

"Double data entry" and data entry validation (in REDCap)

21 November 2023

Overview of Double Data Entry (DDE)

- Definition: the original entry and re-entry of data from non-electronic (and not “capturable”) documents into electronic data formats for validation
- Purpose: to determine the accuracy of data entry, and to mitigate errors
- Who: multiple team members are tasked with data entry, and an additional member identifies and resolves errors
- The utilization and rationale of double data entry (or other means of data validation) will depend on the research team and project

Double Data Entry in REDCap

Where does it fit in?



Acquisition

- Standardization of data coding
- Standardization of acquisition processes



Electronic Data Capture

- Review of collected data
- Data Entry
- Error Screening Verification
- Data Cleaning with Documentation



Analysis

- Exploratory data analysis
- Statistical data analysis

The Double Data Entry module in REDCap

What Is it?

Allows for two data entry roles and a reviewer role at project level.

Data entry roles:

Each creates a unique record for data entered

Are blind to each other's entries

Reviewer role:

has access to both records

has a comparison tool to display discrepancies and resolve them.

creates a merged record using the data entered and any resolved discrepancies.

Benefits:

1. catches data entry errors during Electronic Data Capture
2. provides records that can be extracted to analyze data entry accuracy

Limitations:

1. Project can not use auto numbering and therefore cannot begin with a survey
2. Will not work for repeating forms in longitudinal projects after the first instance of the form

The following slides show a demonstration of enabling and using the REDCap Double Data Entry module.

To add double data entry:
Note: the steps on this slide must be completed by the REDCap Administrator

1. Click on edit project settings

DDE Test Ed PID 118

Project Home Project Setup Other Functionality **Project Revision History** Edit project settings

Project status: Development Completed steps 0 of 7

Main project settings

Use surveys in this project? [VIDEO: How to create and manage a survey](#)

Use longitudinal data collection with defined events? [?](#)

Use the MyCap participant-facing mobile app? [Learn more about MyCap](#)

2. Enable the double data entry module

Miscellaneous project settings:

Names of Contact Persons (for reference)

This text is not displayed anywhere in the project, and is simply used for bookkeeping purposes for this project.

