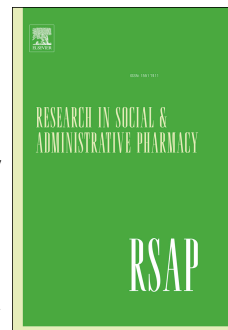


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Strategies for improving medication safety in hospitals: Evolution of clinical pharmacy services

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2

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26

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32

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37 **ABSTRACT**

38

39 **Background:** Medication safety risks are the most important preventable factors jeopardizing patient
40 safety. To manage these risks, extending pharmacists' involvement in patient care and patient safety work
41 has been systematically addressed in patient safety initiatives since the early 2000s.

42

43 **Objective:** To explore the extent and range of clinical pharmacy services in Finnish hospitals to promote
44 medication safety: 1) in 2011, when the first National Patient Safety Strategy, the new Health Care Act and
45 the Medicines Policy 2020 had been recently enacted; and 2) five years later in 2016.

46

47 **Methods:** The study was conducted in 2011 and 2016 as a national online survey targeted to hospital
48 pharmacies (n=24) and medical dispensaries (n=131 in 2011; n=28 in 2016). The questions were analyzed
49 using descriptive statistics and qualitative content analysis.

50

51 **Results:** Overall response rate was 60% in 2011 and 52% in 2016. Clinical pharmacy services were provided
52 by 51% of the responding units in 2011, whereas by 85% in 2016. The reported number of clinical
53 pharmacists had increased during the five years. The most notable increase in reported tasks occurred in
54 conducting medication reconciliations (+63% increase in the number of providing units). By 2016
55 pharmacists had extended their tasks particularly towards system-based medication safety work: e.g.
56 developing instructions for medication-use (91% of the responding units), creating and updating
57 medication safety plans (87%) and using medication error reports in developing the process of medication
58 use safer (78%). Pharmacists' participation in long-term continuing education became more common in
59 2016, which was perceived as helpful in extending their responsibilities to improve medication safety.

60

61 **Conclusion:** Pharmacists' involvement in patient care and system-based medication safety work was
62 reported to become more common in Finnish hospitals during 2011-2016. This development is in line with
63 patient safety policy initiatives and its impact on patient care outcomes should be followed up.

64

65

66

67

68

69 1. INTRODUCTION

70

71 Pharmacotherapy is one of the most common interventions in healthcare. Even effective,
72 pharmacotherapies used in hospitals are often challenging to manage: approximately 6% of hospitalized
73 patients experience an adverse drug event during their hospital stay.¹ In many cases, medications used in
74 hospitals are parenterally administered, which increases a risk for medication errors (MEs).²⁻³ Furthermore,
75 hospitalized patients are often unstable and need intensive and continuous monitoring, as well as fast
76 clinical decision-making. System-based patient safety work has shown that medication errors are one of the
77 most important preventable factors jeopardizing patient safety in healthcare.⁴⁻⁷ To be safe,
78 pharmacotherapies used in hospitals require well-designed care processes both for individual patients and
79 at the organizational level. Therefore, international patient safety initiatives prioritize strategies and
80 policies to improve safe medication practices.⁴⁻⁷ These strategies have emphasized the creation of a safety
81 culture, learning from medication errors through reporting systems and development of preventive actions
82 for prospective risk management.

83

84 The Council of Europe was among the first ministry level institutions in Europe to establish
85 recommendations to improve medication safety as part of patient safety in 2006.⁵⁻⁶ These medication
86 safety recommendations focused on safety culture and considered e.g. early detection of adverse drug
87 events, the setup of medication error reporting systems, strengthening awareness and learning of
88 professionals, introducing electronic prescribing, improving naming, labelling and packaging, and improving
89 medicines information practices. Council of Europe has continued its long-term commitment to medication
90 safety work under the European Directorate of Quality of Medicines (EDQM) with a program to create
91 pharmaceutical care indicators.⁸⁻⁹ Also, European Union (EU) and its stakeholder organizations have
92 coordinated efforts to encourage the member countries to take actions to improve patient and medication
93 safety.¹⁰⁻¹¹ Most lately EU integrated medication safety with drug safety, i.e. pharmacovigilance initiatives
94 through a Directive enacted in 2012.¹²

95

96 All the patient and medication safety initiatives, recommendations and policies over the years have been
97 based on interprofessional team work principles.⁴⁻⁷ As pharmacists as healthcare professionals are
98 specialized in pharmacotherapies, they have been encouraged to take more responsibility of managing safe
99 medication practices in different settings. E.g. EDQM invited European governments and policy-makers to
100 implement the principles and working methods of clinical pharmacy and pharmaceutical care in their
101 national healthcare systems.⁸⁻⁹ Clinical pharmacy is an area of pharmacy concerned with the science and
102 practice of rational and appropriate medication use.¹³⁻¹⁴ According to the principles of pharmaceutical care,
103 pharmacists are expected to ensure the quality and safety of medication therapies in patient care, with

104 emphasis on collaborative care and patient interaction.¹⁴⁻¹⁷ Even though pharmaceutical care and patient-
105 centered clinical pharmacy services have been shown to improve quality, safety and efficiency of care and
106 reduce its costs,¹⁸⁻²¹ their diffusion to many healthcare systems, e.g. in Europe,²² has been slow. Growing
107 evidence of patient safety risks cumulating from medications, also in Finnish healthcare, have created a
108 need to develop new strategies and policies to manage these risks.²³⁻²⁶ The aim of this study was to explore
109 the extent and range of clinical pharmacy services in Finnish hospitals to promote medication safety: 1) in
110 2011, when the first National Patient Safety Strategy²⁷, the new Health Care Act²⁸ and the Medicines Policy
111 2020²⁴ had been recently enacted; and 2) five years later in 2016.

112

113 2. MATERIALS AND METHODS

114

115 2.1. Context of the study

116 In Finland municipalities are responsible for organizing primary healthcare services, which are mainly
117 provided by municipal health centers.²⁸ The secondary special healthcare is organized by central hospitals,
118 each of them located in their own hospital districts (n=21) covered by federations of municipalities
119 (including Åland). For special tertiary healthcare, Finland is divided into five responsibility areas, each with a
120 university hospital. Private healthcare services complete the public health services. Hospital pharmacies
121 (n=24) are located in university hospitals, central hospitals and in some larger health centers with inpatient
122 wards. Medicine dispensaries supply medicines in smaller inpatient healthcare units in the public and
123 private sectors. Some of them operate independently as part of the healthcare organization and others in
124 the public sector operate under hospital pharmacies. The number of medicine dispensaries had remarkably
125 decreased from 94 to 55 between 2011 and 2016 (Finnish Medicines agency, unpublished statistics 2012),
126 while the number of hospital pharmacies (n=24) remained the same.²⁹⁻³⁰ The number of independent
127 medicine dispensaries decreased because of a strategic trend to merge small medicine dispensaries into
128 larger hospital pharmacies in the region. The goal of the merges was to release resources from
129 administrative and logistic work to be reallocated to more patient care oriented clinical pharmacy services.

