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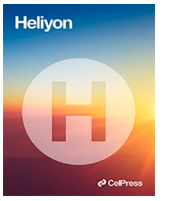

Advanced pharmacy practice of a doctor of pharmacy student at an allied surgical ward in a hospital in Africa

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ABSTRACT

Introduction: The pharmacy profession is undergoing transformational change in Ghana. The role of pharmacists has become more patient-focused with increased accountability and responsibility.
Aim: This study is aimed at reporting the experiential learning on the clinical interventions made and documented at the Allied Surgical Wards of Korle-Bu Teaching Hospital (KBTH).
This involves a review of patient's medical records during the Advanced Pharmacy Practice Experience (APPE) learning. One case each from Eye, Ear, Nose, Throat, (ENT) and Dental units' subspecialty were reviewed from October 7, 2019 to November 15, 2019 b y a Pharm D student.
Conclusion: The student was able to make prompt clinical interventions that contributed to patient care in clinical wards assigned during her clinical clerkship.

1. Introduction

The pharmacy profession in Ghana finds itself amid transformational change [1]. As the role of pharmacists become more patient-focused, the importance of documenting pharmacists' professional activities related to patient care becomes paramount [2]. Unfortunately, this is a skill that many pharmacy graduates have never been taught in their formal education or training. This change will allow pharmacists to take on new and expanded patient-centered roles and responsibilities. However, patient-centered care requires a different set of skills and training (e.g., clinical practice skills, critical thinking skills, decision-making skills under conditions of uncertainty, collaborative interpersonal practice skills) than those that were required to be a good pharmacist in the past (e.g., attention to detail, accuracy, and risk aversion). Pharmacy educational programs will have to produce confident graduates who are capable and inclined to assume responsibility and accountability for drug therapy management [3].

Experiential training is viewed as a necessary requirement for the acquisition of these skills as the profession moves forward with implementation of the vision for Pharmacy [4].

The Doctor of Pharmacy (PharmD) is a professional doctorate degree, also known as a clinical doctorate - a term only used in the health professions. The professional doctorate degree emphasizes practice competencies, which is different from an academic

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doctorate, such as Doctor of Philosophy (PhD) that focuses on knowledge or original research production [5,6].

The United States was the first country to switch to a 6-year PharmD degree as the sole credential for the professional pharmacy programme. The programme focused mainly on clinical pharmacy. Many other countries, including Ghana, followed suit [6–8].

Pharm D is a compound programme. The first three years involve an introduction to pharmacy practice experience (IPPE). The final two years are referred to as the advanced pharmacy practice experience (APPE). Through-out the final APPE year, students are sent to various hospitals across the country to study. During their rotation, students are evaluated on their ability to perform in each area of the subjective, objective, assessment, plan, and outcome (SOAPO) note.

The SOAPO note is an acronym representing a widely used method of documentation for healthcare providers. The SOAPO note is a way for healthcare workers to document in a structured and organized way [9,10]. This widely adopted structural SOAPO note was theorized by Larry Weed almost 50 years ago. It also provides a cognitive framework for clinical reasoning [11].

The APPE in the sixth year, offer students the opportunity to follow up on assigned in-patients, monitor their therapy, and make recommendations regarding medication use under the supervision of a preceptor. The APPE clinical rotations are completely on-field, experience-based, and integrated problem-solving activities designed to train the student to become an active participant in patient care. The rotations were done in five core practice areas and an elective discipline. The five core practice areas included: Internal Medicine, Accident and Emergency/Critical care, Surgery, Child health and Obstetrics and Gynecology. The Electives were selected from Mental Health, Oncology, HIV/AIDS and Tuberculosis, Eye Ear, Nose, Throat & Dental (EENT&D).

Students were exposed to patient care experiences in geriatric care/adult medicine including cases in cardiology, endocrine and nephrology as well as critical care, infectious diseases, pediatrics, gynecology, and obstetrics care issues, etc.

The learning outcomes of the Pharm D included but was not limited to the following.

- Providing patient-centered pharmaceutical care,
- Designing strategies to monitor patients' medication for safety and efficacy.
- Critically evaluating patient data, literature sources and contributing to efficient patient care for best outcomes
- Contributing to the selection of the appropriate drug, dose and dosage form/regimen for specific patients among others

This study therefore is aimed at reporting the experiential learning on the clinical interventions made and documented at the Allied Surgical wards of the Korle-Bu Teaching Hospital (KBTH), by Pharm D student using the SOAPO note.

