

# Package ‘SelfControlledCaseSeries’

January 11, 2023

**Type** Package

**Title** Self-Controlled Case Series

**Version** 4.1.0

**Date** 2023-01-11

**Maintainer** Martijn Schuemie <schuemie@ohdsi.org>

**Description** SelfControlledCaseSeries is an R package for performing self-controlled case series (SCCS) analyses in an observational database in the OMOP Common Data Model. It extracts all necessary data from the database and transforms it to the format required for SCCS. Age and season can be modeled using splines assuming constant hazard within calendar months. Event-dependent censoring of the observation period can be corrected for. Many exposures can be included at once (MSCCS), with regularization on all coefficients except for the exposure of interest.

**VignetteBuilder** knitr

**URL** <https://github.com/OHDSI/SelfControlledCaseSeries>

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

**Depends** R (>= 4.0.0),  
Cyclops (>= 3.2.0),  
DatabaseConnector (>= 5.1.0),  
Andromeda,  
survival

**Imports** SqlRender (>= 1.11.0),  
dplyr (>= 1.0.0),  
Rcpp (>= 1.0.9),  
ParallelLogger (>= 3.1.0),  
EmpiricalCalibration,  
splines,  
ggplot2 (>= 3.4.0),  
methods,  
utils,  
cli,  
pillar,  
checkmate,  
readr

**Suggests** testthat,  
knitr,

markdown,  
 Eunomia  
**Remotes** ohdsi/Eunomia  
**License** Apache License 2.0  
**LinkingTo** Rcpp  
**NeedsCompilation** yes  
**RoxygenNote** 7.2.3  
**Roxygen** list(markdown = TRUE)  
**Encoding** UTF-8

## R topics documented:

computeMdr	3
computePreExposureGainP	4
computeTimeStability	5
createAgeCovariateSettings	6
createCalendarTimeCovariateSettings	6
createControlIntervalSettings	7
createCreateSccsIntervalDataArgs	8
createCreateScriIntervalDataArgs	9
createCreateStudyPopulationArgs	10
createDefaultSccsMultiThreadingSettings	10
createEraCovariateSettings	11
createExposure	12
createExposuresOutcome	13
createFitSccsModelArgs	14
createGetDbSccsDataArgs	14
createSccsAnalysis	16
createSccsDiagnosticThresholds	16
createSccsIntervalData	17
createSccsMultiThreadingSettings	18
createSccsSimulationSettings	19
createScriIntervalData	21
createSeasonalityCovariateSettings	22
createSimulationRiskWindow	23
createStudyPopulation	24
cyclicSplineDesign	25
exportToCsv	25
fitSccsModel	26
getAttritionTable	27
getDbSccsData	27
getFileReference	30
getModel	30
getResultsSummary	31
hasAgeEffect	31
hasCalendarTimeEffect	32
hasSeasonality	32
isSccsData	33
isSccsIntervalData	33

loadExposuresOutcomeList . . . . .	34
loadSccsAnalysisList . . . . .	34
loadSccsData . . . . .	35
loadSccsIntervalData . . . . .	35
plotAgeEffect . . . . .	36
plotAgeSpans . . . . .	36
plotCalendarTimeEffect . . . . .	37
plotCalendarTimeSpans . . . . .	38
plotEventObservationDependence . . . . .	38
plotEventToCalendarTime . . . . .	39
plotExposureCentered . . . . .	40
plotSeasonality . . . . .	41
runSccsAnalyses . . . . .	41
saveExposuresOutcomeList . . . . .	43
saveSccsAnalysisList . . . . .	44
saveSccsData . . . . .	44
saveSccsIntervalData . . . . .	45
SccsData-class . . . . .	45
SccsIntervalData-class . . . . .	46
simulateSccsData . . . . .	46

<b>Index</b>	<b>47</b>
--------------	-----------

computeMdr

*Compute the minimum detectable relative risk*

## Description

Compute the minimum detectable relative risk

## Usage

```
computeMdr(
  object,
  exposureCovariateId,
  alpha = 0.05,
  power = 0.8,
  twoSided = TRUE,
  method = "SRL1"
)
```

## Arguments

object	An object either of type <a href="#">SccsIntervalData</a> as created using the <a href="#">createSccsIntervalData</a> function, or an object of type <a href="#">SccsModel</a> as created using the <a href="#">fitSccsModel()</a> function.
exposureCovariateId	Covariate Id for the health exposure of interest.
alpha	Type I error.
power	1 - beta, where beta is the type II error.
twoSided	Consider a two-sided test?

method            The type of sample size formula that will be used. Allowable values are "proportion", "binomial", "SRL1", "SRL2", or "ageEffects". Currently "ageEffects" is not supported.

### Details

Compute the minimum detectable relative risk (MDRR) for a given study population, using the observed time at risk and total time in days and number of events. Five sample size formulas are implemented: sampling proportion, binomial proportion, 2 signed root likelihood ratio methods, and likelihood extension for age effects. The expressions by Musonda (2006) are used.

### Value

A data frame with the MDRR, number of events, time at risk, and total time.

### References

Musonda P, Farrington CP, Whitaker HJ (2006) Samples sizes for self-controlled case series studies, *Statistics in Medicine*, 15;25(15):2618-31

---

computePreExposureGainP

*Compute P for pre-exposure risk gain*

---

### Description

Compute P for pre-exposure risk gain

### Usage

```
computePreExposureGainP(sccsData, studyPopulation, exposureEraId = NULL)
```

### Arguments

sccsData            An object of type [SccsData](#) as created using the [getDbSccsData](#) function.

studyPopulation    An object created using the [createStudyPopulation\(\)](#) function.

exposureEraId      The exposure to create the era data for. If not specified it is assumed to be the one exposure for which the data was loaded from the database.

### Details

Compares the rate of the outcome in the 30 days prior to exposure to the rate of the outcome in the 30 days following exposure. If the rate before exposure is higher, this indicates there might reverse causality, that the outcome, or some precursor of the outcome, increases the probability of having the exposure.

The resulting p-value is computed using a Poisson model conditioned on the person.

### Value

A one-sided p-value for whether the rate before exposure is higher than after, against the null of no change.

---

computeTimeStability	<i>Compute stability of outcome rate over time</i>
----------------------	--

---

## Description

Compute stability of outcome rate over time

## Usage

```
computeTimeStability(  
  studyPopulation,  
  sccsModel = NULL,  
  maxRatio = 1.25,  
  alpha = 0.05  
)
```

## Arguments

studyPopulation	An object created using the <a href="#">createStudyPopulation()</a> function.
sccsModel	Optional: A fitted SCCS model as created using <a href="#">fitSccsModel()</a> . If the model contains splines for seasonality and or calendar time these will be adjusted for before computing stability.
maxRatio	The maximum ratio between the (adjusted) rate in a month, and the mean (adjusted) rate that we would consider to be irrelevant.
alpha	The alpha (type 1 error) used to test for stability. A Bonferroni correction will be applied for the number of months tested.

## Details

Computes for each calendar month the rate of the outcome, and evaluates whether that rate is constant over time. If splines are used to adjust for seasonality and/or calendar time, these adjustments are taken into consideration. For each month a two-sided p-value is computed against the null hypothesis that the rate in that month deviates from the mean rate no more than maxRatio. This p-value is compared to an alpha value, using a Bonferroni correction to adjust for the multiple testing across months.

## Value

A tibble with information on the temporal stability per month. The column `stable` indicates whether the rate of the outcome is within the expected range for that month, assuming the rate is constant over time.

