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Medication reconciliation at admission to surgical departments: A study at Jericho hospital

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Declaration

I certify that this thesis submitted for the degree of masters, is the result of my own research, except where otherwise acknowledged and that this thesis –or any part of the same material- has not been submitted for a higher degree to any other university or institution.

Signature: .....

Mohammed Ibrahim "Mohammed Rasheed" Attili

Date: March 18, 2018

Dedication

To my strong beloved woman "Ghada" with whom I am a successful man…

To my parents… whose decisions in life changed not only their future but mine as well…

Who always encouraged me to go on every adventure especially this one….

To my men .. Kareem and Karam

To my friends…..

I'll be forever thankful

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Abstract

Background: Adverse Drug Events (ADEs) at care transition expose patients to susceptible harm. Lack of medication reconciliation is a major factor leading to ADEs. It is highly important to apply medication reconciliation at care transitions to minimize medication discrepancies and reduce medication errors. Some patients are at higher risk due to medication errors: those with chronic diseases and poly-pharmacy, elder patients, those with other co-morbid factors and patients who are admitted to certain surgical procedure.

Aim: The study aims to assess prevalence and factors associated with medication discrepancies at admission to surgical operation in hospitals using the Electronic Medical Record (EMR) system and to analyze the factors associated with medication discrepancies.

Method: A prospective cross-sectional observational design was employed. The study was done in Jericho Governmental Hospital. The inclusion criteria was all patients who were aged ≥18 years old, who were admitted for any surgical operation in the hospital at least for 24 hours and underwent major surgery. Data were collected in the period between the middle of July to the end of September, 2016, over a period of 75 days. All patients who were admitted to surgical operation and met the criteria were included.

Findings: A total of 145 patients who satisfy the criteria were included, 19.3% of them had at least one medication discrepancy, 93% of these discrepancies were unintentional. Moreover, 93% of the discrepancies were omission of certain medication at time of admission, 20.7% of discrepancies occurred in patients taking 1-2 medications prior to admission and 7.6% in patients taking 3 or more medications. Logistic regression showed significant association between medication discrepancy and having a chronic disease

(Exp(B) = 12.910, P <0.001), and with the number of medication consumed prior to admission (Exp (B) = 23.953, P <0.001).

Conclusion:

The risk of medication discrepancy was higher in patients with chronic disease and poly-pharmacy. The most frequent medication discrepancy was omission of certain medication consumed prior to admission. Therefore, medication reconciliation should be carried out for susceptible patients who have chronic diseases or consuming medication regularly at time of admission. Moreover, medication discrepancies may occur at any care transition other than admission, so it is highly important to perform medication reconciliation at any care transition.

التسويات الدوائية للمرضى المدخلين للاقسام الجراحية: دراسة في مستشفى اريحا

اعداد: محمد ابراهيم "محمد رشيد" عتيلي

اشراف: د. معتصم حمدان

ملخص الدراسة

خلفية الدراسة: الاعراض العكسية للادوية التي تحدث عند انتقال المريض من مستوى خدمة لاخر تعرض المرضى لخطر دوائي محتمل. يعتبر غياب التسويات الدوائية عاملا رئيسيا في حدوث هذة الاعراض. ولذلك هناك ضرورة كبيرة لتطبيق التسويات الدوائية للتقليل من حدوث الفروقات الدوائية لدى المرضى والحد من حدوث الاخطاء الدوائية. بعض المرضى معرضين اكثر من غيرهم للاخطاء الدوائية: اولئك الذين يعانون من امراض مزمنة ويتناولون مجموعة من الادوية، المرضى المسنين، المرضى الذين يعانون من مجموعة مشاكل صحية تساهم في زيادة الخطورة على حياتهم والمرضى الذين يدخلون من اجل التدخل الجراحي لعلاجهم.

هدف الدراسة: تهدف هذه الدراسة لتقييم مدى انتشار الفروقات الدوائية لدى المرضى المدخلين لاجراء تدخل جراحي وتحديد العوامل التي قد تساهم في حدوث مثل هذه الفروقات في المستشفيات التي تستخدم نظام الملفات الطبية الالكتروني المحوسبولتحليل العلاقة بين الفروقات الدوائية والعوامل المؤثرة.

المنهجية: اعتمدت الدراسة منهجية الوصف التحليلي. اجريت الدراسة في مستشفى اريحا الحكومي. اعتمدت المواصفات التالية لادخال المرضى في الدراسة: ان يكون عمر المريض 18 سنة او اكثر، ان يكون المريض مدخلا لاي تدخل جراحي لمدة 24 ساعة على الاقل وان يكون التدخل الجراحي تدخلا جراحيا رئيسيا. تم جمع البيانات في الفترة الواقعة بين منتصف تموز 2016 وحتى نهاية شهر ايلول 2016 لمدة 75 يوم. كل المرضى الذين شملتهم الدراسة استوفوا شروط الادخال المحددة لاجراء الدراسة.

النتائج: شملت الدراسة 145 مريضا استوفوا الشروط اللازمة. 19.3% من هؤلاء المرضى حدث لديهم فرق دوائي واحد على الاقل، 93% من هذه الفروقات كانت بشكل غير مدرك من قبل الطبيب. اضافة الى ذلك، 93% من هذه الفروقات صنفت كحذف احدى الادوية التي يتناولها المريض وقت الادخال. 20.7% من هذه الفروقات حدثت لدى لمرضى الذين يتناولون دواء واحد او دوائين قبل الادخال و 7.6% حدثت لدى المرضى الذين يتناولون 3 ادوية فاكثر.

اثناء تحليل البيانات باستخدام الانحدار اللوجيستي ظهر هناك علاقة واضحة ومهمة بين الفروقات الدوائية التي تحدث ووجود مرض مزمن لدى المريض وكذلك مع عدد الادوية التي ($P<0.001$).وقت ادخال المريض لاقسام الجراحة يتناولها المريض قبل الادخال

الخلاصة: يزداد خطر حدوث الفروقات الدوائية في حال وجود امراض مزمنة لدى المريض ولدى المرضى الذين يتناولون كميات اكبر من الادوية عند الدخول للعمليات الجراحية. الغالبية العظمى من هذه الفروقات كانت حذف احدى الادوية التي يتناولها المريض قبل الادخال. وبذلك فان تطبيق التسويات الدوائية يجب ان يطبق للمرضى الاكثر عرضة لهذه الفروقات خصوصا الذين يعانون من امراض مزمنة ويتناولون عدة ادوية بشكل منتظم يوميا. علاوة على ذلك، الفروقات الدوائية تحدث عند اي انتقال للمريض من مستوى خدمة طبية الى اخر وليس فقط وقت الدخول للمستشفى، وبناء عليه ينصح بتطبيق لبتسويات الدوائية عند اي لحظة انتقال للمريض.

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List of abbreviations

ADEs	Adverse Drug Events
EMR	Electronic Medical Record
CPOE	Computerized Physician Order Entry
BPMH	Best Possible Medication History
BPMDP	Best Possible Medication Discharge Plan
NPSG	National Patients Safety Goals
JCI	Joint Commission International
JCAHO	Joint Commission international on Accreditation of Healthcare Organizations
PAHO	Pan American Health Organization
IHI	Institute for Healthcare Improvement
MoH	Ministry of Health
SOPs	Standard Operation Procedures
Res	Reconciliation Errors
TJC	The Joint Commission
WHO	World Health Organization
US	United States
AMO	Admission Medication Orders
PHC	Public Health Care
NCC MERP	National Coordination Council for Medication Error Reporting and Prevention
ENT	Ear, Nose and Throught
OTC	Over The Counter
PRN	When Needed

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Chapter one

Introduction

1.1 Background

Medication errors are common at transition of care. Adverse Drug Events (ADEs) are the most common medication errors at care transition. Care transition occur when the patient is admitted to the hospital from emergency department, transferred from one level of care to another level or discharged from hospital. At the point of care transition medication discrepancies occur and lead to ADEs (Sullivan et al., 2005).

Incomplete medication history at time of admission contributes to Up to 27% of all hospital prescribing errors (Dobrzanski et al., 2002). An interest about identification and correction of medication discrepancies and errors at the time of admission is growing among healthcare safety practices (medication reconciliation).

At the time of hospital admission, accurate medication histories are considered important part of medication safety. First, they may reveal reasons for adverse drug events. Second, errors in me11dication history can lead to inappropriate drug therapy during hospital stay. Third, computerized physician order entry (CPOE) systems may be unable to detect errors. For example, CPOE systems would not be capable of detecting unintentional omissions of medications taken before admission without coded databases about previous medications consumed by patients.

Medication Reconciliation is designed to prevent medication discrepancies at care transition, and thus minimize ADEs. Medication reconciliation is a process by which a

complete medication history is documented at any care transition, forming a list of all medication, and then the mediation history is compared with the admission medication orders and discharge order list. The core of medication reconciliation is collecting the Best Possible Medication History (BPMH) at admission and preparing the Best Possible Medication Discharge Plan (BPMDP) at discharge (Ketchum et al,. 2005).

Medication reconciliation should take place at any level of care transition. Physicians, nurses and pharmacists are responsible for collecting the BPMH. Many researches indicated that clinical pharmacists are highly encouraged to be responsible for the process of medication reconciliation (NPSG, 2006).

The Joint Commission international (JCI) on Accreditation of Healthcare Organizations (JCAHO) defines medication reconciliation as "the process of comparing a patient's medication orders to all of the medications that the patient has been taking". This reconciliation is done to avoid medication errors such as omissions, duplications, dosing errors, or drug interactions. At each transition of care in which new medications are ordered or existing orders are rewritten medication reconciliation should be performed. Transitions in care include changes in setting, service, practitioner or level of care (NPSG, 2006).

1.2 Problem statement

Based on the above information, about medication reconciliation at hospital admissions assessment of outcomes and risk factors for medication discrepancies, and the impact of their use on human health care, the researcher studied the risk factors for medication discrepancies at hospital admission.

