

# Successful Utilization of the Electronic Client Reporting within HMIS: A Step Towards Data Digitalization in Sindh Province, Pakistan

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## Abstract

**Background:** The implementation of electronic case reporting (ECR) within the contraceptive Logistics Management Information System (cLMIS) represents a significant advancement in health data management by the Population Welfare Department in Sindh, Pakistan. This initiative, piloted in 200 Family Welfare Centres, aims to improve the quality and efficiency of family planning services, particularly in peri-urban areas where infrastructure challenges remain.

**Methodology:** A qualitative research design was used, with purposive sampling of 95 respondents, including District Population Officers, Family Welfare Workers, Family Welfare Assistants, and Social Mobilizers. Data was collected through direct observations, Focus Group Discussions (FGDs), and in-depth interviews. Thematic analysis was employed to identify recurring themes related to the benefits and challenges of ECR implementation.

**Results:** Participants highlighted significant improvements in data quality, reduced time spent on data entry, and enhanced accessibility to logistics information. However, challenges such as resistance to the system from older staff, limited access to technology (e.g., smartphones, laptops), and inadequate internet connectivity in remote areas were noted. These issues were compounded by a reluctance to adopt the new system, particularly among those nearing retirement.

**Conclusion:** The implementation of ECR within cLMIS demonstrates considerable potential to enhance the management of family planning services in low-resource settings. While technological barriers and resistance to change pose challenges, the benefits of improved data accuracy, efficiency, and logistics access suggest that ECR could play a crucial role in strengthening health systems in similar contexts.

**Keywords:** Electronic case reporting; data digitalization; contraceptive management information system

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## Introduction

Globally, digitalization in health systems has been gaining increasing momentum particularly in the area of Health Management Information Systems (HMIS), where digitalization is leading to improvements in service delivery, decision-making and data accuracy (1–4). These systems are critical in reporting on family planning programs where timely and accurate data can directly influence contraceptive supply, quality of care, and decision-making (1).

In low-and-middle income countries (LMICs), digitalization of family planning data has led to several improvements in program monitoring and evaluation (3–6). In Uganda, family planning service data from the public and private sector was integrated into the District Health Information System 2 (DHIS2) software which created data harmonization and minimized data redundancies (2). In Bangladesh, a digital logistics management was developed and integrated with the national HMIS which enabled real-time inventory tracking reducing stock-outs for Implanon from 69 percent to one percent (6). In West African countries, Benin, Nigeria, and Ghana, mobile-based digital platforms were initiated for community health workers to enter client-level data at service delivery points allowing tracking of client-level indicators (4,5).

Sindh province's Population Welfare Department (PWD) launched Electronic Client Reporting (ECR) within its contraceptive Logistics Management Information System (cLMIS) as an



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innovative web-based program with the vision to enhance family planning data reporting in resource-constrained settings. The pilot was implemented in 200 Family Welfare Centers in Sindh, Pakistan, with the aim of simplifying and enhancing mechanisms of data reporting and collection as well as provision of quality family planning services by minimizing human errors and improving accuracy of data recording. The new digitalized system reduces data entry time and streamlines the process of data entry to improve efficiency and logistics by providing credible and up-to-date information for family planning needs. ECR implementation further addressed challenges, such as low technological access, making it functional even in poor infrastructure and is adaptable to fit staff capacity by ensuring proper data management in family welfare centers with minimal technical capacity (7).

As noted above, studies have shown that implementation of ECR in the context of family planning and public health at large significantly improves efficiency in management of patient or client records (7,8). ECR integrates seamlessly with HMIS, enhancing efficiency in operations and proper management of logistics, resulting in a scalable and sustainable solution for Sindh. Data collection within the ECR system begins at the family welfare centers, where family planning record is taken and gathered into the system. The information is then forwarded to the HMIS for aggregation and saved within a central database. The consolidated data is part of decision-making, resource allocation, and proper planning and management.

The launch of the ECR system in the healthcare sector in Pakistan will enhance the quality of family planning data management by circumventing the pitfalls of the old paper-based system. The present study intends to assess the extent to which implementation of ECR enhances the precision of data, automates the data entry system, and enhances logistics in the family planning services. Moreover, the aims to document the technological and capacity-related issues encountered in implementing the digital system while investigating the experiences of healthcare providers and provides information on how digital systems can guide future policy and integration measures for family planning services in Pakistan.

## Methodology

### Study Design:

This study employed a mixed-methods study design to evaluate the implementation and impact of the Electronic Client Reporting (ECR) system within the Health Management Information System (HMIS) for family planning services in Sindh, Pakistan.

By integrating both qualitative and quantitative data, the study ensured a multidimensional understanding of the ECR system's effectiveness, usability, and associated challenges. The study was conducted in two selected districts of Karachi, East and Keamari, which represent diverse demographic and infrastructural

conditions in urban and peri-urban settings. These districts were purposively selected to reflect the variation in service delivery contexts and to assess the adaptability of the ECR system across different operational environments.

