

# Pharmaceutical Care – A case study of Connaught Hospital

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**Abstract- Background** –Pharmacy practice has shifted from a product centred approach to a patient centred approach. This study evaluated the need for and impacts that pharmaceutical care services at the ward level would have at Connaught Hospital, Freetown

**Objective** –To identify medication related problems, and assess the need for , relevance and impact of pharmaceutical care in this setting

**Methods** – Adapted Validated observational instruments for rating the value of Pharmacists clinical services and for assessing medication related problems and recommendations (interventions) were used to evaluate the severity of error, value of pharmaceutical care service, identify medication related problems and recommend solutions to these problems

**Results:** Of the 150 cases 77 had errors that were relevant, and 53% (80 of 150) of the services rendered were important. Medication related problems identified and recommendations were all shown to have a potentially positive impact on patient wellbeing and therapeutic outcomes as well as direct or indirect cost saving impact

**Conclusion:** There is a need for pharmaceutical care services and patient care will improve significantly when it is present

**Index Terms-** Pharmaceutical Care, Medication Related Problems, severity of error, value of service

## I. INTRODUCTION

The role of pharmacists have diversified from dispensing medications, to patient care, patient counsellor ,health care education and community service to clinical practice. Clinical and cost-effectiveness evidence are needed to justify the existence or extension of routine clinical pharmacy services in hospital settings.

The role of Clinical Pharmacists in the care of hospitalised patients has evolved over time with increased emphasis on collaborative case handling. Clinical Pharmacists are involved in the optimization of the Health care delivery system by fully participating in pharmaceutical care and identifying drug therapy problems and medication errors. In Sierra Leone as in some other West African countries this role is non-existent. This study seeks to evaluate the impact of that gap and the impact of pharmaceutical care will have on the quality of health care delivery and the optimization of medicine use in a resource limited setting such as Connaught hospital.

Clinical pharmacy practice in the form of pharmaceutical care and therapeutic interventions by the Pharmacist in the hospital setting in Sierra Leone is practically non-existent. This study will seek to evaluate tangible potential clinical pharmacy interventions that could have cut down costs, improved therapeutic goals of treatment outcomes and improve the quality of life of the patient and thus evaluate or verify the relevance of clinical pharmacists in improving the health care delivery in the hospital setting.

## II. OBJECTIVES OF STUDY

- To evaluate potential clinical pharmacy interventions at Connaught hospital.
- To determine the severity of errors of medication related problem and value of service if pharmaceutical interventions and hence the whether such interventions would be important
- To determine the frequency of occurrence of specific drug therapy problems
- To determine qualitatively any indirect cost savings due to improved patient safety and reduced morbidity and mortality.

A study was conducted by Busman et al to evaluate pharmacist clinical interventions in a Dutch hospital setting<sup>[1]</sup> The objective of the study was to assess the relevance of a clinically active pharmacist method compared to the traditional working method.

It was concluded that Clinical pharmacy services provided by a junior hospital pharmacist on an internal medicine ward contributed to rationalization of drug therapy and was therefore likely to increase medication safety.

In a study done on medication errors and adverse drug events in paediatric inpatients by the Harvard Medical Practice Study<sup>[2]</sup> it was estimated that 3.7% of hospitalized patients experienced an adverse event related to medical therapy in New York State in 1984<sup>[2]</sup> A more recent study reached similar estimates.<sup>[3]</sup> An Institute of Medicine report in 1999 estimated that 44 000 to 98 000 people die each year at least in part because of medical error<sup>[4]</sup> (Kohn et al ,1999

In the Harvard Medical Practice Study, the most common adverse events were complications of medication use (19.4% of all events).<sup>[5]</sup> Thirty percent of patients with drug-related injuries died or were disabled for more than 6 months, although not all morbidity and mortality was directly attributable to these drug-related injuries.<sup>[2]</sup> In response to these concerned findings, the Adverse Drug Event Prevention Study was performed, which addressed medication errors and adverse drug events (ADEs) in

hospitalized adults in more detail.<sup>[6][7]</sup> It found that ADEs were common (occurring at a rate of 6.5 per 100 adult admissions), costly, and often had severe sequelae.<sup>[6][7]</sup> Other studies largely confirmed these findings.<sup>[8]</sup>

