Physician awareness of fluid volume administered with intravenous antibiotics – a structured interview-based study

Running title: Antibiotic fluid awareness

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Abstract

Objective
Fluids administered as drug diluents with intravenous (IV) medicine constitute a substantial fraction of fluids in inpatients. Are physicians aware of fluid volumes administered with IV antibiotics for patients with suspected infections? Does addressing this lead to adjustments in 24-hour fluid administration/antibiotics?

Methods
This cross-sectional interview-based study was conducted in three emergency departments. Physicians were interviewed after prescribing around-the-clock IV antibiotics for ≥24 hours to patients with suspected infection. A structured interview guide assessed the physicians’ awareness, considerations, and practices when prescribing IV antibiotics. The 24-hour antibiotic fluid volume was calculated.

Results
We interviewed 100 physicians. The 24-hour fluid volume administered with IV antibiotics was 400mL (interquartile range: 300–400). Totally, 53% of physicians (n=53) were unaware of the fluid volume administered with IV antibiotics. 76% (n=76) did not account for the antibiotic fluid volume in the 24-hour fluid administration. 96% (n=96) indicated that they would not adjust prescribed fluids after receiving information about 24-hour antibiotic fluid volume administered for their specific patient; no comorbidities associated with fluid intolerance was primary reason for not adjusting prescribed fluids/antibiotics. 79% (n=79) opted for visibility of fluid volumes administered with IV antibiotics in the medical record.

Conclusion
The majority of physicians were unaware of fluid volumes administered as a drug diluent with IV antibiotics. The majority chose not to make post-prescribing adjustments to their planned fluid administration; they regarded their patient as fluid tolerable. The physicians opted for visibility of fluid volumes administered as diluents during the prescribing process.

Keywords: fluid therapy, positive fluid balance, infusions, intravenous, crystalloid solutions, intravenous antibiotics.
Capsule Summary

1) What is already known about this topic?
Fluid administered as a drug diluent with IV antibiotics constitutes a substantial proportion of fluids given to hospitalized patients. It is unknown if physicians are aware of this when prescribing IV antibiotics. Physician awareness about this is important to avoid fluid overload.

2) What does this study add?
We found that physician awareness about fluid volumes with IV antibiotics was low. Physicians should be informed about this important issue in order to avoid fluid overload in the future.
Introduction

Administration of intravenous (IV) fluids to hospitalized patients is common clinical practice and indicated for resuscitation purposes as well as non-resuscitation purposes, such as maintenance and administration of IV medication, including IV antibiotics [1-3].

The optimal fluid volume is still uncertain [4]. A liberal approach increases the risk of fluid overload, which is associated with higher mortality and morbidity [5-7]. Thus, the focus has shifted towards fluid restriction [8]. However, a recent meta-analysis of sepsis and septic shock studies did not find any differences in outcomes between restrictive and usual fluid administration [9].

Observational studies have found that a substantial proportion of fluids are given for non-resuscitation purposes, such as drug diluents for medications, including antibiotics [6, 10, 11]. Drug diluents are an often-overlooked fluid volume despite being a modifiable factor in preventing fluid overload [11]. Depending on the choice of IV antibiotics, the volume of the diluting agent varies. It remains unclear whether physicians are aware of the fluid volume administered as a drug diluent with prescribed IV antibiotics.

The aim of this study was to investigate whether physicians in the emergency department (ED) are aware of the fluid volume administered with the prescribed antibiotics. Furthermore, we investigated if addressing this issue would lead to adjustments in prescribed 24-hour fluid administration or choice of antibiotics.

Methods

Study design

This was a cross-sectional interview-based study with data obtained from short, structured interviews.

Study participants

The study included 100 physicians at three EDs in Central Denmark Region: Aarhus University Hospital (n=50), Regional Hospital Viborg (n = 25), and Regional Hospital Randers (n = 25). A physician was eligible for an interview after prescribing around-the-clock IV antibiotics to an adult ED patient (> 18 years) with suspected or confirmed infection who was planned to be admitted for at
least 24 hours. Single-dose prescriptions were not included. Participation was voluntary, and data were anonymized. Each physician participant, hereafter called participant, consented with a signature after the interview and could only participate once.