### Sampling:

A purposive sampling technique was used to select 95 participants from staff at 200 Family Welfare Centres (FWCs) operating under the Sindh Population Welfare Department. Participants were chosen based on their direct involvement in family planning service delivery and data management. The sample included District Population Officers (5), Family Welfare In-charges (25), Family Welfare Assistants (30), and Social Mobilizers (35), all of whom interact with the ECR system in their professional roles. This composition allowed the study to capture perspectives from both managerial and frontline service levels.

### Data Collection:

Data collection was carried out through multiple methods to ensure depth and triangulation. Four focus group discussions (FGDs) were conducted, with two held in each district and comprising of six to eight participants per session. These discussions aimed to explore experiences and perceptions of the ECR system's functionality, benefits, and challenges. In addition, ten in-depth interviews were held with District Population Officers and senior Family Welfare In-charges to gather detailed insights into policy implications, system integration, and organizational support structures. To assess changes in efficiency and workload, 24 time logs were collected from Family Welfare Assistants and In-charges, comparing data entry durations before and after the ECR system was introduced. Furthermore, 15 structured feedback interviews were conducted to assess user satisfaction, system usability, and barriers to adoption. The interview guide incorporated Likert-scale items to quantify user responses.

### Data Analysis:

Qualitative data from interviews and FGDs were audio-recorded, transcribed, and analyzed thematically using NVivo 12. Inductive and deductive coding strategies were applied to identify recurring patterns and themes related to system usability, data accuracy, capacity issues, and operational improvements. Quantitative data from feedback interviews and time logs were analyzed using SPSS version 26. Descriptive statistics such as means, medians, and frequency distributions were computed, and inferential analyses including paired t-tests were conducted to compare performance indicators pre- and post-implementation of the ECR system.

### Ethics:

An informed consent was obtained from the participants. Participation was voluntary, and all participants were informed

about their right to withdraw at any time, or to refuse to answer any questions. This study was approved by the Research Ethics Committee of Research and Development Solutions (Ref: No. RADS/IRB-GSM/26-11-2024/067).

## Results

### Qualitative Findings

Thematic qualitative analysis identified five key thematic areas (Table 1). Theme 1, Improved Data Quality and Efficiency underpinned improved data quality and efficiency due to expedited data entry and reduced discrepancies. Theme 2, Ease of Accessibility, encapsulated participants' positive feedback on usability and secure access of the interface, appreciating the system's interface simplicity and ease of accessibility. Theme 3, Improved Logistics Management, highlighted the benefits of the ECR in logistics management, particularly in inventory tracking at the facility-level. Theme 4, Gaps in Training and Capacity Building, highlighted issues faced by the staff in operating the system, particularly by older staff with a lower technological skillset who needed hand-holding in operating the system. Theme 5, Connectivity Issues, highlighted the challenges with connectivity issues, especially in the mobile clinics and clinics located in remote areas.

**Table 1: Thematic Analysis of Qualitative Findings on ECR Implementation**

#	Theme	Description
1	Improved Data Quality & Efficiency	The ECR system expedited data entry and reduced manual errors, resulting in more accurate, complete, and reliable client records. Built-in validation checks and automated summaries enhanced internal consistency and reporting efficiency, supporting better planning and performance tracking.
2	Ease of Accessibility	Users appreciated the intuitive interface, which simplified data entry through dropdown menus and pre-filled options. Secure login protocols and data privacy features enhanced user confidence, especially among those with limited technical experience.
3	Improved Logistics Management	The system supported real-time tracking of contraceptive stock levels, improving supply planning and reducing the risk of stock-outs. Digital inventory data facilitated timely procurement and distribution, although some delays persisted due to weak integration with central logistics systems.
4	Gaps in Training & Capacity Building	Limited digital literacy among older or less technically proficient staff posed challenges to system adoption. While initial trainings were helpful, lack of refresher sessions and on-site troubleshooting hindered sustained usage and confidence in handling the system.
5	Connectivity Issues	Inadequate internet access, particularly in remote and mobile clinics, disrupted real-time data entry and created reporting backlogs. Users suggested offline functionality to maintain continuity and data completeness in low-connectivity areas.

### Quantitative Findings

Study results show that the implementation of the ECR system has resulted in significant improvements in key performance

indicators. Participants believed that the quality of data improved from 60% to 85%, with a paired t-test indicating a significant difference ( $t = -7.45$ ,  $df = 94$ ,  $p < 0.01$ ). They also believed that the efficiency of data recording increased from 50% to 75%, with a paired t-test indicating a significant decrease in data input time ( $t = -5.12$ ,  $df = 94$ ,  $p < 0.05$ ). Furthermore, the participants indicated real-time access rose from 55% to 80%, with a paired t-test showing a substantial increase ( $t = -8.20$ ,  $df = 94$ ,  $p < 0.01$ ) (Table 2).

**Table 2: Pre- and Post-Implementation Comparison of ECR System Performance Indicators (n = 95)**

Indicator	Pre-ECR Mean (%)	Post-ECR Mean (%)	t-value	df	p-value
Data Quality	60	85	-7.45	94	< 0.01
Efficiency (Time Saved)	50	75	-5.12	94	< 0.05
Real-time Data Access	55	80	-8.20	94	< 0.01

39% participants also highlighted resistance to change as a barrier in adopting the ECR, followed by technological barriers at 34% and poor digital literacy at 27%. A chi-square test indicated a significant negative correlation between resistance to change and user satisfaction with the system ( $\chi^2 = 12.75$ ,  $p < 0.05$ ) (Table 3).

