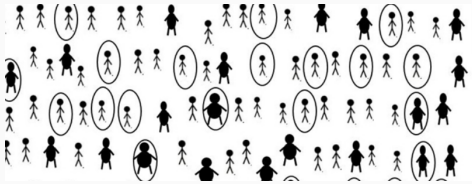
Session 4: Cross-sectional and longitudinal studies

Biostatistics Support & Research Unit (BRU)
IGTP

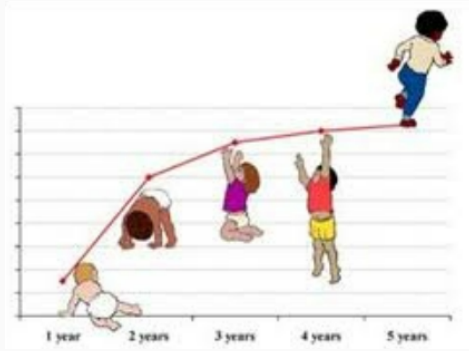
November, 2025

Contents

Cross-sectional project



Longitudinal project



Repetition of instruments or events

Cross-sectional project

1.Cross-sectional project

Definition

2.Cross-sectional project in REDCap

Definition

Activity

Cross-sectional project

Definition

A **cross-sectional study** is characterised by:

1. Being observational (no intervention).
2. Being retrospective or prospective.
3. Collecting a single measurement (the variables of interest are collected at a single point in time).

With this design, it is possible to estimate prevalences at a specific point in time (for example, the prevalence of a disease).

Cross-sectional project in REDCap

Definition

REDCap refers to cross-sectional or prevalence studies as a **classic project**.

- **Properties:**
  - Default project.
  - Longitudinal mode disabled.
  - Each instrument can be filled once per record.

Cross-sectional project in REDCap

Activity: Cross-sectional project

- **Goal of the study:** Calculate the prevalence of diabetes mellitus.

Study scheme	
Instruments	Point of interest
Demographic	☑
Comorbidities *Fields:* *- Comorbidities (Yes/No)* *- Comorbidities matrix (previously created)** **show it only if comorbidities = Yes* *(keep the filter for the COPD field)*	☑

Enter a few records and calculate the prevalence of diabetes in your project.

Cross-sectional project in REDCap

Solution

Steps:

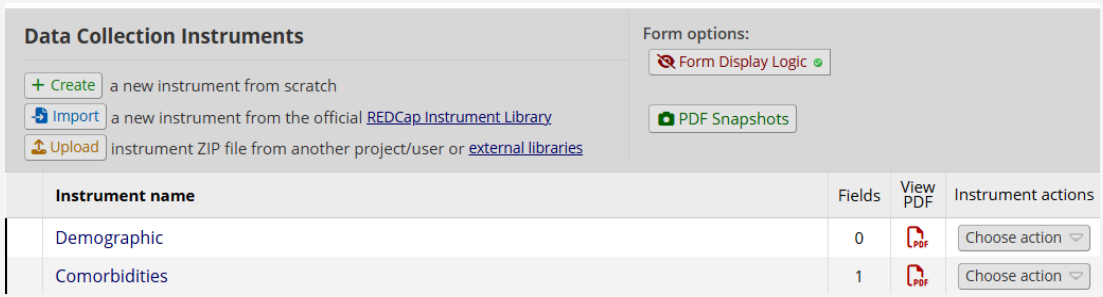
1. Create the instrument *Comorbidities*.
2. Add the field *Comorbidities* (Yes/No).
3. Move the matrix of *Comorbidities* to the new instrument
4. Only display the matrix fields if *comorbidities=Yes*.
5. Enter comorbidity data for some patients in order to calculate prevalence.
6. Calculate the prevalence of diabetes mellitus recorded in our project using the *Stat & Charts* functionality.

Cross-sectional project in REDCap

Solution

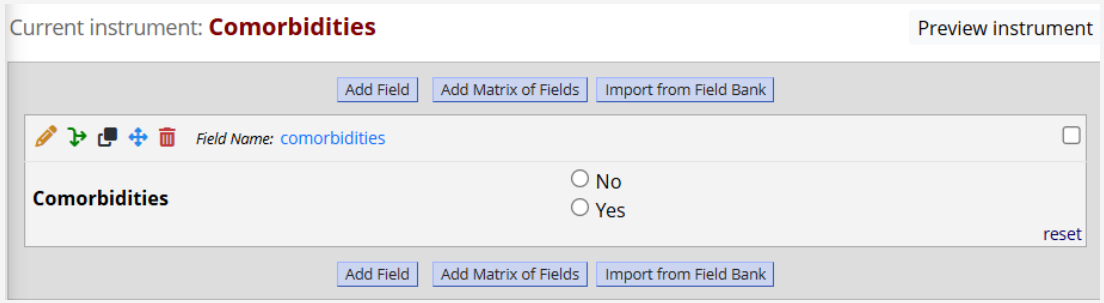
1. **Create the instrument *Comorbidities*.**

`Online Designer » Add new instrument » Comorbidities`



2. **Add the field *Comorbidities* (No/Yes).**

`Online Designer » Comorbidities » Add Field » Multiple Choice - Radio Buttons (Single Answer) » Choices: 0,No / 1,Yes`

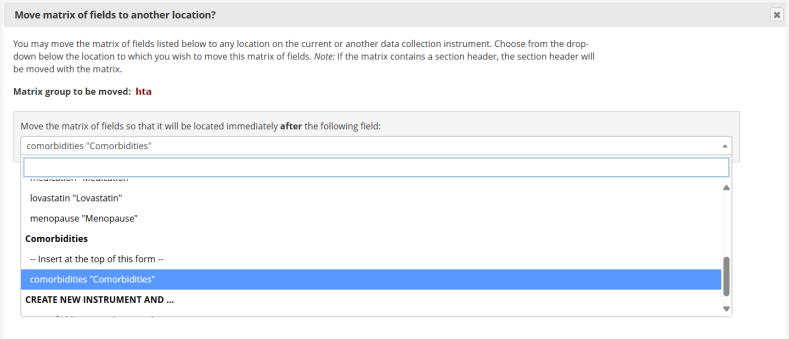


Cross-sectional project in REDCap

Solution

3. **Move the matrix of *Comorbidities* to the new instrument.**

`Online Designer » Demographic » ✣Move matrix of fields to another location » Move the matrix of fields above so that it will be located immediately *AFTER* the following field: » Comorbidities`

