# AN AUDIT OF THE IMPACT OF A CLINICAL PHARMACIST ON RATIONAL DRUG USE AT KENYATTA NATIONAL HOSPITAL

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## A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF MASTER OF PHARMACY IN CLINICAL PHARMACY

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# Declaration

This dissertation is my original work and has never been presented anywhere for a degree award in any university.

Signature_____ Date____24-11-09_____

**Dr. Samuel Chege Gitau**


This dissertation has been presented to the University of Nairobi for examination with my approval as supervisor;


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I would like to thank the following people for their unwavering support and guidance;

## Dedications

This research project is dedicated to my family; my wife Cecilia Wangari and our children Tiffany, Terrence and Ethan; thank you for your prayer and encouragement. I love you very much.

# List of Abbreviations

**7A**-ward seven A of Kenyatta National Hospital

**7B**-ward seven B of Kenyatta National Hospital

**7C**-ward seven C of Kenyatta National Hospital

**7D**- ward seven D of Kenyatta National Hospital

**8A**- wards eight A of Kenyatta National Hospital

**8B**- wards eight B of Kenyatta National Hospital

**8C**- wards eight C of Kenyatta National Hospital

**8D**- ward eight D of Kenyatta National Hospital

**ADE**-Adverse Drug Event

**ADR**-Adverse Drug Reaction

**AIDS**-Acquired Immunodeficiency Syndrome

**ANOVA**-Analysis of Variance

**ARVs** –Antiretroviral Drugs

**ASHP**-American Society of Hospital Pharmacy

**BD**-twice daily

**DVT**-Deep Vein Thrombosis

**EDA**-Exploratory Data Technique

**ERSD**-End Stage Renal Disease

**HIV**-Human Immunodeficiency Virus

**ICIUM**-The First International Conference on Improving Use of Medicines

**IV**-Intravenous

**KCl**-Potassium Chloride

**KNH**-Kenyatta National Hospital

**mMol/l**- Millimole per litre

**MSH**-Management Sciences for Health

**n** -Sample size

**OD**-Once daily

**Pharmacy 40**-Main pharmacy of Kenyatta National Hospital (KNH)

**Pharmacy 8**-The pharmacy located on 8$^{th}$ floor of KNH hospital complex serving the internal medicine wards

**RDU**-Rational Drug Use

**rINN**- Recommended International Non-Proprietary Names (generic)

**RPM** -Rational Pharmaceutical Management Plus Program

**SPSS**- Statistical Package for Social Scientists

**Stat**- at once

**WHO**-World Health Organization

# Definition of terms

**Rational drug use**- It is the use of drugs that result in a patients receiving medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, and at the lowest cost to them and their community.

**Drug related problems**- It is all circumstances involving a patient's drug treatment that actually or potentially, interfere with the achievement of an optimal outcome and include medication errors, adverse drug events and adverse drug reactions.

**Medication errors**-It is any error in the medication process (that is, prescribing, dispensing, administering of drugs), whether there are adverse consequences or not.

**Adverse drug event**-Any injury related to the use of a drug, regardless of whether a therapeutically appropriate dosage is used, although the causality of this relationship may not be proven.

**Adverse drug reactions**-It is any response to a drug which is noxious and unintended, and which occurs at doses normally used in humans for prophylaxis, diagnosis or therapy of diseases, or for the modification of physiological functions.

**An intervention**- For the purpose of the audit, it was any action by the clinical pharmacist that directly resulted in a change to patient management or therapy. It included querying a prescription, discussing an issue, counselling a patient or responding to a question concerning a drug such as toxicity, availability or therapeutic alternative.

**Pharmaceutical care**- It is responsible provision of drug therapy for the purposes of achieving definite outcome that improve patient's quality of life.

# Abstract

The management and use of drugs has clinical, economic, and environmental implications. Irrational use of drugs has been recognized not only as a cause of poor health outcomes but also an important factor of increased health care costs. Furthermore, irrational drug use also increases risks of medication errors, adverse drug reactions and events. World Health Organization (WHO) and the First International Conference on Improving Use of Medicines (ICIUM), held in Thailand in 1997, recommended regular drug use audits since detection of problems is the first step in evaluating the underlying causes before taking remedial action.

A preliminary report of a baseline audit on rational drug use (RDU) carried out at Kenyatta National Hospital (KNH) between January and February 2009 using the WHO/DAP manual *'How to investigate drug use in health facilities'* showed high incidences of irrational drug use in all the clinical areas. As part of the various strategies to combat irrational and inappropriate drug use, the department of pharmacy *medicine and information centre*, in collaboration with the clinical pharmacist, made medication interventions and repeated the audit to assess the impact on rational drug use.

The audit utilized a cross-sectional study design with pre-intervention and post-intervention study arms. The clinical pharmacist took part in medical ward round on alternate days in the intervention wards and in the course of provision of "pharmaceutical care" made medication interventions which were classified using a scheme adapted from Hatoum *et al,*. The outcomes and the reason for the intervention were also recorded.

One hundred and fifty six interventions were made in a period of one month. Interventions pertaining to unavailability of prescribed drugs were most frequent at 29.5%. Other interventions included; Clarification of treatment in cases where prescription was illegible (16.7%), Dose ,frequency and duration of treatment (14.1%), Choice of treatment (11.5%), Adverse drug reaction or interaction (8.3%), Recommendation of alternative therapy (8.3%), Transcription error (5.1%), Administration or formulation or route (4.5%) and cost (2.6%). Only 1.3% of the interventions were rejected.

The most important reason for intervention was unavailability of prescribed drugs (41%). Other reasons were safety and effectiveness of prescribed drugs at 22.4% and 19.9% respectively. Cost as a reason accounted for 5.8% while the rest of the interventions (10.9%) had shared reasons.

A comparison of RDU parameters in the intervention wards at baseline and after intervention showed significant improvement in the average proportion of drugs prescribed in generic names; at 72.4%, after intervention compared to at 57.7% at baseline ($P<0.001$). There was an insignificant increase, in percentage of drugs actually dispensed from 82.8 % at baseline to 86.6% after intervention ($p= 0.454$).

The results of this audit showed that the interventions led to an improvement in rational drug use in the targeted wards.

# Chapter One

# Background and Introduction

## 1.0 Rational Drug Use

The first major conference on rational drug use was held in 1985 in Nairobi. The conference recommended that rational drug use involved patients receiving medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, and at the lowest cost to them and their community [1].

A Management Science for Health (MSH) publication classified irrational drug use into four broad aspects [2];

1. Diagnosis:-aspects of diagnosis that may result in irrational drug use include;

    a. Inadequate examination of patient.

    b. Incomplete communication between patient and the doctor.

    c. Lack of documented medical history.

    d. Inadequate laboratory Resources.

2. Prescribing:- aspects of prescribing that may result in irrational drug use include;

    a. Extravagant prescribing.

    b. Over-prescribing.

    c. Incorrect prescribing.

    d. Under-prescribing.

    e. Multiple prescribing.

3. Dispensing:- aspects of dispensing that may result in irrational drug use include;

    a. Incorrect interpretation of the prescription.

    b. Retrieval of wrong ingredients.

    c. Inaccurate counting, compounding, or pouring.

    d. Inadequate labelling.

e. Unsanitary procedures.

4. Patient adherence:- aspects of patient adherence that may result in irrational drug use include;

   a. Inadequate verbal instructions.

   b. Inadequate counselling to encourage adherence.

   c. Inadequate follow-up/support of patients.

   d. Treatments or instructions that do not consider the patient's beliefs, environment or culture.

   e. Packing

      i. Poor-quality packaging materials.

      ii. Odd package size, which may require repackaging.

      iii. Unappealing package.

