



Government of Western Australia
Child and Adolescent Health Service



Research Skills Workshop 2019 CAHS Research Education
Program

Advanced REDCap

Table of Contents

Piping	3
How to use Piping	3
Randomisation Module.....	5
Setting up a randomisation module	5
Randomisation User Privileges	11
Randomising a record	11
Advanced Calculations	15
Calculated fields.....	15
Building an Equation	19
Advanced Functions.....	21
Advanced HTML for customising text	22
Adding HTML Tags onto REDCap Instrument form fields	22
Glossary of Terms.....	25
Double Data Entry and Data Comparison	26
Double Data Entry.....	26
Data Comparison Tool	27
Record Locking and ESignatures	29
Record Locking Customisation	29
Esignatures and Locking Management	31
Data Quality	35
Execute Rules	35
Add a new rule	38
Using SMS with REDCap.....	39

Piping

How to use Piping

The “Piping” feature in REDCap allows you to insert previously collected data into text on a data collection form or survey. This provides great precision and control over question wording. It can also be used in other ways, such as customising survey invitations (Ex: by including the respondent’s name in the email) or survey completion text (Ex: thanking your respondent by name after completing a survey).

Where Can Piping be Used?

Piping can be used in many different places in REDCap. Here is a list of all the places where piping can be used to insert a data value *INTO* text.

- Field Label
- Field Note
- Section Header
- Matrix field column headers
- Option labels for multiple choice fields (radio, drop-down, checkbox)
- Slider field labels (Ex: text displayed above slider bar)
- Custom record locking text (if defined, displayed at bottom of form)
- Survey instructions
- Survey Completion Text
- Survey invitation emails (sent via Participant List or Automated invitations) – includes both subject and message
- Custom text displayed at top of Survey Queue
- Inside the URL for a survey’s “Redirect to a URL” setting

From What Field Types Can Data be Piped?

Data can be piped into the locations listed above *FROM* any type of field in REDCap with the exception of:

- Checkbox fields
- File Upload fields.

If you are piping the answer *FROM* a multiple-choice field (radio, drop-down), it will display the option label (not the coded data value) into the location where the field is piped, but for all other field types, it will pipe the literal data value.

How to use Piping

Setting up piping is very simple. Piping does not have to be enabled in any way in order to use it. All you need to do to pipe a data value into any of the valid places is insert into your text the variable name inside square brackets. For example, if we have a survey question that asks “What is your first name?”, in which the variable name for that question is “first_name”, then the following question may be setup as “[first_name], what is your date of birth?”. If the user entered “John” as their first name, then text for the next question would literally read as “John, what is your date of birth?”. In the same way, you could use [first_name] in your survey’s survey completion text when the survey is completed, in which “Thanks for taking our survey, [first_name]!” would be displayed to the respondent as “Thanks for taking our survey, John!”.

If you are piping the answer **FROM** a multiple-choice field (radio, drop-down), it will display the option label (not the coded data value) into the location where the field is piped. For example, if you had a drop-down question that said “What is your favorite ice cream?” with the choices “Chocolate”, “Vanilla”, and “Strawberry” (all coded at 0, 1, 2, respectively); then after selecting “Chocolate”, the next question would read “On a scale of 1 to 10, how much do you like Chocolate?”. But for non-multiple-choice fields, such as Text Notes, Slider fields, it will pipe the literal data value.

If you have a longitudinal project, you may utilise cross-event Piping if you wish. In the same way that cross-event calculation and branching logic are set up, you simply prepend the variable name inside square brackets with the unique event name inside square brackets. For example, if you collected a person’s first name on the event named “Enrollment”, which as the unique event name “enrollment_arm_1”, then you could set up piping as “[enrollment_arm_1][first_name], what is your date of birth?”. Thus, it will pipe the first name value only from the “Enrollment” event and not any other event, whereas if the unique event name is not prepended to a variable in the longitudinal project, it will pipe the data value from the current event.

Randomisation Module

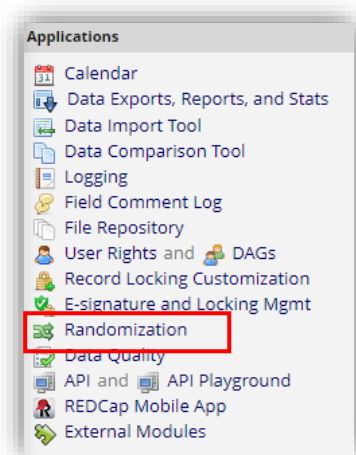
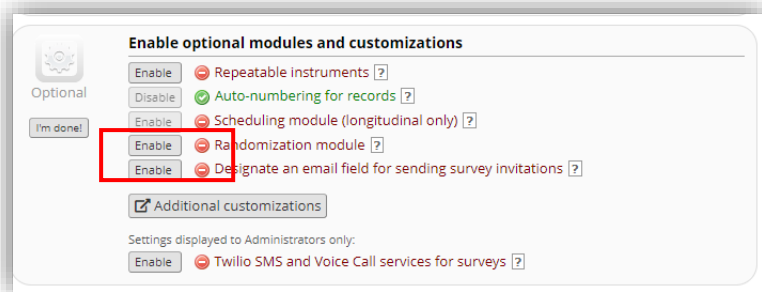
Randomisation is a process that assigns participants/subjects by chance (rather than by choice) into specific groups, typically for clinical research and clinical trials. Randomisation in REDCap works by allowing you to create your custom allocation list, which will serve as a lookup table for deciding how to randomise your subjects (Ex: records in your project). In this module, you first define the Randomisation model with various parameters. Based on the defined parameters, the module creates a template allocation table, which you can use to structure the Randomisation table you will import. The module also monitors the overall allocation progress and assignment of randomised subjects.

REDCap does not create the Randomisation table for you. This table must be generated outside of REDCap using other software (Ex: Excel, SAS, Stata, R), most likely by the statistician involved in your project. By letting you create your own allocation table outside of REDCap, it lets you and your team choose exactly how you wish to structure your allocations and assignments

Note: The “Setup” phase for Randomisation is ONLY available while the project is in development status, so the entire setup process should be completed before the project is moved to production status. Once the project is in production, the “Setup” tab will become permanently locked and no settings can be modified or can any assignments be undone.

Setting up a randomisation module

A Randomisation model defines how the subjects in the study are randomised. To start the process, click on the “Enable” button beside the “Randomisation module” on the project set-up page.



Next, click on the “Randomisation” link under “Applications” menu.

Randomisation Setup

The Randomisation model is defined on the “Setup” tab and consists of three main steps:

1. Define your Randomisation model
2. Download template allocation tables (as Excel/CSV files)
3. Upload your allocation table (CSV file)

Step 1: Define your Randomisation model

Setup Dashboard

STEP 1: Define your randomization model

This step will allow you to define the randomization model you will be implementing and all its parameters, which includes defining strata (if applicable) and optionally randomizing subjects per group/site (if a multi-site study).

A) Use stratified randomization?

It is often necessary to ensure equal treatment among a number of factors. Stratified randomization is the solution to achieve balance within one or more subgroups, such as gender, race, diabetics/non-diabetics, etc. By choosing strata (multiple choice criteria fields), you may then be able to ensure balance within those subgroups. [Tell me more](#)

B) Randomize by group/site?

If this is a multi-center/multi-site project (or something similar), you may want to stratify the randomization by each group/site. You can select an existing multiple choice field that represents the groups/sites. OR you can use Data Access Groups to stratify by group/site.

C) Choose your randomization field

This is the field where the allocated randomization (treatment) group will be saved and stored, and is where the Randomize button will appear on your data collection form.

- select a field - ▼

Save randomization model Erase randomization model

The first step in the setup process is to define your Randomisation model you will be implementing and all its parameters, which includes defining strata (if applicable) and optionally randomising subjects per group/site (if a multi-site study). In this step, you will define the type of Randomisation and how the Randomisation is applied to the subjects. There are two Randomisation types, use stratified Randomisation and randomise by group/site.

Use Stratified Randomisation? Stratified Randomisation ensures that different groups are balanced. The balance is specified in the allocation table. Increasing the number of stratification variables will lead to fewer subjects per stratum.

A) Use stratified randomization?

It is often necessary to ensure equal treatment among a number of factors. Stratified randomization is the solution to achieve balance within one or more subgroups, such as gender, race, diabetics/non-diabetics, etc. By choosing strata (multiple choice criteria fields), you may then be able to ensure balance within those subgroups. [Tell me more](#)

Choose strata (criteria fields used for stratification; may specify up to 14 multiple choice fields)

ethnicity (Ethnicity) ▼ for Enrollment (Arm 1: Drug A) ▼

Randomisation by group/site? If this is a multiple site study, this option allows you to stratify the Randomisation by each group. When this option is checked, you are given the opportunity to select Randomisation by data access groups or by a REDCap dropdown list of sites.

B) Randomize by group/site?

If this is a multi-center/multi-site project (or something similar), you may want to stratify the randomization by each group/site. You can select an existing multiple choice field that represents the groups/sites, OR you can use Data Access Groups to stratify by group/site.

Choose your Randomisation field This is the field that will receive the Randomisation group designation.