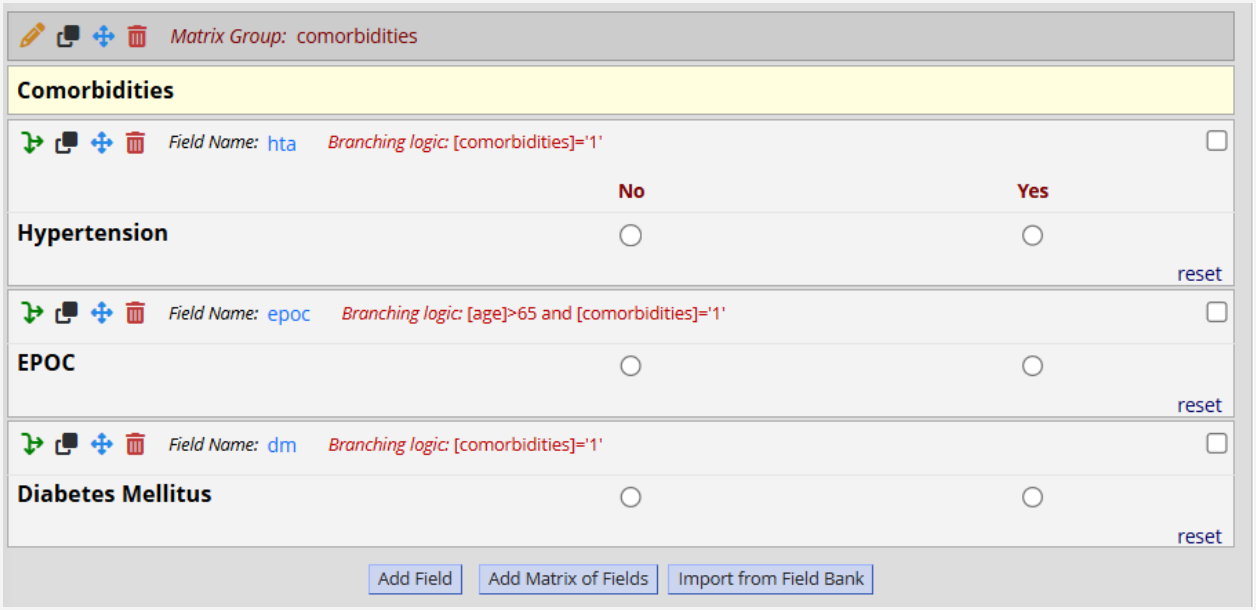


Cross-sectional project in REDCap

Solution

4. **Only display the matrix if *comorbidities=Yes***

```
Branching Logic » Drag-N-Drop Logic Builder/Advanced Branching Logic
Syntax » [comorbidities]='1'
```



Cross-sectional project in REDCap

Solution

5 **Calculate the prevalence of diabetes mellitus recorded in our project using the *Stat & Charts* functionality.**
Data Exports, Reports, and Stats » All data » Stat & Charts

Cross-sectional project in REDCap

Activity Overview

Proposed scheme

Study scheme	
Instruments	**Point of interest**
Demographic	☑
Comorbidities	☑

REDCap scheme

Record ID **1**

Data Collection Instrument	Status
Demographic	
Comorbidities	

Individual dashboard

Record ID	Demographic	Comorbidities
1		
2		
3		

Global dashboard

Longitudinal project

1.Longitudinal project


Definition


Longitudinal project in REDCap

2.Longitudinal mode configuration


Definition


Enable

3.Events


Definition


Configuration


Activity

Longitudinal project

Definition

A **longitudinal study** is characterized by:

1. Collecting data from the same subjects repeatedly over time to assess changes.
2. Being observational or interventional in nature.
3. Being prospective, retrospective, or ambispective.

Longitudinal project en REDCap

Definition

- **Properties:**
  - Longitudinal mode enabled.
  - Multiple events (visits).
  - Instruments can be linked to multiple events.

Longitudinal mode configuration

Longitudinal mode

In order to create **longitudinal projects**, REDCap offers a **longitudinal mode**.

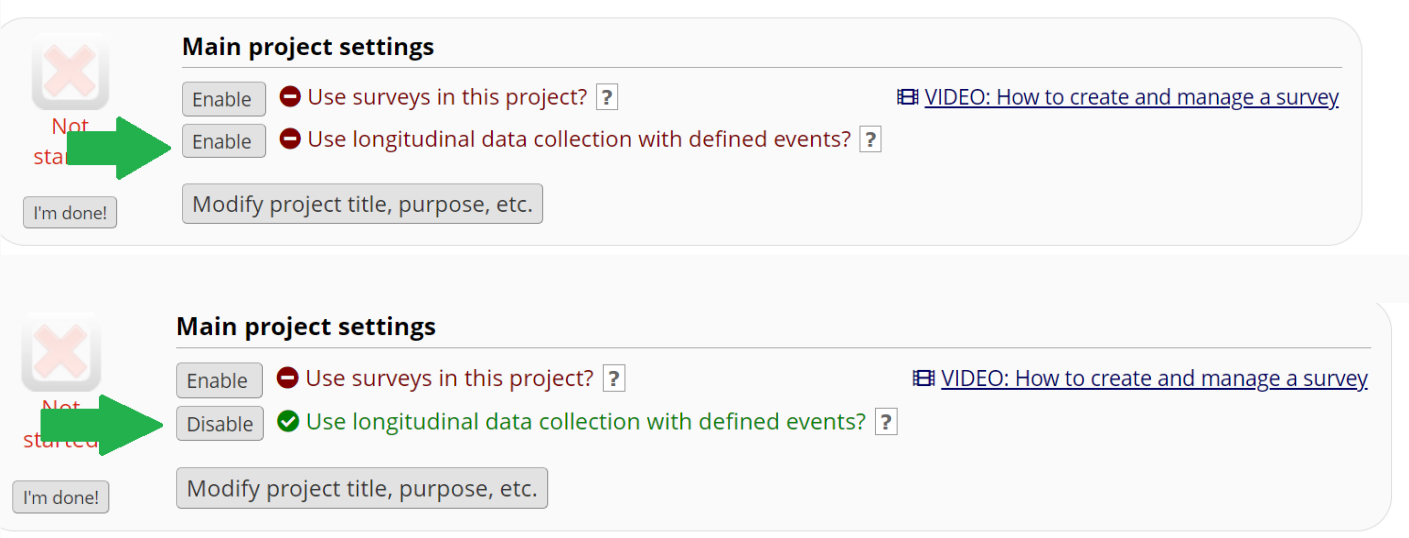
The **longitudinal mode** allows any form or survey to be used multiple times: the form is created once and then assigned to different events/visits throughout the project.

Longitudinal mode configuration

Enable longitudinal mode

1. Access to `Project setup`.
2. Enable longitudinal mode.

   `Use longitudinal data collection with defined events? » Enable`



Events

Definition

Events allow instruments to be used a *finite* number of times for any project record.

It is normally used to collect the same instrument during different events/visits.

Events

Definition

The events allow the creation of a **longitudinal project**.

- **Properties:**
  - Longitudinal mode enabled.
  - Instruments can be linked to multiple events.

Events

 Configuration

To configure events, follow these two steps:

- STEP 1:  Define events
- STEP 2:  Link instruments to events

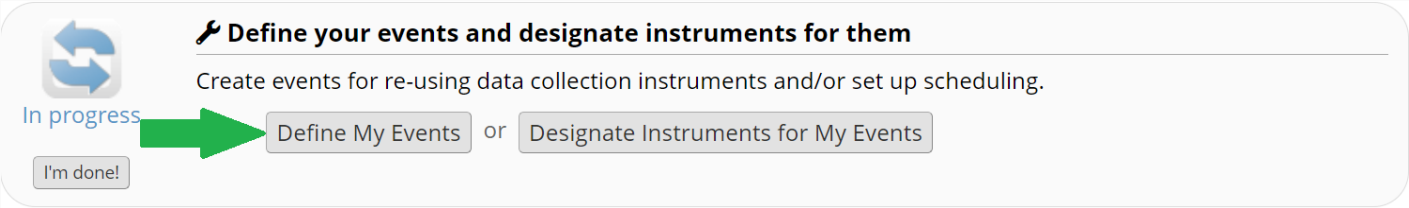
Events

Configuration

STEP 1: Define event

1. Access to `Project setup`.
2. Define events

   `Define your events and designate instruments for them » Define My Events`.



