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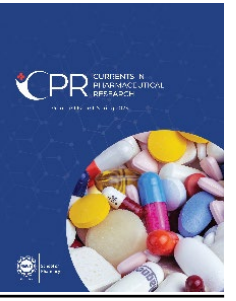

Title:	**Impact of Drug Information Centers on Healthcare Outcomes: A Narrative Review of Pre- and Post-Implementation in South Asian Countries**
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Impact of Drug Information Centers on Healthcare Outcomes: A Narrative Review of Pre- and Post-implementation in South Asian Countries

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ABSTRACT

Drug Information Centers (DICs) play a vital role in the provision of accurate, reliable, and updated information on medications to healthcare professionals as well as the general public. These centers are now taking a step forward in the healthcare field. This narrative review aimed to analyze the evolution and impact of DICs on South Asian countries, such as India, Pakistan, Bangladesh, Sri Lanka, and Nepal. Furthermore, it also discussed the role of DICs in healthcare as well as the barriers in the establishment of such services in developing countries. The established DICs in these South Asian countries improves rational drug use and enhances patient safety even though there are significant challenges to establish and expand these centers in South Asia. The DICs established in India, Nepal, and Pakistan have significantly contributed in the enhancement of patient safety and rational use of medications. However, there are challenges in establishing DICs in Sri Lanka and Bangladesh. Innovative strategies, such as telemedicine services and collaboration with healthcare institutes, academics, and regulatory authorities would expand the services of DICs across South Asia.

Keywords: drug information centers (DICs), drug information services (DISs), healthcare, medicine information, South Asia

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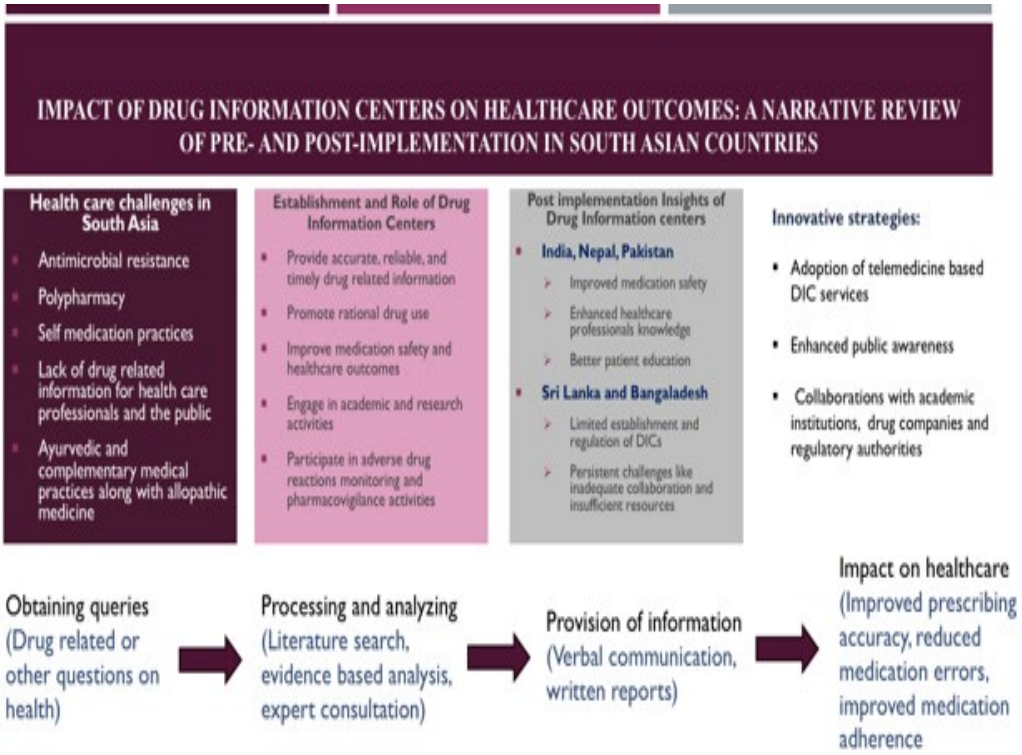
GRAPHICAL ABSTRACT



1. INTRODUCTION

Drug Information Centers (DICs) are formalized units, established within healthcare systems that aim to provide reliable, accurate, and updated drug-related information in a timely manner to healthcare providers and the general public [1–5]. The services of DICs play a pivotal role in improving the rational medication usage, prevention of medication errors, as well as adverse drug events [1–5]. The functions of DICs underscore its need for establishment and expansion of such services in developing countries. Provision of drug information, support in education, academic, and research area, pharmacovigilance activities, as well as medication counseling have significant impact on overall healthcare improvement [1, 4–7].