---

```
createAgeCovariateSettings
```

*Create age covariate settings*

---

### Description

Create age covariate settings

### Usage

```
createAgeCovariateSettings(  
  ageKnots = 5,  
  allowRegularization = FALSE,  
  computeConfidenceIntervals = FALSE  
)
```

### Arguments

ageKnots	If a single number is provided this is assumed to indicate the number of knots to use for the spline, and the knots are automatically spaced according to equal percentiles of the data. If more than one number is provided these are assumed to be the exact location of the knots in age-days
allowRegularization	When fitting the model, should the covariates defined here be allowed to be regularized?
computeConfidenceIntervals	Should confidence intervals be computed for the covariates defined here? Setting this to FALSE might save computing time when fitting the model. Will be turned to FALSE automatically when allowRegularization = TRUE.

### Details

Create an object specifying whether and how age should be included in the model. Age can be included by splitting patient time into calendar months. During a month, the relative risk attributed to age is assumed to be constant, and the risk from month to month is modeled using a cubic spline.

### Value

An object of type AgeCovariateSettings.

---

```
createCalendarTimeCovariateSettings
```

*Create calendar time settings*

---

### Description

Create calendar time settings

**Usage**

```
createCalendarTimeCovariateSettings(
  calendarTimeKnots = 5,
  allowRegularization = FALSE,
  computeConfidenceIntervals = FALSE
)
```

**Arguments**

calendarTimeKnots

If a single number is provided this is assumed to indicate the number of knots to use for the spline, and the knots are automatically spaced according to equal percentiles of the data. If a series of dates is provided these are assumed to be the exact location of the knots.

allowRegularization

When fitting the model, should the covariates defined here be allowed to be regularized?

computeConfidenceIntervals

Should confidence intervals be computed for the covariates defined here? Setting this to FALSE might save computing time when fitting the model. Will be turned to FALSE automatically when allowRegularization = TRUE.

**Details**

Create an object specifying whether and how calendar time should be included in the model. Calendar time can be included by splitting patient time into calendar months. During a month, the relative risk attributed to calendar time is assumed to be constant, and the risk from month to month is modeled using a cubic spline.

Whereas the seasonality covariate uses a cyclic spline, repeating every year, this calendar time covariate can model trends over years.

**Value**

An object of type seasonalitySettings.

---

```
createControlIntervalSettings
```

*Create control interval settings*

---

**Description**

Create control interval settings

**Usage**

```
createControlIntervalSettings(
  includeEraIds = NULL,
  excludeEraIds = NULL,
  start = 0,
  startAnchor = "era start",
```

```

    end = 0,
    endAnchor = "era end",
    firstOccurrenceOnly = FALSE
  )

```

### Arguments

includeEraIds	One or more IDs of variables in the <a href="#">SccsData</a> object that should be used to construct this covariate. If no IDs are specified, all variables will be used.
excludeEraIds	One or more IDs of variables in the [SccsData] object that should not be used to construct this covariate.
start	The start of the control interval (in days) relative to the startAnchor.
startAnchor	The anchor point for the start of the control interval. Can be "era start" or "era end".
end	The end of the control interval (in days) relative to the endAnchor.
endAnchor	The anchor point for the end of the control interval. Can be "era start" or "era end".
firstOccurrenceOnly	Should only the first occurrence of the exposure be used?

### Details

Create an object specifying how to create a control interval for the self-controlled risk interval (SCRI) design.

### Value

An object of type ControlSettings.

---

```
createCreateSccsIntervalDataArgs
```

*Create a parameter object for the function createSccsIntervalData*

---

### Description

Create a parameter object for the function createSccsIntervalData

### Usage

```

createCreateSccsIntervalDataArgs(
  eraCovariateSettings,
  ageCovariateSettings = NULL,
  seasonalityCovariateSettings = NULL,
  calendarTimeCovariateSettings = NULL,
  minCasesForAgeSeason = NULL,
  minCasesForTimeCovariates = 10000,
  eventDependentObservation = FALSE
)

```



**Arguments****eraCovariateSettings**

Either an object of type EraCovariateSettings as created using the createEraCovariateSettings() function, or a list of such objects.

**ageCovariateSettings**

An object of type ageCovariateSettings as created using the createAgeCovariateSettings() function.

**seasonalityCovariateSettings**

An object of type seasonalityCovariateSettings as created using the createSeasonalityCovariateSettings() function.

**calendarTimeCovariateSettings**

An object of type calendarTimeCovariateSettings as created using the createCalendarTimeCovariateSettings() function.

**minCasesForAgeSeason**

DEPRECATED: Use minCasesForTimeCovariates instead.

**minCasesForTimeCovariates**

Minimum number of cases to use to fit age, season and calendar time splines. If needed (and available), cases that are not exposed will be included.

**eventDependentObservation**

Should the extension proposed by Farrington et al. be used to adjust for event-dependent observation time?

**Details**

Create an object defining the parameter values.

---

**createCreateScriIntervalDataArgs**

*Create a parameter object for the function createScriIntervalData*

---

**Description**

Create a parameter object for the function createScriIntervalData

**Usage**

```
createCreateScriIntervalDataArgs(eraCovariateSettings, controlIntervalSettings)
```

**Arguments****eraCovariateSettings**

Either an object of type EraCovariateSettings as created using the createEraCovariateSettings() function, or a list of such objects.

**controlIntervalSettings**

An object of type ControlIntervalSettings as created using the createControlIntervalSettings() function.

**Details**

Create an object defining the parameter values.

---

```
createCreateStudyPopulationArgs
```

*Create a parameter object for the function createStudyPopulation*

---

### Description

Create a parameter object for the function createStudyPopulation

### Usage

```
createCreateStudyPopulationArgs(
  firstOutcomeOnly = FALSE,
  naivePeriod = 0,
  minAge = NULL,
  maxAge = NULL
)
```

### Arguments

firstOutcomeOnly	Whether only the first occurrence of an outcome should be considered.
naivePeriod	The number of days at the start of a patient's observation period that should not be included in the risk calculations. Note that the naive period can be used to determine current covariate status right after the naive period, and whether an outcome is the first one.
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.

---

```
createDefaultSccsMultiThreadingSettings
```

*Create default SelfControlledCaseSeries multi-threading settings*

---

### Description

Create SelfControlledCaseSeries multi-threading settings based on the maximum number of cores to be used.

**Usage**

```
createDefaultSccsMultiThreadingSettings(maxCores)
```

**Arguments**

maxCores	Maximum number of CPU cores to use.
----------	-------------------------------------

**Value**

An object of type `SccsMultiThreadingSettings`.

**See Also**

[createSccsMultiThreadingSettings\(\)](#)

**Examples**

```
settings <- createDefaultSccsMultiThreadingSettings(10)
```

---

createEraCovariateSettings
<i>Create era covariate settings</i>

---

**Description**

Create era covariate settings

**Usage**

```
createEraCovariateSettings(  
  includeEraIds = NULL,  
  excludeEraIds = NULL,  
  label = "Covariates",  
  stratifyById = FALSE,  
  start = 0,  
  startAnchor = "era start",  
  end = 0,  
  endAnchor = "era end",  
  firstOccurrenceOnly = FALSE,  
  allowRegularization = FALSE,  
  profileLikelihood = FALSE,  
  exposureOfInterest = FALSE  
)
```

**Arguments**

includeEraIds	One or more IDs of variables in the <a href="#">SccsData</a> object that should be used to construct this covariate. If no IDs are specified, all variables will be used.
excludeEraIds	One or more IDs of variables in the [SccsData] object that should not be used to construct this covariate.
label	A label used to identify the covariates created using these settings.
stratifyById	Should a single covariate be created for every ID in the <a href="#">SccsData</a> object, or should a single covariate be constructed? For example, if the IDs identify exposures to different drugs, should a covariate be constructed for every drug, or a single covariate for exposure to any of these drugs. Note that overlap will be considered a single exposure.
start	The start of the risk window (in days) relative to the startAnchor.
startAnchor	The anchor point for the start of the risk window. Can be "era start" or "era end".
end	The end of the risk window (in days) relative to the endAnchor.
endAnchor	The anchor point for the end of the risk window. Can be "era start" or "era end".
firstOccurrenceOnly	Should only the first occurrence of the exposure be used?
allowRegularization	When fitting the model, should the covariates defined here be allowed to be regularized?
profileLikelihood	When fitting the model, should the likelihood profile be computed for the covariate defined here? The likelihood profile can be used to avoid making normal approximations on the likelihood and can be used in methods specifically designed to make use of the profile, but may take a while to compute.
exposureOfInterest	If TRUE, the fitted coefficient for this variable will be reported when using <code>runSccsAnalyses()</code> . Requires <code>includeEraIds</code> to be a exposure reference ID as defined in <code>createExposure()</code> .