All these aspects of irrational drug use result in 'drug related problems'. Drug-related problems are defined as all circumstances involving a patient's drug treatment that actually, or potentially, interfere with the achievement of an optimal outcome and include medication errors, adverse drug events and adverse drug reactions [3].

Medication errors occur throughout the entire medication process (that is during prescribing, dispensing and administering of drugs) whether there are adverse consequences or not [4]. Table 1 illustrates the medication process and steps which have been reported to be associated with medication errors [3].

**Table 1: Important steps associated with medication errors in hospitalized patients**

| Prescription errors |
|---|
| • Wrong drug (e.g. drug not suitable for diagnosed indication) |
| • Correct drug, wrong patient (e.g. ignoring contraindications, drug-drug interactions or drug allergies) |
| • Wrong formulation (e.g. tablets for a patient who is not able to swallow) |
|   Wrong dose |
| **Transcription and/or interpretation errors** |
| • Error in transcription of prescriptions (e.g. misinterpretation of spoken prescriptions) |
| • Misinterpretation of abbreviations, hand-written prescriptions (e.g., illegible writing) |
| **Preparation and dispensing errors ( when prescription is correct)** |
| • Calculation error, preparation error |
| • Error in dispensing (e.g. wrong patient, wrong drug) |
| **Administration error** |
| • Wrong dose |
| • Omission of dose or additional dose |
| • Wrong administration time |
| • Incorrect handling of drugs during administration (e.g. depot injection instead of infusions ) |
| • Wrong infusion rate |

Medication errors are risk factors for adverse drug reactions and events [5, 6]. American Society of Hospital Pharmacy (ASHP) guidelines defined adverse drug reaction (ADR) as any response to a drug which is noxious and unintended, and which occurs at doses normally used in humans for prophylaxis, diagnosis or therapy of diseases, or for the modification of physiological functions [7]. Adverse drug event (ADE) has been defined as any injury related to the use of a drug, regardless of whether a therapeutically appropriate dosage is used, although the causality of this relationship may not be proven [4].

It has been reported that medication error and ADEs are frequently observed in prescriptions for hospitalized patients leading to increased duration of hospitalization, fatalities and cost. An analysis of articles published between 1990 and 2005 on the topics of medication errors and/or ADEs in hospitalized patients, focusing on the frequency, risk factors and avoidance of problems

associated with pharmacotherapy, reported that medication errors occurred in a mean of 5.7% of all episodes of drug use process [8].

In 1993, the WHO Action Programmed on Essential Drugs (WHO/DAP) published the manual *'How to investigate drug use in health facilities'* in response to the increased awareness of the problems impeding the rational use of drugs. The manual described four general broad categories which could be used when investigating drug use [9]. These included;

1. Evaluation of treatment practices.

2. Comparison the performance of facilities or prescribers

3. Periodic monitoring and supervising of specific drug use behaviour, for example, use of antibiotics.

4. Assessessment of the impact or effectiveness of an intervention using special tools such as indicator(s).

The manual described indicators which could be used to assess drug use for each of the categories in outpatient health facilities. Indicators are standardized measurements of various aspects of hospital operations related to drug management and use that can be compared to normal ranges in order to establish adequacy of performance or other diagnostic conditions. Properties of a good indicator include [9];

i.     It must be importance to reflect a significant dimension of performance.

ii.    It must be measurable within existing constraints of time and variable quality and availability of source data.

iii.   It must be reliable to give consistent results over time and with different observers.

iv.    It must be valid to allow a consistent, clear interpretation and similar meaning across different environments.

 WHO/DAP's manual *'How to investigate drug use in health facilities'* was instrumental in standardizing drug use studies. It developed and described methodologies to measure performance in three general areas related to rational drug use.

These included;

A. Pharmaceutical prescribing by health providers.

B. Key element of patient care covering both clinical consultation and pharmaceutical dispensing.

C. Availability of facility specific factors which support rational drug use, e.g. therapeutics committees.

The manual recommended only a small number of core indicators named below:-

A. Prescribing indicators;

    i.    Average number of drugs per prescription.

    ii.    Percentage of drugs prescribed by recommended international non-proprietary names (rINN) or generic.

    iii.    Percentage of encounter with an antibiotic prescribed.

    iv.    Percentage of encounter with an injection prescribed.

    v.    Percentage of drugs prescribed from an essential list or formulary.

B. Patient care indicator;

    i.    Average consultation time.

    ii.    Average dispensing time.

    iii.    Percentage of drugs actually dispensed.

    iv.    Percentage of drugs adequately labelled.

    v.    Patients' knowledge of correct dose.

C. Facility indicators;

    i.    Availability of key drugs.

    ii.    Availability of copy of essential drug list or formulary.

This manual, though initially meant for outpatient and therefore primary health facilities, has been used to assess drug use in tertiary hospitals such as Kenyatta National Hospital (KNH). Between January and February, 2009, KNH carried out a baseline study on rational drug use using the indicators.

The drug use indicators for outpatient settings do not address a number of the factors and situations that affect drug use in hospitals such as the duration of stay or the different diseases treated. For example, an indicator such as 'the time to dispense a prescription' to an ambulatory patient is meaningless in an inpatient setting. Similarly, the type and severity of illness that causes patients to be hospitalized often necessitates the use of intravenous drugs. Therefore, the indicator 'percentage of injectables prescribed' would be expectedly higher for in patient hospitals than in outpatient facilities, and thus less meaningful for inpatient drug use.

The First International Conference on Improving Use of Medicines (ICIUM), held in Thailand in 1997, identified the need for a set of indicators and appropriate methodology to assess the use of drugs in hospitals. These indicators, the conference suggested, would not only be useful for screening, monitoring, and assessing the impact of drug use but they could also be adapted for RDU research purposes [11].

Management Sciences for Health (MSH) developed a manual '*How to Investigate Antimicrobial Drug Use in Hospitals: Selected Indicators*' which was appropriate for assessment of rational use of drugs in an inpatient setting. It followed the pattern of previous Rational Pharmaceutical Management plus Program (RPM) assessment guides and the WHO guidelines by presenting a limited number of indicators useful for screening, monitoring, and assessing impact. It had indicators for antimicrobial drug use and management according to a standard format and suggested procedures to apply them in a hospital study. Though developed in response to increased antimicrobial drug resistance, its methodology could be applied to assess RDU of other classes of drugs used in an inpatient setting [11].

A progress report published after the Sixtieth World Health Organization (WHO) Assembly in 2007 noted that only 40% of the members had carried out a drug use audit in the last two years. The reports urged member's states to invest sufficiently in human resources and provide adequate financing in order to strengthen institutional capacity in order to ensure more appropriate use of medicines in both the public and private sectors [12].

## 1.1 Clinical Pharmacy Services and Rational Drug Use.

One strategy that would improve rational drug use (RDU) would be application of clinical pharmacy practice. The practice has developed over the last thirty years and is characterized by concerns of the pharmacist for the outcome of treatment in an individual patient leading to the concept of 'pharmaceutical care' [13]. Pharmaceutical care has been defined as responsible provision of drug therapy for the purposes of achieving definite outcome that improve patient's quality of life. It has been suggested that pharmaceutical care involves the process through which a pharmacist co-operate with the patient and other professionals in designing, implementing and monitoring a therapeutic plan that will produce specific therapeutic outcomes in a patient. Thus clinical pharmacy is reflected by pharmacist's participation in patient care as part of a clinical team, working with other professionals to improve patient care and optimize the use of drugs.

Clinical pharmacists are ideally placed to influence prescribing by hospital doctors because they have appropriate knowledge about therapeutics and they are in regular contact with prescribers. They therefore, would provide comprehensive drug management to patients and providers thus resulting in appropriate drug use.

