

Effects of Medication Reconciliation Service Provided by Student Pharmacists in a Tertiary Care Emergency Department

Arinzechukwu Nkemdirim Okere, PharmD, MS¹; Charles Gessert, MD, MPH²; Colleen Renier, BS²; and Michael Swanoski, PharmD, CGP, FASCP³

¹College of Pharmacy, Ferris State University, Big Rapids, MI; ²Essentia Health, Essentia Institute of Rural Health, Duluth, MN; and

³College of Pharmacy, University of Minnesota, Duluth, MN

Acknowledgements: The authors gratefully acknowledge Michael Bouthillier, Pharm.D and Stephanie Fowers, BA for their critiques of the manuscript, Amanda Gomley, Pharm.D candidate for assisting in manuscript preparation, Pharmacy and Emergency Department of Essentia Health, Duluth, MN and members of the Essentia Institute of Rural Health clinical research staff.

Disclosure: The authors declare no conflicts of interest associated with the services evaluated in the case study.

Keywords: Medication reconciliation; Patient education; Patient counseling; Emergency services; Emergency department

Abstract

Objective: The primary objective of this case study was to evaluate the impact of a medication reconciliation service (MRS) provided by student pharmacists in an emergency department (ED).

Methods: Eligible patients were assigned to two groups, MRS or non-MRS. Patients in the MRS group were seen by student pharmacists while the non-MRS group followed usual care. As part of the services provided by the student pharmacists, medication reconciliation was provided under the supervision of a clinical pharmacist. At the conclusion of their ED visit, patients were asked to complete a survey addressing knowledge of medications, confidence in medication taking and patient satisfaction. To evaluate the impact of provision of MRS by student pharmacists on readmission rates in the ED, the electronic health records of the institution were queried for subsequent inpatient hospitalizations and ED visits.

Results: Based on the study, patients in MRS group were more likely to be satisfied with the education provided to them in the ED ($p=0.016$) and had greater confidence in taking their medications ($p=0.03$). Sixty days post ED visit MRS group readmissions were significantly lower compared to non-MRS group ($P=0.047$).

Conclusions: Students' participation in the provision of medication reconciliation led to reduction of readmission in the tertiary care ED, improved patient satisfaction and confidence in medication use.

Background

Approximately 40% of medication errors are associated with lack of medication reconciliation, about 20% of which can be avoided.^{1,2} Medication reconciliation has been defined by the Institute of Health Improvement (IHI) as follows: "It is a formal process of gathering and documenting a complete and accurate list of each patient's current home medications—including name, dosage, frequency and route—and comparing admission, transfer, and/or discharge medication orders to that list. Discrepancies are brought to the attention of the prescriber and, if appropriate, changes are made to the orders. Any resulting changes in orders are documented."³ As part of the 100,000 lives campaign launched by IHI, medication reconciliation was added as one of the important steps needed for preventing adverse drug reactions.⁴ Furthermore, in 2005, the Joint Commission added

medication reconciliation as one of the National Patient Safety (NPS) goals.⁵

With increasing number of emergency department (ED) visits and overcrowding, implementation of medication reconciliation can be challenging. The mandate by the Joint Commission to implement medication reconciliation has not been adequately achieved by many hospitals, especially in emergency departments.⁶ Nationally, EDs have attempted several approaches to provide medication reconciliation,⁷⁻¹⁰ and have found that proper application of medication reconciliation can result in accurate documentation of patient medications and allergies, and improved prevention of medication errors.^{8,9} Several studies have shown that clinical pharmacist provision of medication reconciliation reduces medication errors, saves costs associated with medication errors, and provides accurate documentation of patient medications.¹¹⁻¹⁵

As part of the American Society of Health System Pharmacist (ASHP) initiatives, pharmacist involvement in medication reconciliation is highly recommended.¹⁶ However, medication reconciliation provided solely by pharmacists can