Two studies suggest that about one third of ADEs were associated with medication errors and were thus preventable.<sup>[6]</sup> Bates et al found that medication errors were common, occurring at a rate of 5 per 100 medication orders. However, only 7 in 100 medication errors had significant potential for harm, and 1 in 100 actually resulted in an injury.<sup>[7]</sup>

A clinical pharmacist participating in physician rounds in an adult ICU decreased preventable ADEs by 66%.<sup>[7]</sup> In addition, ward-based interventions may reduce costs of care. During a 3-month study, a clinical pharmacist made 345 interventions in an adult ICU, leading to a \$24 000 cost reduction.<sup>[9]</sup>

A study was done by Dean et al titled - Prescribing errors in hospital inpatients: their incidence and clinical significance.<sup>[10]</sup> This study was based on the estimation that 1–2% of US inpatients are harmed by medication errors, the majority of which are errors in prescribing. The UK Department of Health has recommended that serious errors in the use of prescribed drugs should be reduced by 40% by 2005; however, little is known about the current incidence of prescribing errors in the UK. This pilot study sought to investigate their incidence in one UK hospital. Pharmacists prospectively recorded details of all prescribing errors identified in non-obstetric inpatients during a 4 week period. The number of medication orders written was estimated from a 1 in 5 sample of inpatients. Potential clinical significance was assessed by a pharmacist and a clinical pharmacologist. About 36 200 medication orders were written during the study period, and a prescribing error was identified in 1.5% (95% confidence interval (CI) 1.4 to 1.6). A potentially serious error occurred in 0.4% (95% CI 0.3 to 0.5). Most of the errors (54%) were associated with choice of dose. Error rates were significantly different for different stages of patient stay ( $p < 0.0001$ ) with a higher error rate for medication orders written during the inpatient stay than for those written on admission or discharge. While the majority of all errors (61%) originated in medication order writing, most serious errors (58%) originated in the prescribing decision. It was concluded that there were about 135 prescribing errors identified each week, of which 34 were potentially serious.

The impact of clinical pharmacists' consultations on geriatric drug prescribing was studied in a prospective randomized controlled trial of patients 65 years of age and over discharged on 3 or more medications for chronic conditions from a 450-bed community hospital.<sup>[11]</sup> The pharmacists provided consultation to experimental patients and their physicians at hospital discharge and at periodic intervals for 3 months post discharge. Using a standardized tool, a physician-pharmacist panel, blinded to study group assignment of patients, evaluated the appropriateness of prescribing for a random sample of 236 patients. Eighty-eight percent had at least one or more clinically significant drug problems, and 22% had at least one potentially serious and life-threatening problem. Drug-therapy problems were divided into six categories: 1) inappropriate choice of therapy; 2) dosage; 3) schedule; 4) drug-drug interactions; 5) therapeutic duplication; and 6) allergy. Experimental patients

were less likely to have one or more prescribing problems in any of the categories ( $P = 0.05$ ) or in the appropriateness ( $P = 0.02$ ) or dosage ( $P = 0.05$ ) categories. A summary score, measuring the appropriateness of the patient's total drug regimen, indicated that experimental patients' regimens were more appropriate than those of controls ( $P = 0.01$ ). Results of this trial reveal that clinical pharmacists can improve the appropriateness of geriatric drug prescribing in outpatient settings.

In a study titled economic effects of clinical pharmacy interventions: A literature review<sup>[12]</sup> A variety of clinical pharmacy interventions have been assessed, but the body of evidence relating to any particular type of intervention is small. Cost-saving interventions comprise a small percentage of clinical pharmacy interventions, but they generated substantial savings. Clinical pharmacists provided added value by participating in multidisciplinary teams attending rounds. Clinical pharmacy interventions reduced preventable adverse drug events and prescribing errors, thereby yielding savings related to cost avoidance. Interventions relating to antibiotic therapy lowered costs of care without adversely affecting clinical outcomes. The results of cost-benefit analyses suggested that general clinical pharmacy interventions are associated with cost savings. Most economic evaluations of clinical pharmacy interventions suffered from a number of methodological limitations relating to the absence of a control group without clinical pharmacy interventions, limited scope of costs and outcomes, focus on direct health care costs only, exclusion of pharmacist employment cost, use of intermediate outcome measures, exclusion of health benefits, and absence of incremental cost analysis. Some avenues for designing future economic evaluations include the use of a control group, detailed descriptions of the interventions provided; evaluations conducted from a societal perspective, consideration of patients' health benefits when assessing economic effect of interventions and hospital costs, and the inclusion of sensitivity and incremental analyses.<sup>[12]</sup>

