Electronic Data Capture

and Study Management

William Mattingly

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Contents

List of Figures	5
Preface	9
I Project Creation	11
1 Creating Your Study	13
1.1 Setting Up Your REDCap Project	13
1.2 Navigating Around Your Project	16
1.3 Setting Up Project Features	17
2 Designing Your eCRF	19
2.1 Using the Online Designer Tool	19
2.2 Creating Your Data Instruments	20
2.3 Choosing Data Fields	21
2.4 Using Surveys in Your Study	24
2.5 Creating a Longitudinal Study	30
3 Managing Your Study Team	33
3.1 Who Can Access Your Study	33
3.2 Assigning Study Roles	36
3.3 Using Data Access Groups	36
4 Customizing Your Project	39
4.1 Enabling Optional Modules	39
4.2 Making Additional Customizations	40
4.3 Moving Project to Production	42

II	Project Management	45
5	Improving Study Quality	47
5.1	Exporting Data and Generating Reports	47
5.2	Importing Study Data	51
5.3	Comparing Study Records	52
5.4	Viewing Access Logs for Your Study	52
5.5	Using the Field Comment Log	53
5.6	Storing Files Securely	53
5.7	Validating and Locking Records	53
5.8	Creating Data Quality Rules	54
6	Application Programmer Interface	57
6.1	What is an API	57
6.2	Requesting a Token	57
6.3	Using the API Playground	57
6.4	Writing Your Script	59
7	REDCap Mobile App	61
7.1	Accessing the App Stores	61
7.2	Setting Up Your App	61
7.3	Setting Up Your Mobile REDCap Project	61
7.4	Collecting Your Study Data on the App	63
7.5	Using Your Device Camera to Collect Data	63
A	Setting Up a REDCap Installation	67
A.1	Obtaining a Copy	67
A.2	Example Install	67
	Bibliography	73

List of Figures

1.1	REDCap NavBar	13
1.2	Project Creation Dialog	14
1.3	Research Project Metadata	15
1.4	REDCap Sidebar	16
1.5	Project Setup Page	17
1.6	Project Home Page	18
2.1	Data Collection Instruments Panel	19
2.2	Online Designer Page	20
2.3	Sample Data Instrument Page	20
2.4	Add Field Dialog	21
2.5	Text Box Field	21
2.6	Calculated Field Equation Box	22
2.7	Multiple Choice Selections Box	22
2.8	Visual Slider Label Fields	23
2.9	File Attachment Dialog	23
2.10	Sidebar: Data Collection	24
2.11	Sidebar: Data Collection w/ Surveys	25
2.12	Data Collection Instrument Panel w/ Surveys	25
2.13	Basic Survey Options	26
2.14	Survey Design Options	26
2.15	Survey Customizations Panel	27
2.16	Survey Access Panel	28
2.17	Survey Termination Options	29
2.18	Project Setup Longitudinal Panel	30
2.19	Define Events Page	30
2.20	Add New Events Panel	31
2.21	Designate Instruments Page	31

3.1	User Rights Navbar	34
3.2	Add New Users Panel	34
3.3	Basic Rights Panel	35
3.4	Mobile and Locking Privileges	36
3.5	Other Privileges Section	36
3.6	User Role Table	37
3.7	Create New Groups Panel	37
3.8	Data Access Groups Table	37
4.1	Optional Modules Panel	39
4.2	Additional Customizations Dialog	41
4.3	Project Setup Bookmarks Panel	43
4.4	Project Setup Production Panel	43
5.1	Data Exports Page	48
5.2	Report Name Panel	48
5.3	Reports Access Panel	49
5.4	Fields to Include Panel	49
5.5	Report Filters Panel	50
5.6	Report Order By Panel	50
5.7	Other Export Options Panel	51
5.8	Sidebar: Reports Section	51
5.9	Data Imports Page	52
5.10	Data Comparison Page	52
5.11	Logging Page	52
5.12	Optional Modules Page	53
5.13	File Repository Page	53
5.14	E-signature Page	54
5.15	Data Quality Page	55
6.1	API Page	58
6.2	API Token Panel	58
6.3	API Playground Page	59
6.4	Sample API Request	59
6.5	Sample API Response	59
6.6	API Languages Panel	60
7.1	Mobile App Device Menu	62

7.2	Mobile App Page	62
7.3	App Download Links	62
7.4	Set up Mobile Project on Device Panel	63
7.5	Sync Progress Screen	64
7.6	Mobile App Capture Screen	64
7.7	Mobile App Barcode Reader	65
A.1	CentOS Startup Screen	68
A.2	CentOS Installation Summary	68
A.3	CentOS User Password Setup	69
A.4	CentOS Install Complete Screen	70
A.5	Configuration Check Results	72

Preface

This book is intended for potential and current users of the REDCap electronic data capture software developed and maintained by Vanderbilt University.[1] While project creators are usually interested in performing either a prospective or retrospective clinical study, this software has much to offer as a general purpose web-based database. It has commonly been used in applications including biological sample tracking, personnel management, and form submission systems. In addition to covering its standard use case of electronic data capture this book will also examine the use of REDCap for these different application domains.

The most important question to ask when considering REDCap as a data management tool is whether a suitable server is available to you. The software is available to the project's member consortium, and users representing academic or non-profit institutions can apply for membership and download REDCap at no cost. However, since it is web-based, it must be hosted on some type of physical hardware in order to be securely accessed by its users. The installation is not a 1-click process, and it requires some knowledge of the host operating system and computer networking.

Due to REDCap's growing popularity, many academic institutions have already worked with their information technology department to establish a REDCap server for their faculty and staff. Users coming from this space would only need to request an account through their institution in order to get started creating their own project. Some organizations will have a specific on-boarding policy for new users, possibly including a signed agreement to use the system responsibly and conform with all necessary regulatory requirements involving the use of human subjects.

REDCap is a continually evolving software project with a very active user ecosystem. New versions are released on a regular schedule, and while this book will use the most recent version available at the time of writing, REDCap v 9.1.0, not all features will be covered. One of the goals of this book is to provide new users a concise resource for getting started with REDCap, and a comprehensive user manual would detract from that goal. REDCap does, however, have excellent contextual help provided within the software, and whenever there is more information on a topic, the reader will be directed to the relevant location.

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Part I

Project Creation

Chapter 1

Creating Your Study

The primary unit of organization in REDCap is the project. Depending on the application of REDCap, a project can be customized to support a public survey, a longitudinal study or even an inventory tracking system. The first step to creating and customizing a new project is to select New Project from the home screen.

1.1 Setting Up Your REDCap Project

After logging in to your REDCap instance, click the New Project button from the tabs at the top of the screen as seen in Figure 1.1. The project creation dialog shown in Figure 1.2 will display and you can enter specific metadata for the project.

Project title

This field will hold the title of the project. The title should be descriptive and concise. As you will likely be making more than one REDCap project, it will be helpful to have some sort of organizational scheme to your project titles. Since REDCap uses a unique number to refer to projects internally, you can rename your projects after they are created and even after data has been entered.

Purpose of this project

This field holds the type of project you will be creating. There are four primary types by which REDCap projects are organized: Practice, Operational Support, Research, and Quality Improvement. If the intended use of your project falls outside these categories, you can select Other and type in the purpose of your project. It's important to note that these selections are for organization and reporting metrics only and will not affect the options and features available to your project once it is created.

- **Practice / Just for Fun** If you are interested in quickly looking through REDCap's available features or experimenting with project creation and setup, this is the appropriate purpose selection.
- **Operational Support** As discussed previously, some of the many useful applications of REDCap involve taking advantage of its design as a secure web-based database. These can include inventory tracking, time management, file upload submissions and many others. If you are planning to use

Figure 1.1: REDCap's NavBar at the top of the system home screen is used to navigate to the project creation dialog.

+ Create a new REDCap Project

You may begin the creation of a new REDCap project on your own by completing the form below and clicking the Create Project button at the bottom.

Project title:
Title to be displayed on project webpage

Purpose of this project:
How will it be used?

Project notes (optional):
Comments describing the project's use or purpose that are displayed on the My Projects page.

Start project from scratch ☒ Create an empty project (blank slate)
or begin with a template? ☐ Upload a REDCap project XML file (CDISC ODM format) [?](#)
☐ Use a template (choose one below)

★ Choose a project template (comes pre-filled with fields, forms/surveys, and other settings) [+ Add templates \(Administrators only\)](#)

select template	Template title (sorted by title)	Template description
☐	Basic Demography	Contains a single data collection instrument to capture basic demographic information.
☐	Classic Database	Contains six data entry forms, including forms for demography and baseline data, three monthly data forms, and concludes with a completion data form.
☐	Human Cancer Tissue Biobank	Contains five data entry forms for collecting and tracking information for cancer tissue.
☐	Longitudinal Database (1 arm)	Contains nine data entry forms (beginning with a demography form) for collecting data longitudinally over eight different events.
☐		Contains nine data entry forms (beginning with a demography form) for collecting data on

Figure 1.2: REDCap’s project creation dialog has the necessary fields for project metadata.

REDCap for this purpose, it is important to put some thought into the needs of your support project and consider REDCap’s limitations. It may be faster and less costly to adopt other software than to modify REDCap or use it in a way it was not intended.

- **Research** This is the primary type of project for which REDCap was designed. This can include observational studies, retrospective chart reviews, clinical trials, etc. When selecting the project type, REDCap will open a dialog for additional information.
- **Quality Improvement** Quality improvement projects will generally collect and analyze data in an ongoing effort to improve patient safety and clinical processes. Data collected for these projects must still be stored in HIPAA compliant environments, making REDCap an ideal choice for hosting this sort of project.

Assign project to a Project Folder

REDCap provides an organizational structure to help manage your projects. If you have already created project folders, you can select this checkbox and choose a folder to assign to your new project.

Project notes

Project notes is a free text field you may use to store information about your project that may help identify it to other members or provide a visual reminder about certain aspects of the project, such as the PI or clinical coordinator.

Project Templates

A new REDCap project can be blank, meaning it has no predefined structure, or it can take its structure from another project. Most projects will start with a blank slate, and have their structure created interactively through REDCap’s Online Designer.

New projects created by upload are XML files that follow the CDISC ODM format. Extensible Markup Language (XML) is a type of plain text file designed to contain arbitrary forms of structured data. The

Purpose of this project:
How will it be used? Research

Name of P.I. (if applicable): First name MI Last name

Email of P.I. (if applicable):

Name of P.I. as cited in publications (if applicable): (e.g., Harris PA)

IRB number (if applicable):

Please specify:

- ☐ Basic or bench research
- ☐ Clinical research study or trial
- ☐ Translational research 1 (applying discoveries to the development of trials and studies in humans)
- ☐ Translational research 2 (enhancing adoption of research findings and best practices into the community)
- ☐ Behavioral or psychosocial research study
- ☐ Epidemiology
- ☐ Repository (developing a data or specimen repository for future use by investigators)
- ☐ Other

Figure 1.3: Projects of type research include additional fields to store information like Principal Investigator name and contact information.

Operational Data Model (ODM) is an XML specification designed by the Clinical Data Interchange Standards Consortium (CDISC) to facilitate easy communication and exchange of electronic clinical research tools like electronic case report forms (eCRFs) and clinical data sets. If you are planning to migrate a REDCap project from one REDCap system to another, you will need to export it in ODM-XML format from the source system first, before uploading it through the file upload dialog.

Project templates are projects that an administrator has designated may be used as a starting point for other projects. REDCap is distributed with some templates for common study types available (assuming they have not been disabled by institutional REDCap administrators).

