

Impact of Clinical Pharmacist Educational Intervention on The Potential Drug-Drug Interactions in Surgical Intensive Care Unit

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(Clinical Pharmacy)

By the pharmacist

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List of abbreviations

ACCP	American College of Clinical Pharmacy
ADEs	Adverse drug events
ADRs	Adverse drug reactions
CDSS	Clinical decision support software
CP	Clinical pharmacy
CPOE	Computerized physician order entry
CPR	Cardio pulmonary resuscitation
CYP	Cytochrome P
DDIs	Drug drug interactions
DIs	Drug interactions
DTC	Drug and therapeutic committee
EBM	Evidence based medicine
FDA	Food and Drug Administration
ICU	Intensive care unit
NSAIDs	Non steroidal anti-inflammatory drugs
OTC	Over the counter
PDA	Personal digital assist
PDDIs	Potential drug drug interactions
PhC	Pharmaceutical care
SCCM	Society of Critical Care Medicine

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Introduction

Pharmaceutical care

The concept of pharmaceutical care in its modern sense was introduced in 1980: “Pharmaceutical care includes the determination of the drug needs for a given individual and the provision not only of the drug required but also the necessary services (before, during or after treatment) to assure optimally safe and effective therapy. It includes a feedback mechanism as a means of facilitating continuity of care by those provide it **(Hepler, 2004)**.”

There are numerous published studies that show that many admissions to hospitals, emergencies, and health problems during admission are due to the medication given to patients. It is essential for pharmaceutical services to continue evolving towards a healthcare perspective, as preventable morbidity and mortality related to drug dispensing are still unresolved. Therefore, it is a priority to implement a pharmaceutical care programme (phC) in hospital units, consisting of strategies devised in this field, to obtain better drug therapy results. To provide this solution, pharmacists have been incorporating phC in the design, implementation and optimisation of hospital pharmaceutical services, alongside concepts of continuous improvement and quality assurance. Such integrated clinical actions by pharmacists have led to pharmacological treatment being optimised in the patients they serve every day, regardless of the care setting. Although the idea of pharmaceutical care was developed mainly by pharmacists, pharmaceutical care is not “about” pharmacists. It is fundamentally an idea about a system for the delivery of patient care. It requires cooperation by a variety of hospital and community pharmacists, physicians, nurses, and other professionals **(Silva-Castro et al., 2010)**.

Clinical pharmacy

Clinical pharmacy has been defined by the American College of Clinical Pharmacy (ACCP), as “a health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, wellness and disease prevention” (ACCP, 2015).

The American College of Clinical Pharmacy’s definition of clinical pharmacy embraces the philosophy of pharmaceutical care, and therefore, the primary object of pharmacy practice and research is the patient. The clinical pharmacy practice model must thus facilitate patient-centered care, whereby all activities and interactions are focused on improving the care of the patient. Clinical pharmacists bring a unique set of knowledge and skills to the team responsible for direct patient care, and they are accountable for improving the medication outcomes of the patient. Hence, they must be qualified as the drug therapy experts. This expertise, which comes from the knowledge, skills, and experiences gained during postgraduate residency training, should be validated by board certification appropriate to the area of specialization (Haas et al., 2012).

It can be concluded that clinical pharmacy needs different professional work and skills toward the patient which can be optimized by encouraging more cooperation between pharmacists and other health care staff to reach desired outcomes. For clinical pharmacist, it is necessary to know and decide the goal of therapy, best drug choice, choosing between drug alternatives, risks and risk – benefit ratio, knowledge of adverse drug events (ADEs) and drug interactions. In addition, clinical pharmacists should be well aware on how to use the drug (Aljbouri et al., 2013).

Clinical pharmacists are uniquely trained in therapeutics and provide comprehensive drug management to patients and providers (includes physicians and additional members of the care team). Pharmacist intervention outcomes include economics, health-related quality of life, patient satisfaction, medication appropriateness, adverse drug events, and adverse drug reactions (ADRs). Reviews have been published about clinical pharmacy services in various settings, including ambulatory care, geriatrics, psychiatry, critical care, economic outcomes, and health-related quality of life (Kaboli et al., 2006).

