

# Package ‘CaseControl’

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**Type** Package

**Title** Case-Control

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**Description** CaseControl is an R package for performing (nested) matched case-control analyses in an observational database in the OMOP Common Data Model.

**VignetteBuilder** knitr

**URL** <http://ohdsi.github.io/CaseControl>, <https://github.com/OHDSI/CaseControl>

**BugReports** <https://github.com/OHDSI/CaseControl/issues>

**Depends** R (>= 3.2.2),  
Cyclops (>= 3.0.0),  
DatabaseConnector (>= 3.0.0),  
Andromeda,  
survival,  
FeatureExtraction (>= 3.0.0)

**Imports** SqlRender (>= 1.6.0),  
rlang,  
dplyr,  
Rcpp (>= 0.11.2),  
ParallelLogger (>= 2.0.0),  
plyr,  
cli,  
pillar

**Suggests** testthat,  
knitr,  
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EmpiricalCalibration

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**License** Apache License 2.0

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CaseData-class	<i>Case Data</i>
----------------	------------------

---

### Description

CaseData is an S4 class that inherits from [Andromeda](#). It contains information on cases.

A CaseData object is typically created using [getDbCaseData](#), can only be saved using [saveCaseData](#), and loaded using [loadCaseData](#).

### Usage

```
## S4 method for signature 'CaseData'
show(object)
```

```
## S4 method for signature 'CaseData'
summary(object)
```

**Arguments**

object            An object of class 'CaseData'.

**See Also**

[isCaseData](#)

---

computeMdr

*Compute the minimum detectable relative risk*

---

**Description**

Compute the minimum detectable relative risk

**Usage**

```
computeMdr(caseControlData, alpha = 0.05, power = 0.8, twoSided = TRUE)
```

**Arguments**

caseControlData    A data frame describing the cases and controls as created using the [createCaseControlData](#) function. This should at least have these columns: isCase, exposed.

alpha            Type I error.

power            1 - beta, where beta is the type II error.

twoSided        Consider a two-sided test?

**Details**

Compute the minimum detectable relative risk (MDRR) for a given study population, using the actual observed sample size and number of exposed controls. Computations by Miettinen (1969) and Rothman and Boice (1979) are used. Based on and verified using Ken Rothman's EpiSheet.

**Value**

A data frame with the MDRR and some counts.

**References**

Miettinen OS (1969) Individual matching in the case of all or none responses. *Biometrics*, 25, 339-354.

Rothman KJ, Boice JD (1979) *Epidemiologic Analysis with a Programmable Calculator*. NIH Publication No.79-1649.

---

createCaseControlData *Create case-control data*

---

## Description

Create case-control data

## Usage

```
createCaseControlData(
  caseControlsExposure,
  exposureId,
  firstExposureOnly = FALSE,
  riskWindowStart = 0,
  riskWindowEnd = 0,
  exposureWashoutPeriod = 0
)
```

## Arguments

caseControlsExposure	An object of type caseControlsExposure as created using the <a href="#">getDbExposureData</a> function.
exposureId	The identifier of the exposure.
firstExposureOnly	Should only the first exposure per subject be included?
riskWindowStart	The start of the risk window (in days) relative to the index date. This number should be non-positive.
riskWindowEnd	The end of the risk window (in days) relative to the index date. This number should be non-positive.
exposureWashoutPeriod	Minimum required numbers of days of observation for inclusion of an exposure.

## Details

For each case and control, assesses whether exposure takes place within the risk window. The output can be directly used in a conditional logistic regression.

## Value

A data frame with these columns:

**personId** The person ID  
**indexDate** The index date  
**isCase** Is the person a case or a control?  
**stratumId** The ID linking cases and controls in a matched set  
**exposed** Was the subject exposed during the risk window?