It was concluded that most pharmaco-economic evaluations of clinical pharmacy interventions demonstrated limitations in their methodological quality and applicability to current practice. Future evaluations should use a comparative study design that includes the incremental cost-effectiveness or cost: benefit ratio of clinical pharmacy interventions from a societal perspective. A study was done titled: Reduction in Heart Failure Events by the Addition of a Clinical Pharmacist to the Heart Failure Management Team Results of the Pharmacist in Heart Failure Assessment Recommendation and Monitoring (PHARM).<sup>[13]</sup> The basis of this study was that multidisciplinary approach to managing heart failure has been shown to improve outcomes. The role of a clinical pharmacist in treating heart failure had not been evaluated. It was concluded that outcomes in heart failure can be improved with a clinical pharmacist as a member of the multidisciplinary heart failure team.

A study was done to evaluate cost implications of and potential adverse events prevented by interventions of a critical care pharmacist.<sup>[14]</sup> A decentralized clinical pharmacist assigned to a surgical intensive care unit (ICU) documented all interventions made from mid-October 2003 through February 2004 using a standardized written form. The data were

retrospectively evaluated and the following information was extracted:

Results: A total of 129 interventions were documented over 4.5 months. The majority of interventions were identified during chart review (40%) and patient care rounds (39%). The potential cost avoidance of the documented interventions was \$205,919-\$280,421. Interventions identified during patient care rounds and chart reviews were most likely to achieve the greatest impact on cost avoidance. It was concluded that among the interventions performed and documented by a clinical pharmacist in an ICU, patient care rounds and chart-review activities were associated with the greatest number of interventions and the greatest potential cost avoidance.

A study was done by Schumock G.T et al titled-Economic Evaluations of Clinical Pharmacy Services—1988–1995<sup>[15]</sup>.

The objectives of this effort were to summarize and critique original economic assessments of clinical pharmacy services published from 1988–1995, and to make recommendations for future work in this area. A literature search was conducted to identify articles that were then blinded and randomly assigned to reviewers to confirm inclusion, abstract information, and assess the quality of study design. The 104 articles fell into four main categories based on type of service described: disease state management (4%), general pharmacotherapeutic monitoring (36%), pharmacokinetic monitoring services (13%), and targeted drug programs (47%). Articles were categorized by type of evaluation; 35% were considered outcome analyses, 32% outcome descriptions, and 18% full economic analyses. A majority (89%) of the studies reviewed described positive financial benefits from the clinical services evaluated; however, many (68%) did not include the input costs of providing the clinical service as part of the evaluation. Studies that were well conducted were most likely to demonstrate positive results. Commonly, results were expressed as net savings or costs avoided for a given time period or per patient. Seven studies expressed results as a benefit cost ratio (these ranged from 1.08:1 to 75.84:1, mean 16.70:1).

It was concluded that, overall this body of literature contains a wealth of information pertinent to the value of the clinical practice of pharmacy. Future economic evaluations of clinical pharmacy services should incorporate sound study design and evaluate practice in alternative settings.

In another study done by Dooley et al titled- A prospective multicentre study of pharmacist initiated changes to drug therapy and patient management in acute care government funded hospital.<sup>[16]</sup>The main aim of this study was to determine the cost savings of pharmacist initiated changes to hospitalized patients' drug therapy or management in eight major acute care government funded teaching hospitals in Australia.Reduction in LOS accounted for the majority of the savings measured. This is not surprising as increased LOS has been consistently associated with suboptimal medication use <sup>[2][7]</sup>) and a large proportion of the interventions were initiated to either reduce adverse events or increase treatment efficacy and were considered to have been of moderate or major clinical significance. Reducing LOS may result in increased patient throughput, which in turn could result in an overall increase in hospital expenditure. This could be one argument that these interventions would not result in savings that could be realized for the individual hospital overall. However, it

must be acknowledged that the expenditure on the individual patient would be less when interventions occurred. The hospital would save on these patients and in Australia further throughput activity would be balanced by case-based funding streams. Benefits of the interventions performed by pharmacists in this study not only include the savings associated with reducing the duration of hospitalization but also the associated positive outcome of the ability to treat more patients.