2. CASE presentation

This is an educational case report which involved the review of patient medical records at the allied surgical wards of the Korle-Bu Teaching Hospital (K·B.T.H) in Ghana. The six-week review spanned from October 7, 2019, to November 15, 2019, and utilized an intervention documentation pro forma (SOAPO note), provided by the university, which gathered relevant clinical information from patients' folders. Data recorded from the folders included demographic characteristics of patients, presenting signs and symptoms, clinical history, family history, social history, diagnostic tests performed, diagnosis, co-morbidities, and prescribed medications. The data was documented using patient initials so that the patient involved could not be identified or traced. To protect patient records, the folders were not taken out of the ward neither did the student take pictures of the folder.

Pharm D student was trained at the faculty of pharmacy and pharmaceutical sciences, Kwame Nkrumah University of Science and Technology (KNUST), on how to use the SOAPO note to profile patient cases and document interventions.

The primary outcome variable was clinical interventions made and documented by PharmD student. Eligible rotations included three areas of Allied surgery- Eye, Ear, Nose, Throat (ENT), and Dental. Criteria for inclusion were cases of patients who were on admission in the allied surgery wards during the study period. Patient records were reviewed on the ward whiles they were on admission during the study period. Data was collected and gathered by sixth year Doctor of Pharmacy candidate from KNUST over a period of 6 weeks. Several cases were chosen and the decision on cases to profile was made by the specialist pharmacist and the pharm D student. There was no age cut-off for case selection and no gender bias.

Clinical interventions involved written and verbal interactions with other healthcare professionals, patients, and caregivers, and were documented on a paper data collection form for the period of the study.

Students were required to submit a minimum of three (3) SOAPO notes. Each SOAPO note was assessed by a full-time faculty member at a College of Pharmacy at KNUST. Students were rated on the ability to perform in each area of the SOAPO note using a rubric with a scale of 1–5 (1 = not appropriate to 5 = very appropriate).

Table 1
Summary of the disease conditions and demographics of the case studies selected for the SOAPO.

Type of specialty	Disease Conditions	Age (years)	Gender
Ear, Nose, Throat (ENT) unit	• Acute exacerbation of Rhinosinusitis with nasal polyps	31	Female
Dental unit	• Right Sub-masseteric and Submental Abscess • Moderate Anemia	13	Male
Eye unit	• Bilateral congenital cataracts • Malnutrition	3	Female

2.1. Case series

Three patient cases were profiled as seen in Table 1. One case was selected from each Specialist Unit of the Allied surgery department.

CASE 1 was a 3-year-old female who presented with bilateral white pupil of the eye. The condition had occurred a year prior to the presentation. Mother used herbal medication to treat the condition to no avail. She had no family history of cataract. No history of trauma. Mother said pregnancy and delivery was uneventful. Child was delivered by spontaneous vaginal delivery at term. Mother had no rash or infection during pregnancy. The child received all relevant vaccinations from birth and is up to date. She is the only child of her mother but the fourth of her father. Father is married to two women. Father is a commercial driver and mother is a food vendor. Assessment of child's development showed delayed growth in weight, and speech, as well as inability to walk or crawl without assistance. Child only sits unsupported. On examination, a scan of the eye showed a dense, mature cataract on both eyes. Diagnosis of bilateral congenital cataract and malnutrition was made by ophthalmologist.

Cataracts may be secondary to hereditary factors, trauma, inflammation, metabolic or nutritional disorders, intrauterine infection, and exposure to radiation [12]. For this patient, metabolic disorders or nutritional disorders were suspected to be the cause of the cataract. Therefore, Pharm D student recommended that further tests should be done to confirm the main cause of cataract in this patient. This is because according to the Royal College of Ophthalmologists (RCOPHTH) guidelines, neonates with bilateral cataracts and no family history warrant a pediatric evaluation and or urinalysis for reducing substances to rule out galactosemia (a metabolic disorder) [13].