Clinical pharmacy is an essential component in the delivery of pharmaceutical care. Understanding clinical pharmacy can improve the technical quality of pharmaceutical care. Understanding pharmaceutical care can enrich and broaden the philosophy and practice of clinical pharmacy (Hepler, 2004).

Clinical pharmacy (CP) and pharmaceutical care (PhC)

Clinical pharmacy and pharmaceutical care are closely related when put into practice. In fact, they ought to be mutually dependent, as PhC provides the original purposes for CP, when it is seen as a professional practice rather than as an applied health science. PhC describes the format for pharmacists to coordinate their work around a process focused on patient care. CP is the basis for PhC and, without it, it is not possible to assess the medication according to necessity, effectiveness and safety. It is clear that the patient should be the focus of the caring practice, and also for the pharmacist. CP has indeed been set as a target, although its primary recipients are physicians who receive information, documentation and knowledge on the rational use of medicines. In fact, as stated by Hepler, CP has defined and developed practice. PhC should be enriched with CP to develop the knowledge and skills necessary for quality contributions from the pharmacist. Also CP has to incorporate PhC to understand health and drug therapy as a unit, and to measure the specific results provided by each of the processes (Silva-Castro et al., 2010).

Role of clinical pharmacist in the intensive care unit

Pharmacists have been performing clinical services for more than 3 decades. Numerous research articles and several surveys have identified areas in which critical care pharmacists make significant contributions to patient care. Most of this literature describes the role and responsibilities of these pharmacists on multidisciplinary health care teams as follows:

drug-use evaluation programs, drug error management, in-service education, pharmacokinetic consults, drug therapy monitoring, nutrition team participation, patient drug counseling, adverse drug reaction programs, written drug histories, cardiopulmonary resuscitation (CPR) team participation, drug information services, multidisciplinary medical rounds, written documentation in medical records, and clinical research.

Activities specific to the CPR team are as follows: provide artificial respiration, administer chest compressions, prepare drugs, administer drugs, record drug administration, provide drug information, calculate dosages and infusion rates, and set up or operate intravenous pump devices (**Papadopoulos et al., 2002**).

Critical care pharmacy is recognized as one of the most advanced disciplines within Pharmacy practice. In 2000, the Society of Critical Care Medicine (SCCM) and the American College of Clinical Pharmacy (ACCP) published a position paper describing the scope of pharmacy practice for critical care pharmacists and pharmacy services. According to this position paper, clinical pharmacy practice in the intensive care unit (ICU) setting consists of patient care activities, educational functions, scholarly responsibilities, and administrative duties. The levels of service across these practice domains were defined as fundamental (i.e., those vital to the safe provision of patient care). Higher-level services were categorized as desirable (i.e., some specialized critical care pharmacy activities) or optimal (i.e., integrated and dedicated critical care pharmacy activities with aims of maximizing patient outcomes through practice, teaching, and research) (**MacLaren et al., 2013**).

A framework for optimizing the delivery of pharmaceutical care to the critically ill. modified from SCCM/ACCP position paper on critical care pharmacy services . (ADEs adverse drug events) (*Kane et al., 2003*)

1. **Fundamental activity** a pharmacist dedicated to critical care services whose activities are vital to the safe provision of pharmaceutical care
 - Evaluates patient drug regimens based on the pharmaceutical care model and assesses their efficacy
 - Provides nutritional care
 - Prevents and documents ADEs and medication errors
 - Provides written communication of recommendations
 - Monitors pharmacokinetics
 - Provides drug information
 - Educates other healthcare professionals
 - Participates in reports for accrediting agencies, institutional committees, and programs

2. **Desirable activity** In addition to fundamental activities, includes more specialized critical care pharmacotherapeutic services

- Participates in patient care rounds
- Maintains knowledge of primary literature
- Reviews medication history
- Educates through didactic/experiential teaching
- Aids in preparing protocols and critical care pathways
- Contributes to research and medical writing

3. **Optimal activity** In addition to fundamental activities, and desirable activities includes an integrated, specialized, and dedicated model of critical care which aims to optimize pharmacotherapeutic outcomes, through the highest level of teaching, research and outcomes research to the medical community and pharmacotherapy practices

- Facilitates patient/family discussions about treatment
- Provides accredited educational sessions
- Reports results of his/her independently initiated/collaborated clinical, pharmaco-economic, and outcomes research to the medical community through lectures and publications
- Develops post-doctoral training programs

Review of the role of critical care pharmacist in literature

The “Critical Care Safety Study” indicated that adverse events and serious errors were common and potentially life threatening in intensive care (**Rothschild et al., 2005**). Awareness of the potential seriousness of medication errors (MEs) in ICUs is also evident in the significant variety from many sources of reported rates of MEs. These studies generated from European countries, North America, South America and the Middle East indicate concern to address MEs as well as the establishment of ME rates that can be used to measure the benefit or otherwise of various interventions (**Breeding et al., 2013**).

