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1 **On-call duties in hospital pharmacies: national survey and elaboration of**
2 **a training program for pharmacy residents**

4 **Gardes en pharmacie hospitalière: enquête nationale et élaboration d'un**
5 **programme de formation pour les internes**

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14 **Key words:** residents training; in-house on-call duties in hospital pharmacies; harmonization
15 of practices; quality improvement, risk management

17 **Mots clés:** formation des internes ; gardes en pharmacie hospitalière, harmonisation des
18 pratiques ; amélioration de la qualité ; gestion des risques

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38 **ABSTRACT**

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41 Objectives:

42 During their residency, pharmacy residents are required to attend a hospital on-call program
43 in order to insure the continuum of care for inpatients. This activity is subject to risks, and
44 requires a prior training. Our aim was to develop and to optimize such a training program.

45

46 Methods:

47 To this end, we first established a baseline study of the existing training methods in our
48 hospital and those in the different hospitals of France in which pharmacy residents realize in-
49 house on-call duties, associated with an identification of both pharmacists and students' needs
50 in our institution. These preliminary studies were used to create a transversal, structured and
51 harmonized training program.

52

53 Results:

54 The results of our national survey highlighted great disparities of training between the
55 establishments and point out the lack of structure, organization and harmonization of the
56 training, which residents expected to be improved. Our training program contains 3 parts:
57 initial theoretical training, initial practical training and continuous training. Beyond the
58 harmonization of the theoretical training's materials between the different sectors of the
59 pharmacy, new tools were introduced like an in-house on-call duty notebook complementary
60 to trainings adapted to note taking, simulation's workshops and interactive quizzes. The
61 training was gradually implemented in our hospital pharmacy, in collaboration with the
62 pharmacists of the different activity sectors

63

64 Conclusions:

65 The next steps of our work will be to assess pharmacists and pharmacy residents' satisfaction
66 about our program and its efficacy.

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68

69

70 **RESUME**

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73 Objectifs:

74 Au cours de leur internat, les internes en pharmacie sont appelés à réaliser des gardes pour
75 assurer la continuité des soins des patients hospitalisés. Cette activité à risque nécessite une
76 formation préalable. Notre objectif a été de développer et d'optimiser un programme de
77 formation adapté à cette activité.

78

79 Méthodes:

80 Un état des lieux initial des formations existantes a été réalisé au sein de notre hôpital et dans
81 les différents établissements hospitaliers français dans lesquels les internes en pharmacie
82 effectuent des gardes. Un programme de formation transversale, structuré et harmonisé a été
83 créé.

84

85 Résultats:

86 Les résultats de l'enquête nationale soulignent d'importantes disparités entre les
87 établissements concernant la formation. Ils mettent aussi en exergue le manque de
88 structuration, d'organisation et d'harmonisation de cette formation et les souhaits
89 d'amélioration des internes. Le programme de formation développé est constitué de 3 parties :
90 formation théorique, pratique et continue. Outre l'harmonisation des supports de formation
91 utilisés, de nouveaux outils ont été introduits tel qu'un guide pratique de garde, des sessions
92 de simulations sur des cas réels et des questionnaires interactifs. Le programme a été
93 implémenté de façon graduelle en collaboration avec les pharmaciens de chaque domaine
94 d'activité.

95

96 Conclusions:

97 La prochaine étape de ce travail sera d'évaluer son impact sur la satisfaction des internes et
98 des formateurs ainsi que sur l'efficacité des formations.

99

100 **I. INTRODUCTION**

101 In several countries in the world (1,2) the training of future hospital pharmacists includes
102 several years working under supervision in hospitals. Often called pharmacy residency, it
103 allows pharmacy residents to put their theoretical knowledge into practice with training
104 courses in different pharmacy activity sectors (3). In France it lasts 4 years and is composed
105 of eight 6-month training courses. Like in other countries, it also includes the obligation to
106 attend a hospital on-call program (4), to maintain a continuum of care for inpatients outside
107 daily working hours. In the main French regional establishments, it consists in in-house on-
108 call duties. On-call activities are varied and may be different from one hospital to another.
109 The core activity is drug and medical devices dispensing but pharmacy residents may also be
110 involved in the manufacture of medicines, assist the on-call pharmacist who realizes
111 chemotherapy preparations or solve a sterilization problem.