Dense and mature cataracts can lead to significant reduction in vision, which is reversible mainly with cataract surgery. Cataract surgery, also called lens replacement surgery, is the removal of the natural lens of the eye that has developed an opacification and its replacement with an artificial intraocular lens.

Treatment objectives were to improve vision, to prevent the development of amblyopia and to improve nutrition. To prepare the child for surgery, antibiotics were given as pre-operative and post-operative prophylaxis. For pre-operative prophylaxis povidone iodine 5% and gentamicin (aminoglycoside antibiotic) were used. The attribute of a preoperative antibiotic is that it must be bactericidal and have broad spectrum activity. This makes gentamicin an appropriate choice. Gentamycin is a time dependent antibiotic. It can act for 8–12 h and its activity can last throughout the surgery to prevent endophthalmitis [14].

For post-operative prophylaxis, a fluoroquinolone antibiotic (ofloxacin) was used. According to BNF 2019, ofloxacin is indicated for post-operative prophylaxis and the treatment of corneal ulcers [15]. Fluoroquinolones have good tissue penetration, are concentration dependent (this means they are fast acting at high doses) and are of low toxicity [14]. This makes ofloxacin a good topical agent to prevent post-operative endophthalmitis.

To relieve pain and inflammation, topical prednisolone 1% to be administered every 2 h was prescribed. To ease pain and photophobia from sunlight, Cyclopentolate 0.5% to be administered twice a day was prescribed. These medications and their doses were all appropriate except dosing of ofloxacin eye drop (Table 2) according to the Ghana standard treatment guidelines (STG) 2017 and the British National Formulary (BNF) 2019 [15,16].

Attention was called by Pharm D student to inappropriate dosing of ofloxacin eyedrop during the first 48 h of administration. BNF 2019 states that for the treatment of corneal ulcers and prophylaxis against superficial bacterial eye infection, ofloxacin eye drop should be applied every 2–4 h for the first 2 days, then reduced to 4 times a day for 10 days [15].

The Pharm D student raised concern about the need for complete documentation of prescribed medications. The duration of treatment of antibiotics prescribed was not documented in folder.

To cater for malnutrition in the child, a multivitamin syrup was prescribed on discharge to increase her appetite as seen in Table 3. The recommendation for a dietician review was made by Pharm D student so that mother feeds the child nutritious well-balanced meals.

The medications prescribed on the ward were monitored for efficacy and toxicity. There was no toxicity. Overall, there was a good pharmacotherapy outcome.

The Pharm D student provided pharmacological and non-pharmacological counselling. Key amongst them were concerning the need for the parent to bring the child for regular review and the long-term use of 'Pred Forte'- a medication containing prednisolone (steroid) and a sudden end to its use without consent from the prescriber.

One week after discharge, patient was presented for review. Her corneal ulcer was healing well. Four weeks after surgery, patient's

Table 2
Current Medications on ward listed in ascending order with respect to the start dates.

Medication [name/ strength/Route]	Dosage/ Frequency	Start Date	End Date	Reason for use	Comment
Gutt Ofloxacin 0.3%	1 drop 6 hourly	15/10/19	Not Available	To prevent local infection of the eye	Appropriate Medication but inappropriate dosing
Gutt Cyclopentolate 1%	1 drop 12 hourly	15/10/19	Not Available	To induce cycloplegia (this will aid in easing the pain after surgery)	Appropriate
Syrup Paracetamol 250mg/5 ml	5 mls 8 hourly	15/10/19	Not Available	To manage pain and fever	Appropriate
Gutt Prednisolone 1%	1 drop 2 hourly	15/10/19	20/10/19	To reduce inflammation	Appropriate

Table 3
Discharge medication of patient in ophthalmic ward.

Medication [name/strength/Route]	Dosage/Frequency	Duration of therapy	Reason for use
Gutt Ofloxacin 0.3%	1 drop 6 hourly	**Not Available**	To prevent local infection of the eye
Gutt Prednisolone 1%	1 drop 2 hourly	**Not Available**	To manage inflammation
Gutt Cyclopentolate 1%	I drop 12 hourly	**Not Available**	To induce cycloplegia (this will aid in easing the pain after surgery)
Syrup Paracetamol 250mg/5 ml	5 mls 8 hourly	**Not Available**	To manage pain and fever
Syrup Multivitamin	5 mls daily	30 days	To treat malnutrition and improve appetite

vision started improving. Mother said baby was more active than before and feeding well.

