

REDCap: My Self-Learning Digital Transformation Initiative for the FMR study

Sachin T. Bhagat,

Data Manager and Analyst,

The Foundation for Medical Research,

Mumbai, India sachinb@fmrindia.org

In a research organization managing Research data is a major challenge and this burden increases significantly when handling longitudinal clinical and public health studies. FMR implemented the longitudinal project for TB patients. For this project FMR required a secure, standardized, and scalable platform capable of handling participant enrollment, longitudinal follow-up, real-time data collection, data validation, user management, and reporting. Other electronic data capture (EDC) systems often involve substantial licensing costs. Recognizing this challenge, I undertook the responsibility of implementing Research Electronic Data Capture tool (REDCap) entirely from scratch without any direct technical guidance or formal training. This initiative involved learning Linux server administration, web server configuration, database management, cybersecurity, networking, SSL implementation, and REDCap administration independently through documentation, experimentation, and troubleshooting.

In view of the above; however, an additional critical challenge that is faced is the beginning of this journey.

I had no prior experience installing or administering REDCap servers. Every component required independent learning, including:

- Linux operating system administration
- Ubuntu Server
- Apache Web Server
- PHP configuration
- MariaDB/MySQL database management
- SSL certificate installation
- Domain configuration
- DNS management
- Firewall configuration
- Cron job scheduling
- REDCap Control Center configuration
- Email server configuration
- Mobile App synchronization
- User rights management

- Data Access Groups
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The implementation required studying official REDCap documentation, Linux manuals, technical forums, and experimenting through multiple trial-and-error cycles until every component functioned correctly.

Implementing REDCap independently presented several significant challenges.

The first challenge was the absence of direct technical guidance. Every problem had to be investigated independently, often requiring several hours of reading technical documentation and experimenting with different configurations.

Another major challenge involved integrating multiple technologies simultaneously. REDCap itself is only one component of a larger ecosystem that includes Linux, Apache, PHP, MariaDB, DNS services, SSL certificates, email servers, and networking infrastructure. A configuration issue in any one of these components could prevent the entire system from functioning correctly.

The mobile application configuration also required extensive testing to ensure successful synchronization between offline data collection devices and the central server.

Despite these challenges, persistence, continuous learning, and systematic troubleshooting enabled the successful completion of the project.

The implementation of REDCap has generated substantial benefits for the organization.

1. Significant Cost Savings: REDCap itself is available at no licensing cost for eligible institutions, allowing financial resources to be redirected toward research activities rather than software procurement.

2. Centralized Data Management: All participant information is now stored in a centralized, structured database, eliminating multiple Excel files and reducing duplication.

3. Improved Data Quality: Field validations, mandatory fields, branching logic, and automated calculations significantly reduce human errors during data collection.

4. Enhanced Data Security: Participant information is protected through encrypted communication, controlled user access, and comprehensive audit logs.

5. Increased Operational Efficiency: Research staff can enter data directly into REDCap mobile app/server, eliminating repetitive manual data entry and reducing turnaround time between data collection and analysis.

6. Real-Time Monitoring: Investigators can monitor recruitment, follow-up completion, missing data, and study progress through real-time dashboards and reports.

7. Scalability: The installed infrastructure can accommodate additional research projects without requiring major new investments, making it a long-term institutional asset.

8. Regulatory Compliance: Audit trails, controlled user access, standardized data collection, and secure storage help meet Good Clinical Practice (GCP) and institutional research governance requirements

I am very thankful to FMR for giving me the such a tremendous opportunity. This project significantly expanded my technical capabilities beyond my traditional role in Monitoring, Evaluation, and Data Management. Through this initiative, I developed practical skills in Linux administration, server deployment, database management, cybersecurity, networking, troubleshooting, and research informatics.

More importantly, the experience strengthened my ability to independently solve complex technical problems, integrate multiple technologies, and deliver an enterprise-level research solution without relying on external source. These competencies will continue to benefit future digital health and research initiatives at the foundation

The successful installation and implementation of REDCap for the FMR study represents more than a software deployment; it is an example of self-driven innovation and organizational capacity building. Starting without prior experience or direct technical guidance, I independently established a secure, fully functional Electronic Data Capture system that now supports high-quality longitudinal research.

The platform has strengthened data quality, improved operational efficiency, enhanced participant data security, reduced long-term software costs, and created a reusable digital infrastructure for future studies. This initiative demonstrates how self-learning, perseverance, and problem-solving can produce sustainable technological solutions that deliver lasting value to an organization.