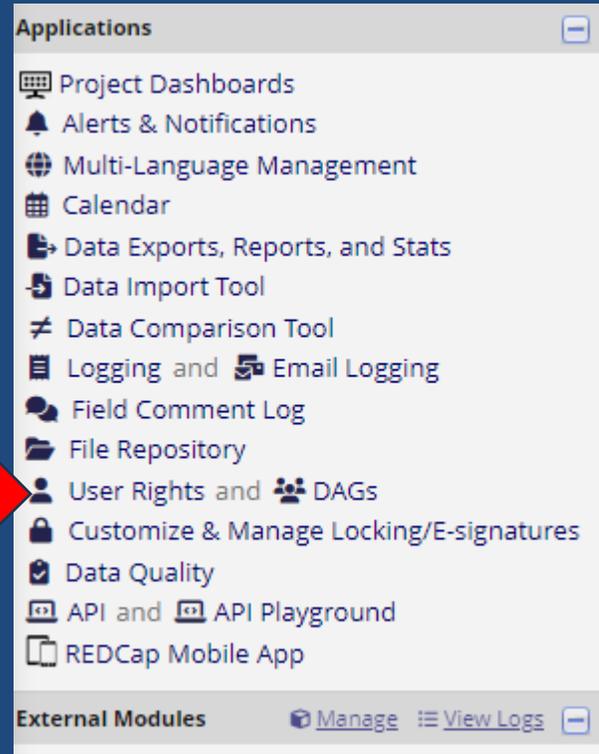
Double Data Entry module

Enabled **2**

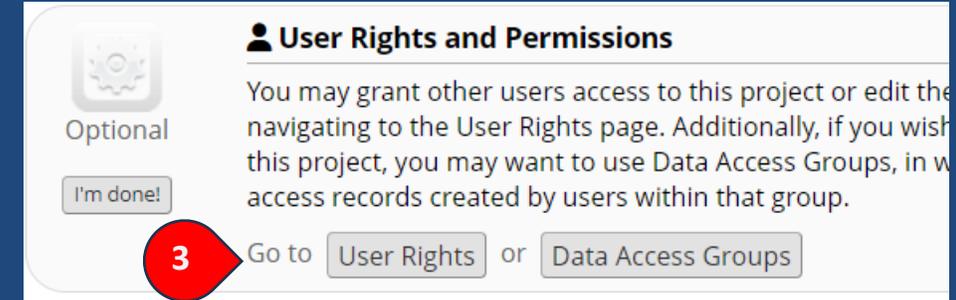
Allows two project users to be set as Data Entry Person #1 and Data Entry Person #2 (using User Rights page), and allows them to create records with the same name and enter data for the same record without seeing one another's data. Only one person at a time can be set as person #1 or #2. All other users are considered Reviewers. Reviewers have the ability to merge a record created by person #1 and #2 after viewing differences and adjudicating those differences using the Data Comparison Tool, thus creating a third record in the set.

Next, assign users to roles:

3. Click on User Rights



OR

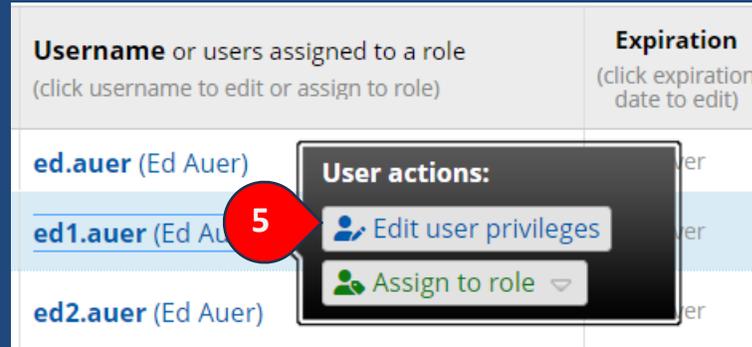


4. Click on a user

Role name (click role name to edit role)	Username or users assigned to a role (click username to edit or assign to role)
—	ed.auer (Ed Auer)
—	ed1.auer (Ed Auer)
—	ed2.auer (Ed Auer)

Assign users to roles (cont.):

5. Click edit user privileges



6. Assign to a role



Repeat steps 4 through 6 to assign data entry Person # 2 and a Reviewer

Data Entry:

7. Person #1 adds a record for Record ID 1

Choose an existing Record ID	-- select record -- ▾
Enter a new or existing Record ID	1

NEW Record ID 1	
Data Collection Instrument	Status
Data Entry Form	<input type="radio"/>
Survey (survey)	<input type="radio"/>

8. Enters the data

➕ Adding new Record ID 1.

Record ID	1
First Name:	<input type="text" value="Ima"/>
Last Name	<input type="text" value="Participant"/>
Cell Phone Number	<input type="text" value="785 123 4567"/>
Favorite Color	<input checked="" type="radio"/> Red <input type="radio"/> Blue <input type="radio"/> Green <input type="radio"/> Purple <input type="radio"/> Other

reset

Form Status	
Complete?	<input type="text" value="Complete"/> ▾

Data Entry (cont.):

9. Person #2 adds a record for Record ID 1 (note it looks to Person #2 like this is the only Record for Record ID 1)

Choose an existing Record ID	-- select record --
Enter a new or existing Record ID	1

NEW Record ID 1	
Data Collection Instrument	Status
Data Entry Form	<input type="radio"/>
Survey (survey)	<input type="radio"/>