Corresponding Author: Arinzechukwu Nkemdirim Okere, Pharm.D., M.S. 100 Michigan Street NE Grand Rapids, MI 39503, Phone: 616-391-0863, Email: arinzeokere@ferris.edu

be expensive, time consuming or difficult to apply.^{6,11} In many institutions, the use of student pharmacists for the purpose of assisting in the provision of medication reconciliation, especially in the collection of the medication history, is advocated. Padiyara has shown positive impact made by fourth year student pharmacists in the documentation of medication histories and provision of patient education.¹⁷ Similarly, Mersfelder et al. demonstrated that the use of student pharmacists led to documentation of accurate medication histories, which documented both prescribed drugs and over-the-counter medications.¹⁸ It is noteworthy that not only are medication reconciliation services provided to these institutions by student pharmacists, but it is also a great learning opportunity for the students.¹⁹ In addition, the use of student pharmacists in the provision of MRS can prevent medication discrepancy. Medication discrepancy is an important reason for hospital readmission, and two-thirds of readmissions occur within the first three months.²⁰ According to Friedman et al. preventable hospital readmission is an important indicator of poor quality of care and is expensive.²⁰ Another factor contributing to hospital readmission is patient satisfaction with the care they received.²¹ In an inpatient hospital study conducted by Boulding et al., patients with a higher index of satisfaction had a lower 30-day hospital readmission rate.²¹ Patients that are satisfied with the care they received in the ED are more likely to be compliant with recommended medication regimen and counseling.^{15, 22-24}

Furthermore, Burge et al. conducted an analysis of factors associated with medication knowledge and adherence in 150 patients with chronic diseases who had self-reported problems with medication adherence.²⁵ The researchers showed that patients confidence in taking medications as prescribed was associated with better medication knowledge and that greater patient confidence was one predictor of adherence.²⁵ It is well-documented that confidence, which involves a patient's perceived medication knowledge, is a predictor of adherence.^{25,26} There is no study demonstrating the role of medication reconciliation in readmission rates, patient satisfaction and confidence in medication taking in the ED. We hypothesized that proper application of medication reconciliation will improve readmission rates, patient satisfaction and confidence in medication taking.

The objective of this case study is to evaluate the impact of medication reconciliation provided by student pharmacists in the ED as it relates to readmission rates, knowledge of medications, patient satisfaction and confidence in medication use. This case report will further discuss the resultant positive impact made by the student pharmacists in the provision of MRS in the ED.

Methods

Setting

This 3- month pilot study was conducted in a 380-bed Trauma II community hospital. The emergency department has 38 beds with approximately 33,000 ED visits annually. At this Level II community trauma center, an emergency department pharmacist position does not exist. Physicians expressed concern that previous medication use was not accurately documented with former patients. Furthermore, because of the busy nature of the ED environment, it was unlikely that any of the healthcare providers will have time to call patients' local pharmacies to clarify or verify patient home medications.

In an effort to address the current need to improve the medication reconciliation process in this institution, a team was assembled to discuss ways to implement medication reconciliation in the emergency department, improve continuity of care, and provide effective medication therapy management while in the ED. Members of the team included the pharmacy director, emergency physicians (representative), the pharmacy clinical manager, 2 staff pharmacists and a student pharmacist. Prior to putting a team together, there was unanimous approval by the ED team on a proposal to allow pharmacy involvement in the provision of medication reconciliation as described by IHI. The team decided to use third-year student pharmacists, who had taken some or most of their pharmacotherapy classes, to provide medication reconciliation as described by IHI under the supervision of the shift staffing clinical pharmacist. Most of the student pharmacists recruited for the MRS program had prior hospital experience. Almost all recruited students were either working in the institution or undergoing an advanced pharmacy practice experience (APPE) rotation in same institution. However, this was not a requirement. The team also created a list of outcomes that were measurable (see subheadings "instrument development" and "outcome measures"). The ED healthcare team believed that this unique opportunity would provide multiple benefits as they evaluated the impact of MRS provided by student pharmacists. These students would receive a unique clinical experience and would collect data for the emergency department leadership.

