Physicians' and Nurses' Attitudes and Actions Regarding Perioperative Medication Management

Susanne Winther Olsen, MPQM, RN, Eva Draborg, MSC, PhD, Marianne Lisby, PhD, MHSc, RN

Purpose: *To investigate physicians' and nurses' attitudes and actions related to the prescription and administration of perioperative antibiotics and opioids during a 2-week period.*
Design: *A quantitative descriptive and analytical research design performed at a Danish University Hospital.*
Methods: *An email survey using an 18-item questionnaire was sent to 163 nurses and physicians involved in the perioperative period.*
Findings: *Of 163 participants, 114 (69.9%) returned the questionnaire. Between 12% and 29% of the respondents reported that they did not correctly manage the medication, although they thought it to be important. Between 41% and 68% of the respondents experienced incorrect medication management with significant differences among professions and specialties.*
Conclusions: *The study confirms a knowing-doing gap in medication management in perioperative settings, highlighting the need to address this issue, to ensure that physicians and nurses act in accordance with their beliefs and consider the importance of medication safety in interdisciplinary work across specialties.*

Keywords: *medication errors, adverse drug events, perioperative period, human factors, attitudes, survey.*

MEDICATION ERRORS ACCOUNT for over 40% of the adverse events reported in hospitals.[1-4] The perioperative period is considered to present the most risk, with an estimated 7.2% adverse drug events (ADEs) compared with 1.4% in general.[5] Antibiotics and opioids top the list of drugs associated with serious preventable ADEs, but these drugs are also important in the perioperative period.[1,6,7] This raises concerns about the impact of human errors and possible weaknesses in the perioperative medication process,[1,5] which can be fragmented because of challenges in collaborative professional relationships, clarification of responsibilities and communication, and differing documentation systems.[4,8-11] Both latent errors (related to organizational and system factors) and active errors (eg, lack of medication, incorrect dose or medication, and rule violations) occur in the perioperative period.[1,7,10,12-16]

A systemic approach to improving medication management is the introduction of an electronic unified medication system, which can lead to a higher transparency in the medication process.[2] The risk of ADEs increases when prescriptions

Susanne Winther Olsen, MPQM, RN, Department of Anesthesia and Intensive Care, Odense University Hospital, Svendborg, Denmark; Eva Draborg, MSC, PhD, Department of Public Health, University of Southern Denmark, Odense, Denmark; and Marianne Lisby, PhD, MHSc, RN, Research Center for Emergency Medicine, Aarhus University Hospital, Aarhus, Denmark.

Conflict of interest: None to report.

Address correspondence to Susanne Winther Olsen, Department of Anesthesia and Intensive Care, Odense University Hospital, Svendborg, Denmark; e-mail address: Susanne.olsen@rsyd.dk.

1089-9472/$36.00
https://doi.org/10.1016/j.jopan.2018.08.005

and administrations are not documented in a unified system. This is often the case when the anesthetic journal is recorded on paper rather than in an electronic medical record (EMR).[5] Documentation in different systems makes it difficult to identify possible drug interactions and complicates a unified drug prescription, dispensing, and administration.[3,17,18]

Previous research on medication management has primarily focused on working procedures, communication, and cooperation in relation to system and organizational factors, whereas individual attitudinal aspects have, to the best of our knowledge, not been described.

The purpose of the present study was (1) to investigate the attitudes and actions of physicians and nurses regarding the prescription and administration of antibiotics and opioids in the perioperative course and (2) to determine if there is divergence between experienced incorrect medication management between professions and specialties in the perioperative period.

Methods

Design and Setting

We performed a survey of physicians' and nurses' attitudes regarding their medication management and their perceived actions within a predefined 2-week period (March 25 to April 9, 2014). The study was carried out at a Danish University Hospital and involved three orthopaedic surgery units, an anesthesia unit, and a postanesthesia care unit (PACU). Approximately 13,000 orthopaedic surgeries are performed annually in the setting, with 5,000 same-day surgery patients and approximately 8,000 in-hospital patients.

Definitions

Medication process: Includes the processes from ordering (prescribing), dispensing, administering, and monitoring,[13] documented in an electronic unified medication system.

