European Journal of Internal Medicine 24 (2013) 227–233

Contents lists available at SciVerse ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Original article

Evaluation of clinical pharmacist's interventions in an infectious diseases ward and impact on patient's direct medication cost

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ARTICLE INFO

Article history:
Received 7 October 2012
Received in revised form 14 November 2012
Accepted 21 November 2012
Available online 12 December 2012

Keywords:
Clinical pharmacy
Medication error
Internal ward
Cost

ABSTRACT

Background: A clinical pharmacist is a key member of the antimicrobial multidisciplinary team involved in patients' pharmacotherapy monitoring. The aim of this study was to determine the frequency and type of medication errors, the type of clinical pharmacy interventions, acceptance of pharmacist interventions by health-care provider team, nursing staff satisfaction with clinical pharmacy services, and the probable impact of clinical pharmacy interventions on decreasing direct medication costs at an infectious diseases ward in Iran.
Methods: All clinical pharmacist interventions such as preventing medication errors were recorded in a previously designed pharmacotherapy monitoring forms. Direct medication cost of patients admitted during the study period was compared with that of subjects hospitalized at the same ward during the year before the intervention period to determine the impact of clinical pharmacy interventions on direct medication costs.
Results: The 3 most frequent medication error types were incorrect dose (35.5%), omission error (24.3%), and incorrect medication (14.3%). The mean number of clinical pharmacist intervention per patient was 3.2. Forty percent of clinical pharmacists' interventions are moderate to major clinical significant. Thirty nine percent of clinical pharmacist's interventions had moderate to major financial benefits in present study. The direct medication cost per patient was decreased about 3.8% following clinical pharmacist's interventions.
Conclusion: Our data demonstrated that incorrect dose was the most frequent medication error in the infectious diseases ward. Major portion of clinical pharmacist interventions were accepted by physicians and nursing staff. Clinical pharmacist interventions non-significantly decreased the direct medication cost of patients.

1. Introduction

Medication errors can be defined as "a failure in the treatment process that leads to, or has the potential to lead to harm to the patient [1]." It may occur at different stages of medication use process including manufacturing or compounding, prescribing, transcribing, dispensing, administration, and the subsequent monitoring of medication effects [2]. According to landmark 2006 report from the Institute of Medicine, medication errors injure 1.5 million Americans each year and cost $3.5 billion [3]. Studies of adverse events have demonstrated that they occur in approximately 4% to 14% of hospital admissions and that 50% to 70% are due to preventable errors [4].

Clinical pharmacists are a key member of health-care provider team that contributes significantly in preventing medication errors [5]. Mialon et al. reported an 80% reduction in medication errors and a projected cost saving of over $800,000 annually after implementing clinical pharmacy services at an emergency department of Children's Medical Center in Dallas, Texas [6]. Participation of a clinical pharmacist in the daily rounds of a general medicine unit reduced the rate of preventable adverse drug events by 78% [7]. A study by Weant et al. at a neurosurgical setting in a university hospital in the United States implicated that clinical pharmacist interventions resulted in a total annual pharmacy and intravenous therapy savings of $859,130 and $1,626,565 to the hospital and patients, respectively [8]. Implementing a rational antibiotic prescription program by a multidisciplinary steering committee comprising a pharmacist from 1997 to 2000 in a 600-bed teaching hospital in France resulted in a significant decrease in the cost of antimicrobials per inpatient day (from $13.8 in 1997 to $11 in 2000, $P<0.001$) as well as the prevalence of Enterobacteriaceae producing extended-spectrum beta-lactamases (from 12.5% in 1997 to 3.6% in 2000, $P<0.001$) [9]. A case–control study by Pasquale et al. in a 963-bed network spread over 3 sites in the United States assessed the interventions of a pharmacist–physician antibiotic support team in switching levofloxacin from intravenous to oral in community-acquired pneumonia between March and November 2000. They demonstrated fewer days of intravenous levofloxacin therapy in cases compared with controls (1.6 days vs. 2.9 days; $P<0.005$). Length of stay was 0.4 days less for cases compared with controls; however, this decrease did not statistically significant ($P=0.4$). Interventions were associated with an overall estimated cost savings of $124,480 [10].

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0953-6205/$ – see front matter
http://dx.doi.org/10.1016/j.ejim.2012.11.014

Due to undeniable role of clinical pharmacists in decreasing medication error and cost saving, studies considering different aspects of clinical pharmacist interventions in hospitalized patients have been at the center of attention and interest during the last few years. The aims of the present study were to determine the frequency and type of medication error and the role of clinical pharmacist in detecting and preventing them; assess the type of clinical pharmacy interventions and their acceptance by health-care provider team; evaluate nursing staff satisfaction with clinical pharmacy services; and investigate the probable impact of clinical pharmacy interventions on decreasing direct medication costs at an infectious diseases ward in Iran. To the best of our knowledge, no study has been performed in Iran so far to evaluate the effect of clinical pharmacy services on medication costs. Infectious diseases ward of our hospital was selected for this survey because it is a referral center for various infectious diseases in Iran and different clinical pharmacist services have been offered in this ward in recent years.

2. Methods

This prospective, interventional study was performed during a 1-year period from early September 2010 to early September 2011 at 60-bed infectious diseases ward of Imam Hospital, a multispecialty health care university setting in Tehran, Iran. The Institutional Review Board (IRB) and the Medical Ethics Committee of the hospital approved the study.