**Details**

Create an object specifying how to create a (set of) era-based covariates.

**Value**

An object of type `EraCovariateSettings`.

---

createExposure

*Create exposure definition*

---

**Description**

Create exposure definition

**Usage**

```
createExposure(exposureId, exposureIdRef = "exposureId", trueEffectSize = NA)
```

**Arguments**

exposureId	An integer used to identify the exposure in the exposure cohort table.
exposureIdRef	A string used to refer to the exposure when defining covariates using the <code>createEraCovariateSetting</code> function.
trueEffectSize	For negative and positive controls: the known true effect size. To be used for empirical calibration. Negative controls have <code>trueEffectSize = 1</code> . If the true effect size is unknown, use <code>trueEffectSize = NA</code> .

**Details**

Create an exposure definition, to be used with the [createExposuresOutcome](#) function.

**Value**

An object of type Exposure.

---

```
createExposuresOutcome
```

*Create a exposures-outcome combination.*

---

**Description**

Create a exposures-outcome combination.

**Usage**

```
createExposuresOutcome(outcomeId, exposures)
```

**Arguments**

outcomeId	An integer used to identify the outcome in the outcome cohort table.
exposures	A list of object of type Exposure as created by <a href="#">createExposure()</a> .

**Details**

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

**Value**

An object of type ExposuresOutcome.

---

```
createFitSccsModelArgs
```

*Create a parameter object for the function fitSccsModel*

---

## Description

Create a parameter object for the function fitSccsModel

## Usage

```
createFitSccsModelArgs(
  prior = createPrior("laplace", useCrossValidation = TRUE),
  control = createControl(cvType = "auto", selectorType = "byPid", startingVariance =
    0.1, seed = 1, resetCoefficients = TRUE, noiseLevel = "quiet"),
  profileGrid = NULL,
  profileBounds = c(log(0.1), log(10))
)
```

## Arguments

prior	The prior used to fit the model. See Cyclops::createPrior for details.
control	The control object used to control the cross-validation used to determine the hyperparameters of the prior (if applicable). See Cyclops::createControl for details.
profileGrid	A one-dimensional grid of points on the log(relative risk) scale where the likelihood for coefficient of variables is sampled. See details.
profileBounds	The bounds (on the log relative risk scale) for the adaptive sampling of the likelihood function.

## Details

Create an object defining the parameter values.

---

```
createGetDbSccsDataArgs
```

*Create a parameter object for the function getDbSccsData*

---

## Description

Create a parameter object for the function getDbSccsData

**Usage**

```
createGetDbScsDataArgs(
  useCustomCovariates = FALSE,
  useNestingCohort = FALSE,
  nestingCohortId = NULL,
  deleteCovariatesSmallCount = 0,
  studyStartDate = "",
  studyEndDate = "",
  maxCasesPerOutcome = 0,
  exposureIds = "exposureId",
  customCovariateIds = ""
)
```

**Arguments**

useCustomCovariates	Create covariates from a custom table?
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.
nestingCohortId	A cohort definition ID identifying the records in the nestingCohortTable to use as nesting cohort.
deleteCovariatesSmallCount	The minimum count for a covariate to appear in the data to be kept.
studyStartDate	A character object specifying the minimum date where data is used. Date format is 'yyyymmdd'.
studyEndDate	A character object specifying the maximum date where data is used. Date format is 'yyyymmdd'.
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.
exposureIds	A list of identifiers to extract from the exposure table. If exposureTable = DRUG_ERA, exposureIds should be CONCEPT_ID. If exposureTable = "drug_era", exposureIds is used to select the drug_concept_id. If no exposure IDs are provided, all drugs or cohorts in the exposureTable are included as exposures.
customCovariateIds	A list of cohort definition IDs identifying the records in the customCovariateTable to use for building custom covariates.

**Details**

Create an object defining the parameter values.

---

createSccsAnalysis	Create a SelfControlledCaseSeries analysis specification
--------------------	--

---

### Description

Create a SelfControlledCaseSeries analysis specification

### Usage

```
createSccsAnalysis(
  analysisId = 1,
  description = "",
  getDbSccsDataArgs,
  createStudyPopulationArgs,
  createIntervalDataArgs = NULL,
  fitSccsModelArgs
)
```

### 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.
getDbSccsDataArgs	An object representing the arguments to be used when calling the <a href="#">getDbSccsData</a> function.
createStudyPopulationArgs	An object representing the arguments to be used when calling the <a href="#">getDbSccsData</a> function.
createIntervalDataArgs	An object representing the arguments to be used when calling the <a href="#">createSccsIntervalData</a> or <a href="#">createScriIntervalData</a> function.
fitSccsModelArgs	An object representing the arguments to be used when calling the <a href="#">fitSccsModel</a> function.

### Value

An object of type SccsAnalysis, to be used with the [runSccsAnalyses](#) function.

---

createSccsDiagnosticThresholds	Create SCCS diagnostics thresholds
--------------------------------	------------------------------------

---

### Description

Threshold used when calling [exportToCsv\(\)](#) to determine if we pass or fail diagnostics.



**Usage**

```
createSccsDiagnosticThresholds(
  mdrThreshold = 10,
  easeThreshold = 0.25,
  timeTrendPThreshold = 0.05,
  preExposurePThreshold = 0.05
)
```

**Arguments**

**mdrThreshold** What is the maximum allowed minimum detectable relative risk (MDRR)?

**easeThreshold** What is the maximum allowed expected absolute systematic error (EASE).

**timeTrendPThreshold** What family-wise p-value threshold (alpha) will be used to determine temporal instability?

**preExposurePThreshold** What p-value threshold (alpha) will be used to determine whether the rate of the outcome was higher just before exposure initiation?

**Value**

An object of type `SccsDiagnosticThresholds`.

---

```
createSccsIntervalData
```

*Create SCCS era data*

---

**Description**

Create SCCS era data

**Usage**

```
createSccsIntervalData(
  studyPopulation,
  sccsData,
  eraCovariateSettings,
  ageCovariateSettings = NULL,
  seasonalityCovariateSettings = NULL,
  calendarTimeCovariateSettings = NULL,
  minCasesForAgeSeason = NULL,
  minCasesForTimeCovariates = 10000,
  eventDependentObservation = FALSE
)
```

**Arguments**

studyPopulation	An object created using the <a href="#">createStudyPopulation()</a> function.
sccsData	An object of type <a href="#">SccsData</a> as created using the <a href="#">getDbSccsData</a> function.
eraCovariateSettings	Either an object of type EraCovariateSettings as created using the <a href="#">createEraCovariateSettings</a> function, or a list of such objects.
ageCovariateSettings	An object of type ageCovariateSettings as created using the <a href="#">createAgeCovariateSettings()</a> function.
seasonalityCovariateSettings	An object of type seasonalityCovariateSettings as created using the <a href="#">createSeasonalityCovariateSettings</a> function.
calendarTimeCovariateSettings	An object of type calendarTimeCovariateSettings as created using the <a href="#">createCalendarTimeCovariateSettings</a> function.
minCasesForAgeSeason	DEPRECATED: Use minCasesForTimeCovariates instead.
minCasesForTimeCovariates	Minimum number of cases to use to fit age, season and calendar time splines. If needed (and available), cases that are not exposed will be included.
eventDependentObservation	Should the extension proposed by Farrington et al. be used to adjust for event-dependent observation time?