Perioperative period: Consists of the preoperative period (on the ward), the intraoperative period (in the operating room), and the postoperative period (in the PACU).

Unified medication systems: In the surgery unit and the PACU, prescriptions and administrations were primarily documented in the EMR. In the anesthetic unit, it was documented on a local paper-based medical record.

Population

The study population consisted of health care professionals working in perioperative patient care that is nurses and physicians from the orthopaedic department, anesthetic nurses, and anesthesiologists from the Anesthetic Unit and only nurses from the PACU.

Data Collection

A questionnaire addressing attitudes was developed to gain an understanding and a possible explanation of the reasons behind the performed action by the staff related to the medication management. The questions were inspired by the survey of Rozenblum et al on attitudes of physicians and nurses regarding the patient experience.[19]

The questionnaire consisted of five questions addressing the background information (gender, age, profession, seniority, and specialty) of respondents and three main themes: (1) Actions related to medication safety with five questions (eg, "How often do you document prescription/administration of antibiotics/opioids in the EMR?"); (2) assessment of and attitude toward medication safety included four questions (eg, "How important is it for you to document prescription/administration of antibiotics/opioids in the EMR?"); and (3) experienced incorrect medication management with four questions (eg, "How often have you experienced omitted administration of antibiotics?").

To assess the face and content validity of the questionnaire, it was tested on a selected group of four physicians (senior doctors) and four nurses with considerable experience in perioperative care and was amended and shortened based on the feedback gathered. For example, division of question 9 into two questions. The final version of the questionnaire consisted of 18 questions, 17 closed-ended questions and one open-ended question.

Apart from a few dichotomous response categories ("yes" and "no") for respondent characteristics,

a 5-point Likert scale was used (eg, very important, important, neither/nor, less important, and not important), supplemented with the response categories "do not know" and "not relevant."

The questionnaire was distributed by email to all physicians and nurses in the perioperative setting, that is, 50 physicians and 113 nurses, via SurveyXact.[20] Two reminder emails were sent within 1 week, also via SurveyXact.

Data Analysis

Descriptive and analytical statistics were applied. Dichotomous and categorical data were described as numbers and proportions. Parametric data were described as means and 95% confidence intervals (CIs).

To examine differences between the respondents' attitudes and actions concerning medication management, we used χ^2 test or Fischer's exact test as appropriate with a level of statistical significance of .05. The response categories were dichotomized as follows: "very important/important" and "neither important nor unimportant/less important/not important." The responses do not know and not relevant were excluded from the analysis.

Ethical Considerations

The local hospital managers approved the study. According to Danish law, approval from the Regional Committees on Health Research Ethics for Southern Denmark was not required because of the nature of the study. In addition, notification to the Data Protection Agency was not needed as no personally identifiable data were collected. The respondents were informed about the purpose of the study, assured anonymity, and that data would be stored and handled confidentially. Completing the questionnaire was considered to constitute consent for study participation.

Findings

Respondent Characteristics

Of the total of 163 physicians and nurses, 114 returned the questionnaire corresponding to a response rate of 69.9%. As shown in Table 1, three-quarters of the respondents had more than 10 years of experience in their job, and 76% were nurses.

Physicians accounted for 49.4% of respondents in orthopaedic surgery units and 16% in the anesthesia unit, whereas the PACU respondents were all nurses.

Nonresponders

A comparison between respondents (114) (Table 1) and nonrespondents (49) showed that the latter were significantly more likely to be men (44.8%; 95% CI, 30.7 to 59), physicians (50%; 95% CI, 35.2 to 64.8), and staff from the orthopaedic surgery units (79.6%; 95% CI, 65.7 to 89.8). Almost everyone in the PACU participated in the survey, leaving significantly fewer in the nonrespondent group (4.1%; 95% CI, 0.5 to 14.0).

Attitudes and Actions

Table 2 illustrates the physicians' attitudes toward and actions regarding the documentation of prescriptions. Most orthopaedic surgeons thought it to be important to document prescriptions of antibiotics and opioids in the EMR, and most also did this in practice for antibiotics (95.5%) and opioids (95.5%). All the anesthetists thought it was important to document these prescriptions in the EMR, but none did so in practice.