CASE 2 was a 31 year-old female with a body mass index of 30 kg/m^2. She presented with yellowish and greenish nasal discharge, fever, headaches, facial swelling, left orbital pain and was bleeding sparingly from the nostrils. Relevant signs showed elevated body temperature (fever) of 39.6 °C and a respiratory rate of 22 cpm. Patient had a past medical history of chronic rhinosinusitis with nasal polyps. Upon questioning, patient revealed that a recent cold she had triggered the condition. Patient had been on an intranasal corticosteroid (fluticasone furoate) for the past 6 months. Patient is allergic to dust and neither drinks nor smoke. Anterior Rhinoscopy revealed pus in both middle meatus and grossly inflamed inferior turbinates as well as an inflamed oropharynx. A diagnosis of acute exacerbation of chronic rhinosinusitis with nasal polyps was made by the physician in charge based on the presenting complains and tests performed. Chronic rhinosinusitis (CRS) is an inflammatory disease of the sino-nasal cavity persisting for at least 12 weeks [17]. Based on current guidelines, an acute exacerbation of rhinosinusitis is defined as a transient worsening of preexisting symptoms in patients with CRS [18,19]. Occasional exacerbations can be associated with infection which in this case was a common cold (respiratory infection).

The goals of therapy were to improve the patient's quality of life, promote sinus drainage, reduce mucosal edema in the nasal cavity, eradicate infections that may be present in the nasal cavity and associated cavities, reduce the number of hospital visits and to prevent the development of orbital and intracranial complications [20].

Both gram-positive and gram-negative bacteria as well as anaerobes have been sampled from patients with CRS [21]. According to the Canadian clinical guidelines 2011, if appropriate bacteriologic samples cannot be obtained and empiric therapy is required, as in most clinical situations, consideration should be given to therapies that have broad spectrum activity [22]. The patient was prescribed with ceftriaxone a broad-spectrum antibiotic with more gram-negative activity at a dose of 2 g daily. For anaerobic coverage, metronidazole was prescribed at an appropriate dose of 500 mg 8 hourly. According to the Canadian Clinical Practice Guidelines 2011, staphylococcus aureus (a gram-positive bacteria), is one of the organisms implicated in rhinosinusitis and penicillin antibiotics are the first line agents used in treating these infections [22]. Hence a prescription of IV flucloxacillin (penicillin antibiotic) 500 mg to be administered 6hourly was appropriately prescribed.

To promote sinus drainage and reduce mucosal edema, xylometazoline spray and syrup carbocisteine were prescribed as shown in Table 4. Oral paracetamol was also prescribed for fever reduction and to relieve patient's headaches and sinus pain.

On discharge (Table 5), patient was asked to resume the use of the intranasal corticosteroid (fluticasone furoate) spray to help reduce the size of the nasal polyps. Nasal polyps are benign inflammatory outgrowths of sino-nasal tissue originating in the ethmoid sinuses and projecting into the nasal airway beneath the middle turbinate [23,24].

These medications and their doses were all appropriate according to the Ghana standard treatment guidelines (STG) 2017 and the British National Formulary (BNF) 2019 [14,15].

Medications were monitored for efficacy and toxicity. Patient suffered an adverse reaction at the site of injection. There was induration at the site. The intravenous line was taken out and patient was not receiving her antibiotics. Patient was obese and the doctors struggled to set a new line at a different site. This led to missed doses of the antibiotics which could have resulted in treatment failure or antibiotic resistance. Patient vomited four times the night after starting oral carbocisteine. Hence patient became non-compliant. Pharm D student intervened by suggesting to the team to replace carbocisteine with nasal saline wash and steam

Table 4
Current Medications on ward listed in ascending order with respect to the start dates).