## 1.2 Research Questions

1. Does the presence of a clinical pharmacist result in improved rational drug use?

2. What interventions can be made by a clinical pharmacist and how do those interventions compare with those published elsewhere?

## 1.3 Study Justification

The management and use of drugs has clinical, economic, and environmental implications. Irrational drug use not only results in poor health outcomes and increased health care costs but it has also been recognized as a major cause of anti-microbial resistance [14-16]. Moreover, both adverse drug event and reaction incidences increase as a result of irrational drug use [2]. Bond *et al*, have shown that medication errors are risk factors for adverse drug reactions and events [5].

World Health Organization (WHO) and the First International Conference on Improving Use of Medicines (ICIUM) recommended regular drug use audit. This is because detection of problems is the first step in evaluating the underlying causes before taking remedial action [11, 12].

Previous studies had reported a positive impact of a clinical pharmacist's interventions in various aspects of rational drug use. These impacts included reduction of medications errors [17, 18], prevention of adverse drug events and improved patients' satisfaction in outpatient care [19-22], prevention of adverse drug events (ADEs) in critically ill patients [23, 24], improvement in adherence in chronically ill patients [25-27] and significant health care savings [20, 28, 29].

Despite these positive impacts, there are no studies conducted at KNH, the largest referral hospital in Kenya, to assess if clinical pharmacy service has any impact despite post graduate student routinely rotating in the internal medicine wards and offering medication use interventions. This audit would help establish the impact, if any; of a clinical pharmacist intervention on pharmaceutical care and rational drug use (RDU).

Department of pharmacy, KNH, carried a baseline audit of RDU parameters between January and February, 2009, using WHO/DAP manual *'How to investigate drug use in health facilities'* methodology. A preliminary analysis of baseline audit results showed that they did not meet the WHO recommended target ranges [12]. This audit would provide the pharmacy department, as key stakeholder of RDU, with a possible viable option of improving rational use of drugs.

### 1.4 Goal of the Study

The audit was carried out to evaluate the impact of clinical pharmacist's interventions on rational drug use (RDU) in the internal medicine wards of Kenyatta National Hospital (KNH). The result of the audit was expected to help the health managers especially the pharmacy department with a possible option of not only improving appropriate use of medicine but also improving patient health outcomes through reduction of medication errors, adverse drug reactions (ADR) and adverse drugs events (ADE), cost and improvement of quality of life.

At the national level, the result of this audit will also be used for advocacy to press for increased training and recognition of clinical pharmacists as specialists in pharmaceutical care.

### 1.5 Broad Objectives

1.  To audit the impact of a clinical pharmacist on the rational drug use parameters compared to the baseline carried out at KNH between January and February 2009.

2.  To evaluate the clinical pharmacist's interventions in KNH wards 7A and 7D and to compare with those published elsewhere.

### 1.5.1 Specific Objectives

1.  To classify the interventions identified in ward 7A and 7D based on the following criteria;

    i.      Dose or frequency or duration of treatment.

    ii.     Clarification of treatment (where prescription is illegible).

    iii.    Availability of drugs (when prescribed drug is not supplied or dispensed).

    iv.     Transcription error.

    v.      Administration or formulation or route.

    vi.     Change of treatment.

    vii.    Identification of adverse drug reaction or interaction.

    viii.   Recommendation of alternate therapy.

    ix.     Choice of treatment.

2.  To classify the outcomes of the interventions into the following categories;

    i.      Advice accepted.

    ii.     Advice not accepted.

    iii.    Treatment changed by the pharmacist.

    iv.     Only information was provided to the intervention.

3. To classify the reasons for the interventions into the following categories;

    i.    Safety.

    ii.    Effectiveness.

    iii.    Supply.

    iv.    Cost.

4. To compare KNH January-February 2009 baseline RDU parameters of wards 7A and 7D with repeat audit results after the clinical pharmacist intervention. The parameters compared were;

    i.    Average duration of antibiotic therapy.

    ii.    Percentage of drugs prescribed by generic names.

    iii.    Percentage of drugs actually dispensed.

5. To compare rational drug use (RDU) parameters of intervention wards 7A and 7D with those of control wards 8C and 8D. The parameters compared included;

    i.    Average duration of antibiotic therapy.

    ii.    Percentage of drugs prescribed by recommended international non-proprietary names (rINN) or generic names.

    iii.    Percentage of drugs actually dispensed.

## Chapter two

## Literature Review

### 2.0 Impact of Clinical Pharmacy on Medication Use

Clinical pharmacy services in an in-patient setting would include taking part in medical ward rounds as part of a multi-disciplinary team, conducting comprehensive admission drug histories, identification and management of adverse drug reaction and events, drug information and drug protocol management. Bond *et al,* using data from three large American hospital databases have shown provision of these of services would improve patient outcomes [19, 30].

Several studies and reviews have been published concerning the clinical pharmacy services in various settings. In a study carried out to evaluate effectiveness of a Medication Reconciliation Project concluded that valuable service was provided that improved the quality of patient care via identification and prevention of significant drug-related problems and allergies. Three hundred and thirty medications reconciliation were made and nine hundred and twenty two discrepancies were identified with a median number of discrepancies of two per patient [31].

Prowse and Scott in a study that evaluated the impact of a clinic-based pharmacist on prescribing found that a total of nine hundred and seventy two pharmacist-patient consultations were made; 41% of consultations resulted in at least one pharmacist initiated intervention. A total of five hundred and ninety two interventions were made with a median of six prescriptions per day requiring at least one intervention (range 0-13) and a median of eight interventions (range 0-22) occurred each day [25].

An analysis of these interventions showed that 22% of prescribing interventions related to a drug being prescribed with the dose omitted and 14% had an incorrect dose. Other reasons for intervention included; therapy no longer indicated (11%, n=67), a change in medication dosage unrelated to therapeutic drug monitoring (10%, n=61) and a drug being unintentionally omitted (10%, n=62). A further analysis of these interventions by a multidisciplinary panel rated 49% and 8% of the interventions as of being of moderate and severe clinical significance respectively.

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Another multicentre study carried out to evaluate the impact of clinical pharmacist on changes to drug therapy and patient management found significant annualized cost savings relating to length of stay, readmission, drugs, medical procedures and laboratory monitoring. Out of the total of one thousand three hundred and ninety nine interventions made, eight hundred and thirty five interventions impacted on drug costs alone. Five hundred and eleven interventions were having an impact on one or more of the following: length of stay, readmission probability and medical procedures or laboratory monitoring [32].

Hawkey *et al,* in a study carried out to evaluate the medical impact of clinical pharmacy services found seven hundred and sixty nine interventions were made which were about 2.9% of the prescriptions. Sixty of these concerned prescriptions which were rated as having a major potential for medical harm. The commonest problems concerned dosage which was wrong in two hundred and eighty prescriptions and thirty two prescriptions were associated with a major potential for medical harm [33].

Kaboli *et al,* carried out a systematic review of all published articles between January 1, 1985 to April 30, 2005 that aimed to evaluate effects of interventions by clinical pharmacists on processes and outcomes of care in hospitalized adults. Among the twelve trials that evaluated ADE, ADR or medication errors as an outcome, seven had reduced outcome. For trials that evaluated medication adherence, knowledge, and appropriateness, the outcomes improved in seven of eleven studies, while there was shortened hospital length of stay in nine of seventeen trials. Most importantly, there was no intervention that led to worse clinical outcomes and only one reported higher health care use. Improvements in both inpatient and outpatient outcome measurements were observed [34].

