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RESEARCH ARTICLE

Development of a tool for benchmarking of clinical pharmacy activities

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Abstract

Background Initiatives are needed to promote and evaluate clinical pharmacy. In this context, benchmarking could be useful. *Objective* To develop and validate a benchmarking tool for clinical pharmacy activities. *Setting* Six Belgian hospitals. *Method* A narrative literature review and two focus groups were performed to identify (1) clinical pharmacy benchmarking projects, (2) clinical pharmacy activities with a proven positive impact on the quality of care for patients, (3) quality indicators and (4) contextual factors to be included in the tool. Next, a Delphi survey and a test of the tool in practice led to content validation and usability of the benchmarking tool. *Main Outcome Measure* To identify quality indicators and contextual factors to be included in the tool. *Results* Three Delphi rounds were required (rounds 1-2: 9 participants, round 3: 8 participants). Ten quality indicators and 36 relevant contextual factors were selected. These 10 quality indicators represent 6 clinical pharmacy activities that demonstrated to improve patient outcomes: medication reconciliation at admission, patient monitoring, information provided to the health care team, patient education, discharge and transfer medication counselling, and adverse drug reaction monitoring. To collect the information needed to compose the quality indicators and to benchmark, the tool consists of three data collection instruments. An instruction manual accompanies the tool. *Conclusion* We have developed and validated a benchmarking tool, designed to identify and promote clinical pharmacy activities that demonstrated to improve patient outcomes. Future perspectives include the use of the tool on a national scale to identify the most efficient practices and their enablers and barriers.

Keywords Belgium · Benchmarking · Delphi technique · Hospital pharmacy · Pharmacists · Pharmacy service · Quality indicators

Impacts on practice

- The benchmarking tool can be used to carry out three types of audit: (1) Identifying its strengths and weaknesses; (2) Following the evolution of its own performance over time; (3) Benchmarking with other pharmacy services.
- The tool can help to assess and promote the quality of clinical pharmacy practices.
- The tool is applicable to various clinical pharmacy projects thanks to the quality indicators included and the contextual factors which allow to place their results in perspective.

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Introduction

Benchmarking is a marketing technique that compares the practice and performance of various competitors or partners. Benchmarking helps to identify the most efficient practice and to implement it on a larger scale with a view to constantly improve the performance and the quality of the services provided [1, 2].

Implementation of benchmarking in the field of clinical pharmacy allows to (1) compare practices, (2) exchange ideas within and between hospitals, (3) identify strengths and weaknesses of services, (4) foster continuous improvement of practices, and (5) demonstrate the efficiency of clinical pharmacy to hospital administrators [2–6].

Fowler et al. [4] have described the process of benchmarking in clinical pharmacy. One of the first stages in the process is to identify relevant quality indicators (QIs) that can serve to compare the benchmarking partners [7]. Currently there is no international consensus on the use of QIs in clinical pharmacy [5]. Moreover, there is wide variation in clinical pharmacy practice within and between hospitals: what is a priority for one may be of secondary importance for others. Hence it is important to identify bases of comparison and select QIs that can be employed on a large scale. Contextual factors (i.e. years of experience, population targeted by clinical pharmacy program, number of full-time equivalent pharmacists engaged in clinical pharmacy program) may influence the applicability of QIs and are therefore important variables to take into account in benchmarking [4].

Several clinical pharmacy benchmarking projects have been published [4–6, 8–14]. However benchmarking projects vary between countries in line with the variation in priorities, activities, and methods of developing and evaluating clinical pharmacy practices [5, 6, 8, 9, 12]. Our project is set in Belgium. The Belgian federal government funds clinical pharmacy in acute care hospitals since 2006. This funding is proportional to the number of beds. Each hospital is free to choose the population and department that are targeted by clinical pharmacy activities. Therefore, activities vary from one Belgian hospital to another and the number of pharmacists is limited [15].

Aim of the study

The aim of this study was to develop and validate a tool for a standardised comparison of clinical pharmacy practices that could be used in Belgian hospitals. The tool aims to measure QIs and contextual factors relevant to the Belgian context.

