



ORIGINAL ARTICLE

Whose responsibility is medication reconciliation: Physicians, pharmacists or nurses? A survey in an academic tertiary care hospital



Amna Al-Hashar ^{a,*}, Ibrahim Al-Zakwani ^a, Tommy Eriksson ^b,
Mohammed Al Za'abi ^a

^a Department of Pharmacology & Clinical Pharmacy, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Oman

^b Department of Clinical Pharmacology, Laboratory Medicine, Lund University, Lund, Sweden

Received 2 April 2015; accepted 28 June 2015

Available online 7 July 2015

KEYWORDS

Medication reconciliation;
Patient safety;
Medication errors;
Health personnel;
Pharmacist;
Health care surveys;
Oman;
Arabs

Abstract *Background:* Medication errors occur frequently at transitions in care and can result in morbidity and mortality. Medication reconciliation is a recognized hospital accreditation requirement and designed to limit errors in transitions in care. *Objectives:* To identify beliefs, perceived roles and responsibilities of physicians, pharmacists and nurses prior to the implementation of a standardized medication reconciliation process. *Methods:* A survey was distributed to the three professions: pharmacists in the pharmacy and physicians and nurses in hospital in-patient units. It contained questions about the current level of medication reconciliation practices, as well as perceived roles and responsibilities of each profession when a standardized process is implemented. Value, barriers to implementing medication reconciliation and the role of information technology were also assessed. Analyses were performed using univariate statistics. *Results:* There was a lack of clarity of current medication reconciliation practices as well as lack of agreement between the three professions. Physicians and pharmacists considered their professions as the main providers while nurses considered physicians followed by themselves as the main providers with limited roles for

Abbreviations: SQUH, Sultan Qaboos University Hospital; ACI, Accreditation Canada International; JCI, Joint Commission International

* Corresponding author at: Department of Pharmacology & Clinical Pharmacy, College of Medicine & Health Sciences, Sultan Qaboos University, P.O. Box 38, Al-Khod, Muscat 123, Oman. Tel.: +968 99351322; fax: +968 24141107.

E-mail address: amna@squ.edu.om (A. Al-Hashar).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

pharmacists. The three professions recognize the values and benefits of medication reconciliation yet pharmacists, more than others, stated limited time to implement reconciliation is a major barrier. Obstacles such as unreliable sources of medication history, patient knowledge and lack of coordination and communication between the three professions were expressed. *Conclusions:* The three health care professions recognize the value of medication reconciliation and want to see it implemented in the hospital, yet there is a lack of agreement with regard to roles and responsibilities of each profession within the process. This needs to be addressed by the hospital administration to design clear procedures and defined roles for each profession within a standardized medication reconciliation process.

© 2015 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Medication errors are an important cause of morbidity and mortality (Aspden et al., 2006). They are common e.g. at transitions in care as a result of gaps in communication and information transfer among health care providers and between them and their patients. Several studies have reported on medication errors when patients are discharged from, admitted to, or transferred within the health care (i.e. “interfaces of care”). There are reports that 60% of all medication errors occur in such interfaces (Rozich and Resar, 2001). Medication reconciliation is a process designed to limit medication errors and discrepancies at transitions in care (Gleason et al., 2004). In a recent systematic review it was concluded that “The evidence demonstrates that this process has the potential to identify many medication discrepancies and reduce potential harm” (Lehnbohm et al., 2014). It is a required organizational practice by Accreditation Canada International (ACI) and is a Joint Commission (JCI) mandate since 2006 (JCI, 2006).

Medication reconciliation is defined by the Institute for Health Improvements (IHI) as “the process of creating and maintaining the most accurate list possible of all medications a patient is taking (including drug name, dosage, frequency, and route) and using that list to guide therapy. The goal is to provide correct medications to the patient at all transition points within the hospital. Medication reconciliation can be considered complete when each drug the patient is taking has been actively continued, discontinued, held, or modified at each transition point”. Transitions in care include changes in setting, service, practitioner or level of care (IHI, 2015). A structured medication reconciliation process comprises five steps: (1) develop a list of current medications; (2) develop a list of medications to be prescribed; (3) compare the medications on the two lists; (4) make clinical decisions based on the comparison; and (5) communicate the new list to appropriate caregivers and to the patient (JCI, 2006).

