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A Computerized Database for Adverse Drug Reactions

Strengthening a Hospital-Based Pharmacovigilance Programme in India

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Modern information technology can be used by healthcare professionals (HCPs) for various purposes and make a substantial contribution in optimizing the quality of medication use in institutions.[1] The use of healthcare databases at the hospital level as sources of information on various aspects of drugs has been previously described in literature; for example, the use of drug information databases on the hospital intranet for easy access by HCPs,[2] implementation of a relational database for the storage and recovery of data from queries in a drug information unit,[3] and the use of centralized hospital databases to store information about drug allergies.[4]

In the field of drug safety, the use of information technology has revolutionized the identification of adverse drug reactions (ADRs), data analysis and the communication of safety data. Safety data collected by various means are stored for future retrieval and analysis by national pharmacovigilance centres and regulatory agencies by means of ADR databases such as the Canadian ADR Monitoring Program Database, WHO ADR database (Vigibase), US FDA Adverse Event Reporting System (AERS) database and the Australian ADR database. Among these, only a few, such as the Canadian ADR Monitoring Program Database, are available in the public domain for searching without any restrictions, while others have limited access but have provision for gaining specific data by contacting the respective agencies.

At the hospital or institutional level, in this era of advanced information technology, ADR reporting activities often occur through paperless systems, and information is stored directly in computerized databases. These databases could be utilized for future retrieval and additional research.[5-9] However, in developing countries such as India, where pharmacovigilance activities themselves are in the nascent stage, the advances happening in this field are minimal compared with those in developed countries. Even though there is published work[7-9] on the use of ADR databases for advanced research at the hospital level, the extended use of such databases in promoting the activities of the ADR reporting programme on a routine basis is less reported.

Here we share our experiences in developing a database to record ADRs reported in the ADR unit of a tertiary care teaching hospital (Kasturba Hospital, Manipal) in South India. We also describe how the database was utilized, and the way in which it helps in strengthening the ADR reporting programme at the hospital level.

1. Adverse Drug Reaction Reporting Programme and Development of the Database

A spontaneous ADR reporting programme was initiated at Kasturba Hospital in July 2001. The ADR reporting unit here is one of the peripheral

centres for the national pharmacovigilance programme. The unit is coordinated by the Department of Pharmacy Practice, and other activities of the department include operating a drug information centre and other clinical pharmacy activities. When the ADR unit receives initial notification of an ADR, a member of the unit collects additional details regarding the reaction and records these in a separate ADR documentation form. Thereafter, appropriate evaluation is performed for various parameters such as causality, severity and preventability. Up until July 2007, 2012 ADRs had been reported in the ADR unit, including reports from Kasturba Hospital as well as the Dr T.M.A. Pai Hospital, a 250-bed multispecialty hospital associated with Kasturba Hospital. Even though an online ADR reporting form is made available through the intranet of the hospital, most often (>95% of the time), ADRs are reported using the printed forms that are also in use. In developing a computerized database, in addition to having computerized back-up storage of ADR data, we wanted to make the retrieval of data easier for various extended functions.

After assessing various database management systems, we chose to use Microsoft Office Access® 2003 for the design of our storage and retrieval system. The development of the database was outsourced to a programmer. System requirements were defined by the ADR reporting unit and, after suitable review and pilot testing, the format of the database was finalized. The entire programming of the database and future maintenance was estimated to cost $US75. The cost of developing the database was low and is affordable for similar hospital-based ADR reporting units in India or other developing countries.

The database user interface has three sections: a data entry page (ADR notification form); a search page (equipped with the suitable search parameters to conduct specific search); and a help page. The data entry page includes details on patient demographics, name of the reporter, and drug and reaction details. The drug classes involved in the ADRs are included according to anatomical therapeutic chemical (ATC) classification (level 2) based on the WHO Completed ATC Index 2007.[10] Reactions are codified based on the preferred term as per the WHO-ADR terminology[11] and the corresponding system organ class (SOC) included. The search page includes parameters for carrying out a specific search based on drug, drug class, reaction, SOC, patient details (age and sex), reporting department and period of reporting. It is also possible to search on a combination of parameters.