Protocol Design

A study protocol was designed by the investigators and was then approved by the Institution's Scientific Review Board and Institutional Review Board (IRB). The students who provided medication reconciliation were third- and fourth-year student pharmacists of the University of Minnesota. These students offered medication reconciliation service, as

described by IHI, under the supervision of a clinical pharmacist.

A scheduling roster was created so each student would have an opportunity to rotate in the ED. Prior to the study period, participating student pharmacists were only trained to improve their understanding of what medication reconciliation entails and their expectations. The outcome measures of the study were not disclosed to the students.

Instrument development: A five point Likert scale survey instrument was designed to obtain information regarding patients' confidence and knowledge of medication use. A panel of experts comprised of 3 research nurses, 1 physician and 1 biostatistician reviewed the content of the survey. They evaluated the content based on the following: 1) its relevance to understanding patient attitude towards medication use; 2) its value in predicting patients' level of confidence and knowledge of medication use; and 3) its application to other populations and disease states. The final version of the survey was approved by the Institution Review Board (IRB) (See Table 1 for final version).

Patient selection: During the 3-month study period (June-August), eligible patients were identified in the ED by the staff nurses, and were assigned to two groups: the MRS group, or the non-MRS group (for those following routine care without provision of MRS from student pharmacists). Group assignment was based on the patient medical record number; patients with even last digit numbers were assigned to the MRS group, while patients with odd last digit numbers were assigned to the non-MRS group.

Selected patients included all adult and pediatric patients seen in the ED for the first time during the study period. Patients were excluded if they were unconscious at time of admission or cognitively impaired. Study investigators were not involved in patient selection, interview or collection of surveys.

Study procedure: Patients assigned in the MRS patient group received medication reconciliation from a student pharmacist. This involved 5 phases: 1) verification through patient interview, 2) clarification on when patient last refilled prescription through his or her pharmacy, 3) reporting discrepancies or drug related issues to ED physician, 4) documentation of accurate medication list, and 5) providing education and a copy of a reconciled list to patient prior to discharge.

At the conclusion of the ED visit, patients were asked to complete a survey addressing perceived confidence in knowledge of medications and patient satisfaction, using a

five-point Likert scale (See Table 1). Patients returned the survey to a box located in the ED (for the purpose of this study) or mailed the surveys back with a self-addressed envelope. Students rotated through the ED to provide MRS during the peak hours, from 10am to 5pm.

Outcome measures: This pilot study was designed to measure several endpoints: ED readmission rates and inpatient admissions at 30, 60 and 90 days post-index ED visit, perceived levels of knowledge of medications, and confidence and satisfaction as measured by the survey five-point Likert scale. The Patient Survey (See Table 1) has a series of nine questions. It includes questions encompassing three distinct subscales: 1) satisfaction (one question); 2) confidence (three questions); and 3) knowledge of medication (five questions).

Data collection: The survey was designed to be self-administered by adult patients and caregivers of child patients, and to be anonymous. To evaluate the impact of MRS on patients' subsequent inpatient hospitalizations and ED visits, the institution's electronic health records were queried.

Statistical analysis: Descriptive statistical analysis and one-tailed student's t-test analysis were used to assess differences in 30, 60 and 90 days ED readmissions between patients in the two independent groups: those who had received the MRS and those who had not, with a preset significance level of $p < 0.05$. Mann Whitney U-tests (one tailed) were performed to compare Likert scale data between MRS and non-MRS group.

Results

During the three month study period, 443 eligible patients that received ED services were randomized. Of these, 163 patients received MRS (MRS based patients) and 280 patients received routine care in the ED (non-MRS based patients).

Fifty-two of the 163 patients who received the MRS (31.9%) returned their surveys; as did 77 of the 280 non-MRS patients (27.5%). Surveys that did not include any variation in responses to survey questions (i.e. the same answer was given to all of the survey questions) and those that were incomplete were eliminated from analysis. In all, 75 surveys (28 MRS based patients and 47 non-MRS based patients) were used in the analysis.