Types of Research Project

If your project falls under the category of research, REDCap provides additional metadata fields to track relevant research information as shown in Figure 1.3. These fields are only used for tracking and project reporting statistics, and do not affect the type of features available in the project.

- **Name of P.I.** A research project is generally led by a single individual called the primary investigatory (PI). In research involving human or animal subjects it is this individual that ultimately maintains responsibility that the research is conducted in an ethical manner. REDCap has some features which can use the PI's name to search the internet for publications related to a REDCap project.
- **Email of P.I.** This is the primary contact information for the PI of the project.
- **Name of P.I. as cited in publications** REDCap's internal publication matching routine will use information from this field to search for PI publications if it is provided.
- **IRB number** If the project involves a study requiring approval from the institutional review board (IRB) of an organization, this field can contain that information.
- **Research Type** The checkboxes under *please specify* refer to the category of research your study would fall under.
 - **Basic or bench research** For a project holding data used to develop and test theories about physical and chemical phenomena
 - **Clinical Research study or trial** For a project holding patient clinical data related to an investigational or observational study or trial
 - **Translational Research 1** A project participating in the “Bench-to-Bedside” process of translating knowledge from the basic sciences into new treatments
 - **Translational Research 2** Translating the results of clinical trials into standard practice

Figure 1.4: REDCap’s project-level sidebar includes links to a user’s projects, REDCap’s instant messenger, and project specific settings pages.

- **Behavioral or psychosocial research study** A project evaluating the behavior of human subjects as it effects their health or general well-being
- **Epidemiology** Projects aimed at discovering the relationship between diseases and the many factors which can cause them
- **Repository** A project serving as the look-up table for a bank of specimens
- **Other** If your project does not fall into one of the previous categories, you can specify Other and describe the purpose of your research project.

1.2 Navigating Around Your Project

After filling out the required information from the Create Project dialog, and clicking the Create Project button, you will be automatically navigated to the home page for your new project. If you navigate away from this page, you can get back to your project by navigating to the My Projects page and selecting it from the list of projects to which you have access. You are assigned access to all projects you create by default.

You may notice your project home page has changed the context of your REDCap session. When first logging in you were in the system context which shows the home page content and NavBar along the top. When in the project context the NavBar along the top is removed, and a sidebar with common project links and some useful contextual information is added to the left side of the screen as seen in Figure 1.4.

At the top of the sidebar, under the logo is the name of the current user and a link to log out of REDCap. Next are links to the My Projects page and REDCap Messenger, an instant messaging app allowing users to communicate directly or as a group. Next are four collapsible sections:

- Project Home and Design
- Data Collection
- Applications
- Help & Information

We will be going through the Data Collection and Applications sections in the following chapters, but for now we will focus on Project Home and Design.

The links in this section will allow you to navigate to the different subpages of your project and the project status indicator shows you whether your project is currently in development or production mode. The project subpages are

Figure 1.5: REDCap’s project setup page is the landing page when navigating to a project in development mode.

- Project Home
- Project Setup
- Designer
- Dictionary
- Codebook

We will focus on Designer, Dictionary and Codebook in the Data Collection chapter, but for now we will start with the Project Setup page, as this is the first page you land on after clicking “Create Project” from the project creation dialog. This will also be your landing page when navigating to your project from the My Projects page (while in Development Mode). The project setup page is shown in Figure 1.5.

The title of your project will be at the top of the page to the right of the sidebar, and a new set of tab buttons are located beneath it. We will focus on the Project Setup and Project Home tabs, but Other Functionality and Project Revision History will come up later. As we mentioned before, REDCap includes a lot of contextual information to guide you while using it, and one of these is a project creation checklist. While it isn’t necessary to check off the setup items as you go through them, it’s a good idea to make use of them, even as a REDCap expert. Going through the setup checklist, in order for every project will increase the consistency of your project development. Each panel in the Project Setup page has a button to check to track completion, so we start the process at the Main project settings panel.

1.3 Setting Up Project Features

The first decision to make for a new project is whether or not it will be utilized as a survey or using a traditional data entry process. This is most often determined by the scientific domain of your project. Social sciences will often make use of surveys whereas observational clinical studies usually involve a clinical research coordinator entering data directly. If there is any part of your project that will need responses from the subject, you should enable surveys by clicking the Enable button next to Use surveys in this project.

The next decision is whether or not your project will be longitudinal. A longitudinal project is one which follows a group of subjects over an extended period of time, collecting the same data points at a set interval. This is usually done for prospective clinical trials, but could also be the case with a study involving surveys. This is why these two options are available independently, as projects can be survey-based, longitudinal, both, or neither.

You will need to navigate to the Main project settings panel if you ever decide to change the metadata of your project like the title, project notes, etc. Now that you’ve decided if your project uses surveys or is longitudinal, you can click the I’m done! button in the Main project settings panel to track the completion of this step. The next checklist item is the Design your data collection instrument panel and this will be covered in the next chapter, Data Collection.

The tables below provide general dashboard information, such as a list of all users with access to this project, general project statistics, and upcoming calendar events (if any).

Current Users (1)	
User	Expires
wamatt01 (William Mattingly)	never

Project Statistics	
Records in project	0
Most recent activity	06/28/2019 9:26pm
Space usage for docs	0.00 MB

Upcoming Calendar Events (next 7 days)		
Time	Date	Description
		No upcoming events

Figure 1.6: REDCap’s project home page is the landing page for projects in production mode and shows the list of users with access to the project and the current number of records.

Before moving on in the project setup, click on Project Home. This page shown in Figure 1.6 becomes the landing page once your project design is complete and the project moves to production. In past versions of REDCap this is where several useful links were located, such as the link to the project codebook, a list of all the variables defined in your project, and a link to download your data dictionary. In the most recent version of REDCap these have been moved to the sidebar, making them much more accessible. However, there is still some useful information on the project home page including a list of the users that have access to your project, a list of upcoming events, when using REDCap’s calendar feature, and the number of records and most recent activity in your project.

Chapter 2

Designing Your eCRF

In the last chapter you created a new study project using the REDCap new project dialog. In this chapter we create the electronic case report form that will be used to collect survey or data fields.

2.1 Using the Online Designer Tool

Continuing with the Project Setup checklist from the previous chapter, the Design your data collection instruments panel shown in Figure 2.1 is the starting point for creating a new electronic case report form. There are several links of note in this panel. The Online Designer button will take you to the `online_designer` page and the Data Dictionary button leads to the `data_dictionary_upload` page. Links to these pages are also on the right sidebar as Designer and Dictionary. There is also the REDCap Shared Library button leading to a database of data collection instruments approved by REDLOC, the REDCap data collection working group. It's a good idea to experiment with creating your own data collection instruments before moving on to downloading validated instruments from the shared library.

The `online_designer` page seen in Figure 2.2 has a tab bar that is the same as the tab bar present on the `project_setup` page, with a couple of exceptions. Instead of tabs for Other Functionality and Revision History there are now tab links to the Data Dictionary and Codebook. If you have trouble locating a tab button that was present before, it may be because the page you are currently on has changed. Many of REDCap's layouts are contextual, meaning they can change in subtle ways when you navigate to a new page. Underneath the tab bar is a link to an instructional video for the Online Designer and a button called Create snapshot of instruments. REDCap's online designer automatically saves any changes you make to your instruments as you develop them, but it does not implement any sort of undo feature. It's a good idea to make regular snapshots of your instruments, in case you want to revert to a previous version.

Figure 2.1: The data collection instruments panel is the starting point for the initial setup of a project.

Figure 2.2: The online designer page provides an interactive builder for electronic CRFs.

Figure 2.3: The data instrument page includes controls for adding new data fields to the project.

2.2 Creating Your Data Instruments

If you examine the Data Collection Instruments panel, you should see several buttons under Add new instrument, Create, Import, and Upload. Import will take you to a page to pull an instrument from the REDCap shared library and Upload will open a dialog for uploading a Zip file containing a REDCap instrument. Create utilizes the online designer to develop a data instrument interactively. Below these buttons is a list of the instruments currently in your project. Every new blank REDCap project starts with the My New Instrument as its first instrument. Next to the instrument you will see cells describing the number of fields the instrument currently contains, a link to download a PDF of the current instrument, and button for performing miscellaneous instrument action. Clicking Chose Action will allow you to rename the instrument, copy it, delete it, or download it in Zip format to upload into another REDCap project. Notice you cannot delete an instrument if it is the only one in the project.

Mousing over the instrument name will show a pencil icon next to it which indicates that clicking will take you to the page for editing this instrument. Editing an instrument is how fields are added or removed interactively. Each instrument has its own page name, and editing it will take you to its page, as you can see in the URL of your browser window.

The page for editing an instrument is shown in Figure 2.3 and has a blue button that will return you to the Online Designer page, a button to allow previewing the way the instrument will look from a data entry screen, the label of the current instrument, and a list of the fields in the current instrument. Beneath each field will be two buttons Add field and Add Matrix of Fields. These buttons support the creating of new fields interactively within Online Designer.

Figure 2.4: The add field dialog includes settings for choosing the type of field, field label, and field variable name.

Figure 2.5: The text box will take input from the device keyboard when the box area has the focus.

2.3 Choosing Data Fields

Each field in the project has several metadata elements associated with it, the two most important of which are its label and variable name. Using the first field as an example, its label name is Record ID and its variable name is `record_id`. When looking at a survey or a data entry form, the field label will be displayed. When looking at a report or data export, it will be the variable name.

Clicking on the Add Field button will launch the Add New Field dialog shown in Figure 2.4 which starts with a drop-down list to select the type of the new field and a link to a short video tutorial. Each field type changes the layout of the Add New Field dialog to allow entry of additional data regarding the field.

Text Box

The first and most common type of field used in projects, is the Text Box. A text box field is meant to have input typed from a user's keyboard, and is best for data that can not be known in advance like a physician's notes or an open-ended survey response question.

In a live form or survey a text box will have its label and input field contained in a styled rectangle. The field input is on the right side and the field label is on the left with two icons. Clicking on the H icon will open the data history log for the field. Clicking the bubble icon will open either the field comment log or the data resolution workflow depending on which is enabled for the current project. These two features will be discussed in chapter Project Customizations. Survey input fields differ only in that they will not display these two icons.

Notes Box

The notes box input is similar to the text box, but is intended for larger amounts of text input. The box will appear larger on the screen for both survey and data entry forms. Unlike text box entry, there is no

Figure 2.6: Calculated fields require a calculation string specifying how the field value is derived.

Figure 2.7: Multiple choice fields require a list of possible values.

validation that can be defined for the notes box.

Calculated Field

A calculated field in REDCap is one which derives its value from other fields that have already been input into the form or survey. Its best use is for numerical calculations that would be tedious to perform upon each record. For example BMI is a common health metric used by clinicians and is based on a patient's height and weight. Height and weight are commonly stored in electronic medical records, and use a calculated field, the field for BMI in REDCap would automatically populate once the corresponding fields for height and weight were filled. The calculated field can also perform more advanced manipulations such as calculating a follow-up date based on a date of service or an age based on a date of birth.

Multiple Choice

Multiple choice fields provide the means for a user to select the value for a field from a list of options. This is more convenient for a user, but also has advantages in terms of data quality. The form designer can determine the only values that will go into the final database by limiting the possible selections. Values can be selected by clicking on a drop-down menu, or by displaying the entire list of options at once using what's called a radio button. For long lists, the drop-down option is necessary. Also useful for long lists is a selectable option for letting the user find the desired value from the list by typing into a search box.

Checkboxes

Checkboxes can be used when a field allows multiple different values to be associated with it, as in a "select all that apply" question. In the data dictionary, REDCap will number each checkbox item, and this number is used to refer to the response in reports and branching logic.

