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Naturalistic Evaluation of Pharmacotherapy Consultations Provided to Hospital Clinicians: A Developing Country's Perspective

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Abstract

Background: Critical appraisal of published literature for hospital clinicians has never been taken as an initiative in developing countries. **Objective:** This study was aimed at evaluating the nature of pharmacotherapy consultations from the drug information center (DIC) of the Postgraduate Institute of Medical Education and Research, Chandigarh, India. **Methods**: The DIC received pharmacotherapy consultation requests from January 2016 to December 2017. Various aspects such as clinical queries, patient-related factors, and disease-related information in these requests were recorded and analyzed. Descriptive statistics and χ^2 test were used for the analysis of the data and feedback evaluation, respectively. **Results**: During the study, a total of 179 consultation requests were documented. On 19 (10.61%) encounters, pharmacotherapy consultations occurred for emergency patient care. Of the 179 queries, 31 (17.3%) were answered immediately while 148 (82.68%) were answered within an average time of 1.6 hours. The most common type of query was the pharmacotherapy of disease, followed by dose calculation and dose modification. Communications with DIC staff took place for timely critical appraisal of the medical literature, followed by a judicious selection of higher antimicrobials and other drugs. The time taken for answering a query was found to be a statistically significant determinant of user satisfaction ($P < .05$). **Conclusion**: The evidence level–specific drug information service was established and catered to hospital clinicians through critical evaluation of offline and online resources. DIC services have the potential to revolutionize the pharmacy and pharmacology curriculum in developing countries.

Keywords

drug information, pharmacology, evidence-based medicine, Drug information Center, critical appraisal of literature, pharmacy, curriculum

Background

The well-known saying "all that glitters is not gold" is applicable for the health care system as well when we analyze evidence generated by the medical literature and author's financial gain from pharma companies. Often times, conflict of interest is not disclosed appropriately to readers by eminent authors of the standard textbooks and original research papers.[1] The link between the literature of evidence-based drug information and pharmacotherapeutic practices appears to be missing. This gap further widens especially in a developing country like India. Thus, an onus lies with pharmacists and pharmacologists to contribute to the strengthening of evidence-based medicine practice.[2] The role of a drug information center (DIC) is to provide pharmacotherapy consultation on an appropriate drug, dosing selection, adverse event causality assessment, and advice for many other clinical situations (see Figure 1). In general, enquirers are doctors but may include pharmacists, patients, and their next-of-kin.[3] Proper functioning of the DICs improves the quality of evidence-based medicine practice by providing updated and authentic information to health care professionals. As stated by the World Health Organization, DICs are an integral part of national health programs to achieve personalized medicine and for providing better patient care.[4]

A study of drug information services in more than 230 hospitals in the United States shows a decrease in economic

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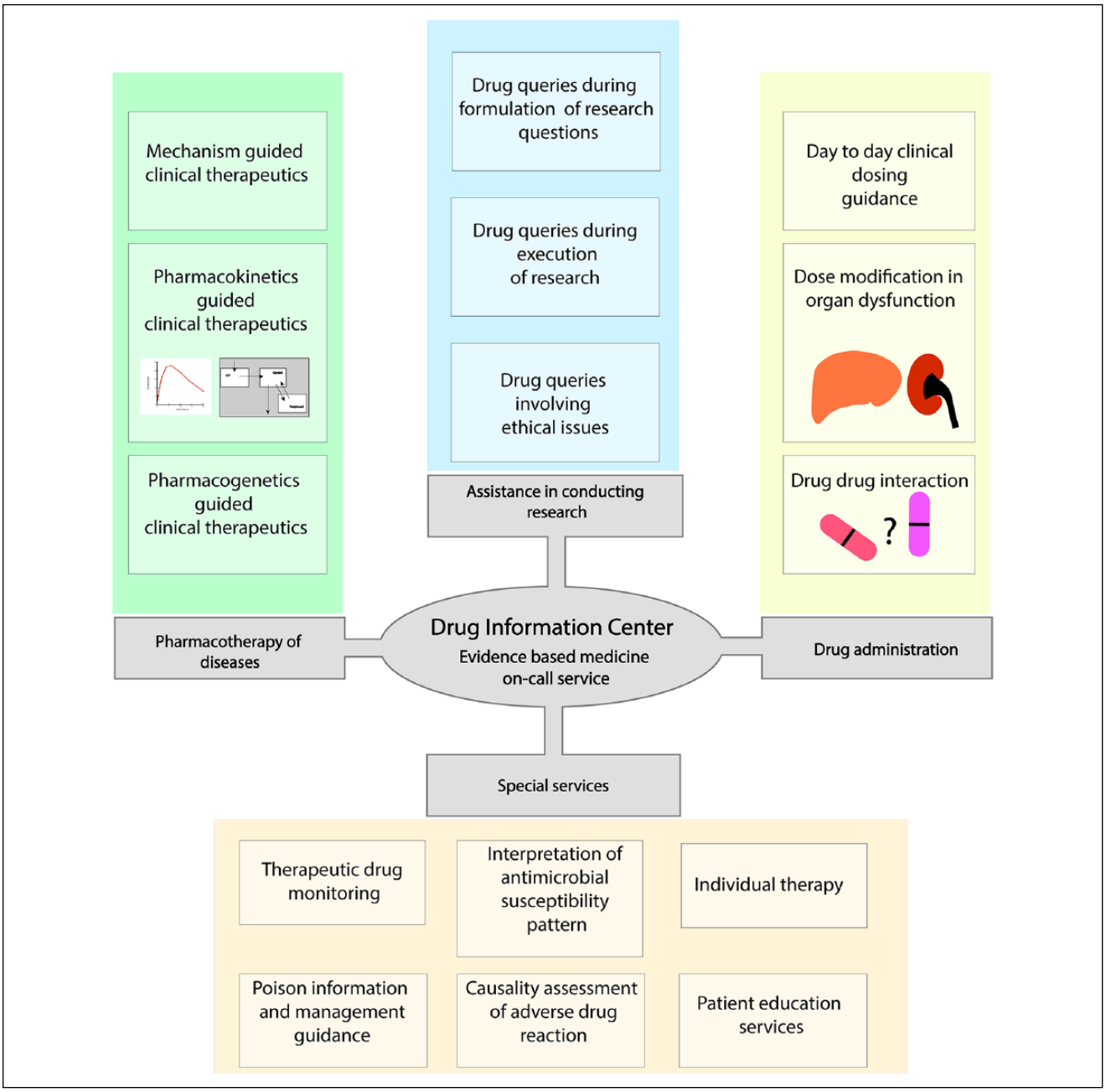