ADRs reported in the unit up until July 2007 were coded and entered into the database by a staff member of the ADR reporting unit. At present, consecutive entry of ADR reports in the database is performed by a staff member of the ADR reporting unit. In the longer term, we plan to train the postgraduate students of the Department of Pharmacy Practice in coding and entry of data, which could be done under staff supervision.

The database is available on two computers in the ADR reporting unit. The data entry is password protected, while the data search is open access to all members of the ADR unit, which includes staff and students of the parent Department of Pharmacy Practice. Data searches performed by students will be validated by a senior member of the unit before being communicated to the HCP.

2. Utilization of the Database

A simple printed documentation form (the Database Utilisation Documentation Form) was designed to capture the details of the individual instances in which the database was utilized. It is mandatory that this form is completed each time the database is accessed, either by the HCP using the database or the member of the ADR reporting unit who uses the database for responding to a query, providing feedback on any reported ADR or for any other purpose. The form includes details on the purpose of use, demographics of the person using the database, and the information provided based on the search conducted. Such documentation will help in evaluation of the utility of the database, pattern of information sought, assessment of the need for optimization of the database, as well as to assist in future searches for similar queries.

Table I. Description of the specific instances for which the adverse drug reaction (ADR) database was utilized

Responding to queries on details of specific ADRs reported in the unit
1. Details of any previous reports of cotrimoxazole-induced hyponatraemia
2. Details on response to drug withdrawal, especially time for improvement of symptoms in patients with clindamycin-induced pseudomembraneous colitis
3. Details of any previous reports on cardiovascular abnormalities associated with amphotericin B
4. Details of any previous report of hyperammoninaemia reported with valproic acid
5. Pattern of methotrexate-induced pneumonitis, especially time to onset of symptoms after administration of the drug
6. Details of reports on dysphonia with inhaled corticosteroids
7. Details of reports on tremor with levosalbutamol
8. Details of any report of adrenal suppression with inhaled corticosteroids
To provide supplementary information on in-house data, while providing feedback in response to an ADR reported by a healthcare professional
1. Details of reports of headache with clindamycin/amikacin
2. Details of reports of anaphylaxis with amoxicillin
3. Details of reports of generalized weakness with clindamycin/amikacin
4. Pattern of ADRs affecting skin and appendages reported to with amoxicillin
5. Details of ADRs affecting skin and appendages reported to with tinidazole
6. Details of toxic epidermal necrolysis or other severe dermatological reactions reported with hydroxycarbamide (hydroxyurea)
7. Details of toxic epidermal necrolysis or other severe dermatological reactions reported with phenytoin
8. Details of thrombocytopenia reported with heparin
To provide supplementary information along with the responses to queries received by the drug information centre in relation to drug safety
1. Incidence of peripheral neuropathy with nevirapine and zidovudine
2. Pattern of thrombocytopenia caused by first-line antitubercular drugs
3. Dosage of pyridoxine for treatment of isoniazid-induced neuropathy
4. Pattern of leflunomide-induced gastrointestinal ADRs
Research purposes
1. Details of phenytoin-induced ADRs reported in a unit of the General Medicine Department were queried as the physician wanted to evaluate the pattern of these ADRs as a research project

In the 6-month period following completion of data entry into the system, during which time the HCPs were encouraged to utilize the services, the database was accessed for various purposes 21 times. A description of the specific instances for which the ADR database was utilized is provided in table I. They included eight queries for details on reports of certain specific ADRs reported earlier in the unit; for example, there was a query on cotrimoxazole-induced hyponatraemia and a query on the pattern of valproic acid-induced hyperammonaemia as a similar reaction was suspected in a patient treated by the enquirer. In another eight instances, the database was searched to supplement information retrieved during a literature search to provide feedback to the HCP in response to a reported ADR. At our hospital, the HCPs reporting the ADRs were satisfied with the new practice in which information on other similar ADR reports in the hospital can be provided, along with information from the literature. In general, people tend to be more contented with data from their own population/clinical setting, and drug safety is no exception.