Antimicrobial resistance (AMR) is an emerging challenge in low- and middle-income countries than high-income nations. By offering accurate information on proper antibiotic use and counseling patients, DICs actively contribute to combating AMR [4–6, 8]. The DICs extended their rules during COVID-19 pandemic, which proved to be a crucial forward step for

the establishment and effectiveness of DICs in lower middle-income countries [9, 10]. The COVID-19 pandemic may act as a bridge to provide the public with objective, trustworthy information about COVID-19, its management, and its treatment strategy [9]. Additionally, the DICs disseminated educational materials regarding the COVID-19 pandemic [10]. Moreover, these centers serve as hubs for academic and research activities, providing opportunities for clinical pharmacy training and continuing professional development for healthcare professionals [11, 12].

However, developing countries often face unique challenges, such as a higher prevalence of self-medication practices and limited access to unbiased drug information [1, 4–6, 13, 14]. Traditional healthcare systems, such as Siddha, Unani, and Ayurveda also contribute to polypharmacy and the risk of unknown drug interactions [4, 5]. In countries, such as India, Pakistan, Nepal, Bangladesh, and Sri Lanka, these challenges underscore the critical need for establishing and maintaining well-functioning DICs to address these healthcare concerns effectively.

This narrative review aimed to compare healthcare outcomes before and after the implementation of DICs in South Asian countries, providing insights into their functions, contributions, and impact. Additionally, it sought to identify the barriers and facilitators affecting the successful operation of DICs in this region, offering a foundation for further improvements in healthcare systems.

2. METHODOLOGY

Articles were searched using developed keywords, such as “drug information centers”, “drug information services (DISs)”, “medicine information”, “South Asia”, and “healthcare” via Google Scholar, Pubmed, and google search engine. A total of 58 articles containing full research articles (33), review articles (19), commentary articles (3), letters to editor (2), and reports (1) were screened and included. Table 1 shows the objectives of selected studies in this review.

Table 1. Objectives of the Concerned Studies

S.no	Literature Review	Objectives
1	A reflective commentary on drug information services (DISs) in Nepal	To draw attention towards the recent scenario of DISs in Nepal, to discuss the challenges in

S.no	Literature Review	Objectives
		establishing and running DICs, and to analyze the ways of strengthening DICs
2	An overview on DICs	To identify various concepts of DICs in different countries and to understand the differences in their functioning
3	Overview of status and challenges of DISs in India	This analyzes the status and challenges of DISs in India
4	Status of DICs and DISs in India	To highlight the current status of DICs and requirements to develop its services further
5	Perspectives on DISs in Nepal	This study discussed the need of DICs in Nepal, the problems in the effective running of DICs, and the current status of DICs in Nepal
6	The impact of DICs to improve medication safety in Saudi Arabia	To assess the use of DICs by healthcare professionals in Saudi Arabia
7	The functions of DICs and the challenges associated with establishing DICs in India	To understand the roles of DICs and the actions to be taken in establishing a DIC in India
8	The evolution of DICs and specialists	To discuss the evolution of DICs and role of drug information specialists
9	The functions of DICs at the Manipal Teaching Hospital	To discuss the various functions carried out by the DICs at Manipal Teaching Hospital
10	Assessment of DISs and their utilization in a tertiary care teaching hospital	To assess the usage of DISs and create awareness for the utilization of DICs
11	Perspectives on DICs in developing countries and challenges in developing DICs in those countries	To analyze the role of DICs in developing countries, requirements for setting up a DIC, and challenges while establishing a DIC in developing countries