ADE in patients at care transition exposes patients to susceptible harm. Lack of medication reconciliation is a major factor that can lead to these ADE. It is very important to apply medication reconciliation at care transitions to minimize medication discrepancies and reduce medication errors. Some patients are at higher risk due to medication errors: those with chronic diseases and those consuming more than one medication, elder patients, those with other co-morbid factors, and patients who are admitted to certain surgical procedure where the focus is on the surgical intervention. Many factors contribute to the absence of medication reconciliation in health organizations. These factors include: absence of organization buy-in and leadership, absence of Standard Operation Procedures (SOPs), absence of patient's engagement in the process and low awareness of medical staff about medication reconciliation

1.3 Justification of the study

Most health care facilities today are operating with limited resources, including financial and staffing limitations. A sound project plan helps to identify roles, responsibilities, and staff resources. A strong business case outlines the financial incentives for the facility.

Examples of two models to calculate potential gross savings of a newly designed or improved medication reconciliation process are provided. Specifically, the first model demonstrates a cost benefit analysis of reducing preventable adverse drug events (ADEs); the second model demonstrates a cost benefit analysis of the use of pharmacists or other staff to perform medication reconciliation.

Jericho Hospital was chosen as example of MoH hospitals to be the target of this study since that MoH is the main provider for secondary health services (45% of total hospitals

with 1579 beds and 204527 admissions). Moreover, MoH operates 63.1% of general hospitals beds and 43.4% of specialized hospitals beds. In addition to that, the MoH runs specialization residency program.

1.4 Significance

In some countries 67% of admitted patients encounter at least one or more discrepancies occur on admission, transfer and discharge (Sullivan et al, 2005). Medication discrepancies are due to omission or commission of some medications and vary in their level and severity (Sullivan et al., 2005). Although most of these discrepancies are harmless and few are harmful, some of the ADEs caused by medication discrepancies are fatal.

Medication reconciliation is being considered as a solution to decrease ADEs and minimize medication errors. Hospital-based medication reconciliation practices have been adopted as a patient safety solution by the World Health Organization (WHO) in the World Alliance for Patient Safety launched by Pan American Health Organization (PAHO).

The report of Institute of Medicine entitled ‘‘to err is Human: Building a Safer Health System’’, published in 2000, stressed the significant health and economic consequences that drug adverse events and medication errors cause in the healthcare settings. Medication Reconciliation is one of the Joint Commission’s National Patient Safety Goal and the WHO high 5s project to enhance patient’s safety by minimizing medication errors (NPSG, 2006). The Institute for Healthcare Improvement (IHI) (in the United States) and Safer Healthcare Now (in Canada) have made medication reconciliation a top priority.

In Palestine, patient safety has been considered the heart of healthcare quality. The growing complexity of healthcare systems and the evidence of incidents that harm patients show the need to make healthcare safer in Palestinian hospitals.

A study by Hamdan about assessment of patient safety culture in Palestinian public hospitals in 2013 concluded that implementation of quality improvement strategies; including accreditation in hospitals is positively associated with patient safety. The Palestinian public hospitals survey results reveal that staff feels less positive toward patient safety culture within their organization. Several dimensions of patient safety culture need to be improved, especially those related to developing effective incident reporting system and establishing a non-punitive culture, allocating more staff and adequate work hours and ensuring hospital management support for patient safety. The survey should be repeated after implementation of appropriate interventions to monitor improvements in patient safety culture in these hospitals (Hamdan, 2013)

A study in Palestine by Najjar in 2015 emphasized the idea that a more positive patient safety culture is associated with lower adverse events in hospitals at the departmental levels. Further analysis should include a more representative sample to examine the causal relationship between patient safety culture and adverse events incidents. The results showed that, as expected, relationships exist between safety culture and the rate of adverse events at departmental level. Almost all of the relationships tested were in the expected direction. Eight (57 %) of the 15 relationships were statistically significant ($p < 0.05$, $p < 0.01$), indicating that departments with a more positive patient safety culture had lower rates of adverse events in their department (Najjar S. et al, 2015).

1.5 Aim and objectives

1.5.1 General objective

To assess prevalence and factors associated with medication discrepancies at admission to surgical operations in a hospital using the Electronic Medical Record (EMR) system.

1.5.2 Specific objectives

- To determine the prevalence of medication discrepancies at admission to the hospital surgical operation
- To determine the type of reconciliation error caused by discrepancies.
- To analyze the factors (patient and organizational) that might be associated with medication discrepancies
- To correlate medication discrepancies outcomes to the independent variables.

1.6 Limitation of the study

The main limitations of the study are those related to the patient including

1- Lack of comprehensive and integrated health information system

2- Potential recall bias, where the patient is unable to remember certain medications

3- Inability of the patient or family member to identify the name, dose and frequency of certain medications.

4- Patient's possible reluctance to report certain medications ex. Those medications related to sexual dysfunction.

Chapter Two

Literature review

2.1 Introduction

A review of the literature identified implementing a medication reconciliation system can substantially decrease the number of medication errors that occur at the interfaces of patient care and therefore increase patient safety. The main core topics discussed in this chapter provide a foundation for this research are patient safety, medication reconciliation and medication discrepancies.

The first topic of the literature review is an inquiry into patient safety as it pertains to medication safety. Although, this topic is not new by any means, it is important to understand the history and dynamics of why healthcare has come to focus strongly on the patient safety movement and specifically on medication safety in the past decade. This review identifies patient safety issues related to adverse drug events or medication errors, identifies the deficits in the medication process, and establishes the need for a medication reconciliation system.

The second topic examines how a medication reconciliation system enhances patient safety. It builds a case for medication reconciliation, discusses the positives and negatives of such a system along with lessons learned in hospitals that have implemented such a system. The implementation of a medication reconciliation system will need the collaboration of numerous healthcare professionals within the hospital.

2.2 Patient safety as it pertains to medication safety

Healthcare professionals are dedicated to providing safe quality care that is evidence-based and of high clinical standards. However, even with the most efficient and conscientious healthcare professional, things can go wrong and mistakes do occur. The International Council of Nurses (2005) identifies every step in patient care in today's complex health system has the potential for error and holds some degree of risk to patient safety. The Canadian Nurses Association (2005) agrees health care systems are prone to error and failure, and the risk of adverse events is significant.

The critical issues of medical errors and patient safety have been moving up the list of priorities not only for healthcare professionals and administrators, but also for the public, the media and policy makers (IHI, 2005).

Kohn, Corrigan & Donaldson published the report "To Err is Human" (2000) to create the catalyst needed for the patient safety movement of today. The report analyzed the available evidence on patient safety and concluded that healthcare is really not as safe as it should be. Wachter (2004) points out that before the report was released, society's mental model for medication errors was directly related to one person's mistake, a way of thinking reinforced by the medical and nursing programs. The culture in healthcare at the time was extremely punitive. It treated errors as moral issues in isolation of other factors, which led only to sporadic reporting. Wachter (2004) concluded the lack of a system's approach in determining the root causes of medication errors placed minimal pressure one executives, educators or policy makers to focus on or invest in patient safety. Residents taking multiple

medications and the complexity of managing those medications make medication reconciliation an important safety issue (TJC, 2012).

Kohn, Corrigan & Donaldson (2000) estimated, "over 770,000 patients are injured and as many as 44,000 to 98,000 patients die as a result of medical errors in hospitals each year and up to 7,000 hospital deaths are directly attributable to preventable medication errors". Several studies in the United Kingdom and Australia provided a clearer picture of the impact of adverse events in their hospitals. The Australian data clearly demonstrated that adverse events in healthcare were a major public health problem (Wilson, Harrison, Gibberd, & Hamilton, 1999). A United Kingdom's pilot study indicated 53% of preventable adverse events occurred in general medical/surgical wards (Vincent, Neale, & Woloshynowych, 2001). Although there is minimal Canadian data on adverse events in hospitalized patients, Hunter & Bains (1999) in their Ontario study found that 16,344 admitted patients suffered an adverse drug reaction and each year 680 or 4.2% of those patients died (p. 35). Beglaryan & Wong (2004) found the per capita rate of adverse events is similar to the US. They suggest adverse drug events claim 5,000 to 10,000 lives every year in Canada. Forster, Asmis, Clark et al. (2004) found 12.7% of admitted patients to an Ottawa teaching hospital suffered an adverse event and that 38% of those were preventable. The released national study of patient safety in Canadian hospitals estimates that 7.5% of adults admitted to hospital experienced one or more adverse events in 2000 and that 37.3% of these were preventable (Baker et al., 2004). Even though this national study suggests care in Canadian hospitals is safe for the vast majority of patients, unfortunately, some patients still experience preventable injuries and complications related to their care.

Clear, standard and common definitions are important factors in the understanding of patient safety, adverse events, medication errors and their impact across the continuum of care. The definitions and the interpretations of these issues fluctuate depending on the study or the focus of the research. The following definitions most accurately reflect the concept of patient safety and adverse events in the healthcare environment that is the subject of this research.

The Canadian Patient Safety Dictionary (2003) defines patient safety as, "the reduction and mitigation of unsafe acts within the health care system, as well as through the use of best practices shown to lead to optimal patient outcomes". The Disease Management Association of America (as cited in Bennett, 2005) also defines patient safety as "...the prevention of harm to patients ...., with the aim to reduce errors of commission or omission". The Institute of Medicine (1999) definition of patient safety encompasses the processes that protect patients from injury caused by medical mismanagement. Fundamentally, patient safety is about continually working towards avoiding, managing and treating unsafe acts within the healthcare system (Health Canada& Patient Safety Fact Sheet, 2004).

2.3 Adverse drug events and medication discrepancies

Adverse events are "unintended injuries or complications to a patient caused by health care management, rather than by the patient's underlying disease, which prolongs the hospitalization and/or produces disability at the time of discharge" (Baker et al., 2004). Medication errors remain one of the most costly medical errors, often resulting in patient death (TJC, 2012).

The Agency for Healthcare Research & Quality (2005) defines an adverse drug event as "an adverse event involving medication use" (Para 3). Furthermore, Runciman, Roughead, Semple & Adams (2003) believe that adverse drug events "encompass both harm that results from the intrinsic nature of a medication as well as harm that results from medication errors associated with the manufacture, distribution, or use of medicines including those that result from under-use of medicines or failure to prescribe a medicine when indicated". The most common type of adverse event is an adverse drug event or a medication error which is an injury resulting from medical intervention related to a drug (Hughes & Ortiz, 2005). Examples of adverse drug events include wrong dose, wrong drug, wrong technique, wrong patient, wrong time, and wrong route, faulty of drug distribution systems, verbal and written miscommunications and poor packaging and labeling of medications.