Based on our data, patients who received MRS were more likely to report that they understood the potential side effects of their medications ($p=0.047$), knew when to call their physician ($p=0.032$), understand what their medications are for ($p=0.027$) and were satisfied with the explanation of

their medications ($p=0.016$). The MRS subjects also reported greater confidence in taking their medications ($p=0.030$) (Table 2). Patients who received the MRS were more likely to report greater confidence in their knowledge of potential drug interactions with their medications, how and when to use their medications, but those differences were not statistically significant (Table 2).

In the evaluation of inpatient hospitalizations and ED visits, data was collected for 443 eligible patients, with follow-up assessed for 30 days, 60 days, and 90 days after the index ED visit. The numbers of cumulative events of ED visits and hospital admissions were analyzed for each time period. This analysis (Figure 1) found that there was no difference between those who received the MRS and those who did not for the first 30 days ($p=0.227$). However, for the first 60 days following the index ED visit, 25% reduction in the cumulative number of ED visits and hospital admissions were observed in MRS patients ($p=0.047$). No significant difference was observed in the cumulative number of events 90 days post ED visit, though we did note a trend toward decreasing hospital and ED admissions among those who had received MRS ($p=0.053$).

Discussion

This case study is the first to investigate the impact of a medication reconciliation service, provided by student pharmacist, on patient satisfaction and to evaluate its effect on the patients' subsequent behavior relative to ED visits and inpatient admissions.

Potential limitations of this study include the small sample size of the control group, an unequal sampling frame between the MRS and non-MRS groups, the short duration of the study and the relative insensitivity of the data collection due to lack of instrument statistical validation or psychometric analysis. The investigators' initial belief that assigning patients to two study groups based on pre-existing electronic medical record number (MRN) would produce a relatively equal sample size in both groups was incorrect. The reason for the unequal size is unclear to the investigators. Because of the low response rate, and based upon our earlier hypothesis that proper provision of MRS will improve patient behavior, a one-tailed Mann Whitney U-test was used. However, the investigators recognize that a one-tailed Mann Whitney U-tests can increase the power to detect a statistical difference.

Furthermore, eligible patients were provided with a survey form at the conclusion of their ED visit, and were asked to complete the form before leaving the hospital or to mail it in later. Because of the limited funding for this study, no

interventions were used to increase the response rate. Less than half of the eligible patients completed the survey; this low return rate limits the conclusions that can be drawn from the data. Additionally, patients' visits to other emergency departments were not accounted for in this study, which provides direction for additional research.

Piloting the MRS program was a challenge in itself. Identifying peak hours that would be consistent throughout the study period was difficult and tended to vary seasonally (winter vs. summer or spring). The student pharmacists' inexperience in the logistics operations in the emergency room was another issue. However, initial training prior to the study period helped minimize that problem. Furthermore, the ED healthcare team understanding of the current lack of MRS and their unanimous acceptance of the MRS proposal contributed heavily to the success of this pilot program.

It is important to acknowledge that implementing the MRS may be challenging in institutions without a connection to colleges of pharmacy and with limited resources. In the investigators' opinion, the training of pharmacy technicians to collect and verify patients' medication history can fulfill the first two components of MRS as defined by IHI.²⁷ This will save time for pharmacists to fulfill the remaining components of MRS: discovering discrepancies, optimizing drug therapy and providing education. Based on this case study, student pharmacist provision of Medication Reconciliation Service, as defined by the Institute of Health,³ improved patients' perceived understanding of their medications and when to call their primary care providers. It also increased confidence in appropriate use of medications, which reduced patients' return visits to the ED and subsequent hospitalizations. It is noteworthy that there are certain conditions that can predispose patients to use the ED more often than the other. However, this was beyond the scope of this pilot project.

The overall (90-day) differences between the MRS group and the non-MRS group were not statistically significant. The pattern of these findings suggests that the impact of the MRS intervention may have diminished by the end of the observation period, with MRS patients demonstrating a significant decrease in service use at 60 days, but then beginning to "rebound" 90 days post-ED visit. However, this study did not investigate the reasons why patients returned to the emergency department or were readmitted to the hospital.