The antibiotic prescribing and administration process

In the three participating departments, all IV antibiotics were prescribed by physicians in the same regional electronic patient record system. Antibiotics could be prescribed as single medications, e.g., just IV piperacillin-tazobactam, or as a regionally recommended standard prescription package (SPP) containing the recommended antibiotic administration and combination for a certain presentation or infection, e.g., sepsis or pneumonia. All IV antibiotics were administered by nurses who diluted the antibiotics according to the national guidelines and regional standard procedures: 100 mL of saline per antibiotic dosage except for clarithromycin which was diluted in 250 mL of saline (Table 1). Drug diluents and volumes were not visible in the electronic medical records during the prescribing process. If a physician has a special request in terms of fluid volume or diluent, the physician could address these to the administering nurse.

Survey development - Interview design and interview questions

The structured interview guide consisted of 13 questions (Supplement A). Initial questions assessed the characteristics of the participants; department of primary employment, clinical working experience and rank.

The interview guide included four main questions: (1) Are you aware of the general fluid volume administered as a drug diluent with IV antibiotics? (2) Have you accounted for the fluid volume administered with the IV antibiotics when planning 24-hour fluid administration for this specific patient? (3) If you had known the total 24-hour fluid volume administered as drug diluents with IV antibiotics, would it have affected the planned 24-hour fluid administration for this specific patient? (4) Would you prefer to be made aware of the fluid volume administered with the IV antibiotics during the prescribing process?
All four questions could be responded to with either “yes” or “no”. If the participant answered, “yes” to main Question (2) and/or (3), several single select answer options were provided (Supplement A). The participants were provided an option to make additional comments to elaborate their perspectives.

**Pilot study**

Two rounds of pilot tests were performed at the ED at Aarhus University Hospital in March 2022. Ten participants were interviewed, with five participants per pilot. Both tests were conducted face to face to detect potential ambiguity and ensure clarity during the interview.

The first pilot test revealed ambiguities in the interpretation of the questions in terms of fluid therapy vs. fluids given as drug diluents and resulted in an interview briefing about the process by which IV antibiotics are diluted in saline to emphasize that our questions were solely addressing the fluid administered as a drug diluent with the IV antibiotics. These 10 participants’ answers were not included in the study.

**Data collection and interview setting**

The interviews were conducted from March 4 to May 17, 2022, from 12.00 a.m. to 11.00 p.m. on both weekdays and weekends. The interviewer (JA) screened the electronic medical record for ED prescriptions of around-the-clock IV antibiotics. The total 24-hour fluid volume administered as a drug diluent with the specific choice of IV antibiotic was calculated prior to the interview.

The participants were interviewed face to face at their workstation or as a walk-along interview lasting 3-5 minutes. The interviewer sought to find the most convenient time for the interview.

The interviewer filled out an electronic version of the interview questions real-time in Research Electronic Data Capture (REDCap) on a designated tablet while interviewing. Additional comments made by the participants throughout the interview were written down as fieldnotes and then entered into REDCap manually.
Data analysis

Demographic data and responses are presented as numbers and proportions. The total fluid volume administered as drug diluents with IV antibiotics is presented as the median volume [12] with full and interquartile ranges.

Comments from the open-ended portions of the four main questions were manually reviewed and analyzed using a thematic coding approach [13]. Thematic categories emerged when comments with similar content appeared five or more times, presented in Figures 1-3. Consensus on the final themes was reached within the research group.

All descriptive quantitative analyses were performed in Stata version 17 (StataCorp LP, College Station, TX, USA).