10. Enter the data

+ Adding new Record ID 1.	
Record ID	1
First Name:	<input type="text" value="Ina"/>
Last Name	<input type="text" value="Participant"/>
Cell Phone Number	<input type="text" value="785 123 4576"/>
Favorite Color	<input checked="" type="radio"/> Red <input type="radio"/> Blue <input type="radio"/> Green <input type="radio"/> Purple <input type="radio"/> Other
Form Status	reset
Complete?	<input type="text" value="Complete"/>

Both Person #1 and #2 can only see their own record for Record ID 1

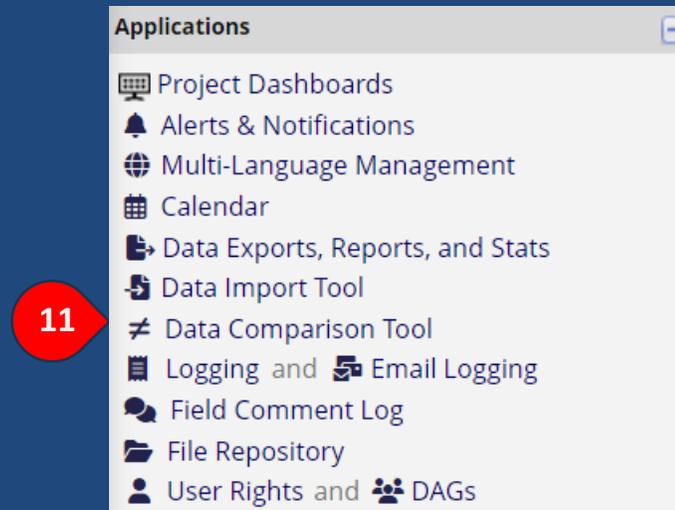
Record ID	Data Entry Form	Survey
<u>1</u>	<input checked="" type="radio"/>	<input type="radio"/>

The reviewer can see both records.

Record ID	Data Entry Form	Survey
<u>1--1</u>	<input checked="" type="radio"/>	<input type="radio"/>
<u>1--2</u>	<input checked="" type="radio"/>	<input type="radio"/>

Error Screening Verification:

11. The Reviewer can look at the records individually or they can click on the Data Comparison Tool to review and resolve discrepancies.



12. The reviewer selects a specific record or all records.

A screenshot of a user interface for record selection and comparison. It features a 'Record ID' header, a dropdown menu with the text '--- Choose a record ---', and two buttons: 'Compare selected record' and 'Compare all records'. The text '— OR —' is centered between the two buttons. A red callout bubble with the number '12' is positioned to the left of the dropdown menu.

Error Screening Verification:

13. The differences between the records are displayed side by side for the reviewer.

14. The reviewer can use the merge function to create a primary record for Record ID 1.

Differences were found between the two records named 1--1 and 1--2.

The table below compares the two records named 1--1 and 1--2. Only the fields that have differing values are listed below. If you need to correct or change the value of one of the records below, simply click on the data displayed in red, and it will take you to that form for that particular record.

MERGE THEM?

If you wish to merge selected values from the two records below into a NEW third record, you may [click here to merge them](#).

13

Label (<i>field name</i>)	Form Name	Record ID	
		1--1	1--2
First Name: (<i>def_first_name</i>)	Data Entry Form	Ima	Ina
Cell Phone Number (<i>def_cell</i>)	Data Entry Form	785 123 4567	785 123 4576

14

Data Cleaning

15. The reviewer uses the Radio buttons to select between Person #1 and Person #2's entries or can enter an entirely new values.

16. Once the review is completed the Merge button is pressed to create the primary record. Note that once merged this option no longer available.

Instructions for merging records:

In the table below, only the fields that have differing values for the existing two records are displayed. Since you are merging these two records, you will need to decide which of those two values you wish to include in the new record you are creating. You may also choose to enter a new value rather than selecting one from the existing records.

Simply click on the dot in each cell to select that field's value as the value to be included for the NEW third record you will be creating. When you are done making your selections, click the Merge Records button at the bottom to create the new record.