Over 10% of the interventions were deemed to have reduced the potential for readmission, and hence, significant costs were avoided. There were a range of different interventions that contributed to reducing potential for re-admission. These included, for example, initiation of prophylactic therapies (such as antibiotics), and instances where continuing therapy was not prescribed but the omission was detected by the pharmacist and therapy recommenced. A number of studies have shown that a large number of hospital admissions are due to adverse drug events, concordance problems, medication errors or suboptimal prescribing <sup>[17]</sup> This study supports the concept that clinical pharmacy services provided to admit patients reduced future healthcare costs.

There was little change in overall expenditure on drugs as a consequence of the interventions, as initiation of drug therapy occurred at a similar rate to cessation of existing therapy. Changes to drug therapy were primarily for clinical reasons and although in many cases involved the initiation of therapy with resultant increase in drug costs, a large number of cases were deemed to have resulted in reduction in LOS and/or reduced probability of readmission. In contrast, formulary restrictions, which contributed more so to reduced drug costs were very much secondary considerations. The clinical significance and the major impact on LOS and potential for readmission were reflective of the clinical focus and proactive nature of the interventions and demonstrate a quality use of medicines approach by the clinical pharmacy services provided. A similar finding was demonstrated in the ambulatory setting by Malone *et al* <sup>[18]</sup>. Studies that have demonstrated significant savings in drug costs by pharmacists have had a cost containment focus and have not independently quantified clinical and economic impact on other resources.<sup>[15]</sup> When annualized, the savings resulting from the interventions quantified at the eight sites was \$4 444 794

The magnitude of the savings determined in this study is comparable with those of other smaller published studies<sup>[19][20]</sup> and is demonstrated over a much larger and broader patient population. Additionally, in some of these studies the resources quantified also included physician and nursing time<sup>[19][20]</sup> Overall, this study has demonstrated a conclusion based on conservative assumptions with the actual savings likely to be significantly greater than those reported and quantified. It must be noted that the clinical activity of therapeutic interventions is an integral component of a clinical pharmacy service and cannot be effectively performed as an isolated activity.

This study clearly demonstrates that routine clinical pharmacist review of inpatient drug therapy is an essential component of the quality use of medicines with a significant potential to reduce LOS and potential for readmission.

A total of 1399 interventions were documented. Eight hundred and thirty-five interventions impacted on drug costs alone. Five hundred and eleven interventions were evaluated by

the independent panels with three quarters of these confirmed as having an impact on one or more of: length of stay, readmission probability, medical procedures or laboratory monitoring. There were 96 interventions deemed by the independent panels to have reduced LOS and 156 reduced the potential for readmission. The calculated savings was \$263 221 for the eight hospitals during the period of the study. This included \$150 307 for length of stay reduction, \$111 848 for readmission reduction.

The annualized cost savings relating to length of stay, readmission, drugs, medical procedures and laboratory monitoring as a result of clinical pharmacist initiated changes to hospitalized patient management or therapy was \$4 444 794 for eight major acute care government funded teaching hospitals in Australia.

### III. METHODOLOGY

- A cross-sectional study was conducted in Connaught Hospital, Freetown, Sierra Leone.
- Adapted validated observational instruments :
- Overhage *et al* an instrument for rating the value of pharmacists' clinical services
- Individualized Medication Assessment and Planning (Imap) tool: for rating the value of pharmacists clinical services and for assessing medication related problems and recommendations (interventions) - used to evaluate the severity of error, value of pharmaceutical care service; and to identify medication related problems

Between June and September 2016, patient files in 3 medical wards were assessed for drug therapy problems which were then documented. The information was analysed for potential clinical pharmacy interventions and the drug therapy problem leading to the need for such intervention identified and documented. The study was done prospectively but not in real time. That is it was done after the physician or medical officer had written on the files not necessarily before the prescription was written. Slightly adapted versions of two validated instruments was used –overhage *et al* Classification of Pharmacist intervention, an instrument for rating the value of Pharmacists clinical services and the Individualized Medication Assessment and Planning (Imap) tool, an instrument for assessing medication related problems and recommendations ( interventions). Basic patient demographics was documented.

The adapted instruments are included in the appendix section Patient age, sex and initial number of drugs at the beginning of admission were also noted.

An initial pilot study was carried out before the research started using 10 initial patients. This initial study was useful as it led to some important adjustments in the research instruments, which made it better suited for the research objective. These patients were not included in the final results.

Connaught Hospital being a 200 bed hospital, a convenience sample of 150 patient files was assessed

Inclusion criteria – In patients in medical wards.