C) Choose your randomization field

This is the field where the allocated randomization (treatment) group will be saved and stored, and is where the Randomize button will appear on your data collection form.

sex (Gender) ▼ for Enrollment (Arm 1: Drug A) ▼

Save randomization model

Erase randomization model

Once all parameters are set, click on the “Save Randomisation model” button.

Step 2: Download template allocation tables (as Excel/CSV files)

The second step in the randomisation setup is to download the allocation table template

STEP 2: Download template allocation tables (as Excel/CSV files)

Below are some example files that you may download to get a general idea for how you may structure your own randomization table. You do not have to use any of these. In fact, **we recommend that you NOT use these exact templates** but instead recommend that you merely use them as an example or baseline to start from in order to create your own custom allocation file. After uploading your allocation table in Step 3 below, it will then be used as a lookup table to perform assignments when subjects are being randomized. **NOTE:** Record names (e.g., study ID) should NOT be included as a column in your allocation table, but only the fields listed in the example files below. [More details](#)

Example #1 (basic)

Example #2 (all possible combos)

Example #3 (5x all possible combos)

The template allocation tables will contain all the raw coded values for the fields used in your Randomisation model. When downloading and opening any of the template allocation tables, you will find some helpful notes in the last column of each file.

- It will list each multiple-choice option's label corresponding to each raw coded value for all the fields utilised (Ex: it will specify 0=Female and 1=Male for the field 'gender').
- If you are using Data Access Groups to randomise by group, then it will additionally list each group name with its corresponding group ID number, which can be used in your allocation table in the same fashion as the raw coded values for your Randomisation field and strata. The last column with the notes will be ignored when you finally upload your custom allocation table in Step 3.

REDCap creates three example files to download that you may use as a structure when creating your own randomisation table. **Note:** It is recommended that you NOT use these exact templates but instead recommend that you use them as an example or baseline to start from in order to create your own custom allocation file.

In order to make the allocation schedule more difficult to predict, a temporary column can be added to the spreadsheet for randomising the order. The Excel function “Rand()” creates a random value between 0 and 1. This number can be used as an easy way to populate a third column in the spreadsheet with a unique random value. If the spreadsheet is sorted by this column, the groups and values will be randomised.

After sorting the table the random value, the column with the Rand() function should be removed before saving the spreadsheet as a CSV file and prior to uploading it as the allocation table into REDCap.


Step 3: Upload your allocation table (CSV file)

STEP 3: Upload your allocation table (CSV file)

Once you have created your custom allocation table as a CSV file and made sure that you kept the format prescribed in the template files from Step 2 above, you may now upload the file below. It will be checked for any possible errors first before it is accepted and stored in REDCap. Please note that you will need to create two different allocation tables: one to be used for testing while your project is in development status and the other for use when in production status. Below are some important reminders before you begin uploading your allocation tables.


Reminders:

- Once your project is in production status, the allocation tables will become locked and unmodifiable.
- Be sure to include more assignments in your allocation table than you think you will need (to accommodate possible drop-out and drop-in of subjects).
- Record names (e.g., study ID) should NOT be included as a column in your allocation table, but only the fields listed in the example files from Step 2 above.

 **Upload allocation table (CSV file) for use in DEVELOPMENT status**

Already uploaded

[Delete allocation table?](#)

 **Upload allocation table (CSV file) for use in PRODUCTION status**

Not uploaded yet

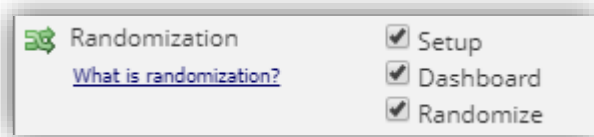
No file chosen

The third and final step in the Randomisation setup is to upload the allocation table. Two allocation tables will eventually need to be defined, one for the development stage and a different one for the production stage. Note: These should NOT be the same allocation table.

Randomisation User Privileges

There are several user privileges that can be utilised for Randomisation, all of which correspond to different roles during the Randomisation process and can be set on the “User Rights” page.

- Setup: will see the “Setup” tab on the “Randomisation” page, which will allow you to fine the Randomisation model and all its parameters, as well as upload your custom allocation table. (Should be the Statistician/Data Analyst)
- Dashboard: will see the (Allocation) “Dashboard” tab on the “Randomisation” page, in which you may view the overall allocation progress and assignments for subjects that have been randomised. (Should be the PI)
- Randomise: will be able to view the “Randomise” button on the data collection form that contains the Randomisation field, thus allowing you to perform the Randomisation on the subject/record you are viewing. (Should be Study Coordinator)



Randomising a record

The fields that have been specified for randomisation will display a “Randomise” button in the data entry screen. This will allow you to generate a random value according to the Randomisation allocation table.

Editing existing Study ID 1	
Study ID	1
General Comments	
Randomization Group	<input type="button" value="Randomize"/>
Form Status	

When a user (who has been given appropriate “Randomise” user privileges) clicks that button, a pop-up box will appear that will allow the user to randomise the subject/record. If any grouping or stratification is being used, the user must provide the group or strata values if any are missing before they can randomise the subject/record. Pressing the “Randomise” button give you an opportunity to double check the required values that will impact the definition of the resulting Randomisation group.

Randomizing Study ID "1" ✕

Below you may perform randomization for Study ID "1" on the field **Randomization Group** (*randomization_group*). Please note that the fields below will become permanently locked and uneditable on the data entry form once this record has been randomized.

Provide any missing values below for Study ID 1, then click the Randomize button below.

Race White ▾

Gender
 Female
 Male

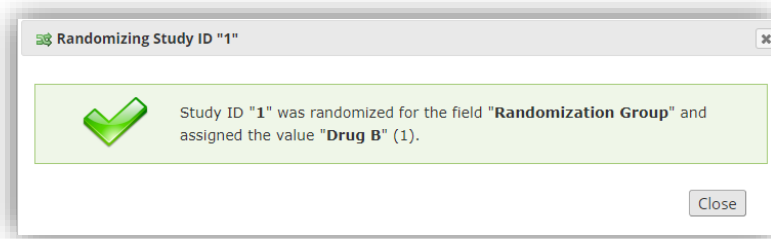
[reset](#)

REMINDER: This project is still in development status, so you should NOT be randomizing real subjects yet. You should only be randomizing real subjects after moving the project into in production status.

When the user randomises the subject/record, REDCap will check the allocation table and assign that subject's/record's Randomisation field value, which will be derived from the next match in the table based upon the criteria (Ex: strata field values, group). If not using stratified Randomisation and not randomising by group/site, then it will simply project the subject with the very next value in the allocation table. After updating or providing missing values, a dialog of the random group that was assigned is displayed.

In addition, after the value of the random group is assigned, the random group field becomes read-only and the value cannot be changed.

A listing of the records that have been randomised is maintained. To examine those records, click on the "Randomisation" link in the "Applications" section of the Navigation Pane.



Dashboard

A dashboard displaying the allocated records and the random group assigned are shown below

The table below displays the allocation dashboard for use in DEVELOPMENT status. All assignments are grouped to show in aggregate the count of records that have been randomized for each row (i.e. combinations). Assignments that have been used get counted in the 'Used' column while those that are still unallocated will get counted in the 'Not Used' column. Once all assignments have been used for a given row/combination, it will display a checkmark icon in its row. The headers in the table are clickable to sort the table by that column either in ascending or descending order.

	Used	Not Used	Allocated records	Randomization Group (randomization_grc)	Race (race)	Gender (sex)
	0	1		Drug A (0)	American Indian/Alaska Native (0)	Female (0)
	0	1		Drug A (0)	Native Hawaiian or Other Pacific Islander (2)	Male (1)
	0	1		Drug A (0)	Black or African American (3)	Female (0)
	0	1		Drug A (0)	More Than One Race (5)	Male (1)
	0	1		Drug A (0)	Unknown / Not Reported (6)	Female (0)
	0	1		Drug B (1)	American Indian/Alaska Native (0)	Male (1)
	0	1		Drug B (1)	Asian (1)	Female (0)
	0	1		Drug B (1)	Black or African American (3)	Male (1)
	1	0	1	Drug B (1)	White (4)	Female (0)
	0	1		Drug B (1)	Unknown / Not Reported (6)	Male (1)
	0	1		Drug C (2)	Asian (1)	Male (1)
	0	1		Drug C (2)	Native Hawaiian or Other Pacific Islander (2)	Female (0)

Important Information about Randomisation

- How you generate your allocation table should be formal, secure, reproducible, and unpredictable. This is best handled by a statistician, NOT the PI.
- Be sure to include more assignments in your allocation table than you think you will need (to accommodate possible drop-out and drop-in of subjects).
- The “Setup” tab on the “Randomisation” page is ONLY available while the project is in Development status. Once the project is in Production, the “Setup” tab will become permanently locked and no settings can be modified or any assignments be undone.
- Practice the process of randomising patients by uploading an allocation table while in Development status and creating dummy records.
- Delete the dummy records and upload the final allocation table before moving to Production status.

Advanced Calculations

Calculated fields

A calculated field can perform real-time calculations based on the data from other fields. REDCap can make real-time calculations on data entry forms. For example, you could create a calculation based off the birthday field and date field in order to find out how old the participant was at the time of the survey.