The literature on patient safety and adverse drug events make reference to 'active' and 'latent' failures. Beglaryan & Wong (2004) and Reason (2000) define active failures as unsafe acts that are committed by healthcare professionals who are in direct contact with the patient or the system, such as picking up the wrong syringe or misreading instructions. Latent failures are weaknesses of a system to identify and catch adverse events before they cause harm. These systems weaknesses include heavy workloads, stressful environments and inadequate communication. By themselves latent failures are often quite subtle but when combined with active failures can result in catastrophic adverse events (Reason, 2000).

Kohn et al. (2000) agree many adverse drug events or medication errors are system-related and not attributable to individual negligence or misconduct. Research shows between 80

and 200 steps may be associated with the administration of a single dose of medication in an acute care setting, beginning when the physician prescribes the medication, to when the pharmacy dispenses it to, and to when the nurse administers it to the patient. Sullivan, Gleason, Rooney, Groszek & Barnard (2005) agree the medication process is multifaceted and involves all disciplines: physician (prescriber), pharmacist (verification, preparation and dispensing), nurse (validation, administration and monitoring) and patient (receiver of the medication).

As healthcare delivery systems become more complex, the potential for adverse drug events and medication errors increases. Rozich & Resar (2001) found there are certain points of care or interfaces in which medication errors tend to happen more frequently. They found that approximately 60% of errors occurred when patients were admitted, transferred to another ward or discharged. Cornish and Gleason also found in their literature reviews that variances between medications patients were taking prior to admission and their admission orders ranged from 30-70% and the most common discrepancy cited was the unintentional omission of a home medication. As well, according to IHI (2005), poor communication of medical information at transition points is responsible for as many as 50% of all medication errors and up to 20% of adverse drug events in hospitals. Forster, Shojania & Van Walraven (2005) similarly found that over12% of patients experienced an adverse drug event within 2 weeks of discharge.

This confirms that adverse events and mistakes happen across the entire continuum of care and a systems design is needed to minimize the incidence of mistakes and enhance patient safety.

In designing a systems approach to medication safety, the challenges faced by organizations include: no clear ownership of the medication process, no standardized guidelines on how to obtain a medication history, competing demands for time that may result in the medication history being given a low priority, lack of knowledge and understanding by front-line staff of the importance of obtaining an accurate medication history. As well, there are many situations where patients are poor or not in a position to list the names of their home medications (Safer Healthcare Now, 2005b).

The study of Sullivan et al. 2005 revealed discrepancies between medication histories and documented orders on more than half of the patients. Medications omitted by the prescriber accounted for more than 40% of the discrepancies requiring intervention. Frequency, dosing, and route of medications accounted for more than 30% of discrepancies (Sullivan et al., 2005).

In healthcare, there is the potential for many safety errors, but medication errors remain the most common. Almost half of medication errors are a result of inadequate medication reconciliation practices (Barnsteiner, 2008). In a pharmacy study evaluating discrepancies and the types of medications involved for patients transitioning from the hospital to the long-term care setting, researchers found that almost 75% of admissions and 21% of medications had medication discrepancies (Martin, 2012).

It is estimated that on average, at least one medication error occurs per hospital patient per day, with at least 1.5 million preventable errors committed annually (National Academy of Sciences, 2006). According to Maanen et al. (2011), the most severe consequences of medication omission or inaccuracy have led to elevated blood pressures, chest pain and

reoccurrence of psychiatric symptoms. Clarification of resident medications is often required as they transition throughout the health care system. Long-term care residents are often transferred to acute care settings or other health care settings creating the possibility for medication discrepancies. In appropriate reconciling of routine medications can lead to inaccurate documentation of medication dosages, routes and indications for use. These discrepancies can lead to implementation of inaccurate medications leading to resident harm.

Medication discrepancies are common at admission to hospital. Patients who are admitted to surgical operations are at high risk of such discrepancies. González et al, 2015 conducted a study that aimed to determine the prevalence of reconciliation errors (REs) at admission to surgery departments. They found that 55.1% had ≥1 RE. Omission of certain medication was the most frequent RE (84.1%). They concluded that patients receiving larger number of drugs before admission are at higher risk to have REs

Hospital admissions can result in many medication errors. Many of these errors are unintended. Cornish et al, 2005 conducted a study on patients who used at least regular prescription medications before they were admitted to hospital. They reported that 53.6% had at least 1 unintended discrepancy. 46.4% of these discrepancies were omission of a regularly used medication. Tam et al, 2005 reviewed previous studies and found that 27%–54% of patients had at least 1 medication history error. 10%– 61% had at least 1 omission error (deletion of a drug used before admission) and that 19%–75% of the discrepancies were unintentional.

When the information is incomplete or inaccurate, there is a gap in the continuity of care and increased risk to the patient. One solution is the medication reconciliation system, a process for collecting and documenting a complete list of each patient's medications on hospital admission and those prescribed during the hospital stay (JCAHO, 2005).

2.4 Medication Reconciliation

Medication reconciliation is defined as the formal process of obtaining a complete and accurate list of each patient's current home medications (including any over-the counter-medications and herbal treatments) and then comparing the physician's admission, transfer and/or discharge orders to that list (IHI, 2005). When any inconsistencies are revealed through this process, they are brought to the physician's attention and if necessary, changes are made to the orders (IHI, 2005; JACHO, 2005; Safer Healthcare Now, 2005b).

Medication reconciliation is seen as the most effective solution for reducing adverse drug events and medication errors (IHI, 2005). It is a process of creating as accurately as possible a list of all the medications a patient is currently taking at home and using this list as a resource as the patient weaves their way through the healthcare system. Reconciling medications involves matching the patient's list of existing medications with the physician's admission, transfer, and discharge orders. Presently, there is no organized way of determining what medications the patient is taking at home and often this information is scattered across numerous forms and places on the patient's hospital chart. The advantages of medication reconciliation include: (a) accurate comparison of home medications to those ordered on admission to hospital, (b) promotion of continuity of care and (c) prevention of medications from being missed from home to hospital. Through the

medication reconciliation process, the healthcare provider obtains the best possible medication history and compares this with admission medication orders.

Each time a patient moves from one care setting to another, staff need to review previous medication orders along with the new orders and plans for care. Prior to discharge, the medications ordered during hospitalization are compared with those ordered for use at home. Discrepancies between the medication history and hospital orders are clarified with the physician. The process is designed in a standardized and systematic manner to ensure complete and accurate reconciliation. Rozich & Resar (2004) reported, "This improvement process promotes seamless communication among the patient's caregivers and appropriate medication therapy to avoid inadvertent duplications or omissions". Therefore the proposed result is that the right patient receives the right medication, in the right dose, at the right time along the continuum of care.

The literature confirms that using a medication reconciliation process at each patient transition point of care can decrease the number of medication errors and more importantly can prevent patient harm. Rozich & Resar (2004) found that a series of interventions in the reconciliation process introduced over a seven-month period successfully decreased the rate of medication errors by 70% and reduced adverse drug events by over 15%. In another study, the utilization of pharmacy technicians to initiate the reconciling process for scheduled surgical patients reduced adverse drug events by 80% within three months of implementation in an American hospital (Michels & Meisel, 2003). Rozich & Resar (2001) believe that a successful reconciling process can also reduce work and re-work of nurses, pharmacists, and physicians associated with the management of medication orders.

During transition of care, inaccurate medication reconciliation is associated with increased risk of adverse events for patients. Older adults are the population most often affected by medication errors, and long-term care facilities struggle to accurately document medication reconciliation. Errors are more common at hospital discharge, but the critical moment for detecting and resolving them is during hospital or long-term care admission (Stover, A. L., 2016).

At the heart of the medication reconciliation system is the development of a tool for reconciling medications at admission, identifying discrepancies, and capturing documentation that will significantly reduce the need for nurses and pharmacists to contact physicians for clarification. A challenge that is faced in many hospitals is the fragmented nature of our health care system (Marriott & Mable, 2002). The sources of information on medications are scattered in a number of different forms and places in the patient chart. Physicians hold some of the information in the patient's chart in their offices, so it is not readily accessible in the hospital. The pharmacists have some information, but only for the prescriptions they have filled. It does not include any over the counter drugs, herbal treatments or adjustments the physician makes to medications that do not require prescription. The patient's hospital record may be incomplete, depending where the care was initiated (ambulatory care, emergency, post-surgery), the patient may not know what they are taking and a single drug may have several different names (chemical name, brand name, generic name). Nurses are often the ones who start the medication process by gathering medical information, the physician writes the orders and the pharmacist often reviews the medication regimen. Although, these tasks are all interdependent and often

conducted in isolation, each healthcare professional must accept accountability and responsibility for their part in the system.

Strong leadership, accountability and commitment are needed in order to move the medication reconciliation system forward. It will require fundamental changes in the way hospitals and healthcare professionals currently work. Nurses, pharmacists and physicians in hospitals must begin to work collaboratively, and silos need to be replaced by interdisciplinary teams. All members of the patient care team need to be involved in the process of medication reconciliation. No single group - nurses, pharmacists or physicians - should be responsible for ensuring that medication reconciliation works (IHI, 2005). Involve staff members early in the change process to help with knowledge transfer and introduction of the tools necessary to sustain the new process.

Dalton et al. (2010) conducted a study at Joseph Medical Center after implementing an improved medication reconciliation document a reduction in discharge medication reconciliation errors was noted from 5% to less than 1%. Three hundred seventy-seven patients were enrolled in a study conducted by Ziaeian, Araujo, Van Ness, & Horwitz, (2012); findings noted that of a total of 22.3% of admission medications were re-dosed or stopped at discharge. Of these, 24.2% were classified as suspected provider errors. Excluding suspected errors, patients had no understanding of 69.3% of re-dosed medications, 81.6% of stopped medications, and 62.0% of new medications. Altogether, 307 patients 81.4% either experienced a provider error or had no understanding of at least one intended medication change. Providers were significantly more likely to make an error on a medication unrelated to the primary diagnosis than on medication related to the primary diagnosis odds ratio 95%, confidence interval 2.65.