Medication [name/strength Route]	Dosage/ Frequency	Start Date	End Date	Reason for use	Comment
IV Paracetamol 1 g	1 vial 8 hourly	15/10/19	19/10/19	To manage pain and fever	Appropriate
IV Ceftriaxone 2 g	1 vial daily	15/10/19	19/10/19	To treat underlying infection	Appropriate
IV Metronidazole 500 mg	1 vial 8 hourly	15/10/19	19/10/19	To treat underlying infection	Appropriate
IV Flucloxacillin 500 mg	1 vial 6hourly	15/10/19	19/10/19	To treat underlying infection	Appropriate
Spray Xylometazoline 0.1%	2 puffs daily	15/10/19	19/10/19	Relief of nasal congestion and dry up of nasal secretion.	Appropriate
Syrup Carbocisteine 2%	10 mls 12 hourly	15/10/19	19/10/19	To loosen mucus and make it easier to cough it up	Appropriate

Table 5
Medications on discharge for ENT patient.

Medication [name/strength/Route]	Dosage/Frequency	Duration of therapy	Reason for use
Tab Paracetamol 500 mg	2 tablets 8 hourly	PRN **(pro re nata)**	To manage pain and fever
Spray Xylometazoline 0.1%	2 puffs in each nostril daily	PRN **(pro re nata)**	Relief of nasal congestion and dry up of nasal secretion.
Fluticasone nasal spray suspension 27.5 mcg	2 sprays in each nostril daily	4 weeks	To reduce nasal inflammation as well as nasal polyp size

inhalation as these also help loosen and clear mucus.

The Pharm D student provided pharmacological and non-pharmacological counselling. The patient was counselled to drink lots of water to keep hydrated and to maintain a good personal hygiene of face and hands to prevent or reduce re-infection. Patient was also counselled on how to use intranasal corticosteroid to prevent infections and get optimal results. The patient was advised on the need to taper the dose of intranasal corticosteroid before stopping its use and the to adhere to therapy. Patient's condition improved and was discharged after 3 days of admission.

CASE 3 was a 13-year-old male who presented with fever (40^{O}C) and a swollen right jaw. Patient has had dental caries for about 2 years prior to presentation but has never seen a dentist. He had been self-medicating with analgesics anytime there was pain. He started noticing the swelling of the right jaw 4 days prior to presentation and fever on the day of presentation. He had no known chronic illness. Physical assessment showed swollen gum, discolored teeth (teeth looking black). Blood tests (Table 6) revealed low hemoglobin (Hb-10.7 g/dL) low mean cell volume (75.2 ft), low mean corpuscular hemoglobin (MCH-24.6 pg) and high white blood cell count (WBC- 14.47 $\times$ 10^9/L).

On questioning, patient eats more than 6 ice creams a day and does not brush twice a day. He sometimes does not brush at all. Extra oral examination showed firm swelling over the right sub-masseteric region which was warm to touch and tender. The presence of discolored teeth was documented after intraoral examination. Dental caries erodes the protective layers of the tooth (ie enamel, dentin) and allow bacteria to invade the pulp, producing pulpitis. Pulpitis can progress to necrosis (the black coloration of the tooth). A panoramic radiography was taken which showed an abscess in the sub-masseteric and sub mental regions. This was so because bacterial invasion of the alveolar bone can cause abscess and pain. A diagnosis of sub-masseteric and sub-mental abscess as well as iron deficiency anemia was made by the dentist. Iron deficiency anemia was due to low Hb, HCT, MCV and MCH values from blood test. A high WBC and neutrophil count indicated the presence of infection. Treatment objectives were to relieve pain, to arrest dental decaying process by excavation and filling of cavities, to educate on good dental habits, drain dental abscess, treat inflammation [25], treat underlying cause of anemia by replenishing iron stores, to restore hemoglobin levels to normal.

Odontogenic infections are polymicrobial, with an average of 4–6 different causative bacteria. The dominant isolates are strictly anaerobic gram-negative rods and gram-positive cocci, in addition to facultative and microaerophilic streptococci. Anaerobic bacteria outnumber aerobes [26]. Beta-lactamase producing organisms occur in approximately one third of dental abscesses [27].

Ciprofloxacin is one of the common drugs used for endodontic infections [28]. The effective action against oral anaerobes, gram-positive aerobic organisms (*Staphylococcus aureus*, Enterobacter spp, Pseudomonas) demand the need for ciprofloxacin for endodontic infections [29].

Clindamycin is a broad-spectrum antibiotic with activity against aerobic, anaerobic, and beta-lactamase-producing pathogens. This antibiotic has been used for many years as prophylactic treatment during dental procedures to prevent endocarditis [30]. In addition to its anti-infective properties, Clindamycin has high oral absorption, significant tissue penetration, including penetration into bone, and stimulatory effects on the host immune system [30].