S.no	Literature Review	Objectives
12	Assessment of new DICs in Ethiopia	To analyze the use and status of DICs located at university teaching hospitals in Ethiopia
13	DICs - need of the hour	To discuss about DICs in India, requirements for setting up a DIC, and challenges in running a DIC in India
14	European DICs	To discuss about European DICs
15	Perceptions of physicians and patients on DISs in a tertiary care hospital	To implement DISs, to provide information on drugs, and to promote awareness on DICs
16	Hospital-based DISs in developing countries	To analyze the advantages of DICs based in teaching hospitals
17	The need for drug and poison information centers in Pakistan	To ascertain the need of drug and poison information centers in Karachi
18	Perspectives on hospital pharmacy practice in Bangladesh	To sum up the current status of pharmacy practices and identify the pharmacist's roles
19	Self-medication practices and factors among undergraduates	To determine the factors associated with self-medication practices and create awareness on self-medication practices
20	Knowledge of prescribed medication information among non-English proficient patients in Sri Lanka	To evaluate the knowledge on prescribed medications and explore factors in determining the knowledge
21	Evaluation of performance of DICs in a tertiary care hospital in South India	To evaluate the performance of DICs in the provision of drug information
22	Prevalence of self-medication practices in India	To systematically review the prevalence of self-medication and its associated factors
23	Self-medication and non-prescription practices in Nepal	To obtain data on self-prescribing and analyze the factors influencing self-medication

S.no	Literature Review	Objectives
24	The state of primary healthcare in South Asia	To investigate the strengths and deficiencies of different primary healthcare approaches in the South Asian region and provide a comparative analysis between countries
25	A systematic review on factors and consequences of polypharmacy practices in South Asia	To sum up the factors and consequences of polypharmacy practices
26	Systematic review and analysis on factors associated with polypharmacy	To analyze the prevalence and factors associated with polypharmacy practices
27	Assessment of a drug and poison information center in Pakistan	To evaluate the use of drug and poison information center services
28	Pharmacovigilance practices in South Asian countries	To examine the current pharmacovigilance activity and make recommendations for safe monitoring of medicines
29	Scoping review on the need for drug information in Asia and Africa	To quantify and map the English language concerns in written medication information
30	Self-medication practices in Pakistan and the need for proper monitoring	To emphasize the need for proper monitoring on self-medication practices in Pakistan
31	Assessment on the role of DICs towards safety of drug usage	To analyze the services provided by the DICs at Manipal Teaching Hospital
32	A cross sectional study on patient knowledge on prescribed drugs and package inserts	To assess the knowledge and awareness towards package inserts
33	Evaluation of patient information leaflets on topical medications	To evaluate the quality of patient information leaflets drugs available in the market and to

S.no	Literature Review	Objectives
		analyze the design, content, and readability
34	Analysis on package inserts available in Pakistan	To assess the information written on pharmaceutical package inserts of products marketed in Pakistan
35	Evaluation of errors found in patient information leaflets available with medicines in Pakistan	To assess and evaluate the errors found in leaflets available with medicines in Pakistan
36	A retrospective study on the quality of information available in product information insert	To evaluate the completeness and appropriateness of information against references
37	Evaluation of information on drug-drugg interactions in the medicine package leaflets	To evaluate the extent and nature of information on drug interactions presented in the package leaflets
38	Antimicrobial resistance surveillance in South East Asian and South Asian countries	To explore the state of AMR and highlight the opportunities and progress in tackling AMR
39	Evaluation on sources of drug information and impact of DICs on Indian community	To discuss the role of DICs and rational use of medications
40	Assessment and evaluation of DISs provided in a teaching hospital in India	To evaluate the types of queries on drugs and quality of services provided by the DICs
41	Assessment of DISs in Kanchipuram Tertiary Care Hospital	To assess DISs in hospitals over eight months
42	Evaluation of quality of services provided by the DICs in a tertiary care hospital	To assess the quality of services provided by the DICs over three years
43	Review on DISs in a teaching hospital, India	To review the activities carried out by DICs

S.no	Literature Review	Objectives
44	Establishment of a drug information unit and pharmacovigilance cell in a provincial hospital of Nepal	To brief about the establishment of a drug information unit and pharmacovigilance cell
45	Evaluation of utilization of drug information resources by healthcare providers	To study the drug information resources used by medical practitioners and the need for a drug information unit
46	Evaluation of promotional materials in a hospital in Nepal	To analyze whether the promotional materials met World Health Organization's (WHO) ethical criteria for medicinal drug promotion
47	Analysis of potential drug–drug interactions in hospital settings in Pakistan	To investigate the frequency of potential drug–drug interactions and analyze the management of frequently identified interactions
48	Assessment of the current state of pharmacovigilance system in Pakistan	To evaluate the functions of pharmacovigilance system
49	Retrospective analysis on potential drug–drug interactions among elderly patients hospitalized in Sri Lanka	To study how hospitalization affects potential drug-drug interactions
50	DISs and their role in rational drug therapy	To discuss the clinical impacts of DICs and their future
51	Novel role of DICs during the COVID-19 pandemic	To explore the additional roles of DICs with respect to drug information provision during pandemic times
52	Satisfactory outcomes of DICs and their services	To evaluate the outcomes and user satisfaction levels of pharmacist-led tele-health services
53	Dissemination of awareness and educational materials on	To describe the distribution and acceptance of COVID-19