---

createCcAnalysis	Create a case-control analysis specification
------------------	--

---

## Description

Create a case-control analysis specification

## Usage

```
createCcAnalysis(
  analysisId = 1,
  description = "",
  exposureType = NULL,
  outcomeType = NULL,
  nestingCohortType = NULL,
  getDbCaseDataArgs,
  selectControlsArgs,
  getDbExposureDataArgs,
  createCaseControlDataArgs,
  fitCaseControlModelArgs
)
```

## Arguments

analysisId	An integer that will be used later to refer to this specific set of analysis choices.
description	A short description of the analysis.
exposureType	If more than one exposure is provided for each exposureOutcomeNestingCohort, this field should be used to select the specific exposure to use in this analysis.
outcomeType	If more than one outcome is provided for each exposureOutcomeNestingCohort, this field should be used to select the specific outcome to use in this analysis.
nestingCohortType	If more than one nesting cohort is provided for each exposureOutcomeNestingCohort, this field should be used to select the specific nesting cohort to use in this analysis.
getDbCaseDataArgs	An object representing the arguments to be used when calling the <a href="#">createGetDbCaseDataArgs</a> function.
selectControlsArgs	An object representing the arguments to be used when calling the <a href="#">createSelectControlsArgs</a> function.
getDbExposureDataArgs	An object representing the arguments to be used when calling the <a href="#">createGetDbExposureDataArgs</a> function.
createCaseControlDataArgs	An object representing the arguments to be used when calling the <a href="#">createCreateCaseControlDataArgs</a> function.
fitCaseControlModelArgs	An object representing the arguments to be used when calling the <a href="#">createFitCaseControlModelArgs</a> function.

**Details**

Create a set of analysis choices, to be used with the [runCcAnalyses](#) function.

---

```
createCreateCaseControlDataArgs
```

*Create a parameter object for the function createCaseControlData*

---

**Description**

Create a parameter object for the function createCaseControlData

**Usage**

```
createCreateCaseControlDataArgs(
  firstExposureOnly = FALSE,
  riskWindowStart = 0,
  riskWindowEnd = 0,
  exposureWashoutPeriod = 0
)
```

**Arguments**

firstExposureOnly	Should only the first exposure per subject be included?
riskWindowStart	The start of the risk window (in days) relative to the index date. This number should be non-positive.
riskWindowEnd	The end of the risk window (in days) relative to the index date. This number should be non-positive.
exposureWashoutPeriod	Minimum required numbers of days of observation for inclusion of an exposure.

**Details**

Create an object defining the parameter values.

---

```
createExposureOutcomeNestingCohort
```

*Create exposure-outcome-nesting-cohort combinations.*

---

**Description**

Create exposure-outcome-nesting-cohort combinations.

**Usage**

```
createExposureOutcomeNestingCohort(
  exposureId,
  outcomeId,
  nestingCohortId = NULL
)
```

**Arguments**

exposureId	A concept ID identifying the target drug in the exposure table. If multiple strategies for picking the exposure will be tested in the analysis, a named list of numbers can be provided instead. In the analysis, the name of the number to be used can be specified using the #' exposureType parameter in the <a href="#">createCcAnalysis</a> function.
outcomeId	A concept ID identifying the outcome in the outcome table. If multiple strategies for picking the outcome will be tested in the analysis, a named list of numbers can be provided instead. In the analysis, the name of the number to be used can be specified using the outcomeType parameter in the <a href="#">createCcAnalysis</a> function.
nestingCohortId	A concept ID identifying the nesting cohort in the nesting cohort table. If multiple strategies for picking the nesting cohort will be tested in the analysis, a named list of numbers can be provided instead. In the analysis, the name of the number to be used can be specified using the nestingCohortType parameter in the <a href="#">createCcAnalysis</a> function.

**Details**

Create a set of hypotheses of interest, to be used with the [runCcAnalyses](#) function.

---

createFitCaseControlModelArgs

*Create a parameter object for the function fitCaseControlModel*

---

**Description**

Create a parameter object for the function fitCaseControlModel

**Usage**

```
createFitCaseControlModelArgs(
  useCovariates = FALSE,
  excludeCovariateIds = c(),
  includeCovariateIds = c(),
  prior = createPrior("laplace", useCrossValidation = TRUE),
  control = createControl(cvType = "auto", startingVariance = 0.01, tolerance = 2e-07,
    cvRepetitions = 10, selectorType = "byPid", noiseLevel = "quiet")
)
```

**Arguments**

useCovariates	Whether to use the covariates in the caseControlsExposure.
excludeCovariateIds	Exclude these covariates from the model.
includeCovariateIds	Include only these covariates in the model.
prior	The prior used to fit the model. See createPrior for details.
control	The control object used to control the cross-validation used to determine the hyperparameters of the prior (if applicable). See createControl for details.