Medication reconciliation is a process that is both complex and time consuming. Physicians, nurses and pharmacists are usually involved with different roles at different levels. However, it can be difficult to see the true value of medication reconciliation and to commit to it as a profession in an already busy and challenging work environment. Lee et al., have looked into the views of healthcare providers and their perception of their roles and responsibilities in completing in-patient medication reconciliation and found lack of agreement among clinicians about their different roles (Lee et al., 2014). This has also been seen in other similar studies (Clay et al., 2008;

Vogelsmeier et al., 2013). To our knowledge, no prior studies in the Arabian Gulf region have addressed the issue of perceptions and roles of health care providers prior to the actual implementation of a standardized medication reconciliation process.

In this study, our aim was to identify beliefs and perceived roles, responsibilities and barriers to implementing medication reconciliation in an academic tertiary care hospital seeking an international accreditation by ACI.

2. Methods

The survey was conducted at Sultan Qaboos University Hospital (SQUH), a 450 bed-academic, tertiary care hospital with a number of specialties including medicine, surgery, pediatrics and obstetrics and gynecology (OB/Gyne). The hospital was undergoing accreditation by ACI and one of the accreditation requirements was to implement medication reconciliation. At the time of the survey, the hospital was still in the process of developing policies and procedures for the implementation of a structured medication reconciliation process. The survey was designed based on questions from two prior surveys, ((ISMP), 2006) and (Schnepf, 2006) with adjustments to suit the local SQUH setting. The survey covered areas such as current profession and seniority level, the number of years in this hospital, whether any form of medication reconciliation was practiced at the time of the survey, roles on identified medication reconciliation steps from admission through discharge, value of medication reconciliation, available time to implement, barriers to implementation, priority areas to start medication reconciliation and finally the role of information technology.

Survey questions varied in type and included questions with yes/no answers, Likert scale, multiple choices as well as those with open-ended questions. At the time of the survey, there were about 250 physicians working at in-patient units and 60 pharmacists/assistant pharmacists in the pharmacy. Clinical pharmacy is practiced in SQUH and all clinical inpatient areas were covered by clinical pharmacists. From the nursing side, there were about 800 nurses working in in-patient areas in the hospital. The survey was distributed as hard copies during a 2-month period from September to October 2013. In the case of physicians and nurses, this was done during clinical and management meetings to cover staff that was caring for the admitted patients only and not out-patients. Targeted pharmacists were all staff (including assistant pharmacists) working in the pharmacy. On perceived roles in medication reconciliation

from admission through discharge, the respondent was allowed to select more than one profession for every step. Evaluation of results was by the percentage of number of times each profession was selected against each step in the reconciliation process.

Descriptive statistics were used to describe the data. For categorical variables, frequencies and percentages were reported. Differences between groups were analyzed using Pearson's χ^2 tests or Fisher's exact tests (for those cells < 5). For continuous variables, mean and standard deviation were used to summarize the data. An *a priori* two-tailed level of significance was set at 0.05. Statistical analyses were conducted using STATA version 13.1 (STATA Corporation, College Station, TX, USA).

The survey research was submitted and approved by Sultan Qaboos University, College of Medicine & Health Sciences' Ethics Committee (MREC # 715, 1/5/2013).

3. Results

A total of 464 questionnaires were collected representing an average response rate of 42%. Responses were received from

143 (57%) of all physicians, 47 (78%) of all pharmacists and assistant pharmacists and 274 (34%) of all nurses that were targeted (Table 1). Majority of the respondents (45%; $n = 212$) spent ≥ 5 years at SQUH.

On current medication reconciliation practices, the results show that the majority of staff believe that there was some level of medication reconciliation currently practiced in the hospital at admission, upon transfer within the hospital and on discharge. However, respondents believe that medication reconciliation was currently practiced more at discharge (61%; $n = 285$) than at admission (35%; $n = 165$). There was less agreement on whether there was a standardized medication reconciliation process at the hospital (Table 2).