Medication reconciliation errors occur across transitions in patient care (Duran-Garcia et al., 2012). "Twenty-two percent of preventable medication reconciliation errors occur during admissions, 66 percent during transitions in care, and 12 percent during discharge" (Santell, 2006). National Priorities Partnership, (2010) estimates that medication errors total nearly $16 billion each year. As of January 1, 2006 the Joint Commission required all hospitals to have a procedure in place for reconciling patient medications across the continuum of care (Wortman, 2008). Of all medication errors in a hospital, 25% in hospitalized patients are caused by a failure to reconcile new prescriptions with ongoing home treatments (Duran-Garcia et al., 2012).

Medication errors continue to exist across all transitions of patient care (Duran-Garcia et al. 2012). Improving patient safety through medication reconciliation is only a small component of endeavors needed to improve the quality of care delivered in long-term care settings. Developing programs and projects designed to promote accuracy in medication reconciliation practices keeps patients safe, improve patient outcomes and reduces health care costs (Wortman, 2008).

2.5. Interdisciplinary Collaboration

The challenge of patient safety in complex environments such as acute care hospitals requires a multi-faceted approach and the involvement of all key stakeholders in the healthcare system (IHI, 2005). Meeting these demands requires health professionals to work in partnership with each other, as well as with other professionals such as risk managers, and with patients in order to provide safe quality care. Since nurses and pharmacists do not have the authority to change medication therapy without a physician's

order, it is essential they work collaboratively with physicians and other allied health professionals to develop a clear understanding of common and diverse issues and goals, while at all times keeping patient safety as the common link. The need for teamwork and collaboration has been clearly established throughout the literature on patient safety (IHI, 2005; JACHO, 2005; Safer Healthcare Now, 2005b).

Katzenbach & Smith (as cited by Penn State University, 2006) define team as, "A small number of people with complementary skills who are committed to a common purpose, performance goals and approach for which they are mutually accountable" (Para 2).

Healthcare organizations are accountable and responsible for creating and maintaining environments in which safety becomes the foundation for all decisions affecting patient care, making it simpler for healthcare providers to do no harm and ensure patient safety. With the launch of the Canadian Patient Safety Institute and the Safer Healthcare Now Campaign, patient safety is now receiving growing and much needed attention (Safer Healthcare Now, 2005a). Orchard, Curran &Kabene (2005) believe that such a shift will move decision-making to the level of practice that can directly impact patient safety. This will require efforts at the individual, team, institutional, educational and government levels to move this collaborative effort forward.

The lack of supporting technology and information systems is a commonly cited barrier to implementing patient safety initiatives, encouraging collaborative processes and system wide restructuring of resources (Bates, 2000; Bayley, Savitz, Rodriquez, Gillanders& Stoner, 2005). The Canadian Coordinating Office for Health Technology Assessment (2004) found "technologies such as computerized provider order entry, clinical decision-

making support tools, automated dispensing, bar codes for drug dispensing and computerized medication administration records all decrease medication error rates" (p. 1). However, technologic tools such as computerized provider order entry are only as accurate as the healthcare workers using them. Bates (2000) confirms "the best medication processes will thus not replace people but will harness the strengths of information technology and allow people to do the things best done by people, such as making complex decisions and communicating with each other".

The advances in telecommunications and information technology will increase the ease of information transfer across different settings and healthcare providers bringing consistency and coordination to the medication process. Clinical information technology will enable workflow changes that streamline medication processes and make it easier for clinical professionals to work together, communicate and share their professional expertise (McKesson Corporation, 2003). This in turn will create opportunities for increased inter-disciplinary collaboration to provide safer, patient care. Clinical information technology will assist to improve the quality of care and medication safety by ensuring a standardized process is being used across the continuum of care (McKesson Corporation, 2003). In addition, these advances will ultimately result insignificant change, assist in knowledge transfer and eventually produce a culture shift in healthcare.

2.6 Summary

Providing safe and high quality care to patients is an increasing priority across all levels of healthcare, and government systems. Adverse drug events or medication errors are a complex issue and can occur as a result of variety of factors within the healthcare system.

The majority of adverse events or medication errors result from unsafe systems rather than individual incompetence.

Medication reconciliation is identified as the most effective solution for reducing the number of medication errors at each transition point as the patient moves across the continuum of care (IHI, 2005; Safer Healthcare Now, 2005b). Reconciling medications is a systematic process that develops an up-to-date, medication profile for all healthcare providers' reference during patient's admission, transfer and discharge while in hospital. Any discrepancies or inconsistencies found by comparing this profile against the physicians written admission orders are brought to the attention of the physician.

Medication reconciliation along with good communication, shared decision-making involving an interdisciplinary team and the patient is crucial to preventing adverse drug events. Adverse drug events and medication errors in acute care facilities are common, costly and often preventable (IHI, 2005; Safer Healthcare Now, 2005b). Medication safety is a complex issue, although many healthcare professionals with responsibility for medication safety improvements have experiences with different phases of the medication process, rarely have they been brought together to establish a comprehensive medication safety process which covers the continuum of care. Medication reconciliation has been identified as a key factor in promoting patient safety and reducing medication errors as patients move from one level of care to another.

Chapter 3

Conceptual framework

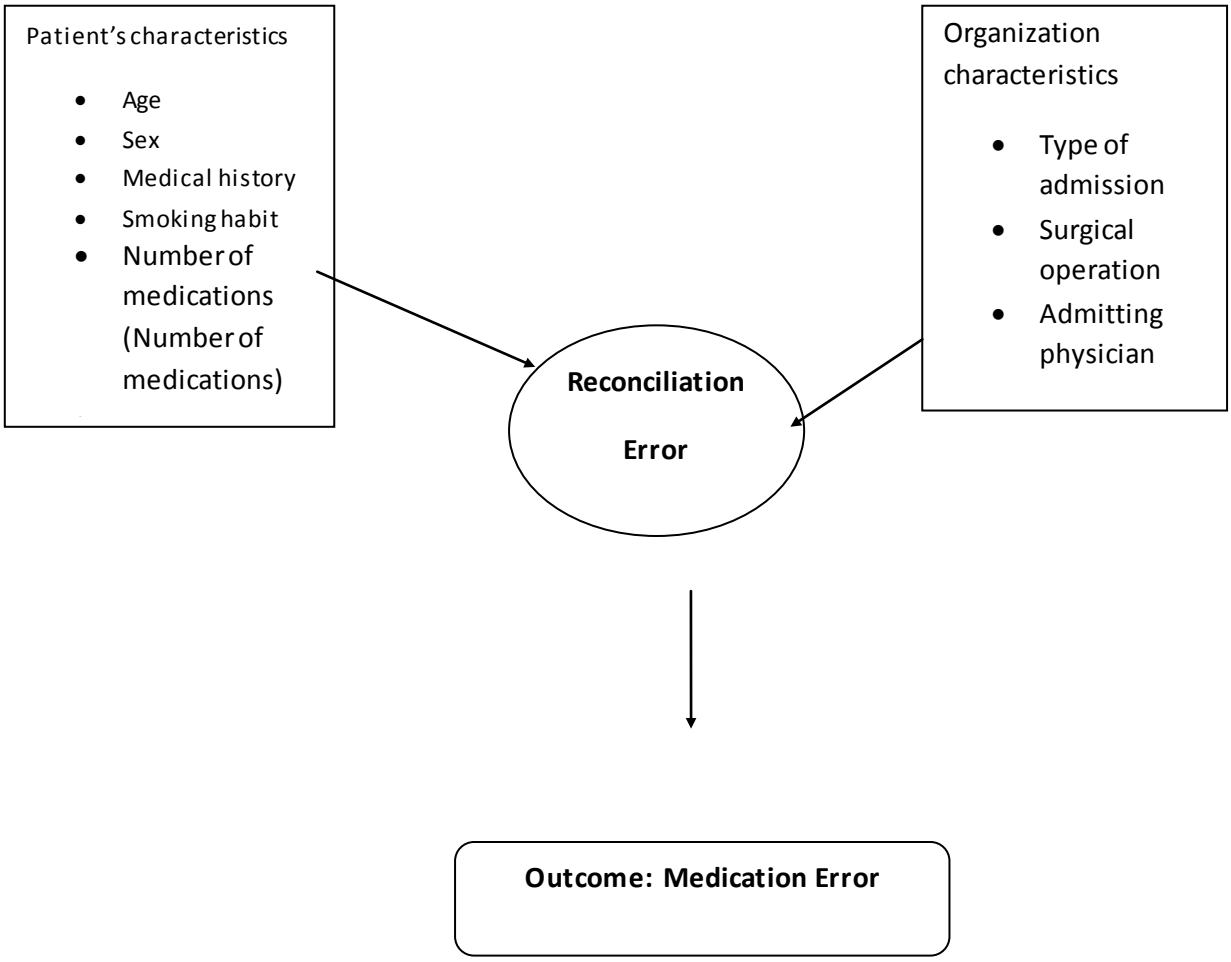
3.1 Theoretical framework of the study

Medication reconciliation is defined as " the process of creating the most accurate list possible of all medications a patient is taking — including drug name, dosage, frequency, and route — and comparing that list against the physician's admission, transfer, and/or discharge orders, with the goal of providing correct medications to the patient at all transition points within the hospital" (IHI).

3.2 Conceptual framework of the study

As show in figure 3.1 the dependent variable is the reconciliation errors (REs) that will be detected during the reconciliation process by the pharmacist. REs will be communicated to the responsible provider (physician) to identify its type whether it is intentional or unintentional. The attributable factors will be those factors related either to the patient: age, sex and medical history, smoking habit and number of medications, or those related to the characteristics of the organization: type of admission (emergency or planned), surgical operation and admitting physician (resident or specialist).

Figure 3.1 Conceptual framework



3.3 Conceptual definitions

Discrepancies– "Any difference between the chronic medication consumed before hospital admission and the medication prescribed in hospital" (González-García et al 2015). Joint Commission on Accreditation of Healthcare Organizations classified these discrepancies, and Delgado Sanchez considered discrepancies that were not justified by the attending physician as Reconciliation Errors (Sanchez 200).

