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PRACTICE REPORT

Development of Clinical Pharmacy services at King Khalid University Hospital and its impact on the quality of healthcare provided

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Abstract Clinical Pharmacy is a unique service provided by the leading pharmacy departments in the United States. The concept of Clinical Pharmacy evolved after the significant increase in number of pharmaceuticals in the market and the increasing potential of drug interactions. However, the Clinical Pharmacist is not merely an individual who advises on drug interactions. There are a number of functions which include but are not limited to; the design of appropriate drug therapy, such as Pharmacokinetic assessment and evaluation to optimize drug therapy, drug information dissemination to the physicians and other healthcare providers and participation as a toxicology consultant in Poison management.

At the King Khalid University Hospital (KKUH) the first Clinical Pharmacy services program began in 1983. The aim of this study is to evaluate the impact of our Clinical Pharmacy program on the patients' care as well as its perception by the Medical staff that came from different parts of the world.

Our Clinical Pharmacists were asked to record any suggestions or interventions in the form. The forms were all collected at the end of each day and entered into a database for analysis. Each intervention was analyzed in order to assess the merit of the action in terms of the therapeutic, financial and direct cost impact.

The study showed a positive impact on the patients' care as well as on the economy of the drugs prescribed. Meanwhile, the service was very much appreciated by the Medical staff as well as other healthcare providers.

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1. Introduction

The pharmacy department at KKHU was the first pharmacy department to implement the Clinical Pharmacy program outside the Continental USA. This unique service was established in 1983 with one clinical pharmacist, following which fifteen Clinical Pharmacists were recruited after the initial trial and the service was expanded to cover all hospital Clinical disciplines. During the initial period of implementation the service was assessed using a questionnaire sent to each physician and nurse for their opinions of Clinical Pharmacists who provide services for their respective areas. This method is biased and does not give an accurate depiction of the services provided by Clinical Pharmacists but rather a personal judgment of an individual.

The clinicians practicing at this institution came from all corners of the globe and most have little or no experience in working with Clinical Pharmacists. Meanwhile, the administrators at KKHU are not familiar with what a clinical pharmacist is capable of achieving in terms of both financial savings for the hospital as well as therapeutic benefits for the patients.

The purpose of this study was to determine what services Clinical Pharmacists are providing, how they are providing them, and the overall quality of these services. Quantification of the information was a priority in order to assure thorough, non-biased results. The information collected is to help us answer the following questions:

- What is the most frequent type of Clinical Pharmacy interaction?
- Who is the primary initiator of the intervention?
- Were the recommendations provided by the Clinical Pharmacists usually accepted, modified, or ignored?
- What time of the day do most interventions occur and how much time is spent on each intervention?
- Of the interventions taking place what percentage is therapeutically beneficial, have no therapeutic benefit or is detrimental to the patient?
- What is the impact of the intervention on immediate direct costs to the health care system?
- What is the long term financial impact of the intervention of the health care system?

2. Methodology

Seven Clinical Pharmacists and two Clinical Pharmacy residents were involved in collecting data for the study over a three month period. Each one was asked to record any suggestions or interventions on a form provided (Fig. 1). The forms were all collected at the end of each day and entered into a database computer program for analysis. Most of the information on the form was self explanatory, and did not require any interpretation. Each intervention was analyzed in order to assess the merit of the action in terms of the therapeutic, financial and direct cost impact.

A suggestion was considered therapeutically positive if it met with the standard of practice for the particular case. For example, adjusting non-therapeutic or toxic Aminoglycoside levels appropriately was considered therapeutically positive.

The financial impact was based on the long-term effect of the intervention. For example in the above case the intervention would be classified as financially positive since optimizing the dose will lead to a more rapid recovery and hence shorten the length of hospitalization. If an inappropriate suggestion had been made this may lead to unnecessarily prolonged hospitalization and increased cost to the health care system.

Direct cost was defined as the immediate effect of the intervention on the health care system regardless of the long-term financial impact. For example if a clinical pharmacist requested an Aminoglycoside serum concentration determination, this will result in increased direct costs, although the concentration may be sub therapeutic and necessitate subsequent dosage modification.

All interventions were analyzed by three Clinical Pharmacists until a consensus was reached concerning the impact of the intervention. Each intervention was designated as either positive, negative, or having no effect on the therapeutic, long-term financial and direct cost criteria defined above.

3. Results

A total of 8796 interventions were documented during the three month period (five working days a week). Interventions occurred throughout the hospital encompassing 28 wards (including all intensive care units), IV pharmacy, Drug and Poison information Center (DPIC), outpatient pharmacy, non hospital related clinics, hospital related clinics and in the homes of several Clinical Pharmacists. The DPIC had the most number of documented interventions with 900 interventions.