Results

Demographic characteristics of the participants

Of the 100 participants interviewed, 46% (n = 46) were directly employed in the ED, 51% (n = 51) in the department of medicine, and 3% (n = 3) in the department of surgery. Furthermore, 38% percent (n = 38) of the participants had > 10 years, 17% (n = 17) between 6 to 10 years, 26% (n = 26) between 1 to 5 years and finally, 19% (n = 19) had < 1 year of working experience. The characteristics of the participants are presented in Table 2.

The total 24-hour fluid volume administered as a drug diluent with antibiotics varied between 200 and 900 mL. The median fluid volume was 400 mL (interquartile range: 300-400 mL).

Awareness of the fluid volume with IV antibiotics

The distribution of responses is presented in Table 3. In total, 53% (n = 53) of the participants were not aware of the total 24-hour fluid volume administered with the prescribed IV antibiotics. While 47% (n = 47) of the participants stated to be aware, 4% (n=4) indicated that they usually did not reflect upon the fluid volume administered as a drug diluent during their daily practice. Furthermore, 44% (n = 44) were not aware that the fluid volume administered with IV antibiotics varied depending on the choice of antibiotics. Reflecting on general awareness of fluid volumes led to 28 comments.
Supplement B). Of these, 21 were thematically coded as, “not reflected upon during daily practice”.

Six of the representative comments are shown in Figure 1.

Accounting for the antibiotic fluid volume

Of the participants, 76% (n = 76) did not account for the fluid administered with the prescribed IV antibiotics when planning 24-hour fluid administration for their specific patient. The 24% (n = 24) of the participants who did account for the fluid administered with IV antibiotics made the following changes: 3% (n = 3) of the participants prescribed a 24-hour registration of fluid balance (input and output) to detect potential fluid accumulation, 12% (n = 12) of participants reduced other prescribed IV fluids to account for the fluid volumes administered with IV antibiotics, and 9% (n = 9) of participants prescribed a 24-hour plan for fluid administration with a maximum administration of both oral and IV fluids. Of 37 comments regarding considerations and decision-making during the prescribing process (Supplement B), 15 of them where addressed whether the patients had comorbidities making them fluid intolerant, which is presented as the thematic code “absence of relevant comorbidities” in Figure 2.

Post-prescribing fluid adjustments

A total of 96% (n = 96) chose not to make adjustments to either their prescribed antibiotic nor 24-hour plan for fluid administration after being presented with the total IV antibiotic fluid volume. A total of 75 comments were given based on this question (Supplement B); 52 of them where about the health status of the patient, presented as the thematic code “health status of this specific patient” in Figure 3. Participants elaborated that they regarded exactly their specific patient as quite healthy and able to tolerate fluids: “I am treating an uncomplicated patient and he/she tolerates fluids. But if the patient had severe comorbidities, then it would have affected the plan.” Despite sticking to the already prescribed fluids, several added the following comments: “But I must admit, I am quite surprised about the fluid volume. I will keep that in mind for future prescriptions.” and “I will think about this information from now on since 400 mL can be [too] much fluid for a patient with heart disease” (Supplement B).
After being informed about total IV antibiotic fluid volumes, 4% (n=4) of participants changed their 24-hour plan of fluid administration. Of these, two had prescribed antibiotics for patients with severe pneumonia, including both IV clarithromycin and IV piperacillin-tazobactam, resulting in 900 mL of drug diluent over a 24-hour period. Both participants changed IV clarithromycin to oral intake thereby reducing the fluid volume by 500 mL.

**Improving awareness during the prescription process**

The majority (79%; n = 79) indicated that they would prefer visibility of the fluid volumes administered as a drug diluent with IV antibiotics in the electronic medical record to improve awareness during the prescribing process. The following comments were made: “It would be very helpful if the fluid volumes administered with IV antibiotics were visible in the prescribing section of the electronic medical journal. In this way, we would become more aware while making the treatment plan and thereby preventing the potential risk of volume loading the patients, especially the patients that can’t tolerate fluid.” Participants found that the most clinically effective way of doing this, would be during the prescribing process. However, some were speculated that information about fluid volume used as a drug diluent could potentially confuse the prescribing physician in an emergent setting risking delayed initial IV antibiotic treatment.

