

Using REDCap Application in Tracking and Evaluation of Occupational Health Questionnaires for Animal Care and Use Program

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ABSTRACT

An occupational health program and personnel safety are essential components of an animal care and use program. This paper describes the development and implementation of an online occupational health risk assessment and screening process for personnel involved in the animal care and use program at the University of South Alabama. The COVID-19 pandemic necessitated a change from pre-pandemic operating procedures to reduce public health risks to personnel and provided an opportunity to convert from a paper-based process to an online platform powered by REDCap. The transition from a paper to digital format provided opportunities to create efficiencies and standardized best practices in screening, evaluating, and monitoring health risks assessments. The database and forms developed in partnership between the Occupational Health Program and the REDCap@USA team are enabling more streamlined and efficient data collection to support program and regulatory requirements within the institution. Academic institutions and non-profit organizations interested in developing or enhancing online health risk assessments and monitoring may consider utilizing REDCap and adapting the OHP process described in this article.

INTRODUCTION

Higher education institutions must provide a healthy and safe workplace for all personnel exposed to animals in biomedical research and/or teaching. *The Guide for the Care and Use of Laboratory Animals*, 8th edition (National Research Council of the National Academies, 2011), and PHS Policy (Office of Animal Laboratory Welfare, 2015) mandate a safe working environment for personnel involved in the animal care and use program within the institution. *The Guide* specifies that “hazard identification and risk assessment” are essential components of an Occupational Health Program (OHP) and that “health and safety specialists” should be involved in the evaluation of the OHP, hazards, and enrollee (National Research Council (US) Committee for the Update of the Guide for the Care and Use of Laboratory Animals, 2011). The University of South Alabama’s OHP is administered by the Office of Research Compliance and Assurance (ORCA). The Institutional Animal Care & Use Committee (IACUC) reviews OHP during semi-annual program reviews.

BACKGROUND

The OHP covers persons having direct or indirect contact with animals to evaluate health risks associated with occupational exposures. Individuals having indirect contact with animals are facility maintenance workers located within animal housing areas, personnel listed on an

IACUC protocol handling animal tissues, and members of the IACUC who have no direct contact with animals. Historically, the OHP healthcare provider required most personnel to obtain an in-person health assessment as part of the risk assessment process at a designated healthcare facility. During the COVID-19 pandemic and corresponding public health safety concerns (specifically social distance mandates and “stay at home” orders), the OHP faced challenges and could not continue with pre-pandemic operating procedures.

During the public health pandemic response to COVID-19, many institutions turned to REDCap (Research Electronic Data Capture) for health surveillance tracking, testing, and vaccination efforts, including over 20 U.S. states using REDCap for their vaccination enrollment plans (Vanderbilt University, 2021). Utilized by over 5,000 institutions in 141 countries (Vanderbilt University, 2021), REDCap is an easy-to-use and secure software application developed by Vanderbilt University (Harris et al., 2009) and available via a consortium model to any academic, non-profit, or government partner wishing to adopt the software. This consortium-based support model gives partner institutions access at no charge to their own REDCap system housed on local institutional servers, but does require that each institution has its own user and IT support who manage local installations of the platform and support

local users of the software (Harris et al., 2019). REDCap was developed to support clinical and translational research projects and is compliant with the Health Insurance Portability and Accountability Act (HIPAA) required to protect individually identifiable electronic health information. The University of South Alabama (USA) adopted REDCap in 2015. Still, the campus Computer Center providing server support requested that only de-identified health information be entered into the system, which limited use for those within the USA Health System needing to collect HIPAA-protected information associated with individuals. The second instance of REDCap was implemented within the USA Health System on a HIPAA-compliant server in February 2020, just before USA transitioned to a work from home model for most campus employees in mid-March. The subsequent increased demand for REDCap within the institution to support projects associated with COVID-19, including health screenings, contact tracing, testing and vaccination efforts, led to the formation of an expanded group of designated Biomedical Library staff called the REDCap@USA team to better support institutional REDCap users and project builds.

In response to the COVID-19 pandemic, the IACUC and ORCA decided that the current OHP operational processes needed to be modified. The IACUC and ORCA wanted to ensure the program's integrity

would be maintained, which meant reducing in-person office visits when possible yet still providing a proper risk-based provider assessment for research personnel. With this information in mind, ORCA initiated preliminary discussions with USA's COVID-19 Health Surveillance team to learn more about the possible uses for REDCap beyond COVID-19 contact tracing. After meeting with the Health Surveillance team, ORCA recognized numerous benefits in using REDCap's electronic data collection and management processes to replace the current OHP paper-based system. ORCA then met with the IACUC and presented information on why REDCap would benefit the IACUC OHP program.