Clinical pharmacy services in general have been shown to decrease the rate of ADRs and other medication errors by 25%-40%, and clinical pharmacists in the intensive care unit (ICU) can reduce the rate by 60%. Clinical pharmacists in a coronary care unit (CCU) identified medication errors at an alarming frequency (24 medication errors/100 admissions) (**Milfred-Laforest et al., 2013**).

There are many potential drug-drug interactions (PDDIs) with high perceived relevance in the ICU that appear to require attention and follow-up. A recent study concludes that PDDIs occurred in 11% of admissions to the general ICU, after limiting analysis to severe and relevant DDI types. The most frequently encountered drug classes were antithrombotic agents and antibacterials for systemic use. Computerized decision support may help reduce the number of PDDIs but needs to be tailored to the environment in which it operates (**Askari et al., 2013**).

Knowing about interactions and their causes may help to avoid them. One study, in which hospital personnel on an intensive care unit were informed of drug interactions by written drug information based on a computerized clinical decision support system, was very successful, reducing the number of interactions from 66% to 54% and the number of unwanted events from 44% to 25% (**Bertsche et al., 2010**). A recent study results show that the implementation of a preventive interventions program by a multidisciplinary team resulted in a significant reduction on the prevalence of patients with medication errors at an adult ICU (**Romero et al., 2013**). Another Jordanian study findings highlighted the importance of the presence of clinical pharmacist in ICU. The results of this study showed a significant reduction in the consumed quantities of drugs and therefore a reduction in the cost of drug therapy (**Aljbouri et al., 2013**).

Implementing a DDI screening procedure results in significantly lower number of important DDI in ICU and shortens length of hospital stay. **Bista et al., (2009)** carried out an interventional study in Nepal to evaluate the impact of educational intervention on the pattern and incidence of (PDDIs) analyzed using Micromedex electronic database. The study concluded that educational interventions can minimize the incidence of DDIs.

Another interventional educational study evaluated the impact of several inservices aimed at educating nursing staff on reducing the drug interaction of

fluoroquinolones with polyvalent-cation supplements. The study showed that educational inservices directed toward nursing staff were successful in significantly reducing the incidence of this drug interaction **(DePestel et al., 2007)**.

Drug-drug interactions

Drug interactions (DIs) represent an important and widely under recognized source of medication errors. Drug-drug interactions are a cause of adverse drug reactions, resulting in adverse outcomes associated with drug therapy **(Bista et al., 2009)**.

Drug-drug interactions, a subclass of preventable medical errors, are particularly concerning because they are associated with an increase in patient morbidity and mortality. The addition of computerized physician order entry (CPOE) to the medication order process is an opportunity to reduce medication errors and improve safety. Clinical decision-support software, a component of CPOE systems, offers physicians guidance on dosing, formulary decision support, duplicate therapy, drug-allergy interactions and drug-drug interactions. Specifically, computerized drug-drug interaction surveillance systems may assist in detecting and preventing clinically significant drug-drug interactions **(Smithburger et al., 2010)**.

Drug-drug interactions represent a significant problem in the prescribing of medications and, as more drugs are released onto the market, the potential number of interactions increases. However, many theoretical drug interactions are not clinically relevant as they do not result in a clinically significant adverse outcome. Certain drug types, such as those with a low therapeutic index, and certain patient characteristics, including increased age or renal impairment, can increase the potential for clinically relevant adverse outcomes. With an ageing population, more polypharmacy and an increase in the number of people taking alternative therapies, there is an increasing potential for drug interactions and a growing need for clinical vigilance, surveillance and reporting **(Brewer and Williams, 2012)**.