**Discussion**

When prescribing IV antibiotics to ED patients with suspected infection, more than half of the participants in this study were not aware of the fluid volume administered as a drug diluent with antibiotics. Of the participants who were aware of the fluid volumes, some of them added that they did not give antibiotic fluids much thought when executing the prescription, emphasizing our hypothesis that physicians are not critically aware of the fluid volume administered with IV antibiotics. Furthermore, more than a third of the participants were not aware that the drug diluting volume varied depending on the choice of antibiotic.

When presented with the total fluid volume administered as a drug diluent over a 24-hour period for their specific patient, the majority did not change either their planned 24-hour fluid
administration nor antibiotic prescriptions, since they regarded their patient as fluid tolerable.

However, several of the participants were quite surprised about the total fluid volume administered with IV antibiotics, stating that it was higher than expected, and that they would consider the fluid volumes administered as drug diluents in their future prescriptions.

**Targeting non-resuscitation fluids**

The majority of the participants did not account for the fluid volume administered with IV antibiotics, which could be due to a common misconception that fluids used as drug diluents for IV medications, including antibiotics, are unlikely to significantly contribute to fluid overload in hospitalized patients. However, several observational studies have shown that the majority of IV fluids are prescribed for non-resuscitation purposes, sometimes called the fluid creep, such as IV medications and maintenance fluids in both stable and unstable patients [5, 6, 11, 14]. We found, that fluid volumes administered as drug diluents with IV antibiotics varied between 200 and 900 mL. Data from a multicenter observational study found that fluids administered with antibiotics are a significant contributor to IV fluids in intensive care unit septic shock patients [10]. To prevent fluid overload in hospitalized patients, fluids used as drug diluents, including antibiotics, should be perceived as a relevant modifiable target.

**Variations in practice**

IV antibiotics are usually administered through a “piggyback”, with a single dose of antibiotics diluted in saline administered within 10-15 minutes. According to the national clinical guidelines, the recommended diluent volume for a single dose of antibiotics is 50-150 mL of normal saline (Table 1) for most IV antibiotics. The EDs included in this study used a fluid volume of 100 mL per antibiotic dosage. The different options for diluting volumes for antibiotics may result in variation in practice. This is in accordance with two observational studies that found that the choice of fluid volume to be administered for non-resuscitation depended on tradition and local practice [6, 10]. We did not investigate if physicians or nurses were aware of the possibility of reducing volumes nor changing diluents. Providing isotonic fluids to patients who require treatment with low-salt fluids and others
who require salts could be important to consider, highlighting the potential complexities in fluid management and the importance of tailoring diluent choices to specific patient needs.

Managing and administering IV medicines, including IV antibiotics, is traditionally assigned to nurses. Since the prescribing physicians are rarely involved in the administration of IV medicine, physicians tend not to give antibiotic fluids much thought when prescribing IV antibiotics. The lack of clarity regarding who decides the volume of the drug diluent could explain why the majority of the physicians were unaware of the fluid volume administered with IV antibiotics.

**Comorbidities and awareness**

Despite a majority retaining their initially planned 24-hour fluids, there was consensus among the participant that patients with known comorbidities such as kidney- and/or heart disease should be treated with a more fluid-restrictive approach. Thus, in such clinical scenarios, they would have accounted for all fluids including drug diluents. This is in alignment with the findings of recent fluid studies, in which a more restrictive fluid approach was observed among physicians treating patients with known heart failure or impaired kidney function, indicating a higher awareness when dealing with fluid-intolerable patients [15-17].