The three professions had different views on their role and other professions' roles (Table 3). The nurses saw more roles for physicians in every step of the process followed by the nursing profession and saw fewer roles for pharmacists. The only exception was in medication reconciliation on discharge where pharmacists were rated second to the physician, and providing counseling on discharge where pharmacists were considered the main provider followed by nurses and physicians with 76%, 54% and 50%, respectively. On how pharmacists

Table 1 Job characteristics of survey sample.

Current job/position	Years at SQUH*			Total
	n (%)			
	< 1	1–5 years	> 5 years	
Junior physician	38 (59%)	24 (38%)	2 (3%)	64 (14%)
Senior physician**	8 (10%)	30 (38%)	41 (52%)	79 (17%)
Pharmacist	3 (18%)	6 (35%)	8 (47%)	17 (4%)
Assistant pharmacist	1 (3%)	10 (33%)	19 (63%)	30 (6%)
Junior staff nurse	25 (18%)	83 (61%)	29 (21%)	137 (30%)
Senior staff nurse***	6 (4%)	25 (18%)	106 (77%)	137 (30%)
Total	81 (17%)	178 (38%)	212 (45%)	464 (100%)

*SQUH: Sultan Qaboos University Hospital; Senior physician**: \geq registrar; Senior staff nurse***: head nurse, deputy head nurse or team leader.

Percentages are row percents except for the total column for which percentages are column percents.

Table 2 Current medication reconciliation processes.

Process	Yes n (%)	To some extent n (%)	No n (%)	Don't know n (%)	Total
Are medications currently reconciled during admission?					
Physicians	44 (31%)	70 (49%)	12 (8%)	17 (12%)	143
Pharmacists	6 (13%)	27 (60%)	6 (13%)	6 (13%)	46
Nurses	115 (43%)	128 (47%)	19 (7%)	7 (3%)	269
Are medications currently reconciled on transfer from unit to another?					
Physicians	38 (26%)	55 (38%)	24 (17%)	26 (18%)	143
Pharmacists	5 (11%)	16 (34%)	6 (13%)	20 (42%)	47
Nurses	157 (60%)	84 (30%)	19 (7%)	8 (3%)	271
Are medications currently reconciled on discharge?					
Physicians	78 (54%)	49 (34%)	5 (3%)	11 (8%)	143
Pharmacists	15 (32%)	20 (42%)	6 (13%)	6 (13%)	47
Nurses	192 (71%)	52 (19%)	8 (3%)	17 (6%)	269
Is there currently a standardized medication reconciliation process at SQUH					
Physicians	22 (15%)	23 (16%)	38 (26%)	60 (42%)	143
Pharmacists	7 (15%)	12 (25%)	17 (36%)	11 (9%)	47
Nurses	115 (43%)	46 (17%)	55 (20%)	51 (19%)	267

Percentages are row percents.

Table 3 Perceived roles of the three professions in a structured medication reconciliation process.