112 This on-call work is subject to risks especially due to emergencies: pharmacy residents have
113 to be able to carry out each of them and to prioritize some requests. Some situations may lead
114 to stress and cause them to make wrong choices. In addition, residents are often alone to face
115 the requests coming from all the hospital's clinical units, and can rapidly be submerged. On-
116 call activities can furthermore be very different from the residents' daily routine making it
117 difficult to perform adequately these activities. To sum up we can distinguish contributing
118 factors for medications errors in all these elements (5–8): lack of experience, small staff,
119 context of emergency, accumulation and interruption of tasks, stress and tiredness. Over the
120 past few years the importance of training for healthcare providing was pointed out to reduce
121 medication errors and secure medical and pharmaceutical practices (6–8). Developing the
122 residents' training could represent one of the means to prevent medication errors and improve
123 practices.

124 There is currently no standardized on-call program in France: each establishment sets up its
125 own organization rules. The training must be fast and efficient, as they have also to train for
126 their daily activities. With a goal based on securing the medication process and improving
127 quality in our hospital, our project was to optimize pharmacy residents' training for in-house
128 on-call duties and thus to develop a structured training program, including theoretical and
129 practical courses, which could be implementable in any hospital.

130 **II. MATERIEL AND METHODS**

131 A working group was established constituted of the residents' coordinator, the training

132 referent at the pharmacy department and the pharmacy residents' representative.

133 First a baseline study of the existing training methods in our hospital and those in the different
134 hospitals of France associated with an identification of both pharmacists and students' needs
135 in our hospital was conducted. Figure 1 presents the flowchart of the methodology that was
136 used.

137 Secondly, we used the results of the different surveys to optimize the existing training
138 program based on 3 steps: initial theoretical training, initial practical training and knowledge
139 assessment/continuous training. We tried to develop and improve it by introducing new
140 training methods such as e-learning and simulation.

141 **A. Baseline study of the training methods and identification of needs**

142
143 The working group met regularly to create the different surveys intended to characterize in-
144 house on-call duties and the related training provided to residents in France, and to identify
145 pharmacists and residents' needs about the current training to on-call activities in our hospital.

146 1. In our hospital

147
148 We created a 23 questions survey using RedCap[®] software intended to the 10 senior
149 pharmacists in charge of the different activity sectors about their training's characteristics and
150 their opinion. Some questions focused on their satisfaction about the training they give and
151 their possible needs for more time or means.

152 Pharmacy residents' opinions and needs were collected using 12 surveys created with Google
153 form[®] about the training's modalities, strengths and suggestions for improvement.

154 2. In the other hospitals in France

155
156 A 28 questions survey was created with Google form[®] to characterize the training conditions.
157 The last question called "Comment" enabled the residents to express themselves freely. It was
158 sent by email to the 25 French pharmacy residents' associations. The translated version of the
159 survey is presented in Supplementary Data.

160 **B. Elaboration of our training program**

161
162 The group met regularly to think about a training program matching the expectations of both
163 pharmacists and pharmacy residents. Its requirements were the following:

- 164 - To ensure all residents get adequate training

- 165 - To standardize the training between all the sectors
- 166 - To be repeatable
- 167 - To be inexpensive
- 168 - To develop practical training
- 169 - To be time efficient i.e. with a suitable format and arranged to facilitate fast learning
- 170 - To introduce innovative tools

171 It was presented to all senior pharmacists of our hospital for validation and then developed
172 gradually by a step-by-step approach, starting with the more critical pharmacy activity sectors
173 (activities occasionally done during on-call shifts, technicity and/or complexity of these
174 activities).

175 **III. RESULTS**

176 **A. Baseline study of the training methods and identification of needs**

177 1. In our hospital

178 The training currently takes place at the beginning of each 6-month period. It is provided by
179 the 10 senior pharmacists and includes a theoretical training, often completed with a practical
180 training. Each training session lasts between 30 minutes up to 2 hours.

181 Except for one sector, each theoretical training course is given to the entire group of all the
182 residents, which suits all of senior pharmacists. The most widely used training tool is oral
183 explanations (55%) often completed with paper documents (45%) and/or slideshows (45%).
184 The content often includes a presentation of the service with its general (64%) and specific
185 (55%) operational modalities. Internal procedures are sometimes presented (55%). Some
186 practical issues are explained such as concrete cases (55%) or older residents' experiences
187 (55%). The majority of senior pharmacists considered they have enough time to realize it
188 (91%). They are all in favor of the current organization of theoretical teachings during the
189 first two weeks of each semester.