Number of medications: the number of many drugs that are administered to t or consumed by patient at the same time

Intentional discrepancy – "Any intended difference in patient's medication made by the provider and documented in the patient's EMR"

Unintentional discrepancy – "Any difference that was made in patient's medication and not intended by the provider or intended but not documented"

3.4. Operational definitions

3.4.1. Dependent variable: includes the medication discrepancies (intentional and unintentional)

3.4.2. Independent variables:

- **Patient's characteristics:**
  - Gender (Male / Female)
  - Age (15-30, 31-50, 51-83)
  - Past medical history

- **Type of surgery**
  - General
  - Urology
  - Orthopedic
  - ENT
  - Obstetrics and Gynecology
- **Type of admission**
  - Emergency
  - Planned
- **Provider characteristics**
  - Specialist
  - Resident
- **Previous chronic disease**
  - No chronic disease
  - At least one chronic disease
- **Number of medications**
  - No medications
  - 1-2 medications
  - ≥ 3 medications

- **Discrepancy type**
  - None
  - Intentional
  - Non-intentional
  - Both
- **Medication error**
  - Omission of a pre-admission prescription medication
  - Incorrect addition of a medication not part of the patient's pre-admission regimen (commission)
  - Different dose
  - Different route
  - Different frequency
  - Different medication (within the same drug class)

Chapter Four

Methodology

4.1 Introduction

The study aims to assess prevalence and factors associated with medication discrepancies at admission to surgical operation in a hospital using the Electronic Medical Record (EMR) system, to identify the type (intentional or unintentional) of these discrepancies and to analyze the factors (care provider, patient, and organizational) that might be associated with medication discrepancies

4.2 Study design

A prospective cross-sectional observational design was employed. Patients studied when they were admitted to any surgical operation in the hospital over a period of time. A pharmacist was involved in applying medication reconciliation standard operation procedures (SOPs) within the first 24 hours of patient's admission and through the period of stay in the hospital until discharge. The pharmacist collected the best possible medication history (BPMH) and compared it with the admission medication orders (AMO) by the provider at admission.

The Best Possible Medication History (PBMH) was obtained from multiple sources including patients, family members, old prescription medication lists, discharge information on the patients' medications from recent hospital admissions; patient's records form primary health care (PHC) centers and contacts with community pharmacies and

physicians. At least two sources were used to obtain the BPMH and the patient himself or one of his companions from which the history was collected through an interview should be the main and mandatory source. The PBMH then was compared with Admission Medication Orders (AMO) for medications prescribed by the provider at the time of admission. Then, the discrepancies between PBMH and AMO were identified.

The pharmacist documented all discrepancies. After that the pharmacist reviewed the results collected to identify the type of reconciliation error (intentional or unintentional). The data was analyzed to identify the prevalence, risk factors, type and level of medication error.

4.3 Classification of medication errors and potential harm assessment

Medication errors were classified by type of error: omission of a pre-admission prescription medication, incorrect addition of a medication not part of the patient's pre-admission regimen (commission), different dose, different route and different frequency or different medication (within the same drug class).

Any discrepancy was documented and any undocumented discrepancy was considered a medication error.

4.4 Target population

The study setting is Jericho governmental hospital in the West Bank. The study targeted surgery department in the hospital. Average surgical operation is 160 monthly. Jericho Hospital was chosen because of many reasons. Jericho Hospital is a general secondary hospital where many types of surgery operations are being performed, including general

surgery, gynecology and obstetrics, urology, orthopedic and ENT surgery. Furthermore the study needed a direct clinical interaction between the researcher and the patient or the family and the providers and full access to the patient's medical record and the researcher has the privilege and authority to do so in Jericho Hospital according to the laws of MoH. In addition, Jericho hospital serves not only patients who are resident in Jericho district but also those patients from other districts ex Hebron, Ramallah, Tubas, Nablus and Jerusalem districts. Finally, Jericho Hospital is applying the WHO Patient Safety Friendly Hospital Initiative since few years.

4.5 Sample of the study

The targeted population is patients admitted to the surgical operation. Admission to the hospital and undergoing surgery itself is a risk. So we tried to target all patients who met the selection criteria as much as possible. Criteria that make the patient eligible to participate are:

1- Age of 18 years and older

2- Undergoing major surgery

3- Admitted for at least 24 hours

4.5.1 Sample type and size

The sample of the study was a convenient sample that targeted all patients who were admitted to any surgical operation and met the eligibility criteria. The researcher tried to include these patients as much as possible. The sample size was around 145. This sample was enough to perform the study according to the average number of surgery operations

performed in the hospital and the previous studies about the same topic. (Gonzalez Garcia, 2005)

4.6 Study period

The study was carried from over 75 days from the middle of July to the end of September 2016, a period of time that was enough to meet the needed sample size.

4.7 Instruments

- **Interview**

Data collected by interviews with patients, companions and caregivers to obtain BPMH. An interview questionnaire was used to standardize the process.

- **Types of medication**

Types of medication noted on the BPMH included ALL prescribed (based on the advice of prescriber) and non-prescribed medications (not based on prescriber's advice):

• prescribed (medications the patient is instructed to take by the prescriber)
• non-prescribed (the prescriber did not advise the patient to take the medication)
• prescription medication

• Non-prescription medication (e.g., over-the counter (OTC))

• Complementary or herbal medication

• Recreational drugs

• 'PRN (i.e., "as needed") medication

4.8 Data collection

- **Creation of the BPMH**

Requires use of a systematic process for obtaining a medication history by:

1. Interviewing patients and/or family where possible.

2. Verifying and documenting the history.

If a patient or family is unable to participate in a medication interview, other sources may be utilized to obtain medication histories and/or to clarify conflicting information. These sources include patient's previous medical record within the same hospital or other MoH hospitals linked to the electronic information system, previous medical records from other private providers and patient's record in primary healthcare center. Other sources should never be a substitute for a thorough patient and/or family medication interview where it is possible.

- **EMR revision**

The EMR was reviewed to identify the Admission Medication Orders (AMO) at the time of admission. Then discrepancies between BPMH and AMO were documented on the form used.

4.9 Validation of the tool

The form used to collect data was obtained from previous studies and was modified to accommodate the organization structure. The form was sent to two surgeons and four clinical pharmacists for validation. All responded that the form was applicable and valid.

4.10 Data sources

Data were obtained from the patient himself or one of the accompanying family members if the patient is unable to provide information about his or her medications, patient's medical record on the hospital, patient's previous medical record on other MoH hospitals documented in the EMR applied in MoH hospitals and patient's medical record in PHC or other providers when possible.

At least two sources were used to collect data and the patient or family member was one of these sources.

4.11 Data analyses

Descriptive analysis: Distribution of medication discrepancies among the different independent variables used in the study were measured and summarized the data results as tabulated description, graphics and statistical explanation.

Inferential analysis: Univariate and multivariate correlation analysis were used to identify the relation between gender, age group, admission type, admitting physician, surgery department, concomitant chronic disease and poly-pharmacy with the existence of medication discrepancies. Then the relation between the independent variable (medication discrepancies) and discrepancy type and the type of medication error was identified. Multivariate analysis was used to identify the relation between different variables and the outcome (SPSS) V 18 (Released 2009. PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc).

4.12 Ethical considerations

- Ethical approval was obtained from Al-Quds University – School of Public Health review board to conduct the study
- Ethical approval from Ministry of Health through the General Directorate of Health Education and the General Directorate of Hospitals. A permission letter was sent from School of Public health at Al-Quds University and an approval letter was received from the general directorate of health Education MoH through the General Directorate of Hospitals, a copy was sent to the general director of Jericho Hospital to facilitate the research.
- Patients included in the study were told about the research and they had the choice to be enrolled or not during the interview. A verbal consent was obtained from all patients
- Revision of patient's medical record is already ethical since it is part of the tasks performed by the researcher pharmacist during daily work activity according to MoH job description and specifications.
- Confidentiality was assumed during the study. The only identification code that was used during the study is the patients electronic file number which is used to review the patient's EMR.
- There was no conflict of interests in the study.

Chapter Five

Results

5.1 Introduction

The researcher included 145 patients in the study. All the patients included in the study were admitted to a surgery department in the hospital and met the eligibility criteria of the study.

5.2 Descriptive Analyses

5.2.1 Characteristics of the patients

As shown in Table 5.1, 35.2% of the patients were males. Almost half of the patients (47.6%) were between 31 and 50 years old, 37.9% were between 18-30 years old. The majority (83.4%) were nonsmokers. Emergency admissions accounted for 6.2% of the total admissions while planned admissions were 93.8%. General surgery amounted 40.7%, followed by Obstetrics and Gynecology 24.8%, orthopedic 15.2%, urology 11%, and ENT was 8.3% of the total surgery types performed. With regard to admission, 95 (65.5%) of the patients were admitted by a resident physician, while 50 (34.5%) were admitted by a specialist. Patients with past chronic disease history represented 18.6% of the patients.

Table 5.1: Demographic characteristic of patients (N=145)

Variable	Frequency (%)
Gender	
Male	51 (35.2)
Female	94 (64.8)
Age group	
18-30	55 (37.9)
31-50	69 (47.6)
51-83	21 (14.5)
Smoking habit	
Smoker	24 (16.6)
Non smoker	121 (83.4)
Admission type	
Emergency	9 (6.2)
Planned	136 (93.8)
Surgical operation	
General	59 (40.7)
Urology	16 (11)
Orthopedic	22 (15.2)
E.N.T	12 (8.3)
Obstetrics and Gynecology	36 (24.8)
Admitting physician	
Resident	95 (65.5)
Specialist	50 (34.5)
Chronic disease	
No chronic disease	118 (81.4)
Have at least one chronic disease	27 (18.6)

