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

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Physicians’ and nurses’ attitudes and actions regarding perioperative medication management

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Running title: Perioperative medication
Physicians’ and nurses’ attitudes and actions regarding perioperative medication management
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Abstract

Purpose: To investigate physicians’ and nurses’ attitudes and actions related to the prescription and administration of perioperative antibiotics and opioids during a two-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: 114/163 (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
Introduction

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 to 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 due to 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 (e.g., lack of medication, incorrect dose or medication, 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 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, while individual attitudinal aspects have, to the best of our knowledge, not been described. The purpose of the present study was (i) to investigate the attitudes and actions of physicians and nurses regarding the prescription and administration of antibiotics and opioids in the perioperative course; (ii) to determine if there is divergence between experienced incorrect medication management between professions and specialties in the perioperative period.

Method

Design and setting

We performed a survey of physicians’ and nurses’ attitudes regarding their medication management and their perceived actions within a pre-defined two-week period (March 25th to April 9th 2014).
The study was carried out at a Danish university hospital and involved three orthopedic surgery units, an anesthesia unit, and a post-anesthesia care unit (PACU). Around 13,000 orthopedic 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.
The perioperative period consists of - the pre-operative period (on the ward), the intraoperative period (in the operating theater) and the post-operative 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 healthcare professionals working in perioperative patient care i.e. nurses and physicians from the orthopedic department, anesthetic nurses and anesthesiologists from the Anesthetic Unit and only nurses from the PACU.

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

The questionnaire consisted of five questions addressing the respondents’ background information (gender, age, profession, seniority, and specialty), and three main themes: 1) Actions related to medication safety with five questions (e.g., “How often do you document prescription/administration of antibiotics/opioids in the EMR?”); 2) Assessment of, and attitude towards, medication safety included four questions (e.g. “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 (e.g, “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, i.e. 50 physicians and 113 nurses, via SurveyXact©(20). Two reminder emails were sent within one week, also via SurveyXact©.

Data analysis
Descriptive and analytical statistics were applied. Dichotomous and categorical data were described as numbers and proportions. Parametric data was described as means and 95% confidence intervals. To examine differences between the respondents’ attitudes and actions concerning medication management, we employed Chi² Test or Fischer’s exact test as appropriate with a level of statistical significance of 0.05. The response categories were dichotomized as: “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 due to 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, were 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’ experience in their job, and 76% were nurses. Physicians accounted for 49.4% of respondents in orthopedic surgery units and 16% in the anesthesia unit, while the PACU respondents were all nurses (data not shown).

Table 1: Characteristics of the Respondents

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

N: Number; *95% CI: 95% confidence interval; PACU: post-anesthesia care unit

Non-responders

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

**Attitudes and actions**

Table 2 illustrates the physicians’ attitudes towards and actions regarding the documentation of prescriptions. The majority of orthopedic 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 of 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, while nurses in the orthopedic surgery units were least likely (p=0.025), see Table 3. In contrast, nurses in the anesthetic unit were least likely to report that they documented the administration of opioids (p<0.001).

**Table 2: The association between how often the respondents document prescribed/administered antibiotics and opioids and their assessment of the importance of doing so (N=107*)**

<table>
<thead>
<tr>
<th>Type of Medication</th>
<th>Antibiotics</th>
<th>Opioids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of the</td>
<td>Important (%)</td>
<td>Not important (%)</td>
</tr>
<tr>
<td>importance of</td>
<td>Physicians (n=25)</td>
<td></td>
</tr>
<tr>
<td>documenting</td>
<td>Prescriptions</td>
<td></td>
</tr>
<tr>
<td>prescription or</td>
<td>Often</td>
<td>84</td>
</tr>
<tr>
<td>administration</td>
<td>Seldom</td>
<td>12</td>
</tr>
<tr>
<td>Nurses (n=82)</td>
<td>Often</td>
<td>79</td>
</tr>
<tr>
<td>Administration</td>
<td>Seldom</td>
<td>20</td>
</tr>
</tbody>
</table>

*Three missing data.

