



REDCap Data Quality Process

Introduction

Implementing a project in REDCap automatically imposes a degree of structure on data collection. However, without a formal data quality process, even the best-designed project can be bogged down over time as a result of poor data quality. This document outlines a data quality process that offers a starting point for most REDCap projects. It is not intended as a detailed discussion of data quality practices.

Critical Variables

Identify your critical variables. For a research study database, these are normally the variables that represent study outcomes or any variables that have the capacity to influence outcomes. They may also include variables that represent dates and times. (No one, least of all a statistician, likes to see study events that are out of sequence.)

Supporting data, that is not critical, should also be collected as accurately as possible and you may wish to apply checks to this data. However, in a large project it is often most practical to focus resources on the most critical data first.

Enforce Data Types

Your REDCap project should be designed to enforce data types wherever possible. Use REDCap's variable types and validations to ensure that data is formatted correctly during data entry.

- Avoid free text if the data is known to be categorical. Use radio buttons, drop-downs and checkboxes instead.
- Apply an appropriate validation to numeric variables. How many decimal places do you require? Is the variable collecting only integer data, etc?
- If you are collecting email addresses, phone numbers, etc. choose an appropriate validation.
- Apply data types and validations wisely. They are "hard" checks that can prevent data entry if applied incorrectly.

Range Checks

For numerical data add range checks to any variables where values are expected to fall within a specific range.

- Range checks are an aide to data entry, alerting the user to values that may be incorrect. They are "soft" checks. When range checks are violated REDCap displays a warning but it does not prevent data entry from continuing.

- If applied too rigorously range checks can be annoying or an impediment to data entry.
- For clinical values where results are expected to be within a “normal range” consider your study population. For example, in an oncology study where participants are often quite sick, range checks based on “normal range” may be too narrow and result in too many interruptions to data entry. In this scenario it is better to use normal range +/- a percentage.

Inform Data Entry

Where data is expected in a particular format or have known units it is helpful for data entry staff to understand what is expected. Use REDCap’s Field Note feature to display hints such as:

Systolic Blood Pressure:	<i>mmHg. (Int)</i>
Weight:	<i>Kg (nnn.nn)</i>
Name:	<i>First, Last</i>

Branching

Use branching logic to display only variables that are relevant based on current context. For example, do not display the pregnancy test question if your participant is male or is not of childbearing potential.

Data Quality Rules

REDCap provides the Data Quality module where you can write rules to identify possible issues with your data. Building data quality rules in REDCap may look complex, but it is really not much harder than writing branching logic. REDCap does provide a few standard, built-in rules. These built-in rules can be useful, but may also create too much noise. It is often better to build custom rules to specifically check your data. Such rules might be...

- Missing data - For each critical variable, check that the data has been entered.
- If your study has inclusion/exclusion data, check that these questions are answered correctly to allow inclusion in the study.
- Has the study participant consented? If so, does the date of consent fall within an appropriate range of dates for the study?

Data Listings

Some checks are complex to program into data quality rules, or may be too time consuming to be practical. Under these circumstances it may be more efficient to configure reports that display the data to be checked. It is often easier to review a listing than to inspect individual pieces of data. For example, in a clinical trial where clinic visits and procedures are expected to follow sequentially, it is often best to simply list the dates and review them manually.

Discrepancy Resolution

Once you discover an issue or discrepancy in your data it will need to be resolved. For smaller, less complex projects this might simply involve correcting the data or emailing someone to establish a correct value. For a multi-site study you may wish to use REDCap’s built-in query process wherein queries can be entered into the system and assigned to users for resolution.

Consider writing and maintaining a data handling manual. This is an important tool that can help you and the study team handle issues consistently over time. Every time a situation arises that requires a decision you can document that decision in the data handling manual. Next time a similar situation arises the solution will already be documented and can be applied consistently.

