Evaluation of Resident Clinical P'cists' Interventions and Recommendations in an Ophthalmic Ward of a Teaching Hospital in Ghana

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Abstract
The traditional role of a pharmacist predominantly involved the dispensing of medications in both hospital and community settings. Consequently, the pharmacist was quite detached from other healthcare professionals with respect to patient care. The profession has since evolved to become recognized as an essential part of the clinical team. Pharmacist interventions, therefore, are pivotal in clinical pharmacy services within a hospital. The primary objective of this study was to evaluate the number of medicine-related interventions and recommendations at the Lions International Eye Center (LIEC) of the Korle Bu Teaching Hospital.
The current study, which is a prospective, single-centre, patient chart review, was carried out using clinical pharmacy residents from the Ghana College of Pharmacists and covers the period 5/12/2018 to 15/04/19. Each type of recommendation documented was categorized and analysed for acceptance or non-acceptance by physician ophthalmologists, whilst each intervention was classified and quantified according to the type of medication errors (ME) identified.
During the 4-month study period, the clinical pharmacy residents recommended 19 drug therapy changes and identified 70 interventions of medication errors for 13 patients taking a total of 95 drugs at the centre. Recorded acceptance rate of interventions by ophthalmologists was 7% (5/70), rejection rate was 3% (2/70) whilst the rate of interventions with an unknown acceptance/non-acceptance outcome was 90% (63/70). The most prevalent type of medication errors was the identification of omissions of patient's drug frequency (20.6%), followed by drug monitoring (17.1%).
Clinical interventions made were moderately significant and primarily related to medications used in the ophthalmic specialty setting. Further studies are needed to strengthen such outcomes and improve acceptance for the benefit of patients seeking eye care at the Centre.

Keywords: Clinical pharmacist, interventions, medication errors, ophthalmologist, teaching hospital.

Introduction

The traditional role of a pharmacist predominantly involved the dispensing of medications in both hospital and community settings. Consequently, the pharmacist was quite detached from other healthcare professionals. The profession has, since, evolved to become recognized as an essential part of the clinical team. Pharmacists have diversified into alternative areas of care (Gallagher *et al*., 2014). Pharmaceutical or patient-centred care is now an integral component of the enhanced role which pharmacists offer in a clinical setting (Khalili *et al*., 2013; Klopotowska *et al*., 2010; Kopp *et al*., 2007; Lada *et al*., 2007; Olson *et al*., 2005; Shen *et al*., 2011).

Pharmacist interventions, therefore, are pivotal in clinical pharmacy services within a hospital. Clinical pharmacist interventions are carried out throughout a patient's stay from outpatient care, through patient admission to discharge. It may occur during general ward rounds, pharmacist-led patient chart review, at the point of medicine dispensing or at the request of another healthcare professional.

A pharmacist intervention is defined as any action taken by a pharmacist during patient management or therapy with the aim of improving patient outcome (Alderman and Farmer, 2001).

The interventions which sum up clinical pharmacy practice include advice to clinicians on choice of pharmacotherapy, monitoring for efficacy and toxicity of medications, education and counselling of patients on their disease condition and

complications, self-monitoring, medication adherence, lifestyle modification and medicine use reviews.

The emergence of pharmacy as a clinical profession has given pharmacists the skills and knowledge to improve the outcomes of drug therapy. It also presents them with the responsibility for those results. Practitioners of pharmaceutical care -which is responsible for the provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life -are concerned with the effect of their services on patients' quality of life and not merely with the act of providing services. They work with other health-care professionals as equals to ensure that therapeutic goals are achieved, and that drug-related illness does not occur or is quickly detected and resolved (Penna, 1990).

A pharmacist's expertise in pharmacology, pharmacotherapy and pharmaceutics ensures they have the requisite capabilities to offer suggestions to other healthcare staff on possible alterations to a patient's therapy (Marriott *et al*., 2008; Sosabowski and Gard, 2008). This helps to ensure optimal patient outcomes, which has the potential to have an add-on economic benefit to the healthcare institution.