190 Practical training is generally dispensed to all residents (56% of trainings) and consists mainly
191 of oral explanations (67%) through complementary training with pharmaceutical assistants
192 and technicians (78%), practical exercises/performances (56%) and detailed visit of the
193 facilities (56%). It is completed by a part of companionship between experienced and novice
194 residents. Senior pharmacists don't need additional time for their practical training (78%) and
195 the current organization suits all of them.

196

197 Once trainings are completed, pharmacy residents have to take a 2-hours written knowledge
198 assessment; its modalities satisfy 90% of senior pharmacists who think it enables them to
199 correctly assess residents' knowledge.

200 To conclude 55% of them are satisfied with their current training, but some think it could be
201 improved if they had additional time (27%) and/or means (9%).

202

203 Residents returned 133 surveys (85%) which represents on average 10 surveys per resident.

204 The participation rate of each survey was between 69% and 92%. The training was globally
205 well appreciated by the residents but its organization and modalities could be improved
206 (Figure 2).

207

2. In the other hospitals in France

208

209 34 hospitals returned 108 completed surveys (Figure 3) but 2 hospitals were excluded
210 (activities described were not within the scope of this work).

211

212 Between 7 and 26 residents are involved in the on-call program in each establishment. In 44%
213 of hospitals, they realize the on-call component in a different site from the one they work in
214 during the day. Residents are often alone (84%) to realize on-call activities. The different on-
215 call activities distribution is presented Figure 4A.

216 All trainings at the beginning of each 6-month period was provided by pharmacists. It is
217 mainly composed of both theoretical and practical parts (81%) but sometimes only of a
218 theoretical (13%) or a practical part (6%) (Figure 4B).

219 Theoretical training is often given to the entire group of all the residents (87%) and mainly
220 lasts between 5 to 10 hours (36%) or between 10 to 15 hours (27%) (Figure 4C). The support
221 used is oral explanations (93%) and/or slideshows (67%). It often includes a presentation of
222 the activity sector with its general (93%) and specific (97%) activities completed with a
223 description of facilities (97%). Internal procedures can be presented (83%). The
224 functionalities used in the pharmacy software are also explained (93%) (Figure 4E).

225 Practical training is generally given to small groups of residents (64%). It is shorter than
226 theoretical training as it takes between 5 to 10 hours (46%) or less than 5 hours (43%) (Figure
227 4D) and the main support is oral explanations (100%). It contains principally practical

228 exercises/performances (71%), practical software or specific computer resources training
229 (75%) and detailed visit of the facilities (75%) (Figure 4F).

230 An evaluation session has been set up in 47% of hospitals. It is mainly composed of practical
231 sessions/performances (67%) and/or written evaluation (53%) and often lasts 1 hour (66%).

232 The evaluations were corrected by pharmacists in all cases.

233

234 This survey was well perceived by pharmacy residents. Some residents think the training they
235 received is too light, too short and/or not practical enough. Some of them feel unsecure and
236 considered in-house on-call duties as dangerous.

237

238 **B. Elaboration of our training program**

239

240 The working group matched the results of the different surveys and the current training
241 program with the objectives to create an efficient and complete training program (Figure 5).

242 The major decisions are presented hereafter:

- 243 • To maintain the current training organization (i.e. the consolidation of all theoretical
244 trainings during the first two weeks of each 6-month period).
- 245 • Development of practical training sessions using simulation
- 246 • Implementation of e-learning modules and evaluations (using quizzes and e-learning) to
247 be realized throughout the semester

248 Our training program presented in Figure 6 was validated by the senior pharmaceutical team
249 in April 2017.

250 We began to set it up for outpatient dispensing practices, because of the higher risk of
251 potential errors, the wide variety of situations and the stress of being in direct contact with the
252 patients, and the following activities in which it was implemented were inpatient dispensing
253 and temporary authorized drugs dispensing.

254

255 *a) Theoretical training (Task 2)*

256

257 We harmonized the training materials between the different pharmacy sectors by developing a
258 common frame with the software Powerpoint® (Task 2.1).

259 We added a theoretical training about the declaration of adverse events (introduced in May
260 2017).

261 To help pharmacy residents to assimilate the trainings' explanations and take notes at the
262 same time, an in-house on-call duty notebook was developed (Task 2.2). It contents:

263 - the training program's schedule

264 - a general introduction to in-house on-call duties

265 - a module for each pharmacy activity sector: the detailed plan of the theoretical training
266 support with blank spaces for note taking, the plan of practical training and a check-list of
267 skills to have gained at the end of the training.

268 We implemented a 1-hour training course about in-house on-call duties' generalities and its
269 practical organization (Task 2.3) on the first day of each 6-month period. It combines a visit
270 of the pharmacy and explanations about practical aspects of on-calls duties.