Figure 5.1 Age group

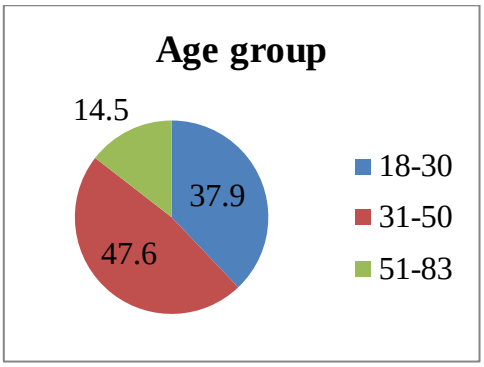


Figure 5.2 Gender

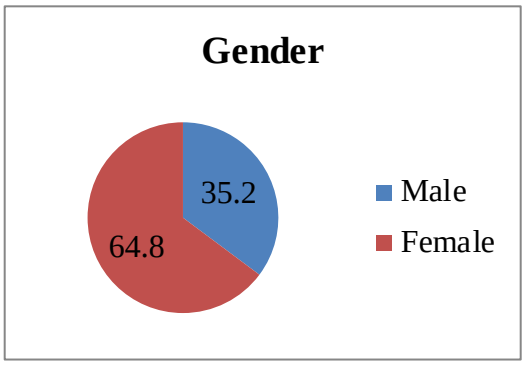


Figure 5.3 Admission type

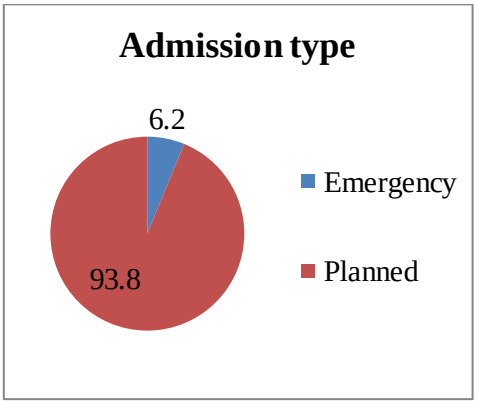


Figure 5.4 Surgical operations

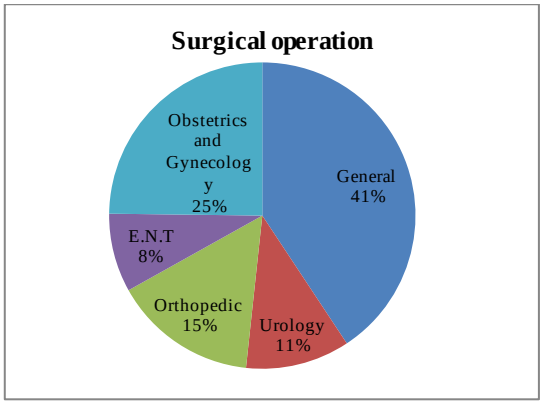


Figure 5.5 Admitting physician

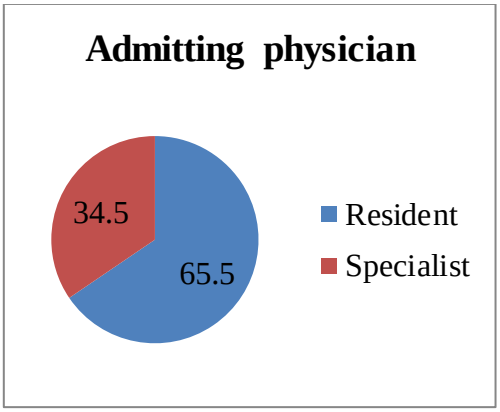
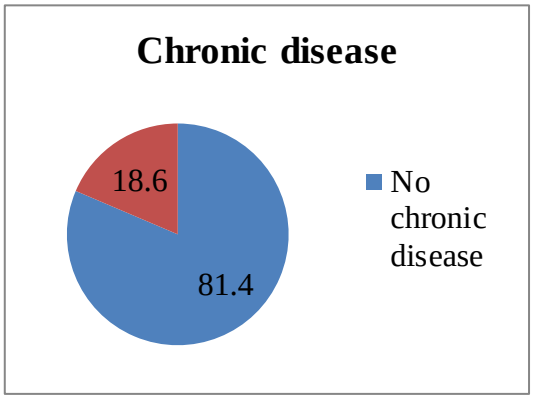


Figure 5.6 Chronic disease



5.2.2 Prevalence and type of discrepancies

Table 5.2 shows that 104 (71.7%) patients was not taking any medication regularly prior to admission, 30 (20.7%) patients were taking 1-2 medications and 11 (7.6%) were taking 3 or more medications. Among the 41 patients taking medication regularly before admission, 28 (19.3%) of them had medication discrepancy at time of admission, whereas 26 (93%) of these discrepancies were unintentional. The most common unintentional discrepancy (93%) was omission of certain pre-admission medication.

Table 5.2: Prevalence and type of discrepancies

Variable	**Frequency (%)**
Number of medications	
None	104 (71.7)
1-2 medications	30 (20.7)
≥ 3 medications	11 (7.6)
Discrepancy	
No discrepancy	117 (80.7)
At least one discrepancy	28 (19.3)
Discrepancy type	
Intentional	2 (7)
Unintentional	26 (93)
Medication error	
Omission	26 (93)
Different rout	1 (3.5)
Different medication	1 (3.5)

Figure 5.7 Number of medications

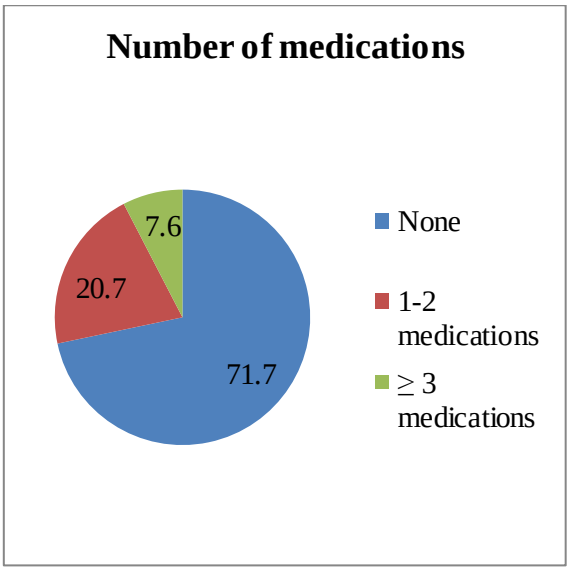


Figure 5.8 Discrepancy

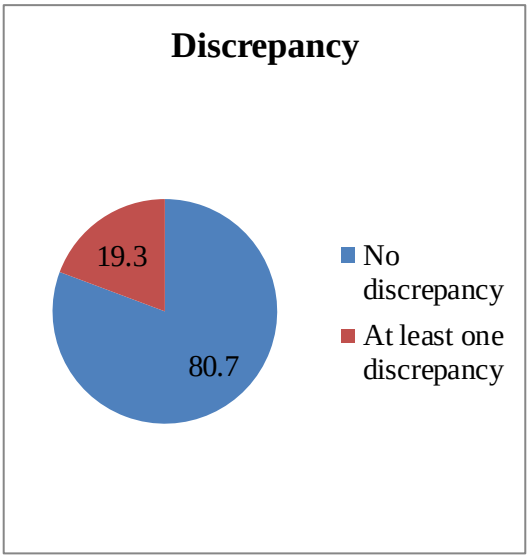


Figure 5.9 Discrepancy type

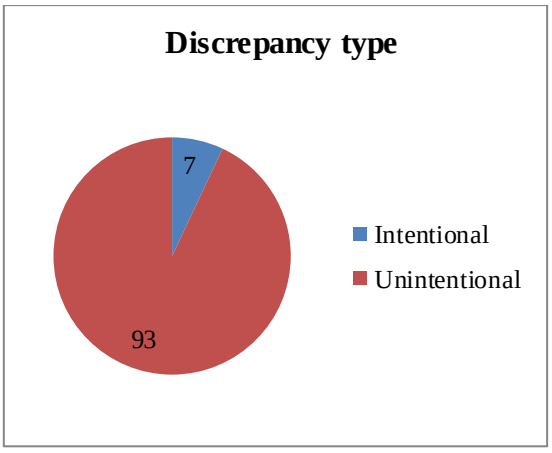
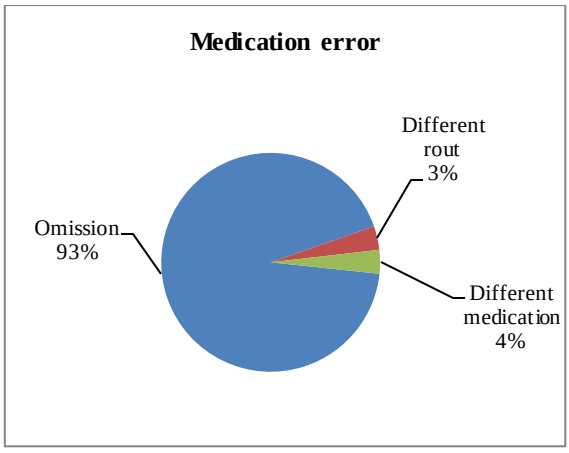


Figure 5.10 Medication error



5.3 Inferential analysis

5.3.1 Cross tabulation of discrepancy with independent variables

The cross-table analysis (chi-square and fisher exact tests) in table 5.3 was conducted to test if the discrepancy is in relation or affected by the independent variables. . Whereas, 8 (28%) of all males included in the study experienced at least one discrepancy compared to 20 (72%) of females who experienced discrepancy. However, no statistically significant difference was observed among the two groups ($p>0.05$). Patients who are between 30-51years had the highest prevalence of discrepancy (46.4%) followed by those who age 51-83 years group had (35.7%) of total discrepancies and the difference was statistically significant ($p<0.002$). The majority of discrepancies were noticed in planned surgery (96.5%) of total discrepancies, no significant differences were observed. According to surgery type, almost half of discrepancies were in general surgery (43%), and one third in obstetrics and gynecology (29%), urology surgery, orthopedic and ENT accounted for less than one third (28%) of total discrepancies collectively, yet these differences are not statistically significant ($p>0.05$). Although around two thirds of discrepancies (64%) resulted when patient is admitted by a resident physician, this was statistically insignificant ($p>0.05$). Patients with chronic diseases have higher ration of discrepancy than those who don't have ($p<0.001$). Lastly, patients taking 1-2 medications prior to admission had the majority of discrepancies (71.5%) compared to those taking 3 or more medications (28.5%), this difference between the two groups was statistically significant ($p<0.001$).