Numerous studies have shown that pharmacists make valuable contributions to improve clinical, economic, and patients' outcomes (Schommer *et al*., 2002; ASHP guidelines 2004; Suseno *et al*., 1998; Lim *et al*., 2004; Boyko *et al*., 1997; Hatoum *et al*., 1998; Zimmerman *et al*., 1995; Gandhi *et al*., 2001; Schumock *et al*., 1996; Zaidi *et al*., 2003; McMullin *et al*., 1999; Kane *et al*., 2003; Lee *et al*., 2002).

Evidence of the clinical benefit and reduction in Adverse Drug Effects (ADEs) associated with enhanced roles of pharmacists in a hospital setting, are also well documented in literature (Kopp *et al*., 2007; Kaboli *et al*., 2006; De Rijdt *et al*., 2008; Dooley *et al*., 2004).

Previous studies have shown that integrating pharmacists into rounding teams can enhance patient care through interventions at the point of assessment and prescribing (Boyko *et al*., 1997).

Ocular pharmacology is one of the least-managed areas of pharmaceutical care by pharmacists. However, pharmacists play a major role in health promotion towards eye care; they are in a position to advice patients upon the symptoms presented and demonstrate the proper use of ophthalmic drops and ointments. Ocular pharmacists can greatly improve eye care, bringing to bear their expertise in this specialized field of care.

The Ghana College of Pharmacists was established by section 84 to 113 of Act 833, 2011 with the mandate of promoting specialist training in pharmacy and related disciplines at the highest level in the country.

The postgraduate pharmacy residency programmes have been developed to provide more advanced and structured training in several areas of pharmacy practice, including patient care. The Korle-Bu Teaching Hospital is one of the centers selected for the training of the postgraduate clinical pharmacy programme because of the availability of well-trained and skilled faculty.

The aim of this study was to evaluate the interventions of the two clinical pharmacy residents on the ophthalmic wards of the hospital. This was aimed at establishing the need for the effective documentation of clinical pharmacists posted to the Eye Center. The results of this evaluation would showcase the value pharmaceutical care adds to the holistic management of patients at the Eye Center.

The evaluation was run based on the knowledge of therapeutic use of drugs, healthcare records and chats with ophthalmologists, ophthalmic nurses as well as the needs of patients themselves.

The goal was to achieve maximal therapeutic effect of medication while minimizing the risks related to the use of the drugs.

Methodology

The current study which is a prospective, single-centre, patient chart review covers the period 5/12/2018 to 15/04/19. Data extraction took 4 months to complete. The primary objectives were to evaluate the number of interventions that resident clinical pharmacists posted to the eye clinic by the Ghana College of Pharmacists could make by working in collaboration with ophthalmic doctors, nurses and optometrists and also to determine the most efficient method of working with ophthalmic physicians.

Responsibilities of the pharmacy residents included reviewing patient profiles, detecting and preventing adverse drug events, adjusting doses for disease state or compromised renal function, monitoring drug interactions, performing discharge medication counselling, converting intravenous to oral dosage forms (de-escalating dosage forms), recognizing untreated indications and assisting with medication reconciliation.

Data Collection

Data collected included patient demographics, name of prescribing doctor, admitting diagnosis/provisional diagnosis and other medication therapies. Others were, whether interventions were solicited by the physician, the type of intervention, whether recommendations were accepted, medication reconciliation and all other relevant information on the patient folders.

Intervention Analysis

Clinical pharmacy interventions were provided by two clinical pharmacy residents under the supervision of a Senior Specialist Pharmacist. The types of intervention documented during pharmacist's visit were categorized into two main blocks: medication review and patient compliance.

Clinical pharmacy interventions were carried out at in-patient ophthalmic wards and during pharmacist-led patients' medication review. The primary goal of the clinical pharmacist's interventions was to improve patient therapy.