130

131 Clinical pharmacy as a concept was defined in Finland in 2010 for initiating a national specialization
132 program for hospital and health center pharmacists with special reference to systems approach to patient
133 and medication safety.³¹ The following definition was constructed based on an inventory of definitions by
134 key international clinical pharmacy organizations: *Clinical pharmacy is a health science focusing on*
135 *pharmacists' contributions to medicines optimization and health promotion. Clinical pharmacy emphasizes*
136 *rational medicine use and promoting it, development and evaluation of pharmaceutical services, medicines*
137 *management, and medication safety. Prerequisites for clinical pharmacy are interprofessional collaboration*

138 *and collaboration with patients. Clinical pharmacy covers all social and healthcare settings in inpatient and*
139 *outpatient care where pharmacotherapy is part of the care of the patients.* The concept “ward pharmacy”
140 has a longer history in Finland and it has been defined as “a medication management at hospital wards
141 conducted by pharmaceutical staff”.²⁴ The ward pharmacy as a concept reflects the long-time core mission
142 of Finnish hospital pharmacists in the management of medicines supply and logistics.³²⁻³⁴ The first clinical
143 pharmacy posts in Finnish hospitals were established in the end of the 1980s, but the development of
144 clinical pharmacy services has been slow.³³⁻³⁴ Moreover, pharmacy education in Finland, as in many other
145 countries, has not prepared pharmacists to be involved in patient care and to provide clinical pharmacy
146 services as a part of the healthcare team.³⁵⁻³⁶ The first steps towards more systematic training in
147 pharmacists’ clinical skills were taken through national accreditation training for comprehensive medication
148 reviews which started in 2005.³⁷ It has had spillover effects on undergraduate training, specialization
149 training of community and hospital pharmacists, and practice development.

151 In Finland, increasing pharmacists’ involvement in patient care and assuring safe medication practices in
152 hospitals was recommended for the first time in 2006 when Ministry of Social Affairs and Health guided
153 each healthcare unit to set up a medication safety plan, i.e., an organization-based medication risk
154 management plan.²³ The plan should have a description of the system, processes, resources and persons in
155 charge for safe pharmacotherapies. The plan became obligatory as part of the patient safety risk
156 management plan in 2011 when the new Health Care Act was enacted.²⁸ Implementation of these patient
157 and medication safety initiatives were supported by the National Patient Safety Program in 2011-2014.²⁷
158 The Medicines Policy 2020, established in 2011, also supported the same strategic objectives with special
159 emphasis on the pharmaceutical sector’s contributions to safe and rational pharmacotherapy.²⁴ The
160 recommended actions have been conveyed through international recommendations, particularly by The
161 Council of Europe,⁵⁻⁶ The European Union,¹⁰⁻¹¹ WHO,³⁸ research data derived from reporting systems for
162 patient safety incidents,^{25,39} and benchmarking best practices.

164 **2.2. Study design and method**

165 This study was conducted as a national online survey targeted at all hospital pharmacies and medicine
166 dispensaries serving inpatient healthcare units. The survey was first conducted in 2011 and repeated in
167 2016 for a follow-up of developments.

169 **2.3. Development of the survey instrument**

170 Six semi-structured theme interviews were conducted to develop the survey instrument in 2011. The
171 interviewees were selected by purposive sampling to present the widest range of clinical pharmacy services
172 in Finnish hospitals at that time. Recruitment was facilitated by the Finnish Pharmacists’ Association and

173 the Faculty of Pharmacy, University of Helsinki, Finland. Interviewees were working on the wards or as
174 leaders of clinical pharmacy teams in different hospitals and health centers with inpatient wards. In
175 addition to the interviews, information gathered from practice development projects in Finland and
176 international scientific literature was used for developing the survey instrument. Definitions for clinical
177 pharmacy,¹³⁻¹⁴ pharmaceutical care,¹⁵⁻¹⁷ and patient and medication safety from systems approach⁵⁻⁶ were
178 used to outline the range of services included in the structured list of the survey instrument. Medication
179 safety and prospective risk management aspects were emphasized in the selection of the tasks and
180 services.^{5-6,40-41} In order to get a better understanding of the evolution of pharmacists' contributions to
181 patient care and medication safety a detailed list of tasks (n=29) was developed. The more detailed list was
182 expected to increase sensitivity of the measures compared to using general statements of services, such as
183 counseling patients on their medications, or checking and reviewing medications. As Finnish hospital
184 pharmacists do not have a long history in providing other than logistic services, we intentionally included
185 also clinical tasks that are not so "advanced" but reflect merely early phase of clinical pharmacy service
186 implementation in the 1960s, e.g., provision of drug information to ward personnel. These services are still
187 an important part of the infrastructure needed for medication safety and risk management.⁴¹ They also can
188 perform as indicators for transition from early phase clinical pharmacy services towards more advanced
189 and sophisticated ones. The list of tasks and services included in the survey is presented in Figure 3.

190
191 The final survey instrument was divided into three parts: 1) questions gathering background information on
192 the respondent's healthcare organization; 2) questions for hospital pharmacies/medicine dispensaries
193 providing clinical pharmacy services to inpatient care; and 3) questions for non-providers of clinical
194 pharmacy services (Figure 1). The questions employed a five-point Likert scale, multiple choice questions
195 and open fields for responses. Structured questions were used to gather the background information of
196 the responding units, the current range of clinical pharmacy services provided, how they are planned and
197 managed, and the evaluated benefits and outcomes (if studied in the responding unit) of these services.
198 The survey instrument was piloted for content and face-validity with three clinical pharmacists from
199 separate organizations. Time required for responding to the survey varied between 10-40 minutes
200 depending on the range of the services provided by the respondent's organization.