The team also surveyed ED physicians to obtain their opinion and satisfaction on the provision of medication reconciliation provided by student pharmacist. ED physicians expressed satisfaction for the service provided and the accuracy of the

information (as it relates to therapy) that was obtained (data not included). This is consistent with other studies that have demonstrated complete patient medication histories that were collected and accurately documented by student pharmacists.^{17, 18}

Post-ED Study:

Data collected was presented to the emergency department leadership. It took a year-and-a-half to prepare and present an in-house paper that led to the creation of two ED pharmacist positions in this institution.

With the inception of the medication reconciliation service in the investigators' institution, the two ED pharmacists are responsible for provision of medication reconciliation services with the assistance of student pharmacists. They provide direct patient education and pharmacokinetic consult services. Additionally, they are responsible for reviewing microbiological tests and then to modify antibiotics, following antibiotic susceptibility test results. When necessary, the pharmacist initiates a follow-up call to patients after discharge from the emergency room to notify patient about changes in their antimicrobial therapy. The MRS program provided an opportunity for a new level of patient care provided by these pharmacists in the case institution's emergency department.

Conclusions

Based on our study, there was significant reduction in readmission rates 60 days post ED visit. Therefore, student pharmacists' participation in the provision of medication reconciliation can contribute to improved quality of patient care, reduce readmission rates in the emergency department and improve patient perceived confidence and knowledge in taking medication.

The result of this pilot study warrants additional investigation with larger diverse population samples and will allow for the use of other emergency departments.

References

1. Rozich JD, Howard RJ, Justeson JM, et al. Patient safety standardization as a mechanism to improve safety in health care. *Jt Comm J Qual Saf.* 2004;30(1):5-14.
2. Gleason KM, Groszek JM, Sullivan C, et al. Reconciliation of discrepancies in medication histories and admission orders of newly hospitalized patients. *Am J Health Syst Pharm.* 2004;61:1689-95.
3. Institute of Health Initiative. 2009; <http://www.ihl.org/IHI/Programs/AudioAndWebPrograms/WebandACTIONMedReconciliation.htm>.
4. Overview of the 100,000 Lives Campaign.
5. <http://www.ihl.org/offering/Initiatives/PastStrategicInitiatives/5MillionLivesCampaign/Documents/Overview%20of%20the%20100K%20Campaign.pdf>. Accessed Dec 12, 2012.
6. Elements of Performance for NPSG.08.04.01. 2008; Pre-publication version:http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals/09_hap_npsgs.htm. Accessed August 14, 2008.
7. Miller SL, Miller S, Balon J, Helling TS. Medication reconciliation in a rural trauma population. *Ann Emerg Med.* Nov 2008;52(5):483-491.
8. Wortman SB. Medication reconciliation in a community, nonteaching hospital. *Am J Health Syst Pharm.* Nov 1 2008;65(21):2047-2054.
9. Haig K. Medication reconciliation. *Am J Med Qual.* Sep-Oct 2006;21(5):299-303.
10. Stover PA, Somers P. An approach to medication reconciliation. *Am J Med Qual.* Sep-Oct 2006;21(5):307-309.
11. Varkey P, Resar RK. Medication reconciliation implementation in an academic center. *Am J Med Qual.* Sep-Oct 2006;21(5):293-295.
12. Schenkel S. The unexpected challenges of accurate medication reconciliation. *Ann Emerg Med.* Nov 2008;52(5):493-495.
13. Aldridge VE, Park HK, Bounthavong M, Morreale AP. Implementing a comprehensive, 24-hour emergency department pharmacy program. *Am J Health Syst Pharm.* Nov 1 2009;66(21):1943-1947.
14. Brown JN, Barnes CL, Beasley B, Cisneros R, Pound M, Herring C. Effect of pharmacists on medication errors in an emergency department. *Am J Health Syst Pharm.* Feb 15 2008;65(4):330-333.
15. Cohen V, Jellinek SP, Hatch A, Motov S. Effect of clinical pharmacists on care in the emergency department: a systematic review. *Am J Health Syst Pharm.* Aug 1 2009;66(15):1353-1361.
16. Hayes BD, Donovan JL, Smith BS, Hartman CA. Pharmacist-conducted medication reconciliation in an emergency department. *Am J Health Syst Pharm.* Aug 15 2007;64(16):1720-1723.
17. American Society of Health-System Pharmacists. ASHP Health-System Pharmacy 2015 Initiative. www.ashp.org/s_ashp/cat1c.asp?CID=420&DID=462. Accessed Dec 12, 2012.
18. Padiyara RS. Student pharmacists and medication reconciliation upon hospital admission: proposing a way to meet ASHP 2015 objective 1.1. *J Am Pharm Assoc (2003).* 2008 Nov-Dec;48(6):701.