Since contact tracing is largely based on risk assessment, ORCA suggested to the IACUC as a best practice that REDCap be used to evaluate potential risks(s) associated with working with animals, including a standardized health assessment of personnel. ORCA recognized the benefit in using REDCap to streamline processes utilizing electronic forms for data collection while still effectively maintaining the integrity of a risk-based approval process detailed in the OHP. In addition to using REDCap for data collection, associated OHP educational training materials can be linked through REDCap for enrolled participants. REDCap is designed for ease of use with multiple online and video resources for guidance. System-generated email

notifications can be sent when records are added, leading to labor-saving communications between the healthcare provider and the IACUC office.

REDCAP FOR COLLECTION OF OHP INFORMATION

ORCA began working with the REDCap@USA team in June 2020 to implement this project. The REDCap@USA team supports the development of REDCap surveys and databases for a wide range of research, performance improvement, and process support projects within the USA campus and health system. To recreate the current forms in a digital format and implement the changes requested by ORCA, REDCap team members consulted with the Office of Research Compliance and Assurance, including the IACUC Administrator, to better understand current processes and reviewed existing paper-based procedures and tracking of OHP enrollment status. An online platform for submitting the OHP health questionnaire was then developed. The REDCap platform includes a process for reviewing information submitted to the IACUC Office by the healthcare provider and a tracking mechanism to obtain healthcare provider documentation regarding work for specific laboratory settings. The pitch for utilizing REDCap was presented during a semi-annual program review and its use for administrating the OHP approved by the IACUC.

Additionally, REDCap will be used to monitor changes to relative risk, including an annual health questionnaire required of Biosafety Level-3/Animal Biosafety Level-3 personnel and a triennial health questionnaire for personnel exposed to animals or animal products. These databases have been specifically designed to collect health questionnaires and evaluate medical histories. The use of REDCap is expected to streamline risk assessment and enrollment in OHP. To improve communications between the healthcare provider and the ORCA, the design of the database includes various automated email notifications. For example, 60-day and 30-day reminders are sent to the enrolled personnel, the healthcare provider, and the ORCA. It's important to note that the exchange of information among all parties is done securely through the REDCap program, which is housed on a HIPAA-compliant institutional server and configured to meet IT security best practices (Vanderbilt University, n.d.). REDCap also has the capability to process identifiable, anonymous, or pseudonymous participant data, depending on project needs.

BENEFITS OF ELECTRONIC VS. PAPER-BASED DATA COLLECTION

A paper health screening form was filled out by employees, who were asked to provide their contact information, employee ID, job title, department and supervisor's name, and email. The same information is collected in digital format with the

additional capability of validating email addresses, phone numbers, and zip codes using the short text field type. Entry points have been added to collect the email addresses of the employee and supervisor, which are essential for the distribution of automated alerts/notifications and survey (form) invitations. The alerts/notifications feature automates at least ten points of contact that previously would have been performed manually. Any information collected via REDCap is only accessible to the ORCA administrators, medical providers, and REDCap administrators who have access to the project via their REDCap account, which is secured with a username and password. The ORCA administrators'

user rights do not allow access to the initial health screening, annual/triennial reviews, or medical record request forms. Using REDCap's "piping" feature, contact information from the initial health screening form needed by the ORCA administrators is automatically copied to the OHP Profiles form. The only information passed to the employee's supervisor is delivered in an email which includes the employee's name and their clearance status. Relying on electronic data collection reduces the risk of inadvertently exposing PHI compared to the paper-based collection methods, while being able to mimic the look and feel of the paper forms with which employees are familiar.

B. Occupational Information					
5. Please indicate the frequency of exposure to:	No Exposure	Infrequent	1-3xMnth	1-3xWk	Everyday
Animal & Animal Tissues (blood, waste, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Human Tissues & Fluids	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Biological Hazards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Carcinogens	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1. Section of the original paper enrollment form

B. Occupational Information
1. Please indicate the frequency of exposure to:

	No Exposure	Infrequent	1-3xMnth	1-3xWk	Everyday
Animal & Animal Tissues (blood, waste, etc.) * must provide value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human Tissues & Fluids * must provide value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biological Hazards * must provide value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Carcinogens * must provide value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radiation * must provide value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Figure 2. Electronic format of the section utilizing the matrix field type in REDCap

Incorporating branching logic creates a reduced data entry load for employees filling out the initial health screening and allows the employee to move through the process more efficiently. Branching logic may be employed when fields or questions are not needed for specific populations or need to be hidden under certain conditions.