Therapeutic and dosing administration interventions were the most frequently encountered and accounted for nearly 60% of all interventions, followed by Pharmacokinetic and total parenteral nutrition interventions, which accounted for 9% and 9.5% of interventions, respectively. Availability, supply, and miscellaneous interventions accounted for approximately 6% of interventions each. Side effects, adverse drug reactions, educational, pregnancy and lactation, interactions and compatibility, and poisoning interventions accounted for less than 5% each of the total interventions.

Of all interventions, Clinical Pharmacists initiated 43%, physicians 42%, nursing staff 5.5%, satellite pharmacists 5.4% and other personnel 4.1%. 86% of the suggestions made by Clinical Pharmacists were accepted and only 2% modified and 3% ignored. Nine percentage of interventions did not produce a suggestion that required acceptance; hence these were labeled as not applicable.

Analysis of the therapeutic merit of the interventions shows that 90% of the interventions had a positive therapeutic impact while 9% had no therapeutic impact and 1% had a negative impact.

Immediate direct costs increased due to the intervention in 27% of the cases. No effect on direct cost and a decrease in direct costs were seen in 50% and 23% of the cases, respectively.

Long term financial impact of the interventions was positive (reduce healthcare costs) in 96% of the cases, increased in 1% and had no effect in 3%.

The average time involved by a clinical pharmacist was 9.59 min per interventions with a range of 1–240 min. The time of the day in which most interventions occurred was 10 am

<i>Clinical Pharmacist Name:</i>	<i>Date</i>	<i>Time</i>
<i>Area / Ward</i>	<i>Hospital No</i>	<i>Bed No.</i>
<i>Intervention Description:</i>		
<i>Intervention Initiated By:</i>		
<ol style="list-style-type: none"> 1. <i>Clinical Pharmacist</i> 2. <i>MD</i> 3. <i>RN</i> 4. <i>LAB.</i> 5. <i>SATELLITE RPh</i> 6. <i>OTHER</i> 		
<i>Suggested Action</i>		
<ol style="list-style-type: none"> 1. <i>Accepted</i> 2. <i>Modified</i> 3. <i>Ignored</i> 4. <i>N/A</i> 		
<i>Category:</i>		
<ol style="list-style-type: none"> 1. <i>Administration /Dose</i> 2. <i>Availability /supply</i> 3. <i>Treatment</i> 4. <i>Pregnancy /Lactation</i> 5. <i>SE /ADR</i> 6. <i>Compatibility / interaction</i> 7. <i>Pharmacokinetics</i> 8. <i>Educational</i> 9. <i>TPN</i> 10. <i>Poisoning</i> 11. <i>Other Time involved</i> 		

Figure 1 Form used by the Clinical Pharmacists to document interventions.

with a range of 9–3:30. Table 1 shows that the average time for administration and dosage interventions was 5.4 min (range 1–45 min), for availability 4.6 min (range 1–14 min), for therapeutic interventions 6.69 min (range 1–90 min), for side effects and adverse drug reactions 11.2 min (range 2–60 min), for pregnancy and lactation interventions 7.1 min (range 1–60 min), for Pharmacokinetic interventions 8.14 min (range 1–30 min), for educational 46.77 min (range 2–240 min), for total parenteral nutrition 13.03 min (range 1–45 min), for Poisoning interventions 23 min (range 5–30 min), and for other 21.33 min (range 1–180 min).

Table 1 The average time taken by Clinical Pharmacists for various interventions.

Intervention	Average time (min)	Range (min)
Administration and dosage	5.4	1–45
Availability	4.6	1–14
Therapeutic	6.69	1–90
Side effects and ADR	11.2	2–60
Pregnancy and lactation	7.1	2–20
Interaction and compatibility	14.5	1–60
Pharmacokinetics	8.14	1–30
Educational	46.77	2–240
Total parenteral nutrition	13.03	1–45
Poisoning	23.0	5–30
Other	21.33	1–180

4. Discussion

The unique feature of this study is the material itself since no one in this institution has ever attempted to actually document all the interventions of the Clinical Pharmacy staff over a period of time. After reviewing the data, it was clear that Clinical Pharmacists were not just attending rounds and making passive suggestions. They were actively involved in the decision making process on a prospective basis. The clinical staff were involved throughout the entire hospital and not just the in the wards in which they were assigned. The drug information service handled 900 interventions in a three month period plus the regular ward assignments for the employees. Clinical Pharmacists were also contacted at home several times in the management of poisonings.

After calculating the time involved per intervention as an average one sees that a clinical pharmacist is a very efficient decision-maker both in terms of therapeutics and in minimizing cost. Although the response time for the questions varied considerably based on the type of questions (Table 1).

Therapeutic interventions, administration, and dosage accounted for a majority of the interventions. This is an impressive statistic since these are exactly what is expected of Clinical Pharmacists. The therapeutic, dosing, and administration interventions were the most significant interactions. Recommendations of Clinical Pharmacists involved prolonging, discontinuing, or modifying (i.e. adding or deleting drugs from a regimen) therapy, adjusting dosages and evaluating treatment outcome.