Who is primarily responsible for the following activities within a medication reconciliation process (you can tick more than one profession for each step) ^a	Nurse	Pharmacist	Physician/prescriber	<i>p</i>
<i>Nurses' responses (N = 273)</i>				
a. Interviewing patients on admission and obtaining an accurate medication history	100 (37%)	45 (16%)	269 (98%)	< 0.001
b. Verifying the medication history list against the medications ordered on admission	112 (41%)	75 (27%)	220 (81%)	< 0.001
c. Reconciling the discrepancies between the patient's medication history list and the medications ordered on admission	117 (43%)	108 (40%)	192 (70%)	0.006
d. Reconciling medications upon transfer of a patient to another level of care/unit	176 (64%)	56 (20%)	158 (58%)	< 0.001
e. Reconciling medications at the time of discharge	111 (41%)	150 (55%)	194 (71%)	< 0.001
f. Sending the patient's discharge medication list to the patient's physician/next provider (if the patient is transferred to another level of care)	147 (54%)	57 (21%)	170 (62%)	< 0.001
g. Provide counseling and instructions on use of medications for patients upon discharge	148 (54%)	208 (76%)	137 (50%)	< 0.001
<i>Pharmacists' responses (N = 46)</i>				
a. Interviewing patients on admission and obtaining an accurate medication history	13 (28%)	35 (76%)	35 (76%)	< 0.001
b. Verifying the medication history list against the medications ordered on admission	2 (4%)	40 (87%)	24 (52%)	< 0.001
c. Reconciling the discrepancies between the patient's medication history list and the medications ordered on admission	4 (9%)	41 (89%)	23 (50%)	< 0.001
d. Reconciling medications upon transfer of a patient to another level of care/unit	24 (52%)	29 (63%)	21 (46%)	0.240
e. Reconciling medications at the time of discharge	8 (17%)	42 (91%)	25 (54%)	< 0.001
f. Sending the patient's discharge medication list to the patient's physician/next provider (if the patient is transferred to another level of care)	22 (48%)	22 (48%)	23 (50%)	0.971
g. Provide counseling and instructions on use of medications for patients upon discharge	8 (17%)	44 (96%)	10 (22%)	< 0.001
<i>Physicians' responses (N = 143)</i>				
a. Interviewing patients on admission and obtaining an accurate medication history	26 (18%)	32 (22%)	131 (92%)	< 0.001
b. Verifying the medication history list against the medications ordered on admission	28 (20%)	70 (49%)	110 (77%)	< 0.001
c. Reconciling the discrepancies between the patient's medication history list and the medications ordered on admission	26 (18%)	82 (57%)	93 (65%)	< 0.001
d. Reconciling medications upon transfer of a patient to another level of care/unit	50 (35%)	59 (41%)	99 (69%)	< 0.001
e. Reconciling medications at the time of discharge	25 (17%)	80 (56%)	125 (87%)	< 0.001
f. Sending the patient's discharge medication list to the patient's physician/next provider (if the patient is transferred to another level of care)	27 (19%)	48 (34%)	105 (73%)	< 0.001
g. Provide counseling and instructions on use of medications for patients upon discharge	30 (21%)	113 (76%)	83 (58%)	< 0.001

^a Percentages do not add up to a 100% because more than one answer was allowed.

perceived their role, they viewed their profession as the main service provider in all steps followed by physicians and saw little input from the nurses. The exception was on sending medication list to the next provider where they saw similar role for pharmacists, nurses and physicians with 48%, 48% and 50%, respectively. The steps that gained the highest percentage for pharmacists as perceived by pharmacists themselves were patient counseling on discharge with 96% and medication reconciliation on discharge with 91%. Physicians on the other hand, also viewed their own profession as the main service provider in the majority of steps followed by pharmacists. The exception to this was in providing medication counseling where they viewed this as the pharmacist's role followed by themselves with 76% and 58%, respectively. They saw little input from the nurses in all steps except medication

reconciliation on transfer where nurses were viewed as a partner with physicians and pharmacists with 69% for physicians, 41% for pharmacists and 35% for nurses.

On how respondents viewed some statements on medication reconciliation, there was generally a consensus that medication reconciliation is important, leads to a reduction in patient harm, their profession has a role in it and senior management was committed to strategies to improve patient safety (Table 4). However, there was less agreement when asked whether they had time to implement the process with 47% of pharmacists disagreeing or strongly disagreeing. All professions were keen to see medication reconciliation implemented at SQUH and saw its direct benefit to the patient.

Majority (66%; $n = 301$) agreed there was a role for information technology and 25% ($n = 113$) did not know whether

Table 4 Views using Likert scale on statements related to the implementation of a medication reconciliation process.