**Details**

This function creates covariates based on the data in the sccsData argument, according to the provided settings. It chops patient time into periods during which all covariates remain constant. The output details these periods, their durations, and a sparse representation of the covariate values.

**Value**

An object of type [SccsIntervalData](#).

**References**

Farrington, C. P., Anaya-Izquierdo, A., Whitaker, H. J., Hocine, M.N., Douglas, I., and Smeeth, L. (2011). Self-Controlled case series analysis with event-dependent observation periods. *Journal of the American Statistical Association* 106 (494), 417-426

---

```
createSccsMultiThreadingSettings
```

*Create SelfControlledCaseSeries multi-threading settings*

---

**Description**

Create SelfControlledCaseSeries multi-threading settings

**Usage**

```
createSccsMultiThreadingSettings(
  getDbSccsDataThreads = 1,
  createStudyPopulationThreads = 1,
  createIntervalDataThreads = 1,
  fitSccsModelThreads = 1,
  cvThreads = 1,
  calibrationThreads = 1
)
```

**Arguments**

`getDbSccsDataThreads`  
The number of parallel threads to use for building the `SccsData` objects.

`createStudyPopulationThreads`  
The number of parallel threads to use for building the `studyPopulation` objects.

`createIntervalDataThreads`  
The number of parallel threads to use for building the `SccsIntervalData` objects.

`fitSccsModelThreads`  
The number of parallel threads to use for fitting the models.

`cvThreads`  
The number of parallel threads to use for the cross- validation when estimating the hyperparameter for the outcome model. Note that the total number of CV threads at one time could be `fitSccsModelThreads * cvThreads`.

`calibrationThreads`  
The number of parallel threads to use for empirical calibration.

**Value**

An object of type `SccsMultiThreadingSettings`.

**See Also**

[createDefaultSccsMultiThreadingSettings\(\)](#)

---

`createSccsSimulationSettings`

*Create SCCS simulation settings*

---

**Description**

Create SCCS simulation settings

**Usage**

```

createSccsSimulationSettings(
  meanPatientTime = 4 * 365,
  sdPatientTime = 2 * 365,
  minAge = 18 * 365,
  maxAge = 65 * 365,
  minBaselineRate = 0.001,
  maxBaselineRate = 0.01,
  minCalendarTime = as.Date("2000-01-01"),
  maxCalendarTime = as.Date("2010-01-01"),
  eraIds = c(1, 2),
  patientUsages = c(0.2, 0.1),
  usageRate = c(0.01, 0.01),
  meanPrescriptionDurations = c(14, 30),
  sdPrescriptionDurations = c(7, 14),
  simulationRiskWindows = list(createSimulationRiskWindow(relativeRisks = 1),
    createSimulationRiskWindow(relativeRisks = 1.5)),
  includeAgeEffect = TRUE,
  ageKnots = 5,
  includeSeasonality = TRUE,
  seasonKnots = 5,
  includeCalendarTimeEffect = TRUE,
  calendarTimeKnots = 5,
  outcomeId = 10
)

```

**Arguments**

<code>meanPatientTime</code>	Mean number of observation days per patient.
<code>sdPatientTime</code>	Standard deviation of the observation days per patient.
<code>minAge</code>	The minimum age in days.
<code>maxAge</code>	The maximum age in days.
<code>minBaselineRate</code>	The minimum baseline rate (per day).
<code>maxBaselineRate</code>	The maximum baseline rate (per day).
<code>minCalendarTime</code>	The minimum date patients are to be observed.
<code>maxCalendarTime</code>	The maximum date patients are to be observed.
<code>eraIds</code>	The IDs for the covariates to be generated.
<code>patientUsages</code>	The fraction of patients that use the drugs.
<code>usageRate</code>	The rate of prescriptions per person that uses the drug.
<code>meanPrescriptionDurations</code>	The mean duration of a prescription, per drug.
<code>sdPrescriptionDurations</code>	The standard deviation of the duration of a prescription, per drug.

simulationRiskWindows	One or a list of objects of type SimulationRiskWindow as created using the <a href="#">createSimulationRiskWindow()</a> function.
includeAgeEffect	Include an age effect for the outcome?
ageKnots	Number of knots in the age spline.
includeSeasonality	Include seasonality for the outcome?
seasonKnots	Number of knots in the seasonality spline.
includeCalendarTimeEffect	Include a calendar time effect for the outcome?
calendarTimeKnots	Number of knots in the calendar time spline.
outcomeId	The ID to be used for the outcome.

### Details

Create an object of settings for an SCCS simulation.

### Value

An object of type SccsSimulationSettings.

---

createScriIntervalData

*Create Self-Controlled Risk Interval (SCRI) era data*

---

### Description

Create Self-Controlled Risk Interval (SCRI) era data

### Usage

```
createScriIntervalData(
  studyPopulation,
  sccsData,
  eraCovariateSettings,
  controlIntervalSettings
)
```

### Arguments

studyPopulation	An object created using the <a href="#">createStudyPopulation()</a> function.
sccsData	An object of type <a href="#">SccsData</a> as created using the <a href="#">getDbSccsData</a> function.
eraCovariateSettings	Either an object of type EraCovariateSettings as created using the <a href="#">createEraCovariateSettings</a> function, or a list of such objects.
controlIntervalSettings	An object of type ControlIntervalSettings as created using the <a href="#">createControlIntervalSettings</a> function.

## Details

This function creates interval data according to the elf-Controlled Risk Interval (SCRI) design. Unlike the generic SCCS design, where all patient time is used to establish a background rate, in the SCRI design a specific control interval (relative to the exposure) needs to be defined. The final model will only include time that is either part of the risk interval (defined using the `eraCovariateSettings` argument, or the control interval (defined using `controlIntervalSettings`).

## Value

An object of type [SccsIntervalData](#).

## References

Greene SK, Kulldorff M, Lewis EM, Li R, Yin R, Weintraub ES, Fireman BH, Lieu TA, Nordin JD, Glanz JM, Baxter R, Jacobsen SJ, Broder KR, Lee GM. Near real-time surveillance for influenza vaccine safety: proof-of-concept in the Vaccine Safety Datalink Project. *Am J Epidemiol*. 2010 Jan 15;171(2):177-88. doi: 10.1093/aje/kwp345.

---

createSeasonalityCovariateSettings  
*Create seasonality settings*

---

## Description

Create seasonality settings

## Usage

```
createSeasonalityCovariateSettings(
  seasonKnots = 5,
  allowRegularization = FALSE,
  computeConfidenceIntervals = FALSE
)
```

## Arguments

- |                            |  |
|----------------------------|--|
| seasonKnots                | If a single number is provided this is assumed to indicate the number of knots to use for the spline, and the knots are automatically equally spaced across the year. If more than one number is provided these are assumed to be the exact location of the knots in days relative to the start of the year. |
| allowRegularization        | When fitting the model, should the covariates defined here be allowed to be regularized?   |
| computeConfidenceIntervals | Should confidence intervals be computed for the covariates defined here? Setting this to FALSE might save computing time when fitting the model. Will be turned to FALSE automatically when <code>allowRegularization = TRUE</code> .  |

**Details**

Create an object specifying whether and how seasonality should be included in the model. Seasonality can be included by splitting patient time into calendar months. During a month, the relative risk attributed to season is assumed to be constant, and the risk from month to month is modeled using a cyclic cubic spline.

**Value**

An object of type seasonalitySettings.

---

```
createSimulationRiskWindow
```

*Create a risk window definition for simulation*

---

**Description**

Create a risk window definition for simulation

**Usage**

```
createSimulationRiskWindow(
  start = 0,
  end = 0,
  endAnchor = "era end",
  splitPoints = c(),
  relativeRisks = c(0)
)
```

**Arguments**

start	Start of the risk window relative to exposure start.
end	The end of the risk window (in days) relative to the endAnchor.
endAnchor	The anchor point for the end of the risk window. Can be "era start" or "era end".
splitPoints	Subdivision of the risk window in to smaller sub-windows.
relativeRisks	Either a single number representing the relative risk in the risk window, or when splitPoints have been defined a vector of relative risks, one for each sub-window.