Yes - No

Yes-No and True-False fields are simply multiple choice type fields locked to two options. These come up frequently enough in survey and forms that it saves time to have a built-in type already set up.

Signature

REDCap supports digitized input from the mouse or a tablet screen which it will store in a field as an image file. This is intended for capturing signatures and other forms of consent.

File Upload

If a file needs to be uploaded in response to a survey or record, the file upload field can be used to provide a link to open a file attachment window. Once open the user can navigate to the file location in their operating

Labels displayed above slider (optional):

Left label (bottom, if vertical):

Middle label:

Right label (top, if vertical):

Display number value (0-100)? ☐

Figure 2.8: The visual slider maps slider screen position to a numerical value in a specified range.

Optional file attachment, image, audio, or video:

Embed an external video (provide video URL)

e.g. <https://youtube.com/watch?v=E1cCuWMupz0>,
<https://vimeo.com/62730281>, <http://example.com/movie.mp4>

Display format of video: ☐ Inline ☒ Inside popup

– or –

Attach an image, file, or embedded audio

☒ Upload document

Display format of attachment on page:

☐ Link

☐ Inline image

☐ Audio file (play in embedded player on page)

[Compatibility notice for embedded audio](#)

(Images wider than 600 pixels will be downsize to fit page.)

Figure 2.9: The file attachment dialog supports uploading a file from the local device or embedding a video url.

system and upload it through their browser. REDCap does not currently provide a convenient way to export all of the files for a given project. Doing so requires the help of a programming language and the REDCap API.

Slider / Visual Analog Scale

The visual slider field stores a response as a number, but unlike the standard text box entry it provides an on-screen slider to visually associate with the response.

Descriptive Text

Descriptive text is a selection that does not map to an entry in the data dictionary, but rather provides a place to present content to the survey respondent or data entry personnel. Content like text, images, download links to files, and even embedded videos can be placed on a form or survey using the descriptive text field type.

Begin New Section

The intention of the begin new section selection is to help organize the survey or form visually. Adding a new section provides a separator between groups of fields and can only be placed between two fields that have already been added. It can not be placed at the end or beginning of a form.

Text Box Validation Rules

One of REDCap’s most useful features is its input validation rules. These provide feedback to a user upon any input of data that is not of the expected type for a field or does not fit a pattern determined by the form designer. A list of the rules are shown in table

Sidebar: Data Collection

After creating the fields for a project it is useful to look at the project sidebar again and notice the Data Collection section. This section will appear differently depending on whether surveys have been enabled for the project in project setup.

Table 2.1: Supported REDCap Validation Rules

Validation
Letters only
Date (D-M-Y)
Date (M-D-Y)
Datetime (M-D-Y H:M)
Datetime w/ seconds (M-D-Y H:M:S)
Datetime w/ seconds (Y-M-D H:M:S)
Datetime (Y-M-D H:M)
Email
Integer
MRN (10 digits)
MRN (generic)
Number
Number (1 decimal place)
Number (2 decimal places)
Phone (North America)
Social Security Number (U.S.)
Time (HH:MM)
Time (MM:SS)
Zipcode (U.S.)

Figure 2.10: Standard data collection sidebar.

Without surveys, there are two links and an expandable list that are part of the data collection section. The first link is the Record Status Dashboard. This takes you to the record status dashboard page and shows a visual representation of all the instruments in the project and their states of completion.

The other link is the Add/Edit Records Link which takes you to the add record page. On this page a record from the current records can be selected, or a new record can be added. If auto numbering is enabled, the user only needs to click add record to be taken to the data entry field. Otherwise before adding a record, the user will have to assign the record some record ID.

The last link is a smaller one which reads show data collection instruments. This is a newer feature in REDCap and clicking on it displays the full list of instruments in the project. Each instrument will be shown as a link and clicking an instrument link will first prompt the user to select a record if one is not selected. Otherwise it will navigate to the selected instrument for the current record.

The content of the data collection section of the sidebar includes one additional link when surveys are enabled, the survey distribution tools link. This link leads to a page which allows customization of how surveys will be made available to participants. This page is covered in the next section on surveys.

2.4 Using Surveys in Your Study

Now that we are familiar with the way to structure form fields and instruments from the previous sections, we will look at the REDCap features aimed specifically at administering surveys. As discussed in the project

Figure 2.11: Data collection sidebar with surveys enabled.

Figure 2.12: The data collection instrument panels has new options available when surveys are enabled in the project.

creation section, the first step to using surveys in REDCap is to make sure the surveys feature is set to enabled on the project setup page. Once it is, several new options are available in both the data collection sidebar and the online designer.

With surveys enabled, navigating to online designer page shows a new section called Survey Options. Within this section are the Survey Queue, Survey Login, Survey Notifications and Automated Survey Invitations Upload links. Additionally there is a new button on each instrument in the instrument list called Enable as survey, and a new section called survey related options. Enabling an instrument as a survey will show the Survey settings and Automated Invitations buttons to appear in the survey related options section. We'll go over each section.

Basic Survey Options

The basic survey options include the Survey Title and the Survey Instructions. These will be placed at the top of the device on which the survey is being viewed. The survey instructions box can have text that is marked up with bold or italics, and can even include html like hyperlinks and tables.

Information can be piped from fields in a record to personalize the survey instructions. For example, if the survey is being sent to respondents that already have demographic data from a form in REDCap containing their name and email, these field values can be included in the survey instructions. For completely anonymous surveys where the record is blank at the time the survey is distributed, there will be no information stored to pipe from.

Survey Design Options

The survey design options panel includes several options to help customize survey presentation. A logo can be added to provide branding to a survey affiliated with a certain institution or organization. Enhanced radio buttons and checkboxes provide alternative mobile-friendly user interface elements for those fields, making it easier to complete the survey on a mobile device. Survey font and text size can be changed, as well as the survey theme. A preview window in the survey design options panel shows the effects of changes made to these settings.

Survey Customizations

The survey customizations panel includes options for modifying how the survey is presented to different audiences. Questions are numbered by default but this can be disabled with the Question Numbering option. The entire survey form can be displayed on a single web page, or the survey can be split into multiple pages based on the sections of the REDCap survey form. This can be useful if you wish to avoid having a survey appear too long at the beginning, or when you don't want survey respondents to be distracted by other

Set up my survey for data collection instrument "My First Instrument" Save Changes Cancel

Basic Survey Options:

Survey Title
My First Instrument
Title to be displayed to participants at the top of the survey page

Survey Instructions
(Displayed at top of survey after title)

Paragraph **B** *I* [Link](#) **Align Left** **Align Center** **Align Right** **Justify** **Undo** **Redo** **Table** **Text Color** **Background Color** **Code** **Insert Image**

Please complete the survey below.

Thank you!

[How to use Piping here](#)

Figure 2.13: Basic survey options can be edited from this screen.

Survey Design Options:

Logo
(Optional: display an image above the survey title)
Add new logo:
Browse... No file selected.
(Images wider than 600 pixels will be downsized to fit page.)
☐ If using a logo, hide survey title on survey page?

Use enhanced radio buttons and checkboxes?
(Includes Yes/No and True/False fields)
Standard radios and checkboxes Show example

Size of survey text
Large

Font of survey text
Open Sans

Survey theme
Default Customize

Survey design preview (sample survey): Expand

This is the survey title

Your survey instructions will go here. The instructions can tell your survey participant about the purpose as well as what to expect once they have completed the survey. Below is a listing of various question types to be displayed on your survey.

This is a section header to divide the survey page into sections.

Figure 2.14: Survey design options control the appearance and theme of the survey.

Survey Customizations:

Question Numbering
For custom numbering, each question's number will be blank by default until manually added via the Online Designer or Data Dictionary. Auto numbered

Question Display Format
One page or multiple pages? Section headers, which begin new sections on the instrument, will serve as the page break in a multi-page survey, in which each page will begin with a section header. All on one page
☐ Display page numbers at top of survey page
☐ Hide the 'Previous Page' button (i.e., Back button) on the survey page (prevents respondents from going back to previous pages)

Allow participants to download a PDF of their responses at end of survey? No
Display a button for the participant to download a PDF file of their responses for the survey they just completed. This option will not be available if the Survey Auto-continue or Survey Queue auto-start option is enabled. Also, if a field utilizes the @HIDDEN action tag, it will not be displayed in the PDF.

Survey-specific email invitation field -- select a field --
Designate an email field for sending survey invitations for *this survey only*. Note: This option will override the project-level email invitation field (if enabled on the Project Setup page) and will also override any email address originally entered into the Participant List. Also, if this field has no value and the project-level email field is enabled, then the project-level email field's value will be used instead.

For 'Required' fields, display the red 'must provide value' text on the survey page? Yes
If 'No', then it will NOT display the following text beneath all 'Required' fields: * must provide value

Text-To-Speech functionality Disabled
(Allows text on survey page to be read audibly to participants.) When enabled, icons will be displayed next to all text on the survey page, and when clicked, the text will be read out loud to the participant (must have computer speakers turned on). NOTICE: All text that is spoken is sent to a service hosted at Vanderbilt University that utilizes the IBM Watson Text-to-Speech API service. Be advised that if the survey utilizes piping, for privacy concerns, data piped from Identifier fields will *not* be sent to the service with the rest of the text but will instead be redacted. [Administrators: How to disable this feature](#)

Figure 2.15: The survey customizations panel controls special features of the survey like numbering and text-to-speech support.

text on the page when answering a question. You can allow users to navigate back to previous pages or not depending on your preference for the survey.

REDCap can allow survey participants to download a PDF of their responses after they have completed the survey but setting that field to yes in the customization panel. This PDF file is generated by REDCap after the survey is complete, and the link provided to the respondent will allow them to download it through their browser.

Survey-specific invitation fields can be set to allow different survey forms in a REDCap project to be sent to different email addresses. For simple surveys, one record will correspond to a single survey. However, REDCap supports projects with multiple surveys where responses are all stored in a single record. Using the survey-specific invitation field, different surveys could be sent to different email addresses, and therefore different respondents. For example a patient record could include surveys sent to different caregivers and physicians.

Survey Access

The survey access panel provides settings to limit when and how the survey can be accessed. Response Limit disables the survey after a certain number have been collected and Time Limit and Survey expiration limit the amount of time a respondent can spend on the survey and the date at which it can be accessed respectively.

Surveys can allow respondents to return later to complete a survey that has been previously started. REDCap will generate a return code for a respondent when they choose to save and return later, and upon entering this code they can complete their original survey. Return codes can be disabled for anonymous surveys, but should be left enabled for surveys with identifying information as all responses would be visible to returning respondents. Surveys also support allowing respondents to return and change their previous responses, but this is also disabled by default.

Survey Termination Options

The termination options panel controls the behavior following completion of a survey. If multiple surveys

Survey Access:

Response Limit (optional)
(Maximum number of responses to collect. Prevents respondents from starting the survey after a set number of responses have been collected.) ?

(e.g., 150) If left blank, the response limit will not be enforced.

Will include

Custom text to display to respondent on survey when limit is reached:

Time Limit for Survey Completion (optional)
(The amount of time that each respondent has to complete the survey based on when they were initially sent the survey invitation. Note: This feature excludes public survey links.) ?

days hours minutes

If the respondent loads the survey after this time has passed, it will not allow them to begin or continue the survey. (If all are left blank, the time limit will not be enforced.)

Survey Expiration (optional)
(Time after which the survey will become inactive.) ?

M/D/Y H:M

The time must be for the time zone **America/New_York**, in which the current time is 07/17/2019 21:59.

Allow 'Save & Return Later' option for respondents?
(Allow respondents to leave the survey and return later.) ?