Formatting calculated fields:

In order for the calculated field to function, it will need to be formatted in a particular way. This is similar to constructing equations in Excel or with certain scientific calculators. The variable names/field names used in the project's Data Dictionary can be used as variables in the equation, but you must place [] brackets around each variable. (Ex: [birth_date]) Please be sure that you follow the mathematical order of operations when constructing the equation or else your calculated results might end up being incorrect.

The mathematical operations available are:

- + Add
- Subtract
- * Multiply
- / Divide

Null or **blank** values can be referred to as "" or "NaN". Be careful to include the quotes around NaN.

Data Import and calculated fields

Data cannot be directly imported into calculated fields. If you are importing data to a field you have set up to calculate a value, follow these steps:

1. Temporarily change the field type to text
2. Import data
3. Change the field type back to a calculated field

However, when performing a data import (via Data Import Tool or API), REDCap will perform the calculations for any calculated fields that are triggered by the values being imported. For example, if you have a BMI field whose calculation is based off of a height field and a weight field, then if you perform a data import of height and weight values, it will automatically calculate the BMI for each record that is imported and also save those calculations and log them on the Logging page.

Conditional Logic within calculated fields

Conditional logic may also be used in a calculated field (Ex: an IF/THEN/ELSE statement) by using the function: **if (CONDITION, value if condition is TRUE, value if condition is FALSE)**

Note that all operands in CONDITION must be all numeric or all dates

This construction is similar to IF statements in Microsoft Excel. Provide the condition first (e.g. [weight]=4), then give the resulting value if it is true, and lastly give the resulting value if the condition is false. For example:

if([weight] > 100, 44, 11)

In this example, if the value of the field 'weight' is greater than 100, then it will give a value of 44, but if 'weight' is less than or equal to 100, it will give 11 as the result.

IF statements may be used inside other IF statements (“nested”). Other advanced functions (described below) may also be used inside IF statements.

Using calculated fields within longitudinal Projects

In longitudinal projects, fields from different EVENTS can be used in calculated fields. A calculated field's equation may utilise fields from other events (Ex: visits, time-points). The equation format is somewhat different from the normal format because the unique event name must be specified in the equation for the target event. The unique event name must be prepended (in square brackets) to the beginning of the variable name (in square brackets), Ex: [unique_event_name][variable_name]. Unique event names can be found listed on the project's **“Define My Events”** page on the right-hand side of the events table, in which the unique name is automatically generated from the event name that you have defined.

For example, if the first event in the project is named "Enrollment", in which the unique event name for it is "enrollment_arm_1", then we can set up the equation as follows to perform a calculation utilising the "weight" field from the Enrollment event: [enrollment_arm_1][weight]/[visit_weight]. Thus, presuming that this calculated field exists on a form that is utilised on multiple events, it will always perform the calculation using the value of weight from the Enrollment event while using the value of visit_weight for the current event the user is on.

Add or Modify a Calculated Field

If you add a calculated field where data already exist in a form, the data must be re-saved for the calculation to be performed.

The Data Quality rule (rule H) will find and fix all incorrect values for calculated fields in a project. If any “calc” fields have ended up with incorrect values (whether due to field changes in the project or due to previous data imports), users can now run rule H not only to find any incorrect calculated values, but it will additionally display a button that, when clicked, will auto-fix ALL of them for the project admin.

Calculate the Difference Between Two Date or Time Fields

You can calculate the difference between two dates or times by using the function:

datediff([date1], [date2], "units", "dateformat", returnSignedValue) date1 and date2 are variables in your project.

Units

"y" years 1 year = 365.2425 days

"M" months 1 month = 30.44 days

"d" days

"h" hours

"m" minutes

"s" seconds

Dateformat

"ymd" Y-M-D (default) "mdy" M-D-Y "dmy" D-M-Y

- If the dateformat is not provided, it will default to "ymd".
- Both dates MUST be in the format specified in order to work

returnSignedValue

false (default) true

- The parameter returnSignedValue denotes the result to be signed or unsigned (absolute value), in which the default value is "false", which returns the absolute value of the difference. For example, if [date1] is larger than [date2], then the result will be negative if returnSignedValue is set to true. If returnSignedValue is not set or is set to false, then the result will ALWAYS be a positive number. If returnSignedValue is set to false or not set, then the order of the dates in the equation does not matter because the resulting value will always be positive (although the + sign is not displayed but implied).

Examples:

datediff([dob],[date_enrollee d],"d") Yields the number of days between the dates for the date_enrolled and dob fields, which must be in Y-M-D format.

datediff([dob],"05-31-2007","h","mdy",true) Yields the number of hours between May 31, 2007, and the date for the dob field, which must be in M-D-Y format. Because returnSignedValue is set to true, the value will be negative if the dob field value is more recent than May 31, 2007.

Advanced Functions

The table below lists advanced functions for calculated fields:

Function	Name/Type of function	Notes / examples
if (CONDITION, VALUE if condition is TRUE, VALUE if condition is FALSE)	If/Then/Else conditional logic	Return a value based upon a condition. If CONDITION evaluates as a true statement, then it returns the first VALUE, and if false, it returns the second VALUE. E.g. if([weight] > 100, 44, 11) will return 44 if "weight" is greater than 100, otherwise it will return 11. All operands in CONDITION must be all numeric or all dates!
datediff ([date1], [date2], "units", "dateformat", returnSignedValue)	Datediff	Calculate the difference between two dates or datetimes. Options for "units": "y" (years, 1 year = 365.2425 days), "M" (months, 1 month = 30.44 days), "d" (days), "h" (hours), "m" (minutes), "s" (seconds). The "dateformat" parameter must be "ymd", "mdy", or "dmy", which refer to the format of BOTH date/time fields as Y-M-D, M-D-Y, or D-M-Y, respectively. If not defined, it will default to "ymd". The parameter "returnSignedValue" must be either true or false (lowercase) and denotes whether you want the returned result to be either signed (have a minus in front if negative) or unsigned (absolute value), in which the default value is false, which returns the absolute value of the difference. For example, if [date1] is larger than [date2], then the result will be negative if returnSignedValue is set to true. If returnSignedValue is not set or is set to false, then the result will ALWAYS be a positive number. If returnSignedValue is set to false or not set, then the order of the dates in the equation does not matter because the resulting value will always be positive (although the + sign is not displayed but implied).
round(number,decimal places)	Round	If the "decimal places" parameter is not provided, it defaults to 0. E.g. To round 14.384 to one decimal place: round(14.384,1) will yield 14.4
roundup(number,decimal places)	Round Up	If the "decimal places" parameter is not provided, it defaults to 0. E.g. To round up 14.384 to one decimal place: roundup(14.384,1) will yield 14.4
rounddown(number,decimal places)	Round Down	If the "decimal places" parameter is not provided, it defaults to 0. E.g. To round down 14.384 to one decimal place: rounddown(14.384,1) will yield 14.3
sqrt(number)	Square Root	E.g. sqrt([height]) or sqrt([(value1]^34)/98.3)
(number)^(exponent)	Exponents	Use caret ^ character and place both the number and its exponent inside parentheses: For example, (4)^(3) or ([weight]+43)^(2)
abs(number)	Absolute Value	Returns the absolute value (i.e. the magnitude of a real number without regard to its sign). E.g. abs(-7.1) will return 7.1 and abs(45) will return 45.
min(number,number,...)	Minimum	Returns the minimum value of a set of values in the format min([num1],[num2],[num3],...). NOTE: All blank values will be ignored and thus will only return the lowest numerical value. There is no limit to the amount of numbers used in this function.

max(number,number,...)	Maximum	Returns the maximum value of a set of values in the format max([num1],[num2],[num3],...). NOTE: All blank values will be ignored and thus will only return the highest numerical value. There is no limit to the amount of numbers used in this function.
mean(number,number,...)	Mean	Returns the mean (i.e. average) value of a set of values in the format mean([num1],[num2],[num3],...). NOTE: All blank values will be ignored and thus will only return the mean value computed from all numerical, non-blank values. There is no limit to the amount of numbers used in this function.
median(number,number,...)	Median	Returns the median value of a set of values in the format median([num1],[num2],[num3],...). NOTE: All blank values will be ignored and thus will only return the median value computed from all numerical, non-blank values. There is no limit to the amount of numbers used in this function.
sum(number,number,...)	Sum	Returns the sum total of a set of values in the format sum([num1],[num2],[num3],...). NOTE: All blank values will be ignored and thus will only return the sum total computed from all numerical, non-blank values. There is no limit to the amount of numbers used in this function.
stdev(number,number,...)	Standard Deviation	Returns the standard deviation of a set of values in the format stdev([num1],[num2],[num3],...). NOTE: All blank values will be ignored and thus will only return the standard deviation computed from all numerical, non-blank values. There is no limit to the amount of numbers used in this function.