271 Pharmacy residents regularly meet with the residents' coordinator to talk about in-house on-
272 call duties' conduct. We created in June 2017 a dedicated insert in each written sum up (Task
273 2.4) that will come back on a difficult situation lived by a resident and how to deal with it.

274 ***b) Practical training (Task 3)***

275

276 Role-play was chosen as the simulation model (Task 3.1).

277 The set up of simulation's workshops requires (Task 3.2):

278 - a test version of the pharmacy software program

279 - a room to realize the workshops; we opted for the pharmacy conference room that will be
280 reconfigured to recreate as faithfully as possible the real conditions of on-calls' equipment
281 and layout

282 - accurate scenari and corresponding debriefing sheets

283 - a satisfaction survey

284

285 To optimize the efficacy of the companionship between residents we set up in May 2016 a
286 planning which limits the number of new residents taking part in old residents' on-call duties
287 (Task 3.3).

288 ***c) Evaluation of knowledge/Continuous training (Task 4)***

289

290 The current written test was maintained and completed with other forms of evaluation:

291 - a continuous evaluation by using Quizz boxes[®] at the end of some monthly coordination
292 meeting (a databasis of MCQ tests was created) (Task 4.2); the residents' coordinator will
293 choose 4-5 questions to evaluate the residents.

294 - the implementation of e-learning sessions for the continuous training and the evaluation of
295 knowledge will request more time depending of institutional choices and investments
296 (Task 4.1).

297

298 **IV. DISCUSSION**

299

300 The results of our preliminary study about the on-call duty training conditions in French
301 hospitals highlight the great disparities in training between the establishments and point out
302 the lack of structure, organization and harmonization of the training. The main differences are
303 the following:

304 - Some training programs are only composed of a theoretical or a practical part whereas these
305 two parts are complementary. An evaluation of knowledge occurs in only 47% of hospitals,
306 despite the fact that it is fundamental to evaluate the efficiency of training and what the
307 participants understand and remember.

308 - All the trainings occur at the beginning of each 6-month period and only 6% of the hospitals
309 set up a continuous training. It may be an issue because pharmacy residents receive a lot of
310 information in a very short period and have no occasional reminders during the rest of the
311 semester. The duration of the theoretical and practical training is of 5 and 10 hours
312 respectively: this duration could seem insufficient in the light of the numerous activities
313 residents have to master.

314 - Training supports exist in various forms, being mainly oral explanations: it means that
315 residents have no written trace of trainings they received except of their inner notes.

316 This lack of harmonization between the institutions is inconsistent with the current trend in
317 the health field to have harmonized practices, especially in the context of territorial hospital
318 organizations required by the law of modernization of the French health system in 2016 (12).

319 Our results show that residents do sometimes feel that their training is insufficient, which
320 could be even truer for residents with daily activities that are not similar to the on-call duties
321 they have to perform, or for residents coming from other surrounding hospitals. A formalized
322 and harmonized on-call duty training program can help them to gain knowledge and skills that
323 can be used everywhere. Our training program can represent a first modest step in the way of
324 homogenization between health institutions. It could enable residents to take full advantage of
325 on-call experience, which would provide benefits such as the opportunity to practice

326 autonomously, thinking critically, using their knowledge base and developing decision-
327 making skills (13,14).

328 Very little data exist in the literature about on-call programs and training although
329 pharmacists' on-call duties is a common practice all over the world (2,13–16); no
330 homogenization approach is currently identified. Holder and al. realized a national survey in
331 the United States to characterize on-call practices. It identifies variations in activities, location,
332 hours and requirements in on-call programs (15). The most common or frequent activities are
333 drug information consultations, therapeutic drug monitoring, and anticoagulation monitoring,
334 which means that the American on-call activities get closer to clinical pharmacy.

335
336 Training is nowadays a key element in any new activity in healthcare: it is mandatory in
337 France for the healthcare professionals since the 2009 HPST law (17) introduced the
338 obligation of continuing professional development and was reinforced by the law of
339 modernization of the French health system in 2016 (12). Moreover the 2009 HPST law
340 obliged the French establishments to define and put into practice a continuous quality and
341 safety of the care improvement policy and a risk management process in order to prevent and
342 treat the adverse events bound to their activities. Training is a way to anticipate the risks of
343 any new activity and belongs to the tools used for the *a priori* risks management as referred to
344 in several French laws. Thus some studies tend to show that training helps to decrease
345 medication errors but further observational studies will be necessary to precise and quantify
346 this point (18,19). Instilling a culture of safety may have a greater impact on reducing
347 medication errors (20). To facilitate the implementation of an adequate and complete training
348 program, it could be worthwhile to introduce some key elements concerning on-duty activities
349 in the initial theoretical cursus of the residents, using the current reform of their 3rd cycle
350 studies (R3C) as a possibly simple way to fast-track these changes.