S.no	Literature Review	Objectives
	COVID-19 pandemic by a regional DIC	educational materials by DICs of Brazilian public university
54	Perspectives on the roles of Sri Lankan pharmacists	To highlight the need to strengthen the pharmacist's role in Sri Lanka
55	The impact of DISs on drug safety, clinical outcomes, and patient care in UK	To analyze the impact of medicine information centers on patient care and patient safety
56	Impact on drug queries at DICs after the awareness programs on DISs in a public hospital, Malaysia	To analyze the DISs provided by a public hospital, Malaysia
57	Use of a pilot DIC	To assess the use of pilot DICs established in Uganda
58	Quality evaluation and survey on the need for DICs	To analyze the services provided by DICs in Egypt and evaluate the effectiveness of DICs

3. HISTORICAL DEVELOPMENT OF DRUG INFORMATION CENTER (DIC)

The first DIC was established at the University of Kentucky in 1962 in the United States [3, 4, 5, 15] and earlier, in 1960, in the United Kingdom [3]. In Latin America, Brazil established its first DIC in 2001, followed by Costa Rica in 2003 [3]. Similarly, Singapore inaugurated its DIC in 1980 [3].

In South Asia, the progress of DICs varies across countries. In India, the DICs were inaugurated in 1997 in Jagadguru Sri Shivarathreeshwara, Mysore, Trivandrum Medical Faculty, and Karnataka State Pharmacy Council [4, 5]. Later, the Karnataka State Pharmacy Council collaborated with WHO's India office and established five DICs in Haryana, Goa, Assam, Rajastan, and Chhattisgarth in 2007 [8, 13]. Now, there are about nine independent DICs and over 15 hospital-attached DICs in India which are working successfully [4, 5]. Nepal established its first DIC at Tribhuvan University Teaching Hospital in 1994 [1, 4, 16]. Subsequently, in 1996, the Drug Information Network of Nepal was developed to provide high-quality drug information [1, 12], leading to the establishment of several additional DICs that collaborated within this network. These included the College of

Medical Sciences, KIST Teaching Hospital, B. P Koirata Institute of Health, and Resource for Primary Healthcare [1, 4, 16]. In 2003, the first DIC in private sector was inaugurated in Manipal Teaching Hospital, Pokhara [12]. Pakistan's first DIC was founded in 1995 at Aga Khan University Hospital, although there is no official data on the total number of DICs currently available in the country [15].

In contrast, Bangladesh lacks structured DICs entirely [17, 18]. Similarly, in Sri Lanka, the Department of Pharmacology at the Colombo Medical Faculty initiated a Drug Information Service in January 1999 [19]. However, there are no regulated or structured DICs within government hospitals in Sri Lanka, and the Ministry of Healthcare and Nutrition emphasizes the government to fund a national medicines information center [20]. This highlights the varying levels of development and implementation of DICs across South Asia.

4. ROLE OF DRUG INFORMATION CENTERS (DICS) IN HEALTHCARE

The role of DICs in healthcare is indispensable, offering services that elevate the pharmacy profession and enhance healthcare outcomes. Their functions are diverse and impactful, as outlined below:

4.1. Key Functions of DICs in Healthcare

DICs deliver reliable, accurate, and up-to-date medication information. They address queries related to drug interactions, availability, substitutes for specific medications, and drug identification [1–3, 8, 11, 13, 14, 21, 22].

DICs provide targeted counseling for illiterate patients, patients prescribed medical devices or special dosage forms (e.g., suppositories, pessaries), patients on high-risk medications (e.g., antiepileptics, antibiotics), and pediatric and geriatric patients, and those with poor medication compliance [6]. By offering proper counseling, DICs help minimize adverse drug reactions (ADRs) and other unwanted side effects, such as AMR [1–3, 6, 11, 13, 14, 21].

DIC monitors and assesses medication safety alerts communicated by drug manufacturers, drug distributors, and medical regulatory authorities [6].

DICs work closely with drug and therapeutic committees to evaluate new drugs for hospital formularies and to identify safety concerns or newly

reported side effects [3, 6, 14]. They also collaborate with pharmaceutical manufacturers to obtain information on the quality, dosage forms, and formulations of new drugs [3].

