INTRODUCTION

Drug information service is the service that encompasses the activities of specially trained individuals to provide accurate, unbiased, factual information, primarily in response to patient-oriented drug problems received from various members of the health-care team [1]. These activities are undertaken by the especially well-trained individuals, i.e., clinical pharmacist and doctor of pharmacy professionals who are qualified and registered under the Board of State Pharmacy Council in providing information to optimize the drug therapy [2]. Providing drug information is a fundamental responsibility of all pharmacists irrespective of the practice setting [3]. The World Health Organization (WHO) stated that drug information center (DIC) is a core component of national programs to promote the rational use of drugs [4]. Drug information is key to preventing medication errors. Such information leads to enhanced quality of patient care and thus improved patient outcome [5].

Drug use is a complex practice even a small mistake, and incomplete information has catastrophic implication in patients and results into noncompliance, therapeutic failure, overdose, medication errors, drug interactions and adverse drug reactions (ADRs), which concurrently lead to ineffective and irrational use of drugs. According to the WHO, 60% of drug related problems can be prevented with appropriate information of drugs [6]. Lack of time is some of the factors that make the physicians unable to update their knowledge about drugs which have resulted in an increasing demand for independent and unbiased information about drugs for better patient care [7]. Information must be available in a format suitable for health practitioners and relevant to current clinical practice [8]. In India, irrational use of drugs is common, and this has led to antibiotic resistance, ADRs, drug interactions, and other drug-related problems [9].

The primary function of the center is in accessing to the drug information source and dissemination of the same to the requester [10]. Possible sites for the location of a drug information center include the ministry of health, hospital, university, non-government organization, and the private sector [11]. According to available data, these services can help to detect and prevent ADRs, medication errors and promote rational use of drugs [12]. The center was intended to be utilized as a source center where people could call or contact health-care professionals and ask medicine-related questions [13]. DICs aims to achieve the quality use of medicines by providing and communicating timely, accurate, balanced and comprehensive information on drugs and their usage [14].

In 1962, the first drug information center was initialized at the University of Kentucky Medical Center [15]. In India, Rosemary sharp, a missionary from UK, started the first drug information center at Christian Medical College, Vellore in the early 1970s [16]. Later the Karnataka State Pharmacy Council (KSPC) established its Drug Information Centre in August 1997 to disseminate unbiased drug information to health-care professionals. The center has been registered with International Register of Drug Information Services [17].

Recognizing the need to provide organized drug information to health-care professionals as well as consumers, the WHO India Country Office in collaboration with the KSPC has supporting the establishment of 5 drug information centers. These centers have
been established in Haryana (Sirsa), Chattisgarh (Raipur), Rajasthan (Jaipur), Assam (Dibrugarh), and Goa (Panaji). They started functioning in 2007 [18].

Quality assurance in DIS can be deciding what services are to be provided, providing them, measuring how well the services were provided, and if the services were not found to be acceptable or optimal, undertaking some correctional activity to ensure that future services will be acceptable [19]. In developing countries like India, there are only a few DICs and are limited by lack trained staff, funds and by limited access to current literature. This clearly signifies that there is a need for periodic evaluation of mode of functioning and quality of services provided by the DIC [20]. Pharmacists are challenged with keeping up to date with an increasing number of new drugs and literature [21].

WHO recognizes independent drug information centers as a core component of national programs to promote the rational use of drugs [22].

In 2013, the drug information center was established by Bapuji Pharmacy College in S.S Institute of Medical Sciences and Research Centre (SSIMS and RC), Karnataka. The center focuses on providing unbiased drug information, well referenced, critically evaluated and up to date information which promotes the safe and effective use of medication. Clinical pharmacists and the staff working in our department were specially trained under drug information center with adequate knowledge on clinical research, pharmacology, pharmacetics, pharmaco therapeutics, and statistics.

**Objectives**

The objective of the study was to assess the utilization of drug information services and creating awareness for enhanced utilization of DIC in a tertiary care teaching hospital.

**METHODS**

A retro-prospective observational analysis of DIC was conducted in a tertiary care teaching hospital in Davanagere for 6-months.

