

**Interdisciplinary knowledge gaps on intravenous fluid management in adult patients: survey among physicians and nurses of a university hospital**

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1 **Interdisciplinary knowledge gaps on intravenous fluid management in adult**  
2 **patients: survey among physicians and nurses of a university hospital**

3 *INTRAVENOUS FLUID KNOWLEDGE GAPS IN THE HOSPITAL*

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28 design. Additionally, SW analyzed the data and interpretation was done with SS and AD. SW  
29 prepared the manuscript. SS, IH, AD and PC revised the manuscript.

30

31

32 **Interdisciplinary knowledge gaps on intravenous fluid management in adult**  
33 **patients: survey among physicians and nurses of a university hospital**

34 **Abstract**

35 **Rationale:** Intravenous (IV) fluids are frequently involved in iatrogenic complications  
36 in hospitalized patients. Knowledge of IV fluids seems inadequate and is not covered  
37 sufficiently in standard medical education.

38 **Method:** Two surveys were developed, based on the 2016 British National Institute for  
39 Health and Care Excellence guideline 'IV fluid therapy in adults in hospital', to provide  
40 insight on the learning needs and expectations of physicians and nurses. Each survey  
41 focused on profession-specific practice and consisted of three parts: demographics,  
42 knowledge questions and evaluation of current habits. Physicians and nurses practicing  
43 in a Belgian university hospital were invited to complete the survey electronically,  
44 respectively in January and May 2018.

45 **Results:** A total of 103 physicians (19%) and 259 nurses (24%) participated. Although  
46 every indication for fluid therapy may require a specific fluid and electrolyte mixture,  
47 and hence, knowledge of their exact composition, most physicians and nurses did not  
48 know the composition of commonly prescribed solutions for IV infusion. Senior  
49 physicians did not score better than juniors did on questions concerning the daily needs  
50 of a nil-by-mouth patient. The availability of an IV fluid on the ward guides physicians  
51 to prescribe IV fluids (17%). Nurses (56%) feel they share responsibility in fluid  
52 management as they frequently intervene in urgent situations. More than half of  
53 participants (70% of physicians, 79% of nurses) indicated a need for additional  
54 information.

55 **Conclusions:** A clear need for more structured information on IV fluids was identified.  
56 Both physicians and nurses struggle with fluid therapy. Continuing education on IV  
57 fluid management, emphasizing multidisciplinary collaboration, and monitoring  
58 evidence-based practice is essential to support the clinical decision process in daily  
59 practice.

60 **Keywords: intravenous fluids; fluid management; prescribing practice; nurse**  
61 **collaboration; survey**

# 62 **Interdisciplinary knowledge gaps on intravenous fluid management in adult** 63 **patients: survey among physicians and nurses of a university hospital**

64

## 65 **1. Introduction**

66 Medication errors in the prescribing and the administration process, are important health risks  
67 for hospitalized patients.<sup>1,2</sup> The intravenous (IV) route has been identified as an important risk  
68 factor for administration errors.<sup>3,4</sup> Inpatients often require IV therapy with fluids to maintain an  
69 optimal fluid and electrolyte balance. When too much of an IV fluid is administered or the  
70 wrong solution is prescribed, a significant impact on the patient's fluid status can be expected  
71 and electrolyte disturbances are currently seen, especially in hemodynamically unstable patients  
72 with fluctuating kidney or cardiac function.<sup>5-7</sup> Though frequently prescribed, IV fluids are not  
73 always considered as real medication, with a specific indication, dose and possible side effects,  
74 resulting in errors and potential harm.<sup>8-10</sup>

75 Learning needs of prescribing physicians have been studied thoroughly in different settings.  
76 Knowledge of IV fluids seems inadequate and is not covered sufficiently in standard medical  
77 education.<sup>11-14</sup> Junior physicians in particular struggle with IV fluid prescriptions, while they  
78 are expected to do so early on in real world practice and especially during on-call duty.<sup>15-18</sup>  
79 Research on IV fluid therapy in the United Kingdom (UK) demonstrated the complexity of the  
80 IV fluid prescription and administration. Therefore, the British National Institute for Health and  
81 Care Excellence's (NICE) guideline for 'IV fluid therapy in adults in hospital' was developed  
82 in 2013 and has been the golden standard since.<sup>19</sup> Literature on IV fluid knowledge is scarce  
83 outside the UK. Moreover, surveys questioning fluid knowledge in other countries generally  
84 focus on a specific type of setting like the perioperative period and do not explore hospital-wide  
85 practice.<sup>20,21</sup>