Process

Once you have an appropriate study design and data quality checks implemented in REDCap it is helpful to establish and document a consistent and regular process for reviewing the data and applying the checks. The process could include:

- Manual review of newly entered data
- Running data quality rules
- Reviewing reports

How frequently you review your data using this process will depend on the study. Some studies will require a weekly review, others may only require a monthly or six-monthly review. Data quality should be reviewed on an ongoing basis throughout the project. Don't leave it to the end. It is more efficient to handle data issues as they occur rather than after a significant time has elapsed. At the very least, conduct a quality review before each key project milestone, such as an interim analysis or independent data review.

Assign a member of the study team to take responsibility for data quality and to manage this process. In a multi-site study, it is helpful to make each site accountable for their data issues and REDCap keeps metrics relating to queries and query resolution which may be helpful.

Guidelines and Best Practices

Routine data review and proactive data management are essential to maintaining high-quality research data. Study teams should continuously review, verify, export, back up, and securely retain project data throughout the study lifecycle—not only at project closure.

Effective data management helps study teams:

- Identify workflow issues, data-entry errors, missing or inconsistent data, and unexpected trends early.
- Reduce the risk of data loss.
- Maintain regulatory and study compliance.
- Support data quality and study integrity.
- Prepare for monitoring, audits, analysis, and project closure.

Study teams should routinely:

1. **Export and review study data.** Regular exports help verify data completeness, identify inconsistencies and unexpected values, maintain copies for analysis and retention, and support monitoring and regulatory review.
2. **Perform routine data checks.** Review for missing or incomplete records, invalid or unexpected values, outliers, duplicate entries, incorrect dates or time sequences, unexpected survey responses, calculation discrepancies, and incorrect branching logic.
3. **Review project configuration and workflows.** Confirm that user rights and project permissions, survey

workflows, automated invitations, alerts and notifications, longitudinal event assignments, calculated fields, and branching logic continue to function as expected—particularly after imports, edits, or workflow changes.

4. **Monitor reports and dashboards.** Use custom reports and dashboards to track incomplete records, monitor enrollment, review missing forms or visits, and monitor survey completion.
5. **Use REDCap Data Quality Rules.** Navigate to **Applications → Data Quality** to identify potential issues such as missing required values, invalid field values, incorrect calculated field values, potential duplicate records, and other data discrepancies.
6. **Review uploaded files and eConsent records.** For projects using eConsent Framework PDFs, File Upload fields, or participant-uploaded documents, confirm that required files and consent records are present, accessible, and appropriately retained.
7. **Securely store and back up study data.** Maintain copies of important study data and materials in institutionally approved locations outside REDCap, such as departmental secure servers, institutional OneDrive, or other approved research storage environments. Verify that exported files and backup sets can be opened and restored.

The frequency of review should be appropriate for the study's complexity, enrollment activity, and regulatory requirements.

Important: REDCap should not be treated as the sole or permanent storage location for study data. Study teams are responsible for routinely reviewing, backing up, and securely retaining project data and related materials throughout the study lifecycle.

Project Design and Development

We cannot stress enough how important it is to test your development project thoroughly before having it moved to Production. However, we realize that some users might not know exactly what that means. Therefore, we've created a [Development Project Testing How-to Guide.pdf](#) – highly recommend you check it out. Here's the deal:

- Create lots of test data! This is what Development is for. You want to go through the entire data entry process, end-to-end, in the way you plan to execute the data entry process for real.
 - This means for a data entry project, you'll go to Add/Edit Records and add your data.
 - For a survey project, you'll send yourself or other colleagues surveys and complete them as a survey respondent would.
- Testing helps you quickly identify issues in your project things you wouldn't be able to identify by just looking at the Online Designer.
- Don't wait until you've built all your instruments to test. Any time you build a new instrument, or a complex field, or add some branching logic – make sure it works before moving on! It will save you time in the end.
- Test your draft changes in REDCap before submitting them for review using the [Draft-Preview-Mode.pdf](#) feature.