## Details

Create an object defining the parameter values.

---

```
createGetDbCaseDataArgs
```

*Create a parameter object for the function getDbCaseData*

---

## Description

Create a parameter object for the function getDbCaseData

## Usage

```
createGetDbCaseDataArgs(
  useNestingCohort = FALSE,
  useObservationEndAsNestingEndDate = TRUE,
  getVisits = FALSE,
  studyStartDate = "",
  studyEndDate = "",
  maxNestingCohortSize = 1e+07,
  maxCasesPerOutcome = 5e+05
)
```

## Arguments

useNestingCohort	Should the study be nested in a cohort (e.g. people with a specific indication)? If not, the study will be nested in the general population.
useObservationEndAsNestingEndDate	When using a nesting cohort, should the observation period end date be used instead of the cohort end date?
getVisits	Get data on visits? This is needed when matching on visit date is requested later on.
studyStartDate	A calendar date specifying the minimum date where data is used. Date format is 'yyyymmdd'.
studyEndDate	A calendar date specifying the maximum date where data is used. Date format is 'yyyymmdd'.
maxNestingCohortSize	If the nesting cohort is larger than this number it will be sampled to this size. maxCohortSize = 0 indicates no maximum size.
maxCasesPerOutcome	If there are more than this number of cases for a single outcome cases will be sampled to this size. maxCasesPerOutcome = 0 indicates no maximum size.

## Details

Create an object defining the parameter values.



---

`createGetDbExposureDataArgs`*Create a parameter object for the function getDbExposureData*

---

### Description

Create a parameter object for the function getDbExposureData

### Usage

```
createGetDbExposureDataArgs(covariateSettings = NULL)
```

### Arguments

`covariateSettings`

An object of type `covariateSettings` as created using the `createCovariateSettings` function in the `FeatureExtraction` package. If `NULL` then no covariate data is retrieved.

### Details

Create an object defining the parameter values.

---

`createMatchingCriteria`*Create matching criteria*

---

### Description

Criteria to use to select individual matches for cases.

### Usage

```
createMatchingCriteria(  
  controlsPerCase = 1,  
  matchOnAge = TRUE,  
  ageCaliper = 2,  
  matchOnGender = TRUE,  
  matchOnProvider = FALSE,  
  matchOnCareSite = FALSE,  
  matchOnVisitDate = FALSE,  
  visitDateCaliper = 30,  
  matchOnTimeInCohort = FALSE,  
  daysInCohortCaliper = 30,  
  removedUnmatchedCases = TRUE,  
  seed = 1  
)
```

**Arguments**

controlsPerCase	Maximum number of controls to select per case.
matchOnAge	Match on age?
ageCaliper	Maximum difference (in years) in age when matching on age.
matchOnGender	Match on gender?
matchOnProvider	Match on provider (as specified in the person table)?
matchOnCareSite	Match on care site (as specified in the person table)?
matchOnVisitDate	Should the index date of the control be changed to the nearest visit date?
visitDateCaliper	Maximum difference (in days) between the index date and the visit date when matching on visit date.
matchOnTimeInCohort	Match on time in nesting cohort? When not using nesting, this is interpreted as time observed prior to index.
daysInCohortCaliper	Maximum difference (in days) in time in cohort.
removedUnmatchedCases	Should cases with no matched controls be removed?
seed	The number generator seed. A null value sets seed via <a href="#">Sys.time</a> .

**Value**

A settings object to be used in the [selectControls](#) function.

---

```
createSamplingCriteria
```

*Create sampling criteria*

---

**Description**

Criteria to use when controls are simply sampled from the (nesting) population.

**Usage**

```
createSamplingCriteria(controlsPerCase = 1, seed = 1)
```

**Arguments**

controlsPerCase	Maximum number of controls to select per case.
seed	The number generator seed. A null value sets seed via <a href="#">Sys.time</a> .

**Value**

A settings object to be used in the [selectControls](#) function.