Figure 1. The spectrum of services possible from a fully functional drug information center.

burden by $5226128.22, with a $391604.94 decrease per hospital in medicine-related expenses, and were coupled with a significant fall in mortality rate per year.[5] The timely communication of accurate drug information and its ability to decrease morbidity was also emphasized in the World Health Organization conference on "Rational Drug Use" in Nairobi.[6] Evolving Internet services in developing countries provides a plethora of drug information for doctors, patients, and their relatives without any quality check. The patient workload in some countries or the occasional mental inertia makes doctors to turn to e-services, seeking an answer to a clinical question, mostly at the time of dire need.[7] Therefore, DICs function like a bridge between doctors and the literature by providing accurate, unbiased, and up-to-date drug information for better patient care.[2]

There are very few centers throughout the developing countries that deal with drug information services. This is due to the lack of infrastructure, limited workforce, and less interest in specialists in this particular area. Most of the centers are working in collaboration with hospitals either at

secondary care (district level) or tertiary care levels.[8] In most DICs in India, drug information is provided by either pharmacists or pharmacologists.[9] With this background, a DIC was established in our institute, and in this study we discuss the evolutionary changes, needs, and pattern of pharmacotherapy consultation by clinicians from our experience as a DIC in India.

Methods

Site of Data Collection

The DIC was established in the Pharmacology Department in December 2015. The Postgraduate Institute of Medical Education and Research, Chandigarh, is a 1500-bed tertiary care hospital in North India, attending to 850 000 patients in an outpatient department and 58 000 patients in an inpatient department per year. At our center, the DIC was set up with one pharmacology faculty, who has completed an MBBS—a primary patient care education curriculum with a specialization in MD Pharmacology— being in-charge of the DIC, and six MD Pharmacology residents on a monthly DIC rotation. There was no funding or any support received for providing DIC services to hospital doctors. The study was approved by the Intramural Institutional Ethics Committee, vide letter No. INT/IEC/2017/326.

Means and Procedure of Data Collection

The clinical queries were received through a variety of channels such as landline phone, mobile phone, WhatsApp, and e-mail round the clock during the two-year (January 1, 2016, to December 31, 2017) study period. One pharmacology postgraduate resident at a time was allotted for the one-month DIC rotation. When a resident received a query from the clinician via any of the previously mentioned communication channel, it was discussed with the DIC faculty in-charge as soon as possible and corroborated with the available evidence or reference before finally communicating to the requester. Patient details were noted in a case record form for age, sex, current diagnosis, treatment, planned treatment, and proper investigations. The DIC team also recorded the date and time of question and the date and time of answering the query along with clinician's details such as their e-mail ID, mobile number, or WhatsApp number in the case record form for the effective two-way communication with references. The resident on duty at the DIC documented the references sought for answering the queries. The DIC team maintained the details of every communication along with their references in the DIC room in both physical and electronic forms. WhatsApp is an end-to-end encrypted application. Therefore, patient confidentiality was assured while making use of these platforms as well.

Feedback Evaluation Plan

A questionnaire was designed to evaluate the quality of pharmacotherapy consultation service (see Supplementary Table 1, available online). The designed questionnaire was then transcribed into an online Google survey form and circulated to all the enquirers. The survey was conducted within a time span of 15 days after answering the clinical query. After sending initial forms to the enquirers via e-mail, reminders were sent one week later via social media platforms such as WhatsApp and Facebook in order to encourage participation and improve the response rate.