By default, REDCap creates a single event.

		Event #	Event Name	Custom Event Label (optional)	Unique event name (auto-generated)
		1	Event 1		event_1_arm_1

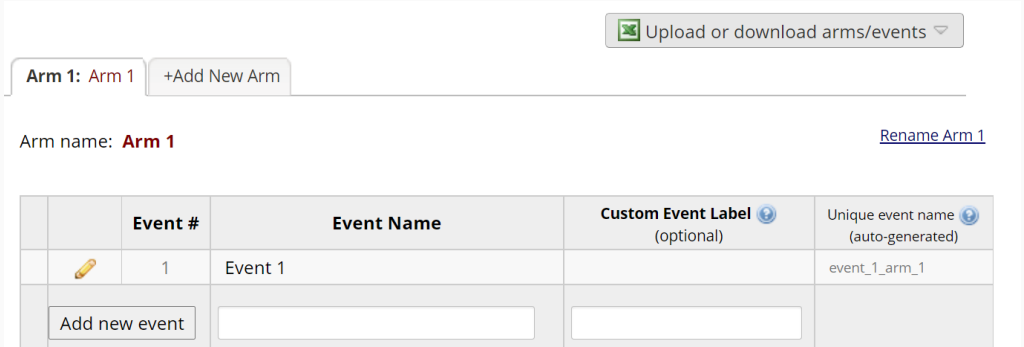
Events

Configuration

STEP 1: Define events

3 Functionalities

Download events in CSV
Edit Rename and label.
Create a new event



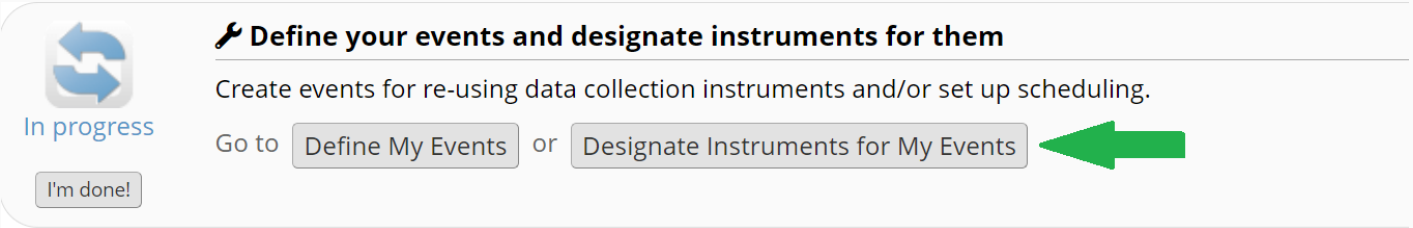
Events

Configuration

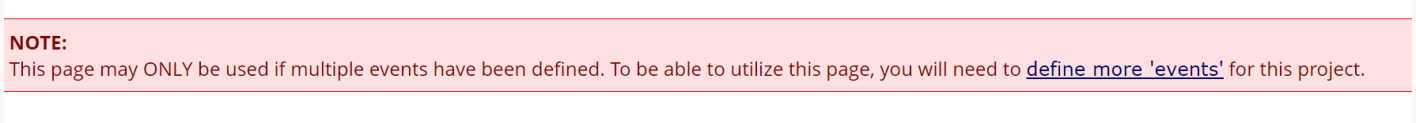
STEP 2: Link instruments to events

1. Access to `Project setup`.
2. Link instruments to events.

   Define your events and designate instruments for them » Designate Instruments for My Events.



Instruments can only be linked if two or more events have been defined.



Events

Configuration

STEP 2: Link instruments to events

3 Functionalities

Begin editing
Relate events-instruments

Events

Activity: Events configuration

Study scheme			
Instruments *Label:*	Baseline visit	Second visit *sample date*	Final visit *sample date*
Demographic	☑		
Comorbidities	☑		
Laboratory results *Fields:* *- Sample date (D-M-Y)*	☑	☑	☑

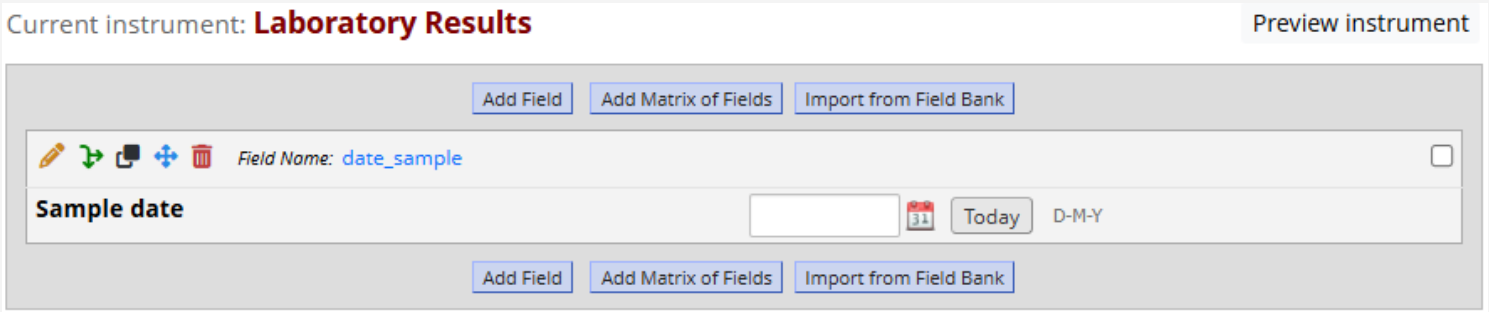
Solution

1. Add a new instrument: *Laboratory results* with the variable *Sample date*, format D-M-Y.
2. Create the events *Baseline visit* (previous name: Event 1), *Second visit* and *Final visit*.
3. Use the field *Sample date* as the event label for *Second visit* and *Final visit*.
4. Link instruments *Demographic* and *Comorbidities* to the *Baseline visit* event.
5. Link the new *Laboratory results* instrument to all three events: *Baseline visit*, *Second visit* and *Final visit*.

Solution

1. **Add a new instrument: *Laboratory results* with the variable *Sample date*, format D-M-Y:**

`Online Designer » Add new instrument » Create » *Laboratory results*`
`Add Field » Text Box » Validation: Date (D-M-Y) » *Sample date*`



Events

Solution

2. **Create the events *Baseline visit*, *Second visit* and *Final visit*.**

2.1 `Project setup » Define your events and designate instruments for them » Define My Events`

2.2 `Edit » Event Name: "Baseline visit"`

2.3 `Add new event » Event Name: "Second visit"`

2.4 `Add new event » Event Name: "Final visit"`

	Event # [event-number]	Event Label [event-label]	Custom Event Label (optional)	Unique event name (auto-generated) [event-name]	Event ID (auto-generated, unchangeable) [event-id]
	1	Baseline visit		baseline_visit_arm_1	1807
	2	Second visit	[date_sample]	second_visit_arm_1	1808
	3	Final visit	[date_sample]	final_visit_arm_1	1809

Solution

3. **Use the field *Sample date* as the event label for *Second visit* and *Final visit*.**

`Project setup » Define your events and designate instruments for them » Define My Events » Edit » Custom Event Label: "[date_sample]"`

		Event # [event-number]	Event Label [event-label]	Custom Event Label (optional)	Unique event name (auto-generated) [event-name]	Event ID (auto-generated, unchangeable) [event-id]
		1	Baseline visit		baseline_visit_arm_1	1807
		2	Second visit	[date_sample]	second_visit_arm_1	1808
		3	Final visit	[date_sample]	final_visit_arm_1	1809

Data Collection Instrument	Baseline visit	Second visit 12-02-2025	Final visit 08-10-2025
Demographic			
Comorbidities			
Laboratory Results			

Solution

4. Link instruments *Demographic* and *Comorbidities* to the *Baseline visit* event.
5. Link the new *Laboratory results* instrument to all three events: *Baseline visit*, *Second visit* and *Final visit*.