☐ Allow respondents to return without needing a return code ?

☐ Allow respondents to return and modify completed responses ?

Figure 2.16: The survey access panel controls how the survey is made available.

are in the project, the completed survey can be set to automatically move to the next one for the current respondent if this is the desired behavior. If not or if the project only has one survey for the current respondent, the survey can redirect the browser to a new web address or customized text can be entered similar to the survey instructions section.

If a survey will be functioning as a legal consent document, REDCap's e-Consent Framework can be used to provide the necessary storage and documentation requirements. It's important to check with your local institution to ensure your deployment of REDCap has been approved to manage electronic consents.

Finally, the survey can be configured to send a confirmation email to the respondent which includes their responses. This must be configured to come from a REDCap user or account associated with the project. At this point the settings can be saved and will be live once the survey is made available to potential respondents.

Now that the survey presentation has been established through the survey settings, we can take a look at the other survey features found on the designer pages.

Survey Queue

The survey queue provides a way to link multiple surveys in a project together and provide a convenient visualization to a respondent detailing which surveys they have completed, which are in progress, and which still need to be done. Clicking on this button brings up the survey queue dialog, which allows surveys to be added and ordered in the queue. The survey designer can also decide how the queue will handle the completion of surveys, i.e., whether a respondent is returned to the main page of the survey queue each time they complete a survey or they are automatically redirected to the next survey they should complete.

Survey Login

A survey login provides a secure way for users to authenticate to a survey before they provide information. The authentication can be a combination of up to three fields, for example first name, last name and date of birth. This provides a means to more securely track who is accessing a particular survey. This simplifies the process for returning to complete a survey later, as the user can use their authentication questions rather than a return code.

Survey Notifications

Each REDCap user associated with a project can receive email notifications when a survey is completed. The notification provides a link to the record for the completed survey, but cannot be customized to include different text or data piped in from the survey responses.

Automated Invitations

Survey Termination Options:

☐ **(Optional) Auto-continue to next survey:** Automatically start the next survey instrument after finishing this survey ?

— OTHERWISE —

☒ **Redirect to a URL**
(Redirect to a webpage when survey is completed)

Provide a full URL, e.g. <http://www.example.com/mypage.html>

[How to use Piping here](#)

— OR —

☒ **Survey Completion Text**
(Displayed after survey is completed as "thank you" text or as acknowledgement text)

Paragraph ▼ **B** *I* 🔗 ☰ ☷ ☹ ☶ ↶ ↷ 🔄

☰ ☷ ☹ ☶ ☐ ☑ A ▼ [A] 📄 <> Ix

Thank you for taking the survey.

Have a nice day!

[How to use Piping here](#)

e-Consent Framework

- and -

PDF Auto-Archiver

Upon survey completion, a compact PDF copy of the survey response will be automatically stored in the project's File Repository, from which the archived PDFs can be downloaded at any time.

☒ Disabled

☐ Auto-Archiver enabled

☐ Auto-Archiver + e-Consent Framework [What is the e-Consent Framework?](#)
(Includes end-of-survey certification & archival of PDF consent form)

Send confirmation email (optional)?
(Email the respondent when they complete the survey)

No ▼

Save Changes

-- Cancel--

Figure 2.17: The survey termination options determine survey behavior after completion.

Figure 2.18: The longitudinal panel show up in project setup when a project has longitudinal data collection enabled.

Figure 2.19: Define my events page.

Automated survey invitations provide a way to have REDCap automatically send survey invitations based on condition within the survey project. This can involve the completion of other surveys in the project or logic within the project itself. For example, if a record includes fields for names and other demographic information, and you only want to invite respondents with complete information to complete the survey, a condition for an automated invitation could be that certain fields cannot be empty. Once the condition evaluates to true, and those fields contain data, REDCap will schedule and send the invitation.

2.5 Creating a Longitudinal Study

After enabling longitudinal data collection forms on the project setup page, there will be a new panel on the project setup checklist. This panel contains the links to two new pages, Define my events and Designate instruments for my events.

Define Events

On the Define Events page you will be able to specify which events are part of your project. Each event will belong to an arm, and if you only wish to have a single group of events in your longitudinal study, all your events will belong to arm 1. On the Define Events page you are able to add new arms to your study and add new events to each arm.

REDCap will start new longitudinal projects with a single event named Event 1 in Arm 1, just as the first instrument in new projects is My First Instrument. You can change the name of Event 1 to something more descriptive by clicking on the pencil icon to edit the name.

Designate Instruments

Now that we have created events, we need to tell REDCap which instruments will be collected for each event. Although you could assign every instrument to each event, that would not be the best use of the longitudinal project. For example, if you wanted to collect patient lab data over 3 visits, your REDCap project would have a demographics form for patient information, a medical history form, and a lab values form. You could then divide your project into 4 discrete events. The first would be Enrollment or Project start. This event would have the Demographics and Medical history forms as its instruments. Then you would have Visit 1, Visit 2, and Visit 3. The Lab Values instrument would be in each of these events, but not in the Enrollment event. Likewise the Demographics and Medical History events would not be included in the Visit events.

Arm 1: **Arm 1**
+Add New Arm

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

	Event #	Event Name	Custom Event Label (optional)	Unique event name (auto-generated)
	1	Event 1		event_1_arm_1
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 20%;"> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;">Add new event</div> <div style="border: 1px solid #ccc; height: 20px; width: 100%;"></div> </div> <div style="width: 80%;"> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;">Descriptive name for this event</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;">Custom Event Label (optional) Example: [visit_date], [weight] kg</div> </div> </div>				

Figure 2.20: The add new events panel supports adding new arms and events by name.

Project Setup
Define My Events
Designate Instruments for My Events

Since you have defined multiple events on the [Define My Events](#) page, you may now select which data collection instruments that you wish to utilize for each event by using the table below. This allows you to enter data on any data collection form multiple times for any given project record. Any and all data collection instruments can thus be used for any event defined.

Click the **Begin Editing** button to change the relationships below by designating which forms you wish to utilize for which events. When you are finished making changes, click the **Save** button to finalize your changes.

Begin Editing
Save
Select All
Deselect All

Data Collection Instrument	Event 1 (1)	Event 2 (2)
My First Instrument	☐	☐

Figure 2.21: Instruments can be designated as longitudinal from the designate instruments page.

Chapter 3

Managing Your Study Team

In the last chapter we continued the process of project creation with the design and implementation of the electronic case report form. In this chapter we will discuss the process of granting other REDCap users access to your project. By default the project creator will have access to all aspects of the project, and this may be sufficient for small projects. However, in most cases several project roles will be necessary for a successful study, including the primary investigator, co-investigators, data collection personnel, and biostatisticians. Since REDCap is web-based it can support collaboration on research projects between these individuals. It can also support the grouping of users based on specific records in the project to which they should have access, in the form of Data Access Groups (DAGs).

Sidebar: Applications

In Chapter 4 we looked at the Data Collection section of the sidebar and in this section we will look at the section titled Applications. The assignment of user rights to users in a project will affect which links are displayed in the applications section so we will start with a quick description of each of these links and discuss what types of users should have access to each. The applications themselves will be discussed more fully in subsequent chapters.

- **Alerts & Notifications** – send email alerts
- **Calendar** – schedule study events
- **Data Exports, Reports, and Stats** – export data
- **Data Import Tool** – import data
- **Data Comparison Tool** – compare records
- **Logging** – access project logs
- **Field Comment Log** – access field comments
- **File Repository** – access exports and uploaded files
- **User Rights and DAGs** – set user rights
- **Customize & Manage Locking/E-signatures** – set locking features
- **Data Quality** – set real-time data quality rules
- **API and API Playground** – set up API access
- **REDCap Mobile App** – set up mobile app access
- **External Modules** – assign external modules to project

3.1 Who Can Access Your Study

From the project setup page, we will move past the optional modules and project bookmarks panels to the User Rights and Permissions panel. Optional modules and project bookmarks will be covered later, as their

Figure 3.1: The navbar of the user rights page includes the user rights and data access groups pages.

Figure 3.2: Users can create roles, assign users to created roles, or assign custom user rights to a user.

default values are usually sufficient for most projects. Within the user rights panel are links to the user rights and data access groups pages.

The first panel on the user rights page is the add new users panel. This is where a user in the REDCap system can be associated with the current project. Only users that have been given accounts in the REDCap instance are available to be assigned from this screen. If a user needs access to the system, a REDCap administrator will have to establish an account for them. Once this is done, their account will be accessible from the user rights page.

There are two ways to add a new user to a project. The first is to add them and manually assign their rights for the different project applications. The second is to assign them to a project role that has already had project rights for the role assigned. We will start with adding a user with custom rights.

For a small project with few users, adding with custom rights is a much faster way to get the project up and running. To add a user, start typing in their name or username in the field until their account information appears below the text entry box. If the account you are looking for does not appear you will want to verify you have the right information and that the desired account is currently in the REDCap system. Once you have selected the right account name, you can click the add with custom rights button to open the add new user dialog.

There are several panels in the adding new user dialog. On the left side are the panels for the types of project application access the user should have and on the right is the list for the types of data entry rights a user should have. The data entry rights are separated by REDCap instrument, and can be set to No Access, Read Only or View & Edit. If an instrument is set to No Access for a user, they will not be able to view or export any of the data associated with that instrument. Users with Read Only can read or export data for an instrument, but not change it. Users with View & Edit have full access to the instrument.

The project application access on the right has several sections starting with Basic Rights. The Expiration Date field allows setting an expiration date for the users access to this project. Next are the highest level privileges for the project, usually intended for the project designer and PI. Project Design and Setup allows adding new fields to the instruments and changing project settings in the project setup page. User rights allows adding new users to the project and editing their types of access. The user rights page is only accessible when this right is assigned. Creators of a project will have these rights set by default when the project is first created. Data Access Groups allows the Data Access Groups page to be accessed and those groups to

Adding new user "wamatt01"

You may set the rights for the user below by checking the boxes next to the application tools to which you wish to grant them access. You may also grant them or deny them access to individual data collection instruments, if so desired. To save your selections, click the "Add user" button at the bottom of the page.

Basic Rights

Expiration Date (if applicable) (M/D/Y)

Highest level privileges:

- ☐ Project Design and Setup
- ☐ User Rights
- ☐ Data Access Groups

Privileges for data exports (including PDFs and API exports), reports, and stats:

Data Exports

* De-identified means that all free-form text fields will be removed, as well as any date/time fields and Identifier fields.

- ☐ No Access
- ☒ De-identified*
- ☐ Remove all tagged Identifier fields
- ☐ Full Data Set

Add/Edit/Organize Reports ☒
Also allows user to view ALL reports (but not necessarily all data in the reports)

Stats & Charts ☒

Data Entry Rights

NOTE: The data entry rights "only" pertain to a user's ability to view or edit data on a web page in REDCap (e.g., data entry forms, reports). It has no effect on data imports or data exports.

	No Access	Read Only	View & Edit
My First Instrument	☐	☐	☒

New User Notification

☒ Notify user of their project access via email? ☒

Add user **Cancel**

Figure 3.3: The basic rights panel determines the highest level privileges including project settings, adding users, and data export.

be changed. Next in basic rights are the privileges for all types of data exports. A user must have some type of export privilege assigned and the default is de-identified. This means no data field with the identifiable flag set during eCRF creation can be exported along with any date or free form text field. The other options are No Access, Remove all tagged Identifier fields, and Full Data Set. Remove all tagged Identifier Fields relaxes the date and free form text restrictions of de-Identified but still removes fields tagged with Identifier. Full Data Set provides no restrictions and No Access disables exports entirely.