The questionnaire collected information on the current designation of the doctor along with the satisfaction rating, ability to contact DIC, interpretability of pharmacology resident on call, answer received in the suitable time frame or not, application of the advice in patient care, and the interest to contact the DIC again in the future. Replies to these question, such as opinion ratings "excellent," "very good," "good," and "satisfactory," were grouped together as "Satisfied Enquirers," and the opinions such as "poor" and "very poor" were separately grouped together as "Unsatisfied Enquirers." The frequency of responses was measured in both groups. The interpretability and understandability of pharmacology resident on DIC duty was also measured as frequency of correct and incorrect interpretation. Those answers that were received by the clinicians in suitable and unsuitable time frames were collected based on the replies: "Absolutely" and "Yes" were grouped together as "Answered in suitable time frame," whereas "Yes, sometimes," "No," and "Never" were grouped separately as "Not answered in suitable time frame."

Data Analysis

The statistical analysis was performed using IBM SPSS version 22 (SPSS, Chicago, IL). The descriptive statistics are mentioned as frequency and percentages. Homogeneity between binomial responses was assessed using a χ^2 test. P value less than .05 was assumed to be significant.

Results

The DIC recorded a total of 179 communications in the two-year study period. Nineteen (10.61%) communications required specific drug information on an urgent basis for patient care, and the other 160 (89.39%) communications were of nonurgent nature. The mean reaction time, that is, the average time required to answer the question, was 1.6 hours (0-73 hours). For certain rare clinical question encounters, two to three days were required to obtain information on the procedure, to obtain drugs for patient care that are approved in other countries, and to check the

Table 1. Drug Information Center Communication Methods.

Mode of Contact Made to DIC Person, n (%)	Mode of Primary Reply Back to Clinicians, n (%)
Mobile phone calls: 139 (77.65)	Mobile phone calls: 147 (82.12)
Mobile text messages: 5 (2.79)	Mobile text messages: 5 (2.79)
Landline phone calls: 22 (12.29)	WhatsApp messages: 2 (1.11)
WhatsApp messages: 9 (5.02)	E-mails: 4 (2.23)
E-mail queries: 4 (2.23)	Bedside consultations (documentation in patient file): 21 (11.73)

availability of drugs such as adrenocorticotropic hormone preparations, cysteamine bitartrate, diazoxide, sodium thiosulfate, and oxacillin in the local market.

The residents of clinical departments frequently contacted the DIC for precise and updated drug information. The maximum number of queries made to the DIC was by junior residents (101, ie, 56.42%), followed by senior residents (60, ie, 33.51%) and the faculties (18, ie,10.05%) of clinical disciplines. On breakdown of the 18 faculty queries, the DIC team received nine communications from additional professors (5.02%), 6 from assistant professors (3.35%), two from associate professors (1.11%), and one query from a professor (0.55%). Queries were received and responded through various means of communication (see Table 1). Furthermore, the responses were supported with literature references and provided to consultants in electronic form after giving a primary answer (mean number of references per query was 1.79, and ranged from 1 to 5). Almost all clinical departments of our tertiary care hospital actively utilized the service of the DIC. Percentage-wise distribution of consultations in various departments is presented in Table 2.

In 38 encounters (21.22%), the help of primary literature sources such as critical evaluation of PubMed literature and obtaining the drugs that were approved in other countries was required. Catering drug information services to clinical disciplines required the assistance of secondary source of drug literature such as pregnancy and lactation risk evaluation, dose modification, specific interactions, and so on, in 77 clinical question (43%) encounters. The assistance of tertiary literature sources such as therapeutic drug monitoring interpretation, antibiotic susceptibility test interpretation, and dose calculation were required in 64 encounters (35.75%). The types of queries asked by clinical discipline doctors and common references that were utilized while providing evidence-based drug information are categorized and presented in Figures 2 and 3, respectively.

Table 2. Department-Wise Distribution of Pharmacotherapy Consultations.

Departments	N (%)
Obstetrics and gynecology	43 (24.02)
Pediatrics	22 (12.29)
Internal medicine	21 (11.73)
Anesthesiology	10 (5.58)
Orthopedics	9 (5.02)
Otorhinolaryngology	9 (5.02)
Ophthalmology	8 (4.46)
Neurosurgery	7 (3.91)
Psychiatry	6 (3.35)
General surgery	5 (2.79)
Cardiology	5 (2.79)
Pulmonary medicine	4 (2.23)
Pediatric hematology oncology	4 (2.23)
Neurology	4 (2.23)
Cardiac anesthesia	3 (1.67)
Hepatology	3 (1.67)
Renal transplant unit	3 (1.67)
Neonatology department	3 (1.67)
Dental department	2 (1.11)
Gastroenterology	2 (1.11)
Pediatric endocrinology	2 (1.11)
Dermatology	2 (1.11)
Child psychiatry	1 (0.55)
Pediatric neurology	1 (0.55)