201
202 The same online survey instrument was utilized in the follow-up survey in 2016 (Figure 1). Most of the
203 questions remained the same, but some of the open-ended questions were changed to structured
204 questions in 2016. The structured list of clinical pharmacy services was updated (Figure 3) for the survey in
205 2016 by adding 12 services implemented after the first survey in 2011. Furthermore, the updated list also
206 contained such clinical pharmacy services that were set as a goal by the European Association of Hospital
207 Pharmacists (EAHP) for delivering hospital pharmacy services in every European health system.⁴² In 2011,

208 the respondents were asked to submit any available reports on the studies they had conducted to show the
209 outcomes of the services they provided. Reports received in 2011 (n=9) were used to develop a structured
210 list of benefits and outcomes to the 2016 survey (see Figure 6).

211

212 **2.4. Conducting the survey in 2011 and 2016**

213 The online survey was conducted in 2011 and in 2016. The survey was e-mailed to all chief hospital
214 pharmacists (n=24 in 2011 and 2016) and all managers of the medicine dispensaries (n= 94 in 2011 and
215 n=55 in 2016). The e-mail addresses of the chief hospital pharmacists were received from the Faculty of
216 Pharmacy, University of Helsinki. The managers of the medicine dispensaries were contacted using the
217 membership register of The Finnish Pharmacists' Association provided by the officer of the Association.
218 While there were 55 managers of medicine dispensaries in 2016, only the managers of the independent
219 ones, not managed by hospital pharmacies, were invited to participate in the survey (n=28 out of 55
220 managers). This is because information on clinical pharmacy services provided by the non-independent
221 medicine dispensaries were covered by the responses from the hospital pharmacies under which they
222 operated. The chiefs and managers were asked to forward the survey to the pharmacists in their
223 organization who provided or managed clinical pharmacy services so that that there would be one
224 coordinated response per organization. The survey was planned to be open for two weeks and two
225 reminders were sent during that period. After the period, a third e-mail reminder was sent, and the survey
226 was extended to be open for one more week for responses.

227

228 **2.5. Data analysis**

229 The structured questions were analyzed with descriptive statistics using Microsoft Excel.⁴³ The responses
230 from hospital pharmacies and medicine dispensaries were analyzed separately to identify differences in the
231 operations of these units. Likewise, in some questions the responses from hospital pharmacies were
232 divided into university hospitals, central hospitals and community hospitals to identify differences between
233 these hospital pharmacies. The open-ended questions were analyzed by applying a conventional content
234 analysis.⁴⁴ Systems approach to human errors and risk management as illustrated in the Reason's Human
235 Error Theory was applied to illustrate reported tasks where clinical pharmacists contributed to medication
236 safety at all stages of the medication-use process.⁴⁵

237

238 **2.6. Study ethics**

239 According to the scientific ethical guidelines in Finland, an ethics committee approval was not required for
240 a survey without patient data.⁴⁶ The survey participants were informed that the participation was voluntary
241 and responding to the survey implied an informed consent. The invitation to participate in the survey was
242 sent by e-mail, including a cover letter with a description of the study and a link to an online questionnaire.

243 Detailed information of the responding organizations was not asked for, only whether the unit was a
244 hospital pharmacy or a medication dispensary and the county in which the unit was located. All responses
245 were confidential.

246

247 **3. RESULTS**

248 **3.1. Survey participants and coverage**

249 In 2011, the responses were received from 20/24 of the hospital pharmacies (83%) and 51/94 medicine
250 dispensaries (54%), yielding an overall response rate of 60% (n=71/118). In 2011, the hospital pharmacies
251 were not asked if they were university, central or community hospital pharmacies, but the total coverage
252 was 83%. In 2016, 18/24 of hospital pharmacies (75%) and 9/28 of the independent medicine dispensaries
253 (32%) responded to the follow-up survey resulting in an overall response rate of 52% (n=27/52, Figure 2).
254 Among the respondents in 2016 were all five university hospital pharmacies (100%), 13 central hospital
255 pharmacies and one community hospital pharmacy (Figure 2) covering 74% (n=14/19) of the central and
256 community hospital pharmacies, which provide clinical pharmacy services to the largest inpatient
257 healthcare units.

258

259 **3.2. Reported clinical pharmacy services in 2016 compared to 2011**

260

261 The relative number of responding units providing clinical pharmacy services increased during 2011-2016
262 from 51% to 85% (Table 1). Thus, the proportion of the units reporting non-provision of clinical pharmacy
263 services decreased from 49% in 2011 to 15% in 2016. The main reported reason for not providing clinical
264 pharmacy services was the small number of pharmacy staff, which was commonly 1-2 pharmacists in
265 medicine dispensaries. The reported number of clinical pharmacists and hospital units receiving clinical
266 pharmacy services had increased during the five-year study period (Table 1). More typically they were
267 reported to split their work time between 2-3 units both in 2011 and 2016, only a small number of the
268 clinical pharmacists were reported to work in one unit (ward, clinic). According to the responses of the
269 both surveys, the services were most commonly available in surgical and internal medicine wards. All five
270 university hospitals reported having clinical pharmacy services in intensive care, pediatric and oncology
271 units in 2016.

272

273 **3.2.1 Evolution of reported tasks of clinical pharmacists**

274 Reported tasks performed by clinical pharmacists in 2011 and 2016 are presented in Figure 3. The figure
275 shows extension and implementation of the new tasks, most of which were related to improving

276 medication safety. Of the twelve reported new tasks in 2016, most widely performed were tasks assuring
277 medication safety at the organizational level, such as developing instructions for medication use and
278 medication therapy (91% reported), taking part in creating and updating medication safety plans (87%),
279 taking part in multiprofessional working groups (87%) and developing medication-use processes by using
280 data from medication error reports (78%, Figure 3). In 2016 clinical pharmacy services covered all crucial
281 stages of the medication-use process (Figure 4). The reported major new contributions within the five
282 years period was the new role in developing, auditing and instructing the medication use-process with the
283 system approach,⁴⁵ conducting medication reconciliations (+63%) and counselling patients (+39%, Figure 3).

284
285 Clinical pharmacists were reported having access to patient records in almost all (96%) and access to
286 laboratory results in the majority (83%) of the responding units in 2016 (this was not asked in 2011). The
287 proportion of logistic tasks (e.g. ordering and stock control) remained the same (83% reported, Figure 3). In
288 2016, the respondents were asked to estimate how much time was spent on logistic tasks compared to
289 other tasks. More than half (59%, n=16) of the respondents estimated that 5-50% of the time was spent on
290 logistic tasks, while in almost one-third of the units (30%, n=8), less than 5% of the working time was used.
291 A variation between the tasks of different clinical pharmacists was reported: some performed only logistic
292 tasks, while others had none. Additionally, the respondents reported in an open question their perceptions
293 about the most important tasks actually performed by the clinical pharmacists in their organization at the
294 time of the survey: drug information to ward personnel (48%, n=13), medication reconciliation (33%, n=9),
295 inducting ward personnel (26%, n=7), and developing the medication-use process (22%, n=6).