Kucukarslan *et al,* in a study that evaluated the impact of a pharmacist as part of medical rounding team found that the rate of preventable ADEs was reduced by 78% (from 26.5 per 1000 hospital days to 5.7 per 1000 hospital days). There were one hundred and fifty documented interventions recommended during the rounding process, one hundred and forty seven of which were accepted by the team. The most common interventions were dosing-related changes and recommendations to add a drug to therapy [35].

Similar results were shown by Leape *et al,* in a before and after study design that compared rate of preventable ADEs at baseline and after intervention. Preventable adverse drug events (ADEs) were also compared with a control that did not receive any intervention. The study found that the overall rate of preventable ADEs decreased by 66% from 10.4 per 1000 patient-days (before the intervention) to 3.5 (after the intervention). In the control unit, the rate was essentially unchanged during the same time periods; 10.9 and 12.4 per 1000 patient-days. Three hundred and sixty six recommendations related to drug prescription were made, of which 362 (99%) were *accepted by physicians [23].*

Few studies have reported impact of clinical pharmacy service on specific diseases. Macgregor *et al,* in a study that evaluated quality and cost of surgery management in an outpatient anticoagulant clinic managed by a clinical pharmacist found that the international normalized ratios were within the target range at six months and one year. The cost of surgery reduced for 48% of the patients and the waiting time was less than ten minutes compared to the hospital wait which routinely exceeded one hour [36].

Bodgen *et al,* in a randomized single blind controlled trial that assessed the impact of pharmacist and physician teamwork approach to uncontrolled hypertension found that the percentage of patients achieving the targeted blood pressure due to the intervention (where the pharmacist and physician worked together) was more than double the control arm, (55% versus 20%, p< 0.01) . The diastolic pressure declined 14 and 3 mmHg in intervention and control arms respectively (p< 0.001) [37].

Another study by the same investigators on cholesterol reduction found similar results with percentage rate of achieving national goals double in the intervention compared to the control (43% versus 21% p< 0.05). The total cholesterol levels in the intervention arm declined by 1.1±1.2 mMol/l compared to 0.3±1.3 mMol/l of the control [38].

These positive outcomes have resulted in expansion of scope of clinical pharmacy practice. Since unlike traditional pharmacists, clinical pharmacist work directly with health care providers such as physicians', nurses and patients to provide services not simply associated with dispensing of drugs. These offer them unique chance to improve rational drug use [39].

# Chapter Three

## Methodology

### 3.0 Study Area

The audit was carried out at internal medicine department of Kenyatta National Hospital (KNH) which is located on seventh and eighth floors of KNH hospital complex. Wards 7A and 7D were selected for interventions to be made while wards 8C and 8D were used as controls to assess the impact of the interventions. Ward 8C did not receive any intervention while ward 8D had a regular clinical pharmacy services by one of the senior lecturers in the department of Pharmaceutics and Pharmacy Practice, University of Nairobi.

The wards used in the audit, the intervention wards 7A and 7D, and control wards 8C and 8D were selected because they had same bed capacity and similar patient disease profiles which included cardiovascular diseases ( such as hypertension and heart failure), diabetes mellitus, HIV/AIDS infection and renal diseases.

The intervention wards were visited on alternate days for a month and in the course of the medical rounds all interventions were recorded. Both wards averaged about sixty beds each although the numbers of patients admitted differed from time to time. The patient population ranged from forty to sixty five for each ward during the duration of the audit.

### 3.1 Research Design

The audit utilized a cross-sectional study design with pre-intervention and post-intervention study arms. The pre-intervention arm utilized results of a baseline study carried out in KNH between January and February 2009. Only results for wards 7A, 7D, 8C and 8D were used. For post-intervention study arm, an audit of rational drug use was repeated and the results were provided for analysis.

### 3.2 Target Population

The rational drug use audit was carried out at internal medicine department, KNH on seventh and eighth floors comprising wards 7A, 7B, 8C and 8D. All patients in the wards at the start of the

audit, those admitted in the course of the audit and those present at the day of the audit were included unless their prescription sheet could not be found.

### 3.3 Data Collection

#### 3.3.1 Rational Drug Use Parameters

All the patients' treatment sheets in wards 7A, 7D, 8C and 8D were included in the audit of the rational drug use (RDU) parameters and data was recorded on RDU data collection form (form 6.1 on the annexes). The indicators used in the audit were those described on the WHO/DAP manual '*How to investigate drug use in health facilities*' [9] and included;

|       |                                                              |
|-------|--------------------------------------------------------------|
| i.    | Number of drugs per prescription                             |
| ii.   | Percentage of drugs prescribed by nonproprietary (generic) names |
| iii.  | Percentage of antibiotics prescribed per treatment sheet     |
| iv.   | Duration of antibiotic therapy                               |
| v.    | Percentage of drugs actually dispensed                       |

#### 3.3.2 Training of Data Collectors

Eight level four (fourth year) undergraduate pharmacy students from School of Pharmacy, University of Nairobi, were recruited and trained on data collection based on the model training course for the data collector [9]. They were then randomly paired and each pair assigned to a ward. Based from the baseline audit, KNH's pharmacy department had estimated that half a day was adequate for data collection. The afternoon of 5th August, 2009 was selected for repeat audit of RDU parameters. Advance preparations were made with respective ward matrons to avail the treatment sheets.

#### 3.3.3 Clinical Pharmacist's Interventions

Wards 7A and 7D were visited on alternate days for a month, and in course of the medical rounds ,clinical pharmacy services modelled on 'medicines management protocol' which is currently regarded as the "pharmaceutical care" was offered [13, 40]. The medication interventions made were recorded in an intervention form (form 6.0 on annexes).

For the purpose of the audit, an intervention was any action that directly resulted in a change to patient management or therapy [41]. It included querying a prescription on the treatment sheet, for example, inclusion of a drug in the treatment sheet, discussing a medication issue with members of the medical team (such as physicians, senior house officers, junior doctors, nurses or medical students), counselling a patient or responding to a question concerning a drug such as adverse drug reaction or event, availability or therapeutic alternative. Multiple interventions per patient were made based on the information on the treatment sheet or that gathered from the patient.

The medication interventions were classified using criteria adapted from Hatoum *et al,* [42]. This classification was also used by the adverse drug events (ADE) Prevention Study Group [23, 43, 44]. The classification criteria are shown in Table 2 with examples of each from this audit.

**Table 2: Classification, definition and examples of interventions from the study**

| Intervention Type | Definition | Example from this project |
|---|---|---|
| **Clarification of prescription** | Consulting the prescribers on their intention especially where abbreviations or unfamiliar proprietary names are used | E.g. septrin II OD ( no specification of tablet strength especially where different strength are available) |
| **Transcription error** | Illegible prescription on the treatment sheet | Aldomate 50mg prescription was corrected and written to atenolol 50mg |
| **Recommendation of alternative therapy** | Recommendation of alternative drug to treat same disease for cost or availability reasons | Use of IV ceftriaxone ( for unavailable ciprofloxacin) in a acute gastritis HIV positive patient |
| **Identification of drug reaction or interaction** | Change interaction records to reflect current status of allergies or interaction, including updates from patient | Penicillin rash* |
| | Recommend discontinuing or changing medication due to a moderate to severe reaction | Discontinuation of ARVs in a severe coetaneous reaction |
| **Availability of prescribed drugs** | Change medication to one that is available or to issue a patient with a prescription for purchase from private pharmacy | Substitution of drugs within the same class, e.g., ß-blockers atenolol and carvedilol |

| Dose or frequency or duration of treatment | Appropriate dosing<br>Change medication dose based on patient age, co-morbidities, or other medications | Change artovastatin dose from 10 to 20mg OD). |
| | Dose adjustment for drug Interaction<br>Increase or decrease medication dose in consideration of other medications | Decrease weekly warfarin dose in response to added amiodarone* |
| Choice of treatment/therapy | Change medication to one with fewer side effects, greater chance of patient compliance. | Change chloropamide to glipizide for patient with renal insufficiency who has experienced early morning hypoglycaemic events* |
| | Medication without indication- discontinue a medication because a patient no longer has symptoms, or lab values obviate the need | Continuing with heparin therapy for DVT prophylaxis |
| Cost intervention | Patient cannot afford original drug- Change to a less expensive medication | Change branded Augmentin® to cheaper co-amoxclav |
| Administration route or formulation | Any change in the medication's route of administration based on the clinical status | Change IV to oral ciprofloxacin- when patient was able to take oral medications. |

*(not encountered in this project)

In addition to classification of the intervention as shown in Table 2, the outcome for each intervention was also recorded. These outcome categories were mutually exclusive and included;

    i.    Advice accepted.

    ii.    Advice not accepted.

    iii.    Treatment changed by the pharmacist.

    iv.    Only information was provided for the intervention.