The vast majority of nurses in all specialties found it important, but rarely documented the administration of antibiotics (21%) and opioids (29%) in the EMR (Table 2). Nurses in the anesthesia unit were most likely to report that they documented the administration of antibiotics, whereas nurses in the orthopaedic surgery units were least likely ($P = .025$) (Table 3). In contrast, nurses in the anesthetic unit were least likely to report that they documented the administration of opioids ($P < .001$).

The respondents were asked whether medication management in the perioperative period was considered unified, that is prescriptions and administrations being documented in the same EMR. Sixty percent from the anesthesia unit, 51% from the orthopaedic surgery units, and

Table 1. Characteristics of the Respondents

Characteristic (N = 114)	n (%)	95% CI
Gender		
Female	86 (75.4)	66.5-83.0
Male	28 (24.6)	17.0-33.5
Age		
Mean	46.7	44.8-48.7
Years of professional experience		
< 1	7 (6.1)	2.5-12.2
1-5	12 (10.5)	5.6-17.7
6-10	9 (7.9)	3.7-14.5
>10	86 (75.4)	66.5-83.0
Clinician		
Nurse	87 (76.3)	67.4-83.8
Physician	27 (23.7)	16.2-32.6
Perioperative specialty		
Surgery units	50 (43.9)	34.6-53.5
Anesthesia unit	20 (17.5)	11.1-25.8
PACU	44 (38.6)	29.6-48.2

CI, confidence interval; N, number; PACU, postanesthesia care unit.

50% from the PACU stated that it was unified, which was a statistically significant difference ($P = .019$).

Medication Safety in the Perioperative Period

Table 4 shows the respondents' experiences regarding incorrect medication management. As can be seen the amount of experienced lack of prescriptions (written or electronic) varied significantly among specialties ($P = .018$), with most respondents experiencing this in the anesthetic unit.

When asked about incorrect administration, more nurses than physicians experienced an omission of administration ($P = .001$). This was mainly stated by nurses from the anesthetic unit and the PACU, whereas delayed administration ($P = .001$) was mainly recorded by nurses from the PACU.

Discussion

The purpose of this study was to examine physicians' and nurses' attitudes regarding the management of antibiotics and opioids in the perioperative period, and their actions and finally, their experience of incorrect medication management.

We found a notable divergence between physicians' attitudes toward the prescription of opioids and antibiotics and their actual documentation practice. For nurses, the divergence between attitudes and actions in relation to the administration of these drugs turned out to be even greater.

In addition, we found that three of four respondents experienced incorrect medication management, with significant differences between professions and specialties.

Divergence Between Actions and Attitudes Toward Executed Documentation

We found that most physicians considered it important to document the prescription of antibiotics and opioids. Thus, the significant difference

Table 2. Association Between How Often the Respondents Document Prescribed/Administered Antibiotics and Opioids and Their Assessment of the Importance of Doing So (N = 107*)

	Assessment of the Importance of Documenting Prescription or Administration	Type of Medication			
		Antibiotics		Opioids	
		Important (%)	Not Important (%)	Important (%)	Not Important (%)
	Frequency of Documentation				
Physicians (n = 25)	Often	84	0	84	4
Prescriptions	Seldom	12	4	12	0
Nurses (n = 82)	Often	79	0	71	0
Administration	Seldom	20	1	25	4

*Three missing data.

Table 3. Documentation of Prescribed and Administered Antibiotics and Opioids in the EMR (%)

	Often	Seldom	Do not Know	Missing	*P* Value
Prescription of antibiotics (physicians n = 27)					
Surgery units (n = 24)	91.7	4.15	0	4.15	.002
Anesthesia unit (n = 3)	0	100	0	0	
Prescription of opioids (physicians n = 27)					
Surgery units (n = 24)	95.9	0	0	4.15	< .001
Anesthesia unit (n = 3)	0	100	0	0	
Administration of antibiotics (nurses n = 87)					
Surgery units (n = 26)	65.4	11.5	7.7	15.4	.025
Anesthesia unit (n = 17)	94.1	5.9	0	0	
PACU (n = 44)	79.5	11.4	9.1	0	
Administration of opioids (nurses n = 87)					
Surgery units (n = 26)	88.5	0	3.8	7.7	< .001
Anesthesia unit (n = 17)	5.9	58.8	29.4	5.9	
PACU (n = 44)	81.8	15.9	2.3	0	

EMR, electronic medical record; PACU, postanesthesia care unit.

between actions of orthopaedic surgeons and anesthesiologists suggests that the responsibility for documenting these prescriptions was expectantly placed on the orthopaedic surgeons—in line with the procedures of units.