**Inclusion criteria**

- Drug information provided to various health-care professionals (doctors, nurses, paramedical).
- Drug queries generated or requisitioned from various departments in the entire hospital.

**Exclusion criteria**

- Drug information provided to patients at the time of patient counselling.
- Any other drug information provided to the patient through direct access to DIC.

**Ethical issues**

The ethical clearance for the study was obtained from the Institutional Ethical Committee of Bapuji Pharmacy College, Davanagere.

**Study procedure**

The drug information request and documentation forms from the DIC were retro-prospectively analyzed for 6-months, for collecting the following parameters such as professional status of enquirer, specialty of practice, mode of receipt of query, purpose of enquiry, time frame to reply, and references used. The quality of services provided by the DIC was assessed on feedback questionnaire given by the enquirer, which comprised questions pertaining to awareness, utilization, opinion, etc. Education program was conducted in the hospital for the students of Pharm. D regarding their role in patient care and the systematic approach to answering drug information enquiries. Awareness about DIC and its services was created in the hospital by circulating brochures and interacting with health-care professionals.

**RESULTS**

**Retrospective analysis**

A total number of 943 queries were received to drug information center of SSIMS and RC from January 2013 to August 2015 (Table 1).

Among these, most of the queries were given by post-graduate (PG)/interns 474 (50.27%) followed by physician 282 (29.90%) and pharmacist 68 (7.21%) (Table 2).

Out of 943 queries, 542 (57.49%) were obtained during ward rounds, 393 (41.67) via direct access and 8 (0.85%) by others (Table 3).

Among these, 719 (76.25%) were enquired to update knowledge, 221 (23.43%) for better patient care and 3 (0.32%) for other purposes (Table 4).

Our retrospective analysis illustrates that most of the queries were asked regarding indication 358 (18.60%) and least regarding poisoning 22 (1.14%) (Table 5).

Around 629 (66.70%) queries were given as printed material, 197 (20.89%) as written, 62 (6.58%) as verbal and 55 (5.83%) in both written and verbal form (Table 6).

Time frame for reply for the majority of queries was within a day (46.45%) followed by within 2-4 hrs (27.78%) (Table 7).

**Table 1: Year-wise distribution of queries**

| S. No. | Year                 | Total number of queries received | Average number of queries received |
|--------|----------------------|---------------------------------|-----------------------------------|
| 1      | 2013 (January-December) | 237                             | 20                                |
| 2      | 2014 (January-December) | 401                             | 33                                |
| 3      | 2015 (January-August)  | 305                             | 38                                |

**Table 2: Professional status of enquirer**

| S. No. | Professional status of enquirer | Number of queries (%) |
|--------|--------------------------------|-----------------------|
| 1      | PG/Intern                       | 474 (50.27)           |
| 2      | Physician                       | 282 (29.90)           |
| 3      | Pharmacist                      | 68 (7.21)             |
| 4      | Nurse                           | 64 (6.79)             |
| 5      | Surgeon                         | 37 (3.92)             |
| 6      | Others                          | 8 (0.85)              |
| 7      | Resident                        | 6 (0.64)              |
| 8      | Dermatologist                   | 4 (0.42)              |

**Table 3: Mode of receipt of the queries**

| S. No. | Mode of receipt of the query | Number of queries (%) |
|--------|------------------------------|-----------------------|
| 1      | During ward rounds           | 542 (57.48)           |
| 2      | Direct access                | 393 (41.67)           |
| 3      | Others                       | 8 (0.85)              |
| 4      | Telephone                    | 0 (0)                 |

**Table 4: Reason of requisition**

| S. No. | Reason of requisition | Number of queries (%) |
|--------|-----------------------|-----------------------|
| 1      | Update knowledge      | 719 (76.25)           |
| 2      | Better patient care   | 221 (23.43)           |
| 3      | Others                | 3 (0.32)              |
About 516 (54.72%) queries were answered by using Micromedex followed by textbooks 243 (25.77%), websites 107 (11.35%), and journals 77 (8.16%) (Table 8).