`Project setup » Define your events and designate instruments for them » Designate Instruments for My Events » Begin Editing`

Activity Overview

Proposed scheme

Study scheme			
Instruments *Label:*	Baseline visit	Second visit *sample date*	Final visit *sample date*
Demographic	☑		
Comorbidities	☑		
Laboratory results	☑	☑	☑

REDCap scheme

Record ID **1**

Data Collection Instrument	Baseline visit	Second visit 12-02-2025	Final visit 08-10-2025
Demographic			
Comorbidities			
Laboratory Results			

Individual dashboard

Record ID	Baseline visit			Second visit	Final visit
	Demographic	Comorbidities	Laboratory Results	Laboratory Results	Laboratory Results
1					
2					
3					

Global dashboard

Implication in the data

Visualisation / Download data

Cross-sectional projects: A single record is created for each individual.

Longitudinal projects: Projects involving repeated instruments or repeated events

For each individual, a row is created for:

- Each event

Record ID record_id	Event Name redcap_event_name	Repeat Instrument redcap_repeat_instrument	Repeat Instance redcap_repeat_instance	Date of creation of the record date_record	Weight weight	Height height	Date of birth date_birth	Sex sex	Menopause menopause	Medication		
										Statins medication___0	Anticoagulants medication___1	Antidiabetics medication___2
1	Baseline visit									Unchecked (0)	Unchecked (0)	Unchecked (0)
2	Baseline visit									Unchecked (0)	Unchecked (0)	Unchecked (0)
2	Second visit											
2	Final visit											
3	Baseline visit									Unchecked (0)	Unchecked (0)	Unchecked (0)

Identification of the record = 2 Final visit

*Variable that identifies the register: `redcap_event_name`

Implications in the design

[⚡]Smart variables

There are **smart variables** specific to **Events** and they only work if we have longitudinal mode enabled.

Smart variable	Action	Result example*
[event-number]	Number ordinal event	2
[event-name]	Name event	baseline_visit_arm_1
[event-label]	Label event	Baseline visit
[previous-event-name]**	Name previous event	Does not exist
[previous-event-label]	Label previous event	Does not exist
[next-event-name]**	Name next event	second_visit_arm_1
[next-event-label]	Label next event	Second visit

*Example: Event (Baseline visit)

** Smart variables can be linked to fields, for example:
[previous-event-label][date_sample]

Implications in the design

[ϟ] Smart variables

Smart variable	Action	Result example*
[first-event-name]**	Name first event	baseline_visit_arm_1
[first-event-label]	Label first event	Baseline visit
[last-event-name]**	Name last event	final_visit_arm_1
[last-event-label]	Label last event	Final visit
[arm-number]	Number of the arm	1
[arm-label]	Label of the arm	Control group

*Example: Event (Baseline visit)

**Smart variables can be linked to fields, for example: [last-event-name][date_sample]

Implications in the design

Piping 

Cross-sectional projects

1. Define the field
2. —

[date_sample]

» dates of laboratory results at a single point in time.

Longitudinal projects

1. Define the event
2. Define the field

[baseline_visit_arm_1][date_sample]

» date of laboratory results at baseline visit

Implications in the design

Branching logic

Cross-sectional projects

Logic context: If of legal age.

1. Define the field
2. Define the operator
3. Define the value of comparison
4. —

[age]>18

Longitudinal projects

Logic context: If of legal age.

1. Define the event
2. Define the field
3. Define the operator
4. Define the value of comparison

[baseline_visit_arm_1][age]>18

Implications in the design

Activity: Implications in the design

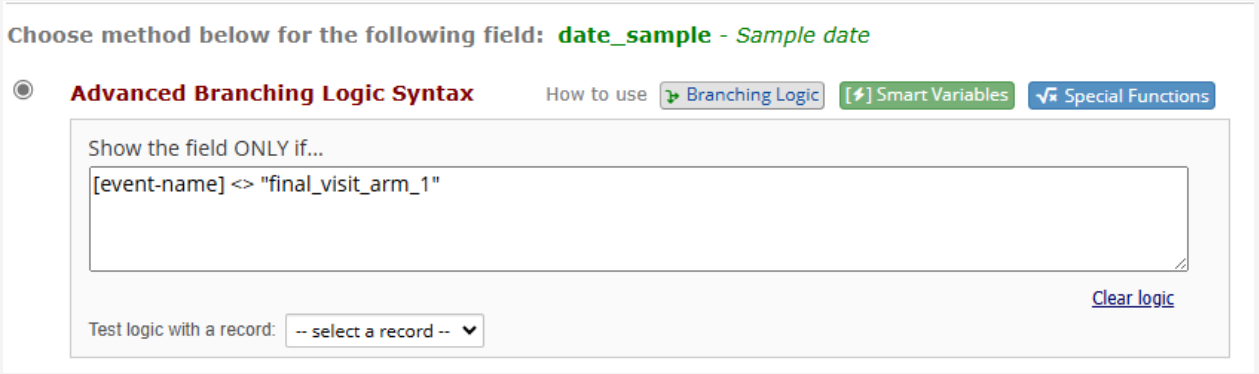
1. Ensure that the sample date (laboratory results) is not visible at the final visit.
2. Add a variable called ‘Previous sample date’ (laboratory results) and set it to the date of the previous visit.

Implications in the design

Solution

1. **Ensure that the sample date (laboratory results) is not visible at the final visit.**

`Online Designer » "Laboratory results" » "Sample date" » Branching Logic » Advanced Branching Logic Syntax » [event-name] <>'final_visit_arm_1'`



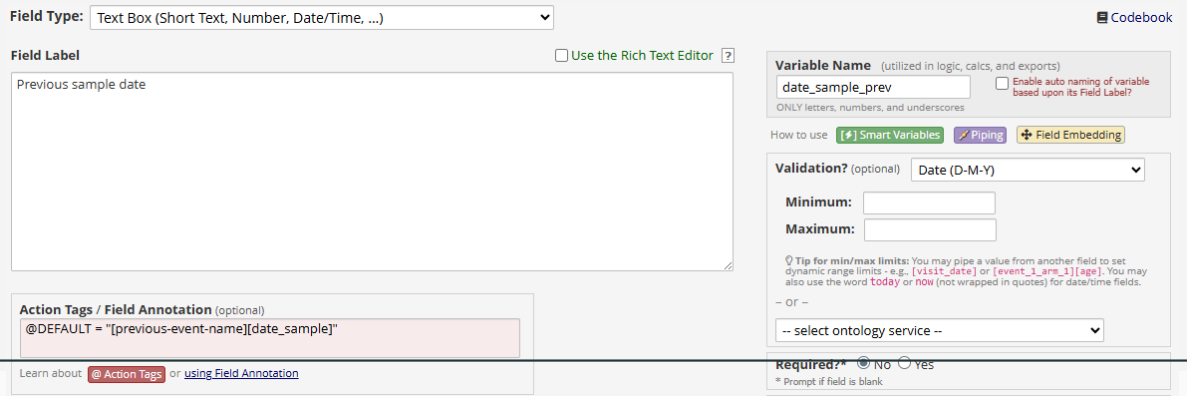
Implications in the design

Solution

2 **Add a variable called 'Previous sample date' (laboratory results) and set it to the date of the previous visit.**

2.1. `Online Designer » "Laboratory results" » Add Field » Text Box » Validation: Date (M-D-Y)`

2.2. `Online Designer » "Laboratory results" » "Previous sample date" » Action Tags: [previous-event-name][date_sample]`



Remarks

- REDCap internally stores dates as M-D-Y
- Does it make sense to include this action tag in the baseline visit? How can we deal with this?