Building an Equation

Basic Coding:

Variables must be between brackets – [variable]

Using basic math signs

- Add +
- Subtract -
- Multiply *
- Divide /

Variables must be in the same event

Always make sure in subtraction or extraction equations that larger values comes first, to avoid false negative values

Scoring Calculations:

Using the 'Sum' function you can calculate a score from multiple answers. The calculation uses the coded value of an answer for example Yes=1, No= 0, to return a numerical score

Sum ([variable1],[variable],[variable3])

No spaces

For scoring, never use a multiple selection checkbox. Leave each score as simple as separate.

Conditional values for equations

If you need to numerically auto classify a value.

Example: If BMI is more than 30, give 1 as an answer = if([bmi]>30,1,0)

if(CONDITION,if condition is TRUE, if condition is FALSE)

SUM vs ADDITION

- sum([q1],[q2],[q3],[q4])
 - Sum of questions 1-4, even if one of the values is blank. – Blank values or missing data will be ignored

- [q1]+[q2]+[q3]+[q4]
 - Sum of questions 1-4 but only if every question has a value. – Blank values won't be ignored! This Allows secondary prevention of missing data in important equations!

Common Equations

BMI

Original form: $BMI = \frac{\text{mass(kg)}}{(\text{height(m)})^2}$

Translation to REDCap: $-(\text{[weight]} / ([\text{height}] * [\text{height}]))$

Date and Time

Basic Code: – datediff([date1],[date2],"y")

Used to calculate age, length of hospital stay and time between visits.

Examples of time calculations:

Age at enrolment: – datediff([date_enrolled],[dob],"y", true)

Time between project start and recruitment – datediff("01-02-2018",[dob],"m","dmy", true) Current age – datediff("today",[dob],"y", true)

Advanced Functions

Round - Approximation

round('your equation')

Returned values are approximated to nearest decimal E.g. if result = 34.6756, it will be rounded to 34.7

Square root

sqrt([variable] or 'your Equation') E.g. if variable value = 9, it will be square rooted to 3

Or If you need a square root of a whole equation, enter it between brackets (and).

Exponents

([variable]^'exponent')

Returned values are exponential to certain value E.g. 3rd exponent of height – $**([height]^{(3)})**$

Minimum and Maximum values

min([v1],[v2],[v3],...)

max([v1],[v2],[v3],...)

Returned value is the min/max value of these variables. e.g. outcomes from different visits – least weight patient recorded during his follow ups

Mean value

mean([v1],[v2],[v3],...)

Returned value is the mean of these variables. e.g. mean weight patient recorded during his follow ups

Median value

median([v1],[v2],[v3],...)

Returned value is the median of these variables. e.g. mean weight patient recorded during his follow up

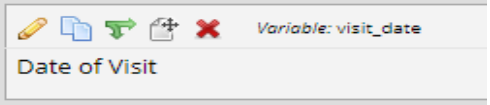
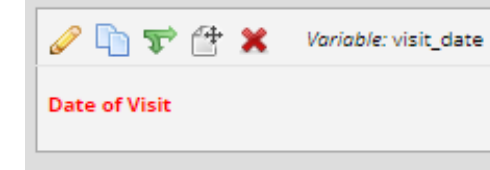
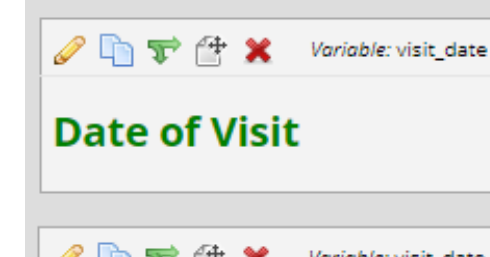
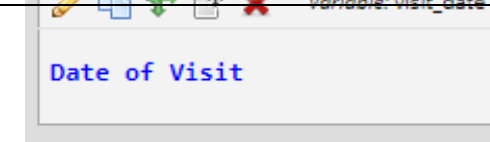
Advanced HTML for customising text

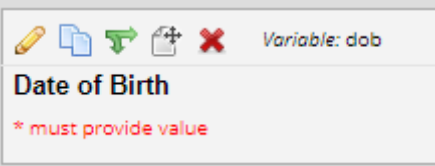
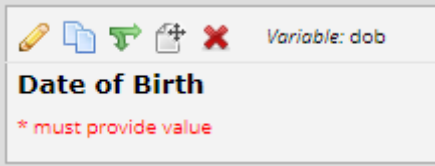
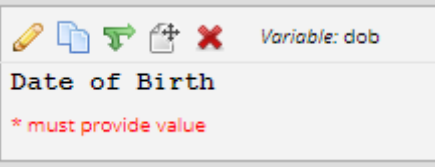
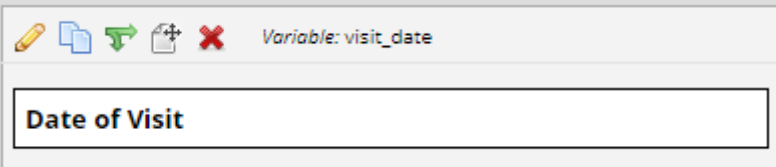
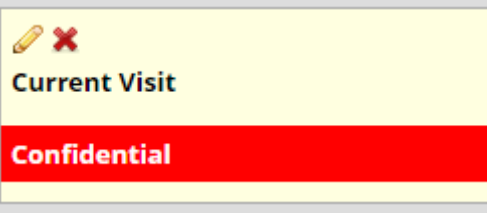

Adding HTML Tags onto REDCap Instrument form fields


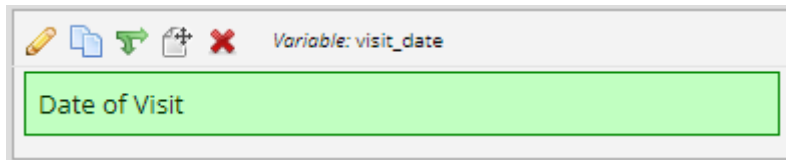
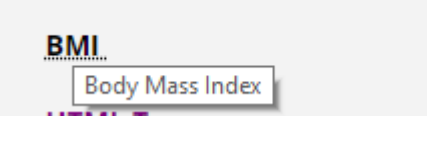
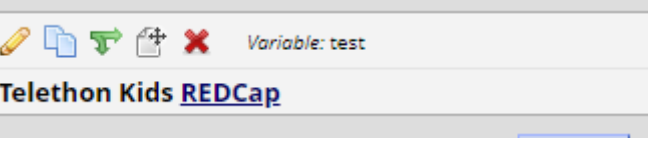
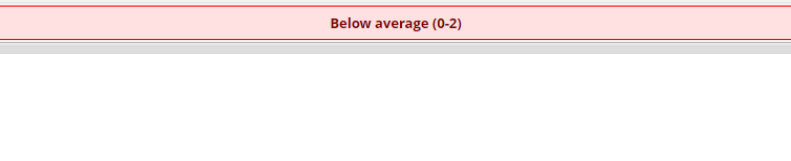
REDCap enables users to be able to change the colour of an instruments text, surrounding area with a different colour text box, unbold text from the default bold, italic text.

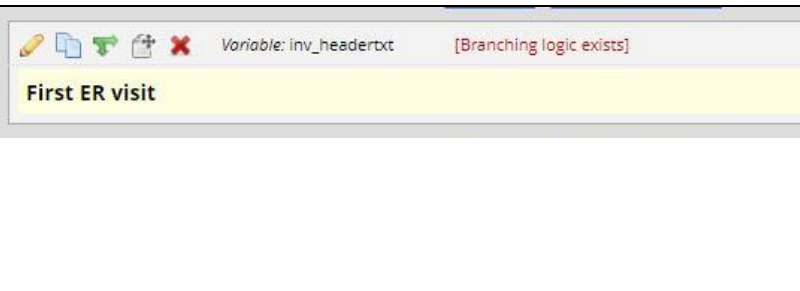
The below table lists the HTML tags and a sample of what they will look like on the form. The HTML tag is added around the text in the Field Label section of editing or adding a new field.

