

## ORIGINAL RESEARCH

# Enhancing Medicine Information Services: A Future-Proof, Low-Cost Data Management Strategy

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**Aim:** A state-wide obstetric medicines information service (OMIS) is offered as a free telephone service by pharmacists at a tertiary women's and newborn hospital. The methods for recording OMIS enquiries included using hard-copy tools, Microsoft Excel® spreadsheets, and Microsoft Access® databases, which had significant limitations that hindered service delivery and user efficiency. The study aimed to develop an electronic tool that is easily accessible across various electronic devices, with secure data storage and access.

**Method:** Databases used by other medicine information services were explored. Electronic Data Capture (REDCap®) was deemed the most appropriate tool, as a secure, web-based application, and was selected for its simplicity and robust functionalities.

**Results:** The REDCap® system was used to develop, test, and review the efficient capture and reporting on essential components of OMIS enquiries. Six months post implementation, a user satisfaction survey was circulated to all pharmacists who deliver and supervise the service. The REDCap® features considered as the most satisfactory were the simultaneous multi-user access functionality, the ease of entering data, and time efficient in data entry with drop-down selection. The integration of REDCap® and Microsoft Power BI® enabled continuous and efficient reporting of data collected. Data displayed on the dashboard could be filtered to obtain a relevant report effectively, including call count by caller type, calls received by month, patient type, and location of caller.

**Conclusion:** The implementation of REDCap® and PowerBI® in data management in the medicine information service has significantly improved data accuracy, user satisfaction, and reporting efficiency.

**Keywords:** Medicine Management; Information; Pharmacy; Pregnancy; Obstetrics-Gynaecology

## Introduction

Providing information on the safety of medicine use during pregnancy and breastfeeding is inherently complex, highlighting the necessity for Medicines Information Services experienced in this area to have access to dedicated systems for data capture and management. Exploring and refining these practices is important in meeting the critical need for effective data management in this specialised area of healthcare.

It is common for women to take medications during pregnancy or to conceive while on therapy. However, healthcare providers and consumers face a significant lack of evidence-based information regarding the use of drugs during pregnancy or while breastfeeding due to limited studies and data involving pregnant women and

medication use compared with other areas of medicine that have abundant data.<sup>1–3</sup> The hospital, as the principal referral and specialist tertiary hospital for obstetrics and gynaecology in the state, often receives enquiries from health professionals and the public. The inquiries are directed to clinical pharmacists who are trained and skilled, have expert knowledge and clinical experience in this field.

For over 30 years, the clinical pharmacists at this hospital have provided a free telephone service that offers evidence-based information both to consumers and healthcare professionals. The service responds to between 2,500 and 3,000 enquiries annually, covering topics such as medication use pre- and post-conception, teratogenic risks during pregnancy, reproductive toxicities from drug exposure, and drug compatibility with breastfeeding, including information on maternal and infant drug levels, potential effects on the breastfed infant, and impacts on lactation.

Given the complexity and medico-legal implications of the information provided, it is crucial for the pharmacy department to document these enquiries in accordance

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with practice standards, such as the Society of Hospital Pharmacist Medicines Information Practice Standards.<sup>4</sup> Complete documentation ensures the maintenance of comprehensive records, optimal quality assurance, and allows for accurate auditing of responses, thereby minimising the medico-legal risks for the health organisation. It also allows for education and training to be facilitated and for the recognition of common medication trends and patterns.

Historically, data collection at the study hospital involved hard-copy records and manual entry into Microsoft Excel®. Although Microsoft Access® was later adopted for data collection, it had significant limitations, such as the inability to support simultaneous multi-user access, susceptibility to spelling errors in free-text fields, lack of ongoing technical support, and non-automated reporting. Manual data manipulation and reporting has restrictions that include a limited capacity to undertake tasks such as trending and a requirement that data is manually distributed to users. The above-listed limitations hindered service delivery and user efficiency, prompting the pharmacy department to explore alternative approaches for recording and reporting inquiries.

### **Aim**

The study aimed to develop an electronic tool that is easily accessible across various electronic devices, modifiable at the site of use, and that has secure data storage and access. The intent of this study was to share the experience of the newly developed tool, which is efficient, low-cost, and future proof for managing medicine information data.