86 Different interventions have been described to improve prescribing by optimizing fluid balance  
87 charts or by implementing a guideline or care bundle.<sup>22-25</sup> So far, most improvement programs  
88 focus on the perspective of the physician, whereas other healthcare professionals can also  
89 contribute to safer and qualitative IV fluid therapy. Nurses, for example, are actively involved  
90 in the administration and monitoring of fluids. Their involvement has proven to increase patient  
91 safety as well, but their conceptual knowledge on IV fluid therapy has not been studied as has  
92 been done in physicians.<sup>26-28</sup> The quality of care delivered by nurses is influenced by individual  
93 characteristics of the nurse and organizational aspects. In a study of Aiken et al. (2017), a richer  
94 skill mix of the nursing staff, defined as the ratio of professional nurses in the hospital to all

95 direct care nursing personnel, was associated with a lower odds of mortality (Odds ratio 0.89,  
96 95% confidence interval 0.80-0.98).<sup>29</sup> An inter-professional collaboration of physicians, nurses  
97 and pharmacists has already been recommended to decrease errors in IV fluid management in  
98 the pediatric setting.<sup>30</sup>

99

## 100 **Background**

101 Evidence of knowledge gaps of medical doctors in IV fluid management in the hospital is  
102 lacking outside of the UK. A structured questionnaire to evaluate practice on IV fluid therapy  
103 is not available. First, we aimed to develop a survey to identify the learning needs and  
104 expectations of physicians and nurses managing IV fluid therapy in hospitalized adult patients.  
105 Although nurses should be aware of different concepts related to fluid balance and IV fluid  
106 administration, their knowledge base of IV fluid therapy has not been explored yet. Therefore,  
107 we evaluated daily fluid management in these two groups of healthcare professionals, active in  
108 a Belgian hospital.

109

## 110 **Methods**

111 In this study, two complementary surveys were developed in Dutch, targeting two groups of  
112 healthcare professionals working at a 721-bed tertiary care hospital in Belgium. The first group  
113 were physicians (senior and junior) actively prescribing IV fluids for adults. The second group  
114 were nurses treating adult patients.

115 A multidisciplinary expert team (an emergency physician, an intensive care physician, a clinical  
116 pharmacist, a nurse and the hospital's quality coordinator) developed different items for each  
117 survey. The questions were based on similar surveys done in other countries, since a validated  
118 survey instrument was lacking. The content was adapted according to the NICE guideline for  
119 'IV fluid therapy in adults in hospital' because of the absence of a Belgian guideline at the time  
120 of the study.<sup>19</sup>

121 Both surveys consisted of three parts, (1) basic demographics, (2) habits whilst managing IV  
122 fluids, (3) knowledge of the healthcare professional on IV fluids.

123 The surveys were developed through a step-wise process of construction, review, pilot testing  
124 and clarification. Each survey was tested by the targeted professional (respectively, three  
125 physicians and three nurses). The hospital's Pharmacy and Therapeutics Committee approved  
126 the final versions.

127 Physicians active in adult care were invited to participate via an electronic invitation in January  
128 2018 to fill in the survey. Every physician received an invitation via the hospital's intranet web  
129 page with a hyperlink to the online survey made using SurveyMonkey®  
130 (www.surveymonkey.com, SurveyMonkey Inc., San Mateo, CA, USA). Similarly, the nurses  
131 were invited later on in May 2018. Each group of professionals was given one month to  
132 complete the survey. Participation was voluntary. An electronic reminder was sent after two  
133 weeks. Participants who did not prescribe or administer these fluids due to their field of  
134 expertise or workspace (e.g. pediatrics) were excluded.

135

### 136 **Data analysis**

137 We aimed to map the knowledge and daily practice of physicians and nurses on IV fluids by  
138 means of a structured survey. A descriptive statistical analysis was performed of the  
139 respondents' answers using IBM SPSS Statistics® v26 software (IBM Corp., Armonk, NY,  
140 USA). For continuous variables, the mean with standard deviation or median with interquartile  
141 range (IQR) were provided as appropriate. For categorical variables, absolute (n) and relative  
142 frequencies (%) were used. Answers of junior physicians were compared to those of seniors,  
143 and the physicians' results were compared to nurses' results using the Chi square test ( $\alpha=0.05$ ).  
144 All registered responses were included, even if the survey was only partially completed.