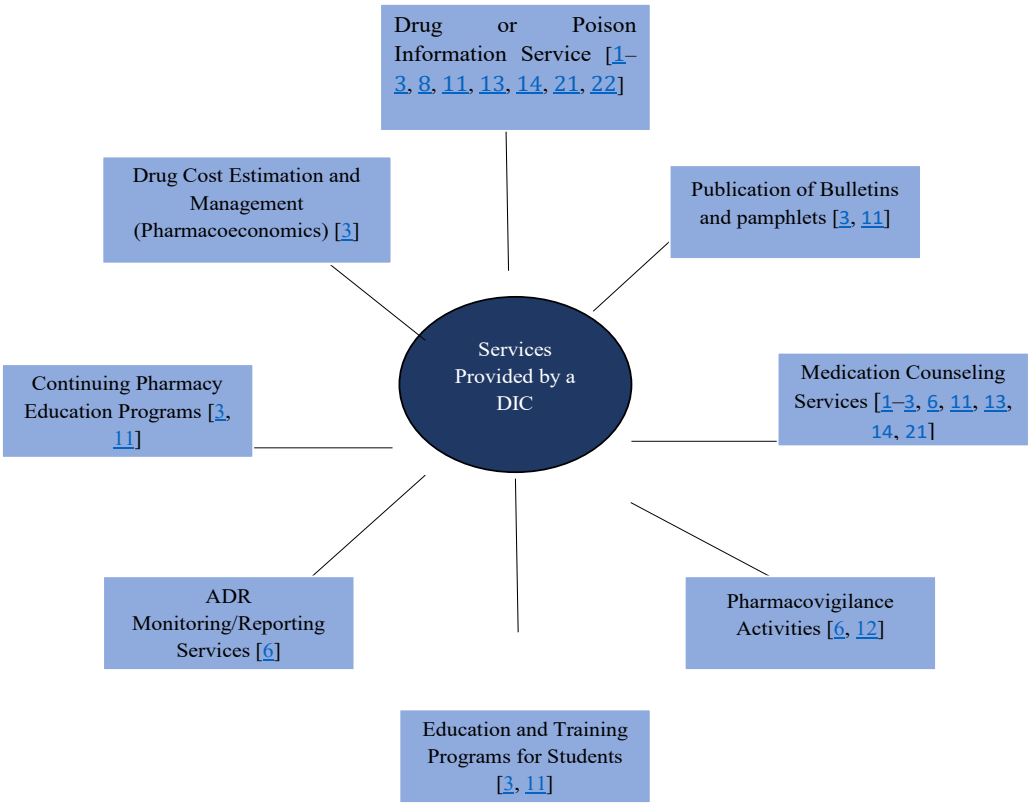


Figure 1. Roles of DIC

DICs support the education of undergraduate and postgraduate students, fostering an interest in pharmacology and guiding them in addressing drug-related queries and counseling patients [3, 11]. Furthermore, they play a key role in research areas, such as pharmacoepidemiology, Pharmacoeconomics, and the rational use of medications [3]. Additionally, DICs publish drug bulletins, case reports, and reviews, benefitting academic institutions and the general public [3, 11]. They also organize Continuing Professional Development (CPD) and education programs for healthcare providers [3, 11].

Most of the DIC members participate in ward rounds and identify drug-related queries arising during the rounds [6]. The DICs coordinate and

support various medication programs, such as AMR awareness campaigns, vaccination programs, and preventive missions for infection controls and pandemic situations [1, 8, 10, 23].

The DICs actively participate in ADR monitoring and reporting, ensuring patient safety by identifying and mitigating drug-related risks [6].

The functions and roles of DICs benefit the patients and society by reducing medication and healthcare-related costs [24]. Furthermore, DICs also keep a check on inappropriate usage of medication, reducing medication errors and patient mortality rates by promoting good clinical care practices. This also leads towards an increase in the quality of patient care, improving medication adherence and patient compliance, as well as promoting safe and effective use of medication [1–3, 8, 10, 11, 13, 14, 21, 23, 24].

5. PRE-IMPLEMENTATION SCENARIO OF DRUG INFORMATION CENTERS (DICS) IN SOUTH ASIA

In South Asia, countries such as Nepal, India, Pakistan, Bangladesh, and Sri Lanka have historically faced challenges in accessing reliable and updated drug information [1, 5, 8, 15]. These challenges usually arise due to limited access to current medical literature, insufficient funding for drug information services, poor documentation and lack of quality assurance programs, as well as the continuous introduction of new drug formulations [1, 5, 8].