The Add/Edit/Organize Reports allows the user to add and view reports, but may have certain data restricted at the report level. The stats are charts setting will allow the user to view the charting visualization for reports when they are viewed.

The next user rights panel focuses on the the REDCap Mobile App access and project record access. If the REDCap Mobile App has been enabled for the project, assigning the REDCap Mobile App privilege will allow the user to interact with the project using the app from their mobile device. You can customize whether or not they are able to download data for all records to the app.

The next section involves Creating, Renaming and Deleting records. The default setting for a new user is to be able to create new records. If this is disabled, the user will only be able to interact with records already entered into the project. Renaming records allows a user to change the record ID for a record. This is not enabled by default as the record ID is the primary way REDCap organizes records, and changing the ID can create inconsistencies with previous data exports, data imports and logging. Deleting records is also not enabled by default as this setting allows a user to purge data from the system. Deleting a record cannot be undone.

Record locking privileges determine the user's ability to lock and unlock records. Records are usually locked as a data quality action to prevent changes to a record once it has been reviewed by a project manager. E-signatures are intended to provide a higher level of validation than locking, as a user with e-signature privileges who locks a record with an e-signature is asked to input their REDCap login credentials to verify that the record should be locked and the time and date of the lock will be recorded in REDCap's audit trail. Locked and e-signature locked records can be unlocked and changed any number of times by users with the relevant privileges.

Finally other privileges include the other project application pages discussed at the beginning of the chapter.

Settings pertaining to the REDCap Mobile App:

☐ REDCap Mobile App	☐ Allows user to collect data offline in the mobile app
What is the REDCap Mobile App?	
Allow user to download data for all records to the app?	☐

Settings pertaining to project records: [Explain these settings](#)

☒ Create Records	☒
☐ Rename Records	☐
☐ Delete Records	☐

Settings pertaining to record locking and E-signatures:

☐ Record Locking Customization	☐
☒ Lock/Unlock Records	☒ Disabled
Users with locking privileges also have access to the E-signature and Locking Mgmt page on the left-hand Applications menu.	☐ Locking / Unlocking with E-signature authority
Watch video about locking	What is an E-signature?
Allow locking of all forms at once for a given record?	☐

Figure 3.4: User privileges for records and REDCap mobile app.

Other privileges:

☒ Calendar	☒
☐ Data Import Tool	☐
☐ Data Comparison Tool	☐
☐ Logging	☐
☒ File Repository	☒
☐ Data Quality	☐ Create & edit rules
What is Data Quality?	☐ Execute rules
☐ API	☐ API Export
What is the REDCap API?	☐ API Import/Update

Figure 3.5: Privileges for REDCap pages like the data import tool and data quality are in the other privileges section of user rights assignment.

The privileges allow access to the project calendar, data import tool, Data Comparison Tool, Logging, File Repository, Data Quality and API pages.

3.2 Assigning Study Roles

As mentioned before, the privileges for a user can be assigned manually, but for larger projects with a large number of users and REDCap instruments, it is more efficient to use REDCap's User Roles. A user role is a named template with all of the privileges on the user rights page already set. For example a user role for someone who will only be doing data entry for a project might have View & Edit access to all instruments, but no export or project design privileges. A biostatistician could have View Only access to all instruments and Full Export rights but not the create record privilege. Once these roles are established, adding new users to a project becomes very simple. In addition, it becomes much easier to track the different types of access users within an organization possess and roles in REDCap can be reconciled with roles in other management systems such as those used by an institutional review board.

3.3 Using Data Access Groups

Data Access Groups are a mechanism provided by REDCap to separate access to project records based on which user created the record. This is useful for studies which may be multi-site in nature. Data entry

Role name <small>(click role name to edit role)</small>	Username or users assigned to a role <small>(click username to edit or assign to role)</small>	Expiration <small>(click expiration to edit)</small>	Project Design and Setup	User Rights	Data Access Groups	Data Export Tool	Reports & Report Builder	Graphical Data View & Stats	Calendar	Data Import Tool	Data Comparison Tool	Logging	File Repository	Record Locking Customization	Lock/Unlock Records	Data Quality (create/edit rules)	Data Quality (execute rules)	API	REDCap Mobile App	Create Records	Rename Records	Delete Records
---	wamatt01 (William Mattingly)	never	✗	✗	✗	De-identified	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✗

Figure 3.6: The user role table provides a snapshot of the complete privileges of a user or role.

Create new groups: Add new data access groups to which users may be assigned.

+ Enter new group name
Add Group

Assign user to a group: Users may be assigned to any data access group.

Assign user -- Select User -- to [No Assignment] Assign

Figure 3.7: Access groups can be created and users assigned from the create new groups panel.

personal at one site must have view and edit privileges for their own site data, but should not have it for other sites. Since user rights privileges only restrict access at the instrument level, there would be no way to achieve this in a single project without data access groups.

The data access groups page provides buttons to create new access groups and to assign users to a group. Users who are not assigned to any group will have no restrictions on the records they may interact with. Users assigned to a group, will only be able to interact with records created themselves or by other members of their data access group.

Data Access Groups	Users in group	Number of records in group	Unique group name <small>(auto-generated)</small>	Group ID number	Delete group?
[Not assigned to a group]	wamatt01 (William Mattingly) * Can view ALL records				

Figure 3.8: The data access groups table lists all the current data access groups in the project and shows which users are assigned to each.

Chapter 4

Customizing Your Project

In the last chapter we discussed setting up user management on the user rights and data access groups pages. In this chapter we will discuss some of the customizations and optional modules REDCap makes available.

4.1 Enabling Optional Modules

We return now to the third panel down on the project setup page, **Enable optional modules and customizations**. For many projects, the default settings on this panel are appropriate, but in some cases these additional features can be useful for a project or study.

Repeatable Instruments

The repeatable instruments setting allows instruments in REDCap to be designated as repeating, meaning they can have multiple groups of data per record for that instrument. REDCap's data format is intended to closely resemble flat table formats like excel, where every field of data belong to the same row in the table. There are many instances when it would be more efficient to have multiple data fields linked to the same record. This was done similarly in REDCap with longitudinal projects. Unlike, longitudinal projects, a repeating form does not have to have each event created manually. A new repeating instance within a record can be created on an ad-hoc basis.

Auto-numbering

Auto numbering for records is enabled by default on new projects. This setting tells REDCap to assign a unique record ID field to new records when a user adds a record from the Add/Edit Records page. This ensures that each record ID is unique, which is a requirement for all REDCap projects. If this is disabled, a user will need to enter a unique record ID every time a record is created or uploaded with the data import

Figure 4.1: The optional modules panel contains the most common project customizations. Auto-numbering is enabled by default on new projects.

tool. REDCap will scan the database when a user enters a new record ID, and if a record with that record ID already exists, the new record will not be created.

Scheduling Module

The scheduling module allows you to generate a schedule for visits or labs for the events in a longitudinal project. If this is enabled, a new link will be added to the data collection sidebar called Scheduling. The Define My Events page for longitudinal projects will also have a new field for each event called Days Offset. Days offset allows you to specify how many days an event is after or before the first defined event. Once this is set for the events, going to the Scheduling page will allow you to generate a schedule for events that will be stored on the Calendar page.

Randomization module

Randomization is a process used in clinical trials to vary which subjects are assigned to which control groups in an unbiased way. REDCap's randomization feature allows a project designer to develop a randomization model for this purpose. Once this feature is enabled, a link to the randomization page will appear in the application sidebar.

The randomization page has tabs for setup and a dashboard. In randomization setup, there are settings for using a stratified randomization, randomizing by group or site, and selecting which field and event in the database will be used to store the randomized group assignment. The selected field will have a randomize button on the data collection form for users with the randomization user right. Randomization is also logged in the audit trail when it is performed.

Designate an email field for sending survey invitations

Designating an email field for survey invitations allows REDCap to pull all values from that field for sending survey invitations. Survey level invitations will override this field, and email invitations manually entered in the participant list will supersede both.

4.2 Making Additional Customizations

Another group of REDCap features are accessible from the Additional Customizations button on the optional modules and customizations panel. Clicking this button opens the additional customizations dialog. Each of these features are discussed below.

Custom Record Labels

REDCap can set custom record labels to display on the Add/Edit Records and Record status Dashboard pages. Any static text can be displayed along with piped data from a field, for example, to show a name beside a record ID, the custom record label might be [last_name], [first_name] and would if record 1 was for John Doe, would show as 1 Doe, John on record status pages.

Secondary Unique Field

The record ID for each record in a REDCap project must be unique, but a secondary unique value can also be specified using this setting. REDCap will check all other values for a secondary unique field before allowing a record to be added, updated or imported. This is useful when auto-numbering is used for record IDs in REDCap but the study is using another identifier when communicating to other parties.

Order records

By default records are ordered by the record ID in the Add/Edit records drop down and record status dashboard, but this can be changed with this setting. The field can be used to order the records in ascending order by that field's contents.

Field Comment Log and Data Resolution Workflow

By default REDCap enables a feature called the Field Comment Log which stores plain text comments from users with every field. A small balloon icon next to a field in the data collection form allows a user to add

Additional customizations

You may use the options below to make customizations to the project. When done, click Save to save your changes.

☐
Set a Custom Record Label
You may append other data and/or static text to any record name (e.g., Study ID) as the record is displayed on your data collection instruments, such as inside the drop-down lists when choosing a record and at the top of the page after being selected. Simply provide the text you wish to display below, and place any variable names inside square brackets [], after which the data collected for those variables for that record will replace the variable in the text.
Custom Record Label:
Example: If {[last_name]}, {[first_name]} where entered, then for record '102' it would display '102 (Doe, Jon)'.

☐
Designate a Secondary Unique Field
You may designate a text field to serve as a unique constraint whose value cannot be duplicated or shared by any other record in the project. When a value is entered or imported for the secondary unique field, it will be checked in real time to ensure it is not shared by another record, and if so, it will ask the user to enter another value. Additional options exist below that dictate if and how the secondary unique field will be displayed in conjunction to a record name on various pages in the project.
-- select field --
☐ Display the value of the Secondary Unique Field next to each record name displayed?
☐ Display the field label of the Secondary Unique Field when displaying the value?

☐
Order the records by another field
The default setup is that all records are ordered by their record name (e.g., Study ID) when displayed in the drop-down lists on your data collection instruments, but you may alternatively order the drop-down lists by the values of another field in the project (e.g., last name), if desired. If you wish to order the records by another field, select the field below.
-- select field to order records by --

☒
Enable the Field Comment Log or Data Resolution Workflow (Data Queries)?
For this project, you may enable either the Field Comment Log or Data Resolution Workflow (also known as the Data Queries module). The Field Comment Log (enabled by default) allows users to leave comments for any given field on a data entry form by clicking the balloon icon next to the field. All comments can also be viewed, searched, and downloaded on the Field Comment Log page. Alternatively, if the Data Resolution Workflow is enabled, users will be allowed to open a workflow for documenting the process of resolving issues with data in the project (i.e. opening, responding to, and closing data queries). [View more details](#)
Enable:
☐ Allow users to edit or delete Field Comments (excludes Data Resolution Workflow comments)?

☐
PDF Customizations
Downloadable PDFs of data entry forms and surveys can be customized using the options below. Note: The options will be applied to ALL instruments in the project.

- Set custom header text to appear at top left of every PDF page (it may be left blank, if desired). Note: Only static text can be entered; thus piping cannot be utilized here.
 Default text: Confidential
- Display or hide the REDCap logo and website URL at the bottom right of every PDF page?
 - ☒ Display REDCap logo and website URL (default)
 - ☐ Hide REDCap logo/URL and instead display the following text: *Powered by REDCap*

Save Cancel

Figure 4.2: The additional customizations dialog contains settings for custom record labels and secondary unique fields. The field comment log is enabled by default on new projects.

a new comment to a field or read previous comment left by other users. Date, time and user name are all recorded with each comment. This feature can provide a data history for changes to a field's values.