The reason for each intervention was also recorded. These were not mutually exclusive such that an intervention could have more than one reason and included;

    i.    Safety.

    ii.    Effectiveness.

    iii.    Supply.

    iv.    Cost.

All significant interactions and activities were recorded. These included interactions with other members of health care team such as doctors, nurses, pharmacists, clinical officers and laboratory technicians. Activities recorded included visits to the laboratory and drug stores.

A database was developed to document all interventions. Data collected included types of, reasons for and outcomes of the interventions, for example, whether recommendations were accepted by the doctors. Other data collected included description of significant interactions with other members of the medical team.

### 3.4 Data Analysis

Data was coded and entry done using Microsoft Excel® spreadsheet and analysis was performed using Statistical Package for Social Scientists (SPSS) Version 17. Data was checked for entry error(s) before analysis using exploratory data analysis techniques (EDA).

The interventions were summarized using proportions and presented using tables and graphs. Due to multiple interventions offered per patient, proportions of the interventions were calculated out of all the treatment sheets or patients. To assess the impact of the interventions on rational drug use (RDU), the baseline RDU parameters were compared with repeat audit RDU parameters result after the intervention using paired T-test.

The RDU parameters such as the average proportions of drugs prescribed in generic names and the drugs that were actually dispensed were compared among the intervention wards (7A and 7D), 8C (control ward which received no intervention) and 8D (Control ward which had a regular clinical pharmacist) using ANOVA test. The medians for the percentage of antibiotic therapy with indicated duration were compared among the wards using Kruskal Wallis test.

Graphs and pie charts were drawn to compare various rational drug use parameters. All tests of significance were performed at 5% ($p < 0.05$).

### 3.5 Ethical Consideration

This project was carried as an audit in collaboration with Kenyatta National Hospital (KNH). The service provided was the same as that provided in some parts of the hospital by postgraduate students or experienced hospital pharmacists. This project did not need to be approved as a research project because the interventions under evaluation were already in routine use in other parts of the hospital and form part of the routine service offered by KNH and University of Nairobi department of pharmaceutics and pharmacy practice.

# Chapter Four

## Results

### 4.0 Clinical Pharmacist's Interventions

A total of one hundred and fifty six interventions were made in the intervention wards (7A and 7D) over a period of one month. Out of all the interventions made, 54.5% were in ward 7A while 45.5% were in 7B. The types of interventions made and their frequency are shown in Table 3.

**Table 3: Interventions made by the clinical pharmacist**

| Intervention | Frequency | Percentage (%) |
|---|---|---|
| Availability or supply | 46 | (29.5) |
| Clarify treatment (where Prescription is illegible) | 26 | (16.7) |
| Dose or frequency or duration of treatment | 22 | (14.1) |
| Choice of treatment | 18 | (11.5) |
| Adverse drug reaction or interaction | 13 | (8.3) |
| Recommendation of alternative therapy | 13 | (8.3) |
| Transcription error | 8 | (5.1) |
| Administration or formulation or route | 7 | (4.5) |
| Cost | 4 | (2.6) |

As shown in Table 3, the most common intervention made was addressing availability or supply of the prescribed drugs (29.5%). This involved liaising with pharmacy to check for availability of

prescribed drugs and counselling the patients to buy those out of stock at Kenyatta National Hospital pharmacy.

Among the drugs that were made available to the wards (and hence to the patients) included norfloxacin 400mg tablets, meloxicam 15mg tablets, ciprofloxacin 500mg tablets and carvedilol 25mg tablets. These were available in the main pharmacy of KNH but not in pharmacy 8 which served internal medicine wards. Another drug made available was intravenous (IV) fluconazole which was substituted for out of stock oral fluconazole 200mg capsules.

Figure 1 illustrates the distribution of the interventions given.

**Figure 1: Clinical pharmacist's interventions**
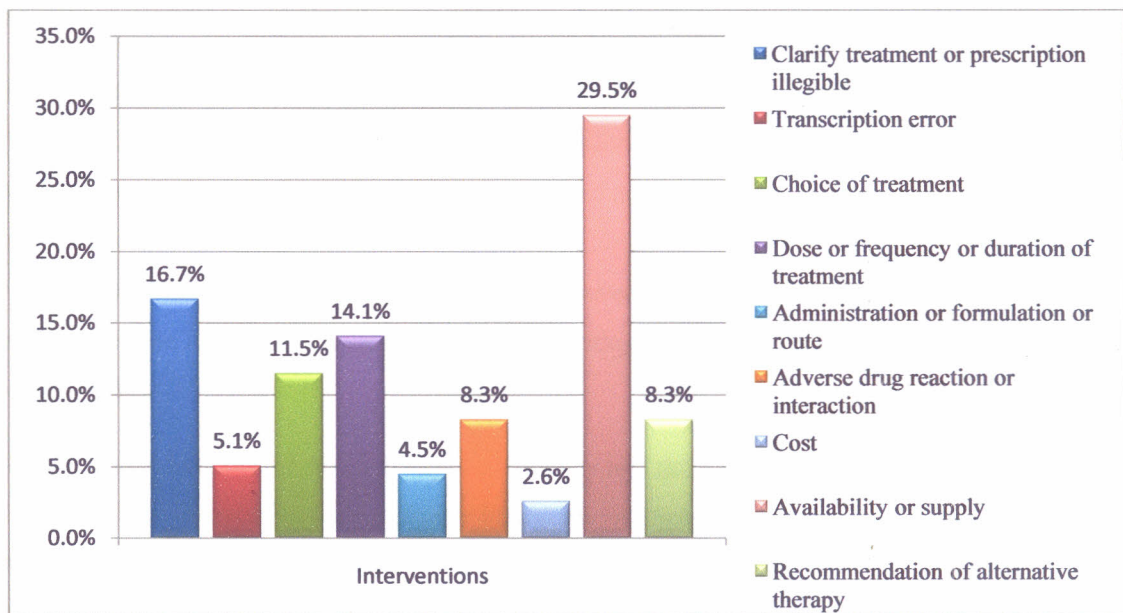


Many cases involved counselling the patient to buy the drug from private pharmacies. Among the drugs that patients bought were aspirin 75mg, warfarin, haematinics (iron tablets or capsules) , thiamine 100mg tablets, vitamin $B_{12}$ (cyanocobalamin-pabrinex®), calcium carbonate (Actal tums®). On many occasions, the doctors' prescription books were used to issue prescription for out of stock drugs.

In the course of the intervention, six visits were made to the pharmacy 8 (which was located on eighth floor of KNH building complex) and the main pharmacy (which was located on the ground floor). The investigator found the staff at the main pharmacy very helpful in providing information of drugs available in the hospital. As indicated above, there were some instances where drugs were available in main pharmacy but out of stock in pharmacy 8.