---

`createSelectControlsArgs`*Create a parameter object for the function selectControls*

---

## Description

Create a parameter object for the function selectControls

## Usage

```
createSelectControlsArgs(  
  firstOutcomeOnly = TRUE,  
  washoutPeriod = 180,  
  controlSelectionCriteria = createMatchingCriteria(),  
  minAge = NULL,  
  maxAge = NULL  
)
```

## Arguments

firstOutcomeOnly	Use the first outcome per person?
washoutPeriod	Minimum required numbers of days of observation for inclusion as either case or control.
controlSelectionCriteria	Either a matchingCriteria object as generated using the createMatchingCriteria function, or a samplingCriteria object as generated using the createSamplingCriteria function.
minAge	Minimum age at which patient time will be included in the analysis. Note that information prior to the min age is still used to determine exposure status after the minimum age (e.g. when a prescription was started just prior to reaching the minimum age). Also, outcomes occurring before the minimum age is reached will be considered as prior outcomes when using first outcomes only. Age should be specified in years, but non-integer values are allowed. If not specified, no age restriction will be applied.
maxAge	Maximum age at which patient time will be included in the analysis. Age should be specified in years, but non-integer values are allowed. If not specified, no age restriction will be applied.

## Details

Create an object defining the parameter values.

---

fitCaseControlModel	<i>Fit the case-control model</i>
---------------------	-----------------------------------

---

## Description

Fit the case-control model

## Usage

```
fitCaseControlModel(
  caseControlData,
  useCovariates = FALSE,
  excludeCovariateIds = c(),
  includeCovariateIds = c(),
  caseControlsExposure = NULL,
  prior = createPrior("laplace", useCrossValidation = TRUE),
  control = createControl(cvType = "auto", startingVariance = 0.01, tolerance = 2e-07,
    cvRepetitions = 10, selectorType = "byPid", noiseLevel = "quiet")
)
```

## Arguments

caseControlData	A data frame as generated by the <a href="#">createCaseControlData</a> function.
useCovariates	Whether to use the covariates in the caseControlsExposure.
excludeCovariateIds	Exclude these covariates from the model.
includeCovariateIds	Include only these covariates in the model.
caseControlsExposure	An object of type caseControlsExposure as created using the <a href="#">getDbExposureData</a> function.
prior	The prior used to fit the model. See <a href="#">createPrior</a> for details.
control	The control object used to control the cross-validation used to determine the hyperparameters of the prior (if applicable). See <a href="#">createControl</a> for details.

## Details

Fits the model using a conditional logistic regression.

## Value

An object of type outcomeModel.

---

getAttritionTable	<i>Get the attrition table for a population</i>
-------------------	---

---

**Description**

Get the attrition table for a population

**Usage**

```
getAttritionTable(caseControls)
```

**Arguments**

caseControls     A data frame of cases and controls as generated by the function [selectControls](#).

**Value**

A data frame specifying the number of cases and events after various steps of filtering.

---

getDbCaseData	<i>Load case data from the database</i>
---------------	---

---

**Description**

Load all data about the cases and nesting cohort from the database.

**Usage**

```
getDbCaseData(
  connectionDetails,
  cdmDatabaseSchema,
  oracleTempSchema = cdmDatabaseSchema,
  outcomeDatabaseSchema = cdmDatabaseSchema,
  outcomeTable = "condition_era",
  outcomeIds = c(),
  useNestingCohort = FALSE,
  nestingCohortDatabaseSchema = cdmDatabaseSchema,
  nestingCohortTable = "cohort",
  nestingCohortId = NULL,
  useObservationEndAsNestingEndDate = TRUE,
  getVisits = FALSE,
  getExposures = FALSE,
  exposureDatabaseSchema = cdmDatabaseSchema,
  exposureTable = "drug_era",
  exposureIds = c(),
  studyStartDate = "",
  studyEndDate = "",
  maxNestingCohortSize = 1e+07,
  maxCasesPerOutcome = 5e+05
)
```