Additionally, widespread self-medication, polypharmacy, and misuse of over-the-counter drugs, exacerbated by high illiteracy rates and poverty [8, 25], have contributed to improper medication practices and elevated health risks in the region [26–31].

A scoping review [32] highlighted significant deficiencies in the availability and accessibility of drug information across South Asia. Patient information leaflets in countries, such as India, Pakistan, Sri Lanka, and Bangladesh were found to be lengthy, filled with complex medical terminology, and often not written in local languages [33]. Critical drug information, such as drug-drug interactions and proper usage instructions, was frequently missing [34–37]. In many cases, medicine information was available only in English, limiting accessibility for patients who could not read or understand English [25, 31, 34, 38]. A study conducted in Nepal concluded that the information available in the promotional materials,

provided by the manufacturers, influences the prescribing patterns of clinicians as Nepal has limited drug information sources [39].

The pharmacovigilance systems and adverse drug reaction reporting mechanisms in South Asia are similarly inadequate [40]. A review study of pharmacovigilance in the region outlined 11 indicators to assess the functionality of pharmacovigilance centers. These included the existence of legal provisions, national pharmacovigilance centers, ADR reporting forms, advisory committees, guidelines, and public health program integration. However, key gaps were identified [40]:

- India and Sri Lanka lacked affiliations between pharmacovigilance centers and regulatory authorities.
- Nepal and Pakistan did not have pharmacovigilance advisory committees.
- No information was available regarding such committees in Sri Lanka.
- Only India, Pakistan, and Bangladesh had integrated pharmacovigilance systems into public health programs, such as immunization initiatives.

According to WHO report, Pakistan lacks a proper disease surveillance system and use of medical information [41]. Additionally, an established clinical pharmacy system does not exist to optimize, manage, and monitor medication usage, leading towards the irrational use of medicines in Pakistan [41]. Furthermore, another study revealed that the ADRs are under reported by healthcare professionals in Pakistan due to lack of knowledge or national ADR reporting system, and the pharmacology vigilant system of Pakistan is not meeting the minimum standards [42].

These inconsistencies could be addressed through the establishment of DICs to monitor drug safety issues and support pharmacovigilance activities effectively.

South Asian countries face additional healthcare challenges including a growing aging population, a rise in non-communicable diseases, and a healthcare system that is a mix of public and private providers [29]. The region also features diverse traditional, complementary, and alternative medicine practices, such as Ayurveda, Siddha, and Unani, which often coexist with conventional medicine [4, 5]. This diversity contributes to polypharmacy, increasing the risk of adverse health outcomes and ADRs [38, 43]. This is because the polypharmacy and comorbidities' high

prevalence of drug-drug interactions can be seen in developing countries [41, 44].

Self-medication is another prevalent issue, with many individuals relying on over-the-counter medications for illness prevention and management [43]. Common practices include reusing the prior prescriptions, consuming leftover medications, improper use of medical devices, and taking advice from family and friends [32]. Poor accessibility to healthcare and the ease of consuming medication as over-the-counter medications are driving factors for these practices observed in India [27], Nepal [28], Bangladesh [29], Sri Lanka [25], and Pakistan [43]. These behaviors result in increased risks of adverse reactions, incorrect diagnosis of diseases, inappropriate treatment regimen, non-adherence to medication, drug abuse and dependence, as well as hospitalization [38, 43].

In South Asian regions, lack of effective drug policies also facilitates the occurrence of these challenges [23, 28]. In Nepal, the regulation of information flow on promotional materials provided by the pharmaceutical manufacturing companies for the American products has not been strictly monitored [39]. In India, lack of access to unbiased and updated information on drugs and poor drug regulation often leads towards irrational drug use [45]. Additionally, the role of pharmacists in Sri Lanka is often restricted to providing limited medicinal information to patients [46].

To address these pressing issues observed in South Asia, DICs may play an important and transformative role in improving the quality of healthcare. These centers have the potential to significantly enhance the rational use of medication and to reduce the risks associated with self-medication, practices, polypharmacy practices, and AMR. These challenges collectively underscore the urgent need for established DICs across South Asia.

6. CHALLENGES IN ESTABLISHING AND RUNNING DICS IN SOUTH ASIA

Despite their potential, DICs in South Asia face several challenges [12, 15, 47] mentioned as follows:

- Limited public awareness about DICs and their services.
- Outdated or unavailable drug information sources.
- Insufficient staffing and financial support.