Ethics approval

Ethical approval (2015/17MAR/116) was obtained from the Hospital-Faculty Ethics Committee of Saint-Luc-Université Catholique de Louvain on 30 March 2015.

Method

Three hospital pharmacists and an expert in pharmacoeconomics and quality all from Belgium agreed on the different stages of the development of the benchmarking tool (Fig. 1).

Firstly, we focused on clinical pharmacy activities for which the added value of hospital pharmacists to improve patient outcomes has been proven in literature. Secondly, we identified QIs which could allow to quantify these clinical pharmacy activities. Finally, we identified contextual factors related to the work environment of pharmacists, which might have an impact on their performances.

Development of the benchmarking tool

Narrative literature review

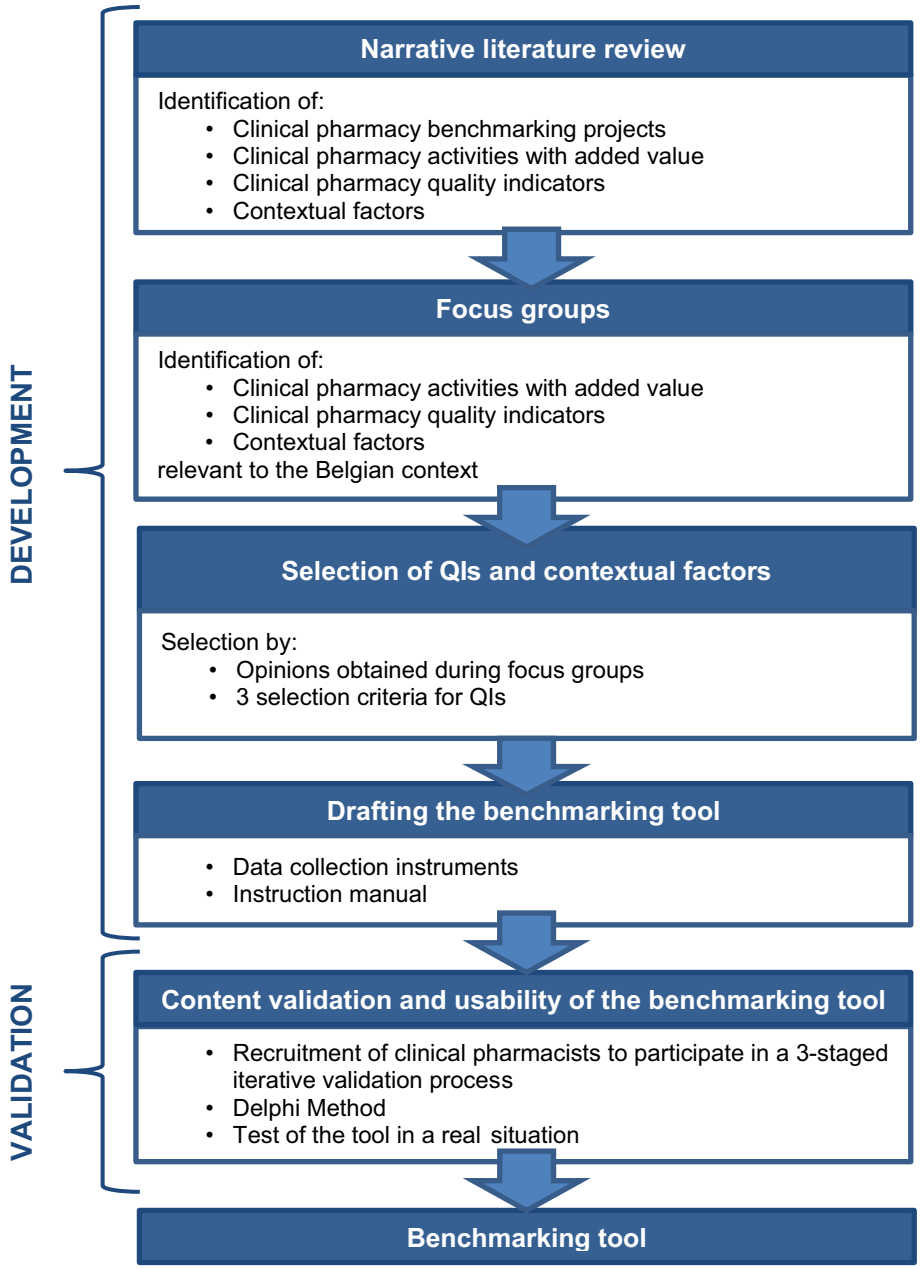
A narrative literature review was performed in PubMed and Google Scholar by M.C. with the aim to identify (1) clinical pharmacy benchmarking projects, (2) clinical pharmacy activities with a proven positive impact on the quality of care for patients, (3) QIs and (4) contextual factors. The following MeSH terms were used: “Pharmaceutical Services”, “Pharmacists”, “Pharmacy Service, Hospital”, “Quality indicator, Health care”, “Guidelines as Topic”, “Benchmarking”, and “Outcome and Process Assessment (Health Care)”.