Evidence-Based Medicine Practice by DIC

On 34 occasions, the DIC team required a critical appraisal of PubMed literature and evidence generation for decision making. The DIC team utilized Type 1A (multicentric randomized controlled trial [RCT]/meta-analysis/systematic review of RCTs) evidence level information in five (2.79%) pharmacotherapy consultations, Type 1B (high-quality individual RCT) in four (2.23%), Type 2A (systematic review of controlled cohort studies/missing one criterion for systematic review in RCTs) in four (2.23%), Type 2B (prospective cohort/low-quality RCT) in eight (4.46%), Type 3A (systematic review of case-control studies/missing one criterion of systematic review in cohort study) in seven (3.91%), Type 3B (retrospective cohort or case-control study) in three (1.67%), and Type 4A (case series/low-quality case-control study/low-quality cohort study) in three (2%) encounters.[10]

A few interesting scenarios where the DIC team received appreciation from clinical departments are mentioned in Table 3.

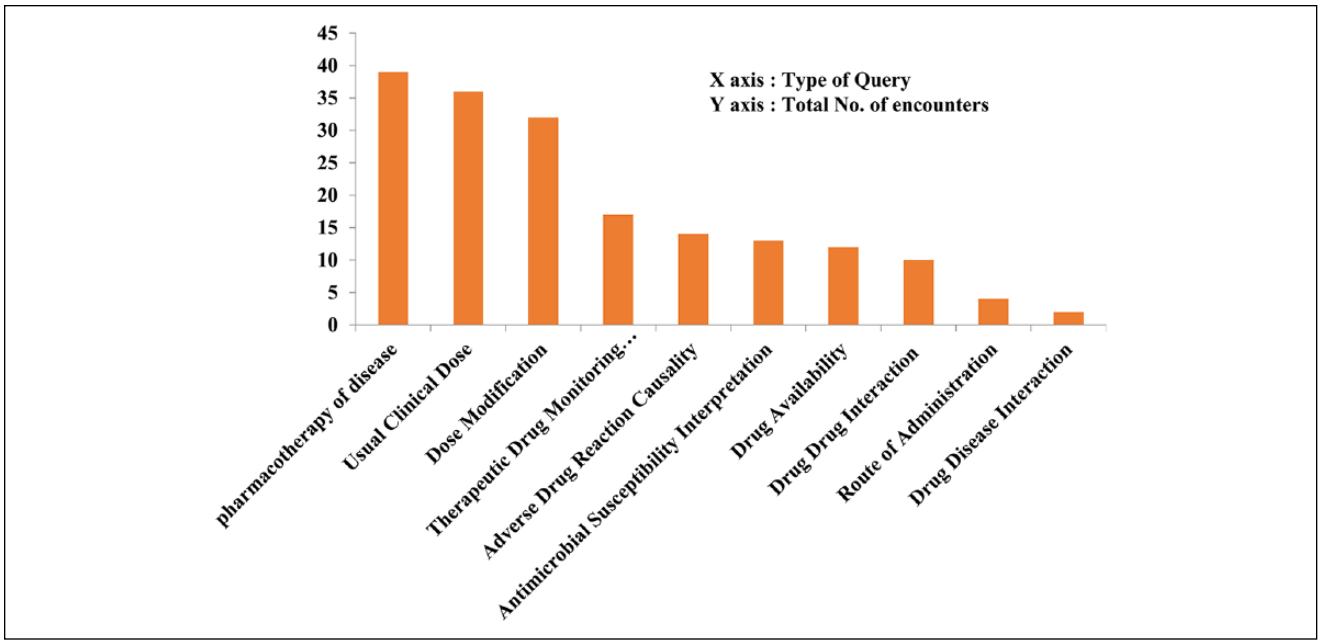

Figure 2. The type of queries asked by clinical discipline doctors.