- Lack of clinical and managerial expertise.

Even though, there are challenges in establishing DICs in South Asia, the established DICs have successfully expanded the services. These services include the provision of accurate and updated medicine information, involvement in pharmacology, vigilance activities, counseling, supporting, and academic and research activities involving continuous professional development programs. Additionally, ADR monitoring and even fighting challenging healthcare situations, such as COVID-19 pandemic are among the services provided by DICs [5, 6, 12, 13, 16, 47, 48]. Innovative approaches, such as telemedical services [10] and collaborations with forensic pharmacology and toxicology departments, drug regulatory authorities, and with other complimentary medication practices could effectively enhance the efficiency of DICs [4, 5].

7. POST-IMPLEMENTATION SCENARIO OF DICS IN SOUTH ASIA

7.1. India

The establishment of DICs in hospitals has significantly improved the quality of healthcare. Studies reveal that 86% of healthcare professionals recognize the value of DICs and 95% of patients believe DICs enhance healthcare quality [47]. For instance, a DIC in a Hyderabad care hospital received positive feedback for providing timely and appropriate responses to drug queries [47]. Similarly, services provided by DICs in Karnataka have been instrumental in promoting rational drug use and improving patient care [48]. Upon the evaluation of drug information services provided by Baseweshwara Medical College Hospital and Research Center Chitradurga, Karnataka, the DICs proved to be efficient for the provision of unbiased services. These services are beneficial to patients as well as healthcare professionals in providing better patient care and updating knowledge on medication use [49].

The DIC in Kasturba Teaching Hospital in South India contributes to the betterment of patient care. This study evaluated the quality of services provided by the DICs and showed that physicians (82%) and patients (16%) were satisfied by these services [50]. Similarly, the studies conducted to evaluate the services provided by the DICs established in SRM Medical College Hospital and Research Center, Kanjipurum [51], Mahatma Gandhi Memorial Hospital [52], and JSS Medical College Hospital [53] revealed

that most of the respondents rated the performance of DICs as good. They mentioned receiving appropriate answers for drug-related queries. These studies showed that the drug information services are important for better patient care.

7.2. Nepal

DICs in Nepal, including those in Lalitpur, Kathmandu, Pokhara, and Kavre, address queries on drug interactions, ADRs, medication availability, costs, and administration methods [1, 12]. Studies highlight that approximately 40% of queries are related to ADRs, underscoring the importance of DICs in mitigating drug-related issues [54].

The drug information unit and pharmacovigilance cell established at Hetauba Hospital in Nepal, delivers information on queries regarding drug allergies, OTC drugs and adverse drug reactions and ADR reporting forms, delivering medication counseling and diabetic diet counseling as well as creating antibiotic awareness [55]. This center also aims to provide information about complimentary and alternate medication in future as well [55].

7.3. Pakistan

In Pakistan, a cross-sectional study involving public and private tertiary hospitals in Karachi revealed that over 90% of healthcare professionals emphasized the need for DICs and over 50% of queries were related to drug interactions and dosages [15].

The evaluation of a drug and poison information center operated by pharmacists in Pakistan revealed that the queries received by centers were mainly from general public on patient counseling, disease awareness, and diet counseling with most queries related to indication of drugs, identification of drugs, side effects, and administration [18]. The study also exhibited that the awareness by the activates enhanced the use of such centers, which is a crucial step for effective running of such centers in Pakistan [18].

7.4. Sri Lanka

The Department of Pharmacology at Colombo Medical Faculty initiated a Drug Information Service in 1999 [19]. While there are no regulated DICs in government hospitals, the available services provide independent drug information as well as publish drug bulletins for medical practitioners [19].

7.5. Perceptions from Patients and Healthcare Outcomes

An assessment of DICs in a tertiary care hospital in India found that 54.93% of users were satisfied with the information provided. Feedback responses indicated that the performance of drug information services was rated as excellent and good [48]. Similarly, DICs in Manipal Teaching Hospital played a significant role in enhancing knowledge and understanding of patient medication by providing adequate counseling services [12].

In a tertiary care hospital, Hyderabad, feedback from both healthcare professionals and patients highlighted the impact of DICs. Approximately, 38.38% of respondents agreed that drug information services improved patient care, while 88% of healthcare professionals and 92% of patients rated the responses from DICs as excellent. Additionally, 20% of patients showed a keen interest in legal compliances regarding drug information services [47].