**Change to administration route/solution**

Changing the administration route from IV to oral is an potential target when aiming for a restrictive fluid approach. The regional antibiotic recommendation for patients with severe pneumonia includes both IV clarithromycin and IV piperacillin-tazobactam resulting in a total of 900 mL of IV fluid in a 24-hour period. It is commonly believed that IV antibiotic are more effective than oral, but when comparing oral clarithromycin with IV clarithromycin in the treatment of moderate to severe pneumonia no significant difference in mortality was found [18]. Other studies found no differences in efficacy when comparing oral with IV antibiotics in treating bacteremia and endocarditis [19, 20]. Since no evidence clearly supports IV antibiotics as superior to oral intake in all patients, the administration of IV fluids could be significantly reduced by treating some infections with oral antibiotics in stead.
Alternatively, IV push medications (minimal diluting volumes equivalent to the size of one saline syringe) could be used. IV piperacillin-tazobactam push administration did not cause any adverse events, harm, or changes in mortality and was well-tolerated in patients with sepsis compared to IV piggybacks [21-23].

**Education and nudging strategies**

The study found a lack of critical awareness when executing the prescription of IV medications, likely due to the overall limited focus on education in prescribing fluids. Junior physicians have been found to be inadequately trained to prescribe fluids [12]. Although most prevalent among junior physicians [24], Leach et al. [25] found all medical ranks, to have inadequate knowledge regarding fluid management.

IV fluids should be handled with the same thoroughness as any other drug [26-28]. Awareness of prescribing IV fluids can be obtained through education, leading to a significant improvement in the accuracy and appropriateness of fluid management [29]. To achieve greater awareness among physicians, the fluid volumes administered as drug diluents when prescribing IV medications could be made visible in the electronic medical records during the prescribing process. The lack of visibility while prescribing may contribute to an underestimation of the fluid volumes administered for purposes other than resuscitation, which is why introducing subtle nudging strategies such as visualization of the fluid volume could lead to a more conscious and careful fluid administration. In general, the exigent circumstances in the EDs, with crowding and critically ill patients, challenge physicians in their decision-making processes and highlight the need for a universal, easy, visible, and transparent prescribing and administration process of IV antibiotics to decrease the fluid creep and restrict intravenous, unnecessary and potentially avoidable IV fluids.

**Limitations**

A strength of this study is that we interviewed a total of 100 participants, which increases both the validity and generalizability of our findings, regarded a strength to the study [30]. Second, the chosen study design made the interviews far less time consuming and inconvenient for the overloaded...
physicians, enabling the interviewer to collect real-time data by interviewing the participants immediately after the prescription of IV antibiotics. Third, the same interviewer (JA) was used throughout the whole study, resulting in a consistent interview style.

There are three main limitations. First, all main questions in the structured interview were designed as closed ended and with simple response options (yes or no) to accommodate the time-consuming aspect, which may have resulted in less-nuanced qualitative data. Some participants, who indicated their awareness of the fluid volume administered with IV antibiotics, admitted that they did not give fluids much thought during daily practice when prescribing antibiotics, indicating a difference between being aware and being critically aware while prescribing. Hence, more response options may have led to an improved accuracy of the data.

Second, the interviews took place at workstations among other working colleagues in the ED with different ranks, including higher-ranked colleagues. These physical circumstances may have intimidated the participants and could challenge their credibility regarding their clinical knowledge and decisions making among colleagues.

Third, the main question regarding post-prescribing adjustments to their planned 24-hour fluid administration could be perceived as confrontational. It is recommended to use only neutral questions to generate genuine answers; hence, if the question had assessed future fluid prescriptions, rather than the completed prescriptions, it may have been perceived as less confrontational. Thus, we could have avoided challenging the clinical judgement of the participants, which also could explain why a majority of the physician participants stuck to their initial treatment plan.

A majority of physicians are not aware of fluid volumes administered as drug diluents with IV antibiotics, highlighting a clinical issue. When presented with the total 24-hour fluid volume administered for their specific patient, the vast majority did not make post-prescribing adjustments to their planned fluid administration nor antibiotic prescriptions since their specific patient did not have relevant comorbidities associated with fluid intolerance. For future prescriptions involving drug diluents, respondents indicated that they would consider accounting for the fluid volume and they would prefer if fluid volumes were shown during the prescribing process.
Article information:

Ethical statement:
The head of departments from the participating departments agreed on study participation. Each participating physician consented with a signature after ended interview. IRB approval was not required in this study.