The use of branching logic also offers the opportunity to capture more information than would have been possible with a space-restricted paper form. To reduce the data entry burden, information that has already been collected on the screening form is pre-filled into subsequent forms.

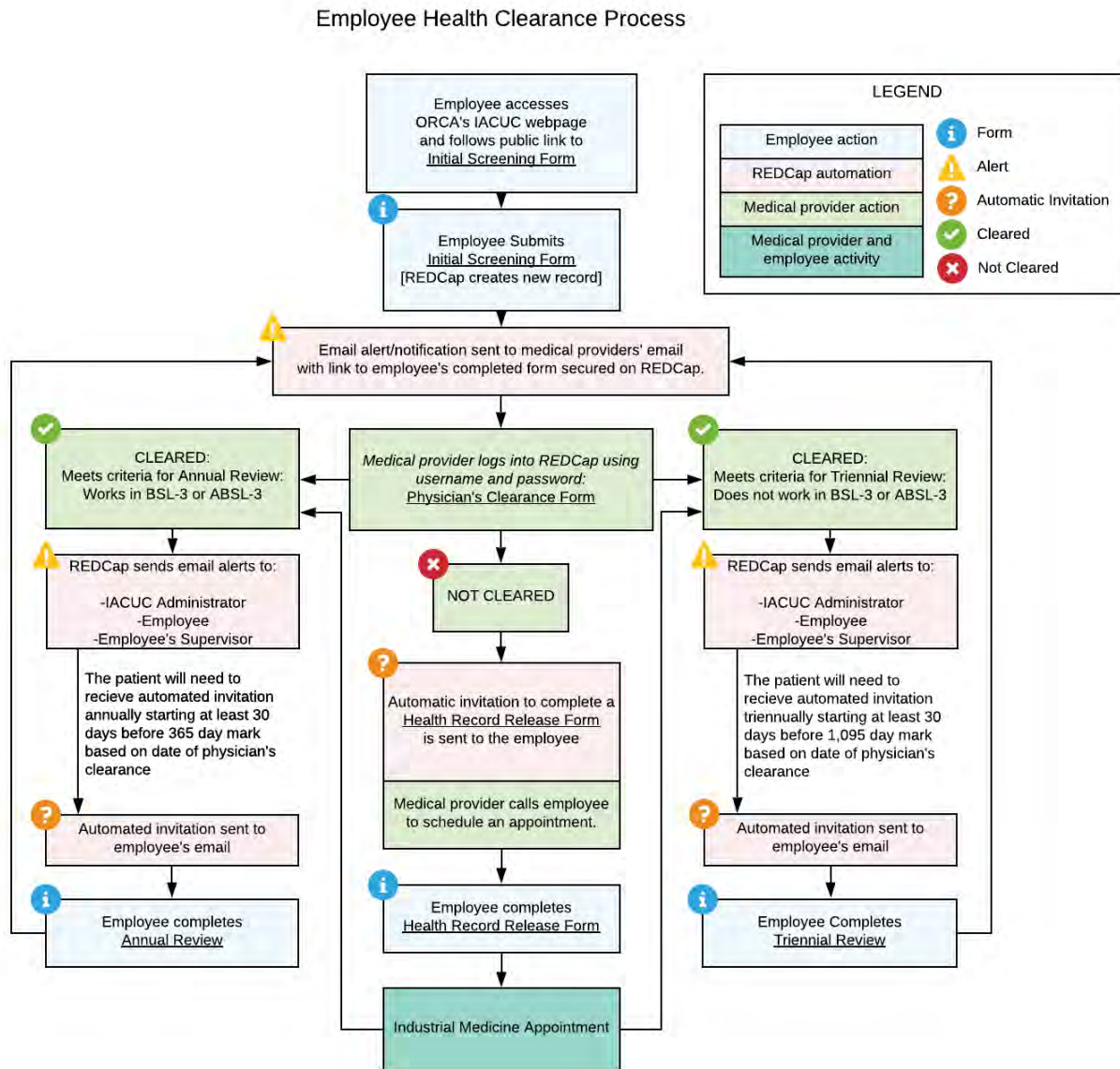


Figure 3. Employee health clearance process

If the employee elects not to participate, they are automatically redirected to a waiver form, which also triggers a notification addressed to the Attending Veterinarian. Once the employee submits their initial health screening form, if the Physician's Clearance Form is not submitted within 3 days a reminder is sent

to the healthcare provider email address and an alert is sent to the IACUC Administrator. Annual and triennial reviews are set up with a similar notification process including links to the most recent forms that have been completed by the employee.