145

### 146 **Ethical considerations**

147 The ethics committee (Commissie Medische Ethiek (O.G. 016), Reflectiegroep Biomedische  
148 Ethiek, UZ Brussel) approved the study (B.U.N. 1432020000227). Informed consent was  
149 waived by the committee. The study was carried out in accordance with the ethical principles  
150 for medical research involving human subjects established by Helsinki's Declaration, protecting  
151 the privacy of all participants, as well as the confidentiality of their personal information.

152

## 153 **Results**

### 154 **Survey development**

155 The surveys were constructed in three phases. First, the clinicians defined the surveys' content.  
156 Second, questions were composed and then evaluated by the quality coordinator. When  
157 appropriate, the answer option "I don't know" was added. To limit the extensiveness of the  
158 questionnaire, the panel chose to show in-depth knowledge questions only to physicians who  
159 actively prescribe IV fluids (i.e. all junior physicians and senior physicians active in

160 anesthesiology, emergency medicine, intensive care or internal medicine). Knowledge  
161 concerning diagnosis and monitoring of patients in need of IV fluids was questioned by means  
162 of a test case in order to evaluate clinical reasoning. This was not the case for the nurses' survey.  
163 Commercial names of the IV fluids were used throughout the survey, as they were mentioned  
164 on the hospital's therapeutic formulary. Knowledge questions for nurses focused primarily on  
165 administration of concentrated electrolytes and less on the composition and appropriate choice  
166 of an IV fluid as this was thought to be the physician's main responsibility. A question on  
167 glucose presence was added because this is important for diabetes management. Total fluid  
168 need for a nil-by-mouth (NBM) patient was considered relevant to avoid under- or  
169 overtreatment. Third, based on the feedback from the persons involved in the pilot tests,  
170 demographics were limited to total years of experience and specialism or ward of activity, to  
171 avoid respondent identification. Additionally answer options were further clarified or extended.  
172 The final instruments are added in Appendix 1 (physicians) and 2 (nurses).

173

## 174 **Survey results**

175 A total of 531 physicians and 1063 nurses received an invitation to participate. Among the  
176 aforementioned, 103 physicians and 259 nurses accepted to participate and were included in  
177 this study, resulting in a response rate of respectively 19.4% and 24.4%. Sixteen physicians and  
178 35 nurses were excluded because they did not prescribe or administer IV fluids in their daily  
179 practice.

180

### 181 *Physicians' survey*

182 The respondents' characteristics are displayed in Table 1. The respondents had a median of  
183 seven years of experience (IQR=11) in clinical practice. Anesthesiologists and emergency  
184 physicians had the highest response rate (respectively 63% and 57%), followed by intensive  
185 care physicians (36%). Response rates in other departments were low. More than half of the  
186 responding physicians were senior staff members (54%). Apart from one senior physician, all  
187 these physicians were actively supervising trainees. Proportionally, respondents working in  
188 critical care units were most likely to be juniors (62% of all participating junior physicians  
189 (n=47); 29 juniors versus 27 seniors). More detailed participant characteristics are described in  
190 Table A3.1 and A3.2 of Appendix 3. Fifteen respondents did not fully complete the survey,  
191 which resulted in a final completed response rate of 17%. A median of 12 minutes was  
192 necessary to complete the survey.

193 Although knowledge on the exact composition of an IV solution (i.e. water, glucose and  
194 electrolytes in various mixtures) is essential to prescribe the right fluid for the diagnosed  
195 condition, the composition of different crystalloids was not well-known by the responding  
196 physicians (e.g. 45% did not know the sodium concentration of one liter of 0.9% sodium  
197 chloride; 57% failed to indicate the right sodium concentration of one liter of Glucion<sup>®</sup>, a  
198 balanced glucose- and electrolyte rich crystalloid; one quarter of the respondents indicated that  
199 PlasmaLyte<sup>®</sup> contained glucose). On the other hand, all respondents, except one, identified the  
200 indication of hydroxyethyl-starches (Volulyte<sup>®</sup>) correctly. Seniors identified the sodium  
201 content in Glucion<sup>®</sup> (a hypotonic glucose and electrolyte mixture) better than physicians in  
202 training did (30% vs 11%,  $p=0.005$ ). There were no other significant differences between junior  
203 and senior physicians.