Interventions made by pharmacists were recorded in a notebook which served as the source of data since there was no electronic medical records system at the time. This was kept at the Eye Center pharmacy, and all interventions were discussed with the consultant Ophthalmologist who had the final decision on whether to accept or reject the decision.

Data Analysis

Reports generated from the clinical pharmacy database were inputted into Microsoft Excel™ format 2010 and summary statistics were calculated; all other analyses were conducted using IBM SPSS Statistical software Version 18.

Ethical Statement

An abstract of this research article was submitted as part of the eye pharmacy operational research presentation at the Eye Center research fair 2019. The team did not, therefore, request for ethical clearance from the hospital since all the research presentations done at that fair were cleared for ethical clearance by the hospital.

Results

During the 4-month data extraction period, 13 patients were reviewed. The mean age and standard deviation (SD) were 28.7 (6.1) years. There were more females (54%) than males (46%) on admission at the time of the study. In all, 70 interventions were identified, with a mean per patient of 5.38.

Recorded acceptance rate of interventions by ophthalmologists was 7% (5/70). About 3% (2/70) of the interventions were recorded as being rejected by ophthalmologists. However, the rate of interventions with an unknown acceptance/rejection outcome was high, 90% (63/70) **(Table 1)**.

Table 1. Intervention analysis

Variable	Number of interventions
Mean age (SD)	**28.7(21.2)**
Female/Male ratio	**1.4**
Total no. of patients who received intervention	**13**
Total no. of interventions	**70**
Mean of intervention per patient (SD)	**5.38 (2.13)**
Range of intervention per patient	**2 to 10**
Intervention Accepted by Ophthalmologists (%)	**5(7.15)**
Intervention Rejected by Ophthalmologists (%)	**2(2.85)**
Intervention with unknown Acceptance outcome (%)	**63(90)**

The most prevalent type of medication errors was the identification of omissions of patient's drug frequency (20.6%), followed by drug monitoring (17.1%), whilst the least prevalent type of medication error was wrong drug (1.4%) **(Figure 1)**.