Conflict of interest statement:
None of the authors have any conflicts of interest to declare

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Author contributions:
JA: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Software; Validation; Visualization; Roles/Writing - original draft; ML: Conceptualization; Methodology; Supervision; Validation; and Writing - review & editing. MKJ: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Resources; Software; Supervision; Validation; Visualization; and Writing - review & editing.

Acknowledgements
We kindly thank all physicians, who participated in the structured interviews.
References


<table>
<thead>
<tr>
<th>IV Antibiotic</th>
<th>ATC-Code</th>
<th>Recommended Diluent and Volume in National Guideline*</th>
<th>Recommended Diluent and Volume in Regional Standard Procedures</th>
</tr>
</thead>
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<tr>
<td>Piperacillin/Tazobactam</td>
<td>J01CR05</td>
<td>50-150 mL, normal saline or isotonic glucose</td>
<td>100 mL, normal saline</td>
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<tr>
<td>Benzylpenicillin</td>
<td>J01CE01</td>
<td>50-100 mL, normal saline</td>
<td>100 mL, normal saline</td>
</tr>
<tr>
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<td>J01FA09</td>
<td>250 mL, normal saline or isotonic glucose</td>
<td>250 mL, normal saline</td>
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<td>Metronidazol</td>
<td>J01XD01</td>
<td>Prediluted, 100 mL</td>
<td>Prediluted, 100 mL</td>
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<td>Cefuroxim</td>
<td>J01DC02</td>
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<td>100 mL, normal saline</td>
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<td>100 mL, normal saline</td>
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<td>100 mL, normal saline</td>
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<td>Meropenem</td>
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<td>J01MA02</td>
<td>Prediluted, 100-200 mL</td>
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<td>Clindamycin</td>
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<td>Depending on dose, 50-100 mL, normal saline or isotonic glucose</td>
<td>100 mL, normal saline</td>
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</table>

* As recommended by iv-vejledninger.dk

ATC: Anatomical Therapeutic Chemical, IV: intravenous
### Table 2. Demographic characteristics of prescribing participants

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>n (%)</th>
<th>(N = 100)</th>
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<tbody>
<tr>
<td><strong>Hospital of employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aarhus University Hospital</td>
<td>50 (50)</td>
<td></td>
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<tr>
<td>Regional Hospital Viborg</td>
<td>25 (25)</td>
<td></td>
</tr>
<tr>
<td>Regional Hospital Randers</td>
<td>25 (25)</td>
<td></td>
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<tr>
<td><strong>Department of employment</strong></td>
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<tr>
<td>Emergency department</td>
<td>46 (46)</td>
<td></td>
</tr>
<tr>
<td>Other medical departments</td>
<td>51 (51)</td>
<td></td>
</tr>
<tr>
<td>Other surgical departments</td>
<td>3 (3)</td>
<td></td>
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<td><strong>Clinical working experience, years</strong></td>
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<td>&lt; 1</td>
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</tr>
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<td>1–5</td>
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<td></td>
</tr>
<tr>
<td>6–10</td>
<td>17 (17)</td>
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<tr>
<td>&gt; 10</td>
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<tr>
<td><strong>Ranking in hospital</strong></td>
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<tr>
<td>Intern</td>
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<tr>
<td>Resident</td>
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<tr>
<td>Senior resident</td>
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<tr>
<td>Specialist</td>
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<td></td>
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<tr>
<td>Attending physician</td>
<td>10 (10)</td>
<td></td>
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<tr>
<td>Other**</td>
<td>7 (7)</td>
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</tr>
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</table>

* All participants were treating patients in the ED, but several had their primary employment in other departments.