Nurses, on the other hand, did not document the administration of antibiotics in the EMR, although they considered documentation to be important. This may be attributable to the fact that two of the three nurses experienced omitted prescriptions. These findings indicate a mismatch between the physicians' perception of documenting prescriptions correctly and what was actually done in clinical practice resulting in inability of nurses to document the administration of these nondocumented drugs' orders. In addition, it reveals a fragmented approach to the medication process, where both physicians and nurses tend to focus on their own responsibility, rather than ensuring the continuity in the medication of patients during the perioperative period. These findings may well reflect the complexity of the multidisciplinary nature of the perioperative setting and teams.[5]

Surprisingly, more nurse anesthetists stated that they documented the administration of antibiotics in the EMR, compared with nurses from the other units, despite the fact that they considered a paper-based anesthesia record to constitute their unified system. This suggests a dual documentation practice with anesthetics being documented on paper and drug prescriptions from surgeons in the EMR. Because opioids in general are considered as part of anesthesia[5] our findings may, in part, explain why significantly fewer nurse anesthetists stated

Table 4. Experience of Omitted and Delayed Prescriptions and Administrations

	Lack of Prescription n (%)	*P* Value	Lack of Administration n (%)	*P* Value	Delayed Administration n (%)	*P* Value
All respondents (n = 110)	75 (68.2)		45 (40.9)		48 (43.6)	
Clinician		.06		.001		< .001
Nurse (n = 84)	56 (66.7)		36 (42.9)		42 (50.0)	
Physician (n = 26)	19 (73.1)		9 (34.6)		6 (23.1)	
Perioperative specialty		.018		.008		.06
Surgery units (n = 47)	31 (66.0)		12 (25.5)		15 (31.9)	
Anesthesia unit (n = 19)	18 (94.7)		9 (47.4)		7 (36.8)	
PACU (n = 44)	26 (59.1)		24 (54.5)		26 (59.1)	

PACU, postanesthesia care unit.

that they documented the administration of opioids in the EMR, compared with nurses from the other specialties.[5] This is also in accordance with other studies,[5,10,21] in which a unified medication management system was highlighted as a solution to minimize ADEs, however, without addressing liability arrangements.[22]

Whether the patient pathway is considered as an entity or a fragmented process, the perioperative period is characterized by use of different documentation systems, person-related medication management, relational circumstances, and interdisciplinary team cooperation.[10] Thus, in future, decision makers should be aware of the human aspects, such as the association between attitudes and actions, when dealing with incorrect medication management associated with multiple documentation systems.

Medication Safety

We found that most respondents experienced incorrect medication management, for example, lack of prescribing or administering a drug or delayed administration, with significant differences between professions and specialties. Significantly more nurses than physicians experienced the omitted or delayed administration of antibiotics and opioids, suggesting a lack of clarity of these terms and a lack of collaboration between the two professions. This is in line with previous studies, in which up to 72.6% of all observed errors were related to "wrong time"[1,15,23] representing one of the "five rights" in patient safety check. Thus, it appears that the nurses did not perceive wrong time to be as important as the other four patient safety checks (correct patient, drug, dose, and route).[24] This perception could be linked to insufficient knowledge or experience,[1,5,10,16] or an expectation of nurses being competent in determining when a drug is not appropriate for a patient.[22,24] Furthermore, unclear boundaries of responsibility regarding coordination and communication in the medication process[21] place demands on perioperative nurses to be aware and articulate medication management in all phases of the perioperative pathway.[22] In addition, our findings substantiate the existence of a fragmented medication management in perioperative setting influenced by different views on medication procedures. A finding that, in previous studies, was imputable to a lack of transparency in documentation systems[1,21,25] and an absence of a shared attitude toward medication.[1,24] A lack of transparency and shared approach suggests that physicians and nurses might pay less than adequate attention to their actions in the overall perioperative medication process, and to how this impacts on patient medication safety.