Label (field name)	Form Name	Choose one of the existing values or enter a new value		
		1--1	1--2	New Value
First Name: (def_first_name)	Data Entry Form	<input checked="" type="radio"/> Ima	<input type="radio"/> Ina	<input type="text"/>
Cell Phone Number (def_cell)	Data Entry Form	<input checked="" type="radio"/> 785 123 4567	<input type="radio"/> 785 123 4576	<input type="text"/>
		<input type="button" value="Merge Records"/> Cancel		

RECORD CREATED!

Record 1 has now been created by merging the values you selected from records 1--1 and 1--2.

The reviewer now sees all three records.

Record ID	Data Entry Form	Survey
<u>1</u>	<input checked="" type="radio"/>	<input type="radio"/>
<u>1--1</u>	<input checked="" type="radio"/>	<input type="radio"/>
<u>1--2</u>	<input checked="" type="radio"/>	<input type="radio"/>

Person #1 and #2 still only see their own Record for Record ID 1 containing the originally entered data.

Record ID	Data Entry Form	Survey
<u>1</u>	<input checked="" type="radio"/>	<input type="radio"/>

REDCap retains all three records by default and these records are included in the exported data. To remove them create a custom report and using an advanced logic filter to remove record IDs containing "--"

STEP 3

▼ **Filters** (optional)

Advanced filter logic: (e.g., [age] > 30 and [sex] = "1") [How do I use special functions?](#)

```
not_contain([record_id], "--")
```

Double Data Entry for electronic capture of paper form data

- **Pros:**
 - gold standard
 - more accurate than single-entry and entry with visual review
- **Cons:**
 - Slower
 - labor intensive

Important considerations:

- Are adequate steps being taken to reduce error at the data acquisition stage?
- What proportion of errors are:
 - reduced by double data entry?
 - caught with data validation techniques?
 - caught with exploratory data analysis?

Alternatives:

- Partial application:
 - Apply to subsample of data to measure error rates
 - Apply to data that is not easy to validate by rule
- Automated data capture with scanning
- Direct electronic surveys

Alternative to the Double Data Entry module

- The following screen shots suggest an alternative to using the Double Data Entry module
- It requires setting up a new **Event** for holding the specific instruments to be entered twice
- It does not require special roles for users of the project, and all users that can see the instruments will see all the entries
- It uses the **Data Comparison Tool** to review discrepancies between the records
- There is *not* an automated method to resolve discrepancies

Create a new Event for duplicate entries.

1. Enable longitudinal data collection, if it isn't already enabled.

1

2. Go to Define My Events to create a new event for the repeated entry.

2

The screenshot shows the REDCap Project Setup page with the following elements:

- Navigation Bar:** Project Home, Project Setup, Other Functionality, Project Revision History, and Edit project settings.
- Project Status:** Development, Completed steps 0 of 8.
- Main project settings:** Includes a 'Not started' status icon, an 'I'm done!' button, and three toggle options: 'Use surveys in this project?' (disabled), 'Use longitudinal data collection with defined events?' (enabled), and 'Use the MyCap participant-facing mobile app?' (disabled). A 'Modify project title, purpose, etc.' button is also present.
- Design your data collection instruments:** Includes a 'Not started' status icon, an 'I'm done!' button, and instructions on adding or editing fields. It provides links to 'Online Designer' and 'Data Dictionary', and mentions the 'REDCap Instrument Library'.
- Define your events and designate instruments for them:** Includes an 'In progress' status icon, an 'I'm done!' button, and instructions on creating events. It provides buttons for 'Define My Events' and 'Designate Instruments for My Events'.