19. Mersfelder TL, Bickel RJ. Inpatient medication history verification by pharmacy students. *Am J Health Syst Pharm.* 2008 Dec 1; 65 (23):2273-5.
20. Cutter B. Verification of inpatient medication histories by pharmacy students. *Am J Health Syst Pharm.* 2009 Jun 1; 66(11):988.
21. Friedman B, Basu J. The rate and cost of hospital readmissions for preventable conditions. *Med Care Res Rev.* 2004 Jun; 61(2):225-40.
22. Boulding W, Glickman SW, Manary MP, Schulman KA, Staelin R. Relationship between patient satisfaction with inpatient care and hospital readmission within 30 days. *Am J Manag Care.* 2011 Jan;17(1):41-8.
23. Taylor C, Bengner JR. Patient satisfaction in emergency medicine. *Emerg Med J.* 2004 Sep;21(5):528-32.
24. Boudreaux ED, O'Hea EL. Patient satisfaction in the Emergency Department: a review of the literature and implications for practice. *J Emerg Med.* 2004 Jan; 26(1):13-26.
25. Toma G, Triner W, McNutt LA. Patient satisfaction as a function of Emergency Department previsit expectations. *Ann Emerg Med.* 2009 Sep; 54(3):360-367.
26. Burge S, White D, Bajorek E, et al. Correlates of medication knowledge and adherence: findings from the residency research network of south Texas. *Fam Med.* 2005 Nov-Dec; 37(10):712-8.
27. Rollnick S, Mason P, Butler C. *Health behavior change: a guide for practitioners.* Edinburgh: Churchill Livingstone, 1999.
28. Johnston R, Saulnier L, Gould O. Best possible medication history in the emergency department: comparing pharmacy technicians and pharmacists. *Can J Hosp Pharm.* 2010 Sep;63(5):359-65.

Table 1: Contents of the survey questions with 3 distinct subscales: C– Confidence, K – Knowledge, S - Satisfaction

Questions	Response
1. I am confident I know what all of my prescribed medications are for. ^C	1. Strongly disagree
2. I can explain how to use all of my prescribed medications. ^K	2. Somewhat disagree
3. I can explain when to use all of my prescribed medications. ^K	3. Neutral
4. I know what medications I cannot take with each of my prescribed medications. ^K	4. Somewhat agree
5. I understand the possible side effects of all of my prescribed medications. ^K	5. Strongly agree.
6. I know when I should call my physician about my medications. ^S	
7. I am satisfied with the explanations given to me about my medications. ^S	
8. My overall confidence regarding taking all of my medications is excellent. ^C	
9. My overall confidence regarding taking all of my medications has improved. ^C	

Table 2. Comparison of Likert scale questionnaire response from MRS and non-MRS group. 75 surveys were usable surveys (28 MRS group and 47 non-MRS group). Data are represented by mean rank. The MRS group rated significantly higher than non-MRS group in questions 1, 5, 6, 7, 8, and 9 (*Mann-Whitney U test, significant $P < 0.05$).