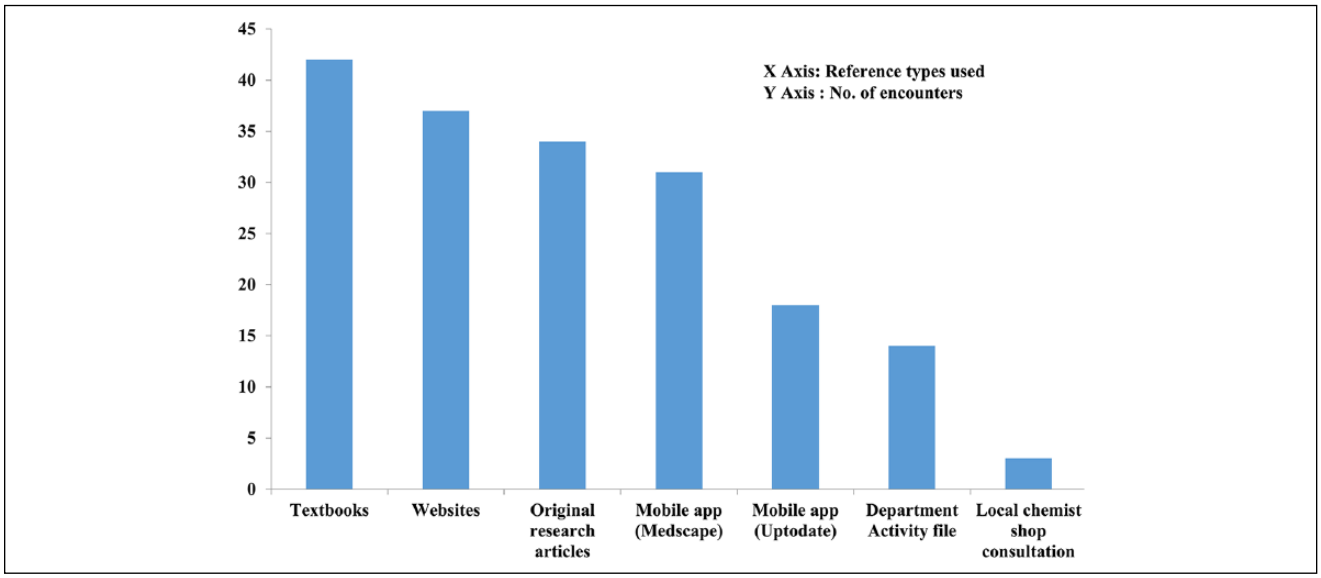

Figure 3. Common references that were utilized while providing evidence-based information.

Feedback Evaluation Results

In the analysis from the feedback of enquirers that contacted the DIC, all the enquirers agreed that contacting the DIC for pharmacotherapy inputs was easy. Out of the 179 consultations, 171 enquirers (95%) were satisfied with the DIC service provided. The evaluation demonstrated that the satisfaction was related to answers obtained within the suitable time frame ($P = .001$). Further analysis showed that there was no statistically significant ($P = .15$) difference in the satisfaction level among the resident and faculty of clinical disciplines. Similarly, the clinical query interpretability of the pharmacology resident had no statistically significant relation with user satisfaction ($P = .19$; see Table 4).

Discussion

The study aimed to describe the evolving services of the DIC in the two year period and to evaluate its role from a pharmacotherapy perspective. The authors of this study documented

Table 3. Ten Most Interesting Cases.

1.	A resistant type 1 diabetes patient not responding to even 100 units of insulin dose was considered for recombinant leptin therapy, which is not available and approved in India yet
2.	Rifampicin allergic leprosy patient requiring desensitization protocol, pharmaceutical preparation method, and dosing in the intensive care unit
3.	A third-trimester pregnant female diagnosed with toxoplasmosis but developed an allergic reaction to spiramycin requiring suitable alternate drug
4.	Colistin-resistant sepsis management
5.	Choosing between unfractionated heparin and low-molecular-weight heparin for neonate with renal failure
6.	Multiple, NSAID allergic patient requiring analgesic therapy
7.	Intrathecal colistin dosing
8.	Loading dose and maintenance dose of vancomycin and colistin in dialysis patients
9.	Evaluation of drug-induced liver injury and DRESS syndrome
10.	Clopidogrel and atorvastatin safety evaluation in pregnancy

Abbreviations: DRESS syndrome, drug reaction with eosinophilia and systemic symptoms; NSAID, nonsteroidal anti-inflammatory drug.

Table 4. User Satisfaction Feedback Evaluation.

	Satisfied (171)	Not Satisfied (8)	P^a
Is satisfaction related to answers obtained within a suitable time frame?			
Received answer in suitable time frame	159	3	$P = .001$
Not received answer in suitable time frame	12	5	
Is satisfaction related to academic experience in clinical discipline?			
Residents of clinical disciplines	155	6	$P = .15$
Faculties of clinical disciplines	16	2	
Is satisfaction related to clinical query interpretability of DIC personnel?			
The DIC personnel were able to interpret the clinical scenario properly?	165	7	$P = .19$
The DIC personnel were not able to interpret the clinical scenario properly?	6	1	

Abbreviation: DIC, drug information center.
[a]$P < .05$ was decided as significant.