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

Record ID	Occupational Initial Health Screening	Election Not To Participate	Physician's Clearance Form	OHP Annual Evaluation	Triennial Review Form
1 Doe, Jane, 01-01-1981					
2 Doe, John, 12-31-1978					

Figure 4. Record dashboard displaying instrument (form) status

🔔 Alert #1: Cleared for Animal Work [Edit](#) [Options](#)

🔔 If the following logic is TRUE when the instrument "Physician's Clearance Form" is saved and has any form status: `[eval_type_pcf] = "1" and ([work_animals_pcf] = "1" or [bs13_and_animals] = "1")`

➡ Send immediately

Send one time (only once per record - i.e., never re-trigger)

👤 Activity: 📧 2 records were alerted ([view list](#)) ✅ Last sent: 03-26-2021 13:24

🔔 Alert #2: Not cleared for work with animals [Edit](#) [Options](#)

🔔 If the following logic is TRUE when the instrument "Physician's Clearance Form" is saved and has any form status: `[eval_type_pcf] = "1" and ([work_animals_pcf] = "2" or [bs13_and_animals] = "2")`

➡ Send immediately

Send one time (only once per record - i.e., never re-trigger)

👤 Activity: 📧 No alerts sent yet

Figure 5. Alerts sent based on answers to the screening form

Automatic invitations have been set up. When an employee is due to complete an annual or triennial evaluation, they will receive an email with a unique link to the necessary form within their record. The conditions required for an invitation to be sent are the completion of the Initial Health Screening and the type of work for which the employee is cleared. The annual email

reminder is activated when the clearance form is completed but is scheduled to be sent 300 calendar days later. If the review form is not completed within 30 days, a reminder email will be sent, with a second and final reminder 30 days later or 5 days before the due date. This provides the employee with three months to submit the review form.



Figure 6. Conditional logic implemented to trigger automatic survey invitation

A benefit of the REDCap automated email system is that the burden of maintaining a database or reminders for annual and triennial review is lessened for the IACUC administrator. REDCap's reports feature was used to create several customized reports, which allow ORCA and the IACUC Administrator to browse a list of employees quickly. These dynamic reports are designed to be updated automatically in real-time each time they are viewed.

REDCap allows reports to be created using as many or few variables from the project as desired, and the reports can be tailored using basic filters or complex logic. Multiple reports can be created and conveniently housed on the left navigation pane within the REDCap project. Data can also be exported to Excel or other statistical software packages such as SPSS, SAS, and R.