Redley and Botti[17] found a divergence associated with type of documentation system; more prescription errors were detected in the group who documented in the EMR rather than in a paper-based system. Conversely, in the group using the paper-based system, a high occurrence of omitted administrations was found,[17] which is similar to our findings—where significantly more nurses than physicians stated that they experienced omitted or delayed administration.

This raises the question as to whether the cognitive processes to ensure compliance with the five "rights" for the nurses have become an almost ritual act, without awareness of the task of administering medicine.[5,7,26] Nurses are expected to prevent medication errors by combining the five safety checks with their knowledge about when a particular drug, dose, drug form, or route of administration is not in the patient's best interest.[22,24]

Thus, in future, more attention should be generated to improve the knowledge and competences regarding the medication process. In addition to understand why the introduction of the five rights of patient medication (the right medication, patient, dose, time, and route) has not yet led to improved safety.

> In addition, the study highlight the challenges that use of different documentation systems may imply for patient safety. Therefore, implementation of a unified documentation system should be highly prioritized in perioperative settings.

Limitations

The study has some limitations. The cross-sectional design provides a snapshot of solely the associations between the respondents' attitudes toward and actions related to medication

procedure, however, without causality. Furthermore, the findings were based on a limited study population, and further studies should be undertaken before the results can be generalized.

One of the limitations in this study is the imbalance between different group sizes of respondents according to professions and specialties. This, however, reflects the distribution of different professions used in the perioperative setting. For the anesthesiologists, the response rate was 42.9% whereas 50% of the surgeons participated. Less nurses from the orthopaedic department (52%), 76.5% of the anesthetic nurses, and 93.5% of the nurses from the PACU participated.

The questionnaire was developed for the purpose of the present study and was face and content validated accordingly; however, it was not validated in other studies. Although the questions are inspired by Rozenblum et al's study of attitudes among physicians and nurses, it was developed for another purpose (expectations and satisfaction).

The survey was performed at a single university hospital with inclusion of physicians and nurses involved in the perioperative period of orthopaedic surgery, which could limit the generalizability of our results. However, several results are in line with the findings in comparable studies, which strengthen the reliability of our findings. Despite the relatively high response rate, a difference in level of interest in medication safety and patient safety between respondents and nonrespondents cannot be excluded. This may in particular apply to findings involving anesthesiologists who had the lowest response rate (42.9%) among the participating professions and specialties. Thus, this might have had an impact on the results.

Conclusions

The study confirms a knowing-doing gap in medication management in perioperative settings, with a notable divergence between physicians' attitudes toward and actual documentation of the prescription of opioids and antibiotics. This indicates a lack of attention to the consequences of one's actions on the overall medication process and, furthermore, of the safety implications involved in the use of a dual medication documentation system.

Almost half of the physicians and nurses in this study had experienced incorrect medication management with a considerably higher number of physicians than nurses. This suggests that the perioperative medication process in its current form is inadequate. In addition, the identified discrepancies between attitudes and actions in daily practice imply a risk of mismanagement. All these issues should be addressed to improve medication safety in the perioperative setting and reduce the high number of ADEs.

In future studies, it would be of interest to examine the competences and knowledge of physicians and nurses regarding, for example, pharmacokinetics as a basis for understanding the importance of correct and timely medication management. Furthermore, the amount of experienced incorrect medication management should be explored in terms of patient safety culture in the perioperative pathway.

Acknowledgment

The authors would like to thank all the participating clinicians from the orthopedic department, the anesthetic department and postanesthetic department at Odense University Hospital.