Repetition of instruments or events

1. Repetition of instruments or events


Definition


Configuration

---

2. Repeating instrument


Activity


Use

---

3. Repeating event


Activity


Use

4.Implications in the data


Visualisation / 
Data download

5.Implications in the design


Smart variables

Repetition of instruments or events

Definition

Repetition of instruments

- Allows you to repeat an instrument as many times as necessary.
- Works on cross-sectional and longitudinal projects.
- Example of use: entry of multiple concomitant medication.

Repetition of events

- Allows you to repeat an event as many times as necessary.
- Only works on longitudinal projects (longitudinal mode enabled).
- Example of use: longitudinal study without a defined number of visits.

Limitations

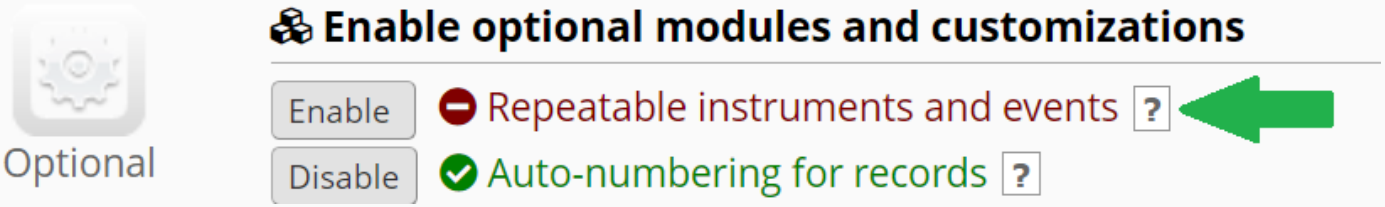
- You cannot add a repeat instrument to a repeat event.
- Repeating instruments or events will make the data more complex.

Repetition of instruments or events

Configuration

1. Access to `Project setup`.
2. Enable repeatable instruments and events setting.

   `Enable optional modules and customisations » Repeatable instruments and events`



Repetition of instruments or events

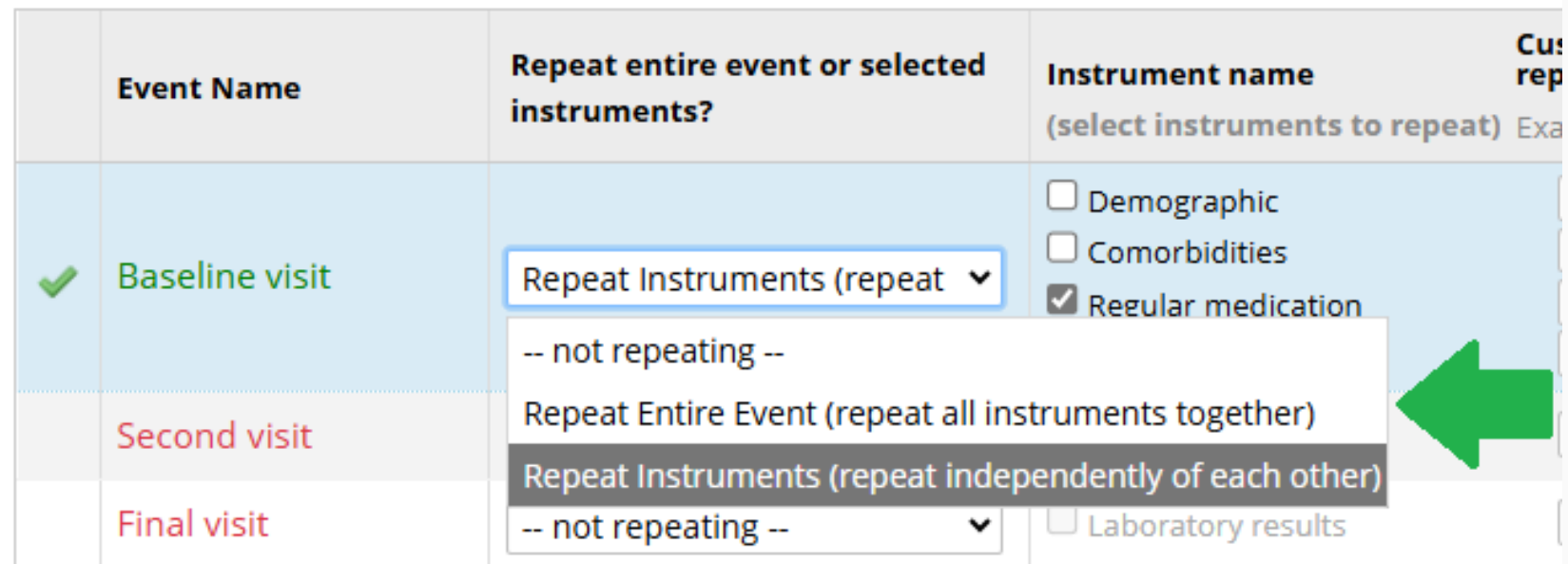
Configuration

3. Select the action for each of the events:

   3.1 Do not repeat.

   3.2 Repeat the entire event (only for longitudinal projects).

   3.3 Repeat instruments at the event.



Repeated instrument

Activity: Longitudinal project with a repeated instrument.

Study scheme			
Instruments *Etiqueta:*	Baseline visit	Second visit *data mostra*	Final visit *data mostra*
Demographic	☑		
Comorbidities	☑		
Regular medication ∞ *Fields:* *- Start date* *- Medicine [text field]* *Label: start date - medicine*	☑		
Laboratory results	☑	☑	☑

∞ Repeated instrument

Repeated instrument

Solution

Steps:

1. Create a new instrument called *Regular medication*.
2. Create the fields: Start date and Medication.
3. Assign the instrument *Regular medication* to the first visit.
4. Label the instrument with the start date and the medication.