**Value**

An object of type SimulationRiskWindow.

---

createStudyPopulation *Create a study population*

---

## Description

Create a study population

## Usage

```
createStudyPopulation(
  sccsData,
  outcomeId = NULL,
  firstOutcomeOnly = FALSE,
  naivePeriod = 0,
  minAge = NULL,
  maxAge = NULL
)
```

## Arguments

sccsData	An object of type <a href="#">SccsData</a> as created using the <a href="#">getDbSccsData</a> function.
outcomeId	The outcome to create the era data for. If not specified it is assumed to be the one outcome for which the data was loaded from the database.
firstOutcomeOnly	Whether only the first occurrence of an outcome should be considered.
naivePeriod	The number of days at the start of a patient's observation period that should not be included in the risk calculations. Note that the naive period can be used to determine current covariate status right after the naive period, and whether an outcome is the first one.
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 a study population for a specific outcome, applying several restrictions.

## Value

A list specifying the study population, with the following items:

- **cases**: A tibble with one row per observation period of a person with the outcome.
- **outcomes**: A tibble listing the days when a case has the outcome.
- **metaData**: A list with meta data about the study population, including the attrition.



---

cyclicSplineDesign	<i>Create a design matrix for a cyclic spline</i>
--------------------	---

---

**Description**

Create a design matrix for a cyclic spline

**Usage**

```
cyclicSplineDesign(x, knots, ord = 4)
```

**Arguments**

x	Vector of coordinates of the points to be interpolated.
knots	Location of the knots.
ord	Order of the spline function.

**Details**

This function is used by other functions in this package.

---

exportToCsv	<i>Export SCCSresults to CSV files</i>
-------------	--

---

**Description**

Export SCCSresults to CSV files

**Usage**

```
exportToCsv(
  outputFolder,
  exportFolder = file.path(outputFolder, "export"),
  databaseId = 1,
  minCellCount = 5,
  sccsDiagnosticThresholds = createSccsDiagnosticThresholds()
)
```

**Arguments**

outputFolder	The folder where runCmAnalyses() generated all results.
exportFolder	The folder where the CSV files will written.
databaseId	A unique ID for the database. This will be appended to most tables.
minCellCount	To preserve privacy: the minimum number of subjects contributing to a count before it can be included in the results. If the count is below this threshold, it will be set to -minCellCount.
sccsDiagnosticThresholds	An object of type SccsDiagnosticThresholds as created using <a href="#">createSccsDiagnosticThresholds()</a>

## Details

This requires that `runSccsAnalyses()` has been executed first. It exports all the results in the `outputFolder` to CSV files for sharing with other sites.

## Value

Does not return anything. Is called for the side-effect of populating the `exportFolder` with CSV files.

---

<code>fitSccsModel</code>	<i>Fit the SCCS model</i>
---------------------------	---------------------------

---

## Description

Fit the SCCS model

## Usage

```
fitSccsModel(
  sccsIntervalData,
  prior = createPrior("laplace", useCrossValidation = TRUE),
  control = createControl(cvType = "auto", selectorType = "byPid", startingVariance =
    0.1, seed = 1, resetCoefficients = TRUE, noiseLevel = "quiet"),
  profileGrid = NULL,
  profileBounds = c(log(0.1), log(10))
)
```

## Arguments

<code>sccsIntervalData</code>	An object of type <code>SccsIntervalData</code> as created using the <code>createSccsIntervalData</code> function.
<code>prior</code>	The prior used to fit the model. See <code>Cyclops::createPrior</code> for details.
<code>control</code>	The control object used to control the cross-validation used to determine the hyperparameters of the prior (if applicable). See <code>Cyclops::createControl</code> for details.
<code>profileGrid</code>	A one-dimensional grid of points on the log(relative risk) scale where the likelihood for coefficient of variables is sampled. See details.
<code>profileBounds</code>	The bounds (on the log relative risk scale) for the adaptive sampling of the likelihood function.

## Details

Fits the SCCS model as a conditional Poisson regression. When allowed, coefficients for some or all covariates can be regularized.

Likelihood profiling is only done for variables for which `profileLikelihood` is set to `TRUE` when calling `createEraCovariateSettings()`. Either specify the `profileGrid` for a completely user-defined grid, or `profileBounds` for an adaptive grid. Both should be defined on the log IRR scale. When both `profileGrid` and `profileGrid` are `NULL` likelihood profiling is disabled.

**Value**

An object of type `SccsModel`. Generic functions `print`, `coef`, and `confint` are available.

**References**

Suchard, M.A., Simpson, S.E., Zorych, I., Ryan, P., and Madigan, D. (2013). Massive parallelization of serial inference algorithms for complex generalized linear models. *ACM Transactions on Modeling and Computer Simulation* 23, 10

---

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

---

**Description**

Get the attrition table for a population

**Usage**

```
getAttritionTable(object)
```

**Arguments**

object	Either an object of type <code>SccsData</code> , a population object generated by functions like <code>createStudyPopulation()</code> , or an object of type <code>outcomeModel</code> .
--------	--

**Value**

A tibble specifying the number of people and exposures in the population after specific steps of filtering.

---

getDbSccsData	<i>Load data for SCCS from the database</i>
---------------	---

---

**Description**

Load all data needed to perform an SCCS analysis from the database.

**Usage**

```
getDbSccsData(
  connectionDetails,
  cdmDatabaseSchema,
  tempEmulationSchema = getOption("sqlRenderTempEmulationSchema"),
  outcomeDatabaseSchema = cdmDatabaseSchema,
  outcomeTable = "condition_era",
  outcomeIds,
  exposureDatabaseSchema = cdmDatabaseSchema,
  exposureTable = "drug_era",
  exposureIds = c(),
```

```

useCustomCovariates = FALSE,
customCovariateDatabaseSchema = cdmDatabaseSchema,
customCovariateTable = "cohort",
customCovariateIds = c(),
useNestingCohort = FALSE,
nestingCohortDatabaseSchema = cdmDatabaseSchema,
nestingCohortTable = "cohort",
nestingCohortId = NULL,
deleteCovariatesSmallCount = 0,
studyStartDate = "",
studyEndDate = "",
cdmVersion = "5",
maxCasesPerOutcome = 0
)

```

## Arguments

### connectionDetails

An R object of type `ConnectionDetails` created using the function `DatabaseConnector::createConnectionDetails` function.

### 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'.

### tempEmulationSchema

Some database platforms like Oracle and Impala do not truly support temp tables. To emulate temp tables, provide a schema with write privileges where temp tables can be created.

### 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 table name that contains the outcome cohorts. If `outcomeTable` is not "condition\_era", then expectation is `outcomeTable` has format of cohort table (see details).

### outcomeIds

A list of IDs used to define outcomes. If `outcomeTable` is not "condition\_era" the list contains records found in the `cohort_definition_id` field.

### exposureDatabaseSchema

The name of the database schema that is the location where the exposure data used to define the exposure eras is available. If `exposureTable = "drug_era"`, `exposureDatabaseSchema` is not used but assumed to be equal to `cdmDatabaseSchema`. Requires read permissions to this database.

### exposureTable

The tablename that contains the exposure cohorts. If `exposureTable` is not "drug\_era", then expectation is `exposureTable` has format of a cohort table (see details).

### exposureIds

A list of identifiers to extract from the exposure table. If `exposureTable = DRUG_ERA`, `exposureIds` should be `CONCEPT_ID`. If `exposureTable = "drug_era"`, `exposureIds` is used to select the `drug_concept_id`. If no exposure IDs are provided, all drugs or cohorts in the `exposureTable` are included as exposures.