Please note: The Text in the red between the tags is the text that you are customising. Tag start with the <> and end with </>. Below are examples and a guide only

How to change the text	HTML Tag	Screenshot of the HTML tag
Unbold text	<code><div style="font-weight:normal;">Date of Visit</div></code>	
Small coloured Text, in a paragraph style. Other text colours are: red, blue, green	<code><p style="color:red; font-size:75%;">Date of Visit </p></code>	
Large, bold green text in a paragraph style Other text colours are: red, blue, green	<code><p style="color:green; font-weight:bold; font-size:150%;">Date of Visit</p></code>	
Coloured monospace text in a paragraph style. Other text colours	<code><p style="color:blue; font-family:monospace;">Date of Visit</p></code>	

are: red, blue, green		
Change the font-family to Arial	<code><div f style="font-family:arial;">Date of Birth</div></code>	
Change the font-family to Verdana	<code><div style="font-family:verdana;">Date of Birth</div></code>	
Change the font-family to Courier	<code><div style="font-family:courier;">Date of Birth</div></code>	
Black bold text in a white box	<code><p style="display:block; padding:5px; border:1px black solid; background-color:white;">Date of Visit </p></code>	
Section Header with confidential white text and red box and default bold heading. With a line break 	<code>Current Visit
 <div style="width:100%; color:#FFF; background-color:#F00; padding:5px; position:relative; top:- 5px; left:- 5px;">Confidential</div></code>	
Italic text and default bold text	<code><i> Date of Visit </i></code>	

Italic text and unbold text	<code><div style="font-weight:normal;"><i>Date of Visit</i></div></code>	
Text and background box colour green Other colours to use are: red, blue, green	<code><div class="green"> Date of Visit </div></code>	
Creates a pop up that spells out the acronym if you hover over it	<code><acronym title="Body Mass Index">BMI</acronym></code>	
Inserts an image	<code></code>	
Creates a URL link that opens in a new window or tab	Telethon Kids <u>REDCap</u> Telethon Kids <code> REDCap </code>	
Creates a red box with centred text	<code><center><div class="red"> Below average (0-2)</div class="red"></center></code>	

<p>To simulate a new section (without forcing a page break and to allow 2 header in a rows) where the header text can be changed based on branching logic.</p>	<p>create a descriptive text variable and then use the header class to display the text.</p> <pre><div class="header">First ER visit</div></pre>	
--	--	---

Glossary of Terms

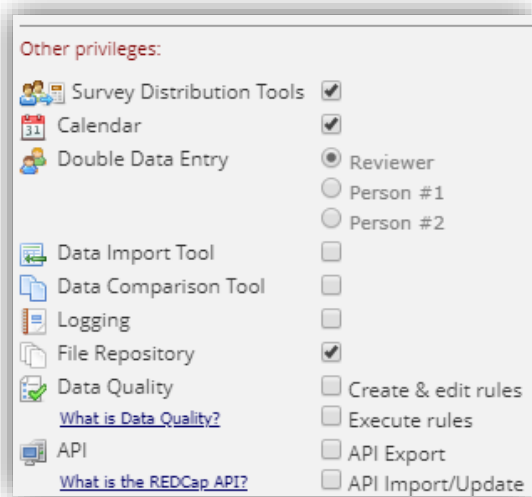
HTML term/tag	Meaning
p	Paragraph, this places the text into a paragraph format with space before the first line and after the first line. This can be combined with other elements style= font family, font size, font weight, colour
br	This tag means a line break
div	This is a division or section, it is used within HTML to contain other elements such as style= font family, font size, font weight, colour

Double Data Entry and Data Comparison

Double Data Entry

As a preventive measure, REDCap prevents users from entering duplicate records. However, some projects may need to enter data twice for each record as a means of ensuring quality data collection by later comparing the records. This can be done using the “Double Data Entry” module. The “Double Data Entry” module needs to be enabled by the REDCap administrator prior to any data being collected in the project. When you contact the REDCap Administrator, be sure to include the name of your project. When the module is enabled, REDCap collects data differently than normal. It allows you to designate any two project users or roles as “Data Entry Person 1” and “Data Entry Person 2”, which is done on the “User Rights” page. You will first need to create new roles for Data Entry 1 and Data Entry 2, which is also done on the “User Rights” page.

Add the necessary user rights to this role. Under “Other privileges:” you will see Double Data Entry privileges



Once both roles have been created, you will need to add users to the role.

Once designated, either of these two users can begin entering data independently and they will be allowed to create duplicate records. They will not be able to access each other’s data and only normal users (called Reviewers) will be able to see all three copies of the data. Once each designated data entry person has created an instance of the same record, both instances can then be compared side by side using the “Data Comparison Tool” and merged into a third instance.

Data Comparison Tool

The “Data Comparison Tool” enables you to select two records (including the event, for longitudinal projects) to compare any data side-by-side. Fields are highlighted where data values differ between the two records. Select a record from each of the lists and click on the “Compare” button.

Data Comparison Tool

This page may be used for comparing two records currently in the project. Select a record from each of the lists below and hit the 'Compare' button. A comparison table will then be displayed showing the differences between the two records.

Record ID	
<input type="text" value="1"/>	<input type="text" value="5"/>

A comparison table will then be displayed showing the differences between the two records. The table compares the two records named 1 and 5. Only the fields that have differing values are listed in the table. 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.

Differences were found between the two records named 1 and 5.

The table below compares the two records named 1 and 5. Only the fields that have differing values are listed below. If you 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 particular record.

Label (field name)	Form Name	Record ID	
		1	5
Participant Identification Number (<i>participant_id</i>)	Post-intervention Outcomes Survey	132	135
1. Overall, I found the workshop useful. (<i>outcomes_1</i>)	Post-intervention Outcomes Survey	1 Strongly disagree (1)	3 (3)
2. I have an improved understanding of the role I play in supporting my child's development. (<i>outcomes_2</i>)	Post-intervention Outcomes Survey	1 Strongly disagree (1)	3 (3)
3. I have an improved understanding of the impact that my relationship with my child has on his/her development. (<i>outcomes_3</i>)	Post-intervention Outcomes Survey	1 Strongly disagree (1)	3 (3)
4. I have an improved understanding of how communication develops. (<i>outcomes_4</i>)	Post-intervention Outcomes Survey	1 Strongly disagree (1)	3 (3)
5. I have identified specific actions that I can do with my child during daily activities to help his/her communication development (<i>outcomes_5</i>)	Post-intervention Outcomes Survey	1 Strongly disagree (1)	3 (3)
6. I am confident in my ability to do these actions with my child during daily activities. (<i>outcomes_6</i>)	Post-intervention Outcomes Survey	1 Strongly disagree (1)	3 (3)
7. Please add any comments that will help us make decisions about improvements or future use of the online education package: (<i>outcomes_comments</i>)	Post-intervention Outcomes Survey		lgog
I would like to withdraw from participation in this research project. (Choice = Please tick to confirm.) (<i>withdrawal_1</i>)	Post-intervention Outcomes Survey	Unchecked (0)	Checked (1)

Record Locking and ESignatures

Record Locking Customisation

The “Record Locking Customisation” application is used for customising the Record Locking option and E-signature option on data collection instruments. The settings are completely optional; however, they can help you gain greater control over the status of the data in your project. Records that are “locked” cannot be updated unless the lock is first removed by a user with “Lock/Unlock” privileges.


Only users with “Lock/Unlock” user privileges can access the “Customisation Module for Esignatures and Record Locking Functionality” page and they are the only ones who can lock and unlock records for a specific form. If they have the additional privilege, they may lock all forms at once for any given record. By default, any user with “Lock/Unlock” privileges will be able to see the Lock option at the bottom of the data collection instrument, although other users will not see this option. Once a form is locked for a record, the form will display (for all users) the time it was locked and the user who locked it and all fields on the form will be disabled/readonly until someone with “Lock/Unlock” privileges unlocks the form.



You may set the “Record Locking” option to be displayed or not be displayed on any given form by checking/unchecking the checkboxes on the far left. By default, the Record Locking option will be displayed on all forms for those with appropriate rights. You may also provide custom text to be displayed for the Lock option by entering it in the text box and clicking “Save”. If you have set the option to display the Lock option but have not set any custom text, the following text will be displayed by default: *“Lock this record for this form? If locked, no user will be able to edit this record on this form until someone with Lock/Unlock privileges unlocks it.”*

Applications

- Calendar
- Data Exports, Reports, and Stats
- Data Import Tool
- Data Comparison Tool
- Logging
- Field Comment Log
- File Repository
- User Rights and DAGs
- Record Locking Customization
- E-signature and Locking Mgmt
- Data Quality
- API and API Playground
- REDCap Mobile App
- External Modules


Display the Lock option for this instrument?	Data Collection Instrument	Also display E-signature option on instrument?	Lock Record Custom Text	Edit / Remove Custom Text
<input checked="" type="checkbox"/>	Demographics	<input type="checkbox"/>	<input style="width: 100%;" type="text"/> <input type="button" value="Save"/>	
<input checked="" type="checkbox"/>	Alcohol Dependence Scale Scored	<input type="checkbox"/>	<input style="width: 100%;" type="text"/> <input type="button" value="Save"/>	
<input checked="" type="checkbox"/>	Final Visit	<input type="checkbox"/>	<input style="width: 100%;" type="text"/> <input type="button" value="Save"/>	


If custom text has been set, it can be edited or removed at any time by clicking the icons on the right . If nothing is changed on the page from its original settings, then the Lock option will be displayed on all forms for any user with “Lock/Unlock” privileges, and will display the default text listed above.

<input checked="" type="checkbox"/>	Demographics	<input type="checkbox"/>	Please lock this form	 
-------------------------------------	---------------------	--------------------------	-----------------------	---


Once you have checked the box to “Display the lock option for this instrument?” you will see a new section in your records. The new section is located in the “Form Status” section under “Complete?”. You will check the box beside “Lock” and click the “Save Record” button.

Form Status

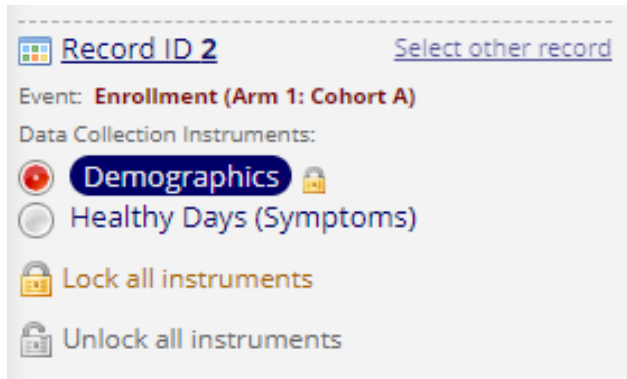
Complete? 