Gentamicin, an aminoglycoside antibiotic is most exclusively reserved for the treatment of serious infections caused by gram-negative bacteria in which less toxic anti-bacterial are ineffective [31].

Amoxicillin/Clavulanic acid is a semi-synthetic antibiotic with a broad spectrum of bactericidal activity, covering both gram-negative and gram-positive microorganisms. Martinez A. B et al., 2004 states that the polymicrobial nature of odontogenic infections necessitates the use of antibiotics active against both aerobic and anaerobic beta-lactamase producing bacteria [32].

The increasing awareness of the role of obligate anaerobic bacteria in the aetiology of oral disease has led to an interest in their chemotherapeutic control [33]. Metronidazole has been proven to be efficacious in treating acute ulcerative gingivitis, pericoronitis, and certain periapical infections hence can be useful in this patient.

Table 6
Hematology investigations and their reference values.

Parameter	Reference Range	Dates
		10/10/19
Hemoglobin (Hb)	(11–18)g/dL	10.7
White Blood Cell (WBC)	(2.5–8.5)$\times$10^9/L	14.47
Neutrophil	(2–7)$\times$10^9/L	11.03
Platelets	(150–450)$\times$10^9/L	182
Mean Cell Volume (MCV)	(76–96)ft	75.2
Mean Corpuscular Hemoglobin (MCH)	(27–32)pg	24.6
Hematocrit (HCT)	(36–54)%	32.9
Red Blood Cell (RBC)	(3.5–5.5)x 10^12/L	4.37

Among dental treatments, oral surgical procedures cause the most pain [34]. During these procedures, damage caused to soft and hard tissues leads to an inflammatory reaction [35]. Shahzad A.S. et al., 2011 stated that submucosal injection of 4 mg Dexamethasone showed significant improvement in swelling, pain, and improving the recovery phase of the patient after surgical endodontic procedures [35].

Vitamin C, a good source of antioxidant, has been proven to facilitate healing after periodontal procedures as well as preventing mouth odors [36].

Paracetamol is indicated for the treatment of mild to moderate pain. It is also indicated for the reduction of fever. According to Newman (2017), the main symptom of a dental abscess is pain. This may be a throbbing pain and is often intense hence the need to manage pain. Secondly fever is also a symptom of dental abscess and paracetamol has antipyretic effects [37].

According to the British National Formulary (BNF) 2019 and STG 2017, all medications in Table 7 that were prescribed and administered were appropriate based on type and dose [15,16].

On discharge a topical vitamin c gel was recommended by Pharm D to be applied orally to promote fast wound healing. A scientific study published in 2013, showed that antioxidants applied to the oral cavity work together with saliva, red blood cells, platelets, and some microorganisms to decompose reactive oxygen species [38]. Recommendations were made by Pharm D concerning an oral gingival gel in Table 8, which contains vitamin C and other antioxidants like aloe vera, green tea, eucalyptus, and vitamin E to provide topical antioxidant effect directly to the gums. Intravenous antibiotics were switched to oral dosage forms at the time of discharge. Iron containing supplement was prescribed to treat iron deficiency anemia.

All medications were monitored for toxicity and efficacy. There was a good pharmacotherapy outcome with no adverse reaction from medications. The Pharm D student provided pharmacological and non-pharmacological counselling. Patient was counselled not to take ciprofloxacin and the iron supplement together due to their interaction. Patient was advised not to take ciprofloxacin with dairy foods. It is either he takes the ciprofloxacin 30 min before eating those foods or 2 h after eating them. Patient was also advised to reduce intake of sugary foods and to brush his teeth at least twice a day. The outcome was that the patient's condition improved, the abscess was drained out and the swelling reduced with no pain or fever on the day of discharge.

3. Discussion

Our study is first in Africa to establish an intervention using SOAPO approach. Even though many studies mainly in the western world have evaluated the potential benefit of pharmacy student participation in clinical activities, there have been few studies from Africa using the SOAPO approach except our study [39,40].