a total of 179 physician-initiated communications from January 2016 to December 2017. This number was more as compared with the 55 queries received in five years from the study done by Behera et al[3] in South India and 867 queries in 10 years in the Slovak Republic by Lassanova et al.[11] The volume of communications was reflective of reasonable discussions and inclination of hospital clinicians toward pharmacotherapy consultations. In 2002, a study by Pradhan[12] reported thousands of queries per year from the US DICs manned by full-time pharmacists. Later on, this communication frequency and the number of operating DICs in the Unites States showed varying trends.[13] Ours is the first study from a low-resource country on pharmacotherapy consultations where 10% of communications occurred for emergency patient care. Of the 179 consults, the DIC team answered 17% of queries immediately and 74% of queries within four hours and nine% within three days. On rare occasions, the DIC team took 48 to 72 hours to respond to specific clinical question encounters. This significant delay has 3 reasons: (1) critical appraisal of PubMed research articles; (2) availability of ACTH preparations, cysteamine bitartrate, diazoxide, sodium thiosulfate, and oxacillin in the local market; and (3) obtaining information on the procedure to get the drug for patient care that is approved in other countries. The response time to clinical queries was reassuring in the present study when compared with the literature and was a significant determinant of user satisfaction. Mohamed et al reported user satisfaction of 98% of the total enquirers was related to answers provided in a suitable time frame from Khartoum Medicines Information Centre of Sudan.[14] In Israel, Lustig reported that the average reaction time differed as per the type of query; one minute was the least reaction time regarding a query on drug availability, and the longest reaction time of 13.5 minutes was for commenting on pharmacotherapy consultation and drug-drug interaction.[15] In Manipal, George and Rao classified the reaction time required for response into three parts: from two to four hours, four to 24 hours, and 24 to 48 hours.[16] A model study predicted that the crucial deciding factor for predicting the time required in handling pharmacotherapeutic queries was the literature review type.[17]

For pharmacotherapy consultations, the DIC received significant numbers of requests from junior residents, followed by senior residents and the faculties of clinical disciplines implying reduction in pharmacotherapy consultations with growth in the medical experience of hospital doctors. Similarly, in a study done by Schwarz et al, the primary

users of the regional DICs in Germany were internists and general practitioners.[18] In few studies from the United States by Pradhan[12] and Rosenberg et al,[13] the consulting population for drug information was primarily pharmacists, followed by physicians and nurses. It is noteworthy that the participation of doctors is also rising in using the DIC services in some parts of the world, the typical example being Italy.[19,20] The organizational structure of the DICs considerably varies from region to region. A survey of the DICs of 18 European countries reports that they are mainly affiliated to hospitals, but rather uncommonly with state departments, other health care organizations outside the hospital, and faculty of pharmacy.[21] A similar trend was reported in an American survey carried out on 151 DICs.[13] In the context of developing countries, DICs are usually affiliated with the department of pharmacology or pharmacy within medical institutions or universities. The location of the DICs within a hospital is favorable due to proximity to different clinical divisions and their respective wards, outpatient departments, intensive care units, and emergency units that promote easy and quick communication in universities or hospital campuses.[22,23] According to Behera et al,[3] it was observed that pharmacology faculty and residents provide pharmacotherapy opinions in South India. A skilled workforce to use the DIC service is of supreme value as it acts as the first level of contact with clinicians. Proper communication skills, literature search, appraisal skills, and knowledge about the efficacy and safety of drugs are fundamental to provide quality services to those who contact the DICs.

In the present study, the maximum number of consultations occurred in the obstetrics and gynecology department, followed by the pediatric department. This contrasts with the findings from different regions of the world as it highly depends on various factors like disease pattern, medication availability, and level of the health care facility in that particular region. In Israel, Lustig reported internal medicine followed by general surgery as the departments that require maximum consultations on drug use.[15] Behera et al[3] reported more consultations for the orthopedic department, followed by the neurology department.[3] Studies from the United States showed a trend of hospital pharmacist requiring help from the DIC pharmacists.[12,13]

The most frequent type of inquiry in this research was about pharmacotherapy of a disease or drug indication—for example, spectrum, resistance, therapeutic indications, and safety and efficacy comparisons of higher antibiotics for vulnerable populations, for example, pregnant or nursing mothers. Studies from regional DICs in Germany, Nepal, Slovak Republic, and Israel have reported a similar consultation pattern.[11,18,22,24] In Iran, Italy, and Finland, the most common type of query was regarding the causality assessment of adverse drug event.[2,25] Mexican DICs reported maximum consultations for safe and effective use of antimicrobials, cardiovascular drugs, and anticoagulant drugs.[26] The second most common type of query in the present study was related to dose modification of higher antimicrobials in dialysis patients and pediatric patients admitted for orthopedic surgeries. It shows a pattern of need for antimicrobial dosing guidance among hospital doctors to curb the menace of rising antimicrobial resistance. Behera et al[3] from South India and Pradhan[12] from the Unites States have reported a similar trend for antimicrobial dose queries.