Statement	Disagree or strongly disagree <i>n</i> (%)	Neutral <i>n</i> (%)	Agree or strongly agree <i>n</i> (%)	Total
It is important to obtain an accurate medication history on admission				
<i>Physicians</i>	1 (1%)	3 (2%)	138 (97%)	142
<i>Pharmacists</i>	2 (4%)	0	45 (96%)	47
<i>Nurses</i>	0	2 (1%)	271 (99%)	273
Medication reconciliation leads to reduction in patient harm				
<i>Physicians</i>	2 (1%)	2 (1%)	138 (97%)	142
<i>Pharmacists</i>	1 (2%)	0	46 (98%)	47
<i>Nurses</i>	0	2 (1%)	268 (98%)	273
I think staff with the same profession as mine, are key members in the reconciliation process				
<i>Physicians</i>	4 (3%)	11 (8%)	127 (89%)	142
<i>Pharmacists</i>	1 (2%)	4 (9%)	42 (89%)	47
<i>Nurses</i>	14 (5%)	32 (12%)	226 (83%)	273
I have time to implement a medication reconciliation process				
<i>Physicians</i>	16 (11%)	41 (29%)	85 (60%)	142
<i>Pharmacists</i>	22 (47%)	15 (32%)	10 (21%)	47
<i>Nurses</i>	35 (13%)	81 (30%)	156 (57%)	273
Senior management is committed to strategies that improve patient safety. i.e. by providing needed support and resources				
<i>Physicians</i>	3 (2%)	29 (21%)	109 (77%)	141
<i>Pharmacists</i>	2 (4%)	11 (23%)	34 (72%)	47
<i>Nurses</i>	8 (3%)	29 (11%)	233 (85%)	273
I would like to see a standardized medication reconciliation process implemented in SQUH				
<i>Physicians</i>	1 (1%)	11 (8%)	130 (92%)	142
<i>Pharmacists</i>	1 (2%)	1 (2%)	45 (96%)	47
<i>Nurses</i>	5 (2%)	10 (4%)	257 (94%)	273
There is no direct benefit to me if a medication reconciliation process is implemented				
<i>Physicians</i>	109 (77%)	13 (9%)	20 (14%)	142
<i>Pharmacists</i>	39 (83%)	4 (9%)	4 (9%)	47
<i>Nurses</i>	209 (77%)	38 (14%)	26 (10%)	273

Percentages are row percents.

information technology had a role. A total of 227 (49%) voted for general medicine wards to be the priority units for implementing medication reconciliation in the hospital followed by pediatrics (15%; $n = 69$) and critical care (14%; $n = 67$).

On a scale of 1–5 on the value of medication reconciliation where 1 is the least value and 5 the highest value, 76% ($n = 342$) gave it a value of 5. As many as 49% ($n = 226$) agreed that there were obstacles that can prevent them or others from implementing medication reconciliation. Examples of such obstacles were stated as lack of time and resources, unreliable sources for medication history, lack of patient knowledge with regard to their medication as well as lack of effective communication between the three health care providers.

4. Discussion

This survey was done prior to the implementation of a structured medication reconciliation process, yet a fair percentage of respondents believed there either was or only to some extent a certain level of medication reconciliation that is currently practiced in the hospital. This can be explained by the fact that the hospital was in its preparation for ACI accreditation and there were discussions going on at different levels on principles

of medication reconciliation. It can also be explained by the fact that some people in their usual practice have taken or seen other people taking medication histories and reconciling discrepancies, perhaps not on regular basis but nevertheless it was practiced ‘to some extent’.

When questioned on whether there was a standardized medication reconciliation process in the hospital, the responses varied which perhaps reflects the lack of understanding of what a standardized process is and can also explain the previously raised point that they thought some level of medication reconciliation was practiced.