The findings were used as a basis for focus groups.

Focus groups

The aim of the focus groups was to formulate suggestions on the design and content of the tool i.e.: identification of the principal clinical pharmacy activities that have considerable added value (based on the literature review and additional activities mentioned by the participants), identification of QIs and contextual factors [16–18]. Two focus groups were organised in two teaching hospitals of the Université catholique de Louvain which both have 10 years of experience in clinical pharmacy. All clinical pharmacists of the two hospitals were invited by e-mail to participate on a voluntary basis. The participants signed an information and consent form. The focus group discussions were led by a moderator (M.C. or O.D.) in the presence of an observer. The estimated duration of the focus groups was 90 min. The

Fig. 1 Method



focus group discussions were audio-recorded, anonymised, and a transversal thematic analysis of the recordings was performed by M.C [19]. There was not a second person person involved to check analysis; however, participants of the focus group were next involved in the validation phase, so they could check that the content of the tool reflected their opinion.

Selection of quality indicators and contextual factors

QIs and contextual factors to be included in the benchmarking tool were selected based on criteria derived from the literature review [5, 9, 10, 13–15] and the results from the focus groups.

The selection criteria for QI and contextual factors were the following [5, 6, 8, 12, 14, 20]:

- Focus on a clinical pharmacy activity associated with a evidence-based impact on clinically important outcomes
- Suitable for any kind of clinical pharmacy program
- Readily available and therefore compatible with continuous performance of clinical activities.

Drafting the tool

The benchmarking tool was composed of standardized forms for collecting required data to measure the selected QI and

contextual factors, definitions of the terms employed, and an instruction manual.

Content validation and usability of the benchmarking tool

The content validation of the tool consisted of a 3-stage iterative process (Fig. 2): testing the tool in practice, a Delphi method and improvement of the tool. Performing these 3 stages was called the "validation phase". The process was repeated until consensus was reached. It involved participation of clinical pharmacists in:

1. A test of the benchmarking tool in a real situation, followed by an evaluation through a feedback form. This form included an evaluation of workload, content, clarity and layout of the tool using a five-point Likert scale (see above). Pharmacists could also provide free text suggestions and comments.
2. A Delphi method was used to reach consensus on the clinical pharmacy activities and the QIs to be included in the tool [5, 12]. The pharmacists assigned a score of from 1 to 5 (on the Likert scale: 1. strongly disagree, 2. disagree, 3. partly agree, 4. agree, 5. strongly agree) to each of the activities according to its priority status for clinical pharmacy and its specificity to the legal role of the pharmacist. The QIs were assessed according to their relevance and ease of measurement in terms of availability and time. The a priori definition of Delphi Consensus was a mean score ≥ 3.5. However, during the first validation phase, almost all the activities and QIs had a mean score ≥ 3.5 despite commentaries from participants to modify or to group activities (ex: medication history taking and medication reconciliation) or QIs. The rank order was then used with intention to keep the five highest ranked activities.