Clinical pharmacy services have provided well established benefits [41–43]. Pharmacists involved with multidisciplinary treatment teams have made interventions that have resulted in improved medication use, reduction of adverse drug events, and improved patient care.

In checking the appropriateness of medication doses, the BNF 2019 and STG 2017 were used [15,16].

The pre-operative and post-operative care given to the ophthalmic patient was adequate. Post-operative care given to cataract patients typically involves prescribing topical antibiotics, corticosteroids, or non-steroidal anti-inflammatory drops for 1–4 weeks [44]. The patient was scheduled for follow-up visits a day after surgery, at one week, at one month, and at 3 months [45]. This was done to monitor patient's recovery and for early detection of complications.

Although antibiotics are frequently used for the treatment of acute exacerbation of chronic rhinosinusitis (AECRS), the data are

Table 7
Current Medications on ward listed in ascending order with respect to the start dates.

Medication [name/strength/Route]	Dosage/ Frequency	Start Date	End Date	Reason for use	Comment
Syrup Vitamin C 100mg/10 ml	10 mls 8 hourly	10/10/19	Not Available	As an antioxidant to promote wound healing and oral health	Appropriate
IV Gentamicin 80 mg	80 mg 8 hourly	10/10/19	18/10/19	To treat infections	Appropriate
IV Paracetamol 1 g	1 g 8 hourly	10/10/19	18/10/19	To manage pain and fever	Appropriate
IV Amoxicillin/Clavulanic acid 1.2 g	1.2 g 8 hourly	10/10/19	18/10/19	To treat infections	Appropriate
IV Metronidazole 500 mg	500 mg 8 hourly	10/10/19	18/10/19	To treat infections	Appropriate
Syrup ferric ammonium citrate 225mg/15 ml	10 mls 8 hourly	10/10/19	Not Available	To treat anaemia	Appropriate
Tab Ciprofloxacin 500 mg	500 mg 12 hourly	18/10/19	Not Available	To treat infections	Appropriate
Tab Clindamycin 150 mg	150 mg 6 hourly	18/10/19	Not Available	To treat infections	Appropriate
Tabs Paracetamol 1 g	1 g 8 hourly	18/10/19	23/10/19	To manage pain and fever	Appropriate
IV Dexamethasone 4 mg	4 mg 8 hourly	18/10/19	21/10/19	To reduce inflammation and pain	Appropriate

Table 8
Medications on discharge for dental ward patient.

Medication [name/strength/Route]	Dosage/Frequency	Duration of therapy	Reason for use
Syrup Vitamin C 100mg/10 ml	10 mls 8 hourly	Not Available	As an antioxidant to promote wound healing and oral health
Syrup Ferric ammonium citrate 225mg/15 ml	0 mls 8 hourly	Not Available	To treat anaemia
Tab Ciprofloxacin 500 mg	500 mg 12 hourly	Not Available	To treat infections
Tab Clindamycin 150 mg	150 mg 6 hourly	Not Available	To treat infections
Vitamin C gingival gel	Apply 6 hourly	For 4 weeks	For regeneration and protection of gums

inconclusive regarding their efficacy [20]. A single randomized control trial to date examined the use of antibiotics in AECRS. When comparing the use of a 14-day course of amoxicillin/clavulanate for AECRS, antibiotics did not change the clinical course of AECRS c ompared to placebo [46]. This could probably explain why despite missed doses of antibiotics the patient still recovered. According to Smith and Rudmik 2017, the main stay of CRS treatment targets sino-nasal inflammation and includes nasal saline irrigations and intranasal corticosteroids [47]. These were prescribed for the patient. Other remedies exist. These include over the counter medications such as decongestants, mucolytics, acupuncture and other complementary medicine therapy. Yet no studies exist on the use of these therapies in AECRS [20].

Bacteria play an essential role in odontogenic infections, but antimicrobial treatment is not always sufficient. For example, patients with fistulas associated with chronic infection or draining abscesses usually need extraction of the offending tooth [25]. That was how dental ward patient was managed.

There are many beneficial aspects to developing an APPE and precepting students in the hospital practice setting. APPEs offer additional advantages for patients and the public. Having students provide in depth care to patients reduces medication-related problems [39,48]. In our study the student reported on all the medication – related problems with little supervision as indicated in the other studies.