Repeated instrument

Solution

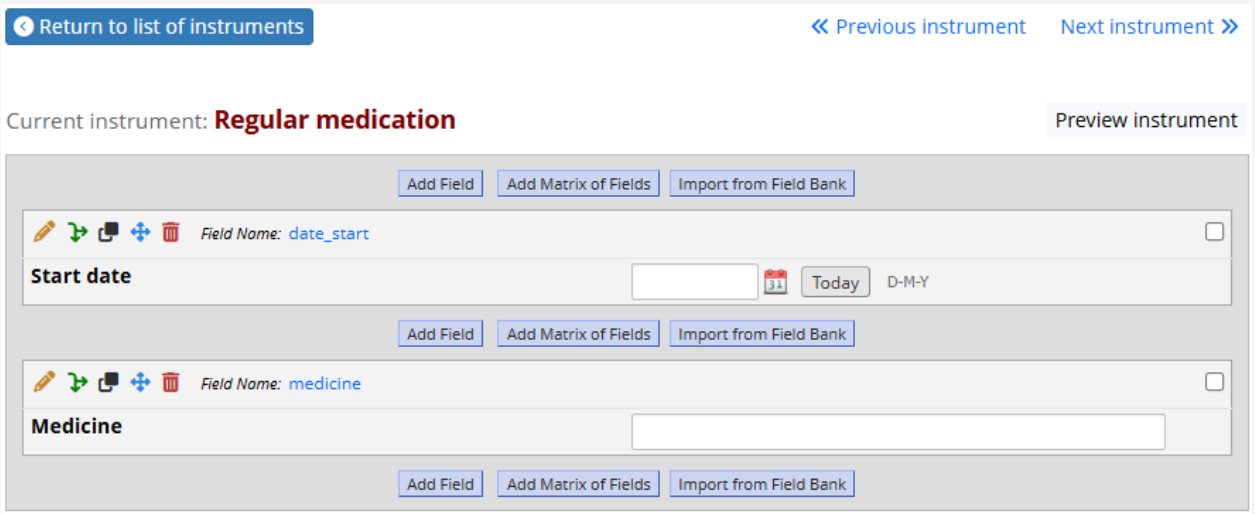
1. Create a new instrument called *Regular medication*.

`Online Designer » Add new instrument » Create`

2. Create the fields: Start date and medication.

1.1. `Add Field » Text Box » Validation: Date (D-M-Y)`

1.2. `Add Field » Text Box`



Repeated instrument

Solution

3. Assign the instrument *Regular medication* at the first visit.

`Project setup » Define your events and designate instruments for them » Designate Instruments for My Events`

Begin Editing | Save

Data Collection Instrument	Baseline visit (1)	Second visit (2)	Final visit (3)
Demographic	✔		
Comorbidities	✔		
Regular medication	✔		
Laboratory results	✔	✔	✔

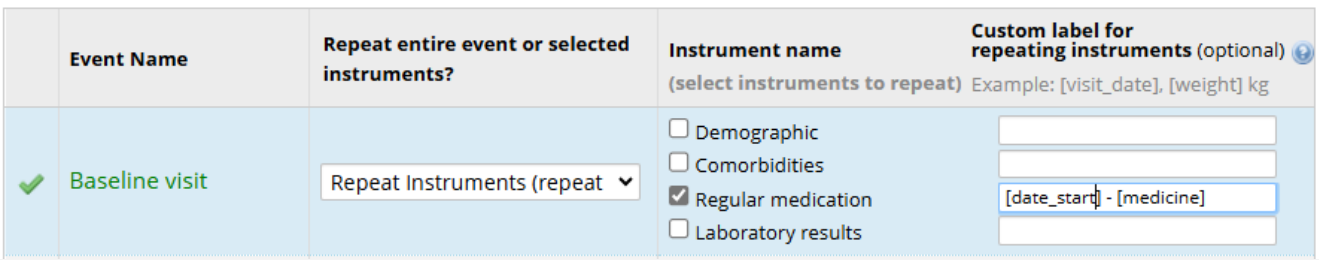
Repeated instrument

Solution

4. Label the instrument with the start date and medication.

4.1. `Project setup » Enable optional modules and customisations » Repeatable instruments and events`

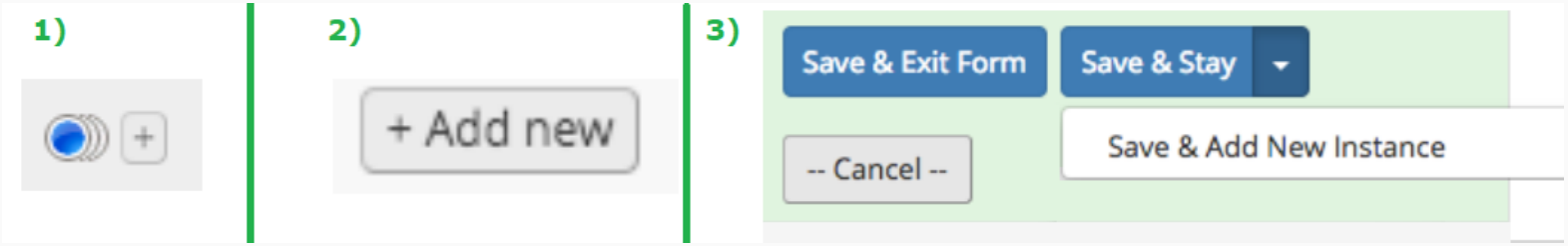
4.2. `Baseline visit » Repeat instruments » "Regular medication" » Label: "[date_start] - [medicine]"`



Repeated instrument

Use

- Users can add recurring instruments in three ways:
  1. Symbol «+» to the initial page of the register.
  2. Button «Add New» to the main page of the register.
  3. Option «Save & Add New Instance» to button «Save & Stay» in an instrument.



Repeated instrument

Solution

- Add three regular medications to a record

Data Collection Instrument	Baseline visit	Second visit	Final visit
Demographic	○		
Comorbidities	○		
Regular medication	● +		
Laboratory results	●	○	○
Delete all data on event:	×		

Repeating Instruments

Regular medication
Baseline visit
(3)

1	●	10-10-2007 - Ibuprofen
2	●	30-07-2012 - Sintrom
3	●	23-10-2018 - Insuline

+ Add new

Repeated instrument

Activity Overview

Proposed scheme

Study scheme			
Instruments	Baseline visit	Second visit	Final visit
Demographic	☑		
Comorbidities	☑		
Regular medications ∞	☑		
Results laboratory	☑	☑	☑

∞ Repeated instrument

Data Collection Instrument	Baseline visit	Second visit	Final visit	Control visit (#1)	+ Add new (#2)
Demographic	○				
Comorbidities	○				
Regular medication	● +				
Laboratory results	●	○	○		
Control of symptoms				●	●
Delete all data on event:	×			×	×

Repeating Instruments

Regular medication
Baseline visit
(3)

1	●	10-10-2007 - Ibuprofen
2	●	30-07-2012 - Sintrom
3	●	23-10-2018 - Insuline

+ Add new

Dashboard individual

Record ID	Baseline visit				Second visit	Final visit
	Demographic	Comorbidities	Regular medication	Laboratory results	Laboratory results	Laboratory results
1	●	○	○	○	○	○
2	●	●	○	○	●	●
3	○	○	○	○	○	○
4	○	○	● +	●	○	○

Dashboard global

Repeated event

Activity: Longitudinal project with one instrument and one repeated event

Study scheme				
Instruments *Label:*	Baseline visit	Second visit *sample date*	Final visit *sample date*	Control visit *visit date* ∞
Demographic	☑			
Comorbidities	☑			
Regular medication ∞	☑			
Laboratory results	☑	☑	☑	
Control of symptoms *Fields:* *- Date visit* *- Visual Analogue Scale (VAS)(0-10)* ∞				☑
	Repeated instrument/event			

Repeated event

Solution

Steps:

1. Create a new instrument called *Control of symptoms*.
2. Create the fields: *Date of visit* and *VAS scale*.
3. Create an event named *Control visit*.
4. Label the event *Control visit* with the visit date.
5. Assign the instrument *Control of symptoms* to the *Control visit*.
6. Ensure that the event *Control visit* can be repeated multiple times.