The hospitals invited to participate in the validation study were intentionally selected in order to include centres in different French-speaking regions in Belgium. Both teaching and non-teaching hospitals that had at least one clinical pharmacist were eligible for inclusion whether they took part or not in the federal government funded positions. The aim was to include 15 to 20 pharmacists working in different Belgian hospitals. For the first validation phase, 15 pharmacists in two hospitals were contacted by e-mail. For the second validation phase, an e-mail was sent to the heads of clinical pharmacy departments of 7 other hospitals. A reminder was sent after one week.

Following anonymisation, the results and the participants' remarks were analysed and the tool was subsequently improved.

Results

Development of the benchmarking tool

Narrative literature review

Except for analysis of antibiotic consumption [21, 22], there are few data available on benchmarking pharmacy services between hospitals [11]. Two Canadian benchmarking projects have been published: the project led by the "Canadian clinical pharmacy key performance indicator collaborative" [5] and the "2013/2014 Canadian Hospital

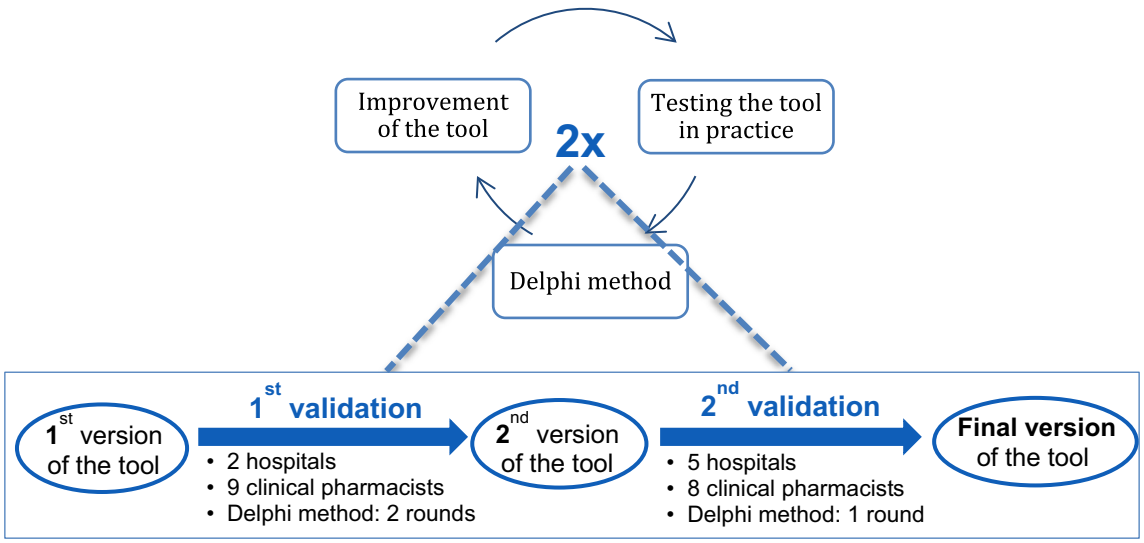


Fig. 2 Validation of the tool in two phases

Pharmacy Report", a report on 170 hospitals representing 71,686 hospital beds in Canada [10]. Self-evaluation of practices is more developed than inter-hospital comparison. For example, self-assessment tool is used in the United States to promote excellence in pharmacy practice and to assess the overall level of hospital pharmacy service development within institutions [29].

Data support that clinical pharmacists improve the quality, safety and efficiency of care in the inpatient setting. We found 53 specific activities performed by pharmacists for which studies demonstrated a significant positive impact on patient outcomes, such as medication reconciliation and patient discharge counselling [5, 23–26].

We retrieved 103 QIs for clinical pharmacy in the literature, however no international consensus has been established. Ng et al. have identified usable QIs for benchmarking in New Zealand [12]. A few similar projects have been performed in Canada [5, 8]. In the United States, a group of researchers developed and tested specific Intensive Care Unit QIs and created collection tools [13, 14].

Based on the literature review three lists were drafted which served as a basis for the discussion during the FGs: a list of 53 clinical pharmacy activities, a list of 103 QI and a list of 58 contextual factors.