Other problems of drug supply were within the wards; at one time a patient prescribed tetracycline eye ointment was not getting it even though it was available in the ward drug store. A similar incident involving enalapril occurred to a different patient. The nurses in ward 7A were cooperative and promptly ordered the drug(s) on being informed of their availability. The doctors were also very cooperative and enquired on drug availability before prescription and this reduced incidence of patients missing drugs available in the hospital.

Other interventions that were undertaken more frequently included clarification of drugs on the treatment sheet (16.7%). The reasons for clarification ranged from illegible handwritings to unclear instructions such as a horizontal line drawn across a certain drug to cancel the prescription. Other types of clarification included "re-prescribing" or "re-writing" drugs that were to be administered at once (stat) such as intravenous Potassium chloride (KCl). This occurred when a treatment sheet was to be "re-written or "renewed" which was mostly done once weekly.

Interventions that altered drugs dosages, frequency and duration of treatment accounted for 14.1%. These included dosages changes interventions such as the dose of vancomycin (e.g. reduced to 1g every 3 days for suspected renal insufficiency without laboratory evidence), low dose spironolactone in liver disease (25mg once daily (OD) instead of recommended 100mg OD).

Interventions that concerned choice of treatment accounted for 11.5%. These included recommendation of a lipid lowering drug; artovastatin 20mg OD (a 3-hydroxy-3-methylglutaryl-CoA reductase inhibitor) for a patient with raised cholesterol. Another included recommendation of calcium carbonate in an end stage renal disease (ERSD) with raised phosphate of 2.39mMol/l (normal 0.85-1.4mMol/l).

unfamiliar trade names such as aldactone and aldomet which had been transcribed as adatone and aldmote respectively.

Drug administration/formulation/route interventions accounted for 4.5% of all interventions. These included prescription of dulcolax® syrup (which is not available in the market) and topical diclofenac gel to apply to the whole body. Oral tablets were prescribed instead and this also reduced cost. Cost intervention accounted for 2.6% and included substitution of expensive brand by cheap non-proprietary drugs (generic).

### 4.1 Outcome of the interventions

**Table 4: Outcome of the Interventions**

| Outcome | Frequency | Percentage (%) |
|---|---|---|
| Advice accepted | 75 | 48.1 |
| Treatment changed by pharmacist | 28 | 17.9 |
| Only Information provided | 32 | 20.5 |
| Advice not accepted | 2 | 1.3 |

As shown on the Table 4, only 1.3% of the interventions were rejected. These included the dose of heparin for DVT prophylaxis where the most effective dose could not be agreed. Noticeably, 17.9% of the cases of treatment were changed with the doctors' consent. These included corrections of transcription errors on the treatment sheet and issuing of prescription for drugs not available in the hospital for private procurement by patients. 20.5% of the outcomes involved provision of information such as availability of drugs, or specific queries such as sterility of reconstituted straw coloured imipenem /cilastatin solution for IV administration.

## 4.2 Reasons for Interventions

**Table 5: Reasons for interventions**

| Reason | Frequency | Percentage (%) |
|---|---|---|
| Safety | 31 | 19.9 |
| Effectiveness | 35 | 22.4 |
| Cost | 9 | 5.8 |
| Supply | 64 | 41 |
| Safety and supply | 2 | 1.3 |
| Safety and cost | 4 | 2.6 |
| Safety and effectiveness | 7 | 4.5 |
| Effectiveness and cost | 2 | 1.3 |
| Effectiveness and supply | 2 | 1.3 |
| **Total** | **156** | **100.0** |

As shown in Table 5, the most frequent medication problem encountered that required intervention was on lack of prescribed drugs (supply issues). Lack of the prescribed drugs was identified among 41% of the interventions. The drugs that had the highest frequency of being marked out of stock from the treatment sheet included warfarin, aspirin 75mg, iron supplements (ferrous sulphate, Ranferon®) and antihelmintics, e.g., albendazole. Failure of patient to get the prescribed drugs resulted in poor health outcomes, for example, in patient who presented with infectious bacterial diarrhoea and ciprofloxacin (which was out of stock) was prescribed. In another case, a patient on DVT treatment was prescribed warfarin 5mg OD which was also out of stock.

The second important reason for interventions was effectiveness of the prescribed drugs which accounted for 22.4%. This was due to wrong prescribed dosages such as incorrectly reduced dose of vancomycin in a suspected renal insufficiency, low dose of artovastatin (10mg OD) for

treatment of elevated cholesterol resulted in ineffective treatments. Low drug levels in the body and thus ineffective treatment result from wrong frequencies and duration of administration of prescribed drugs.

The third reason for intervention was safety which accounted for 19.9%. An example of intervention with safety concern was high dose of prescribed phenytoin in an epileptic patient (200mg TID orally). Cost as a reason accounted for 5.8% of all interventions and involved prescription of expensive branded drugs.

There were few interventions that had shared reasons as shown on Table 5. Seven interventions had shared safety and effectiveness reasons while four interventions had both cost and safety reasons. Effectiveness and supply, effectiveness and cost and safety and supply had each two interventions shared.

An example of an intervention that had shared supply and safety reasons was a prescription of 'aldomate 50mg' in ward 7A. The clinical pharmacist in consultation with the ward's physician concluded the prescription was meant to be atenolol 50mg. As a result of this error, the patient missed that day's dose.

## 4.3 Relationship between Types of and Reasons for Interventions

**Table 6: Relationship between Types of and Reasons for Interventions**

| Types of intervention | Reasons for intervention | | | |
|---|---|---|---|---|
| | Safety | Effectiveness | Cost | Supply |
| Clarification of treatment (where prescription is illegible) | 10 | 5 | 2 | 4 |
| Transcription error | 8 | 0 | 0 | 0 |
| Choice of treatment | 2 | 10 | 2 | 2 |
| Dose or frequency or duration of treatment | 4 | 14 | 0 | 1 |
| Administration or formulation or route | 0 | 1 | 0 | 6 |
| Adverse drug reaction or interaction | 10 | 0 | 0 | 0 |
| Cost | 0 | 0 | 4 | 0 |
| Availability or supply | 0 | 0 | 0 | 46 |
| Recommendation of alternative therapy | 0 | 5 | 1 | 3 |

As shown on Table 6, interventions due to safety reasons were highly related to transcription errors, adverse drug reaction or interaction and lack of clarity or illegibility of prescribed treatment. All transcription interventions were due to safety concern. On the other hand, drug availability or supply, recommendation of alternate treatment, cost and administration route interventions were not related to safety issues.

Interventions due to choice of therapy and dose, frequency and duration of prescribed drugs were highly related to effectiveness while availability of prescribed drugs, transcription error, cost and adverse drug interactions interventions were not related to effectiveness reason.

Cost interventions were highly related to cost reasons only. Supply reasons were highly related to the availability of prescribed drugs and administration or formulation route. Cost, adverse drug reactions and dose, frequency and duration of prescribed drugs interventions were not related to cost as reason for intervention. There were few interventions that had shared reasons for interventions were related as shown on Table 6.1

**Table 6.1: Relationship between Types of and Reasons for Interventions**

| Types of intervention | Reasons for intervention | | | |
| --- | --- | --- | --- | --- |
| | Safety and supply | Safety and effectiveness | Effectiveness and cost | Effectiveness and supply |
| Clarification of treatment (where prescription is illegible) | 2 | 1 | 0 | 1 |
| Transcription error | 0 | 0 | 0 | 0 |
| Choice of treatment | 0 | 2 | 0 | 0 |
| Dose or frequency or duration of treatment | 0 | 2 | 1 | 0 |
| Administration or formulation or route | 0 | 0 | 0 | 0 |
| Adverse drug reaction or interaction | 0 | 1 | 0 | 0 |
| Cost | 0 | 0 | 0 | 0 |
| Availability or supply of prescribed drugs | 0 | 0 | 0 | 0 |
| Recommendation of alternative therapy | 0 | 1 | 1 | 1 |

## 4.4 Rational Drug Use Parameters

### 4.4.1 Comparison of Rational Drug Use parameters between intervention wards and control wards.

The rational drug use (RDU) parameters were compared between the intervention wards (7A & 7D) and control ward 8C that did not receive any intervention. The intervention wards parameters were also compared with ward 8D which had a regular clinical pharmacy service. A total of one hundred and ninety treatment sheets were reviewed, out of which ninety eight belonged to the intervention wards, forty seven ward 8C and forty five from ward 8D.