** Other included: locum tenens physicians.
### Table 3. Distribution of responses

<table>
<thead>
<tr>
<th>Interview question</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N = 100)</td>
</tr>
</tbody>
</table>

**Are you aware of the general fluid volume administered as a drug diluent with IV antibiotics?**

| Yes       | 47 (47) |
| No        | 53 (53) |

**Are you aware that the fluid volume varies depending on the choice of antibiotics?**

| Yes       | 56 (56) |
| No        | 44 (44) |

**Have you accounted for the fluid volume administered with the IV antibiotics when planning the 24-hour fluid administration for this specific patient?**

| Yes       | 24 (24) |
| No        | 76 (76) |

*If responding “yes” to the previous question, how have you accounted for the fluid administered with antibiotics?*

<table>
<thead>
<tr>
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<th>n = 24</th>
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<tbody>
<tr>
<td>Registration of fluid balance (input and output)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Reduction of other prescribed IV fluids</td>
<td>12 (12)</td>
</tr>
<tr>
<td>Prescription of a total 24-hour plan for fluid administration</td>
<td>9 (9)</td>
</tr>
<tr>
<td></td>
<td>0 (0)</td>
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</table>
Prescription of diuretics

If you had known the total 24-hour fluid volume administered as a drug diluent with the IV antibiotics, would it have affected the planned 24-hour fluid administration for this specific patient?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 (4)</td>
<td>96 (96)</td>
</tr>
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</table>

**If responding “yes” to the previous question, which adjustments would you like to make to account for the volumes of fluids administered as drug diluent with the IV antibiotics?**

- Registration of fluid balance (input and output)
- Reduction of other prescribed IV fluids
- Prescription of a total 24-hour plan for fluid administration
- Prescription of diuretics
- Discontinuation/change in prescribed antibiotics

<p>| | | |</p>
<table>
<thead>
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<td></td>
<td>0 (0)</td>
<td>3 (3)</td>
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<tr>
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<td></td>
<td>0 (0)</td>
<td>1 (1)</td>
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</table>

Would you prefer to be made aware of the fluid volume administered with the IV antibiotics during the prescribing process?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>79 (79)</td>
<td>21 (21)</td>
</tr>
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</table>

* Sub-question for the 24 participants who responded, that they had accounted for the volume of fluids administered with the IV antibiotics

**Sub-question for the four participants who responded, that they would like to adjust their treatment plan after being presented with this information.
IV: intravenous
Above figure 1: Figure 1. Thematic coding of comments with similar content when asked about general awareness of fluid volumes administered as drug diluent with IV antibiotics

Below figure 1: IV: intravenous
Figure 2. Thematic coding of comments with similar content when asked about accounting for fluids administered with IV antibiotics when prescribing a 24-hour plan for fluid administration.

IV: intravenous
If you had known the total 24-h fluid volume administered with the IV antibiotics, would it have changed the planned fluid administration for this specific patient?

Thematic coding: Health status of this specific patient

"It doesn’t change anything for this particular patient, since the patient is young and healthy. Young patients tolerate IV fluids."

"If it had been a patient with heart-or kidney disease, I would consider changing the plan."

"It doesn’t change anything for this particular patient. I would have changed, if the patient had heart failure, then even 300 mL would be a significant amount."

"400 mL of fluids doesn’t affect my patient, but if the patient was on a fluid restrictive regimen, then I would have to reduce the other fluid administration."

"If the patient was at risk of developing lung edema, then I would have reduced the other fluid administrations."

"This patient doesn’t have any electrolyte- or fluid imbalances, therefore I won’t make any changes."

"I was not aware that the SPP for severe pneumonia resulted in 900 mL of fluids per day. That is very much fluid, therefore I will change from IV to oral antibiotics instead."

Above figure 3: Figure 3. Thematic coding of comments with similar content when asked about adjustments to the planned fluid administration after prescription.

Below figure 3: IV: intravenous, SPP: standard prescription package (recommended antibiotic administration for a certain presentation/infection)