1c), ylim = range(pretty(c(risk_m, risk_f))))
axis(1, at = hba1c)
axis(2, at = pretty(c(risk_m, risk_f)))
title(
 main = "Diabetes 10-year risk with glycated haemoglobin level:\nQDiabetes-2018 (C-Variant)",
 sub = expression("Age set to 65 years, BMI set to"~40*kg/m^2*", other variables set to defaults"),
  xlab = expression("Haemoglobin"~A[1*c]~"(mmol/mol)"), ylab = "Risk (%)"
)
lines(hba1c, risk_m, type = "b", col = "navy", lwd = 1.5)
lines(hba1c, risk_f, type = "b", col = "red3", lwd = 1.5)
legend("bottomright", legend = c("Male", "Female"), col = c("navy", "red3"), lty = 1, bty = "n")
par(oldpar)
```

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