3. Add the new event and click Save

Arm 1: Arm 1 +Add New Arm

Arm name: **Arm 1** [Rename Arm 1](#)

	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	Event 1		event_1_arm_1	719
 	2	DDE		dde_arm_1	720
<input type="button" value="Add new event"/>		<input type="text"/> Descriptive name for this event	<input type="text"/> Custom Event Label (optional) Example: [visit_date], [weight] kg		

3

4. At the top of the page, choose the Designate Instruments for My Events

[Project Setup](#) [Define My Events](#) [Designate Instruments for My Events](#)

4

5. Select the instruments that will have second entries for comparison and validation and click Save

[Select All](#) | [Deselect All](#)

Data Collection Instrument	Event 1 (1)	DDE (2)
Student	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Condition	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Child-Family Survey	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Story Test	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
KBIT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

5

In the Record Status Dashboard, the first “original” entry of an instrument is now in the first event, while the second “validation” entry for comparison is in the second event.

Note that there are differences between these entries.

Displaying: [Instrument status only](#) | [Lock status only](#) | [All status types](#)

Record ID	Event 1					DDE		
	Student	Condition	Child-Family Survey	Story Test	KBIT	Child-Family Survey	Story Test	KBIT
1101005	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
1101006	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1101007	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1st entry

2nd entry

Story Test Data Access Group: [No Assignment] ?

Editing existing Record ID: 1101005.

Event: **Event 1** 1st

Record ID: 1101005

Story Test

Does the form have the administration date written on it? Yes No reset

Administration date: M-D-Y

Story: Just In Time

1. Dan's bus was coming. Pic 1 Pic 2 Pic 3 Missing reset

2. Dan started to hurry. Pic 1 Pic 2 Pic 3 Missing reset

3. He was just in time to catch it. Pic 1 Pic 2 Pic 3 Missing reset

Story: Magno Tree

4. A big ripe mango hung... Pic 1 Pic 2 Pic 3 Missing reset

5. Above him, a little bird... Pic 1 Pic 2 Pic 3 Missing reset

6. Mario's dad walked up.... Pic 1 Pic 2 Pic 3 Missing reset

7. I'll help you be tall... Pic 1 Pic 2 Pic 3 Missing reset

RAW SCORE: View equation

Story Test Data Access Group: [No Assignment] ?

Editing existing Record ID: 1101005.

Event: **DDE** 2nd

Record ID: 1101005

Story Test

Does the form have the administration date written on it? Yes No reset

Administration date: M-D-Y

Story: Just In Time

1. Dan's bus was coming. Pic 1 Pic 2 Pic 3 Missing reset

2. Dan started to hurry. Pic 1 Pic 2 Pic 3 Missing reset

3. He was just in time to catch it. Pic 1 Pic 2 Pic 3 Missing reset

Story: Magno Tree

4. A big ripe mango hung... Pic 1 Pic 2 Pic 3 Missing reset

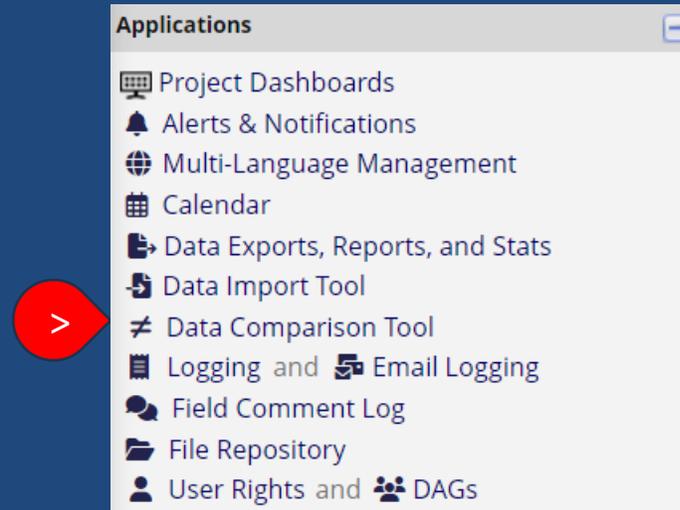
5. Above him, a little bird... Pic 1 Pic 2 Pic 3 Missing reset