### **Methods**

Human Research Ethics approval was gained from the relevant Quality Improvement Committee (Approval number: GEKO 52977) on the 13 Jun 2024. Standards for quality improvement reporting excellence (SQUIRE) guidelines were followed in reporting and publishing the findings.

### **Design**

This is a single centre, retrospective study describing the planning, and implementation of a low-cost documentation tool that is readily available, and that has increased data security and the capability for integration with data visualisation software. The documentation tool was used to review analytics for descriptive data documented.

### **Exploring Options Available**

To explore the databases used in other medicines information centres, the pharmacists at the study hospital reached out to sites across Australia via phone and email. Members in the Specialty Practice Group for Medicines Information by Advanced Pharmacy Australia were also contacted.<sup>4</sup> Based on the information gathered, the authors conducted a literature search to explore the databases used by other sites, utilising online journal databases including Embase, Medline, PubMed, and Google Scholar. Search terms included: "Drug information", "Medicine information" "Midatabank", and "REDCap".

### **REDCap® Database**

Research Electronic Data Capture (REDCap®), is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.<sup>5-6</sup> REDCap®, which is free to WA Health employees, has also been highlighted as an effective system to manage protected health information.<sup>7-9</sup> REDCap® has been well received in WA Health; it has been used for creating surveys and for data capture and management.<sup>10</sup> For example, it was used as the state-wide cold chain breach and vaccine wastage form, and database for pharmacists' clinical interventions and lactation consultants at the study site.<sup>11-13</sup>

The feasibility of using REDCap® was explored by creating an initial electronic data capture tool that included components identified as essential to record for each enquiry. Information documented was divided into seven sections: Staff Name, Caller Details, Patient Details, Enquiry, Responses, References used, and Medication Name. Medications listed in the Australian Medicines Handbook<sup>14</sup> were included in the database, and users can select the medication name using the drop-down tab or can type in the first few letters of the medication name to prompt a suggestion for auto-completion. The pharmacists in the study site developed the data entry platform with assistance from the support team Health Department.

To enable continuous improvement activities, the data entered were retrieved via REDCap® and answers provided to enquirers by the clinical pharmacists were peer-evaluated by the Clinical Deputy Chief Pharmacist.<sup>15</sup> The enquiries documented were randomly selected for peer review monthly. The evaluation of enquiries is recommended to be conducted annually to highlight good practice when answering questions about medicines, to ensure that accurate information and advice is provided to the user in a timely manner based on clinical need, and to provide feedback to staff in training or during appraisals.<sup>15</sup> To enable trend evaluation, REDCap® data was integrated to Microsoft Power BI®, enabling real-time data analysis and interactive visualisation of information within custom fields.

### **User Testing and Feedback**

The pilot tool was tested by the pharmacists and feedback provided during departmental meetings. After testing, the data entry tool was moved to production for a pilot period of 6 months (January to June 2020). During this time, feedback was gathered during departmental meetings and points actioned to refine the data entry tool. For example, additional complementary and alternative medicines were added to the medication field, through analysis of data retrieved from "other" medication selections. Six months post-implementation of the pilot, an electronic Microsoft Forms user satisfaction survey was circulated to all clinical pharmacists who delivered and supervised the service.

## Results

### Options available for Medicines Information Databases

When searching for medicines information services, some studies did not mention the tools used to record and report data.<sup>15–18</sup> While MiDatabank® use in medicine information services is well established,<sup>19–27</sup> only two studies described the usefulness of the database.<sup>26–27</sup> These studies described MiDatabank® as an efficient and user-friendly method of recording enquiries, resulting in a high documentation rate of medicines information queries, an increased speed of response to enquiries, and a reduction in patient complaints about the service.<sup>26–27</sup> RELIS, a network of four Norwegian regional medicine-information and pharmacovigilance centres, was described as a database for recording medicines information enquiries. However, since the information is in Norwegian and not accessible outside of Norway, it was not considered relevant by the study site.<sup>28–29</sup>

No articles mentioned the use of REDCap® to record or report on medicines information enquiries. While MiDatabank® met requirements for data capture and reporting, the fee involved was deemed to be prohibitive for the department as a result of budget constraints. REDCap® emerged as the most appropriate tool for its simplicity, free availability, and being supported by Health Support Services (HSS) within the Health Department and also due to previous experience with the platform within the study site.<sup>12–13</sup> It offers robust functionalities, including electronic form design, workflow management and comprehensive audit trails.