296 297 **3.2.2 Strategy, management and future plans of clinical pharmacy services**

298 In 2011, less than half (42%) of the responding units reported having a manager dedicated to clinical
299 pharmacy services, while in 2016 the majority (74%) reported this (Table 1). A plan or strategy for clinical
300 pharmacy services was reported to be devised in 20% of the responding units in 2011, while in 63% of
301 the units in 2016 (Table 1). In 2016, half of the responding units (52%) were familiar with the European
302 Statements of Hospital Pharmacy⁴² that could be utilized to guide the development of a strategy for
303 hospital pharmacy services.

304
305 Both in 2011 and 2016, the most common plan for the future in the responding hospital pharmacies and
306 medicine dispensaries was reported to be to extend the clinical pharmacy services to new care units within
307 their healthcare organization. In 2016, almost half (44%) of the responding units reported to have a plan to
308 re-develop and extend the clinical pharmacists' role to be more clinical and patient-oriented. Similar plans
309 were reported already in 2011, but a need for continuing education to adopt a more patient oriented role
310 was recognized. The use of information and automation technology was reported as a key in changing the

311 logistics role of clinical pharmacists in both years. In 2016, 30% of the respondents had the opinion that
312 clinical pharmacy services should increasingly be provided in primary care, nursing homes, home care and
313 social care units. Additionally, in 2016, almost two-thirds (62%) of the responding units thought that
314 pharmacists could take a position as medication safety officers or coordinators in the future, while the rest
315 (38%) had no opinion.

316

317 **3.3 Reported importance of continuing education**

318 Participation in long-term continuing education was reported to have been increased during 2011-2016
319 (Figure 5). Only one hospital pharmacy and one medicine dispensary reported that their clinical
320 pharmacists had not participated in any long-term continuing education by 2016. It was perceived that the
321 clinical pharmacists were able to use the expertise acquired through the long-term continuing education
322 well (70% of the responding units) or slightly (30%). Almost half (48%) of the respondents thought that
323 participating in continuing education had supported the development of the patient-centered tasks of
324 clinical pharmacists.

325

326 **3.4 Assessed benefits and outcomes of clinical pharmacy services**

327 Of the responding units, 33% (n=9) reported having assessed the benefits and outcomes of clinical
328 pharmacy services since 2011 (Figure 6). The results were typically reported internally to their own
329 organization (n=7), in the national congresses (n=4) or in national scientific journals (n=2). Increased
330 multiprofessional collaboration, saved working time of nurses and savings in drug consumption were the
331 most commonly reported assessed and achieved benefits and outcomes in 2011 and 2016. In 2016,
332 common patient safety benefits which were not surveyed or reported in 2011 were the increased reporting
333 of medication errors (n=5) and increased number of accurate medication charts (n=5).

334

335

336 **4. DISCUSSION**

337

338 Responses to this national study suggest changes in the pharmacists' involvement in patient care and
339 assuring medication safety in Finnish hospitals within a time period of five years in 2011-2016. This change
340 can be seen in the workforce resources and tasks performed by clinical pharmacists in care units (Figure 3,
341 Figure 4). Their contributions were reported to be extended towards interventions prioritized in
342 international and national patient and medication safety recommendations. Also, clinical pharmacists'
343 competences were reported to have evolved through continuing education and specialization programs
344 towards supporting patient and medication safety initiatives (Figure 5).

345

346 These reported developments in pharmacists' performance in Finnish hospitals can be considered as result
347 of various contributing factors. This quite fast extension of their tasks would not have been possible
348 without the support of national patient and medication safety initiatives and guidelines,^{23-24,27,47}
349 pharmacists' involvement in establishing these policies, and making long-term continuing education
350 available for pharmacists with the focus on systems approach to patient and medication safety.^{38,45} The first
351 steps in creating awareness of medication safety risks and actual errors were taken through a patient
352 safety incident reporting system, which was implemented in Finland in 2007 in the first healthcare units, as
353 have been recommended by international and national guidelines.^{4-7,23-24,28,47} Since then, reporting and
354 learning from medication errors and related research have extended to more than 200 Finnish healthcare
355 organizations, revealing medication safety risks and their characteristics, which has laid the foundation for
356 more prospectively managing the risks.^{25,39,48} This work has facilitated the clinical pharmacists' participation
357 in multiprofessional patient safety work, as has been suggested e.g., by the Council of Europe and EDQM.<sup>5-
358 6,8-9</sup>

359
360 The system-based actions to improve medication safety that were reported to be widely performed by
361 clinical pharmacists in Finnish hospitals in 2016 (Figure 3) cover well the crucial stages of the medication-
362 use process (Figure 4). The actions reported to be performed are in line with the European hospital
363 pharmacy statements, particularly with the statements concerning pharmacists ensuring quality assurance
364 strategies for medicine use processes (5.2), reporting of adverse drug reactions and medication errors (5.4)
365 and ensuring that the information needed for safe medicines use, including both preparation and
366 administration, is accessible at the point of care (5.9).⁴²

367
368 During the five years, the most notable reported increase had happened with conducting medication
369 reconciliations, e.g., on admission (+63%), despite not being reported as a future plan in 2011. Medication
370 reconciliation was not explicitly mentioned as a concept in patient safety and medicines policy documents
371 published in Finland in the beginning of the 2000s.²³⁻²⁴ In many other countries and international
372 recommendations medication reconciliation has been prioritized as one of the key strategies to prevent
373 adverse drug events and improve patient safety at all transitions in care.^{7,49} In the United States (US),
374 medication reconciliation was recommended already in 2005 in the Hospitals' National Patient Safety Goals
375 established by the US Joint Commission on Accreditation of Healthcare Organizations which also
376 established guidelines for performing medication reconciliation.⁵⁰ In Europe, medication reconciliation has
377 been prioritized e.g., by the second European Union (EU) patient safety and quality program (PASQ).¹¹
378 Despite recommendations and guidelines, medication reconciliation practices are challenging to perform
379 and EAHP evaluated that it was the most poorly implemented statement (4.4) in Europe in 2015.^{42,51} The
380 reasons for this were that pharmacists usually had no access to patient information systems or direct