The three categories of wards did not differ significantly in the average proportion of drugs prescribed in generic names, the average proportion of the drugs actually dispensed or the median percentage of antibiotics with indicated duration of therapy (Table 7).

Table 7: Rational Drug Use Parameters between Intervention Wards, Control Ward

| Rational Drug Use Parameter | Intervention wards (7A and 7D) | Control ward1 (8C) | Control ward 2 (8D) | P Value |
|---|---|---|---|---|
| Mean % of drugs prescribed in generic names | 75.3% | 68.0% | 71.9% | 0.203 |
| Mean % of drugs actually dispensed | 87.1% | 89.1% | 91.1% | 0.561 |
| Median % of antibiotic with duration indicated | 0.0% | 0.0% | 12.5% | 0.297 |

In most treatment sheets, duration of most antibiotic was rarely specified.

## 4.4.2 Comparison of rational drug use Parameters in the Intervention Wards at Baseline and after Interventions

The RDU parameters were compared at baseline and after intervention in the two intervention wards (7A and 7D). The average proportion of drugs prescribed in generic names was significantly higher, 72.4%, after intervention than 57.7% at baseline (P<0.001). On the other hand, the average proportion of the drugs actually dispensed did not differ significantly after intervention (Table 8). The duration of antibiotic therapy was not analyzed since the same data were unavailable at baseline.

**Table 8: Rational Drug Use Parameters in the intervention wards at baseline and after interventions**

| RDU Parameter | Baseline | After intervention | P Value |
|---|---|---|---|
| % of drugs prescribed in generic names | 57.7% | 72.4% | <0.001 |
| % of drugs actually dispensed | 82.8% | 86.6% | 0.454 |

**Figure 3: Prescribing by Generic Names**



31
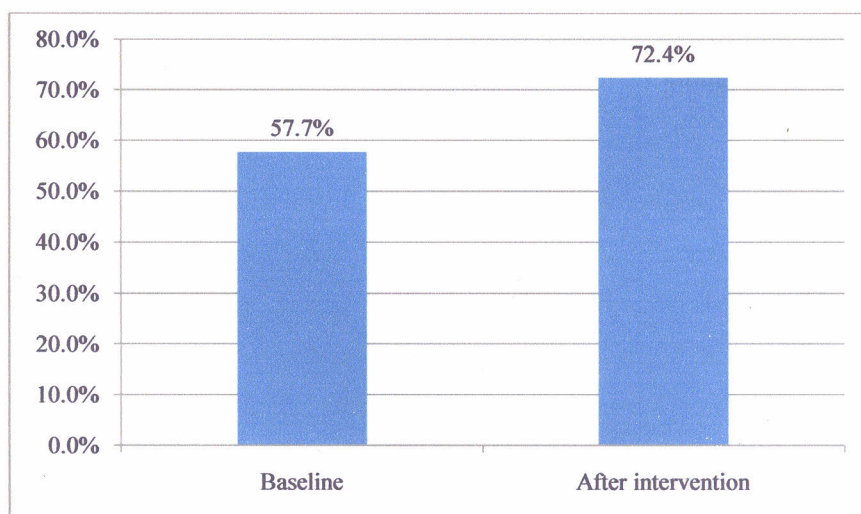
## 4.5 Limitation of the Study

1. This audit was only carried only in the internal medicine wards and hence the result may not be generalized to all the clinical areas of Kenyatta National Hospital (KNH). The intervention period was short and may not have been adequate for the full impact to be assessed. Moreover, the intervention, the collection of data and the classification to the type, outcome and the reason for the intervention were carried by one person. Although this increased consistency of data collection, other investigators might have interpreted the interventions type and reasons differently.

2. The rational drug use (RDU) parameters might have been affected by loss or displacement of some treatment sheets on the day of repeat audit of the RDU. This occasionally happens in case of a special drug order such as a controlled drug, for example, meropenem, where the treatment sheet accompanies the order form to the pharmacy.

3. Finally, the results of the interventions might have been affected by rotation of the doctors and consultants. Senior House Officers who provided bulk of the medical services routinely rotated into different wards. The differences in level of medical practice and experiences of different doctor might have affected the RDU parameters and the interventions.

# Chapter Five

## Discussion

### 5.0 Clinical Pharmacist's Interventions

The results of the audit showed that interventions relating to drug accessibility, a key component of rational drug use were made. Though 29.5% of the interventions were addressing drug inaccessibility to the patient, a further analysis of reasons for interventions showed 43.6% of interventions had a supply component and the two were highly related. This implied that the first choice route of administration of a given prescribed drug had to be changed due to drug unavailability. Moreover, all the trips made to two pharmacies would have been unnecessary if the drugs were availed. These results suggest that drug unavailability in KNH is such a grave issue and availing cheap and efficacious medicine might free a lot pharmacist time to concentrate on other components of rational drug use such as prescribing and dispensing.

There were two main supply failures that were identified; firstly, essential drugs such as warfarin and iron supplement were not procured by the Kenyatta National Hospital (KNH). Secondly, there was distribution failure of procured drugs mainly from the main pharmacy (pharmacy 40) to pharmacy 8. The main pharmacy is the main supply centre of all drugs in Kenyatta National Hospital (KNH) after they are released from the main drug store. The pharmacy managers of various satellite pharmacies within the hospital are required to make drug orders for various wards that they serve. Pharmacy 8 is assigned all wards in level seven and eight (7A, 7B, 7C, 7D, 8A, 8B, 8C and 8D).

Though the procurement rules and regulations resulted in unavailability of prescribed drugs, the main reason for supply failure within the intervention wards occurred due to distribution shortcomings identified in pharmacy 8. Drugs available in the main pharmacy were not ordered on time and information on available drugs was not adequately disseminated to the prescribers. Distribution of procured pharmaceuticals was identified as a critical step in Pharmaceutical Management Cycles by a MSH report on rational drug use. This means that there is need for both administrative and policy interventions to address this problem as recommended by MSH report on rational drug use [2].

Failure of patients to get the prescribed drugs had serious clinical implications. These included poor health outcomes (treatment failure, increased morbidity and mortality) and increased duration of hospitalization [2]. The high prevalence of anaemia among admitted patients, the debilitating diseases resulting in poor appetite and worsening anaemia, and the high number of patients with HIV/AIDs (with resultant anaemia of chronic illness) resulted in prescription of iron supplement in almost every treatment sheet in the intervention wards yet iron supplements are not stocked at KNH [45, 46].

Warfarin is an essential drug since it is indicated in patients with atrial fibrillation, heart valve surgery, deep vein thrombosis (DVT) and for DVT prophylaxis in immobilized patients. Most patients admitted in KNH required either warfarin or heparin for DVT prophylaxis due to immobilization as a result of debilitating disease conditions and /or medical procedures such as operations. Warfarin is preferred to heparin because of ease of administration and is the drug of choice in KNH for patients who have undergone open heart surgery [47].Throughout the audit warfarin was not available and most patients were getting it 'on and off'. Frequent interruption of warfarin therapy could result in adverse drug events (ADE) as reported by Kim et al, [4]. Thus the availability of both warfarin and suitable iron replacement formulations in KNH is essential for patient care.