204 Three responding physicians did not fill in in the second part on prescribing habits, resulting in  
205 100 final respondents for this part. Overall, these participating physicians indicated that they  
206 feel comfortable prescribing IV maintenance fluids or concentrated electrolytes to correct  
207 volume and electrolyte imbalances. Median scores on the presented five point-Likert scales  
208 were respectively 4 (IQR=1) and 4 (IQR=1). A majority (69%) of respondents indicated that  
209 their IV fluid prescriptions are not guideline-based. They indicated that their prescriptions are  
210 based on the availability of the fluid on the ward (17%), what their colleagues or supervisor  
211 taught them (14%), common knowledge (13%), habit (13%), cost (9%) or other reasons (3%).  
212 In 89% of the cases, the physician said to consider the oral intake in the evaluation of a patient's  
213 fluid balance. IV fluids administered to dilute IV drugs are often forgotten in this evaluation  
214 process (10% never evaluates these fluids' volumes; 15% does not consider their composition),  
215 as shown in Figure 1. Although a daily assessment of the patient's volume status is common  
216 practice, a part of the participating physicians (13%) only evaluate this upon occurrence of a  
217 problem, such as an electrolyte imbalance.

218 Among responding prescribers, different habits on the administration of a fluid bolus were  
219 identified, e.g. the IV fluid's volume (80% would prescribe the right amount: 250-500 mL) and  
220 infusion duration (30% indicated the right answer: 10-15 min). The most important clinical  
221 parameter to determine a patient's fluid responsiveness, the passive leg raising test, was  
222 correctly identified by 43% of the respondents (Figure 2).

223 Knowledge on metabolic daily needs of an adult NBM patient was insufficient (Table 2). For  
224 sodium, 42% identified the correct daily needs, being 1 mmol/kg. For potassium, 51% correctly  
225 indicated 1 mmol/kg. The daily need of glucose was correctly identified in 41% of cases.



226 Overall, we did not observe significant differences in the scores between junior and senior  
227 physicians (sodium:  $p=0.407$ ; potassium:  $p=0.391$ ; glucose:  $p=0.865$ ).

228 It was established that the involvement of nurses is necessary based on the fact that 24% of  
229 participating physicians answered that in some cases, nurses choose the IV fluid themselves  
230 (e.g. in absence of an available physician).

231 In general, 46% of respondents indicated that their ward had no guidelines on IV fluid  
232 management or they did not know (25%). A high need for more information on IV fluids was  
233 mentioned by 70% of the respondents. The preferred communication methods were an oral  
234 presentation (54%), a written guideline (49%), e-learning (44%) or information directly  
235 available in the electronic medical record (44%).

236

### 237 *Nurses' survey*

238 Respondents had a median of 18 years of experience (IQR=23). The nurses were active on a  
239 ward (85%) or the outpatient clinic (10%). More details on the workspace of the participating  
240 nurses are added in Table A3.3 of Appendix 3. Of 259 respondents, only 221 nurses finished  
241 the survey completely in a median time of 8 minutes, resulting in a final completed response  
242 rate of 20%. Knowledge on the composition of frequently prescribed crystalloids was limited  
243 (e.g. 36% thought PlasmaLyte<sup>®</sup> contained glucose). The correct daily water need of a NBM  
244 patient was identified by 36% of the participating nurses. The nurse respondents, on their part,  
245 answered that administration related information on concentrated electrolytes is common  
246 knowledge. Potassium chloride was particularly well known (92%); the least encountered  
247 electrolytes were calcium gluconate (33%), magnesium chloride (28%) and sodium phosphate  
248 (16%). Only 33% knew where to find additional information.

249 As stated by 77% of the respondents, the absence of a fluid prescription is a frequent problem.  
250 More than half of the respondents (56%) feel obliged to choose an IV fluid themselves,  
251 especially in urgent situations (38%) or in absence of a physician (24%). Participating nurses'  
252 perceptions on the frequency of fluid balance documentation were different from the  
253 physicians' impressions ( $p<0.001$ , Figure 3).

254 Almost two thirds of the responding nurses (79%) indicated that they evaluate lab results before  
255 choosing a drug diluent. They were more aware of the availability of ward-based guidelines  
256 than physicians (43% versus 29%). There was also a high request (79%) for more information  
257 on IV fluid therapy in this group of healthcare professionals. The same communication methods  
258 were preferred as the ones indicated by the physicians.