381 contact to patients. In our survey in 2016, clinical pharmacists were reported to have access to patient
382 records in almost all (96%) responding units, which is in line with the European hospital pharmacy
383 statements (statement 4.3).⁴² Pharmacists should also ensure accurate recording of all allergy and other
384 relevant medicine-related information in the patient's health record (5.8).⁴² The importance of reconciled
385 medication charts has been identified recently in Finland in the Rational Pharmacotherapy Action Plan
386 2018-2022 to be taken into account in the ongoing social and healthcare reform.^{26,52}

387

388 A positive development was reported in strategic planning and managing clinical pharmacy services in
389 hospitals. However, the content and quality of clinical pharmacy services are not uniform even inside the
390 same organization. More than half of the responding units (52%) reported being familiar with the European
391 Statements of Hospital Pharmacy⁴² in 2016. The Statements could be utilized to standardize the content
392 and availability of clinical pharmacy services. Common future plans that were reported related to changing
393 the focus of clinical pharmacists' role on patient-oriented tasks instead of drug logistics. Automation
394 technology (e.g., automated dispensing systems) which is arriving in Finnish hospitals, was expected to
395 release clinical pharmacists' time from logistic tasks to providing pharmaceutical care services that improve
396 medication safety.⁵³ Furthermore, the Finnish healthcare reform⁵² will enable the reform of current
397 legislation⁵⁴ related to the number of hospital pharmacies with overlapping responsibilities.⁵³ This will also
398 release hospital pharmacy staff for patient care. It is crucial to be prepared with clinical pharmacy skills to
399 be able to provide pharmaceutical care at this point.

400

401 Pharmacists' participation in long-term continuing education, related to pharmaceutical care and system-
402 based medication safety work, was reported to be increased during the five years (Figure 5). The majority
403 (70 %) of the respondents reported that they are able to satisfactorily use their expertise achieved from
404 long-term continuing education and almost half (48 %) of the respondents thought that continuing
405 education had helped them to adopt a more patient-oriented role. The history of long-term continuing
406 education of clinical pharmacy and medication safety is fairly short in Finland: during the first decade of the
407 21st century, the Faculty of Pharmacy in the University of Helsinki started systematic research and
408 education about patient and medication safety issues. Clinical pharmacy oriented hospital pharmacy
409 specialization program has been available since 2010.^{31,55} Post-graduate accreditation training for
410 comprehensive medication review (CRM) started in 2005.^{37,56} Later also a shorter, one-year training for
411 expertise in medication reviews and accreditation training for expertise in ward pharmacy has been
412 available. The post-graduate clinical pharmacy specialization and accreditation training have facilitated the
413 shift of clinical pharmacists' tasks from drug logistics to patient-centered work. Furthermore, the education
414 of basic degrees in pharmacy is under reform to meet the growing need for clinical pharmacy skills. The
415 latter is also addressed in the European hospital pharmacy statement 6.1.⁴²

416

417 The relative proportion of responding organizations which reported having evaluated the benefits or
418 outcomes of clinical pharmacy services had increased from 16 % to 33% during 2011-2016. According to
419 the respondents, the most common evaluated and achieved benefits in 2016 were related to the work of
420 nurses e.g. saved their working time, improved their pharmacotherapy skills and increased their
421 collaboration with pharmacists (Figure 6). Also, savings in drug consumption, increased number of accurate
422 medication charts and increased medication error reporting were common. However, only a few
423 organizations had published their results nationally and international publications were missing. This area
424 needs development, as is also pointed out in the European hospital pharmacy statements (6.4)⁴² and in the
425 national Rational Pharmacotherapy Action Plan.⁵⁷ Furthermore, documenting clinical pharmacy
426 interventions for the patient's health record, according to the European hospital pharmacy statement 4.3⁴²
427 enables more effective outcomes research related to clinical pharmacy services' impact on e.g.
428 readmissions, treatment periods and mortality. Hospital pharmacists should be encouraged and educated
429 for measuring and studying outcomes of clinical pharmacy services to achieve more rigorous evidence.

430

431 **4.1 Strengths and limitations**

432 The results of this national study can be generalized for hospital inpatient care in Finland even though the
433 overall response rates were moderate (60% in 2011 and in 52% in 2016). Despite the moderate response
434 rates, the coverage of the responses in terms of the coverage of the largest inpatient units with hospital
435 pharmacies were 83% in 2011 and 75% in 2016. The survey method was applicable to study national
436 development for strategic management purposes as in other follow-up survey studies in US¹⁹ and Europe²²,
437 even though it has methodical limitations e.g. compared to using actual performance data or observation
438 method. The target group of the survey was knowledgeable for providing data of the recent developments
439 and the status of the clinical pharmacy services. Addressing the survey to all hospital clinical pharmacists
440 would be interesting in the future. Clinical pharmacy services' impact on patient care outcomes should also
441 be followed up with more rigorous methods.

442

443 **4.2 Clinical and practical implications**

444 Evolution of clinical pharmacy services to ensure medication safety and their impact on patient care
445 outcomes should be followed-up regularly also in the future. In 2016, more than half (62%) of the
446 responding organizations thought that pharmacists could be working as medication safety officers in the
447 future. The first post for a medication safety officer (pharmacists) was launched in Finland in 2017 in the
448 Helsinki University Hospital. A national focal point for coordinating medication safety research, practice and
449 competence development should be established^{26,58-59} as has been recommended by the Council of Europe
450 already in 2006⁵⁻⁶, and repeated by other key documents guiding patient and medication safety work.

451

452

453

454

455 5. CONCLUSIONS

456 Pharmacists' involvement in patient care and system-based medication safety work was reported to
457 become more common and planned in Finnish hospitals during 2011-2016. This development is in line with
458 international and national system-based patient safety guidelines and policy initiatives and should be
459 continued. Availability of patient-centered and system-based continuing education and accreditation
460 training has had important impact in this shift towards patient-oriented services.

461

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466

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Table 1. Clinical pharmacy services in hospital pharmacies and medicine dispensaries responding the surveys in 2011 (n=71/118) and 2016 (n=27/52). It should be noted, that the total number of medicine dispensaries has remarkably decreased during 2011-2016 in Finland, while the number of hospital pharmacies has remained the same.

Clinical pharmacy services	2011 (n=71) n (%)	2016 (n=27) n (%)
Responding units not providing clinical pharmacy services	35 (49%)	4 (15%)
Responding units providing clinical pharmacy services	36 (51%)	23 (85%)
- hospital pharmacies	16 (44%)	17 (74%)
- medicine dispensaries	20 (56 %)	6 (26%)
Reported number of full-time* working clinical pharmacists	103	134-215**
Reported number of part-time working clinical pharmacists	54	13-65**
Reported number of hospital units receiving full-time* clinical pharmacy services	108	179-201**
Reported number of hospital units receiving part-time clinical pharmacy services	134	192-236**
Responding units having a manager, whose working time was dedicated to management of clinical pharmacy services	30 (42%)	20 (74%)
Responding units having a plan or strategy for clinical pharmacy services	14 (20%)	17 (63%)

*Full-time = office hours from 8:00 a.m. to 4:00 p.m. during week days.