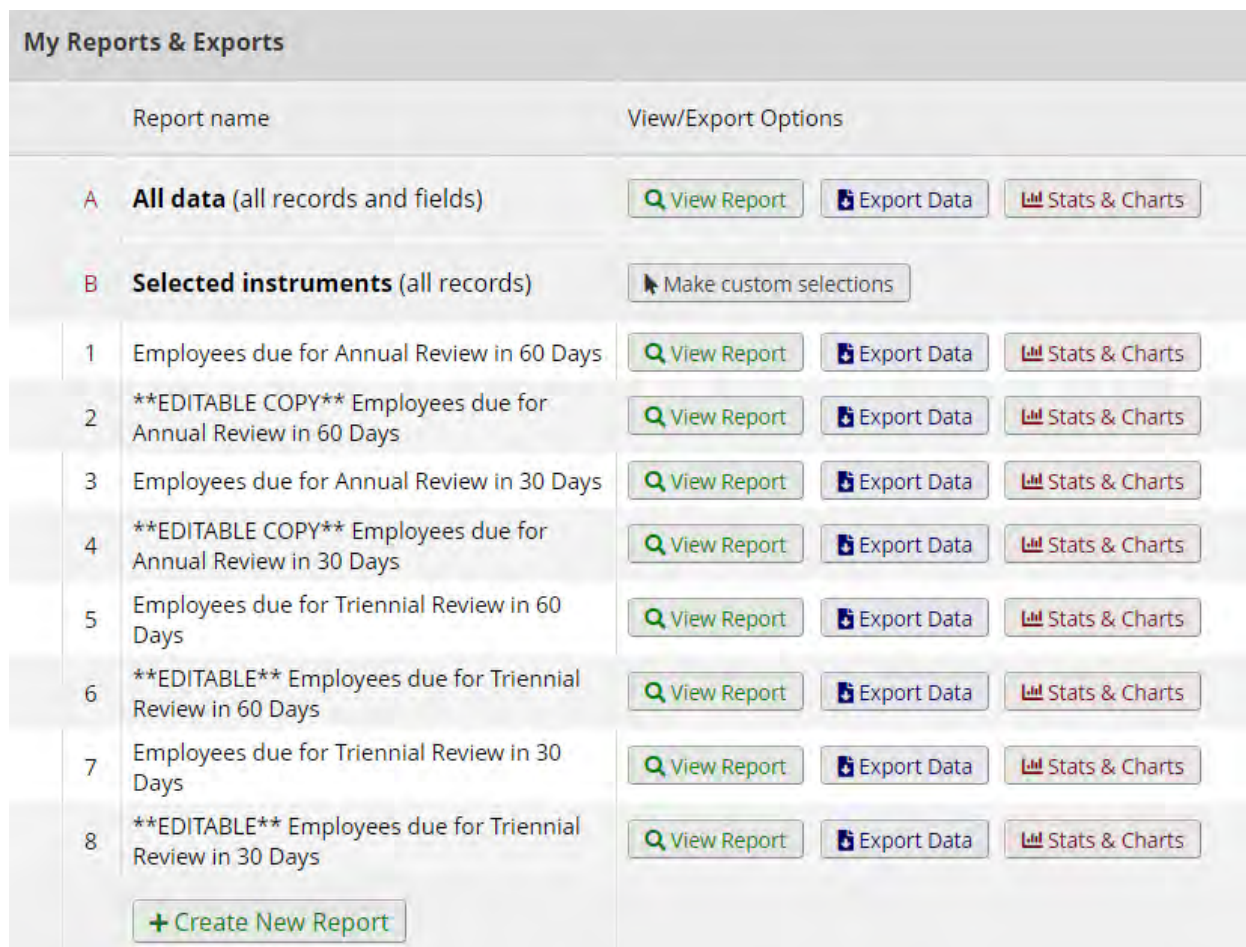


Figure 7. Custom reports can be created, exported, and viewed in several ways

Additionally, a "Profile" form is included in the project database where critical information about each employee (for example, the date of their last review, any waivers, type of work for which they are cleared, and an option to upload documents) are centralized for the use of ORCA and the IACUC Administrator. Individual packages of software called external modules are available for REDCap and can extend functionality, customization, and enhancements at both the system and individual project levels. The "Profile" form employs data imported

from other forms, and the Shazam external module was used to display the form in a concise and easy-to-read manner. This add-on enhances the functionality and cosmetic appearance of the form without interfering with the integrity of the data or how it is managed in the database. Shazam can be enabled for any REDCap project and allows instruments such as surveys and forms to have custom layouts created by using HTML tables to rearrange fields, enabling a design that better replicates the original paper form.

The screenshot displays a web-based form titled 'OHP Profiles form'. At the top, it shows 'Record ID' as 744. The form is organized into several sections:

- Personal Information:** Fields for 'Last Name', 'First Name', and 'Status' (dropdown).
- Professional Information:** Fields for 'Title', 'Waiver' (dropdown), 'PI's Lab', and 'Department'.
- Clearance and Class:** Fields for 'Cleared For' (dropdown) and 'OHP Class' (dropdown).
- Dates:** 'Enrollment Date' and 'Review Date' are date pickers with 'Today' and 'M-D-Y' options. 'Review Due' is a dropdown menu.
- Waiver or Clearance:** Four green 'Upload file' buttons with a small icon.
- Comments:** A large empty text area at the bottom.

 The form has a light blue background and a 'Expand' button in the bottom right corner.