Question #	Survey questions	MRS group – Mean Rank Response (N=28)	Non-MRS group - Mean Rank Response (N= 47)	p-value
1	Confidence-Know what Rx are for	42.3	35.5	$p=0.027^*$
2	Knowledge-Explain how to use Rx medications	41.1	36.1	$p=0.104$
3	Knowledge-Explain when to use Rx medications	41.0	36.2	$p=0.085$
4	Knowledge-Know drug interactions	40.9	36.3	$p=0.179$
5	Knowledge-Understand side-effects	43.2	34.9	$p=0.047^*$
6	Knowledge-Know when to call MD	43.3	34.8	$p=0.032^*$
7	Satisfaction- Explanations on medication	44.0	34.5	$p=0.016^*$
8	Confidence-In taking medications is excellent	43.8	34.6	$p=0.024^*$
9	Confidence-In taking medications has improved	43.8	34.6	$p=0.030^*$

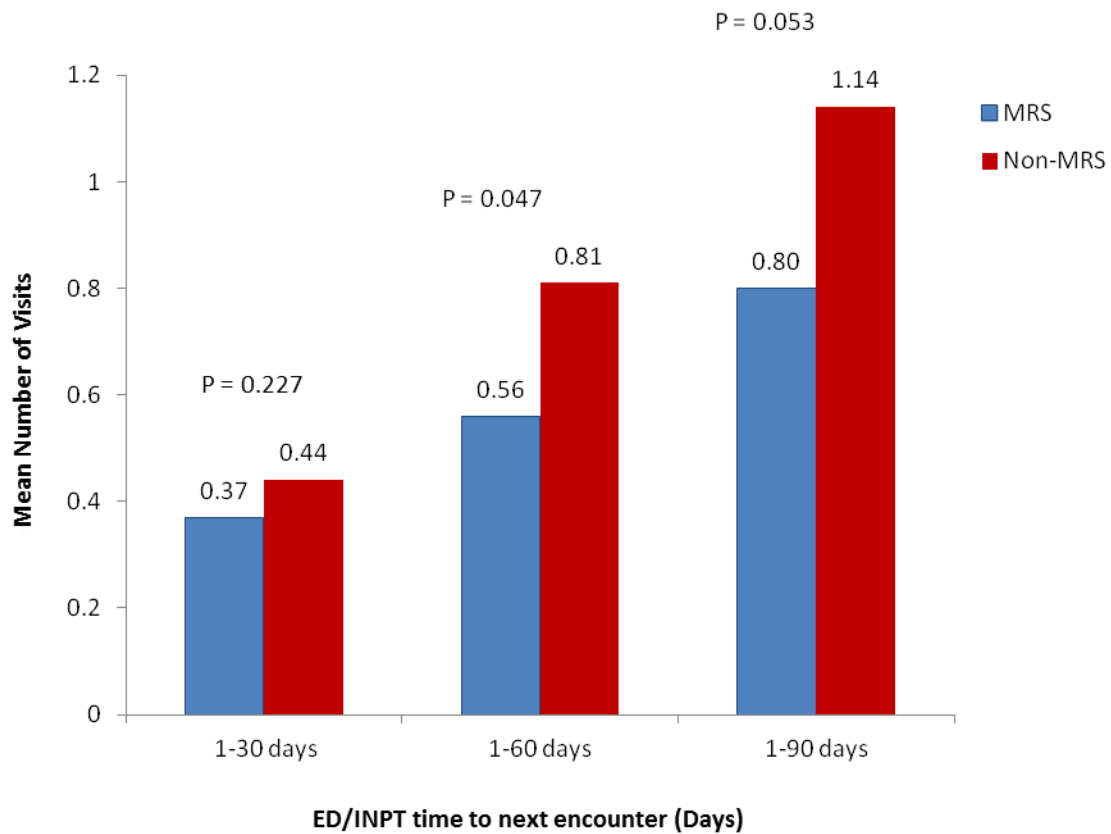


Fig 1. Retrospective evaluation of 443 enrolled ED patients. 163 patients received MRS (MRS based patients) and 280 patients received routine care in the ED (non-MRS based patients). Y-axis represents the mean number of combined ED/inpatient (INPT) visits while the X- axis represents the time period in days (Student's t-test, significant $p < 0.05$).