REDCap also supports a data quality procedure called the Data Resolution Workflow. Only one of the field comment log or data resolution workflow can be enabled at the same time. Enabling the data resolution workflow adds a link to the application sidebar next to Data Quality called Resolve issues. This link will take you to the resolve issues page where a list of current and previous queries can be viewed or exported. These queries can be opened from the data quality page as a result of the execution of a data quality rule or from the data collection form by clicking on the balloon previously used for the field comment log.

PDF Customizations

By default the text on a PDF has several features that are present on every page. Some of these features can be modified with this setting.

- Set custom header text to appear at top left of every PDF page
- Display or hide the REDCap logo and website URL at the bottom right of every PDF page?
- Display or hide the Secondary Unique Field value at the top right corner of the PDF

Data History widget

This setting is enabled by default and makes the data history of a field view-able by clicking the H icon displayed next to it.

Today/Now Button

This setting is enabled by default and displays a button which shows a popup window containing a calendar to make accurate date selection easier. A date/time field will likewise have the calendar and a slider for hour and minutes. Most modern browsers support these features, and there is little reason to ever disable them.

Require a Reason to Change Records

This setting can provide a more rigorous data quality process for a project, by requiring all changes to field values coming after initial data entry to be justified by the user. It should be carefully considered whether this is necessary to improve data quality and data entry workflow. If data must be changed too often, it is likely to encourage poor justifications for the sake of brevity, negating the usefulness of the feature.

Data Entry Triggers

Data entry triggers are an advanced feature that can allow notification of an external website whenever a record is changed in a project. Many systems like electronic medical records and patient registries will have features like these to support real time notification of any change. If this feature is enabled, an HTTP address can be entered into the text box here and the address will be sent an HTTP or HTTPS message containing record information. If your institution has agreed to share information with an external entity and that entity has the capability to set up an HTTP listener to receive data in a certain format from REDCap, this may be the most efficient way to facilitate the transfer.

4.3 Moving Project to Production

If your project has all of the features you need and you have tested that they work as expected, it's time to click the last of the test checkboxes and move your project to production mode. The last box on the project checklist from Chapter 1 was project bookmarks. Project bookmarks provide a way to make links to other projects or even external websites more convenient. Any bookmarks added will appear in a new section on the sidebar. In cases where a link will be a REDCap project, you can specify in the bookmark settings that the link include a project and record ID.

Moving a project to production will sometimes require the approval of a REDCap administrator at your institution. Changes to your study will also be more time consuming after you move to production, as

Figure 4.3: Project bookmarks can be created from the bookmarks panel on the project setup page.

Figure 4.4: Projects can be switched into production mode from the project setup page.

REDCap will keep a thorough history of new changes to the project setup. Requiring further changes to be approved by a REDCap administrator is a safeguard to protect a project from accidental loss of data due to modifying REDCap instruments. For example, removing a field from an instrument will result in the destruction of all data that was previously entered into the field. Given the time and costs needed for data collection, this could be a major loss. REDCap provides administrators some automated protections to inform them how much, if any, data loss would occur if proposed changes are made and production mode safeguards give them the chance to carefully check whether or not this is desired.

This concludes Part 1, project creation, and in the next part we examine project management starting with data quality and reports.

Part II

Project Management

Chapter 5

Improving Study Quality

Data quality in a study is similar to quality control in a manufacturing process. Goods produced without sophisticated quality control may seem to work initially, but usually have defects that become apparent after widespread use. In the same way, a study without data quality procedures can produce results that are inconsistent and inaccurate. These types of results make it hard to justify the time, effort, and cost involved in conducting the study and collecting data in the first place.

REDCap has many features that assist study investigators and coordinators in maintaining a high quality study. Some of these features were discussed in Chapter 3 CRF Design concerning data type validation. Placing restrictions on the type of data that can be entered into a field reduces the number of data entry mistakes that can be made on a project at virtually no cost. The designer need only specify that a field can only hold numbers or fields that match an email address, and the system will automatically prevent any other type of input. The features discussed in this chapter must be executed proactively by a project coordinator.

5.1 Exporting Data and Generating Reports

One of REDCap's most useful and promoted features is its support for user created ad-hoc reports. These reports can provide customized views of the data currently in a project. Reports are accessed by clicking on the Data Exports, Reports, and Stats link in the applications section of the sidebar.

On the Data Exports page, a list of all reports in the project are shown following links at the top to simply display all data in the project in a flat table format. The links View Report, Export Data, and Stats & Charts next to All data will each show all data in the project without any filters. View report will show the data table within the web browser, and Export Data will format the data for download in Excel, CSV and other common statistical formats.

Often the data you are interested in may be contained only in specific instruments in which case the Selected instruments report will be more useful than All data. After clicking Make custom selection, you will be able to highlight the instruments that are of interest, and the report generated will only contain data from fields within the selected instruments.

Create New Report

To take full advantage of REDCap's reporting functionality, a new report should be created. This link will be at the bottom of the list of reports. Create new report also has a tab link at the top of the exports page. After clicking either link you will be on the create report page for a new report.

Each report created for a project has a unique ID that is created by REDCap and stored internally. This ID will be in the URL of a report page and will not change once the report is created. The first step to creating

My Project

Data Exports, Reports, and Stats [VIDEO: How to use Data Exports, Reports, and Stats](#)

[+ Create New Report](#)
[My Reports & Exports](#)
[Other Export Options](#)

This module allows you to easily view reports of your data, inspect plots and descriptive statistics of your data, as well as export your data to Microsoft Excel, SAS, Stata, R, or SPSS for analysis (if you have such privileges). If you wish to export your *entire* data set or view it as a report, then Report A is the best and quickest way. However, if you want to view or export data from only specific instruments (or events) on the fly, then Report B is the best choice. You may also create your own custom reports below (if you have such privileges) in which you can filter the report to specific fields, records, or events using a vast array of filtering tools to make sure you get the exact data you want. Once you have created a report, you may view it as a webpage, export it out of REDCap in a specified format (Excel, SAS, Stata, SPSS, R), or view the plots and descriptive statistics for that report.

My Reports & Exports				
	Report name	View/Export Options	Management Options	Report ID <small>(auto-generated)</small>
A	All data (all records and fields)	View Report Export Data Stats & Charts		
B	Selected instruments (all records)	Make custom selections		
+ Create New Report				

Figure 5.1: The data exports page includes a list of accessible reports and links to create new reports, export the entire data set, or export selected instruments only.

[+ Create New Report](#)
[My Reports & Exports](#)
[Other Export Options](#)

You may create a new report by selecting the fields/variables below that you want to include in the report. You may add as many fields to your report as you wish, and you can choose which users may view this report. You will also need to provide a name for your report, which will then be displayed on the project's left-hand menu for anyone to whom you have given access. You can filter the results returned in the report in a variety of ways, including using complex AND/OR logic. When you are finished, click the Save Report button at the bottom. The new report will then be added to your list of reports, after which you may immediately begin viewing them or exporting them.

Name of Report:	<input type="text"/>
Description (optional): <small>Displayed on page below report name</small>	<input type="text"/> <small>HTML may be used in order to add links or to add style to text.</small>

[Expand](#)

Figure 5.2: Naming new reports is required and providing a description is suggested.

STEP 1

User Access: Choose who can edit and view this report

View Access: Choose who sees this report on their left-hand project menu [?](#)

☒ **All users** – OR – ☐ **Custom user access** (Choose specific users, roles, or data access groups who will have access)

Edit Access: Choose who can edit, copy, or delete this report (requires user to have 'Add/Edit/Organize Reports' privileges)

☒ **All users** – OR – ☐ **Custom user access** (Choose specific users, roles, or data access groups who will have access)

Figure 5.3: New reports can be visible and editable by all users or specific users only.

STEP 2

Fields to include in report [+ Quick Add](#) Add all fields from selected instrument: -- choose instrument --

Field	Field Name	Instrument
Field 1	record_id "Record ID"	Instrument: My First Instrument
Field 2	Type variable name or field label	Instrument:

Additional report options (optional)

☐ Combine checkbox options into single column of only the checked-off options (will be formatted as a text field when exported to stats packages)

Figure 5.4: The fields to include in a report can be added individually or as an entire instrument.

a new report is to give it a name. Since each report has an internal ID, you can feel free to change the name after the report is created. The name should be as descriptive as possible, as the number of reports in a project can grow to be very large. Reports can also have a description that will be displayed at the top of the report page when viewed. This is useful for storing information about the intended purpose of the report for either the report creator or other users of the report.

REDCap's report creation page breaks down the process of creating an effective report into 4 steps, each with its own panel on the create report page. After providing a name and description for the report, the first step is to decide who will need access to it. Access to a report is divided into view access and edit access and these settings are shown in the user access section of the step 1 panel. By default a new report will be accessible to all users in the project for viewing and editing. By switching either to custom user access, you will be able to select the specific users, user roles or data access groups that the new report should be associated with.

In Step 2 of report creation, the fields the report will display need to be selected. By default the Record ID field will be included in the report. The Record ID field can be removed from the report, but at least one field must be in the report for it to be saved. New fields can be added to the report one at a time by typing the name into the text box next to the field number or by using the drop-down.

For large projects with a lot of fields REDCap includes some faster ways to add fields to the report. The Quick Add feature is at the top of the Step 2 panel and launches a dialog containing all fields in the project as checkboxes that can be checked off to quickly add those fields to the report. All fields in an entire instrument can also be added at once from this dialog. This makes it a little easier to fine tune the report to include only the fields that are necessary.

Checkbox fields in the project can be combined into a single column by checking the option under Additional report options. A report with this option selected will save some space by only showing checkboxes that were selected in a record, instead of showing the name of each checkbox with the checked or unchecked value.

The options displayed in Additional report options are related to the project features and will include an option to show survey identifiers for surveys and data access group names for each record if those respective project features are being used.

In step 3 of report creation, filters for the report can be created and assigned. Filters are optional and if

STEP 3

[How to use filters and AND/OR logic](#)

Filters (optional)

Filter 1 **Operator / Value**

Switch format: [Use advanced logic](#)

Live Filters (optional) Live Filters can be selected on the report page for dynamically filtering data in real time. With the exception of the Record ID field, only multiple choice fields can be used as Live Filters (as well as Events, if longitudinal, and Data Access Groups, if any exist).

Live Filter 1

Live Filter 2

Live Filter 3

Figure 5.5: Report filters limit the results of a report to specific constraints such as date or population subset.

STEP 4

Order the Results (optional)

First by **Ascending order**

Then by **Ascending order**

Then by **Ascending order**

[Cancel](#)

Figure 5.6: Report results can be ordered by a different field than record ID.

none are used, the full data set of the selected report field will be shown. Since a report is intended to communicate some selective features of the data, a filter is usually part of an effective report. REDCap includes its own filtering logic that is similar to the branching logic used in data collection forms and surveys and the calculations used for calculated fields.

Filters can be created in two formats, basic and advanced. For a basic filter, you can use the drop down in the Filters section to select the field the filter will act on followed by the operator, such as “equals”, “not equals”, and the value. The operators can vary depending on the type of field and validation that is being used as a filter, ie.. text fields can have the “contains” operator and fields with date validation can have “less than” and “greater than” as operators.

As new filters are added using the drop-down, they need to be combined with either OR or AND logical connection. For example if you wanted only records with a last name of smith and first name of john, you would combine those two filters with the AND connection. Using an OR connection would have the report include anyone with a first name of john and anyone with a last name of smith.