The importance of study also lies in the critical appraisal of the medical literature for evidence synthesis where a team of residents and faculty was formulated for the first time in a low-resource country. Evidence-based medicine is highly difficult for clinicians in low-resource countries because of disproportionate doctor-to-patient ratio, limited budget in health care expenditure by the government, scarcity of national guidelines, genomic research, and alternative medicine systems such as Ayurveda and homeopathy.[27,28] The DIC team practiced evidence-based medicine on-call service for two years for the provision of independent, unbiased information based on medical literature. Of 179 communications, for 19% of encounters, evidence synthesis was performed and communicated evidence level–specific answers to clinicians. On other 81% encounters, the DIC team provided factual and nonjudgmental information about the drug use. The average number of references provided with a specific answer was 1.97 per query. It was less compared with the DIC service study from South India where an average of 2.48 references was provided.[29] This dissimilarity may be because of the differences in complexities or the nature of queries received at the respective DICs. In the present study, a few of the enquirers sought the information not only telephonically but also through various means such as mobile text message, e-mail, or sending any reference document/relevant snapshots via WhatsApp. These observations are different from earlier reported studies such as Behera et al[3] and Pradhan,[12] where the authors used printed or written opinions as a communication tool to clinicians. This difference might be due to two reasons: (1) heavy workload in tertiary care hospitals and simultaneous involvement of DIC staff in core pharmacology departmental activities and (2) technological advancements in developing nations are easing out daily routine work.[30] Of all consultations, 12% of queries requested bedside visits and documentation of pharmacotherapy opinion in the patient's file. The pharmacologist fraternity of India has never been involved in writing patient notes.[31] Tertiary care hospitals routinely maintain medical records in a paper file in contrast to developed countries, which opt for an electronic data format for patient notes.[32]

The continuously evolving services of DICs are just the beginning of rational prescribing and contribution of pharmacologists in treatment decisions. This is an opportunity to further refine pharmacy, pharmacology postgraduate coursework, and promote evidence-based medicine in low- to middle-income countries.[33] A study from Brazil has

suggested that a five-week DIC teaching component was a successful medium for the training of evidence-based medicine to pharmacy graduates. The American Society of Health-System Pharmacists formulated the Residency Learning System Model in 1996 for pharmacy practice residents with a particular emphasis on drug information communication and hospital drug policy development as one of the four mainstay areas of aptitude building.[34] Developed nations have established new ideas such as therapeutic drug monitoring, materiovigilance, and forensic pharmacology; the health care system of low- to middle-income countries can adopt the same for improving health care. Finally, the concept of refining the DIC service training in postgraduate pharmacy and pharmacology residency is required to overcome workforce deficiency and betterment of patient care in resource-limited settings.

Limitations

The current study is not without limitations. This being a pilot study, the small sample size of the study population cannot guarantee the generalizability of the study results to other developing nations. The DIC at the Postgraduate Institute of Medical Education and Research, Chandigarh, is expected to evolve much more in terms of DIC services in future. Thus, clinician requirements may see a change in the pattern of queries.

Conclusion

The establishment of more DICs can effectively overcome the barrier of evidence-based medicine in developing countries. Independent and critical appraisal of medical literature is required in different geographic locations as per disease incidence and cost-effective pharmacotherapy approach feasibility. DICs can also control growing antimicrobial resistance by judicious selection of higher antimicrobials. Pharmacy and pharmacology departments in developing countries have to accept the challenge of patient care contribution.

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References

1. Piper BJ, Lambert DA, Keefe RC, Smukler PU, Selemon NA, Duperry ZR. Undisclosed conflicts of interest among biomedical textbook authors. *AJOB Empir Bioeth*. 2018;9:59-68. doi: 10.1080/23294515.2018.1436095
2. Patil A, Padhy B, Prasanthi SK, Rohilla R. Drug information center in India: overview, challenges, and future prospects. *Int J Pharm Investig*. 2018;8:1-6. doi:10.4103/jphi.JPHI_103_17
3. Behera SK, Xavier AS, Gunaseelan V, et al. Drug information center as referral service in a South Indian tertiary care hospital. *Int J Pharm Investig*. 2018;7:182-187. doi:10.4103/jphi.JPHI_90_1
4. Essential Medicines and Health Products Information Panel. Promoting rational use of medicines: core components—WHO policy perspectives on medicines, no. 5. http://apps.who.int/medicinedocs/en/d/Jh3011e/ Published September 2002. Accessed March 29, 2019.
5. Brand KA, Kraus ML. Drug information specialists. *Am J Heal Pharm*. 2006;63:712-714. doi:10.2146/ajhp050242
6. Mahler H. The rational use of drugs: report of the Conference of Experts, Nairobi, 25-29 November 1985. http://apps.who.int/medicinedocs/documents/s17054e/s17054e.pdf Published 1987. Accessed March 29, 2019.
7. Alper BS, Hand JA, Elliott SG, et al. How much effort is needed to keep up with the literature relevant for primary care? *J Med Libr Assoc*. 2004;92:429-437.
8. Chauhan N, Moin S, Pandey A, Mittal A, Bajaj U. Indian aspects of drug information resources and impact of drug information centre on community. *J Adv Pharm Technol Res*. 2013;4:84-93. doi:10.4103/2231-4040.111524
9. Kshirsagar NA, Bachhav SS, Kulkarni LA, Vijaykumar. Clinical pharmacology training in India: Status and need. *Indian J Pharmacol*. 2013;45:429-433. doi:10.4103/0253-7613.117718
10. McMullen SM, Meade M, Rose L, et al; Canadian Critical Care Trials Group (CCCTG). Partial ventilatory support modalities in acute lung injury and acute respiratory distress syndrome—a systematic review. *PLoS One*. 2012;7:e40190. doi:10.1371/journal.pone.0040190
11. Lassanova M, Tisonova J, Bozekova L, Kriska M. Drug information center. *Bratisl Lek Listy*. 2001;102:305-306.
12. Pradhan SC. The performance of drug information center at the University of Kansas Medical Center, Kansas City, USA—experiences and evaluations. *Indian J Pharmacol*. 2002;34:123-129.
13. Rosenberg JM, Koumis T, Nathan JP, Cicero LA, McGuire H. Current status of pharmacist-operated drug information centers in the United States. *Am J Heal Pharm*. 2004;61:2023-2032. doi:10.1093/ajhp/61.19.2023
14. Lustig MA. Experience with a recently introduced drug information service in an Israeli hospital pharmacy. *Pharm World Sci*. 1999;21:32-34. doi:10.1023/A:1008686524653