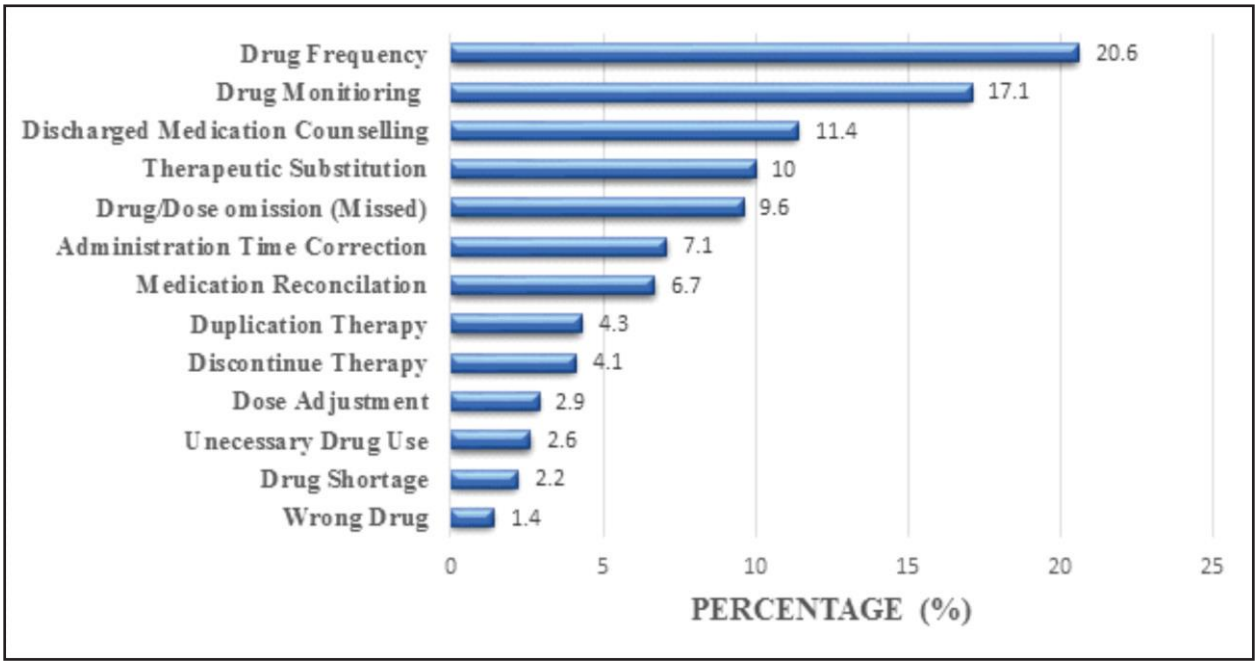

Figure 1: Types of medication errors recorded

A total of 19 recommendations were made. Change in route of administration 26.3% (5/19) and change of dosage forms 26.3% (5/19) were the highest forms of recommendation made by the resident clinical pharmacists' team. This was followed by change in drug dosing 15.8% (3/19), whilst discontinuation of therapy and starting a new drug had the lowest recommendation. (5.3%) **(Figure 2)**.

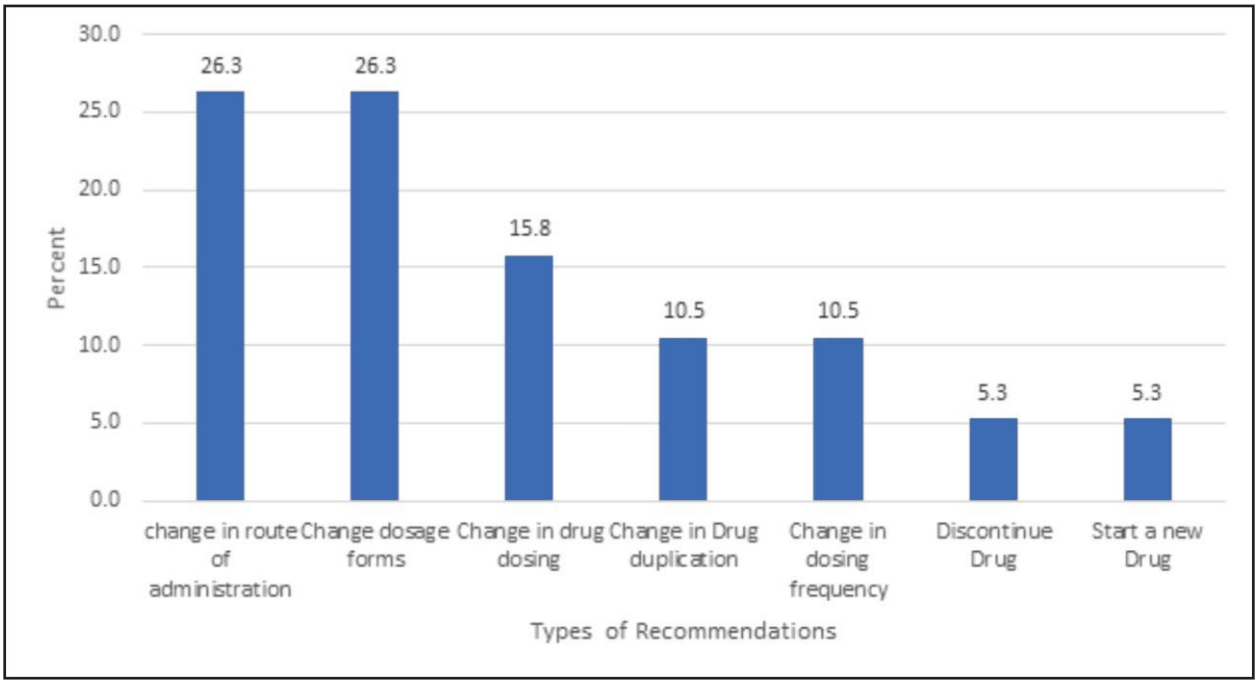

Figure 2: Types of Recommendation made by clinical pharmacy resident

Per the type of disease conditions recorded during the study period, orbital cellulitis had the highest number of patients per admissions 30.8% (4/13), followed by cataract 15.4% (2/13), and cornea lacerations 15.4% (2/13). Fungal keratoconjunctivitis (7.7%), bilateral prolapse (7.7%), congenital ptosis of the right eye (7.7%), eye neurofibromatosis (7.7%) and proptosis (7.7%) were the lowest with one admission each **(Figure 3)**.