The results of the audit compared well with those of published studies that showed the important role of a clinical pharmacist in prevention of ADEs [17, 23]. The transcriptions, clarification of treatment, dosages, and frequency and duration interventions have been shown to prevent medication errors [49]. Lack of clarity of treatment and /or illegible prescriptions was mainly due to use of abbreviations and 'trade' or 'brand' names when prescribing. Use of abbreviations have been recently been reported to be an important source of medication errors [50]. The World Health Organization (WHO) has emphasized the use of recommended international non-proprietary names (rINN) in prescribing to reduce prescription errors and drug costs [12].

The transcription errors and adverse drug interaction interventions in this audit were all related to safety reasons and therefore prevented potential source of medication errors and adverse drug events. The rates of these interventions in the audit were lower than in published studies

probably because of shorter duration of the audit. Prowse had 36% interventions related to dosages over a year in a specialist transplant unit compared to 14% in this audit [25].

The audit also confirmed the important role of a clinical pharmacist as an integral member of the health care team. Most recommendations made were incorporated in to patient management. Kucukarslan *et al*, [35] in a study that evaluated the outcomes of a clinical pharmacist intervention had found similar results (out of one hundred and fifty interventions recommended in the course of the ward round, one hundred and forty seven were accepted by the physician). Leape *et al*, also reported similar results; out of the 366 recommendations made by clinical pharmacist 99% were accepted by physicians [23].

 The trend noted where prescriptions on the treatment sheet are not coordinated because they were written by different members of the health care team, is likely to continue since KNH is a teaching hospital.  Preventive measures should be taken including adequate supervision of junior doctor and students. Other strategies that can be attempted in KNH include regular use of clinical pharmacists' services in the wards and /or a computerized medication monitoring as these have been shown to reduce medication errors [17-24, 33, 35].

The results showed that cost as reason and as a type of intervention was not a prominent feature of this audit even though irrational drug use has been associated with increased cost [12, 20, 28, 29, 32].  The low frequency of reasons for and types of interventions was due to the study design which did not have a measure for the cost of irrational drug use. Cost was probably a reason for lack of availability of prescribed drugs in patients unable to buy prescribed drugs or KNH lacking funds to procure essential drugs.

### 5.1 Impact of the Clinical Pharmacist on Rational Drug Use.

There was an improvement of two RDU parameters that were audited in the intervention wards (7A and 7D) from the baseline. However, only generic prescribing parameter had a significant improvement (from 57.7% at baseline to 72.4% after intervention, $p<0.001$).

A comparison of the generic prescribing between intervention wards and control wards showed a positive though not significant ($p=0.203$) impact. The percentage mean of recommended

international non-proprietary names (generic) prescribing was higher in interventions wards (75.3%) compared to the control wards 68% for wards 8C and 71.9% for 8D.

There is consensus that generic prescribing reduces drug cost [51, 52]. However, caution has been advocated in the case of drugs with narrow therapeutic range such as anti epileptic drugs where the consequences of loss of symptom control are important. The absence of bioequivalence data among generic forms and the relatively broad criteria for bioequivalence with the innovator drug allow differences in bioavailability that are clinically relevant. For this reason, many health authorities including British National Formulary have excluded antiepileptic drugs from overall policy recommendations on generic prescribing. Management of these issues carries a significant cost, which should be weighed carefully against the cost savings acquired when procuring drugs.

A comparison of mean number of drugs that the patient received in the intervention wards showed an insignificant increase from 82.8% at baseline to 86.6% after intervention (p=0.454). However, a comparison of the same parameter between the intervention and the controls wards showed that patients in the control wards received more prescribed drugs ( 89.1 % for ward 8C, 91.1 % for 8D and  87.1% for intervention wards p=0.561). Wards 8D had a clinical pharmacy service for much longer, so this high mean number of drugs received per patient may support the idea that pharmacists improve supply.

However, the higher mean number of drugs received per patient in control ward 8C compared to the intervention wards may also imply that the ward based clinical pharmacist made no difference to the supply service and it may be random fluctuations and ways to improve their impact should be considered. Moreover, post graduate pharmacy students undertaking clinical pharmacy course routinely rotate in internal medicine wards and this could have influenced the results. A well controlled and randomized study should be conducted.

Duration of antibiotic therapy was not compared since few treatment sheets had duration of antibiotic indicated. It was found that many factors were involved such as failure to make diagnosis at the time of admission (hence empiric use of the antibiotic), non-availability of first choice antibiotic and lack of information both concerning drug and patient. For example, most

patients who required ceftriaxone were usually started with benzyl penicillin until the former was availed from the pharmacy.

Most noteworthy, control ward 8D which had had regular clinical pharmacist also had a higher number of antibiotics with duration of therapy indicated; 12.5% compared to 0% in both intervention wards and control ward 8C. This implies a regular clinical pharmacy service is more likely to improve antibiotic use.

## 5.2 Conclusion

The results of this audit showed that the interventions led to an improvement in rational drug use in the targeted wards. Therefore, there is a role that a clinical pharmacist can play in improvement of rational drug use in hospitalized patient. The interventions not only improved rational drug use but they also prevented medication errors and thus preventable adverse drug events. The audit concurs with earlier reports that the presence of a clinical pharmacist presence in the wards reduces medication errors.

## 5.3 Recommendation

1.  Another audit covering more clinical areas should be undertaken in Kenyatta National Hospital following these results of rational drug use parameters after a month of interventions. The audit should allow an adequate period of time for the intervention to be evaluated probably using a different study design. Pharmacists in training at the University of Nairobi, School of Pharmacy, could be used to offer interventions as they rotate in various areas such as paediatrics, critical care and internal medicines department.

2.  Despite the presence of clinical pharmacists in the wards, the use of drugs was still inappropriate especially the antibiotics due to the high number of patients in the wards. The prescriptions were not analyzed before preparation and administration of drugs to the patients. Presence of more clinical pharmacists in the wards might help and KNH should consider hiring them.

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# Annexes

## 6.0 Sample of Interventions Recording Form

Ward_____     Date_____     Clinical pharmacist _____

| | Intervention or problem number | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| **Nature of intervention** | | | | | | |
| Clarify treatment ( or Rx illegible) | | | | | | |
| Transcription error | | | | | | |
| Choice of treatment | | | | | | |
| Dose or frequency or duration of Rx | | | | | | |
| Administration or formulation or route | | | | | | |
| Adverse drug reaction or interaction | | | | | | |
| Cost | | | | | | |
| Availability or supply | | | | | | |
| Recommendation of alternate therapy | | | | | | |
| **Outcome** | | | | | | |
| Advice accepted | | | | | | |
| Advice not accepted | | | | | | |
| Treatment changed by pharmacist | | | | | | |
| Information only | | | | | | |
| **Reason for intervention** <br> Safety <br> Effectiveness <br> Supply <br> Cost | | | | | | |

## Record of significant details of the interventions

1............................................................................................................................

............................................................................................................................


2............................................................................................................................

............................................................................................................................


3............................................................................................................................

............................................................................................................................


4............................................................................................................................

............................................................................................................................


4............................................................................................................................

............................................................................................................................


5............................................................................................................................

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## 6.1 Rational Drug Use Data Collection Form



Department of pharmacy
Medicine and poison information centre
Tel 020-2726300

Ward……………….. IP/No…………………Age…………….. Gender Male ☐ Female ☐

| List of all medicines in use | Dose | Route | Frequency | Duration | Tick (✓) If medicine dispensed |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

For official use

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
|  |  |  |  |  |  |