References

1. Wanzer L, Hicks R. Medication safety within the perioperative environment. *Annu Rev Nurs Res*. 2006;24:127-155.
2. Van Sluisveld N, Zegers M, Natsch S, Wollersheim H. Medication reconciliation at hospital admission and discharge: Insufficient knowledge, unclear task reallocation and lack of collaboration as major barriers to medication safety. *BMC Health Serv Res*. 2012;12:170.
3. Cortelyou-Ward K, Swain A, Yeung T. Mitigating error vulnerability at the transition of care through the use of health IT applications. *J Med Syst*. 2012;36:3825-3831.
4. Santell J. Reconciliation failures lead to medication errors. *Jt Comm J Qual Patient Saf*. 2006;32:225-229.
5. Hicks R, Wanzer L, Goeckner B. Perioperative pharmacology: A framework for perioperative medication safety. *AORN J*. 2011;93:136-145.
6. Chappy S. Perioperative patient safety: A multisite qualitative analysis. *AORN J*. 2006;83:871-897.

7. Dhawan I, Tewari A, Sehgal S, Sinha AC. Medication errors in anesthesia: Unacceptable or unavoidable? *Braz J Anesthesiol*. 2017;67:184-192.

8. Rogers G, et al. Reconciling medications at admission: Safe practice recommendations and implementation strategies. *Jt Comm J Qual Patient Saf*. 2006;32:37-50.

9. Ketchum K, Grass C, Padwojski A. Medication reconciliation. Verifying medication orders and clarifying discrepancies should be standard practice. *Am J Nurs*. 2005;105: 78-85.

10. Zhang Y, Dong Y, Webster C, et al. The frequency and nature of drug administration error during anaesthesia in a Chinese hospital. *Acta Anaesthesiol Scand*. 2013;57: 158-164.

11. Burda S, Hobson D, Pronovost P. What is the patient really taking? Discrepancies between surgery and anesthesiology peroperative medication histories. *Qual Saf Health Care*. 2005;14:414-416.

12. Kluger M, Bullock M. Recovery room incidents: A review of 419 reports from the Anaesthetic Incident Monitoring Study (AIMS). *Anaesthesia*. 2002;57:1060-1066.

13. Lisby M, Nielsen L, Brock B, Mainz J. How are medication errors defined? A systematic literature review of definitions and characteristics. *Int J Qual Health Care*. 2010; 22:507-518.

14. Lisby M, Nielsen LP, Brock B, Mainz J. How should medication errors be defined? Development and test of a definition. *Scand J Public Health*. 2012;40:203-210.

15. Nanji K, Patel A, Shaikh S, Seger D, Bates D. Evaluation of perioperative medication errors and adverse drug events. *Anesthesiology*. 2016;124:25-34.

16. Meadows C, Kaul S. Medicines management in the theatre suite. *J Perioper Pract*. 2009;19:352-357.

17. Redley B, Botti M. Reported medication errors after introducing an electronic medication management system. *J Clin Nurs*. 2013;22:579-589.

18. Boockvar K, Santos S, Kushniruk A, Johnson C, Nebeker J. Medication reconciliation: Barriers and facilitators from the perspectives of resident physicians and pharmacists. *J Hosp Med*. 2011;6:329-337.

19. Rozenblum R, Lisby M, Hockey P, et al. The patient satisfaction chasm: The gap between hospital management and frontline clinicians. *Int J Qual Health Care*. 2013;22:242-250.

20. Dreibjerg T, Krog O. *User Manual SurveyXact*. Aarhus, Denmark: Rambøll Management Consulting; 2013.

21. Hume A, Kirwin J, Bieber H, et al. Improving care transitions: Current practice and future opportunities for pharmacists. *Pharmacotherapy*. 2012;32:325-337.

22. Joy J. Nurses: The patient's first—and perhaps last—line of defense. *AORN J*. 2009;89:1133-1136.

23. Berdot S, Sabatier B, Gillaizeau F, Thibaut C, Prognon P, P D. Evaluation of drug administration errors in a teaching hospital. *BMC Health Serv Res*. 2012;12:60.

24. Stetina P, Groves M, L P. Managing medication errors—A qualitative study. *MedSurg Nurs*. 2005;14:174-178.

25. Keers R, Williams S, Cooke J, Ashcroft D. Causes of medication administration errors in hospitals: A systematic review of quantitative and qualitative evidence. *Drug Saf*. 2013;36:1045-1067.

26. Anto B, James K, Barlow D, Brinklow N, Oborne C, Whittlesea C. Exploratory to identify the process used by pharmacy staff to verify the accuracy of dispensed medicines. *Int J Pharm Pract*. 2013;21:233-242.