Using the advanced logic removes the drop-downs from the panel and replaces them with a text box showing only the filter description using Redcap’s filter language. Using the preceding example, advanced logic for showing first name of john and last name of smith would be: “[first_name]=”john” AND [last_name]=”smith”. REDCap includes a syntax validation tool that will provide feedback as to whether or not any syntax errors have been made, such as braces or quotations missing or in the wrong place.

The next section of the step 3 panel is for live filters. Live filters add a feature to a report that will change an active filter without needing to edit the report. A live filter can only use fields with a multiple choice type, and there are a maximum of three live filters that can be designated for a report.

Finally, in step 4 you set the default ordering for the report output. By default, reports will be sorted by Record ID in ascending order. You can choose up to three levels of ordering, each in ascending or descending order.

Other Export Options

The last tab on the export page is other export options. On this page you are presented with options to

Figure 5.7: The other export options panel provides exporting an XML file of the entire project or PDFs of each data instrument with data for all records.

Figure 5.8: The reports section of the sidebar provides a collapsible list of the accessible reports in the project.

export an entire project as an XML file or data in all data instruments as a PDF file. The XML file is formatted in the CDISC ODM format and will facilitate the transfer of a project to another REDCap server or to another CDISC compatible software system.

Sidebar: Reports

Once reports are added to a project, a new sidebar section is added called Reports. This section shows a list of all the reports in the project by name, and clicking on the report will run the report and take the user to the report page. Only reports that a user has been given access to during report creation will show up on the sidebar.

5.2 Importing Study Data

The data import tool can be an important part of study management, as it allows the direct upload of large volumes of data into a project. Patient data was previously stored in paper reports, and conducting a retrospective study would necessarily involve direct data entry into a system like REDCap. Many institutions now exclusively use electronic medical records and it is possible to get data into an exported table form. Using the data import tool, once data is converted to a flat table format that matches the REDCap header fields, it can be imported into a project in one step. REDCap performs basic type checking and field validation and will alert the user to problems in the import. Before final upload REDCap provides a preview as to which fields will added or changed once the upload is complete.

Figure 5.9: The data import page provides a data template for download and allows upload of properly formatted data for import.

Figure 5.10: Data comparison tool providing side by side comparison of two records.

5.3 Comparing Study Records

The data comparison tool provides a side-by-side view of two records in a project. Two similar cases can be compared vertically this way rather than horizontally as they would be in a report.

5.4 Viewing Access Logs for Your Study

The logging page for a project provides a comprehensive history of all interactions and changes that have been made to it. Events can be filtered by user, date range, and type of change. A list of page views for each project is also available, but not shown by default.

Figure 5.11: The logging screen for a project allows searching for logged project events by user and event type.

My Project

Field Comment Log

This page displays the Field Comment Log for all records/events/fields in this project. You may use the controls below to perform keyword searches in the comments as well as filter the comments by record, event, field, or data access group. Keep in mind that if you do not have user privileges to view some data collection instruments, then comments for any fields on those instruments will not be displayed in the table. Also, if you belong to a data access group, then you will only see results for records that belong to your group. The entire Field Comment Log is downloadable as a file in Excel/CSV format.

Field Comment Log Filters: All records All fields All users Keyword search [Search tips](#) [Apply filters](#) [Reset](#) [Export entire log](#)

Results returned: 0

Click button to view comment log	Record	Field	Comments
[Returned no results]	-	-	-

Figure 5.12: Optional Modules and customizations

My Project

File Repository

This page may be used for storing and retrieving files and documents used for this project. You may upload files here to save for retrieval later, or you may download previously uploaded files in the file list below. Whenever a data export is performed, the resulting data and syntax files are stored here also.

[User Files](#) [Data Export Files](#) [Upload New File](#)

No files have been uploaded yet

Figure 5.13: The file repository page lists uploaded files, previous exports and imports, and provides the dialog to upload new files.

5.5 Using the Field Comment Log

The field comment log and data resolution workflow are usually discussed together since only one or the other can be used in a project at the same time. The field comment log stores and associates user comments to fields in a project database. This is useful in discussing the history of a particular data field. The data resolution workflow provides a system of flagging and following up on potential errors with data entry and project coordinators. For most studies the field comment log provides sufficient reporting and has a smaller learning curve. Larger studies, especially multi-site studies, would benefit from the data resolution workflow, which mirrors the data query system all large clinical trial management systems employ.

5.6 Storing Files Securely

The file repository serves as a location to securely store any documents related to the project. A copy of all data and report exports are stored here, as well as data imports.

5.7 Validating and Locking Records

As mentioned before locking serves as a way to provide validation from a project coordinator that data for a record is complete and correct. Users have both locking and e-signature rights, and e-signatures serve as the highest level of validation for a record, as it requests authentication from the user performing the e-signing, and the signature contains the data, time and user name.

Record Locking Customization

E-signature and Locking Management

The table below displays all existing records in the project with their status as locked or e-signed for all data collection instruments. Forms that do not allow locking (if designated on the Record Locking Customization page) will not be displayed below. If a form has been designated not to display the e-signature option but still allows locking, then it will display 'N/A' for that form's e-signature status. 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 link below.

Export all (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?

Figure 5.14: The e-signature and locking management page lists the name of forms from records that have been locked or e-signed.

5.8 Creating Data Quality Rules

The data quality section page includes a list of common checks that can be performed on data to improve its accuracy and usability. The most common of these is missing data. Missing data will always be the main limiting factor on the ability of a dataset to provide meaningful information. Next to each data quality rule is an Execute button that will perform the check on all records in the database, then provide the total number of occurrences that match the rule.

Rules can be set to run in real-time, that is whenever a case is saved in data-entry, the data quality rule will be executed, and the data quality page will be updated to include new occurrences as well as alerting the data entry user of the data quality event.

My Project

Data Quality

This module will allow you to execute data quality rules upon your project data to check for discrepancies in your data. Listed below are some pre-defined data rules that you may utilize and run. You may also create your own rules or edit, delete, or reorder the rules you have already created. To find discrepancies for a given rule, simply click the Execute button next to it, or click the Execute All Rules button to fire all the rules at once. It will provide 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. [Read more detailed instructions.](#)

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 ?	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	
<div> <div>Add</div> <div> <div>Enter descriptive name for new rule (e.g., Participants below age 18)</div> <div>Enter logic for new rule (e.g., [age] < 18) How do I use special functions?</div> <div> ☐ Execute in real time on data entry forms ? </div> </div> </div>					

Figure 5.15: The data quality page lists the default data quality rules followed by user-created rules. User created rules can be set to run manually or automatically when a record is saved.

Chapter 6

Application Programmer Interface

REDCap's application programmer interface or API makes it possible to use REDCap data with a programming language in real time. This is most useful for performing data analysis without needing to go through the process of downloading a file from REDCap and opening in your statistics package every time a dataset changes.

6.1 What is an API

An application programmer interface is usually added to a software program when it would make it easier to perform large numbers of complex tasks. For example, if the software allowed a user to modify text documents and save them, an API could make it possible to modify hundreds or thousands of documents using a programming language and a single program, rather than spending hours and hours of modifications by hand. The API is the interface that connects a programming language to a software program and REDCap's API supports connecting securely to several different programming languages, each with different strengths.

6.2 Requesting a Token

REDCap uses tokens to maintain secure access to the data through the API. A token is a unique string generated by the REDCap server to identify a user and a project. When a users writes a software program to interface with REDCap through the API, they need only include the project token in the script to gain access to the data they are authorized to view or edit. If the token were lost, it could be used to get data from REDCap, but would not expose the user name or the name of the project, as those are only stored in REDCap.

When navigating to the API page for a project, the page provides a brief description of how the API works and how to request an API token. REDCap tokens are managed by administrators and must be requested for each project. Once you have an API token, you will be able to access everything you could normally access through the user interface through a programming language instead.

6.3 Using the API Playground

The API playground is a web interface within REDCap to quickly test various API functionality. It provides helpful documentation all in the same web page, and once a function is working as expected in the playground,

Figure 6.1: API tokens can be requested from the API page.

Figure 6.2: An alphanumeric token generated by REDCap for secure API access.

My Project

API Playground

The API Playground is an interface that allows experimentation with the REDCap API without actually writing any code. You can explore all the different API methods and their various options to customize a given API request. You may even execute a real API request and see the exact response that REDCap returns from the request. If you are interested in creating an API script, the section at the bottom will provide code samples for various programming languages to give you a head start. For details on the capabilities of the REDCap API and how to use it, please see the [REDCap API documentation](#).

Select an API method from the drop-down list below, after which it will load any other options that are specific to that method.

API Method: Export Project Info

Format: JSON

Errors: JSON

Figure 6.3: The API playground page supports generating example API requests based on the type of output desired.

Raw Request Parameters

Displayed in the box below are all the POST parameters that would be sent in the API request based on the selections above.

```
token: 15D4FD2E72B60F3589E969753DCDA284
content: project
format: json
returnFormat: json
```

Figure 6.4: Sample API request.

it can easily be copied over to the programming environment that will ultimately be used to run a users script.

6.4 Writing Your Script

Figure 6.5 below shows an example for connecting to the API using the scripting language REDCap uses to interact with its database server, PHP. The example demonstrates how to export the project metadata for a project. The data array takes the users token, the content field specifies that project metadata is being requested, and the sending and return formats are specified as json, JavaScript Object Notation. Once the query is constructed the following lines show how to send the query to a REDCap server using PHP's CURL functionality.

Response

Click the Execute Request button to execute a real API request, and it will display the API response in a text box below.

Execute Request

```
{
  "project_id": 283,
  "project_title": "My Project",
  "creation_time": "2019-07-17 19:57:27",
  "production_time": "",
  "in_production": 0,
  "project_language": "English",
  "purpose": 0,
  "purpose_other": "",
  "project_notes": "",
  "custom_record_label": "",
  "secondary_unique_field": "",
  "is_longitudinal": 0,
  "surveys_enabled": 0,
  "scheduling_enabled": 0,
  "record_autonumbering_enabled": 1,
  "randomization_enabled": 0,
  "ddp_enabled": 0,
  "project_irb_number": "",
  "project_grant_number": "",
  "project_pi_firstname": "",
  "project_pi_lastname": "",
  "display_today_now_button": 1,
  "has_repeating_instruments_or_events": 0
}
```

Figure 6.5: The API response will be in a structured format and response data can be extracted using a programming language.

Figure 6.6: Users can browse examples of API requests each of the listed programming languages.

Chapter 7

REDCap Mobile App

Project REDCap has developed a mobile application that can link to a project on a REDCap server. This app is available on the apple store for iOS devices and the Google store for android devices. The app was developed to fulfill the need to enter data for a project in the absence of a connection to the internet. Since REDCap is web-based, it can only be accessed via a web browser and internet connection. For data collection that needs to be performed offline, the REDCap mobile app can be used.

The mobile app is not a stand alone instance of REDCap, it must be connected to an existing REDCap server in order to function. Once it has been paired with a REDCap project, it can store data for that project offline, then perform synchronization with the REDCap server when a data connection is available.

7.1 Accessing the App Stores

Depending on which device you want to use, you will need an account to access either the apple store for iOS or the Google play store for android. The REDCap mobile app is free of charge on both services, but an account is needed with the service to authenticate and download the app. A search for REDCap will likely return the official REDCap app as the first result. Make sure that the name of the app is REDCap Mobile App and the developer is Vanderbilt University Medical Center.