259

## 260 **Discussion**

261 In this single center study, we developed two surveys and used them to evaluate knowledge and  
262 habits of physicians and nurses on IV fluid therapy for adult patients. Based on the results of  
263 both physicians and nurses, we can conclude that knowledge on IV fluids is insufficient in our  
264 hospital. These findings are in line with the results of other hospital-wide survey-based studies  
265 in the UK.<sup>12,14,16-18,31</sup> No similar studies were found in other parts of Europe. Most of these  
266 studies focus on the knowledge base of physicians in training. Confidence in prescribing  
267 appears to grow as physicians continue their training.<sup>32</sup> However, senior physicians did not  
268 perform better than their junior counterparts did.

269 In recent years, more and more high-quality trials have led to evidence-based data on safety and  
270 efficacy of IV fluids to guide prescribers in clinical practice, such as the SMART trial<sup>33</sup> and  
271 SALT-ED trial.<sup>34</sup> Although the participating physicians indicate feeling comfortable  
272 prescribing IV fluids, they fail to adopt an evidence-based approach in choosing the most  
273 optimal fluid for the patient's condition. However, knowledge of IV fluid composition and fluid  
274 status assessment is essential to avoid iatrogenic complications such as electrolyte disturbances  
275 (e.g. hyponatremia) or organ failure due to fluid overload.<sup>6</sup> In a retrospective study in medical  
276 wards, Mousavi *et al.* found 1.3 IV fluid-related errors per admitted patient.<sup>9</sup> Overall, the cause  
277 of medication errors are mostly slips and lapses, followed by knowledge-based mistakes.  
278 Training, expertise and experience of the healthcare professionals, can influence the conditions  
279 in which these mistakes occur.<sup>2,3</sup> For example, there is evidence that interventions aiming to  
280 limit a positive cumulative fluid balance are associated with better patient outcomes.<sup>7</sup> This  
281 suggests that continued education and stimulating awareness on IV fluids in correspondence  
282 with the latest results of fluid management research remains important. Nonetheless, solely  
283 guideline-based practice is no guarantee for clinically relevant patient outcomes.<sup>35</sup> The patient's  
284 context should always be taken into account as well. Therefore, evidence-based practice should  
285 be a combination of knowledge of the most recent evidence combined with clinical judgment  
286 of the individual patient's needs.

287 Both respondent groups emphasized the complementary role of physicians and nurses in IV  
288 fluid management. Nursing staff has a key role in periods where a physician is absent in the  
289 ward, for example during nights or in urgent situations. Therefore, it is mandatory to include  
290 nurses in an interdisciplinary educational program in order to achieve improved knowledge in  
291 all concerned healthcare professionals. Basic information on the water, glucose and electrolyte  
292 content of an IV fluid can easily reduce knowledge-based errors and should be at their disposal

293 at all times. Awareness and accessibility of drug related information is needed, as only 33% of  
294 nurses knew where to find this information. Next to the nurses' double check upon  
295 administration, additional methods can be used to make physicians more aware of prescribing  
296 errors. Medication review by a clinical pharmacist has already proven to be a successful strategy  
297 for other therapeutic situations. The pharmacist can also provide individual or generic feedback  
298 on prescribing errors, which is identified by the physicians themselves as an effective and  
299 preferred method.<sup>36,37</sup>

300 The patient's response to an IV fluid depends on the type and volume of fluid. Nurses can help  
301 the physicians in charge to make an individually adapted IV fluid plan by registering critical  
302 bedside parameters. According to the participating nurses' answers, a detailed fluid balance  
303 documentation in the patient's medical record was indicated more frequently compared to the  
304 physicians' responses. This differing perception can be due to ward-based variations. In critical  
305 care settings, more specific parameters are monitored and fluid balance charting is common  
306 practice. Because of the high proportion of anesthesiologists and emergency physicians in the  
307 group of responding physicians, these physicians may not apprehend the daily practices on the  
308 ward itself because they only see patients briefly. On the other hand, simple parameters to assess  
309 fluid responsiveness in resuscitation are available but their application appears to be not well  
310 known, as shown in Figure 2. A prerequisite for fluid monitoring is choosing and measuring  
311 the right parameter to make a reliable assessment. Nurses require the adequate skill set and tools  
312 to measure the ins and outs of fluids accurately to avoid mismanagement based on inaccurate  
313 results or to avoid disregard of measures by the medical staff.<sup>38,39</sup> However, it is also essential  
314 to avoid over-registration. Nurse documentation has to be standardized, user-friendly and  
315 manageable within their daily tasks.<sup>40,41</sup> Additionally, devices like smart infusion pumps reduce  
316 medication errors, but they can also help caregivers by calculating the volume of inadvertent  
317 fluid load through different sources of fluid administration (e.g. IV medication or catheter  
318 flushing).<sup>42</sup> An electronic clinical decision support system can provide extra information to the  
319 physician upon order entry to prevent fluid or electrolyte imbalances. These systems have  
320 proven to be effective in the prevention of prescribing errors.<sup>43</sup>