## Arguments

connectionDetails	An R object of type ConnectionDetails created using the function createConnectionDetails in the DatabaseConnector package.
cdmDatabaseSchema	The name of the database schema that contains the OMOP CDM instance. Requires read permissions to this database. On SQL Server, this should specify both the database and the schema, so for example 'cdm_instance.dbo'.
oracleTempSchema	A schema where temp tables can be created in Oracle.
outcomeDatabaseSchema	The name of the database schema that is the location where the data used to define the outcome cohorts is available. If outcomeTable = CONDITION_ERA, outcomeDatabaseSchema is not used. Requires read permissions to this database.
outcomeTable	The tablename that contains the outcome cohorts. If outcomeTable is not CONDITION_OCCURRENCE or CONDITION_ERA, then expectation is outcomeTable has format of COHORT table: COHORT_DEFINITION_ID, SUBJECT_ID, COHORT_START_DATE, COHORT_END_DATE.
outcomeIds	A list of ids used to define outcomes. If outcomeTable = CONDITION_OCCURRENCE, the list is a set of ancestor CONCEPT_IDS, and all occurrences of all descendant concepts will be selected. If outcomeTable <> CONDITION_OCCURRENCE, the list contains records found in COHORT_DEFINITION_ID field.
useNestingCohort	Should the study be nested in a cohort (e.g. people with a specific indication)? If not, the study will be nested in the general population.
nestingCohortDatabaseSchema	The name of the database schema that is the location where the nesting cohort is defined.
nestingCohortTable	Name of the table holding the nesting cohort. This table should have the same structure as the cohort table.
nestingCohortId	A cohort definition ID identifying the records in the nestingCohortTable to use as nesting cohort.
useObservationEndAsNestingEndDate	When using a nesting cohort, should the observation period end date be used instead of the cohort end date?
getVisits	Get data on visits? This is needed when matching on visit date is requested later on.
getExposures	Should data on exposures be fetched? All exposure information for the nesting cohort will be retrieved, which may be time-consuming. Usually it is more efficient to fetch exposure data only for the cases and controls, as can be done using the <a href="#">getDbExposureData</a> function.
exposureDatabaseSchema	The name of the database schema that is the location where the exposure data used to define the exposure cohorts is available. If exposureTable = DRUG_ERA, exposureDatabaseSchema is not used but assumed to be cdmSchema. Requires read permissions to this database.

exposureTable	The tablename that contains the exposure cohorts. If exposureTable <> DRUG_ERA, then expectation is exposureTable has format of COHORT table: cohort_concept_id, SUBJECT_ID, COHORT_START_DATE, COHORT_END_DATE.
exposureIds	A list of identifiers to define the exposures of interest. If exposureTable = DRUG_ERA, exposureIds should be CONCEPT_ID. If exposureTable <> DRUG_ERA, exposureIds is used to select the cohort_concept_id in the cohort-like table. If no exposureIds are provided, all drugs or cohorts in the exposureTable are included as exposures.
studyStartDate	A calendar date specifying the minimum date where data is used. Date format is 'yyyymmdd'.
studyEndDate	A calendar date specifying the maximum date where data is used. Date format is 'yyyymmdd'.
maxNestingCohortSize	If the nesting cohort is larger than this number it will be sampled to this size. maxCohortSize = 0 indicates no maximum size.
maxCasesPerOutcome	If there are more than this number of cases for a single outcome cases will be sampled to this size. maxCasesPerOutcome = 0 indicates no maximum size.

### Value

Returns an object of type caseData, containing information on the cases, the nesting cohort, and optionally visits. Information about multiple outcomes can be captured at once for efficiency reasons. The generic summary() function has been implemented for this object.

---

getDbExposureData	<i>Get exposure data for cases and controls from a database</i>
-------------------	---

---

### Description

If additional exposure data or covariate data is required, this function will send the information on the cases and controls back to the server.

Note: For PDW and RedShift, where uploading data can be excruciatingly slow, you can use bulk loading by preparing the environment as described in the [insertTable](#) function in the DatabaseConnection package, and setting oracleTempSchema to a schema where you have write privileges (bulk import can only upload to permanent tables).

### Usage

```
getDbExposureData(
  caseControls,
  connectionDetails,
  oracleTempSchema = NULL,
  exposureDatabaseSchema = NULL,
  exposureTable = "drug_era",
  exposureIds = c(),
  cdmDatabaseSchema = exposureDatabaseSchema,
  covariateSettings = NULL,
  caseData = NULL
)
```