351 We developed a simple but optimized and standardized training program for pharmacy
352 residents by referring to the model of the Deming wheel (Plan-Do-Check-Act). Our working
353 group first structured it in simple and independent tasks, in order to be able to rapidly put it in
354 place without additional resources. Changes in work habits are not easy to set up and it
355 sometimes takes time for work teams to put personal preferences aside and change their
356 behaviors (21,22). Some principles are known to improve adherence to protocols in care units
357 (21–23): effective communication, interdisciplinary collaboration between physicians and
358 nurses, leadership support, organizational aspects and protocol's simplicity. To enhance
359 adherence, our training program was approved by all the pharmacists before implementation.

360 Moreover we will regularly evaluate the efficiency of our program and collect pharmacists
361 and residents' opinion about it.

362 Indeed the current trends in term of education actively involve learners who become actors in
363 the learning methodology (24). It goes even farther as we attend a “gamification” of training
364 with the development of serious games (25,26).

365 The main advantages of these new training methods are (25–29): its flexibility, the increase of
366 students' motivation, a significant freedom for learners, the promotion of communication,
367 student-to-student interactions and peer-learning, the increase of self-confidence and
368 reduction of anxiety, the development of some cognitive and emotional skills. Nevertheless
369 game-based learning haven't really demonstrated their efficacy in term of learning alone or
370 compared with other classical teaching modalities (25,28–30). Some studies suggest a good
371 efficacy of the combination of various teaching techniques (26–29), indicating that one lone
372 tool might not be sufficient to achieve maximum training efficacy. In our case, the impact of
373 the training on the management of the continuum of care for inpatients could be measured by
374 a review of adverse events declared by the clinical units (number of dispensing errors for
375 example) and by an assessment of their satisfaction of this activity. The quality of the
376 pharmacy - clinical units relationship could also be investigated.

377 **V. CONCLUSION**

378
379 The next step of our work will be to assess our training program: we will conduct a study to
380 measure its impact on errors occurring during on-call duties and to measure the pharmacists
381 and pharmacy residents' satisfaction, and then implement any necessary changes.

382

383 **VI. COMPETING INTERESTS AND FUNDING**

384 The authors declare no competing interests nor funding for this work.

385 **VII. REFERENCES**

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490 effect of educational games on medical students' learning outcomes: A systematic review:
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495 **VIII. FIGURE LEGENDS**

496 Figure 1: Methodological process used to summarize existing training methods and to
497 collect pharmacists and students' needs

498 Figure 1: Méthodologie de recueil des données (méthodes de formation existantes et
499 besoins exprimés des pharmaciens et internes)

500

501 Figure 2: Analysis of the residents' opinions on the training session

502 Figure 2: Analyse des opinions des internes sur leur formation aux gardes

503

504 Figure 3: Distribution of hospitals which answered the Google form® survey intended to
505 French pharmacy residents

506 Figure 3: Répartition des établissements hospitaliers pour lesquels une réponse a été
507 obtenue au questionnaire national Google form® sur les gardes des internes en
508 pharmacie

509

510

511 Figure 4: Results of the Google form® survey intended to French pharmacy residents:
512 Pharmacy residents' on-call activities distribution (A), Types of training (B),
513 Approximative duration of theoretical training (C), Approximative duration of practical
514 training (D), Composition of theoretical training (E), Composition of practical training
515 (F)

516 Figure 4: Résultats de l'enquête nationale Google form® sur les gardes des internes en
517 pharmacie : activités réalisées en garde (A), méthodes de formation (B), durée
518 approximative des formations théoriques (C), durée approximative des formations
519 pratiques (D), contenu des formations théoriques (E), contenu des formations pratiques
520 (F)

521

522 Figure 5: Methodological process used to elaborate the training program

523 Figure 5: Méthodologie utilisée pour élaborer le programme de formation

524

525 Figure 6: Composition of the training program

526 Figure 6: Mise en oeuvre du programme de formation

527

528

September
2016

- Distribution of the national survey to the 25 French pharmacy residents' associations