### REDCap® Database Creation and Testing

The final data entry tool developed after incorporating feedback during the testing and six-month pilot is shown in **Figure 1**. The database was a simple, free, secure web-based application. The tool enables the design of electronic forms and workflows as well as providing comprehensive and robust audit trails. REDCap® data entry can be performed on computers, and smart devices with internet access.

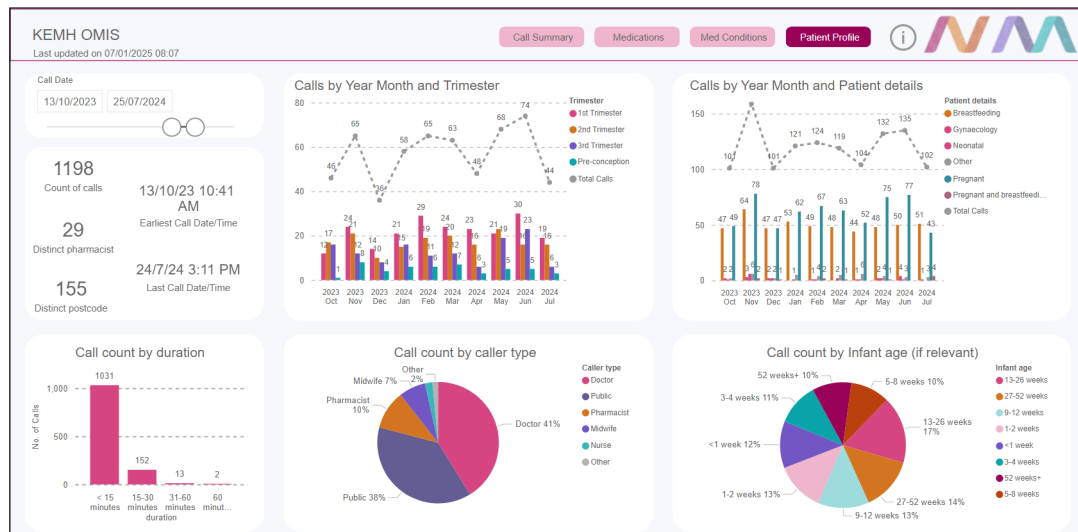
The ability to retrieve data recorded for departmental quality assurance was tested. The study site performs peer reviews on randomly selected calls documented regularly. The peer review assessed the appropriateness of references used, and completeness and appropriateness of answers provided,<sup>4,30</sup> and was done according to the Australian Standards of Practice for Medicines Information Services.<sup>4</sup> The data recorded in the REDCap® database were able to be retrieved for peer evaluation of the answers provided to the enquirers. Data on REDCap® can also be exported as Microsoft Excel® data for manual reporting.

To enable continuous monitoring of trend and call information, the REDCap® database was integrated with Microsoft Power BI® visual dashboard, which allowed automated report and data analysis to be performed, enabling instantaneous understanding of data trends. **Figures 2** and **3** are examples of the integration. **Figure 2** reflects the number of calls received, the types of calls, and patient type, and **Figure 3** displays the location of callers around Australia.

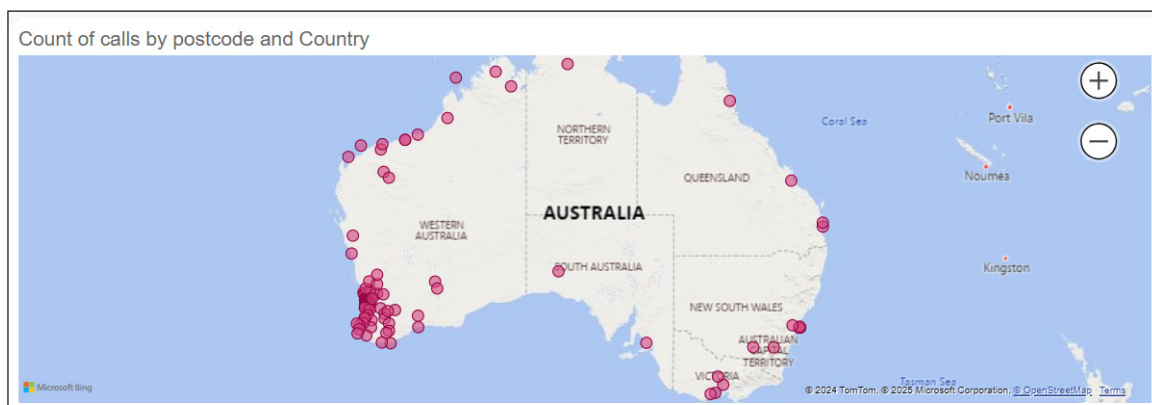
The screenshot shows a web-based data entry form titled 'Details of Enquiry'. At the top, it says 'Please enter the call details below.' The form is organized into several sections:

- Enquirer Name:** A text input field.
- Consent:** Radio buttons for 'Yes' and 'No', with a 'reset' link.
- Referrer:** A text input field.
- Caller Contact Details:** Fields for Phone, Email, Fax, Address, and PostCode.
- Type of call:** Radio buttons for 'Internal' and 'External', with a 'reset' link.
- Caller type:** A dropdown menu with options: Doctor, Midwife, Nurse, Pharmacist, Public, Other, and a 'reset' link.
- Patient details:** Radio buttons for 'Pregnant', 'Breastfeeding', 'Pregnant and breastfeeding', 'Neonatal', 'Gynaecology', and 'Other', with a 'reset' link.
- Information Requested and Response:** Two large text areas for notes, each with an 'Expand' link.
- Was written information provided?:** Radio buttons for 'Yes' and 'No', with a 'reset' link.
- References:** A grid of 18 buttons linking to various resources like 'Pregnancy and Breastfeeding Medicines Guide', 'LactMed', 'eTG', etc.
- Time taken:** Radio buttons for '< 15 minutes', '15-30 minutes', '31-60 minutes', and '60 minutes+', with a 'reset' link.
- Date of Enquiry:** A date picker with 'UTC' and 'GMT+10:00' options.
- Pharmacist:** A dropdown menu.
- Medications:** A section with a 'View supply list/updates' link, a 'Number of medications for this entry' field (set to 1), and a dropdown menu for selecting a medication. The dropdown shows options like 'Corticosteroids', 'Mometasone (DPI)', 'Budesonide', etc.
- Medical condition:** A dropdown menu for selecting a condition. The dropdown shows options like 'Allergic rhinitis (hay fever)', 'Eczema', 'Nausea/vomiting', etc.

**Figure 1:** Data entry on REDCap with medication and condition.



**Figure 2:** An example of a visual dashboard report integrating REDCap® data with PowerBI® dashboard on the number and type of callers and patient details.



**Figure 3:** An example of a visual dashboard report integrating REDCap® data with PowerBI® dashboard on the location (postcode) of caller.

**Table 1:** User Satisfaction Survey Responses.

**The most useful aspects of the Microsoft Access®**

(these features were carried across when creating the REDCap® database)

- Can select pharmacist from drop-down list (n = 7, 87.5%)
- Can select enquiry details from drop-down list (n = 7, 87.5%)
- Date and time automatically populated (n = 6, 75%)
- Can search previous records (n = 6, 75%)

**The most useful aspects of the REDCap®:**

- Can select references from multi-choice checklist (n = 8, 100%)
- Can select medications from drop-down list (n = 8, 100%)
- Can enter multiple medications per call (n = 8, 100%)
- Can have multiple staff on the database at one time (n = 7, 87.5%)

**Participants strongly agreed that REDCap® had made:**

- Accessing the database easier
- Entering calls easier

- Entering calls less-time consuming
- Them more likely to enter calls
- Them more confident that patient/caller privacy is suitably maintained
- Regular reporting easier, less time-consuming, more likely to be conducted
- Ad-hoc and specific reports able to be conducted in a timely manner

**Database User Satisfaction**

The full responses (N = 8) to the user satisfaction survey are in Appendix 1. The proportion of users who stated they were “somewhat or very satisfied” with the database improved from 50% (4/8) for Access® to 100% (8/8) for REDCap®. Most of the users (87.5%, n = 7) were also “somewhat or very dissatisfied” with Access® as only one user can access the database at a time, compared to 100% (8/8) of users “very satisfied” with REDCap as multiple users can access the database at a time. The users were more satisfied with the features of REDCap®, (Table 1). All participants agreed that the transition from Microsoft Access® to REDCap® had a positive impact on practice.