On their perception of their role in the process, physicians and pharmacists each saw themselves as the main service provider except with one or two steps. This can be explained by the traditional role both physicians and pharmacists acquired in the process as shown in the literature (Abuyassin et al., 2011; Lee et al., 2014). Nurses however, also saw a major role for physicians but not pharmacists. In fact, they saw more input from nurses than pharmacists. This is contrary to what other studies reported, on the quality of medication reconciliation steps between nurses, pharmacists and doctors showing better accuracy and quality when pharmacists were involved (Aag et al., 2014; Eriksson et al., 2012). Our explanation to this is the limited number of clinical pharmacists and the fact that nurses do in many cases acquire roles other than their

traditional ones because of the occasional unavailability of pharmacists and also because nurses are present all the time in the wards unlike pharmacists. This explanation is supported by the findings of a survey assessing pharmacist roles in medication reconciliation and showing insufficient recognition of the value of pharmacists' roles by medical and nursing staff (Kern et al., 2014). However, medication counseling on discharge was a step that all agreed on as the main responsibility of the pharmacist. Discharged patients normally collect their medications from the pharmacy and pharmacists are best suited for this role owing to their medication expertise, in addition to the feasibility of completing this step in the pharmacy itself, where pharmacists are available, unlike the wards where few clinical pharmacists may be available.

The agreement that medication reconciliation is important and that it improves patient safety is an important finding and shows the amount of belief staff have on practices toward improving patient safety. However, the three health care providers saw obstacles preventing them from implementing it and a role for information technology to facilitate it, similar to another published study (Boockvar et al., 2011). Moreover, 47% of pharmacists stated they have no time for performing medication reconciliation, again reflecting the limited number of pharmacists and the larger range of roles they themselves, let alone others, expect from them in the context of medication reconciliation as reflected by our findings.

The findings show lack of clarity and agreement between the three professions especially nursing on what their role should be. This is not an unusual finding where Vogelsmeier et al. (2013) and Lee et al. (2014) also found differing perspectives among the three professions. This can be used as an opportunity to define the three professions' different roles especially that of the nurse and segregate it from the roles of physicians and pharmacists. Another opportunity is to use these findings to divide the eight steps in the process between the three professions. This will improve focus and limit duplication of tasks.

This current survey is not without limitations. The SQUH is a tertiary care teaching hospital and our results may not be generalized to other hospital settings with different health care staff mix. Our survey targeted physicians and nurses working in in-patients areas, therefore, eliminating input from out-patient areas. This can be justified by the need to first introduce medication reconciliation in in-patient areas followed by outpatient as stated by ACI. Another limitation was the fact that only 42% of those surveyed responded. Furthermore, there were discussions throughout the hospital to start implementing medication reconciliation. This could have potentially biased our results positively; consequently leading to an overestimation of the current medication reconciliation practices and believes. This bias could also be considered a strength as it has resulted in a better understanding of the process by the respondents and perhaps having enabled them to provide more reliable answers than if they did not fully understand it.

We recommend that there should be clear processes that assign different steps within the policy to the appropriate health care provider. Admission and transfer medication reconciliation where nurses and physicians are best suited to administer it can be assigned to them with the pharmacists being involved in the verification of information. The pharmacists may have more roles on discharge medication

reconciliation and medication counseling as they are also best suited for this. Most importantly a proper training offered to the three professions prior to the actual implementation of medication reconciliation is needed to prevent duplication of work and ensure smooth running and acceptability of the process. Moreover, we recommend that additional resources, in terms of personnel, are made available especially pharmacists to enable them to be key members in the process and best utilize their expertise in medications.

5. Conclusions

The health care providers in SQUH have strong beliefs that medication reconciliation will enhance patient's safety. However, there is a lack of agreement with regard to roles and responsibilities of each profession within the process. Moreover, because of its complex time consuming nature, the majority agree that there are obstacles of time and resources. Multidisciplinary team comprising nurses, pharmacists and physicians can facilitate it and make it more feasible and achievable. This can be made possible by agreement, more clarity of roles and commitment to each ones role in the process.

Acknowledgments

The authors thank the pharmacists, physicians and nurses who completed the survey. We also thank Dr. Huda Al Owaisi from the Nursing Directorate, Ms. Badria Al-Zadjali and Ms. Alaa Sarakbi from the Pharmacy at SQUH for their support.