**Ranges were used in the 2016 survey and actual numbers were asked in the 2011 survey.

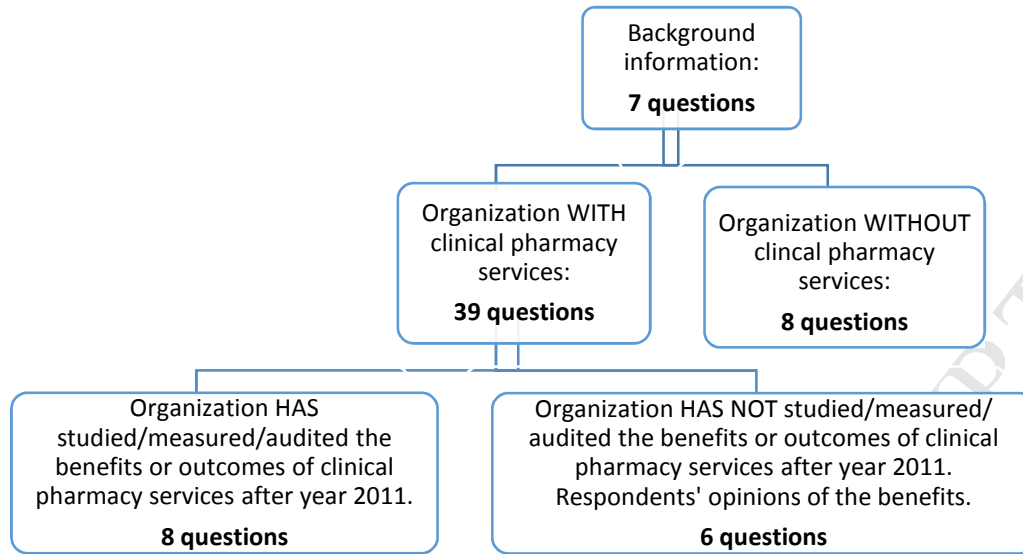


Figure 1. Content of the survey instrument in 2016.

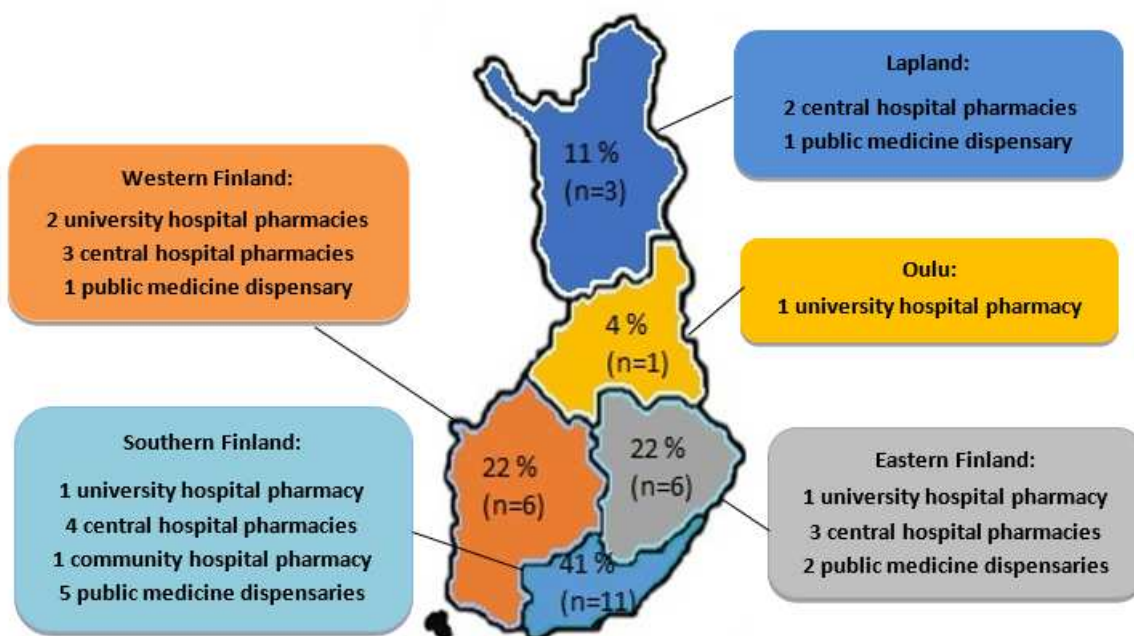


Figure 2. Location of the hospital pharmacies and medicine dispensaries that responded to the survey in 2016 (n=27/52) by county.