The benefits go beyond the educational benefits to students. The profession, preceptors, host sites, and the patients served also benefit from the programme. Exposing students to opportunities to participate in and contribute to patient-care services can enhance the number and quality of students to practice as clinical pharmacists. These students are trained to engage in novel approaches in hospital pharmacy practice. In addition, the practice-based research engaged in by students, preceptors, and colleges of pharmacy during these experiences can further define pharmacy's role in medication management. Ultimately, these students can serve as the future change agents of pharmacy practice, advocating the expansion of the capabilities and roles of pharmacists in general.

Grading rubrics are not the sole beneficial tools to evaluate student performance and provide formative assessments. Studies have shown that students perceive the use of rubrics to be fair and transparent [49]. In this study, incorporation of SOAPO note rubric in APPEs improved student understanding of expectations for documentation. Student perception of SOAPO note assessment was positively affected and there was formative feedback from the preceptor. By the end of the APPE, student confidence in their SOAPO note writing ability improved by approximately 40%.

In our case, consideration was given to the fact that an APPE student was allowed to do the input directly unlike other studies that the interventions are initiated by a pharmacist and passed on to the student before team meetings. Given this, the preceptor felt that the APPE students' impact on patient care was much more. As demonstrated in other studies [50] and in line with Accreditation Council for Pharmacy Education (ACPE), students are mandated to be educated to practice as competent and independent practitioners upon graduation and that sides to the power of our outcome.

A final consideration is the qualitative description of the student's interventions. The interventions evaluated in this study were not intended to be an all-inclusive list of student activities. Pharmacy students routinely perform a variety of tasks, such as medication therapy review, assisting pharmacists with research activities, interacting with other health care professionals concerning patient care, and educating pharmacy staff members through topic presentations. These activities could have had a positive effect on patient care indirectly but were not evaluated by this study. This study clearly demonstrates that aspect and meets the expectations of the APPE using the SOAPO notes. Our study also meets the indicative functions of SOAPO. The pharm D student performed credibly well in the application of SOAPO as outlined in the following studies [9,11].

4. Limitations

In this study, the Pharm D final year student pharmacist displayed an increased ability to document patient care activities in the SOAPO note format. A limitation to using the SOAPO note is the inability to document changes over time. This did not allow further documentation of patient follow-up visits. Short rotation duration could not allow time for patient follow-ups. Possible biases in this study may involve the small sample size of the study population and the short duration (6 weeks) for clinical rotation at the allied surgery unit.

5. Conclusion

The Final year Pharm D student demonstrated pharmaceutical and patient care competencies during their Advance Pharmacy Practice Experiential Training. Significant clinical interventions which contributed to patient care was made in clinical wards assigned during the student's clinical rotation. This has clearly shown the impact that the Doctor of pharmacy student in her clinical training

made in identifying, recommending, and documenting clinical pharmaco-therapeutic interventions. Like pharmacists, this case has demonstrated that pharmacy students can also have a positive and impactful contribution towards patient care.

Ethical Statement

In this study no patients were contacted. Collection of data of patients without names is a routine process in the hospital for examination purposes on medication review. In doing the review all identifiable information of patients were de-identified from the data. The threat to patients was therefore minimal and according to the present Standard Operating Procedure of the Ghana Health Service Ethics Review Committee, ethical approval is not deemed necessary for this study [51] and finally the hospital granted administrative approval for the review and publication of the study.

Author contribution statement

1) conceived and designed the experiments; Mr. Charles Ofei-Palm, Dr Dorcas Gbadago.
2) performed the experiments; Dr Dorcas Gbadago, Dr Raymond Tetteh, Dr Augustina Koduah.
3) analyzed and interpreted the data; Mr. Charles Ofei-Palm, Dr Raymond Tetteh, Dr Augustina Koduah, Dr Daniel Ankrah, Professor Kwame Ohene Buabeng.
4) contributed reagents, materials, analysis tools or data; Mr. Charles Ofei-Palm, Dr Dorcas Gbadago, Dr Augustina Koduah, Dr Daniel Ankrah, Professor Kwame Ohene Buabeng.
5) wrote the paper Mr. Charles Ofei-Palm, Dr Dorcas Gbadago, Dr Daniel Ankrah, Professor Kwame Ohene Buabeng.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e17064.

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