(Contd.)



## Discussion

This is the first study describing the use of REDCap® for the documentation of medicine enquiries. Its implementation has significantly improved data accuracy, user satisfaction, and reporting efficiency. It enhanced the features of previous Microsoft Excel® and Access® databases, ensuring secure data storage and access and is better suited to the needs of the medicines information service as reflected in the user survey. Data security is imperative in the service delivery of the obstetric medicines information service due to the sensitivity of data capture including pregnancy gestation, medications and medical condition. The added benefit for the study site is the cost-effectiveness of the tool developed as the platform is free for employee of the Health Department of the state.

The dashboard in **Figure 2** and **Figure 3** demonstrated the integration of REDCap® and Microsoft Power BI®, which enabled continuous, live reporting that could be used to understand the service provided. A Microsoft Power BI® dashboard is an ideal solution as it provides live reports on the calls documented and allows streamlined, cost-effective and efficient reporting without delays or the need for manual data manipulation **Figure 2** showed that the most common patient type was pregnant women, particularly in their first trimester. This is consistent with a previous study that received more enquiries relating to drugs in pregnancy compared to enquiries relating to drugs in breastfeeding.<sup>20</sup> The findings highlighted the lack of evidence-based information regarding the use of drugs during pregnancy and the importance of obstetric medicine information service.<sup>1-3</sup> **Figure 3** reflected the accessibility of medication information service provided across the state, with areas away from metropolitan area being the more common enquirers. This is likely a result of the limited resources and support in the regions compared with the metropolitan area with more tertiary hospitals and healthcare infrastructure support. The dashboard also showed some callers were from outside the state. While the exact reason is unknown, it may be due to enquirers contacting the study hospital after the medicine information services in their region have closed for the day, due to the time zone difference with Western Australia.

The new system supports simultaneous multi-user access, reduces potential spelling errors, and provides a cost-effective alternative to the current system. The ability to retrieve data easily for peer review, or to modify data capture fields as needed has enhanced the usability for staff. Integrating with Microsoft Power BI® for automated report generation enhances overall service quality and provides meaningful extraction of data to identify trends that can inform education requirements, training and evaluation of resources available to the service.<sup>13</sup>

Limitations of the study include that the accuracy of data is dependent on the documentation of the clinical pharmacists, which is affected by possible under-reporting, and inter-user variability in the documentation on REDCap® database. Another limitation on the

applicability of the study may be the variability of information captured by different medicine information centres. The fields and data in the RedCap® database were designed to meet the needs for the specialty of the hospital, for instance pregnancy trimester and age of infant for the breastfeeding mother. The limitation can be addressed through the flexibility in the design of the database, which can be modified to suit the users. The user experience of the initiative is specific to data from a single hospital, with small number of subjects in the staff survey, which may have potential biases and restrict its broader applicability.

## Conclusions

The new REDCap® database has been successfully implemented at a state tertiary referral centre for women and newborns. The changeover from Microsoft Access® to REDCap® has had a positive impact on practice. Pharmacists agreed that REDCap® has enabled better access and utilisation of a data entry tool, making data entry less time-consuming. The user-friendly, easy-to-access health platform is recommended for consideration in other medicine information centres of similar settings.

## Data Accessibility Statement

Data cannot be shared for ethical/privacy reasons.

The authors had complete access to the data documented in the medicine information documentation database and the documentation and access is ongoing.

## Ethics and Consent

Human Research Ethics approval was gained from the Western Australia Women and Newborn Health Services Quality Improvement Committee (Approval number: GEKO 52977) on the 13 Jun 2024.

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## Competing Interests

The authors have no competing interests to declare.

## Author Contributions

The article has been read and approved by all authors.

TL participated in the conceptualisation, project administration, methodology, data curation, writing – review & editing, supervision. CB participated in the design of the study, carried out the literature review and created the REDCap® database, writing – original draft. ST participated in project administration, methodology, investigation, data curation, writing – original draft. NM participated in supervision, methodology, writing – review & editing. JF participated in leading the integration of REDCap® database and the Microsoft PowerBI® dashboard. All authors read and approved the final manuscript.

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