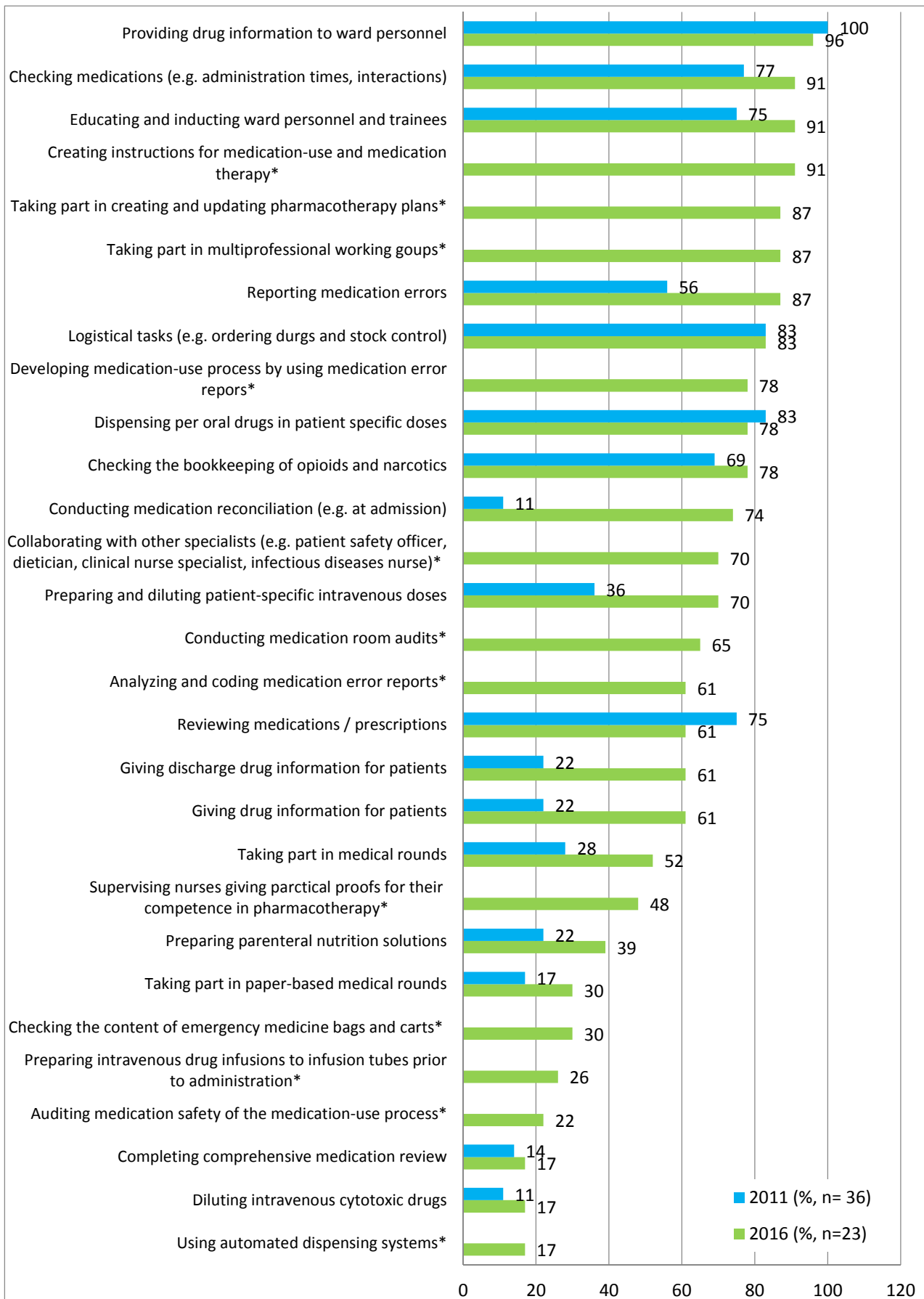


Figure 3. Reported tasks of clinical pharmacists (%) in 2011 and 2016. *New tasks (n=12) added to the year 2016 survey.

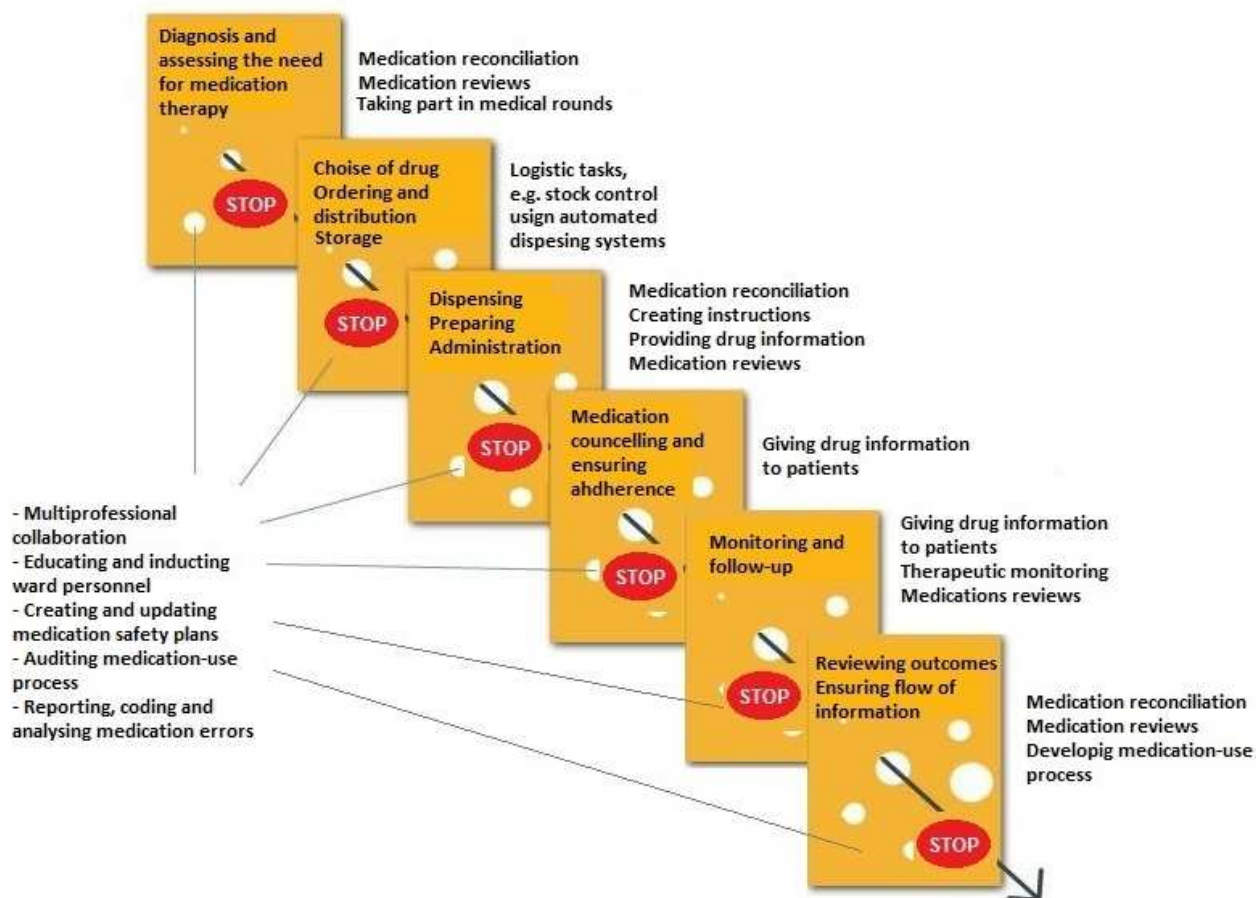


Figure 4. Illustration of the evolution of the tasks of the clinical hospital pharmacists in Finland by 2016 as reported by the responding hospital pharmacies and medicine dispensaries. The figure illustrates the coverage of the clinical pharmacy services of the stages of medication use process by applying Reason's Swiss Cheese Model.⁴⁵