References

- Aag, T., Garcia, B.H., Viktil, K.K., 2014. Should nurses or clinical pharmacists perform medication reconciliation? A randomized controlled trial. *Eur. J. Clin. Pharmacol.* 70, 1325–1332.
- Abuyassin, B.H., Aljadhey, H., Al-Sultan, M., Al-Rashed, S., Adam, M., Bates, D.W., 2011. Accuracy of the medication history at admission to hospital in Saudi Arabia. *Saudi Pharm. J.: SPJ: Off. Publ. Saudi Pharm. Soc.* 19, 263–267.
- Aspden, P., Wolcott, J.A., Bootman, J.L., Cronenwett, L.R., 2006. *Preventing Medication Errors: Quality Chasm Series.* National Academies Press, Washington DC.
- Boockvar, K.S., Santos, S.L., Kushniruk, A., Johnson, C., Nebeker, J.R., 2011. Medication reconciliation: barriers and facilitators from the perspectives of resident physicians and pharmacists. *J. Hosp. Med.* 6, 329–337.
- Clay, B.J., Halasyamani, L., Stucky, E.R., Greenwald, J.L., Williams, M.V., 2008. Results of a medication reconciliation survey from the 2006 Society of Hospital Medicine national meeting. *J. Hosp. Med.: Off. Publ. Soc. Hosp. Med.* 3, 465–472.
- Eriksson, T.H.L., Midlöv, P., Höglund, P., Bondesson, Å., 2012. The hospital LMM-based clinical pharmacy service improves the quality of the patient medication process and saves time. *Eur. J. Hosp. Pharm.* 19, 375–377.
- Gleason, K.M., Groszek, J.M., Sullivan, C., Rooney, D., Barnard, C., Noskin, G.A., 2004. Reconciliation of discrepancies in medication histories and admission orders of newly hospitalized patients. *Am. J. Health-Syst. Pharm.: AJHP : Off. J. Am. Soc. Health-Syst. Pharm.* 61, 1689–1695.
- IHI, 2015. Medication Reconciliation Review [Online]. Institute for Healthcare Improvement Available: < <http://www.ihl.org/resources/Pages/Tools/MedicationReconciliationReview.aspx> > (accessed 25.02.15).

- ISMP, 2006. Survey on Medication Reconciliation [Online]. Available: <<http://www.ismp.org/survey/survey200604.asp>> (accessed 09.12.13).
- JCI, 2006. Using Medication Reconciliation to Prevent Errors [Online]. Available: <http://www.jointcommission.org/assets/1/18/SEA_35.pdf> (accessed 25.02.15).
- Kern, K.A., Kalus, J.S., Bush, C., Chen, D., Szandzik, E.G., Haque, N.Z., 2014. Variations in pharmacy-based transition-of-care activities in the United States: a national survey. *Am. J. Health-System Pharm.: AJHP: Off. J. Am. Soc. Health-Syst. Pharm.* 71, 648–656.
- Lee, K.P., Hartridge, C., Corbett, K., Vittinghoff, E., Auerbach, A.D., 2014. “Whose job is it, really?” physicians’, nurses’, and pharmacists’ perspectives on completing inpatient medication reconciliation. *J. Hosp. Med.: Off. Publ. Soc. Hosp. Med.*
- Lehnbom, E.C., Stewart, M.J., Manias, E., Westbrook, J.I., 2014. The impact of medication reconciliation and review on clinical outcomes. *Ann. Pharmacother.*
- Rozich, J.D., Resar, R.K., 2001. Medication safety: one organization’s approach to the challenge. *J. Clin. Outcomes Manage.* 8, 27–34.
- Schnepf, B. 2006. Decreasing adverse drug events in rural healthcare through medication reconciliation. M.A. Thesis MR20611, (Online) Royal Roads University (Canada). <<http://ezproxy.squ.edu.om:2145/dissertations/docview/304909447/F565CD88997D4BB2PQ/8?accountid=27575>> (accessed 25.02.15).
- Vogelsmeier, A., Pepper, G.A., Oderda, L., Weir, C., 2013. Medication reconciliation: a qualitative analysis of clinicians’ perceptions. *Res. Soc. Admin. Pharm.: RSAP* 9, 419–430.