Repeated event

Solution

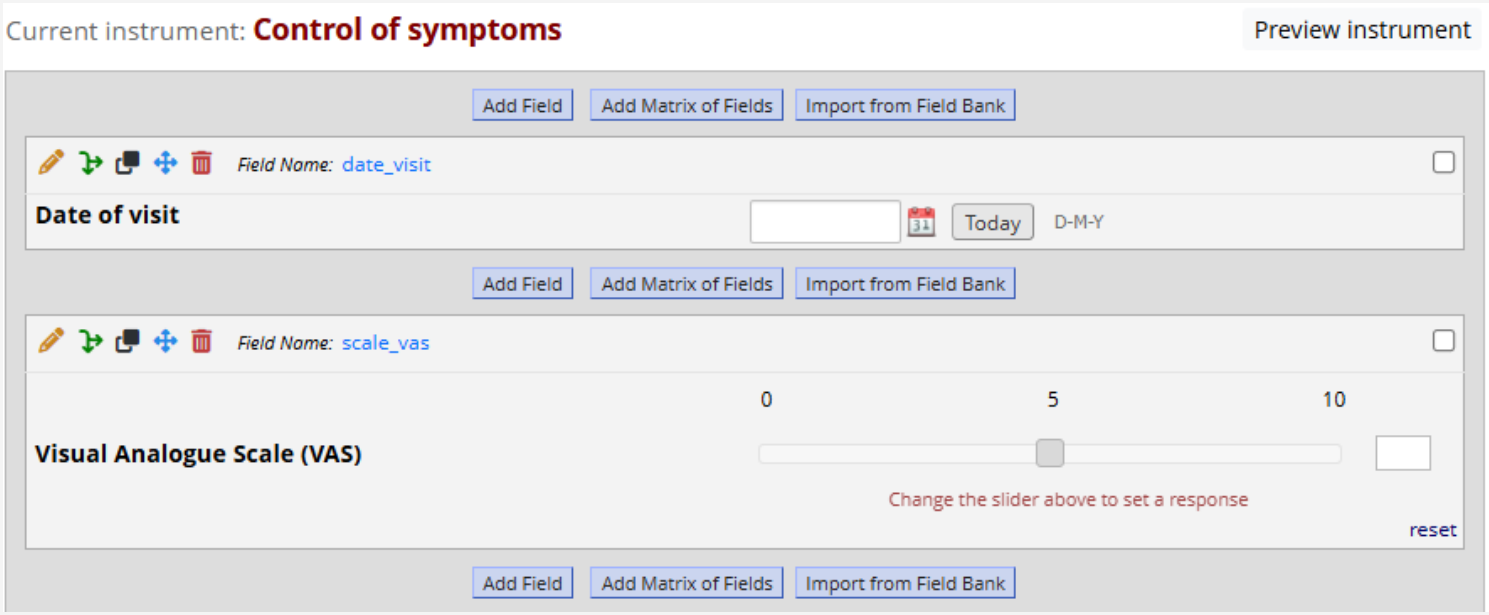
1. Create a new instrument called *Control of symptoms*.

```
Online Designer » Add new instrument » Create » "Control of symptoms"
```

2. Create the fields: *Date of visit* and *VAS scale*.

2.1. `Add Field » Text Box » Validation: Date (D-M-Y)`

2.2. `Add Field » Slider/Visual Analog Scale`



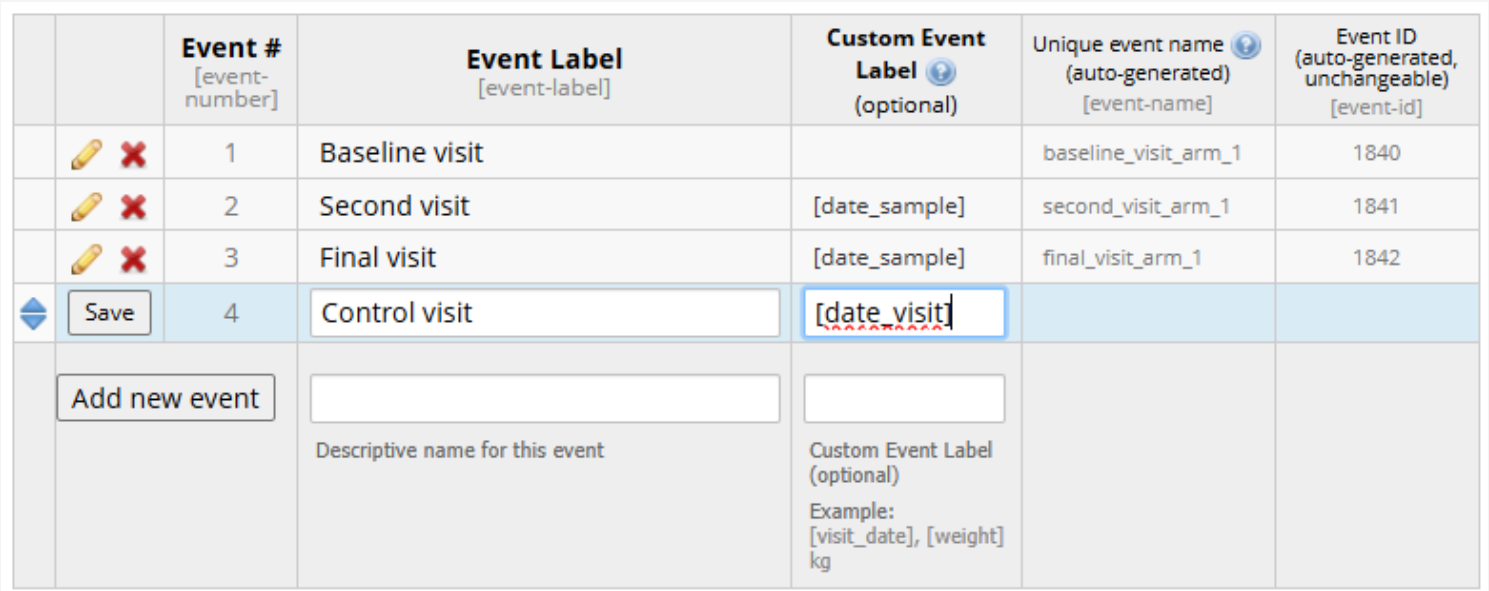
Repeated event

Solution

3. Create a new event *Control visit*.

4. Label the event *Control visit* with the date of visit.

`Project setup » Define your events and designate instruments for them » Designate Instruments for My Events » Add new event » Label:"[date_visit]"`



Repeated event

Solution

5. Assign the instrument *Control of symptoms* to the *Control visit*.

`5.1. Project setup » Enable optional modules and customisations » Repeatable instruments and events`

`5.2. Project setup » Define your events and designate instruments for them » Designate Instruments for My Events`

Begin Editing | Save

Data Collection Instrument	Baseline visit (1)	Second visit (2)	Final visit (3)	Control visit (4)
Demographic	✔			
Comorbidities	✔			
Regular medication	✔			
Laboratory results	✔	✔	✔	
Control of symptoms				✔