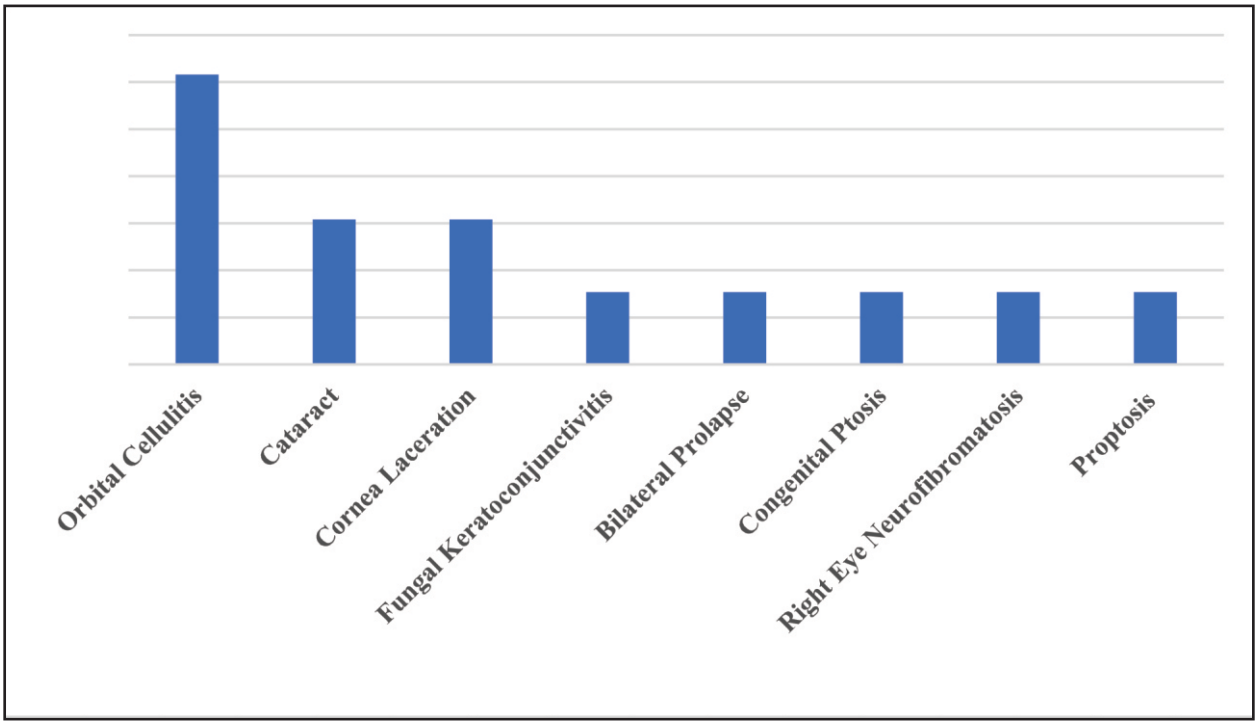

Figure 3: Types of Eye Disease Conditions recorded

Orbital cellulitis had the highest number of interventions per disease condition 30% (21/70) followed by corneal lacerations 15.7% (11/70), cataract and bilateral prolapse with 12.9% (9/70) each; whilst right eye neurofibromatosis had the lowest intervention per disease condition 2.9% (2/70) **(Table 2)**.

Table 2: Disease Conditions & number of interventions.