### useCustomCovariates

Create covariates from a custom table?

customCovariateDatabaseSchema	The name of the database schema that is the location where the custom covariate data is available.
customCovariateTable	Name of the table holding the custom covariates. This table should have the same structure as the cohort table (see details).
customCovariateIds	A list of cohort definition IDs identifying the records in the customCovariateTable to use for building custom covariates.
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 (see details).
nestingCohortId	A cohort definition ID identifying the records in the nestingCohortTable to use as nesting cohort.
deleteCovariatesSmallCount	The minimum count for a covariate to appear in the data to be kept.
studyStartDate	A character object specifying the minimum date where data is used. Date format is 'yyyymmdd'.
studyEndDate	A character object specifying the maximum date where data is used. Date format is 'yyyymmdd'.
cdmVersion	Define the OMOP CDM version used: currently supports "5".
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

This function downloads several types of information:

- Information on the occurrences of the outcome(s) of interest. Note that information for multiple outcomes can be fetched in one go, and later the specific outcome can be specified for which we want to build a model.
- Information on the observation time and age for the people with the outcomes.
- Information on exposures of interest which we want to include in the model.

Five different database schemas can be specified, for five different types of information: The

- **cdmDatabaseSchema** is used to extract patient age and observation period. The
- **outcomeDatabaseSchema** is used to extract information about the outcomes, the
- **exposureDatabaseSchema** is used to retrieve information on exposures, and the
- **customCovariateDatabaseSchema** is optionally used to find additional, user-defined covariates. All four locations could point to the same database schema.

- **nestingCohortDatabaseSchema** is optionally used to define a cohort in which the analysis is nested, for example a cohort of diabetics patients.

All five locations could point to the same database schema.

Cohort tables are assumed to have the following fields: cohort\_definition\_id, subject\_id, cohort\_start\_date, and cohort\_end\_date.

### Value

An [SccsData](#) object.

---

getFileReference	<i>Get file reference</i>
------------------	---------------------------

---

### Description

Get file reference

### Usage

```
getFileReference(outputFolder)
```

### Arguments

outputFolder      Name of the folder where all the outputs have been written to.

### Value

A tibble containing the names of the files for various artifacts created for each outcome-exposures set.

---

getModel	<i>Output the full model</i>
----------	------------------------------

---

### Description

Output the full model

### Usage

```
getModel(sccsModel)
```

### Arguments

sccsModel          An object of type SccsModel as created using the [fitSccsModel\(\)](#) function.

### Value

A tibble with the coefficients and confidence intervals (when not-regularized) for all covariates in the model.

---

getResultsSummary	<i>Get a summary report of the analyses results</i>
-------------------	---

---

**Description**

Get a summary report of the analyses results

**Usage**

```
getResultsSummary(outputFolder)
```

**Arguments**

outputFolder     Name of the folder where all the outputs have been written to.

**Value**

A tibble containing summary statistics for each outcome-covariate-analysis combination.

---

hasAgeEffect	<i>Does the model contain an age effect?</i>
--------------	--

---

**Description**

Does the model contain an age effect?

**Usage**

```
hasAgeEffect(sccsModel)
```

**Arguments**

sccsModel     An object of type SccsModel as created using the [fitSccsModel\(\)](#) function.

**Value**

TRUE if the model contains an age effect, otherwise FALSE.

---

hasCalendarTimeEffect	<i>Does the model contain an age effect?</i>
-----------------------	--

---

**Description**

Does the model contain an age effect?

**Usage**

```
hasCalendarTimeEffect(sccsModel)
```

**Arguments**

sccsModel	An object of type <code>SccsModel</code> as created using the <code>fitSccsModel()</code> function.
-----------	---

**Value**

TRUE if the model contains an age effect, otherwise FALSE.

---

hasSeasonality	<i>Does the model contain an age effect?</i>
----------------	--

---

**Description**

Does the model contain an age effect?

**Usage**

```
hasSeasonality(sccsModel)
```

**Arguments**

sccsModel	An object of type <code>SccsModel</code> as created using the <code>fitSccsModel()</code> function.
-----------	---

**Value**

TRUE if the model contains an age effect, otherwise FALSE.



---

isSccsData	<i>Check whether an object is a SccsData object</i>
------------	---

---

**Description**

Check whether an object is a SccsData object

**Usage**

```
isSccsData(x)
```

**Arguments**

x	The object to check.
---	----------------------

**Value**

A logical value.

---

isSccsIntervalData	<i>Check whether an object is a SccsIntervalData object</i>
--------------------	---

---

**Description**

Check whether an object is a SccsIntervalData object

**Usage**

```
isSccsIntervalData(x)
```

**Arguments**

x	The object to check.
---	----------------------

**Value**

A logical value.

---

`loadExposuresOutcomeList`*Load a list of ExposuresOutcome from file*

---

**Description**

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

**Usage**

```
loadExposuresOutcomeList(file)
```

**Arguments**

<code>file</code>	The name of the file
-------------------	----------------------

**Value**

A list of objects of type ExposuresOutcome.

---

`loadSccsAnalysisList` *Load a list of sccsAnalysis from file*

---

**Description**

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

**Usage**

```
loadSccsAnalysisList(file)
```

**Arguments**

<code>file</code>	The name of the file
-------------------	----------------------

**Value**

A list of objects of type SccsAnalysis.

---

loadSccsData	<i>Load the cohort method data from a file</i>
--------------	--

---

**Description**

Loads an object of type [SccsData](#) from a file in the file system.

**Usage**

```
loadSccsData(file)
```

**Arguments**

file	The name of the file containing the data.
------	---

**Value**

An object of class [SccsData](#).

---

loadSccsIntervalData	<i>Load the cohort method data from a file</i>
----------------------	--

---

**Description**

Loads an object of type [SccsIntervalData](#) from a file in the file system.

**Usage**

```
loadSccsIntervalData(file)
```

**Arguments**

file	The name of the file containing the data.
------	---

**Value**

An object of class [SccsIntervalData](#).

---

plotAgeEffect	<i>Plot the age effect</i>
---------------	----------------------------

---

**Description**

Plot the age effect

**Usage**

```
plotAgeEffect(sccsModel, rrLim = c(0.1, 10), title = NULL, fileName = NULL)
```

**Arguments**

sccsModel	An object of type <code>sccsModel</code> as created using the <a href="#">fitSccsModel</a> function.
rrLim	The limits on the incidence rate ratio scale in the plot.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <code>ggsave</code> in the <code>ggplot2</code> package for supported file formats.

**Details**

Plot the spline curve of the age effect.

**Value**

A Ggplot object. Use the `ggsave` function to save to file.

---

plotAgeSpans	<i>Plot the age ranges spanned by each observation period.</i>
--------------	--

---

**Description**

Plot the age ranges spanned by each observation period.

**Usage**

```
plotAgeSpans(
  studyPopulation,
  maxPersons = 10000,
  title = NULL,
  fileName = NULL
)
```

**Arguments**

studyPopulation	An object created using the <a href="#">createStudyPopulation()</a> function.
maxPersons	The maximum number of persons to plot. If there are more than this number of persons a random sample will be taken to avoid visual clutter.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <a href="#">ggplot2::ggsave()</a> for supported file formats.

**Details**

Plots a line per patient from their age at observation start to their age at observation end.

**Value**

A ggplot object. Use the [ggplot2::ggsave\(\)](#) function to save to file in a different format.

---

plotCalendarTimeEffect

*Plot the calendar time effect*

---

**Description**

Plot the calendar time effect

**Usage**

```
plotCalendarTimeEffect(
  sccsModel,
  rrLim = c(0.1, 10),
  title = NULL,
  fileName = NULL
)
```

**Arguments**

sccsModel	An object of type sccsModel as created using the <a href="#">fitSccsModel</a> function.
rrLim	The limits on the incidence rate ratio scale in the plot.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function ggsave in the ggplot2 package for supported file formats.