**Arguments**

caseControls	A data frame as generated by the <a href="#">selectControls</a> function.
connectionDetails	An R object of type connectionDetails created using the function createConnectionDetails in the DatabaseConnector package.
oracleTempSchema	A schema where temp tables can be created in Oracle.
exposureDatabaseSchema	The name of the database schema that is the location where the exposure data used to define the exposure cohorts is available. If exposureTable = DRUG_ERA, exposureDatabaseSchema is not used but assumed to be cdmSchema. Requires read permissions to this database.
exposureTable	The tablename that contains the exposure cohorts. If exposureTable <> drug_era, then expectation is exposureTable has format of COHORT table: cohort_definition_id, subject_id, cohort_start_date, cohort_end_date.
exposureIds	A list of identifiers to define the exposures of interest. If exposureTable = drug_era, exposureIds should be concept_id. If exposureTable <> drug_era, exposureIds is used to select the cohort_definition_id in the cohort-like table. If no exposureIds are provided, all drugs or cohorts in the exposureTable are included as exposures.
cdmDatabaseSchema	Needed when constructing covariates: the name of the database schema that contains the OMOP CDM instance. Requires read permissions to this database. On SQL Server, this should specify both the database and the schema, so for example 'cdm_instance.dbo'.
covariateSettings	An object of type covariateSettings as created using the createCovariateSettings function in the FeatureExtraction package. If NULL then no covariate data is retrieved.
caseData	An object of type caseData as generated using the <a href="#">getDbCaseData</a> function. If caseData is provided and contains the exposure data (see getExposures in the <a href="#">getDbCaseData</a> function, and if no covariates need to constructed (covariateSettings = NULL), then the no connection to the database is used to create the exposure data. This may be much more efficient in some situations.

---

insertDbPopulation	<i>Insert cases and controls into a database</i>
--------------------	--

---

**Description**

Insert cases and controls into a database

**Usage**

```
insertDbPopulation(
  caseControls,
  cohortIds = c(1, 0),
```



```

    connectionDetails,
    cohortDatabaseSchema,
    cohortTable = "cohort",
    createTable = FALSE,
    dropTableIfExists = TRUE
  )

```

### Arguments

**caseControls** A data frame as generated by the [selectControls](#) function.

**cohortIds** The IDs to be used for the cohorts of cases and controls, respectively.

**connectionDetails**  
An R object of type `connectionDetails` created using the function `createConnectionDetails` in the `DatabaseConnector` package.

**cohortDatabaseSchema**  
The name of the database schema where the data will be written. Requires write permissions to this database. On SQL Server, this should specify both the database and the schema, so for example `'cdm_instance.dbo'`.

**cohortTable** The name of the table in the database schema where the data will be written.

**createTable** Should a new table be created? If not, the data will be inserted into an existing table.

**dropTableIfExists**  
If `createTable = TRUE` and the table already exists it will be overwritten.

### Details

Inserts cases and controls into a database. The table in the database will have the same structure as the 'cohort' table in the Common Data Model.

---

<code>isCaseData</code>	<i>Check whether an object is a CaseData object</i>
-------------------------	---

---

### Description

Check whether an object is a CaseData object

### Usage

```
isCaseData(x)
```

### Arguments

**x** The object to check.

### Value

A logical value.

---

`loadCaseControlsExposure`*Load the caseControlsExposure data from a folder*

---

**Description**

`loadCaseControlsExposure` loads an object of type `caseControlsExposure` from a folder in the file system.

**Usage**

```
loadCaseControlsExposure(folder, readOnly = TRUE)
```

**Arguments**

<code>folder</code>	The name of the folder containing the data.
<code>readOnly</code>	If true, the data is opened read only.

**Details**

The data will be written to a set of files in the folder specified by the user.

**Value**

An object of class `caseControlsExposure`.

---

`loadCaseData`*Load the covariate data from a folder*

---

**Description**

`loadCaseData` loads an object of type `caseData` from a file in the file system.

**Usage**

```
loadCaseData(file)
```

**Arguments**

<code>file</code>	The name of the file containing the data.
-------------------	---

**Details**

The data will be read from the file specified by the user.

**Value**

An object of class `CaseData`.

---

loadCcAnalysisList	<i>Load a list of ccAnalysis from file</i>
--------------------	--

---

**Description**

Load a list of objects of type ccAnalysis from file. The file is in JSON format.

**Usage**

```
loadCcAnalysisList(file)
```

**Arguments**

file	The name of the file
------	----------------------

**Value**

A list of objects of type ccAnalysis.

---

loadExposureOutcomeNestingCohortList	<i>Load a list of exposureOutcomeNestingCohort from file</i>
--------------------------------------	--

---

**Description**

Load a list of objects of type exposureOutcomeNestingCohort from file. The file is in JSON format.