Surprisingly, total parenteral nutrition interventions were the third most frequent type of interventions. This shows that Clinical Pharmacists play a major role in managing patients on parenteral nutrition which is advantageous for the patient and the pharmacy services. A clinical pharmacist has extensive training in this area and hence can provide a unique service that maximizes benefit to the patient and at the same time, with a thorough understanding of drug delivery and cost analysis procedures, can minimize cost.

Pharmacokinetic intervention came in the fourth most frequent intervention. Clinical Pharmacists are known as the pharmacokinetic experts within the hospital and hence are the only members of the healthcare team who are trained to provide this information. The interventions not only included adjustment of patients' dose but also request for drug levels to assess therapy.

An interesting role of the clinical pharmacist is the one of inventory analysis. Availability and supply intervention were the fifth most common. This is possibly the result of daily variations in inventory. Maintaining a constant supply of a drug is almost impossible at our institution, due to the significant variation in consumption based on the practitioners' background. The clinical pharmacist is continually bombarded by questions of availability and supply and hence is a link between the clinician and the stores.

Other interventions included work on research, reviewing material for the pharmacy and therapeutic committee, attending committee meetings etc.

Interventions on side effects and on interactions and compatibility combined account for about 5% of interventions. These were questions, which required some research to be done by Clinical Pharmacists in order to provide the physician with literature on a particular adverse reaction or side effect. Interactions and compatibility interventions were primarily associated with administration of several drugs or IV fluids throughout the same line. Clinical Pharmacists are the only members of the healthcare team who have extensive training in this field and whenever a situation such as this arises a clinical pharmacist's opinion is always sought.

Pregnancy and lactation interventions were restricted to the drug information services. These interventions were all concerning the use of a certain drug during pregnancy or lactation. The drug and poison information center is known throughout the entire hospital and university for its ability to provide answers reliably and quickly to difficult questions such as these.

The primary shortcoming of this investigation is the lack of a method to calculate the long-term financial impact of an intervention. The long-term impact of the intervention is of primary importance in assessing how much money is saved through the actions of Clinical Pharmacists. Some suggestions may result in an immediate saving as the one that leads to a patient's discharge on an earlier date due to an intervention by the clinical pharmacist. The Clinical Pharmacists were able to reduce both immediate and long term expenditures by discontinuing medications that were of no therapeutic benefit or were producing adverse reactions. Unfortunately, we have no figures to estimate the savings that are realized by the use of Clinical Pharmacists in this institution. Other centers have documented major reductions in costs by implementing Clinical Pharmacy programs (Marie et al., 2008; Jennifer et al., 2011; Chisholm et al., 2001; Viktil and Blix, 2008; Weant et al.,

2009; Schumock et al., 2003). However, most of these studies addressed one activity of Clinical Pharmacy Services, e.g. Diabetes, Hyperlipidemia, drug related problems etc.

Healthcare today requires not only the knowledge of pathophysiology, therapeutics and pharmacology but also economics. Healthcare costs continue to rise world-wide resulting in an increased necessity to minimize cost while maximizing therapeutic benefit. This is specifically pertinent in teaching institutions for two basic reasons. First, many of the junior medical staff has absolutely no knowledge of drug cost. With the aid of Clinical Pharmacists, they can learn to prescribe a less expensive agent without compromising the health of the patient. Secondly, the junior medical staff will be the senior staff of tomorrow. They must understand proper prescribing in order to limit the healthcare expenditures of the future. Clinical Pharmacists are unique members of the healthcare team for not only are they aware of proper drug utilization in all fields of medicine but are especially aware of drug costs. Clinical Pharmacists offer a new approach to maximizing healthcare delivery and at the same time in reducing costs.

5. Conclusion

This study provides evidence of the economic value of Clinical Pharmacy services, and the appreciation of the Medical staff of this unique service. However, in our country Clinical Pharmacy is not fully appreciated at the government level i.e. Ministry of Health Hospitals. The main Hospitals that utilize Clinical Pharmacists are the Specialty Hospitals, University Hospitals, and other elite Medical Centers. The Saudi Pharmaceutical Society has a role to play in promoting the image of Clinical Pharmacy and to educate the executive members of the Ministry of Health of the value of Clinical Pharmacists and their impact on cost saving in an escalating cost of Healthcare provision. Clinical Pharmacists should be encouraged to engage in direct patient's care services not to be given administrative positions where their impact on the healthcare quality and development is not noticed nor appreciated. Once the Pharmaceutical services in the country are fully developed and the standards of Pharmacy practice are set and executed then Clinical Pharmacists can move into administrative positions. More comprehensive studies on the role of Clinical Pharmacists need to be carried out and published, this study is the first of its kind in the Kingdom and we are aware of the limitations of this study, however, it is just a start and the future will demonstrate the value and the benefits of involving Clinical Pharmacists and the Clinically oriented Pharmacists in immediate patient's care.

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