Figure 8. OHP Profiles form utilizing Shazam external module formatting capabilities

DRIVERS OF SUCCESS AND CHALLENGES FOR IMPLEMENTATION

The build time for the USA OHP forms and reports in REDCap was approximately 65 hours. Critical components for success in this transition from paper to digital format included consistent and transparent communication between ORCA and REDCap team members. ORCA had a clear vision regarding the desired program changes, provided copies of paper forms with the edits wanted, and promptly answered questions regarding formatting and conversion. The ability to clarify any areas of confusion or misinterpretation of the information on the forms and flexibility with the re-formatting of specific

questions/fields into the digital format allowed for the enhanced design of the project. For example, questions involving past vaccinations and dates received evolved several times, as these fields were initially a forced-entry yes/no question. Through conversations between ORCA and the REDCap@USA team, it was decided that there should be a 'Not Sure' option as many people may not recall every vaccine received but may know one or some of them. Also included was an optional vaccination date field if personnel indicated that they had received a vaccination but could not remember the exact date, as this was anticipated as a potential barrier for submittal of the form. PDF copies of the original OHP forms being adapted within

REDCap was housed in a shared folder on a Google Drive for project documentation. Hand-marked revisions of the paper forms and subsequent iterations were particularly

useful to document changes, for referral and archival purposes over the life span of the project.

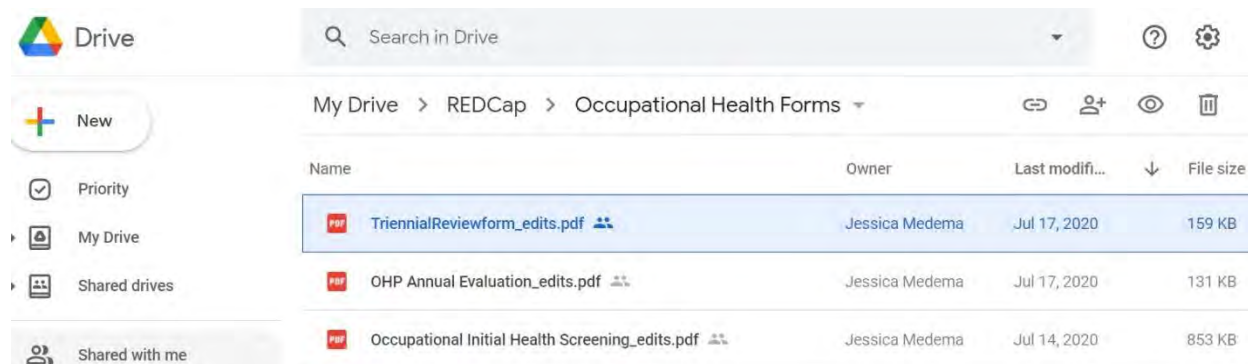


Figure 9. Project documents shared in Google Drive

Challenges in implementing the OHP process from paper to digital format included those not uncommon in projects that contain multiple stakeholders with busy schedules located in separate locations. The project was initiated after the institution had mandated work from home policies for most, but not all, university personnel. Consequently, meetings were held via Zoom, with follow-up communications occurring primarily via email. Training sessions for the healthcare providers and IACUC personnel were also planned via Zoom. That platform allows for screen sharing, making online demos both easy and recordable for later viewing. However, a primary obstacle for the training sessions was finding times where most stakeholders could meet together.

Therefore, alternative tools, including print and video tutorials regarding the OHP process in REDCap, were necessary to ensure those utilizing the forms had adequate training.

REDCap@USA team members are also available for individual user training sessions and to answer questions as needed. While not all institutions utilizing REDCap have dedicated personnel available to take on the primary responsibility of project builds, REDCap has extensive internal documentation, including a list of training videos that allow inexperienced users to become familiar with system features. Additionally, a repository for REDCap data collection instruments and forms is available for download to those within REDCap partner institutions, allowing for

the easy adoption and adaptation of previously vetted projects (Obeid et al., 2013; Vanderbilt University, 2021).

Building a Project

Learn how to build and modify data collection instruments.





Title	Description	Watch Video
Introduction to Instrument Development	An introduction to the Online Designer and Data Dictionary methods of instrument development.	 6 minutes
Online Designer	This online tool is the quickest and most intuitive method for making instrument modifications.	 5 minutes
Data Dictionary	The Data Dictionary is your project structure in a downloadable spreadsheet file. The spreadsheet can be modified and uploaded into REDCap to make instrument modifications. To see an example, download the Data Dictionary demonstration file .	 10 minutes
Project Field Types	An illustration of some popular field types.	 4 minutes

Figure 10. Training videos available on REDCap platform

With reduced traveling to off-site locations for office visits, streamlined data collection, and improved communications between research laboratory staff, the IACUC office, and the healthcare provider,

the utilization of REDCap for the USA OHP program will reduce barriers for both personnel and administrative offices.

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