In four instances, the database was utilized to provide supplementary information along with the response to queries on drug safety made to the drug information centre that is attached to the ADR reporting unit. For instance, there was a query on the pattern of thrombocytopenia caused by first-line antitubercular drugs. Information from the literature was provided, as well as the pattern of antitubercular drug-induced thrombocytopenia reported in the ADR reporting unit (five previous reports). The enquirer was satisfied, and appreciated the new ap-

proach of providing inhouse data on ADRs in response to drug information queries. In another instance, information was sought by a clinician for research purposes; details on phenytoin-induced ADRs reported in a unit of the General Medicine Department were requested as the physician wanted to evaluate any pattern and hopefully come out with a presentation or publication.

In all instances, the database was searched by a member of the ADR reporting unit either in response to a query from the HCP or for other purposes as mentioned earlier. Therefore, the Database Utilisation Documentation Form was completed in all 21 cases by the member of the ADR reporting unit.

3. Discussion

One of the major intentions of developing the database was to assist in the dissemination of information on reported ADRs to the HCPs of the hospital, and thereby contribute to promoting safer use of medications, inform the HCP of the utility of having a reporting programme and further motivate them to report ADRs. HCPs were informed about the availability of a computerized database of ADRs through the hospital circular and periodic drug safety bulletin published by the ADR reporting unit. The HCPs were encouraged to contact the unit to obtain information on previous reports of the ADR they were interested in for better individual patient care, to assist in understanding the pattern of the specific ADR and to carry out advanced research.

We observed from the short period of time one has been available at our institution, that an ADR database in a hospital setting can serve various purposes. It assists in retrieving data for periodic evaluation of patterns for dissemination among the reporting group, provides additional information along with the feedback on individual ADR reports, assists in providing quality responses to drug information requests, assists the clinician in the management of an individual case by understanding the pattern of the reaction and can provide information for conducting advanced research. Evaluating patterns of ADRs may help in identifying drug safety issues specific to the work setting and, in response, assist in the design of interventions at various levels including educational approach for the prescribers and other HCPs. Knowing how useful an ADR report can be could then stimulate reporting by the HCPs. As the data bank grows, it may serve as a means for signal generation at a hospital level.

It is important to keep in mind that the data retrieved from a database based on spontaneous reporting data has inherent limitations of a lack of information on the incidence of the ADR and of not providing the complete picture as under-reporting is a major drawback of this pharmacovigilance tool.

We plan to continue generating awareness on the availability of the database and its utility among the HCPs. Furthermore, we intend to modify the database to include more details on evaluated parameters such as causality, severity, preventability, type and frequency, and predisposing factors so that it will assist in evaluation of patterns and identify drug safety issues at a higher or more specific level. We intend to do periodic evaluation of patterns, which will be disseminated through the drug safety bulletin published by the unit. At present the database is available only in the ADR unit and HCPs have to contact the unit to get details. HCPs are encouraged to obtain the information from the database either by visiting the ADR reporting unit, generating a query by telephone or email or contacting the clinical pharmacist (a member of ADR reporting unit) present in ward rounds in selected departments of the hospital. Limited access to the database is a potential limitation in the present mode of functioning. We are considering the possibility of making the database available in the hospital's intranet after discussion with the hospital management committee. However, consideration needs to be given to issues of patient confidentiality, and misuse and misinterpretation of data as the entire details of the reaction are not included in the database.

From our initial experiences with an ADR database in a hospital setting, we suggest that it can be instrumental in assisting various activities of the ADR reporting unit on a regular basis in promoting safer drug use. Dissemination of information can

help in generating HCP interest in the reporting programme, which will help in strengthening the activities and utilization of hospital-based ADR reporting programmes, especially those in the developmental stages.

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