**Usage**

```
loadExposureOutcomeNestingCohortList(file)
```

**Arguments**

file	The name of the file
------	----------------------

**Value**

A list of objects of type drugComparatorOutcome.

---

runCcAnalyses	<i>Run a list of analyses</i>
---------------	-------------------------------

---

## Description

Run a list of analyses

## Usage

```
runCcAnalyses(
  connectionDetails,
  cdmDatabaseSchema,
  oracleTempSchema = cdmDatabaseSchema,
  exposureDatabaseSchema = cdmDatabaseSchema,
  exposureTable = "drug_era",
  outcomeDatabaseSchema = cdmDatabaseSchema,
  outcomeTable = "condition_era",
  nestingCohortDatabaseSchema = cdmDatabaseSchema,
  nestingCohortTable = "condition_era",
  outputFolder = "../CcOutput",
  ccAnalysisList,
  exposureOutcomeNestingCohortList,
  prefetchExposureData = FALSE,
  getDbCaseDataThreads = 1,
  selectControlsThreads = 1,
  getDbExposureDataThreads = 1,
  createCaseControlDataThreads = 1,
  fitCaseControlModelThreads = 1,
  cvThreads = 1
)
```

## Arguments

connectionDetails

An R object of type ConnectionDetails created using the function createConnectionDetails in the DatabaseConnector package.

cdmDatabaseSchema

The name of the database schema that contains the OMOP CDM instance. Requires read permissions to this database. On SQL Server, this should specify both the database and the schema, so for example 'cdm\_instance.dbo'.

oracleTempSchema

A schema where temp tables can be created in Oracle.

exposureDatabaseSchema

The name of the database schema that is the location where the exposure data used to define the exposure cohorts is available. If exposureTable = DRUG\_ERA, exposureDatabaseSchema is not used but assumed to be cdmSchema. Requires read permissions to this database.

exposureTable

The tablename that contains the exposure cohorts. If exposureTable <> drug\_era, then expectation is exposureTable has format of COHORT table: cohort\_definition\_id, subject\_id, cohort\_start\_date, cohort\_end\_date.

outcomeDatabaseSchema	The name of the database schema that is the location where the data used to define the outcome cohorts is available. If outcomeTable = CONDITION_ERA, outcomeDatabaseSchema is not used. Requires read permissions to this database.
outcomeTable	The tablename that contains the outcome cohorts. If outcomeTable is not CONDITION_OCCURRENCE or CONDITION_ERA, then expectation is outcomeTable has format of COHORT table: COHORT_DEFINITION_ID, SUBJECT_ID, COHORT_START_DATE, COHORT_END_DATE.
nestingCohortDatabaseSchema	The name of the database schema that is the location where the nesting cohort is defined.
nestingCohortTable	Name of the table holding the nesting cohort. This table should have the same structure as the cohort table.
outputFolder	Name of the folder where all the outputs will written to.
ccAnalysisList	A list of objects of type ccAnalysis as created using the <a href="#">createCcAnalysis</a> function.
exposureOutcomeNestingCohortList	A list of objects of type exposureOutcomeNestingCohort as created using the <a href="#">createExposureOutcomeNestingCohort</a> function.
prefetchExposureData	Should exposure data for the entire nesting cohort be fetched at the beginning, or should exposure data be fetch later specifically for a set of cases and controls. Prefetching can be faster when there are many outcomes but only few exposures. Prefetching does not speed up performance when covariates also need to be constructed.
getDbCaseDataThreads	The number of parallel threads to use for building the caseData objects.
selectControlsThreads	The number of parallel threads to use for selecting controls.
getDbExposureDataThreads	The number of parallel threads to use for fetching data on exposures for cases and controls.
createCaseControlDataThreads	The number of parallel threads to use for creating case and control data including exposure status indicators
fitCaseControlModelThreads	The number of parallel threads to use for fitting the models.
cvThreads	The number of parallel threads used for the cross-validation to determine the hyper-parameter when fitting the model.

## Details

Run a list of analyses for the exposure-outcome-nesting cohorts of interest. This function will run all specified analyses against all hypotheses of interest, meaning that the total number of outcome models is `'length(ccAnalysisList) * length(exposureOutcomeNestingCohortList)'` (if all analyses specify an outcome model should be fitted). When you provide several analyses it will determine whether any of the analyses have anything in common, and will take advantage of this fact. For example, if we specify several analyses that only differ in the way the outcome model is fitted, then this function will extract the data and fit the propensity model only once, and re-use this in all the analysis.