Nearly 77 (8.16%) queries were answered by using primary resources, 623 (66.07%) by secondary resources and 243 (25.77%) by using tertiary resources (Table 9).

The majority of the requesters rated the provided drug information as good 518 (54.93%) and satisfactory 142 (15.06%) (Table 10).

Prospective analysis
A total of 394 queries were received from September 2015 to February 2016. The average number of queries received per month was 67. Most of the queries were obtained in the month of February (20.81%) (Table 11).

Out of 394 queries, most of the queries were given by physicians 166 (42.13%) followed by PG/interns 87 (22.08%) and surgeon 50 (12.69%) (Table 12).

Out of 394 queries, 236 (59.89%) were obtained during ward rounds, 140 (35.53%) via direct access, 10 (2.55%) by others and 8 (2.03%) through telephone (Table 13).

Among the queries, 195 (49.49%) were enquired to update knowledge, 194 (49.23%) for better patient care and 5 (1.28%) for other purposes (Table 14).

Our prospective analysis illustrates that most of the queries were asked regarding ADR of the drug 202 (21.28%) and least regarding poisoning 9 (1.09%) (Table 15).

### Table 5: Types of drug query

| S. No. | Types of drug query     | Number of queries (%) |
|--------|-------------------------|-----------------------|
| 1      | Indication              | 358 (18.60)           |
| 2      | ADR                     | 289 (15.02)           |
| 3      | Dosage/administration   | 271 (14.08)           |
| 4      | Drug therapy            | 228 (11.84)           |
| 5      | Others                  | 192 (9.97)            |
| 6      | Pharmacokinetics        | 178 (9.25)            |
| 7      | Interactions            | 118 (6.13)            |
| 8      | Availability/cost       | 108 (5.61)            |
| 9      | Efficacy                | 100 (5.19)            |
| 10     | Pregnancy/lactation     | 61 (3.17)             |
| 11     | Poisoning               | 22 (1.14)             |

ADR: Adverse drug reaction

### Table 6: Mode of reply

| S. No. | Mode of reply     | Number of queries (%) |
|--------|-------------------|-----------------------|
| 1      | Printed material  | 629 (66.70)           |
| 2      | Written           | 197 (20.89)           |
| 3      | Verbal            | 62 (6.58)             |
| 4      | Both (written and verbal) | 55 (5.83) |

### Table 7: Time frame for reply

| S. No. | Time frame to reply | Number of queries (%) |
|--------|---------------------|-----------------------|
| 1      | Within a day        | 438 (46.45)           |
| 2      | Within 2-4 hrs      | 262 (27.78)           |
| 3      | Within 1-2 days     | 145 (15.38)           |
| 4      | Immediately         | 98 (10.39)            |

### Table 8: Data sources used for information

| S. No. | Sources used for information | Number of queries (%) |
|--------|------------------------------|-----------------------|
| 1      | Micromedex                   | 516 (54.72)           |
| 2      | Textbooks                    | 243 (25.77)           |
| 3      | Website                      | 107 (11.35)           |
| 4      | Journals                     | 77 (8.16)             |
| 5      | Others                       | 0 (0)                 |

### Table 9: Categorization of data sources used

| S. No. | Data sources used         | Number of queries (%) |
|--------|----------------------------|-----------------------|
| 1      | Primary resources         | 77 (8.16)             |
| 2      | Secondary resources       | 623 (66.07)           |
| 3      | Tertiary resources        | 243 (25.77)           |

### Table 10: Quality of DI provided

| S. No. | Quality of DI provided    | Number of queries (%) |
|--------|---------------------------|-----------------------|
| 1      | Good                      | 518 (54.93)           |
| 2      | Satisfactory              | 142 (15.06)           |
| 3      | Excellent                 | 122 (12.94)           |
| 4      | Can improve               | 98 (10.39)            |
| 5      | Fair                      | 60 (6.36)             |
| 6      | Poor                      | 3 (0.32)              |