**Table 3: Challenges Encountered During ECR Implementation (n = 95)**

Challenge	Frequency (n)	Percentage
Resistance to Change	37	38.9%
Technological Barriers	32	33.7%
Poor Digital Literacy	26	27.4%

## Discussion

The implementation of the ECR system within the HMIS has demonstrated substantial progress in digitalizing and enhancing family planning service delivery and data quality in Sindh, Pakistan. Quantitative results reveal a statistically significant improvement in key performance indicators, notably data quality, operational efficiency, and real-time data accessibility. These findings align with studies conducted in Bangladesh, Uganda, Ethiopia, Benin, and Ghana, emphasizing the role of digital health interventions in improving data accuracy, minimizing human error, and facilitating timely decision-making in low-resource settings (2-6).

Data quality, a critical component of effective health information systems, improved markedly from 60% to 85% ( $p < 0.01$ ), signifying a reduction in manual reporting errors and enhanced record integrity. This outcome supports prior studies which found that digital reporting tools strengthen the accuracy and reliability of routine health data, particularly in the domain of reproductive health services (1-5). Similarly, operational efficiency improved from 50% to 75%, indicating reduced time spent on data entry which is a result comparable to digitalization

efforts in other LMICs where automated systems streamlined administrative burdens (9). Real-time access also rose significantly (from 55% to 80%), reflecting the ECR system's capacity to support timely data reporting and access to client records, which is essential for planning and service responsiveness (1).

Despite these gains, the study also highlighted important challenges that affect the scalability and sustainability of the ECR system. Resistance to change emerged as the most commonly reported barrier (38.9%). This is consistent with existing literature indicating that behavioural and organizational resistance is a common barrier to health information system adoption, particularly when transitioning from paper-based to digital systems (10). Resistance often stems from fear of increased workload, loss of control over processes, or lack of confidence in using digital tools.

Technology-related barriers and poor digital literacy were also prominent, affecting 33.7% and 27.4% of participants respectively. These constraints are widely acknowledged in studies from similar low-resource settings, where infrastructure limitations, inadequate hardware, and limited user proficiency hinder the full adoption of digital health solutions (11). In particular, older staff members and those stationed in satellite or mobile clinics expressed difficulty adapting to the new system due to limited exposure to digital tools and inconsistent internet connectivity.

Thematic analysis of qualitative data further contextualizes these quantitative findings. Participants recognized improvements in data integrity and workflow efficiency, and praised the system's intuitive design and secure access protocols. However, challenges in logistics management, particularly inventory tracking inconsistencies, signal the need for further integration between digital reporting and supply chain systems. Furthermore, persistent gaps in training and capacity building were noted, underscoring the importance of continuous professional development and on-site technical support to enhance digital literacy and confidence among staff (2). Studies conducted in Bangladesh, Nigeria, and Ghana reported deployment of mobile app-based data entry to reduce time taken to complete forms (4–6). To mitigate the challenges noted here, mobile-based data entry can be piloted with ECR as well considering ubiquitous usage of mobile phones amongst healthcare workers for reporting and coordination (9).

Connectivity issues, especially in mobile clinics and remote satellite areas, also emerged as a critical operational barrier. Inadequate infrastructure compromises the effectiveness of digital systems and threatens to widen disparities in data quality and service access across geographic regions. This finding echoes global evidence from Bangladesh, and West- and sub-Saharan African countries emphasizing the need for context-specific technology adaptation to ensure inclusivity and equity in digital health initiatives (4,5,12).

Taken together, these findings reinforce the potential of ECR systems to transform family planning service delivery through data-driven decision-making and operational efficiency.

However, they also highlighted the need for supportive policies that address human resource capacity, infrastructure gaps, and change management. Long-term success of such interventions depends upon multisectoral collaboration, regular system evaluation, and iterative design improvements based on user feedback.

### Limitations

While the study provides valuable insights, it is limited by its geographic scope, focusing only on two districts. The purposive sampling method, though effective for targeting key informants, may limit the generalizability of findings across all family welfare centers in Sindh. Additionally, the self-reported nature of some data (e.g., time logs and user satisfaction) may introduce reporting bias as well.

### Conclusion

Successful integration of the ECR system into HMIS has high potential to assist significantly in enhancing management of family planning services in resource-limited settings, particularly Sindh, Pakistan. The shift from paper-based systems to digital platforms encountered resistance and technological challenges, especially regarding limited digital literacy and connectivity issues; however, the overall advantages of broadened data quality and operational efficiency strongly advocate for the continued growth of ECR throughout the region.

### Ethical Approval:

The study protocol was reviewed and approved by the Research Ethics Committee of Research and Development Solutions (RADS)

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**Data Availability:** Data supporting the findings are available upon reasonable request.

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### Authors' Contribution:

**All Authors:** Design, analysis, writing of the manuscript, final review

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