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. 60% from the anesthesia unit, 51% from the orthopedic surgery units and 50% from the PACU stated that it was unified, which was a statistically significant difference (p=0.019).
Table 3: Documentation of prescribed and administered antibiotics and opioids in the EMR (%)

<table>
<thead>
<tr>
<th>Prescription of antibiotics (Physicians n=27)</th>
<th>Often</th>
<th>Seldom</th>
<th>Don’t know</th>
<th>Missing</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery units (n=24)</td>
<td>91.7</td>
<td>4.15</td>
<td>0</td>
<td>4.15</td>
<td></td>
</tr>
<tr>
<td>Anesthesia unit (n=3)</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0.002</td>
</tr>
<tr>
<td>Prescription of opioids (Physicians n=27)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery units (n=24)</td>
<td>95.9</td>
<td>0</td>
<td>0</td>
<td>4.15</td>
<td></td>
</tr>
<tr>
<td>Anesthesia unit (n=3)</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Administration of antibiotics (Nurses n=87)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery units (n=26)</td>
<td>65.4</td>
<td>11.5</td>
<td>7.7</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>Anesthesia unit (n=17)</td>
<td>94.1</td>
<td>5.9</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PACU (n=44)</td>
<td>79.5</td>
<td>11.4</td>
<td>9.1</td>
<td>0</td>
<td>0.025</td>
</tr>
<tr>
<td>Administration of opioids (Nurses n=87)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery units (n=26)</td>
<td>88.5</td>
<td>0</td>
<td>3.8</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Anesthesia unit (n=17)</td>
<td>5.9</td>
<td>58.8</td>
<td>29.4</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>PACU (n=44)</td>
<td>81.8</td>
<td>15.9</td>
<td>2.3</td>
<td>0</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

EMR, electronic medical record; PACU: post-anesthesia care unit

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=0.018), with most respondents experiencing this in the anesthetic unit. When asked about incorrect administration, more nurses than physicians experienced an omission of administration (p=0.001). This was mainly stated by nurses from the anesthetic unit and the PACU, whereas delayed administration (p=0.001) was mainly recorded by nurses from the PACU.

Table 4: Experience of omitted and delayed prescriptions and administrations

<table>
<thead>
<tr>
<th></th>
<th>Lack of prescription n (%)</th>
<th>p-value</th>
<th>Lack of administration n (%)</th>
<th>p-value</th>
<th>Delayed administration n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents (n=110)</td>
<td>75 (68.2)</td>
<td>45 (40.9)</td>
<td>48 (43.6)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clinician</strong></td>
<td>0.06</td>
<td>0.001</td>
<td>42 (50.0)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse (n=84)</td>
<td>56 (66.7)</td>
<td>36 (42.9)</td>
<td>42 (50.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Physician (n=26)  19 (73.1)  9 (34.6)  6 (23.1)

Perioperative specialty  0.018  0.008  0.06
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: post-anesthesia care unit

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 towards 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 out of four respondents experienced incorrect medication management, with significant differences between professions and specialties.

Divergence between actions and attitudes towards executed documentation

We found that the majority of physicians considered it important to document the prescription of antibiotics and opioids. Thus, the significant difference between orthopedic surgeons’ and anesthesiologists’ actions suggests that the responsibility for documenting these prescriptions was expectantly placed on the orthopedic surgeons – in line with the units’ procedures.

Nurses, on the other hand, did not document the administration of antibiotics in the EMR, even though they considered documentation to be important. This may be attributable to the fact that 2/3 of the 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 nurses’ inability to document the administration of these non-documented 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 patients’ medication during the perioperative period. Findings that may well reflect the complexity of the multi-disciplinary nature of the perioperative setting and teams (5).
Surprisingly, more nurse anesthetists stated that they documented the administration of antibiotics in the EMR, compared to 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. Since opioids in general are considered as part of anesthesia (5) our findings may, in part, explain why significantly fewer nurse anesthetists stated that they documented the administration of opioids in the EMR, compared to 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 the majority of respondents experienced incorrect medication management e.g. 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) places 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 towards 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 et al. 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 (17). 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 and/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 weaknesses. The cross-sectional design provides a snapshot of solely the associations between the respondents’ attitudes towards, 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 groups sizes of respondents according to professions and specialties. This, however, reflects the distribution of different professions employed in the perioperative setting. For the anesthesiologists, the response rate was
42.9% while 50% of the surgeons participated. Less nurses from the orthopedic department participated (52%), 76.5% of the anesthetic nurses and 93.5% of the nurses from the PACU.

The questionnaire was developed for the purpose of the present study: and was face and content validated accordingly, however, 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 orthopedic surgery, which could limit the generalizability of our results. However, several of the results are in line with 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 non-respondents 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.

**Conclusion**

The study confirms a knowing-doing gap in medication management in perioperative settings, with a notable divergence between physicians’ attitudes towards, 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, that the identified discrepancies between attitudes and actions in daily practice implies a risk of mismanagement. All of these issues should be addressed in order 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, e.g., 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.

References