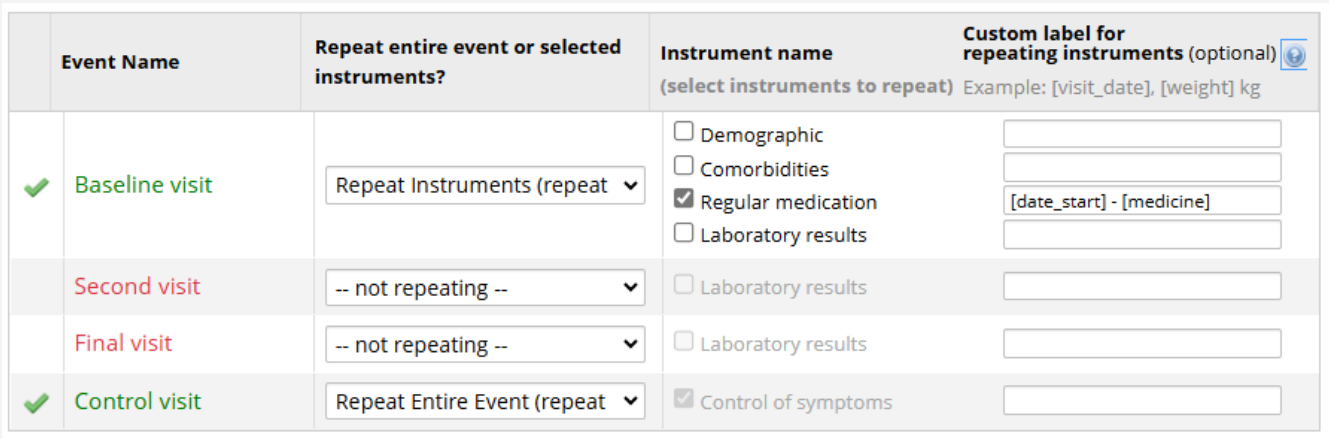
Repeated event

Solution

6. Ensure that the event *Control visit* can be repeated multiple times.

`Project setup » Enable optional modules and customisations » Repeatable instruments and events`

`Control visit » Repeat Entire Event`



	Event Name	Repeat entire event or selected instruments?	Instrument name (select instruments to repeat)	Custom label for repeating instruments (optional) Example: [visit_date], [weight] kg
✔	Baseline visit	Repeat Instruments (repeat	☐ Demographic ☐ Comorbidities ☑ Regular medication ☐ Laboratory results	 [date_start] - [medicine]
	Second visit	-- not repeating --	☐ Laboratory results	
	Final visit	-- not repeating --	☐ Laboratory results	
✔	Control visit	Repeat Entire Event (repeat	☑ Control of symptoms	

Repeated event

Use

- Users can add recurring events as follows:

    1. Symbol «+ Add new» to the initial page of the register.

Repeated event

Activity Overview

Proposed scheme

Study scheme				
Instruments	Visit baseline	Second visit	Visit final	Visit control ∞
Demographic	☑			
Comorbidities	☑			
Regular medication ∞	☑			
Laboratory results	☑	☑	☑	
Control of symptoms				☑

Repeated instrument/event

Data Collection Instrument	Baseline visit	Second visit	Final visit	Control visit 19-10-2016 (#1)	+ Add new 06-02-2023 (#2)
Demographic	○				
Comorbidities	○				
Regular medication	● +				
Laboratory results	●	○	○		
Control of symptoms				●	●
Delete all data on event:	×			×	×

Repeating Instruments

Regular medication
Baseline visit
(3)

1	●	10-10-2007 - Ibuprofen
2	●	30-07-2012 - Sintrom
3	●	23-10-2018 - Insuline

+ Add new

Individual dashboard

Record ID	Baseline visit				Second visit	Final visit	Control visit
	Demographic	Comorbidities	Regular medication	Laboratory results	Laboratory results	Laboratory results	Control of symptoms
1	●	○	○	○	○	○	○
2	●	●	○	○	●	●	●
3	●	●	○	○	○	○	○
4	○	○	● +	●	○	○	●

Global dashboard

Implications in the data

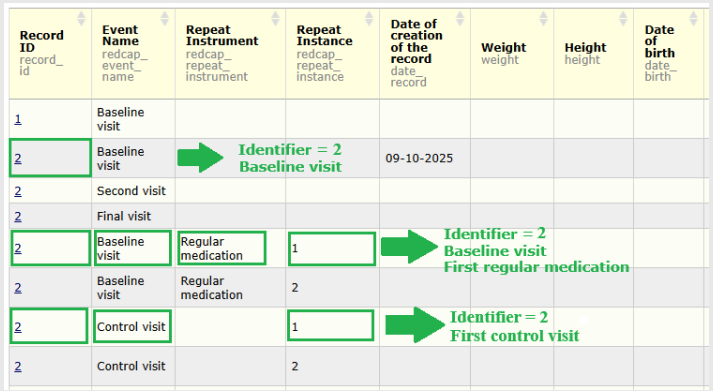
Visualization / Download the data

Cross-sectional projects: It creates a record for each individual.

Projects with repeated instruments or events

A row is created for each individual for:

- Every one of the events
- Every one of the repeated instruments.
- Every one of the repeated events.



*Identifying variables in the register: *redcap_event_name* (event name), *redcap_repeat_instrument* (instrument name) and *redcap_repeat_instance* (number of repetitions).

Implications in the design

[ϟ] Smart variables

There are **smart variables** specific to **event and instrument repetition** that only work if we have the option of repeating instruments or events enabled.

Smart variable	Action	Result example*
[previous-instance]**	Previous instance number	1
[current-instance]**	Actual instance number	2
[first-instance]**	First instance number	1
[last-instance]**	Last instance number	2

*Example: Second instance

** Smart variables can be used with fields, for example: [date_visit][previous-instance]

Implications in the design

Activity: Smart variables with repeated events.

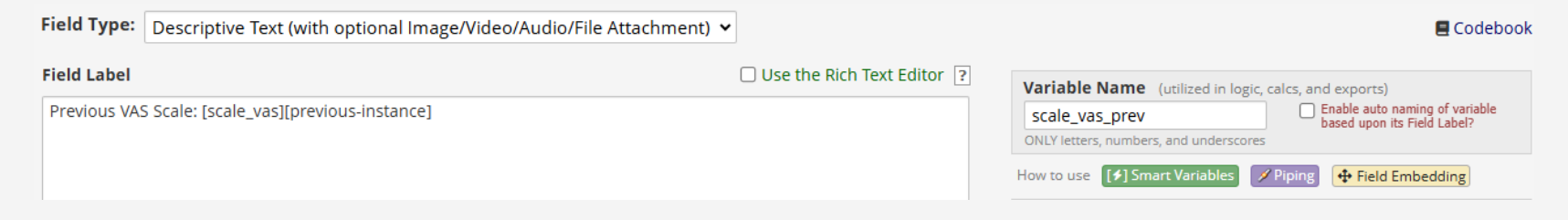
1. Create a descriptive variable to report the value of the *Visual Analogue Scale* from the previous control visit.

Implications in the design

Solution

1. **Create a descriptive variable to report the value of the *Visual Analogue Scale* from the previous control visit.**

`Add Field » Descriptive text » previous VAS Scale: [scale_vas][previous-instance]`



Thank you!