321 Both, responding physicians (70%) and nurses (79%) would welcome more training on IV  
322 fluids. Different methods have been described to educate healthcare professionals. A  
323 combination of interventions was already suggested by the respondents and are in line with  
324 those already suggested in literature. A hospital-wide quality improvement project, as is 'fluid  
325 stewardship', is a possible way to use coordinated interventions to familiarize caregivers with  
326 guidelines and apply them in their daily practice, by means of training, feedback reports and

327 audits. This has proven to be effective in antibiotic prescribing and is a rational approach that  
328 could easily be extrapolated to IV fluids.<sup>10</sup>

329

### 330 **Limitations**

331 We present the first Belgian study to explore the knowledge of physicians and nurses on IV  
332 fluids. Previous studies on general IV fluid management were only performed in the UK and  
333 only focused on prescribers, whereas we also considered nurses to be important, complementary  
334 key caregivers in IV fluid management. This view was shared by responding physicians as well.  
335 In a bi-national survey, organized in Australia and New Zealand, the involvement of nurses was  
336 acknowledged in fluid bolus therapy in critical care wards.<sup>44</sup> We chose not to focus on a  
337 particular unit or setting and have a wide scope. This may be a reason for the low response rates  
338 in the two responding groups, which could have led to a response bias. Besides, web-based  
339 surveys are not a popular tool and IV fluids might be a subject of which people are aware of  
340 their scarce knowledge, potentially adding to the limited response rate. It is also difficult to  
341 reach every caregiver when using an electronic invitation. The time investment to fill in a survey  
342 may be an additional reason for the limited response rate. At the same time, the variety of  
343 responses in these small groups, of which the majority were healthcare professionals working  
344 in critical wards, does indicate a need for uniformity and transparency to ensure an evidence-  
345 based use of IV fluids in our hospital. The actual in-hospital understanding of fluid management  
346 remains a point of discussion as respondents may only tend to participate if they feel their  
347 knowledge on IV fluids is considered acceptable. Therefore, our results may be an  
348 overestimation. On the other hand, healthcare professionals who are too confident of their  
349 knowledge of IV fluids and actually lack sufficient expertise, may have participated which  
350 could have led to an underestimation of current practice.

351

### 352 **Conclusions**

353 Evaluating daily practice on IV fluid management is valuable as a first step towards the  
354 prevention of medication errors. The answers from both the physicians and nurses indicated a  
355 clearly insufficient knowledge and a need for more structured evidence-based information on  
356 IV fluids. A hospital-wide guideline for a multidisciplinary approach of IV fluid therapy is  
357 necessary to support the clinical decision process and add to qualitative clinical practice  
358 throughout the patient's hospital stay. A supplementary program to improve the knowledge of  
359 these healthcare professionals should be considered.

360

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365

## 366 **Declaration of interest**

367 Wuyts S.C.M., Scheyltjens S., Hubloue I., Dupont A.G., Cornu P. declare not having any kind  
368 of conflict of interest.

369

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484 **Figure legends**

485

486 Figure 1: Prescriber’s habits in the evaluation of IV fluids administered to dilute IV drugs

487 Figure 2: Parameter used in the evaluation of fluid responsiveness

488 Figure 3: Physicians’ (n=98) versus nurses’ (n=221) perception on the frequency of fluid  
489 balance documentation

490

491 **Tables**

492 Table 1: Characteristics of responding physicians

	<b>Junior (n = 47)</b>	<b>Senior (n = 56)</b>	<b>Total (n = 103)</b>
Years of experience, median, interquartile range (IQR)	4 (3)	13.5 (18)	7 (11)
Supervisor, n (%)	-	55 (98)	
Specialism, n (%)			
• Anesthesiology	10 (21)	17 (30)	27 (26)
• Emergency medicine	19 (40)	5 (9)	24 (23)
• Gynecology	-	2 (3)	2 (2)
• Intensive care medicine	-	5 (9)	5 (5)
• Internal medicine	14 (30)	19 (34)	33 (32)
• Otorhinolaryngology	-	1 (2)	1 (1)
• Radiology	-	1 (2)	1 (1)
• Surgery	4 (9)	6 (11)	10 (10)