Please lock this form  **Lock**

After you click the “Save Record” button, you will see a dialog box showing the record is locked and who locked it

 **Locked by ahollingsworth** (Ali Hollingsworth) on 01-07-2019 2:06pm
A user has locked record "2" for the form "Demographics". If you have locking/unlocking privileges, you may unlock this record at the bottom of the page.

When a record has been locked, the record information changes in the “Data Collection” menu on the left side of the screen.



Form Status	
Complete?	<input type="button" value="Incomplete"/>
Please lock this form	<input type="button" value="Lock"/> <input type="button" value="Unlock form"/>
Locked by ahollingsworth (Ali Hollingsworth) on 01-07-2019 2:06pm	

Notice, the “Lock all forms” and “Unlock all forms” links listed. To unlock a record from this menu, click on “Unlock all forms” link. After you click the “Unlock all forms” link, you will see a dialog box to verify you want to unlock the record. Click on the “OK” button, to unlock the record


To unlock a record, edit the record and then click on the “Unlock form” button.

After you click the “Unlock form” button, you will see a dialog box to verify you want to unlock the record. Click on the “Unlock” button. After you click the “Unlock” button, you will see a dialog box stating your record was successfully unlocked. Click on the “Close” button






Esignatures and Locking Management

The “E-signature and Locking Management” application gives you various views of the “Lock/E-Sign” status of your data entry forms. E-signatures are an extension of the record locking/unlocking functionality.

The table shown will display all existing records in the project with their status as locked or e-signed for all data entry forms. Forms that do not allow locking will not be displayed. You may use the “Actions” links to filter the table in various ways to show or hide rows based on criteria related to its locking or e-signature status. You may click the View Record link to view that record on the data collection instrument, which will open in a new window. If you would like to export the table as a file in CSV format, simply click the “Download the table below as Microsoft Excel (CSV)” link.

 [Download the table below as Microsoft Excel \(CSV\)](#)

Actions: [SHOW ALL ROWS](#) | [Show timestamp / user](#) | [Hide timestamp / user](#) | [Show locked](#) | [Show not locked](#) | [Show e-signed](#) | [Show not e-signed \(excludes N/A\)](#) | [Show both locked and e-signed](#) | [Show neither locked nor e-signed \(excludes N/A\)](#) | [Show locked but not e-signed \(excludes N/A\)](#)

All Records				
Record	Form Name	Locked?	E-signed?	
1	My First Instrument			View record
1	Visit Details			View record
1	Medication History		N/A	View record
1	Education			View record
2	My First Instrument			View record
2	Visit Details			View record
2	Medication History		N/A	View record
2	Education			View record
3	My First Instrument			View record
3	Visit Details			View record
3	Medication History		N/A	View record
3	Education			View record
4	My First Instrument			View record
4	Visit Details			View record

To activate the E-signature option on a form, you must first use the “Record Locking Customisation” application to display the E-signature option on data collection instruments. Note: Only users with “Lock/Unlock” user privileges can access the “Customisation Module for E-signatures and Record Locking Functionality” page and they are the only ones who can lock and unlock records for a specific form.

Display the Lock option for this instrument?	Data Collection Instrument	Also display E-signature option on instrument?	Lock Record Custom Text	Edit / Remove Custom Text
<input checked="" type="checkbox"/>	My First Instrument	<input checked="" type="checkbox"/>	<input type="text"/> <input type="button" value="Save"/>	
<input checked="" type="checkbox"/>	Visit Details	<input checked="" type="checkbox"/>	<input type="text"/> <input type="button" value="Save"/>	
<input checked="" type="checkbox"/>	Medication History	<input type="checkbox"/>	<input type="text"/> <input type="button" value="Save"/>	
<input checked="" type="checkbox"/>	Education	<input checked="" type="checkbox"/>	<input type="text"/> <input type="button" value="Save"/>	

The E-signature option is displayed to users that have the e-signature privileges on forms for which the esignature option is enabled. Once a data collection instrument has been locked for a given record in the project, a person with e-signature privileges may then apply an e-signature to that form. The e-signature option appears as a check box that says E-signature, which appears just above the "Save Record" button and immediately below the Locked check box.

Complete? Incomplete ▾

Lock this record for this form?
If locked, no user will be able to edit this record on this form until someone with Lock/Unlock privileges unlocks it.

Lock

E-signature [\(What is this?\)](#)

Save & Exit Form Save & ... ▾

-- Cancel --

Although locking a record prevents its data from being modified, the e-signature goes a step farther, and serves as the equivalent of a handwritten signature. If a record has been e-signed, then it denotes that its data has been both locked (to prevent further changes) and authorised (Ex: By a user with e-signature privileges).

Note: Anyone with locking privileges (even if lacking e-signature authority) will negate the e-signature on a form when unlocking the record, after which data changes can be made to the record. The e-signature can be re-applied after such data changes.

For any given record, an e-signature can be saved and negated on a form an unlimited number of times. When saving an e-signature, a user will be asked to enter their username and password for verification. If the username/password verification fails three times in a row, the user will be automatically logged out of REDCap.

Similar to the record locking functionality, the e-signature history is also stored in REDCap's data audit trail on the Logging page. If someone wishes to view the historical record of e-signatures in the project, they may do so by filtering the audit log by "Record locking & e-signatures" either for a specific record or for all records in the project.

Data Quality

The Data Quality application enables you to run tests on your project to check for discrepancies in your data. The “Data Quality Rules” table show some pre-defined data rules that you may utilise and run. You may also create your own rules or edit, delete, or reorder the rules you have already created.

Execute Rules

The pre-defined rules listed in red text cannot be modified, reordered, or removed. They are there if you wish to use them. To find discrepancies for a given rule, simply click the “Execute” button next to it, or click the “Execute rules: All” button to run all the rules at once. The “Clear” button refreshes the view to the original state before any rules were executed.

Data Quality Rules

Execute rules: **All** | A | except A&B | Clear

Apply to: -- All records --

Rule #	Rule Name	Rule Logic (Show discrepancy only if...)	Real-time execution ?	Total Discrepancies	Delete rule?
A	Missing values*	-		Execute	
B	Missing values* (required fields only)	-		Execute	
C	Field validation errors (incorrect data type)	-		Execute	
D	Field validation errors (out of range)	-		Execute	
E	Outliers for numerical fields (numbers, integers, sliders, calc fields)**	-		Execute	
F	Hidden fields that contain values***	-		Execute	
G	Multiple choice fields with invalid values	-		Execute	
H	Incorrect values for calculated fields	-		Execute	

Add

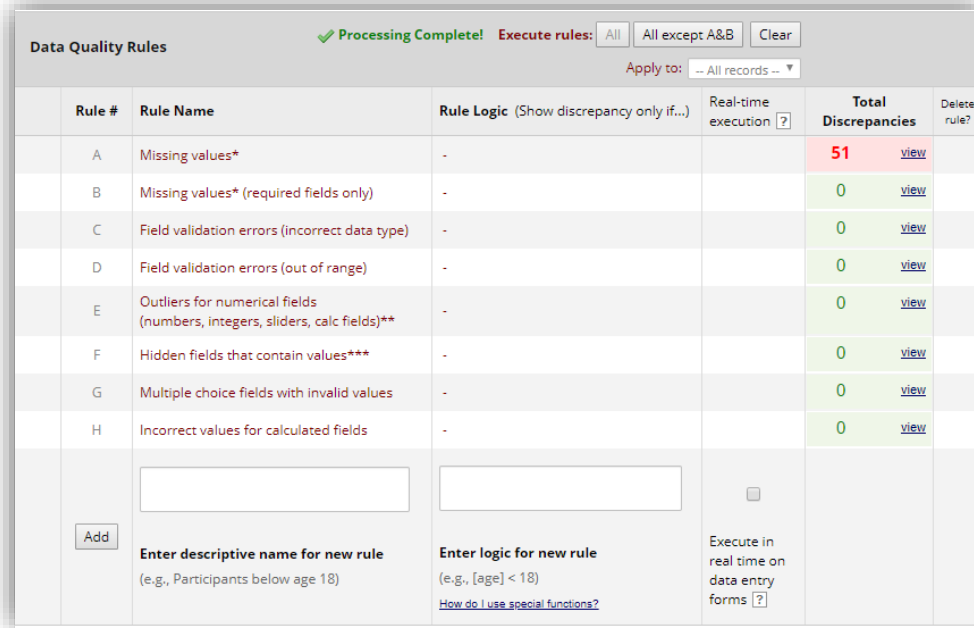
Enter descriptive name for new rule
(e.g., Participants below age 18)

Enter logic for new rule
(e.g., [age] < 18)
[How do I use special functions?](#)

Execute in real time on data entry forms [?](#)

Discrepancies

Once you click on the “Execute rules: All” link, you will see the following table:



The screenshot shows the 'Data Quality Rules' interface. At the top, there is a status indicator 'Processing Complete!' and a dropdown menu for 'Execute rules:' with options 'All', 'All except A&B', and 'Clear'. Below this is an 'Apply to:' dropdown set to '-- All records --'. The main table has columns for Rule #, Rule Name, Rule Logic, Real-time execution, Total Discrepancies, and Delete rule?. The first row (Rule A) is highlighted in red and shows 51 discrepancies. Other rules (B-H) show 0 discrepancies. Below the table is an 'Add' button and a form to create a new rule with fields for 'Enter descriptive name for new rule', 'Enter logic for new rule', and a checkbox for 'Execute in real time on data entry forms'.