7.2 Setting Up Your App

Once you have installed the app on your device, you can open it and start the setup process. The app will ask you to setup a local user account and a PIN for security purposes. Once you have completed this step, you should see a screen like figure. Selecting Set Up Mobile Project will take you to the screen for pairing the device with a project on REDCap.

7.3 Setting Up Your Mobile REDCap Project

Within a REDCap project, a user with mobile app rights can navigate to the REDCap Mobile App page to set up the app with a mobile device. The user must also have an API key which can be requested from the Mobile App page as well. The index page will have a QR code that the mobile app can scan in order to store all the data of the project, such as instruments, field name and data. Once the project has been set up, data can be collected using the device.

Figure 7.1: The main menu for the REDCap mobile app.

Figure 7.2: The REDCap mobile app page.

STEP 1: Download the app on your device

You must first download the REDCap Mobile App on your iOS, Android, or BlueStacks (Android emulator) device by clicking the appropriate icon below, or alternatively, if you are not currently on a mobile device, you can search the App Store or Google Play Store for 'REDCap' on your mobile device to find the app there to download. The app is available for the following platforms: iOS 6.0 or later (iPhone 4 and up, iPad 2 and up) and Android 4.3 or later (phones and tablets).

Figure 7.3: REDCap can email a user links to the REDCap mobile app on the Apple Store and Google Play.

STEP 2: Set up the mobile project on your device

You must have already downloaded the REDCap mobile app on your mobile device or tablet. To set up this project in the REDCap app:

1. Open the app on your device.
2. Click the 'Set Up Mobile Project' button.
3. Click the 'Scan QR Code' button.
4. Scan the QR code that you see displayed below.
5. The project will automatically begin downloading and processing.

[Can't get the QR code to work?](#)

NOTICE: You are a REDCap administrator, and since administrators always have maximum privileges, keep in mind that setting up this project on the mobile app under *this* account means that anyone accessing this project in the mobile app will also have maximum user rights in all parts of that project while in the app.

Figure 7.4: Scanning the QR code for a REDCap project from the mobile app connects the project with the app.

7.4 Collecting Your Study Data on the App

After the project has completed setup, you can navigate to the My Projects section of the app to see a list of the apps that have been set up on your device. Tapping the project you wish to collect data for will take you to the project's mobile home screen. If you now tap Collect Data, you'll be taken to a screen where you can select the instrument. After selecting the instrument, you will see a list of records with data in the current instrument as well as a button for creating a new record.

Just like the record status dashboard from REDCap's data collection sidebar, icons next to each record ID are colored to indicate the status of the record, red for incomplete, green for complete, yellow for unverified, and grey for a record with no data entered. Tapping the record ID will take you to the record with that ID on the instrument you chose previously. Here you can add or edit information for the record and save. You could also have tapped Create New Record to enter data for a new record starting on the instrument chosen previously.

Once you have saved data for a record on the mobile device, it only exists locally until you synchronize your database with the REDCap server. The project mobile home screen will now have a button called Send Data to Server. Tapping this button will prompt you to send all locally saved records to the server or select a partial subset to send. After initiating the upload, you should see the following confirmation screen.

7.5 Using Your Device Camera to Collect Data

The mobile app has some useful features that can be used in projects beyond its ability to save data offline. One of these is to make use of the components that are commonly included on mobile devices like microphones and cameras. For forms which have the upload file type, the mobile app is presented with the following screen when choosing to add data. These options allow taking a phone and recording a video with the phone camera and uploading directly into a REDCap field. Likewise an audio-only file can be recorded using the phone's microphone.

In addition to file upload fields, any text box field that has the @barcode action tag, can use the mobile app to record a barcode directly into the text field for upload into REDCap. On selecting to enter data for a barcode field, the mobile app will open the screen shown in Figure, and lining up the barcode and tapping anywhere on the screen will attempt to process the barcode and show the result in the text box in the app.

Figure 7.5: Progress when syncing the app to the server.

Figure 7.6: The REDCap capture screen.

Figure 7.7: The REDCap barcode reader.

Appendix A

Setting Up a REDCap Installation

If your organization does not have access to a REDCap instance, it is possible to set one up given the necessary hardware environments. Generally, the following things will be necessary to set up an installation of REDCap suitable for managing a clinical data set.

- A computing environment(physical or virtual) capable of running a modern version of Linux (Ubuntu, Debian, RHEL, CentOS) or Microsoft Windows
- A secure network accessible from the internet and capable of transmitting email

Given these two requirements, the REDCap software can be obtained electronically from Vanderbilt and installed at no cost. This section will detail the process of obtaining the software and setting it up on a Linux-based operating system.

A.1 Obtaining a Copy

The REDCap software can be download by consortium members who sign up at <https://www.project-redcap.org/>. Once membership has been approved, you will be able to log in to the REDCap community portal and download the latest and previous versions of REDCap. REDCap will come in a compressed .zip file and will need to be copied to your computing environment and decompressed in order to be used.

A.2 Example Install

Environment Our install environment will use CentOS, a Linux-based operating system. CentOS and Red Hat Enterprise Linux (RHEL), are commonly referred to as SELinux or Secure Linux because of several features that increase system security. These features can also make it more difficult to get software applications to work correctly, which is why versions of Linux like Debian and Ubuntu are more popular among users. REDCap will run well in either environment, but if you are intending to run REDCap in a HIPAA environment you should use a version of SELinux.

CentOS was developed by Amazon as an open source alternative to RHEL. It can be downloaded from . The install image is in an iso format typical for hardware systems. The minimal iso version of CentOS is ideal for a stack running REDCap since a desktop user environment is not necessary.

The install process will prompt the user for several pieces of system information. At this stage the main decision is how much disk space to allocate. 20-30 GB would be sufficient for REDCap including storing incremental database backups on the disk.

Figure A.1: The startup screen for the CentOS operating system.

Figure A.2: This summary screen shows the different CentOS installation settings.

The screenshot shows the 'CREATE USER' window in the CentOS 7 installation environment. The window has a dark blue header with 'CREATE USER' on the left and 'CENTOS 7 INSTALLATION' on the right. Below the header, there are input fields for 'Full name' (containing 'REDCap-user'), 'User name' (containing 'redcap-user'), 'Password', and 'Confirm password'. The 'User name' field is highlighted with a blue border. Below the 'User name' field, there is a tip: 'Tip: Keep your user name shorter than 32 characters and do not use spaces.' There are two checkboxes: 'Make this user administrator' (checked) and 'Require a password to use this account' (checked). Below the 'Password' field, there is a password strength indicator showing 'Strong'. At the bottom of the form is an 'Advanced...' button. In the top left corner of the window is a 'Done' button. In the top right corner, there is a language selector showing 'us' and a 'Help' button.

Figure A.3: The user password setup for CentOS

A root user password for the system will also need to be set. This is analogous with an admin user in other systems. In Linux systems many structures are organized as a tree, including users. So the root user can be thought of as the primary user, or the root of the tree.

Once the CentOS installation completes and the system reboots you will be at the system login screen. If you enter the user name and password you specified in the install process you will be taken to the system prompt. Here you can setup and install system software necessary for hosting an instance of REDCap.

CentOS uses a package manager called yum. Package managers are programs which manage the dependencies of complex software systems. They maintain a centralized database of software programs, their versions, and the versions of all their dependencies in a large tree. When installing the software dependencies of REDCap, like the web server, the package manager will automatically install their dependencies as well.

There is not a REDCap package on any distributed package management systems because the package management system would be a distributor of REDCap at that point. As mentioned earlier, REDCap's license prohibits redistribution of the source code. However, it is not difficult to install each of REDCap's dependencies using a package manager and obtain the source code through the REDCap consortium.

The yum package manager will make changes to the underlying CentOS system, and for that reason, it needs to be run with elevated privileges. Linux systems accomplish this with the `sudo` command. The first thing needed after a fresh install is to update the package manager with the `update` command. This contacts the distributed package manager and updates the package listings.

```
sudo yum update
```

You should see a prompt that explains the `sudo` privilegest of the system and asks you to re-enter your password.

Once the system finishes updating you will be ready to install new software. Editing configuration files from the terminal will be necessary for the installation and a Linux based tools that makes that fairly easy is called nano.

```
sudo yum install nano
```

Apache

Figure A.4: Installation is complete and the OS can be rebooted.

Since REDCap is web-based, it needs a program called a web server to be running in order to function. A simple and reliable web server that is packaged for almost all operating systems is known as Apache HTTP (Hyper Text Transfer Protocol) Server. This program will answer all page requests for REDCap content.

```
sudo yum install httpd
```

Install Apache web server `sudo yum install httpd`

Update Firewall to allow http traffic

```
sudo firewall-cmd --add-service=http --permanent && sudo firewall-cmd --add-service=https --permanent
```

Restart firewall `sudo systemctl restart firewalld`

MariaDB

REDCap stores all its data in a transactional database. Transactional databases are very reliable because they organize information updates into transactions that can be undone in the case of data corruption or mechanical failures. Data updates have little to no chance of compromising the data that is already being stored. The transactional database software used in this install will be MariaDB, the open source equivalent to the MySQL database server now owned by Oracle.

Install mysql (mariadb) `sudo yum install mariadb-server`

```
sudo systemctl start mariadb
```

```
sudo systemctl enable mariadb.service
```

```
sudo mysql_secure_installation
```

Input a root password and remove test database/disallow remote root access

Change mysql config to support Unicode characters (any Names or strings with non-ascii characters or accents will be stored and shown incorrectly in the software if this is not done first)

```
sudo nano /etc/my.cnf
```

```
[client]
default-character-set = utf8mb4

[mysql]
default-character-set = utf8mb4

[mysqld]
skip-character-set-client-handshake
character-set-server = utf8mb4
collation-server = utf8mb4_unicode_ci
```

Create REDcap database Login to MySql

```
mysql -uroot -p
```

Add the redcap database

```
create database redcap;
```

Add user for REDCap application

```
grant all on redcap.* to '<redcapuser>'@'localhost' identified by '<redcapuser-password>';
```

```
exit
```

PHP

PHP is a general purpose programming language that can be interpreted by the Apache Server and is used as REDCap's server side programming language. REDCap's client side software is written mostly in HTML and JavaScript, but since those run entirely on a client's browser, only PHP needs to be installed in the host environment.

```
sudo yum install epel-release
sudo yum install http://rpms.remirepo.net/enterprise/remi-release-7.rpm
sudo yum install php73 php73-php-mysql
sudo systemctl restart httpd
```

PostFix/Sendmail

```
sudo yum install sendmail sendmail-cf
sudo setsebool -P httpd_can_sendmail on
```

Unpacking the Software

Copy REDCap files to environment using sftp client

Move REDcap source to Apache default web root '/var/www/html'

Unzip

```
sudo yum install unzip
```


🔍 Configuration Check

This page will test your current REDCap configuration to determine if any errors exist that might prevent it from functioning properly.

Basic tests

TEST 1: Establish basic REDCap file structure

Search for necessary files and folders that should be located in the main REDCap folder (i.e. "/var/www/html/redcap").

✓ **SUCCESSFUL!** - All necessary files and folders were found.

Figure A.5: Configuration Check Results

```
unzip redcap.**
```

Edit file database.php

```
#Change values below to match your mysql user created above $hostname = 'localhost'; $db = 'redcap';  
$username = ''; $password = '';
```

Installation Steps On the browser you can now navigate to localhost/redcap/install.php or the host name for your installation. The installation can be completed by following the web-based instructions and the steps will be specific to the installation environment.

Once installation is complete, REDCap will perform a configuration check, and any changes that need to be made to installation environment will be listed on screen. Changes can be made to the environment to address problems and returning to the configuration check screen will show their status. Often certain system services, such as the web server, will need to be restarted to update the output.

Bibliography

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