DISEASE CONDITIONS	INTERVENTION Frequency (%)
Cataract	**9 (12.9)**
Right cornea Laceration	**11(15.7)**
Fungal keratoconjunctivitis	**10(14.3)**
Bilateral Prolapse	**9(12.9)**
Orbital Cellulitis	**21(30.0)**
Congenital Ptosis	**5(7.1)**
Right Eye Neurofibromatosis	**2(2.9)**
Proptosis	**3(4.3)**
Total	**70(100)**

Ninety-five (95) drugs were used for the 13 patients identified in the study. Non-ophthalmic preparations accounted for 71% of the number of drugs used. The average eye drop medication per patient was 1.85 whilst the average non-eye drop medication per patient was 5.46. The most used non-ophthalmic medication was intravenous fluids 40% (38/95), followed by antibiotics 31.6% (30/95)**.** The commonest ophthalmic preparations used on admission were antibiotics, with oxytetracycline (oxypol) eye ointment, being the most used.

Discussion

In this study, the team attempted to quantify the role of clinical pharmacy residents in an ophthalmic ward in a teaching/referral hospital. In its present form, it is the first study to describe the role of clinical pharmacy residents as a hospital improvement service in detecting, avoiding, and correcting avoidable medication errors. This study recorded the pharmacists' interventions in the tertiary care setting (Korle bu Teaching Hospital Lions International Eye Centre (LIEC)) and the measures taken by the hospital as a result of the pharmacists' review. Pharmacists were effectively able to intervene to correct audited administration errors although physicians, especially consultants, failed to agree with some these interventions.

In our study, 6.7% of the interventions were on medicines reconciliation. This is in line with other studies that also concluded that, medicines reconciliation has been proven to reduce medication errors and subsequent harm to patients at transition points of care (Sawyer *et al*., 2016; Mekonnen *et al*., 2016). Furthermore, pharmacist-led reconciliation has been shown to have the highest expected cost benefits when compared with other reconciliation processes (Hellström *et al*., 2016).

An accurate medication history at hospital admission, in particular, is vital when evaluating patients' current pharmacotherapy and in determining further treatment options (Reeder and Mutnick, 2008). Our study recorded 2.9% of the total number of medications on dose adjustment which is classified as inconsistent or limited-quality patient-oriented evidence (McMullin *et al*., 1999).

Studies have established that medication histories obtained by pharmacists are more precise and more comprehensive than those obtained by other healthcare practitioners (Karnon *et al*., 2009).

In our study, the resident clinical pharmacist's role in prescribing was usually retrospective, resulting in long delays between the time of prescription and the pharmacist's intervention. Other studies have advocated that it be more advantageous for a pharmacist to be present at the time of prescribing, in order to provide specialized knowledge when it may be needed (Leape *et al*., 1999; Dalton and Bryne 2017).

In our study, drug monitoring (17.1%), duplication of therapy (4.3%), and wrong drug (1.4%), were all factors that might have contributed to the higher incidences of side effects. However, due to the intervention of the resident clinical pharmacists, there were no adverse events recorded in our study leading to substantial cost avoidance, this outcome is compared to other studies that placed emphasis on minimizing side effects as a result of drug monitoring, duplication of therapy and wrong drug (Roose *et al*., 2003; Schommer *et al*., 2002; Kucukarslan *et al*.,2003; Chisholm *et al*., 2000; Hatoum *et al*., 1988)

The three most common MEs found in our study were improper drug frequency or dosage, drug omission, and drug monitoring (potential or actual occurrence); this is similar to a study that was done in China (Jiang *et al*., 2014).

Inappropriate dosing or dosing frequency featured in a South African study that looked into an assessment of the need for pharmaceutical care in a Neonatal Intensive Care Unit (NICU) (Bronkhorst *et al*., 2014). This outcome was also observed in our study.

Recommendations by clinical pharmacists as a result of medications reviews are common, but their acceptance by physicians is variable and depends on the prescribing process itself, the identification of drug-related problems and the methods of communication. The proportion of recommendations that are accepted vary depending on the experience of the pharmacists and the setting. For example, the acceptance rate would perhaps be higher if the physicians are aware of the professional status of the pharmacist who proposed the intervention (Zaal *et al*., 2020).