Rule #	Rule Name	Rule Logic (Show discrepancy only if...)	Real-time execution	Total Discrepancies	Delete rule?
A	Missing values*	-		51	view
B	Missing values* (required fields only)	-		0	view
C	Field validation errors (incorrect data type)	-		0	view
D	Field validation errors (out of range)	-		0	view
E	Outliers for numerical fields (numbers, integers, sliders, calc fields)**	-		0	view
F	Hidden fields that contain values***	-		0	view
G	Multiple choice fields with invalid values	-		0	view
H	Incorrect values for calculated fields	-		0	view

Add

Enter descriptive name for new rule
(e.g., Participants below age 18)


Enter logic for new rule
(e.g., [age] < 18)
[How do I use special functions?](#)

Execute in real time on data entry forms

Rules that identify discrepancies (Ex: where your project contains data for which the calculation expression returns False) are highlighted in red. This table provides you with a total number of discrepancies found for each rule and will allow you to view the details of those discrepancies by clicking the “View” link next to each module allows you to find discrepancies in your project data.

When you click on the “View” link, you will see the following table:

Rule: **Missing values***
Discrepancies found: **51**

Record	Discrepant fields with their values	Status	Exclude 
1	"First Name" first_name = [no data]	Missing value	exclude
1	"Last Name" last_name = [no data]	Missing value	exclude
1	"Street, City, State, ZIP" address = [no data]	Missing value	exclude
1	"Phone number" telephone_1 = [no data]	Missing value	exclude
1	"Ethnicity" ethnicity = [no data]	Missing value	exclude
1	"Race" race = [no data]	Missing value	exclude
1	"Gender" sex = [no data]	Missing value	exclude
1	"Height (cm)" height = [no data]	Missing value	exclude
1	"Weight (kilograms)" weight = [no data]	Missing value	exclude
1	"On average, how many pills did you take each day..." pmq1 = [no data]	Missing value	exclude
1	"Using the handout, which level of dependence do ..." pmq2 = [no data]	Missing value	exclude
	"Would you be willing to discuss your experiences..."		

Close

When you click the “View” button, it will show you the records that failed the data quality test. You can navigate to the record that contains the discrepant value by clicking on the value. When you click on the value, your data form will open. Clicking “exclude” will mark a discrepant value as not to be included as a discrepancy in future executions of this rule.

If a discrepancy has been found for a given rule, any individual discrepancy in the list of results may be excluded from those results in the future. Excluding a result merely prevents it from being included in the count of discrepancies if the rule is executed again in the future. Excluded results can be accessed again by clicking the “view” link at the top of the results table for that rule, after which they can be unexcluded, if desired.

Add a new rule

You may also build and execute your own rules at the bottom of the table. Rules can be set up using a literal logic format (Ex: [age] > 18) that will be evaluated as a Boolean value (true or false) after an existing record's value for that field is substituted (Ex: assuming a record's value is 17 for "age", 17 > 18 evaluates as false). The logic will be applied to all existing records in the project, and for any record for which the logic evaluates as true, it will return it as a discrepancy for that rule. Similar to branching logic and calculated fields, REDCap field names may be utilised in the rule logic by placing the variable name inside square brackets []. Also, for longitudinal projects, you may reference a field on one specific event by prepending the variable name in the logic with the unique event name in square brackets.

Your custom rules can include mathematical operations and also advanced functions to provide you with a great amount of power for validating your project data. You can also activate the real time execution of your custom rules to continually ensure the data integrity of your project.

Data Quality Rules Execute rules: All All except A&B Clear

Apply to: -- All records --

Rule #	Rule Name	Rule Logic (Show discrepancy only if...)	Real-time execution <input type="checkbox"/>	Total Discrepancies	Delete rule?
A	Missing values*	-		Execute	
B	Missing values* (required fields only)	-		Execute	
C	Field validation errors (incorrect data type)	-		Execute	
D	Field validation errors (out of range)	-		Execute	
E	Outliers for numerical fields (numbers, integers, sliders, calc fields)**	-		Execute	
F	Hidden fields that contain values***	-		Execute	
G	Multiple choice fields with invalid values	-		Execute	
H	Incorrect values for calculated fields	-		Execute	

<input type="button" value="Add"/>	<input type="text" value="participants age over 18"/>	<input type="text" value="[age]>18"/>	<input checked="" type="checkbox"/>		
	Enter descriptive name for new rule (e.g., Participants below age 18)	Enter logic for new rule (e.g., [age] < 18) How do I use special functions?	Execute in real time on data entry forms <input type="checkbox"/>		

Add a new rule by entering a description of the rule and the calculation expression. Then click “Add”. If your expression includes a “less than” sign (<), make sure that you include a space after it (as shown above). Special functions may also be used within the logic as well (similar to functions in calculated fields), all of which are listed on the Help & FAQ page. If Data Access Groups exist for this project, then discrepancies will also be stratified according to their group (assuming the user viewing this page is not in a group). Any user within a Data Access Group will only be able to see the discrepancies for their own group. Also, if users do not have user privileges to view or edit data on specific data entry forms, then they will not be able to view data from those forms if displayed in any results on this page as a data quality discrepancy.

Note: Although setting up a Data Quality custom rule may at times be very similar to constructing an equation for a calculated field, calc fields will ALWAYS have to result in a number, whereas the Data Quality custom rule must ALWAYS result with a TRUE or FALSE condition and NEVER a value.

Real Time Execution

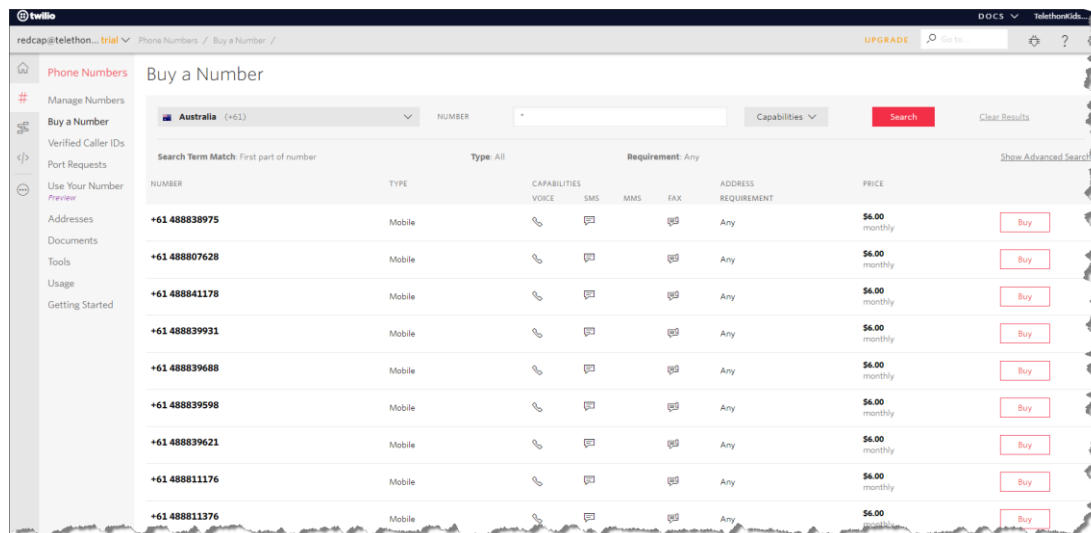
Checking the “Real-time execution” checkbox for any custom data quality rule will enable the rule to be executed invisibly on data entry forms whenever a user clicks the “Save” button to create or modify a record. After clicking “Save”, it will execute all relevant data quality rules invisibly (Ex: behind the scenes) and will display a warning pop-up message if any of the rules have been violated, in which it will display a list of the data quality rules that were violated and also display the fields involved with their data values. If no rules were violated, then it will save the record as usual and not display a pop-up message. Just like the results that are returned when executing rules on the Data Quality page itself, results displayed on data entry forms for “Real-time execution” can be excluded (if desired) so that they will not be displayed again if they are still in violation in the future.

Using SMS with REDCap

REDCap has the capability to make voice calls and send SMS text messages to survey respondents by using a third-party web service named Twilio (www.twilio.com). In this way, you could invite a participant to take a survey by sending them an SMS message or by calling them on their phone, in which the data would be collected in REDCap directly from their phone without having to use a webpage. There are many different options available for how you can invite participants and how they can take your surveys, either as a voice call survey or as an SMS conversation.