DI: Drug information

### Table 11: Month-wise distribution of received queries

| S. No. | Months          | Number of queries (%) |
|--------|-----------------|-----------------------|
| 1      | September 2015  | 52 (13.20)            |
| 2      | October 2015    | 68 (17.26)            |
| 3      | November 2015   | 45 (11.42)            |
| 4      | December 2015   | 70 (17.77)            |
| 5      | January 2016    | 77 (19.54)            |
| 6      | February 2016   | 82 (20.81)            |

### Table 12: Professional status of enquirer

| S. No. | Professional status of enquirer | Number of queries (%) |
|--------|---------------------------------|-----------------------|
| 1      | Physician                       | 166 (42.13)           |
| 2      | PG/interns                      | 87 (22.08)            |
| 3      | Surgeon                         | 50 (12.69)            |
| 4      | Nurse                           | 47 (11.93)            |
| 5      | Dermatologist                   | 17 (4.32)             |
| 6      | Pharmacist                      | 17 (4.32)             |
| 7      | Resident                        | 9 (2.28)              |
| 8      | Others                          | 1 (0.25)              |

### Table 13: Mode of receipt of queries

| S. No. | Mode of receipt of queries     | Number of queries (%) |
|--------|---------------------------------|-----------------------|
| 1      | During ward rounds              | 236 (59.89)           |
| 2      | Direct access                   | 140 (35.53)           |
| 3      | Other                           | 10 (2.55)             |
| 4      | Telephone                       | 8 (2.03)              |

### Table 14: Reason of requisition

| S. No. | Reason of requisition           | Number of queries (%) |
|--------|---------------------------------|-----------------------|
| 1      | Update knowledge                | 195 (49.49)           |
| 2      | Better patient care             | 194 (49.23)           |
| 3      | Others                          | 5 (1.28)              |
Our prospective study has shown that 162 (41.14%) queries were given as printed material, 129 (32.74%) as written, 58 (14.70%) as both written and verbal and 45 (11.42%) in verbal form (Table 16).

Time frame for reply for 133 (33.75%) queries were within 2-4 hrs, 117 (29.69%) were within a day, 93 (23.66%) were within 1-2 days and for 51 (12.90%) were immediately (Table 17).

About 203 (41.17%) queries were answered by using Micromedex followed by textbooks 135 (27.38%), journals 100 (20.28%) and websites 55 (11.17%) (Table 18).

Nearly 100 (20.28%) queries were answered by using primary resources, 258 (52.34%) by secondary resources and 135 (27.38%) by using tertiary resources (Table 19).

Majority of the requesters rated the provided drug information as good 185 (46.95%) and excellent 74 (18.77%) (Table 20).

By comparing the results of both retrospective and prospective studies indicates an average of 29 queries/month was received in retrospective analysis and 67 queries/month in prospective analysis period.

**DISCUSSION**

Drug information service can help to detect and prevent ADRs, medication errors and promote rational use of drugs. Therefore, these centers can positively improve the outcome of therapy.

There was a gradual increase in the number of utilization of drug information service during the prospective analysis period. It was due to the impact of awareness created in the hospital regarding drug information center.

After analyzing the queries, the physicians maximally utilized the drug information services which comprise more than 40% of consult volume compared to PG/interns, surgeons and other health-care professionals.

As a result, it can be stated that the provision of drug information services is a major source of providing DI. Most of the queries were received during ward rounds (59.89%), which could be attributed to the easy accessibility of clinical pharmacist that prompts other health-care professionals to utilize the services. This was similar to the results of the studies conducted by Subash et al. (2009) and Venkatraghavan et al. in the study conducted by Subash et al., 44% of queries received during ward round, whereas it was estimated as 61.5% in the study of Venkatraghavan et al.

The reason of requisition of most of the queries was to update knowledge (49.49%) and for better patient care (49.23%). This is comparable with the study conducted by Jeevangi et al., which showed that maximum queries were on ADR (35.90%). While in the study conducted by Subash et al., in 2013, most commonly asked questions were on drug therapy (34%). Our findings indicate that physicians give more importance to ADRs of various drugs.