Table 5.3: Distribution of medication discrepancies

Variable	Discrepancy (%)	Chi square (x^2 p-value)
Gender		
Male	8 (28)	0.663 (0.415)
Female	20 (72)	
Age group		
18-30	5 (17.9)	12.830 (0.002) Fisher exact
31-50	13 (46.4)	
51-83	10 (35.7)	
Smoking		
Nonsmoker	24 (0.86)	0.129 (0.486)
Smoker	4 (0.14)	
Admission type		
Emergency	1 (3.5)	0.641 (0.451) Fisher exact
Planned	27 (96.5)	
Type of surgery		
General	12 (43)	0.703 (0.974) Fisher exact
Urology	2 (7)	
Orthopedic	4 (14)	
E.N.T	4 (14)	
Obstetrics and Gynecology	8 (29)	
Admitting physician		
Resident	18 (64)	0.023 (0.879)
Specialist	10 (36)	
Chronic disease		
No chronic disease	9 (32)	55.514 (<0.001)
Have at least one chronic disease	19 (68)	
Number of medications		
1-2 medications	20 (71.5)	87.266 (<0.001) Fisher exact
≥ 3 medications	8 (28.5)	

5.3.2 Logistic Regression: discrepancy error

The aim of this analysis is trying to find the variables within the set of data which have an influence and effect on whether we will have a discrepancy error or not within the patients admitted to surgical operations. The dependent variable was encoded to have either the value of NO or YES (having no discrepancy or having at least one discrepancy).

While the independent variable are as follows:

1. Age
2. Sex (male ,female)
3. Admission Type (Emergency , planned)
4. Admission Physician (resident, specialist)
5. Smoke (yes , no)
6. Number of medications
7. Chronic Record (yes, no)
8. Surgical operation (5 different types)

Thus, the logistic regression was applied since the dependent variable has two categories while we have many independent variables (continuous and categorical) as mentioned above.

5.3.3 Sample size – ratio of cases to variables

The minimum ratio of valid cases to independent variables for logistic regression is 10 to 1, with a preferred ratio of 20 to 1. In this analysis, there are 145 valid cases and 7

independent variables and one categorical variable with 5 categories. The ratio of cases to independent variables is 145 to 11, which equals 13 to 1 which satisfies the minimum requirement.

5.3.4 Overall relationship between independent and dependent variables

The presence of a relationship between the dependent variable and combination of independent variables is based on the statistical significance of the model chi-square at after the independent variables have been added to the analysis.

In this analysis, the probability of the model chi-square is (90.568) with P-value <0.0001 which is less than or equal to the level of significance of 0.05 which indicates the existence of a relationship between the independent variables and the dependent variable was supported. As shown in table 5.4

Table 5.4: Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	90.568	11	0.0001
	Block	90.568	11	0.0001
	Model	90.568	11	0.0001

5.3.5 Numerical problems

Multicollinearity in the logistic regression solution is detected by examining the standard errors for the b coefficients. A standard error larger than 2.0 indicates numerical problems, such as multicollinearity among the independent variables, table 5.5 shows a multicollinearity among the admission physician and the all the category of the surgical operation. So they had to be eliminated from the analysis.

Table 5.5: Multicollinearity between variables

	B	S.E.	Wald	Df	Sig.	Exp(B)
Age	.024	.031	.633	1	.426	1.025
Sex1	.856	1.131	.574	1	.449	2.355
Smoke	.435	1.151	.143	1	.705	1.545
AdmType1	1.566	1.532	1.045	1	.307	4.788
Surgical operation			.563	4	.967	
Surgical operation (1)	-.651	3.121	.044	1	.835	.521
Surgical operation (2)	-2.108	2.990	.497	1	.481	.121
Surgical operation (3)	-.443	3.031	.021	1	.884	.642
Surgical operation (4)	-.766	3.683	.043	1	.835	.465
Admitting Physician	-1.191	2.931	.165	1	.685	.304
Number of medications	3.260	.748	18.971	1	.000	26.053
Chronic disease	2.484	.895	7.696	1	.006	11.985
Constant	-6.310	3.674	2.949	1	.086	.002

5.3.6 Relationship of individual independent variables to dependent variable

The probability of the Wald statistic significance for the following variables (Age, Sex, Admission Type, Admission Physician, Smoking, Surgery Department) was more than or equal to the level of significance of 0.05 thus they should be eliminated from the analysis.

While for Number of medications and the chronic disease was significant which have less than or equal to the level of significance of 0.05 thus they should be interred in to the final equation analysis.

5.3.7 The Final Analysis

By recalculating the equation including only the poly-pharmacy and the chronic disease variables, we have the probability of the model chi-square (74.34) with P-value <0.0001, less than or equal to the level of significance of 0.05 which means that there is difference between the model with only a constant and the model with independent variables and we don't have numerical problems as shown in table 8 (S.E. < 2). As shown in table 5.6

Table 5.6: Multicollinearity among variables

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Number of medications	3.176	.674	22.220	1	0.0001	23.953
	Chronic disease	2.558	.747	11.741	1	0.001	12.910
	Constant	-4.177	.682	37.540	1	0.0001	.015

The value of Exp (B) for the number of medications was 23.963, which implies that a one unit increase in the number of medications increase the odds that study respondents have discrepancy by almost 24 times. While the value of Exp (B) for the Chronic disease was 12.91, which implies that having a chronic disease increase the odds that study respondents have discrepancy by almost 13 times.

5.3.8 Classification using the logistic regression model: by chance accuracy rate

The independent variables could be characterized as useful predictors distinguishing survey respondents who have actual adoption from survey respondents who have actual intention if the classification accuracy rate was substantially higher than the accuracy attainable by chance alone. Operationally, the classification accuracy rate should be 25% or more than the proportional by chance accuracy rate.

The proportional by chance accuracy rate was computed by first calculating the proportion of cases for each group based on the number of cases in each group in the classification table. Table 5.7 shows that the proportion in the "No" group is 117/145 = 0.807. The proportion in the "Yes" group is 28/145 = 0.193.

Table 5.7: Proportional by chance accuracy rate

Observed		Predicted		
		Discrepancy		
		No discrepancy	At least one discrepancy	Percentage Correct
Discrepancy	No discrepancy	117	0	100.0
	At least one discrepancy	28	0	.0
Overall Percentage				80.7

Then, we square and sum the proportion of cases in each group ($0.0.193^2 + 0.0.807^2 = 0.681$). 0.681 is the proportional by chance accuracy rate.

5.3.9 Criteria for accuracy classification

The accuracy rate computed by SPSS was 91.0% (as in table 8) which was greater than or equal to the proportional by chance accuracy criteria of 85.1% (1.25 x 68.1% = 85.1%).

The criteria for classification accuracy are satisfied.

The model succeeded in predicting and classifying 91.0% of the discrepancy as dependent variable using the independent variables number of medications and the chronic disease as shown in table 5.8.

Table 5.8: Accuracy rate

Observed			Predicted		
			Discrepancy		
			No discrepancy	At least one discrepancy	Percentage Correct
Step 1	Discrepancy	No discrepancy	113	4	96.6
		At least one discrepancy	9	19	67.9
	Overall Percentage				91.0

5.3.10discriminate analysis

5.3.10.1 Medication errors

Before trying to conduct the discriminate analysis, a simple frequency to the medication error type shows that only two options are valid to the analysis since the other options have a value zero or one. Then the logistic regression is more appropriate for the remaining two categories (Different route and Different medication) as shown in table 5.9

Table 5.9: Frequency of medication error type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	117	80.7	80.7	80.7
	Omission	26	17.9	17.9	98.6
	Different route	1	.7	.7	99.3
	Different medication	1	.7	.7	100.0
	Total	145	100.0	100.0	

By selecting the two options the result was as shown in table 5.10

Table 5.10: Medication error type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	117	81.8	81.8	81.8
	Omission	26	18.2	18.2	100.0

Chapter Six

Discussion, conclusion and recommendations

6.1 Discussion

According to our knowledge there is no research on medication reconciliation and discrepancies that occur at care transition in Palestine. Our study assessed medication discrepancies at admissions to surgical operations since we believed that these patients are at risk of medication discrepancies where the focus is on the surgical problems and patients might face medical consequences due to withdrawal of certain pre-operative and post-operative medications Kennedy, J. M and colleges (2000). The study was carried in Jericho MoH hospital in the period between July 2016 and September 2016. The researcher aimed to determine the prevalence of medication discrepancies at admission to surgical operation, determine the type of error caused by discrepancies and analyze the factors (care provider, patient, and organizational) that might be associated with medication discrepancies. The main tool of the study is clinical interview of patients who were admitted to surgical operation. All patients who were admitted were 18 years and older and admitted to at least 24 hrs to any surgical operations were interviewed. Our study did not aim to generalize the situation in surgical operations on other departments nor the situation in Jericho hospital on other hospitals.

Among 145 patients who were included in the study, 41 of them were taking medications regularly prior to admission not related to surgery. Of these patients 19.3% had at least one discrepancy. A systematic review by Tam et al, (2005) identified 22 studies about errors in medication history. The review showed that 10%–67% of patients had at least one

medication history error which leads to medication discrepancy. In many countries 67% of admitted patients encounter at least one or more discrepancies occur on admission, transfer and discharge (Sullivan et al. 2005). The prevalence of medication discrepancies shown in our study is consistent with the findings of the systematic review of previous studies about the same topic by Tam et al (2005) and Sullivan et al. 2005. This indicates that the situation in our study is similar to that in other studies and patients admitted to surgical operations may face same risks of reconciliation errors. Two of these studies reviewed by Tam et al (2005) included patients who were admitted to surgical operations. The first study was by Dodds, (1982) titled An objective assessment of the role of the pharmacist in medication and compliance history taking showed that mean 0.4 errors per patient when prescription and nonprescription medications were included in medication history. Also a study by Hocking et al (1998) titled Better drug history taking; an assessment of drugs mnemonic showed that 10% of patients had at least one discrepancy.

Moreover, our study showed that 93% of the discrepancies identified were unintentional and were not recognized or not documented by the provider. However, a study about medication discrepancies at time of admission by Cornish and colleagues (2005) showed that 53.6% of patient admitted to general internal medicine clinical teaching units had at least one unintended discrepancy. In addition, another study by Vira and colleagues (2006) about reconciliation differences at hospital admission and discharge showed that almost 60% of patients had at least one unintended errors. In consistence, a systemic review of previous studies showed that 19%–75% of the discrepancies were unintentional (Tam et al, 2005). Our findings are close to the findings of other studies in assessing the type of medication discrepancies Cornish and colleagues (2005), Vira and colleagues (2006). This

may be due to similarities in organization policy and procedures by physicians at time of admission in different sitting and different hospitals in many countries. The differences might be also caused by differences in documentation system and the healthcare member who obtained the history from the patient

In addition, the result of our study showed that 93% of the discrepancies were omission of certain medications at time of admission. However, a González et al, 2015 study on medication reconciliation at admission to surgical operations showed that 84.1% of medication discrepancies were omission of medications consumed by the patient prior to admission. The result of our study is close to González study with a slight difference might be related to differences in documentation of some discrepancies and ignorance of certain medications at time of admission due to inability to recall these medications by the patient, which is one of the main limitations of the study.