SETUP & CONFIGURATION:

A Twilio user account must be created and funded with some money (since there is a cost for each phone call made and for each SMS message sent). REDCap administrator can then enable the feature to a REDCap project. Each account can have one or multiple phone numbers associated with it. Hence, different projects can have different phone numbers associated with it. Same number **cannot** be used for multiple projects concurrently. But after one project is complete or if the project no longer requires to use twilio features a new project can use the same number.



The screenshot shows the Twilio 'Buy a Number' page. The interface includes a sidebar with navigation options like 'Phone Numbers', 'Manage Numbers', 'Buy a Number', 'Verified Caller IDs', 'Port Requests', 'Use Your Number', 'Addresses', 'Documents', 'Tools', 'Usage', and 'Getting Started'. The main content area displays a search filter for 'Australia (+61)', a search bar, and a 'Search' button. Below the search bar, there is a table of available phone numbers. The table has columns for 'NUMBER', 'TYPE', 'CAPABILITIES' (VOICE, SMS, MMS, FAX), 'ADDRESS REQUIREMENT', and 'PRICE'. Each row represents a different phone number, all of which are mobile numbers and cost \$6.00 monthly. Each row also includes a 'Buy' button.

NUMBER	TYPE	CAPABILITIES	ADDRESS REQUIREMENT	PRICE				
		VOICE	SMS	MMS	FAX			
+61 488838975	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488807628	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488841178	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488839931	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488839688	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488839598	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488839621	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488811176	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy
+61 488811376	Mobile	☎	✉	✉	✉	Any	\$6.00 monthly	Buy

The following choices are available for invitation delivery method:

1. Initiate survey as voice call,
2. Initiate survey as SMS conversation
3. Send survey invitation with survey link via SMS
4. Send survey invitation via SMS to take survey as voice call (respondent makes call)
5. Send survey invitation via SMS to take survey as voice call (respondent receives call when replying via SMS)

These methods can be utilized within a single project. The choice of delivery method completely depends upon your specific use case for how you want to collect data from your participants.

VOICE CALL SURVEYS:

When participants take a survey as a voice call, questions are asked one at a time, in which the Twilio service will use text-to-speech technology to read the questions to the participant audibly on their phone. You may choose the language and/or dialect in which the text should be read. Participants will respond by entering numbers on their phone's keypad, thus only numeric responses can be used because of this limitation (this includes the use of integer/number fields and multiple choice questions with numeric codings, in which the participant will enter the numeric coded value on their keypad, not the label that is read to them over the phone). For example, the question might be a Yes-No question, which might look like 'Do you like ice cream? Yes, press 1. No, press 0.', or a number question like 'What is your age?'

SMS SURVEYS:

When participants take an SMS survey, questions are asked one at a time as an SMS text message conversation/thread. Unlike voice calls, participants in voice calls can only respond with numbers, they may respond with any kind of alpha-numeric text for an SMS survey.

NOTE:

Only REDCap administrators can enable the Twilio option to initiate a survey as an SMS conversation. Much like email, SMS is not considered a secure form of communication, so you may not want to administer surveys as SMS conversations if the participant will be submitting identifying information unless you have been granted special permission from the participant to do so. Given such sensitive privacy issues, only your local REDCap administrator can enable the optional setting to use SMS surveys. **You must notify your administrator about this if you wish to have this option enabled.**

COMPATIBILITY:

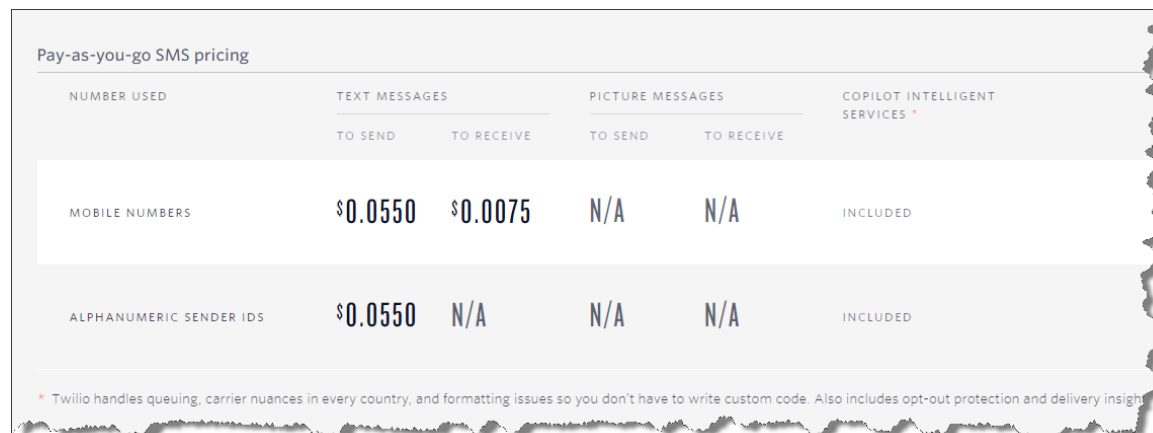
Most of REDCap's survey features still function much the same when taking a survey via SMS or as a voice call. This includes the enforcement of required fields, field validation, branching logic, using the Survey Queue for multiple surveys (only works with Auto-Start enabled), survey email notifications and confirmations, the Participant List, Automated Survey Invitations, survey Stop Actions, and computer adaptive tests (CATs) downloaded from the REDCap Shared Library. **One of the few survey features that is not compatible is the Survey Login feature.**

COST:

To use the Twilio SMS and Voice Call services in a REDCap project, you must connect your project to your Twilio account by entering your Twilio credentials into REDCap. And as REDCap makes calls and/or sends SMS messages using this service, all charges to your Twilio account will be made based upon its usage. This is not done by REDCap but is done internally by Twilio as you use its services. In this way, no monetary transactions are made by REDCap, and thus it is your responsibility to maintain the funds in your Twilio account to ensure that the service continues to work for your REDCap project. If your Twilio account runs out of funds, the Twilio services in REDCap will cease to function.

The rates are different as per the contract type (Pay-as-you-go, Committed-use discount or Volume discounts) and invitation delivery method (programmable Voice, SMS, etc.). Details can be found on <https://www.twilio.com/sms/pricing/au>.

Brief overview of SMS is shown below:



The image shows a screenshot of a pricing table for Twilio's Pay-as-you-go SMS services. The table is titled "Pay-as-you-go SMS pricing" and has a decorative, torn-edge border. It lists costs for mobile numbers and alphanumeric sender IDs, broken down by text and picture messages, and whether Copilot Intelligent Services are included.

NUMBER USED	TEXT MESSAGES		PICTURE MESSAGES		COPILOT INTELLIGENT SERVICES *
	TO SEND	TO RECEIVE	TO SEND	TO RECEIVE	
MOBILE NUMBERS	\$0.0550	\$0.0075	N/A	N/A	INCLUDED
ALPHANUMERIC SENDER IDS	\$0.0550	N/A	N/A	N/A	INCLUDED

* Twilio handles queuing, carrier nuances in every country, and formatting issues so you don't have to write custom code. Also includes opt-out protection and delivery insight.


Other cost associated are cost for phone numbers for the twilio account. Depending on the capabilities of phone numbers (ability to make voice calls, send fax, send receive SMS, etc.), the charge ranges from \$2.50 to \$30 monthly.

PRIVACY & SECURITY INFO:

It is important to understand that this feature utilizes the third-party service Twilio.com, which means that all voice calls and SMS messages will be routed through Twilio's servers. However, REDCap ensures that voice call records and SMS transcriptions do not stay in Twilio's logs but are removed shortly after being completed. This is done for security and privacy concerns (e.g., HIPAA), in which your survey participants' phone numbers and their survey responses do not get permanently logged on Twilio's servers but instead remain securely in REDCap.

GETTING STARTED WITH TWILIO:

To get started you should create an account with Twilio and ask the REDCap administrator to enable the Twilio functionality for your project. Once you have received your Twilio account details, you can provide these details to your administrator to enter into the project settings. It is then the responsibility of the Project owner (or delegate) to configure the Twilio settings for the project.



Complete!

[Not complete?](#)


Enable optional modules and customizations

Modify	<input checked="" type="checkbox"/> Repeatable instruments ?
Disable	<input checked="" type="checkbox"/> Auto-numbering for records ?
Enable	<input type="checkbox"/> Scheduling module (longitudinal only) ?
Enable	<input type="checkbox"/> Randomization module ?
Disable	<input checked="" type="checkbox"/> Designate an email field for sending survey invitations ? Field currently designated: email ("Email Address(es)")

[Additional customizations](#)

Settings displayed to Administrators only:

Modify	<input checked="" type="checkbox"/> Twilio SMS and Voice Call services for surveys ?
------------------------	--



Complete!

[Not complete?](#)

Twilio SMS and Voice Call services

To begin utilizing the Twilio SMS and Voice Call services in this project, click the 'Configure' button below. Once you have the Twilio service enabled and have created a survey in this REDCap project, you may click the 'analyze surveys' button, which will run an analysis on all your surveys to determine if they can be used as an SMS survey or as a Voice Call survey.

Go to [Configure Twilio settings for surveys](#) or [Analyze surveys for SMS & Voice Calls](#)