493

494 Table 2: Metabolic daily needs of a nil-by-mouth patient (juniors (n=43) versus seniors (n=45))

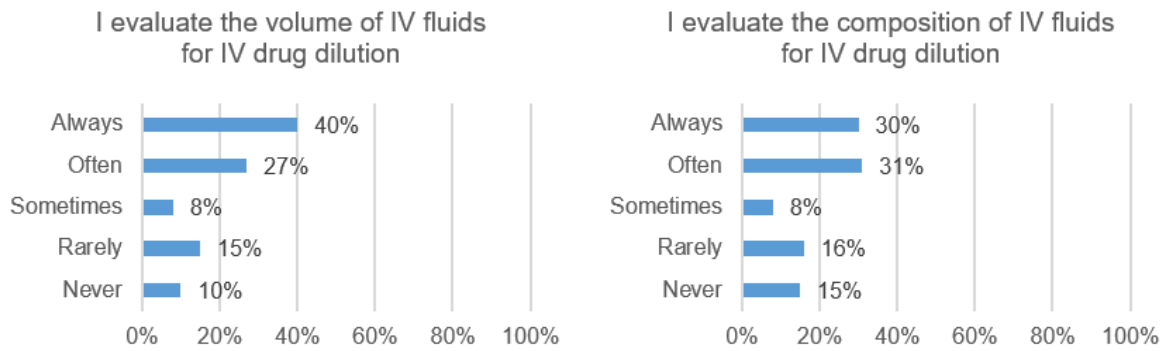
495 - \*Correct answer

	Sodium (mmol/kg/day)					Potassium (mmol/kg/day)					Glucose (g/kg/day)			
	0.25	0.5	1*	1.5	2	0.25	0.5	1*	1.5	2	0.25-0.5	0.5-1.0	1.0-1.5*	1.5-2.0
Junior	2	9	20	6	6	4	10	24	4	1	1	17	17	8
Senior	1	5	17	10	12	6	12	21	5	1	5	8	19	13

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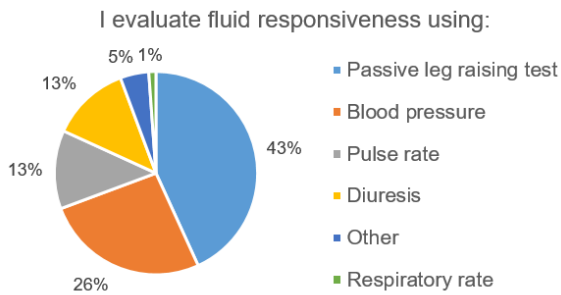
497 **Figures**

498 Figure 1



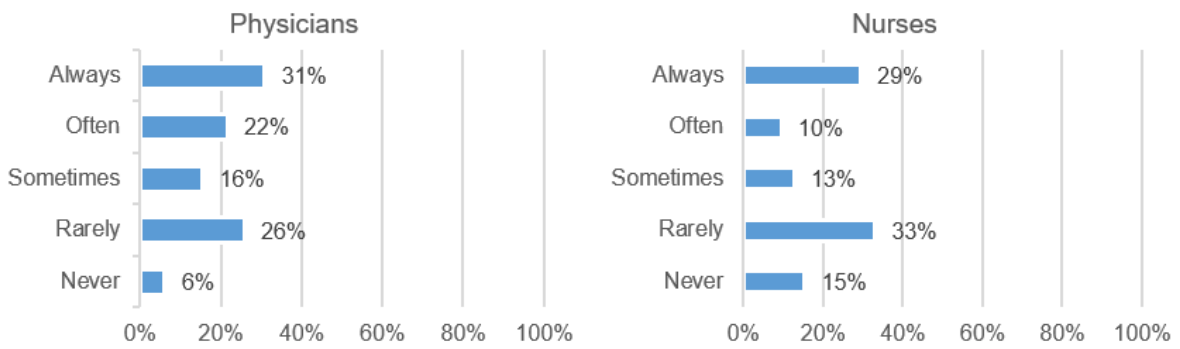
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500 Figure 2



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502 Figure 3



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