---

`saveCaseControlsExposure`*Save the caseControlsExposure data to folder*

---

**Description**

`saveCaseControlsExposure` saves an object of type `caseControlsExposure` to folder.

**Usage**

```
saveCaseControlsExposure(caseControlsExposure, folder)
```

**Arguments**

`caseControlsExposure`

An object of type `caseControlsExposure` as generated using [getDbExposureData](#).

`folder`

The name of the folder where the data will be written. The folder should not yet exist.

**Details**

The data will be written to a set of files in the specified folder.

---

`saveCaseData`*Save the case data to file*

---

**Description**

`saveCaseData` saves an object of type `caseData` to file

**Usage**

```
saveCaseData(caseData, file)
```

**Arguments**

`caseData`

An object of type `CaseData` as generated using [getDbCaseData](#).

`file`

The name of the file where the data will be written. If the file exists it will be overwritten.

**Details**

The data will be written to the file specified by the user.

---

saveCcAnalysisList	<i>Save a list of ccAnalysis to file</i>
--------------------	--

---

**Description**

Write a list of objects of type ccAnalysis to file. The file is in JSON format.

**Usage**

```
saveCcAnalysisList(ccAnalysisList, file)
```

**Arguments**

ccAnalysisList	The ccAnalysis list to be written to file
file	The name of the file where the results will be written

---

saveExposureOutcomeNestingCohortList	<i>Save a list of drugComparatorOutcome to file</i>
--------------------------------------	---

---

**Description**

Write a list of objects of type exposureOutcomeNestingCohort to file. The file is in JSON format.

**Usage**

```
saveExposureOutcomeNestingCohortList(exposureOutcomeNestingCohortList, file)
```

**Arguments**

exposureOutcomeNestingCohortList	The exposureOutcomeNestingCohort list to be written to file
file	The name of the file where the results will be written

---

selectControls	<i>Select controls</i>
----------------	------------------------

---

**Description**

Select controls

**Usage**

```
selectControls(
  caseData,
  outcomeId,
  firstOutcomeOnly = TRUE,
  washoutPeriod = 180,
  controlSelectionCriteria = createMatchingCriteria(),
  minAge = NULL,
  maxAge = NULL
)
```

**Arguments**

<code>caseData</code>	An object of type <code>caseData</code> as generated using the <a href="#">getDbCaseData</a> function.
<code>outcomeId</code>	The outcome ID of the cases for which we need to pick controls.
<code>firstOutcomeOnly</code>	Use the first outcome per person?
<code>washoutPeriod</code>	Minimum required numbers of days of observation for inclusion as either case or control.
<code>controlSelectionCriteria</code>	Either a <code>matchingCriteria</code> object as generated using the <a href="#">createMatchingCriteria</a> function, or a <code>samplingCriteria</code> object as generated using the <a href="#">createSamplingCriteria</a> function.
<code>minAge</code>	Minimum age at which patient time will be included in the analysis. Note that information prior to the min age is still used to determine exposure status after the minimum age (e.g. when a prescription was started just prior to reaching the minimum age). Also, outcomes occurring before the minimum age is reached will be considered as prior outcomes when using first outcomes only. Age should be specified in years, but non-integer values are allowed. If not specified, no age restriction will be applied.
<code>maxAge</code>	Maximum age at which patient time will be included in the analysis. Age should be specified in years, but non-integer values are allowed. If not specified, no age restriction will be applied.

**Details**

Select controls either by individually matching controls to each case, or by random sampling controls from the (nested) population.

**Value**

A data frame with these columns:

**personId** The person ID

**indexDate** The index date

**isCase** Is the person a case or a control?

**stratumId** The ID linking cases and controls in a matched set (only available when matching)



---

summarizeCcAnalyses	<i>Create a summary report of the analyses</i>
---------------------	--

---

**Description**

Create a summary report of the analyses

**Usage**

```
summarizeCcAnalyses(outcomeReference, outputFolder)
```

**Arguments**

outcomeReference	A data.frame as created by the <a href="#">runCcAnalyses</a> function.
outputFolder	Name of the folder where all the outputs have been written to.

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