In our study, interventions accepted by the ophthalmologist were 5(7%). This is very low compared to other studies done in Europe and America where acceptance rates varied between 52% and 100% (Bondesson *et al*., 2012; Chowdhuryet al., 2018; Bosma *et al*., 2018; Yi *et al*., 2016; Rychlickova *et al*., 2016; Taegtmeyer *et al*., 2011; Taegtmeyer *et al*., 2012), although none of these acceptance rates were recorded in an ophthalmic setting.

Most previous studies on the physicians' acceptance rate dealt with interventions proposed during ward rounds by clinical pharmacists who were members of the multidisciplinary care team (Zaal *et al*., 2020). At LIEC, there was no such multidisciplinary ward rounds of which pharmacists are part. Meanwhile, ward rounds are scarcely conducted, and hence most of the reviews were done by the clinical pharmacists and later communicated to the supervising ophthalmologists. Insight into the potential factors associated with acceptance could help optimize pharmacy services aimed at reducing drug-related problems and improving pharmacotherapy.

Some previous studies have shown differences in acceptance rates between surgical and medical wards (Mogensen *et al*., 2013; Barber *et al*., 1997). Meanwhile, the way of communicating the intervention (over the telephone, during ward rounds and/or electronically), and the physician's status (resident vs specialist) affect acceptance rates (Bedouch *et al*., 2012).

Even though a study has reported that pharmacists have poor knowledge, attitude and practice about ophthalmology and its medications (Victor *et al*., 2016), this may not be the case among the resident clinical pharmacists in this study because they were tutored under a Senior Specialist Pharmacist at the Center.

In terms of clinical setting, the current study can be compared to the Egyptian and the Saudi Arabia studies which looked independently at the ophthalmic ward and also recorded very low intervention and number of affected doses (Sabry and Abbassi, 2014; Alzuman S. & Al-humaidan A. 2015),

Interventions rejected by the ophthalmologists were 2 (3%) . This outcome was mindful of the clinical consequences of non-acceptance in terms of patient harm, length of stay and pharmaceutical costs. Although human errors are impossible to eliminate, the goal is to reduce medication problems significantly. Exploring the reasons behind these problems, and implementing efficient systems are key processes that will minimize human error and improve patient outcomes.

Interventions made by the clinical pharmacist residents with an unknown accepted/rejected outcome accounted for 63 (90%) of total interventions made. This could be attributed to

the fact that when an intervention is made, it is likely that the intervention was proposed to the initial prescriber who is most likely to be a resident; he/she will require a permission from a senior ophthalmologist or consultant before he or she could effect a change.

Limitations

Clinical interventions were self-reported by the clinical pharmacy residents. This may have contributed to the high interventions recorded with unknown accepted/rejected outcome of 90% as recorded in the study.

The findings may be difficult to extrapolate to other eye centers/clinics, especially where the pharmacists are more integrated in the ward team.

Conclusion

Clinical interventions made by resident clinical pharmacists from the Ghana College of Pharmacists completing their residency programme were moderately significant and primarily related to medications used in the ophthalmic specialty setting. These results demonstrate a clarion call for greater collaboration between pharmacists and ophthalmologists at the Centre in the interest of patient care.

Recommendations

We recommend the presence of a permanent clinical pharmacist on the wards of the Eye Department.

Evidence from the literature on clinical pharmacist's role in ophthalmic field was very limited globally**,** hence the need to consider curriculum modifications to facilitate learning outcomes is relevant to ophthalmic pharmaceutical care as an elective area of choice.

Again, most of the studies that had been done regarding the clinical pharmacist's role in ophthalmic field focused on patient compliance, medications errors and/or patient counselling, but no study has determined the role of clinical pharmacist as interventionist within patient treatment plan or discussed the type of interventions that can be made for these type of patients

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