During the study period, all patients admitted to infectious diseases ward were recruited. In pre-interventional phase of the study (before early September 2010) medication errors were extracted retrospectively from the patients' medical charts. In post interventional phase of the study (from early September 2010 to early September 2011), detection of medication errors was based on daily reviewing of patient medical files by clinical pharmacists (1 attending and at least 2 residents rotated on a bi-monthly basis). In the pre-interventional phase, the clinical pharmacists focused on drug information programs' education for health care providers (physicians, nurses and medical students) in the wards. After this date, the clinical pharmacists are responsible for the patients' medical chart review and were allowed for providing direct intervention (after confirmation by responsible physician) with respect to prevention and management of medication errors and drug related adverse reactions. Classification of medication error was based on Pharmaceutical Care Network Europe Foundation definitions [11]. The rate of medication errors was calculated by dividing the number of detected errors by the number of patients.

All clinical pharmacy interventions such as preventing medication error were recorded by clinical pharmacists in a previously designed pharmacotherapy monitoring forms. Data on pharmacotherapy monitoring forms include patient demographics (age, sex, weight), chief complaint, admission (primary) and final diagnosis, admission date, past medical and drug history, antimicrobial and non-antimicrobial medications (name, dosage form, dose, frequency and route of administration), clinical and paraclinical data (e.g. renal and liver function tests, serum electrolytes, or complete blood count), and number as well as type of clinical pharmacy intervention. The acceptance of each clinical pharmacy intervention by other health care provider team including nurses and physicians was also registered by clinical pharmacists. Clinical significance of clinical pharmacy interventions was evaluated according to the guideline of Society of Hospital Pharmacy of Australia [12] by an independent (senior) clinical pharmacist and a physician from another ward to reduce probable bias. No considerable disagreements (6.4%) between clinical pharmacist and physician were observed. For these situations, the physician recommendations were considered for analysis.

Interventions regarding medication errors that may caused no patients' harm or injuries, minor injuries or minor treatment required or no increase length of stay or re-admission, major temporary injury or increased length of stay or re-admission or cancelation or delay in planned treatment/procedure, major permanent injury or increased length of stay or re-admission or morbidity at discharge and death or large financial loss were considered clinically insignificant, minor, moderate, major and life saving interventions respectively.

To assess nursing staff satisfaction with clinical pharmacist services at the infectious diseases ward, an 8-item questionnaire was designed and distributed to them at the end of the study (September 2011). The 8 items of the questionnaire included: (1) regular presence of clinical pharmacists in the ward; and clinical pharmacist impact on (2) decreasing medication error; (3) decreasing nursing work load; (4) increasing nursing staff drug information; (5) preventing adverse drug reactions; (6) decreasing treatment costs; (7) patient education; and (8) nursing education about preparation, storage, and administration of parenteral medications. A 4-point scale (0, 25, 50, 75 and 100) was used for each item of the questionnaire. The reliability of the questionnaire was evaluated by the pretest–posttest design. Formal and content validity of the questionnaire was evaluated by expert clinical pharmacists. Internal consistency reliability was tested by finding the Cronbach's alpha coefficient for all the survey items on a sample consisting of 10 randomly selected non-infectious diseases wards nurses. Test–retest reliability was evaluated by finding the Intra-Cluster correlation on the same sample after a week. Based on the findings, content modification of the questionnaire items were applied and the finalized questionnaire was employed, in order to collect data from the major sample.

Data regarding patient medication costs in the infectious diseases ward were obtained from patient drug charge list in the central pharmacy of the hospital. For hospitalized patients, only 10% of patient's drug charges are billed by patient itself and 90% of the remaining charge are supported by insurers companies and governmental supports. Direct medication cost of patients admitted during the study period was compared with that of subjects hospitalized at the same ward during the year before starting the study (from early September 2009 to early September 2010) to determine the impact of clinical pharmacy interventions on direct medication costs. Previously-described criteria were used to assess the economic significance of clinical pharmacy measurements during the study period [13].

Interventions such as changing intravenous heparin for deep vein thrombosis prophylaxis to the subcutaneous route that was only change of route of drug administration (but not dose or duration) was considered with no financial loss. Interventions that lead to discontinuation of an unnecessary drug such as discontinuation of naproxen in a patient who was under treatment with diclofenac were categorized as minor financial loss. Interventions that prevent of patient's organ damage such as adjustment of gentamicin dose in a patient with creatinine clearance of less than 30 ml per minute were considered as potential for financial loss and interventions that prevent serious damage that can cause permanent disability or death of patient such as starting heparin concomitant with warfarin in a patient experienced mitral valve replacement surgery following bacterial endocarditis were considered as potential for significant financial loss.

2.1. Statistical analysis

Categorical variables were expressed as percentage. Continuous data were reported as mean ± standard deviation (SD). Regarding receiving clinical pharmacist services, patients were classified as pre- and post-implementation groups. Statistical Package for the Social Sciences (SPSS) version 11.5 (SPSS Inc., Chicago, IL, USA) was used for descriptive statistical analysis.

3. Results

The demographic, clinical characteristics, medication error, and direct medication cost of pre- and post-intervention groups are demonstrated in Table 1.