6. Mario's dad walked up.... Pic 1 Pic 2 Pic 3 Missing reset

7. I'll help you be tall... Pic 1 Pic 2 Pic 3 Missing reset

RAW SCORE: View equation

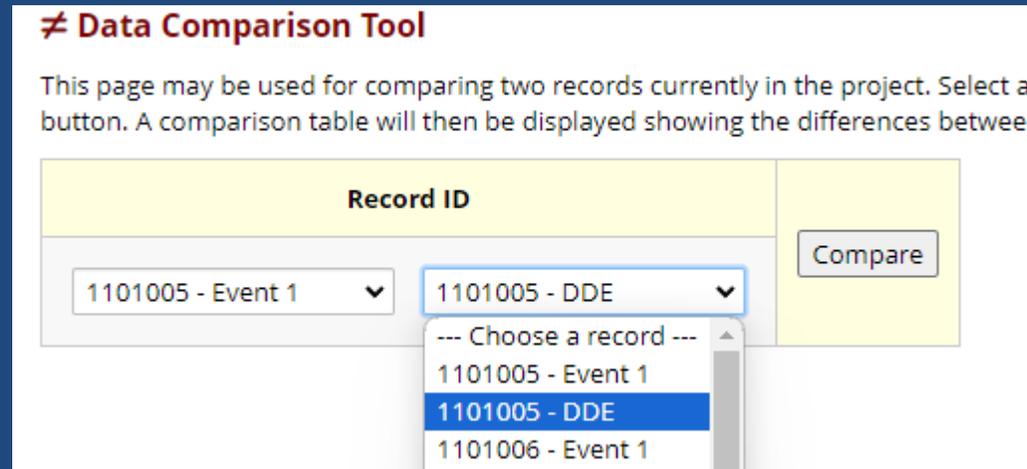
Use the Data Comparison Tool from the left side navigation bar to compare the entries.



This tool, as the text describes, will show a comparison of the records and *display just the differences*.

To do the comparison between events, you need to choose record ID and Event to compare.

In this example, it is a comparison between ID **1101005 - Event 1** and **1101005 - DDE**



Click Compare to generate the table of differences.

The results will show all differences between the events, including missing values for instruments not included between events.

For the instruments that appear in both events, note that the *story_date* variable (A) and *story_7* (B) variable do not match.

Click in the displayed data to jump to the data entry form for the instrument and event. It will open in a new window.

Differences were found between the two records named 1101005 and 1101005 for Event 1.

The table below compares the two records named **1101005** and **1101005**. Only the fields that have differing values are listed below. If you need to correct or change the value of one of the records below, simply click on the data displayed in red, and it will take you to that form for that particular record.

Label (field name)	Form Name	Record ID	
		1101005 Event 1	1101005 DDE
Record type (record_type)	Student	Student (5)	
Site ID (std_site_id)	Student	Site A (1)	
Cohort (std_cohort_id)	Student	Cohort 1 (2021-2022) (1)	
School ID (std_school_id)	Student	01	
Student ID (std_student_id)	Student	005	
Eligible (std_eligible_yn)	Student	No (0)	
Complete? (student_complete)	Student	Complete (2)	
cfs_staff_dataentry (cfs_staff_dataentry)	Child-Family Survey	hallberg	
cfs_staff_timestamp (cfs_staff_timestamp)	Child-Family Survey	2023-11-21 11:25:46	
Complete? (childfamily_survey_complete)	Child-Family Survey	Incomplete (0)	
Administration date: (story_date)	Story Test	11-01-2023	11-02-2023
7. I'll help you be tall... (story_7)	Story Test	Pic 1 (1)	Pic 2 (2)
story_staff_timestamp (story_staff_timestamp)	Story Test	2023-11-27 12:19:15	2023-11-27 11:17:01