15. George B, Rao PGM. Assessment and evaluation of drug information services provided in a South Indian teaching hospital. *Indian J Pharmacol*. 2005;37:315-318. doi:10.4103/0253-7613.16856
16. Reppe LA, Spigset O, Schjøtt J. Which factors predict the time spent answering queries to a drug information centre? *Pharm World Sci*. 2010;32:799-804. doi:10.1007/s11096-010-9440-7
17. Schwarz UI, Stoelben S, Ebert U, Siepmann M, Krappweis J, Kirch W. Regional drug information service. *Int J Clin Pharmacol Ther*. 1999;37:263-268.
18. Taggiasco N, Sarrut B, Doreau CG. European survey of independent drug information centers. *Ann Pharmacother*. 1992;26:422-428. doi:10.1177/106002809202600318
19. Nobili A, Gebru F, Rossetti A, et al. Doctorline: a private toll-free telephone medical information service. Five years of activity: old problems and new perspectives. *Ann Pharmacother*. 1998;32:120-125. doi:10.1345/aph.16430
20. Müllerová H, Vlcek J. European drug information centres—survey of activities. *Pharm World Sci*. 1998;20:131-135. doi:10.1023/A:1008672311674
21. Joshi MP. University hospital-based drug information service in a developing country. *Eur J Clin Pharmacol*. 1997;53:89-94. doi:10.1007/s002280050343
22. Alván G, Andersson ML, Asplund AB, et al. The continuing challenge of providing drug information services to diminish the knowledge—practice gap in medical practice. *Eur J Clin Pharmacol*. 2013;69(suppl 1):65-72. dio:10.1007/s00228-013-1484
23. Hedegaard U, Damkier P. Problem-oriented drug information: physicians' expectations and impact on clinical practice. *Eur J Clin Pharmacol*. 2009;65:515-522. doi:10.1007/s00228-008-0604-5
24. Kasilo O, Romero M, Bonati M, Tognoni G. Information on drug use in pregnancy from the Viewpoint Regional Drug Information Centre. *Eur J Clin Pharmacol*. 1988;35:447-453. doi:10.1007/BF00558237
25. Entezari-Maleki T, Taraz M, Javadi MR, et al. A two-year utilization of the pharmacist-operated drug information center in Iran. *J Res Pharm Pract*. 2014;3:117-122. doi:10.4103/2279-042X.145368
26. Pohjanoksa-Mäntylä MK, Antila J, Eerikäinen S, et al. Utilization of a community pharmacy-operated national drug information call center in Finland. *Res Soc Adm Pharm*. 2008;4:144-152. doi:10.1016/j.sapharm.2007.05.001
27. Gutiérrez RE, Álvarez CRC, Álvarez RMA, Hernández JLF, Godínez JG, López JGLY. Pharmaceutical services in a Mexican pain relief and palliative care institute. *Pharm Pract*. 2007;5:174-178.
28. Bagcchi S. India has low doctor to patient ratio, study finds. *BMJ*. 2015;351:h5195.
29. Joshi K, Ghodke Y, Shintre P. Traditional medicine and genomics. *J Ayurveda Integr Med*. 2010;1:26-32. doi:10.1136/bmj.h5195
30. Akerkar SM, Kanitkar M, Bichile LS. Use of the Internet as a resource of health information by patients: a clinic-based study in the Indian population. *J Postgrad Med*. 2005;51:116-118.
31. Malhotra S, Shafiq N. What clinical pharmacology means to us. *Mens Sana Monogr*. 2006;4:184-206. doi:10.4103/0973-1229.27614
32. Thomas J. Medical records and issues in negligence. *Indian J Urol*. 2009;25:384-388. doi:10.4103/0970-1591.56208
33. de Sousa IC, de Lima David JP, Nobalt L de A. A drug information center module to train pharmacy students in evidence-based practice. *Am J Pharm Educ*. 2013;77:80. doi:10.5688/ajpe77480
34. Brøsen K, Andersen SE, Borregaard J, et al. Clinical pharmacology in Denmark in 2016—40 years with the Danish Society of Clinical Pharmacology and 20 years as a medical speciality. *Basic Clin Pharmacol Toxicol*. 2016;119:523-532. doi:10.1111/bcpt.12681