Exclusion criteria – out-patients and surgical wards

The data was analysed using descriptive statistics – bar charts, pie charts, frequencies, tables and figures. , cross-tabulations

Patient Demographics to recorded included ,age ,sex ,number of drugs at admission ,nature of illness (acute/chronic/multiple chronic)

The overhage *et al* adapted version (adapted by Brian Thompson, 2016) classification for Pharmacist intervention was used to classify interventions. In the unadapted instrument interventions were classified from potentially lethal to serious ,Significant ,Minor , and no error but in the adapted instrument the classification was changed to potentially lethal , Serious , Relevant ,Minor and No error

Value of service in the original instrument (a validated tool known as (The Individualized medication assessment and planning tool) ranged from Extremely Significant, very significant, Significant, somewhat significant, no significance and adverse significance.

In the adapted instrument value of service ranged from extremely Important, Very Important, Important, Somewhat Important, Negligible Importance and No Importance

Implementation of recommendations were sub-divided into three parts –Implemented (that is fully implemented) ,partially implemented and not implemented.

The data obtained was analyzed and interpreted using descriptive statistics

- Of the 150 cases 77 had errors that were relevant, and 53% (80 of 150) of the services rendered were important.
- Medication related problems identified and recommendations were all shown:
- to have a potentially serious and positive impact on patient wellbeing and therapeutic outcomes
- as well as direct or indirect cost saving impact

Table 1 – Severity of error

TABLE 2 Percentage distribution of Value of Service

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Figure 1 - Percentage distribution of implementation of recommendations

Figure 2: Percentage distribution of age of patients

Table 3: Number of Drugs at Admission

NUMBER OF DRUGS AT ADMISSION			
		Frequency	Valid Percent
Valid	2	3	2
	3	20	13.4
	4	57	38.3
	5	35	23.5
	6	18	12.1
	7	10	6.7
	8	6	4

The most frequently occurring initial number of drugs on admission was 4 followed by 5 as the next highest

- In 13% of cases (20 of 150 patients, monitoring was needed to assess effectiveness of response to therapy and to assess for/prevent potential adverse effects
- In 5% of cases (8 of 150 patients) safer medication alternatives were considered necessary
- In 3% of cases (5 of 150 patients) one or more medication was considered not effective for the management of the disease condition.
- In 14% of cases (21 of 150 patients) there was no apparent reason for use of a medication
- In 37% of cases (56 of 150) there was a potential for drug interaction
- In 6% of cases (9 of 150), therapeutic duplication of medication was observed.
- In 1% percent of cases (2 of 150) presented with moderate adverse events, another one percent of cases presented with severe adverse events.
- In 51% of cases (77 of 150 patients) ,duration was not indicated
- In 1% of cases(2 of 150) medication was not available
- In 28% of cases (42 of 150) additional drugs were needed.
- In 22% of cases (33 of 150) it was considered necessary to discontinue drug
- In 47% of cases (71 of 150) it was considered necessary to monitor the patient closely
- In 4% of cases, it was considered necessary to recommend further lab tests
- It was clearly demonstrated that routine clinical pharmacist review of inpatient drug therapy is an essential component of the quality use of medicines with a significant potential to reduce LOS (length of stay) and potential for readmission.
- Reduction in LOS accounted for the majority of the savings measured. This is not surprising as increased LOS has been consistently associated with suboptimal medication use<sup>[2][7]</sup>

#### IV. DISCUSSION

It was clearly demonstrated in a prospective multicentre study<sup>[16]</sup> that routine clinical pharmacist review of inpatient drug therapy is an essential component of the quality use of medicines with a significant potential to reduce LOS (length of stay) and potential for readmission.

Reduction in LOS accounted for the majority of the savings measured. This is not surprising as increased LOS has been consistently associated with suboptimal medication use<sup>[2][7]</sup>

In a study titled economic effects of clinical pharmacy services<sup>[12]</sup> interventions reduced preventable adverse drug events and prescribing errors, thereby yielding savings related to cost avoidance.

The results of cost–benefit analysis suggested that general clinical pharmacy interventions are associated with cost savings. In this study the medication related problems identified and the recommendations maximized therapeutic outcomes which have been shown in all studies to reduce cost of care either directly or indirectly.

It can therefore be concluded that pharmaceutical care services will indirectly and even directly reduce cost and based on the analysis of severity of error and value of service ,there is a need for pharmaceutical care services and patient care will improve significantly when it is present

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