**Details**

Plot the spline curve of the calendar time effect.

**Value**

A Ggplot object. Use the ggsave function to save to file.

---

plotCalendarTimeSpans *Plot the calendar time ranges spanned by each observation period.*

---

### Description

Plot the calendar time ranges spanned by each observation period.

### Usage

```
plotCalendarTimeSpans(
  studyPopulation,
  maxPersons = 10000,
  title = NULL,
  fileName = NULL
)
```

### Arguments

studyPopulation	An object created using the <a href="#">createStudyPopulation()</a> function.
maxPersons	The maximum number of persons to plot. If there are more than this number of persons a random sample will be taken to avoid visual clutter.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <a href="#">ggplot2::ggsave()</a> for supported file formats.

### Details

Plots a line per patient from their observation start to their observation end.

### Value

A ggplot object. Use the [ggplot2::ggsave\(\)](#) function to save to file in a different format.

---

plotEventObservationDependence  
*Plot time from event to observation end for censored and uncensored time.*

---

### Description

Plot time from event to observation end for censored and uncensored time.

### Usage

```
plotEventObservationDependence(studyPopulation, title = NULL, fileName = NULL)
```

**Arguments**

studyPopulation	An object created using the <code>createStudyPopulation()</code> function.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <code>ggplot2::ggsave()</code> for supported file formats.

**Details**

This plot shows whether there is a difference in time between (first) event and the observation period end for periods that are 'censored' and those that are 'uncensored'. By 'censored' we mean periods that end before we would normally expect. Here, we define periods to be uncensored if they end at either the study end date (if specified), database end date (i.e. the date after which no data is captured in the database), or maximum age (if specified). All other periods are assumed to be censored.

As proposed by Farrington et al., by comparing the two plots, we can gain some insight into whether the censoring is dependent on the occurrence of the event.

**Value**

A ggplot object. Use the `ggplot2::ggsave()` function to save to file in a different format.

**References**

Farrington P, Whitaker H, Ghebremichael Weldeselassie Y (2018), Self-controlled case series studies: A modelling guide with R, Taylor & Francis

---

plotEventToCalendarTime

*Plot the count of events over calendar time.*

---

**Description**

Plot the count of events over calendar time.

**Usage**

```
plotEventToCalendarTime(
  studyPopulation,
  sccsModel = NULL,
  title = NULL,
  fileName = NULL
)
```

**Arguments**

studyPopulation	An object created using the <code>createStudyPopulation()</code> function.
sccsModel	Optional: A fitted SCCS model as created using <code>fitSccsModel()</code> . If the model contains splines for seasonality and or calendar time a panel will be added with outcome counts adjusted for these splines.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <code>ggplot2::ggsave()</code> for supported file formats.

**Value**

A ggplot object. Use the `ggplot2::ggsave()` function to save to file in a different format.

---

plotExposureCentered    *Plot information centered around the start of exposure*

---

**Description**

Plot information centered around the start of exposure

**Usage**

```
plotExposureCentered(
  studyPopulation,
  sccsData,
  exposureEraId = NULL,
  highlightExposedEvents = TRUE,
  title = NULL,
  fileName = NULL
)
```

**Arguments**

studyPopulation	An object created using the <code>createStudyPopulation()</code> function.
sccsData	An object of type <code>SccsData</code> as created using the <code>getDbSccsData</code> function.
exposureEraId	The exposure to create the era data for. If not specified it is assumed to be the one exposure for which the data was loaded from the database.
highlightExposedEvents	Highlight events that occurred during the exposure era using a different color?
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <code>ggplot2::ggsave()</code> for supported file formats.

**Details**

This plot shows the number of events and the number of subjects under observation in week-sized intervals relative to the start of the first exposure.



**Value**

A ggplot object. Use the `ggplot2::ggsave()` function to save to file in a different format.

---

plotSeasonality	<i>Plot the seasonality effect</i>
-----------------	------------------------------------

---

**Description**

Plot the seasonality effect

**Usage**

```
plotSeasonality(sccsModel, rrLim = c(0.1, 10), title = NULL, fileName = NULL)
```

**Arguments**

sccsModel	An object of type <code>sccsModel</code> as created using the <code>fitSccsModel</code> function.
rrLim	The limits on the incidence rate ratio scale in the plot.
title	Optional: the main title for the plot
fileName	Name of the file where the plot should be saved, for example 'plot.png'. See the function <code>ggsave</code> in the <code>ggplot2</code> package for supported file formats.

**Details**

Plot the spline curve of the seasonality effect.

**Value**

A Ggplot object. Use the `ggsave` function to save to file.

---

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

---

**Description**

Run a list of analyses

**Usage**

```
runSccsAnalyses(
  connectionDetails,
  cdmDatabaseSchema,
  tempEmulationSchema = getOption("sqlRenderTempEmulationSchema"),
  exposureDatabaseSchema = cdmDatabaseSchema,
  exposureTable = "drug_era",
  outcomeDatabaseSchema = cdmDatabaseSchema,
  outcomeTable = "cohort",
  customCovariateDatabaseSchema = cdmDatabaseSchema,
  customCovariateTable = "cohort",
```

```

nestingCohortDatabaseSchema = cdmDatabaseSchema,
nestingCohortTable = "cohort",
cdmVersion = "5",
outputFolder = "../SccsOutput",
sccsAnalysisList,
exposuresOutcomeList,
analysesToExclude = NULL,
combineDataFetchAcrossOutcomes = FALSE,
sccsMultiThreadingSettings = createSccsMultiThreadingSettings()
)

```

## Arguments

connectionDetails

An R object of type ConnectionDetails created using the function `DatabaseConnector::createConnectionDetails()`.

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'.

tempEmulationSchema

Some database platforms like Oracle and Impala do not truly support temp tables. To emulate temp tables, provide a schema with write privileges where temp tables can be created.

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 cdmDatabaseSchema. Requires read permissions to this database.

exposureTable

The table name 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.

outcomeDatabaseSchema

The name of the database schema that is the location where the data used to define the outcome cohorts is available. Requires read permissions to this database.

outcomeTable

The table name that contains the outcome cohorts.

customCovariateDatabaseSchema

The name of the database schema that is the location where the custom covariate data is available.

customCovariateTable

Name of the table holding the custom covariates. This table should have the same structure as the cohort table.

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.

cdmVersion

Define the OMOP CDM version used: currently supports "5".

outputFolder

Name of the folder where all the outputs will be written to.

sccsAnalysisList

A list of objects of SccsAnalysis as created using the `createSccsAnalysis()` function.

exposuresOutcomeList

A list of objects of type ExposuresOutcome as created using the `createExposuresOutcome()` function.

analysesToExclude

Analyses to exclude. See the Analyses to Exclude section for details.

combineDataFetchAcrossOutcomes

Should fetching data from the database be done one outcome at a time, or for all outcomes in one fetch? Combining fetches will be more efficient if there is large overlap in the subjects that have the different outcomes.

sccsMultiThreadingSettings

An object of type SccsMultiThreadingSettings as created using the `createSccsMultiThreadingSettings()` or `createDefaultSccsMultiThreadingSettings()` functions.

## Details

Run a list of analyses for the exposures-outcomes of interest. This function will run all specified analyses against all hypotheses of interest, meaning that the total number of outcome models is  $\text{length}(\text{sccsAnalysisList}) * \text{length}(\text{exposuresOutcomeList})$ . When you provide several analyses it will determine whether any of the analyses have anything in common, and will take advantage of this fact.

### Analyses to Exclude:

Normally, `runSccsAnalyses` will run all combinations of exposures-outcome-analyses settings. However, sometimes we may not need all those combinations. Using the `analysesToExclude` argument, we can remove certain items from the full matrix. This argument should be a data frame with at least one of the following columns:

- `exposureId`
- `outcomeId`
- `analysisId`

This data frame will be joined to the outcome model reference table before executing, and matching rows will be removed. For example, if one specifies only one exposure ID and analysis ID, then any analyses with that exposure and that analysis ID will be skipped.