A cross-sectional study conducted in Pakistan revealed that 92% of physicians emphasized the need for drug information services in hospitals. Furthermore, 70% of physicians reported that it took them around 15 minutes to search for drug-related information when needed. This indicates that establishing DICs within hospitals could reduce treatment delays and improve the quality of healthcare [15].

In evaluating the utilization of Drug and Poison Information Centers in Pakistan, the study found that services, such as counseling on medications, dietary changes, and diseases were well-received by the general public. The study also suggested that creating awareness about these services could increase their utilization [18].

An assessment of DICs at Kasturba Hospital, Manipal, showed that 65% of users had a positive experience, with the study concluding that DICs support better patient care [50]. Likewise, in tertiary care hospital, Kanchipuram District, 77.4% of respondents rated the performance of DICs as good and suggested expanding the services to operate 24 hours a day [51].

The positive impact of medicine information services on countries, such as the UK, Saudi Arabia, Malaysia, Uganda, and Egypt also aligns with these findings. Data from the UK indicates that medicine information services contributed to a 27.4% reduction in adverse drug reactions, and

77.1% of medicine information services had a positive impact on medication safety [56].

A study conducted in Saudi Arabia found that 88.1% of prescribing errors and 6.6% of administration errors were prevented by drug information specialists. The study emphasized that DICs can significantly enhance the quality of healthcare services in Saudi Arabia [6].

In Sungai Buloh Hospital, Malaysia, research indicated that optimizing therapy through the provision of drug information to both healthcare providers and patients plays a crucial role in improving healthcare outcomes [57].

A pilot DIC established at a university teaching hospital in Uganda reported that the majority of drug-related queries (54.2%) came from physicians, with 41.2% of inquiries related to drug interactions. The study highlighted the necessity of establishing DICs in Uganda, as the pilot center performed well and was enthusiastically utilized by both physicians and patients [58].

Similarly, a study conducted in Egypt to assess the need for DICs revealed that 73.3% of the general public and over 50% of healthcare professionals considered having a DIC to be very important. The study concluded that ensuring safe, effective, and high-quality healthcare can be achieved through the establishment of DICs [59].

Overall, the implementation of DICs in South Asia has proven invaluable in reducing ADRs, minimizing medication errors, and improving patient safety, satisfaction, and knowledge. The DIC plays a crucial role in providing information on rational drug use and keeping healthcare professionals updated. These post-implementation scenarios collectively demonstrate that establishing DICs in healthcare systems, can significantly improve medication safety, healthcare quality, and informed decision-making for both patient and professionals.

8. CONCLUSION

Although, there are challenges in establishing DICs in South Asia, the services of already established centers have expanded from providing reliable drug information, medication, counseling, and pharmacology activities to fighting against sudden pandemic situations, as well as emerging healthcare challenges, such as AMR. These achievements

highlight the potential for further establishment and expansion of DIC in South Asian healthcare systems. By highlighting the positive impact of DICs on healthcare, it would be more effective when the government takes initiatives to implement and expand DICs in all tertiary and regional healthcare facilities. This would ensure the widespread use of reliable drug information among patients as well as healthcare professionals. Allocating sufficient funds and resources to support DIC establishments, providing trainings to pharmacists and other staff to run DICs as well as conducting continuous professional development programs for healthcare workers to stay updated and creating awareness among public on the services and functions of DICs would considerably improve the overall healthcare through improving medication safety, minimizing treatment costs and delays, and reducing medication side effects. The government and healthcare stakeholders must take actions to implement these types of services in healthcare facilities.

8.1 Strengths of the Study

This is the first narrative review that analyzed the development and impact of DICs on South Asia healthcare systems. Additionally, the study provided valuable insights regarding the impact of such centers on healthcare systems. Moreover, the healthcare challenges in South Asia, the role of DICs in tackling those challenges may be obtained in a single glance of this review.

8.2. Limitations of the Study

The current study only reviewed the available literature without conducting a systematic review or meta-analysis. Studies were included only from accessible data bases and open access articles were analyzed where there was a possibility of omitting relevant subscribed articles. As most of the review studies and research articles were in English, findings and analyses from other languages might be underrepresented. Additionally, the absence of statistical analysis limits the assess to precise impact of DIC on healthcare outcomes.

CONFLICT OF INTEREST

The authors of the manuscript have no financial or non-financial conflict of interest in the subject matter or materials discussed in this manuscript.

DATA AVAILABILITY STATEMENT

No data was generated for this study as this was a review article. All the data analyzed in this article was derived from the cited sources mentioned under references.

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