November

- Analysis of the national survey's results with the software Excel®

December
2016

December
2016

- Distribution of the local survey to the 10 senior pharmacists of our hospital

February-
March
2017

- Analysis of the local survey's results with the software Excel®

July-
August
2017

- Collect of the pharmacy residents' opinions in our hospital and analysis of results with the software Excel®



Theoretical training

- Training focused on situations that residents can deal with during on-call duties
- Existence of paper issues, paper-based support, flowcharts...
- Clarity and precision of some trainings
- Presence of concrete examples
- Some trainings done on computers: it enables them to practice the software usage
- Visit of the pharmacy
- Detailed correction of the evaluation of knowledge (Drug dispensation) with all the residents

Practical training

- Realization of the training with the pharmaceutical assistants in the activity sector
- Manipulation of the software
- Training realized in small groups/individual training
- Companionship between experienced and novice residents
- Realization and control of their own pharmaceutical preparations

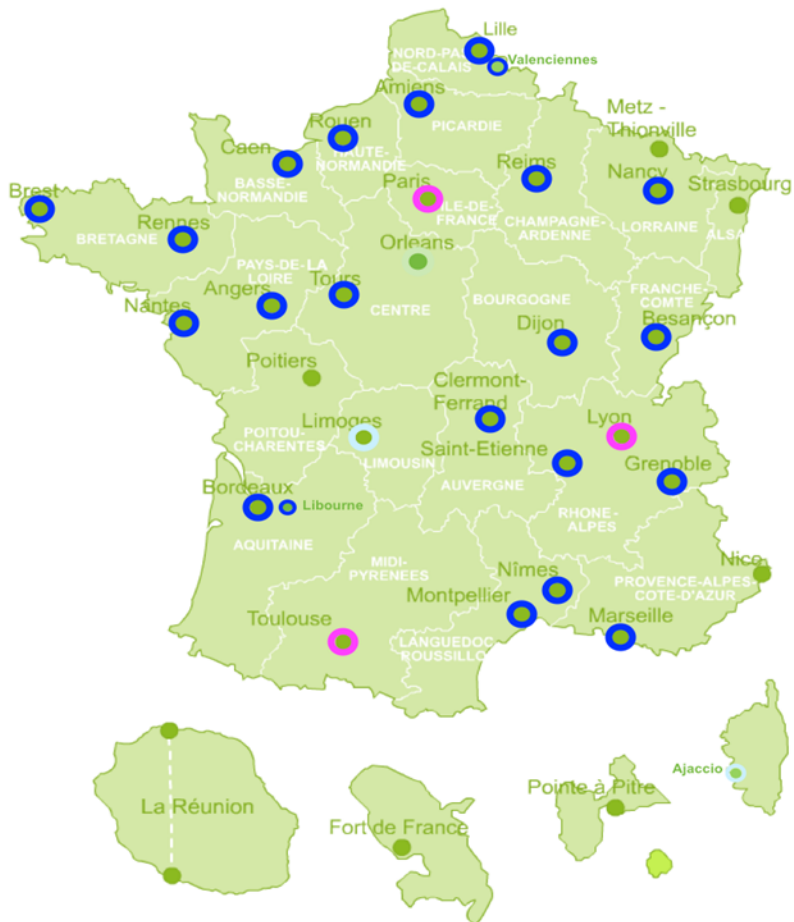


Theoretical training

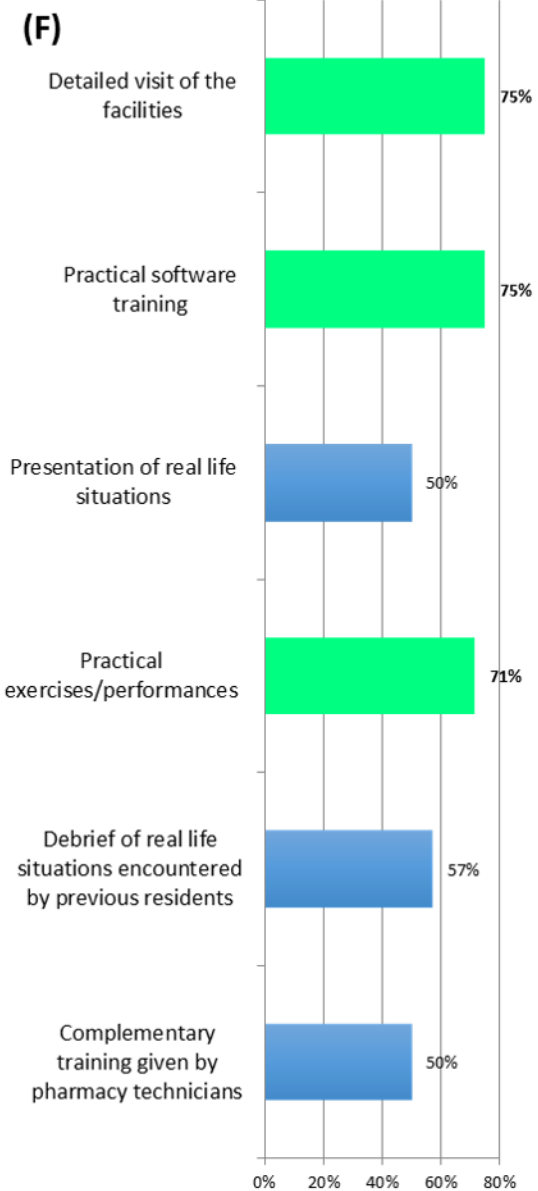
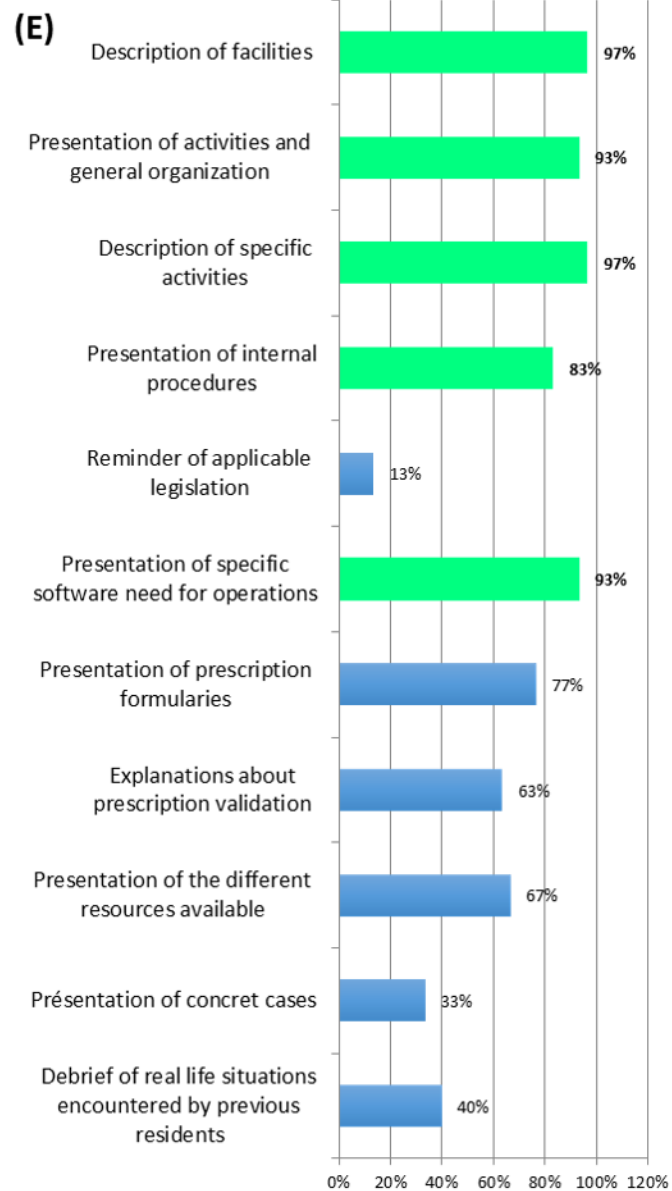
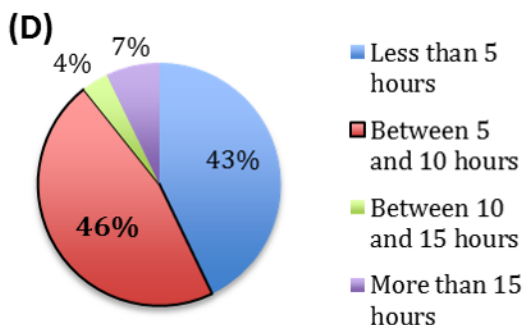
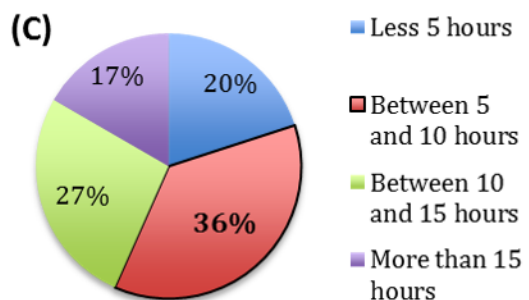
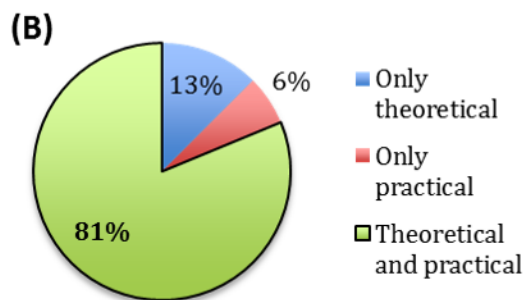
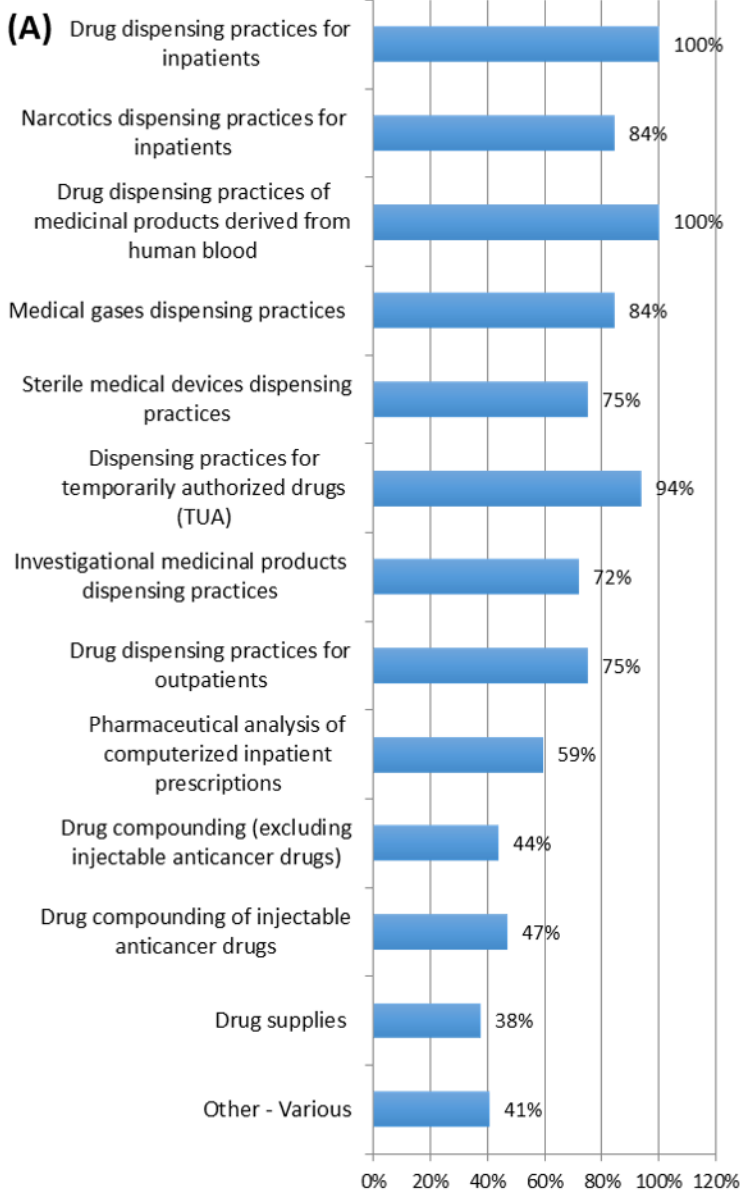
- Presentation of the hospital and the pharmacy, explanations on the drug's circuit...
- More concrete training and practical cases
- Introduction of e-learning and simulation
- More issues paper about real-life situations
- A repertory of sensitive situations
- Explanations about the different storage places of drugs, pharmaceutical preparations and raw materials
- Oral and/or practical knowledge assessment
- Reiterate the training in the semester

Practical training

- Extend the duration of the practical training
- Reiterate the training in the semester
- Optimize the organization of the training
- Update some protocols
- More ride-along, more concrete examples and examples about requested actions in some particular situations
- A repertory of mistakes to avoid
- Practical knowledge assessment
- Other supports requested: simulation, "real life" case studies and paper-based support



- Cities where 1 hospital answered
- Cities where several hospitals answered
- Cities where 1 hospital answered whose organization is not considered as an on-call duty



Task 1 : Conception of program general model