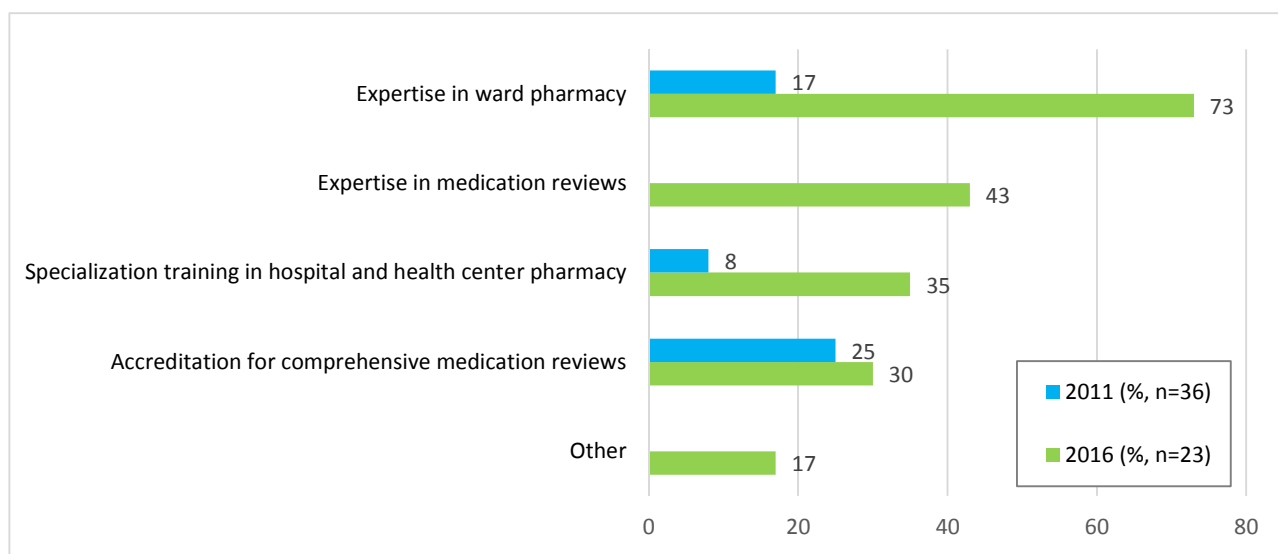


Figure 5. Participation in long-term continuing education and accreditation training of one or more of the clinical pharmacists in the responding units (%). Other (n=4): expertise in patient safety (n=2), master of clinical pharmacy (n=1), hospital's internal continuing education program (n=1). Training for expertise in medication reviews was not yet provided in 2011.

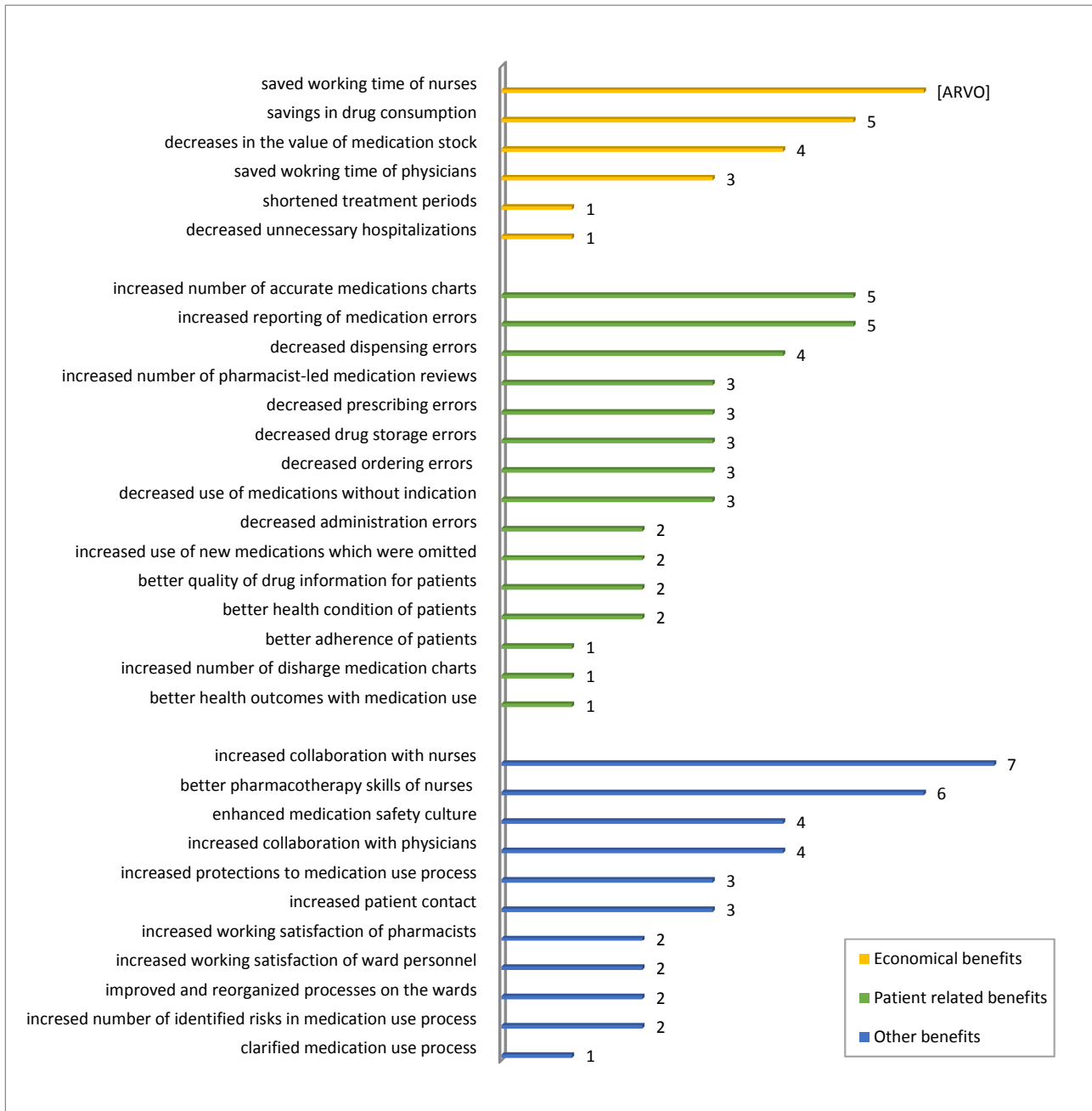


Figure 6. Benefits and outcomes of clinical pharmacy services that were reported to been assessed and achieved in 33% (n=9/27) of the responding units in 2016.