## Value

A tibble describing for each exposure-outcome-analysisId combination where the intermediary and outcome model files can be found, relative to the `outputFolder`.

---

saveExposuresOutcomeList

*Save a list of ExposuresOutcome to file*

---

## Description

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

## Usage

```
saveExposuresOutcomeList(exposuresOutcomeList, file)
```

**Arguments**

exposuresOutcomeList	The ExposuresOutcome list to be written to file
file	The name of the file where the results will be written

---

saveSccsAnalysisList	<i>Save a list of SccsAnalysis to file</i>
----------------------	--

---

**Description**

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

**Usage**

```
saveSccsAnalysisList(sccsAnalysisList, file)
```

**Arguments**

sccsAnalysisList	The SccsAnalysis list to be written to file
file	The name of the file where the results will be written

---

saveSccsData	<i>Save the cohort method data to file</i>
--------------	--

---

**Description**

Saves an object of type [SccsData](#) to a file.

**Usage**

```
saveSccsData(sccsData, file)
```

**Arguments**

sccsData	An object of type <a href="#">SccsData</a> as created using the <a href="#">getDbSccsData</a> function.
file	The name of the file where the data will be written. If the file already exists it will be overwritten.

**Value**

Returns no output.

---

saveSccsIntervalData	<i>Save the cohort method data to file</i>
----------------------	--

---

### Description

Saves an object of type [SccsIntervalData](#) to a file.

### Usage

```
saveSccsIntervalData(sccsIntervalData, file)
```

### Arguments

sccsIntervalData	An object of type <a href="#">SccsIntervalData</a> as created using the <a href="#">createSccsIntervalData</a> function.
file	The name of the file where the data will be written. If the file already exists it will be overwritten.

### Value

Returns no output.

---

SccsData-class	<i>SCCS Data</i>
----------------	------------------

---

### Description

SccsData is an S4 class that inherits from [Andromeda](#). It contains information on the cases and their covariates.

A SccsData is typically created using [getDbSccsData\(\)](#), can only be saved using [saveSccsData\(\)](#), and loaded using [loadSccsData\(\)](#).

### Usage

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

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

### Arguments

object	An object of type SccsData.
--------	-----------------------------

---

SccsIntervalData-class

*SCCS Interval Data*


---

### Description

SccsIntervalData' is an S4 class that inherits from [Andromeda](#). It contains information on the cases and their covariates, divided in non-overlapping time intervals.

A SccsIntervalData is typically created using [createSccsIntervalData\(\)](#), can only be saved using [saveSccsIntervalData\(\)](#), and loaded using [loadSccsIntervalData\(\)](#).

### Usage

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

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

### Arguments

object                    An object of type SccsIntervalData.

---

simulateSccsData

*Simulate SCCS data*


---

### Description

Simulate SCCS data

### Usage

```
simulateSccsData(nCases, settings)
```

### Arguments

nCases                    The number of cases to simulate.

settings                   An object of type SccsSimulationSettings as created using the [createSccsSimulationSettings](#) function.

### Value

An object of type SccsData.

# Index

Andromeda, [45](#), [46](#)

computeMdr, [3](#)

computePreExposureGainP, [4](#)

computeTimeStability, [5](#)

createAgeCovariateSettings, [6](#)

createAgeCovariateSettings(), [18](#)

createCalendarTimeCovariateSettings, [6](#)

createCalendarTimeCovariateSettings(), [18](#)

createControlIntervalSettings, [7](#)

createControlIntervalSettings(), [21](#)

createCreateScCsIntervalDataArgs, [8](#)

createCreateScCsIntervalDataArgs, [9](#)

createCreateStudyPopulationArgs, [10](#)

createDefaultScCsMultiThreadingSettings, [10](#)

createDefaultScCsMultiThreadingSettings(), [19](#), [43](#)

createEraCovariateSettings, [11](#)

createEraCovariateSettings(), [18](#), [21](#), [26](#)

createExposure, [12](#)

createExposure(), [13](#)

createExposuresOutcome, [13](#), [13](#)

createExposuresOutcome(), [43](#)

createFitScCsModelArgs, [14](#)

createGetDbScCsDataArgs, [14](#)

createScCsAnalysis, [16](#)

createScCsAnalysis(), [42](#)

createScCsDiagnosticThresholds, [16](#)

createScCsDiagnosticThresholds(), [25](#)

createScCsIntervalData, [3](#), [16](#), [17](#), [26](#), [45](#)

createScCsIntervalData(), [46](#)

createScCsMultiThreadingSettings, [18](#)

createScCsMultiThreadingSettings(), [11](#), [43](#)

createScCsSimulationSettings, [19](#)

createScCsSimulationSettings(), [46](#)

createScCsIntervalData, [16](#), [21](#)

createSeasonalityCovariateSettings, [22](#)

createSeasonalityCovariateSettings(), [18](#)

createSimulationRiskWindow, [23](#)

createSimulationRiskWindow(), [21](#)

createStudyPopulation, [24](#)

createStudyPopulation(), [4](#), [5](#), [18](#), [21](#), [27](#), [37–40](#)

cyclicSplineDesign, [25](#)

Cyclops::createControl, [26](#)

Cyclops::createPrior, [26](#)

DatabaseConnector::createConnectionDetails(), [28](#), [42](#)

exportToCsv, [25](#)

exportToCsv(), [16](#)

fitScCsModel, [16](#), [26](#), [36](#), [37](#), [41](#)

fitScCsModel(), [3](#), [5](#), [30–32](#), [40](#)

getAttritionTable, [27](#)

getDbScCsData, [4](#), [16](#), [18](#), [21](#), [24](#), [27](#), [40](#), [44](#)

getDbScCsData(), [45](#)

getFileReference, [30](#)

getModel, [30](#)

getResultsSummary, [31](#)

ggplot2::ggsave(), [37–41](#)

hasAgeEffect, [31](#)

hasCalendarTimeEffect, [32](#)

hasSeasonality, [32](#)

isScCsData, [33](#)

isScCsIntervalData, [33](#)

loadExposuresOutcomeList, [34](#)

loadScCsAnalysisList, [34](#)

loadScCsData, [35](#)

loadScCsData(), [45](#)

loadScCsIntervalData, [35](#)

loadScCsIntervalData(), [46](#)

plotAgeEffect, [36](#)

plotAgeSpans, [36](#)

plotCalendarTimeEffect, [37](#)

plotCalendarTimeSpans, [38](#)

plotEventObservationDependence, [38](#)

plotEventToCalendarTime, [39](#)

plotExposureCentered, [40](#)

plotSeasonality, [41](#)

runSccsAnalyses, [13](#), [16](#), [41](#)  
runSccsAnalyses(), [26](#)

saveExposuresOutcomeList, [43](#)  
saveSccsAnalysisList, [44](#)  
saveSccsData, [44](#)  
saveSccsData(), [45](#)  
saveSccsIntervalData, [45](#)  
saveSccsIntervalData(), [46](#)  
SccsData, [4](#), [8](#), [12](#), [18](#), [21](#), [24](#), [30](#), [35](#), [40](#), [44](#)  
SccsData (SccsData-class), [45](#)  
SccsData-class, [45](#)  
SccsIntervalData, [3](#), [18](#), [22](#), [26](#), [35](#), [45](#)  
SccsIntervalData  
    (SccsIntervalData-class), [46](#)  
SccsIntervalData-class, [46](#)  
show, SccsData-method (SccsData-class),  
    [45](#)  
show, SccsIntervalData-method  
    (SccsIntervalData-class), [46](#)  
simulateSccsData, [46](#)  
summary, SccsData-method  
    (SccsData-class), [45](#)  
summary, SccsIntervalData-method  
    (SccsIntervalData-class), [46](#)