In this study, 33.75% of the queries were answered within 2-4 hrs, which is in contrast to the study findings done by Jayasutha et al. where majority of the queries were replied within a day (86%). This is because of the ready availability of authenticated drug information software and ease of getting information from these sources.

In our study, most of the queries were answered in printed material (41.14%). This result was similar to the result (52.46%) of the study done by Mudigubba et al.

To answer the queries, primary, secondary and tertiary sources were used. Among them, most of the queries were answered by using Micromedex (41.17%). These findings are similar to the studies conducted by Aida et al. and Jeevangi et al. where it was 37.3% and 52.45%, respectively. The availability of recent and relevant information in Micromedex makes clinical pharmacists to use it as a major source of providing DI.

Feedback responses clearly demonstrated that majority of enquirers were very much satisfied with the performance of the service and because of the ready availability of authenticated drug information software and ease of getting information from these sources.

### Table 15: Types of drug query

| S. No. | Types of drug query | Number of queries (%) |
|--------|---------------------|-----------------------|
| 1      | ADR                 | 202 (21.28)           |
| 2      | Indications         | 152 (16.32)           |
| 3      | Dosage/administration | 138 (14.52)         |
| 4      | Efficacy            | 72 (8.72)             |
| 5      | Drug therapy        | 71 (8.07)             |
| 6      | Interactions        | 64 (7.27)             |
| 7      | Others              | 48 (5.45)             |
| 8      | Pregnancy/lactation | 47 (5.34)             |
| 9      | Availability/cost   | 46 (5.23)             |
| 10     | Pharmacokinetics    | 40 (4.55)             |
| 11     | Poisoning           | 9 (1.09)              |

ADR: Adverse drug reactions

### Table 16: Mode of reply

| S. No. | Mode of reply | Number of queries (%) |
|--------|---------------|-----------------------|
| 1      | Printed material | 162 (41.14)          |
| 2      | Written        | 129 (32.74)           |
| 3      | Both (written and verbal) | 58 (14.70) |
| 4      | Verbal         | 45 (11.42)            |

### Table 17: Time frame for reply

| S. No. | Time frame to reply | Number of queries (%) |
|--------|---------------------|-----------------------|
| 1      | Within 2-4 hrs      | 133 (33.75)           |
| 2      | Within a day        | 117 (29.69)           |
| 3      | Within 1-2 days     | 93 (23.66)            |
| 4      | Immediately         | 51 (12.90)            |

### Table 18: Data sources used for information

| S. No. | Data sources used for information | Number of queries (%) |
|--------|----------------------------------|-----------------------|
| 1      | Micromedex                       | 203 (41.17)           |
| 2      | Textbooks                        | 135 (27.38)           |
| 3      | Journals                         | 100 (20.28)           |
| 4      | Websites                         | 55 (11.17)            |
| 5      | Others                           | 0 (0)                 |

### Table 19: Categorization of data sources used

| S. No. | Data sources used | Number of queries (%) |
|--------|-------------------|-----------------------|
| 1      | Primary resources | 100 (20.28)           |
| 2      | Secondary resources | 258 (52.34)      |
| 3      | Tertiary resources | 135 (27.38)           |

### Table 20: Quality of the DI provided

| S. No. | Quality of the DI provided | Number of queries (%) |
|--------|----------------------------|-----------------------|
| 1      | Good                       | 185 (46.95)           |
| 2      | Excellent                  | 74 (18.77)            |
| 3      | Satisfactory               | 56 (14.21)            |
| 4      | Fair                       | 46 (11.68)            |
| 5      | Can improve                | 33 (8.38)             |
| 6      | Poor                       | 0 (0)                 |

DI: Drug information
rated as good (46.95%) and excellent (18.77%). Similar to the study conducted by Walli et al. where it showed that majority of the enquirers rated the provided drug information services as good (48.90%).

CONCLUSION
Awareness for enhanced utilization of drug information services is an effective tool for better patient care. Therefore, it is necessary to perform such studies frequently for accessing and analyzing the utilization of drug information services in the hospital.

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