In our study, both univariate and multivariate analyses showed that no significant relation between any of the organization characteristics and medication discrepancies. Regarding to admitting physician, the result of our study is consistent with the results of a study by Susanna E. Bedell et al, 2000 which found that there was no increasing discrepancy in case of whether the physician involved was an intern or specialist. This may be due to similarities in admission procedures between resident and specialist physicians in different settings. On the other hand, regarding to the type of admission the results of our study contradicts the results shown by a González et al, 2015 study which showed that the risk of having discrepancies is much higher in case of elective admission than in emergency admissions. This contradiction between our study and the other study can be justified that

in our study 93.8% of admissions were planned while in González study it was only 34.7%.

In regards to patient's characteristics, univariate analysis showed that the age of the patient, having an accompanying chronic disease and the number of medications are the only patient's factors that were found significant determinants of medication discrepancies. Our result is supported by González et al, 2015 study which showed that patients with old age who receive larger number of medications prior to admission are at higher risk to have medication discrepancies. Another study by Susanna E. Bedell et al, 2000 showed that the two main predictor factors for medication discrepancies are age and number of medications consumed by patient prior to admission. This result confirms the results of our study which indicates that there is a significant relation between age and number of medications and medication discrepancies. This is consistent with our clinical knowledge that older age patients are at higher risk to have multi-chronic disease and larger number of medication being consumed. Furthermore, in our study there was no significant relation between the gender of the patient and discrepancies. This result is the same as the results of a Susanna E. Bedell et al, 2000 study which showed that there was no increase in discrepancies when involving female patients.

Multivariate analysis of the findings of patient's characteristics was necessary to avoid any confounding between variables because we thought that there is a significant relation between age, chronic disease and number of medications. The results showed that the most affecting factors that are associated with medication discrepancy were chronic disease history and number of medications. The exclusion of the age of the patient from the final logistic regression may be related to many factors such as differences in adherence to

medications between different age groups and involving other care givers and family members in the handling medications and recall of medications in the medication history. This is supported by a study by Ralph I. Horwitz, Sarah M. Horwitz, 1993 which showed that older age patients have more compliance to chronic medications such as antihypertensive and congestive heart failure medications.

In the same aspect, the results of our study showed that having a chronic disease prior to admission increases the opportunity to have a discrepancy by almost 13 times , whereas one increase in the number of medications prior to admission will increase the opportunity to have discrepancy by almost 24 times. Having chronic disease will increase the number of medications consumed by the patient and thus increase the opportunity of having reconciliation errors. This result is close to the results of a study by González et al, 2015 which showed that any additional medication on the patient's regimen will increase risk of reconciliation errors by 1.34 folds. The difference between the values of the risk between the two studies might be due to variations in socioeconomic factors and literacy between the two samples and the availability of comprehensive and integrated EMR.

6.2 Conclusion

Medication discrepancies are common at all care transition settings. Discrepancies may occur in all types of medications. The majority of these discrepancies are unintentional. Although many of these medications are harmless, some may have serious health impacts on patients.

Many factors contribute to the prevalence and type of discrepancies. The study showed that the most affecting factors that are associated with medication discrepancy were chronic

disease history and the number of medications. According to the results of the study, the risk of medication discrepancy was higher in patients with chronic disease and wit the increase in number of medications consumed by patient. Moreover, the most frequent medication discrepancy was omission of certain medication consumed prior to admission.

6.3 Recommendations

- For MoH:

- Applying medication reconciliation process at each care transition.
- Involvement of clinical pharmacists in the process of medication reconciliation.
- Establishing a comprehensive and integrated EMR to facilitate the communication of information between different care providers.
- Encourage systematic information dissemination between providers.

- For researchers:

- Further investigation of medication discrepancies in other departments.
- Evaluating the situation in other care transition sittings i.e. transfer and discharge.
- Identifying health impacts for the discrepancies that occur at care transition.
- Assessing the relation between discrepancies and socioeconomic factors.

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Annexes

Annex 1: study interview form

Annex 2: Permission letters from hospitals

PREADMISSION MEDICATION LIST VERIFICATION AND ORDER FORM (Medication Reconciliation)

PATIENT EMR No:
DATE COMPLETED:
TIME STARTED:
TIM E FINISHED:

---

1. Age:
2. Sex: ☐ Male ☐ Female
3. Smoking: ☐ Yes ☐ No
4. Type of admission: ☐ Emergency ☐ Planned
5. Surgical operation: ☐ General ☐ Urology ☐ Orthopedic

   ☐ ENT ☐ Obstetrics and Gynecology
6. Surgical procedure:

   _____

   _____
7. Admission date:____/___/_____ Discharge date:____/____/_____ Hospitalization days:_____
8. Concomitant chronic diseases: ☐ Hypertension ☐ Cardiac disease

   ☐ Diabetes ☐ Renal disease ☐ Respiratory disease

   ☐ Other (please specify):_____

9. Admitting physician: ☐ Resident ☐ Specialist

10. The patient handle medications himself: ☐ Yes ☐ No

11. Any handling problems: ☐ Swallowing, crushing/splitting

    ☐ Opening bottles or blisters ☐ Inhaling

12. Adherence to medications: ☐ Yes ☐ No

LIST BELOW ALL OF THE PATIENT'S MEDICATIONS PRIOR TO ADMISSION INCLUDING OTC AND HERBAL MEDICATIONS (NEW MEDICATIONS OR MEDICATION CHANGES SHOULD BE WRITTEN ON ADMISSION ORDERS)

Source of Medication list: (check all used):

- ☐ Patient medication list
- ☐ Patient/Family recall
- ☐ Pharmacy _____
- ☐ Primary care physician list / PCHIS
- ☐ Physician order list
- ☐ Past Medication Administration Record from facility
- ☐ Other: _____

Allergies:

No allergy

Allergy to _____

					Check continue* OR *Discontinue OR Change			
MEDICATION NAME (WRITE LEGIBLY)	**DOSE (mg, mcg,)**	**ROUTE (PO, GT, SC, IV)**	**FREQUENCY**	**LAST DOSE DATE/TIME**	**Continued on Admission**	**Discontinue on Admission**	**Change**	**Rationale for D/C or Change**
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								

LIST BELOW ALL OF THE PATIENT'S NEW MEDICATIONS ON ADMISSION (ADMISSION MEDICATION ORDERS AMO) COLLECTED FROM PATIEN'S ADMISSION RECORD AND RESPONSIBLE PRESCRIBER OR TRANSCRIBER

MEDICATION NAME (WRITE LEGIBLY)	DOSE (Mg, mcg,)	ROUTE (PO, GT, SC, IV)	FREQUENCY	LAST DOSE DATE/TIME	Rationale for Addition	Order Type	
						Prescribed	Transcribed

Other information from the interview

_____

Number of discrepancies after reconciliation: _____

Completed by: _____

Signature: _____

State of Palestine
Ministry of Health - Nablus
General Directorate of Higher & Continuing Education

دولة فلسطين
وزارة الصحة- نابلس
الإدارة العامة للتعليم الصحي

Ref.: .....
Date:.....

الرقم: ٢٠١٥/٢٠٧/١٦٢٤
التاريخ: ٢٠١٥/١٢/٢٣

الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،

تحية واحترام،،،

الموضوع: تسهيل مهمة طلاب

تماشياً مع سياسة وزارة الصحة المتعلقة بتعزيز التعاون مع الجامعات والمؤسسات الأكاديمية بإتاحة فرص التدريب أمام الطلبة والخريجين والباحثين في المؤسسات الوطنية وإسهاماً في تنمية قدراتهم.

يرجى تسهيل مهمة الطالب: **محمد عتيلي**- ماجستير السياسات والادارة الصحية- **جامعة القدس**، في عمل بحث رسالة التخرج بعنوان: " **Medication Reconciliation at Admission to Surgical Departments: A Study at Jericho Hospital**".

لذا يرجى تسهيل مهمة الطالب في التواصل مع المرضى والعاملين في قسم الجراحة- **مستشفى أريحا** لجمع معلومات الاستبانة، وذلك بعد أخذ موافقتهم، بالاضافة الى الاطلاع على ملفات المرضى لاستكمال المعلومات المطلوبة، علما بأنه سيتم الالتزام بمعايير البحث العلمي والحفاظ على سرية المعلومات.

مع الاحترام،،،

وزارة فلسطين وزارة الصحة
الادارة العامة للتعليم الصحي
د. أمل أبو عوض
مدير عام التعليم الصحي

نسخة: عميد كلية الصحة العامة المحترم/ جامعة القدس

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بسم الله الرحمن الرحيم

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2015/12/19
الرقم: ك ص ع/ 156 /2015

حضرة الدكتورة أمل أبو عوض المحترم
القائم بأعمال مدير عام التعليم الصحي/ وزارة الصحة الفلسطينية

الموضوع: مساعدة الطالب محمد عتيلي

تحية طيبة وبعد،،

يقوم الطلب محمد إبراهيم محمد رشيد عتيلي ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بحث رسالة الماجستير بعنوان:

"Medication Reconciliation at Admission to Surgical Departments: A Study at Jericho Hospital".

وهو بحاجة للتواصل مع المرضى والعاملين في قسم الجراحة لمستشفى أريحا الحكومي لجمع معلومات الاستبانه المرفقة ويحتاج أيضا للاستفسار من الطاقم عن الملف الخاص للمريض لاستكمال المعلومات اللازمة للدراسة. نرجو من حضرتكم تسهيل مهمة الطالب. علماً بان المعلومات ستكون لأغراض البحث العلمي فقط.

شاكرين لكم حسن تعاونكم،،

منعم حمدان
عميد كلية الصحة العامة

كلية الصحة العامة
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نسخة: الملف

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