Focus groups

One hundred and three QIs were found in the literature and were discussed in the focus groups. The focus groups took place on 18 and 23 March 2015 in two teaching hospitals; each focus group included 4 pharmacists. The discussions lasted 103 and 102 minutes respectively.

The discussions highlighted the difficulty of comparing the performance of different clinical pharmacists, the importance of the working context, and the time-consuming nature of QI calculation. The participants stressed the need to estimate the amount of time spent at meetings, training, and supervising students, as these activities encroach on patient-centered activities. They wanted to quantify a number of clinical pharmacy activities, but pointed out that the importance of each activity varies according to the pharmacist's working context: what is a priority activity for one may be of secondary importance for others.

The tool was drafted based on these comments.

Selection of quality indicators and contextual factors

Initially, 10 clinical pharmacy activities whose added value has been clearly demonstrated in the literature, were selected: medication history, medication reconciliation at admission, multidisciplinary meetings, patient monitoring during hospitalisation, patient education, discharge letters, providing information to the health care team, safety, economic factors, and more general activities (i.e. clinical pharmacy activities not focused on individual patients, but involving the general promotion of good medication practice, such as developing a procedure for frontline healthcare professionals). Fifteen QIs that met the selection criteria and were related to these 10 activities were selected when drafting the first version of the tool (Table 2). Only process indicators were selected, because outcome indicators (e.g. readmission) are influenced by multiple factors and are not specific to the quality of clinical pharmacy interventions [27, 28], while contextual factors are seen as structural indicators (Electronic Supplementary Material).

Thirty-two contextual factors were included in the first version of the tool, concerning mainly pharmacist's activities, their training and experience, the context of the hospital, the infrastructure available (e.g. computerized physician order entry), as well as the strategy of pharmacy department.

Drafting the tool

The developed tool records the data needed to calculate QIs and to benchmark the different clinical pharmacy departments.

Content validation of the benchmarking tool

Two validation phases were needed before a consensus was reached (Fig. 2). The characteristics of the clinical pharmacists who took part in the validation process are presented in Table 1.

Nine pharmacists took part in the first validation phase, which took place from 7 to 10 April 2015 in two teaching hospitals (Table 1). The pharmacists took part in two Delphi rounds and tested the first version of the tool in a real situation. This version of the tool included 10 clinical pharmacy activities and 15 QIs (Table 2).

Eight clinical pharmacists from 5 hospitals took part in the second validation phase from 20 to 24 April 2015 (Table 1). None of the pharmacist had taken part in the first one. They evaluated the 5 clinical pharmacy activities and 8 QIs during a new Delphi round (Table 2), tested the second version of the tool in practice and, encoded their activities for one week as a test run. Comments from participants are presented in Table 3.

Description of the benchmarking tool

Ten QIs representing 6 clinical pharmacy activities were included in the validated benchmarking tool (Table 4). These indicators correspond to the 3 selection criteria and were selected according to consensus reached as a result of the Delphi survey. Although it is considered essential for the development of clinical pharmacy, no consensus was

Table 1 Characteristics of the clinical pharmacists who took part in the validation process

Number of hospitals participating	6	
Type of hospital	Teaching (4) – General (2)	
Region	Brussels (1) – Liège (1) – Hainaut (3) – Namur (1)	
Number of hospitalisation beds in the participating hospitals	Average: 790 (minimum: 330 – maximum: 1124)	
Number of pharmacists participating	17*	
Experience as clinical pharmacist	< 5 years of experience in clinical pharmacy (10)	
	> 5 years of experience in clinical pharmacy (7)	
Clinical pharmacy programs covered	Geriatrics (5)	Surgery (3)
	ICU (4)	Cystic fibrosis (1)
	Non patient-centered activities (2)	Anticoagulation (1)
	Antibiotic therapy management group (2)	Nutrition (1)

*Some pharmacists have more than one clinical pharmacy activity

reached on a QI related to economic factors for three reasons: first, there was no QI made of readily available data; secondly, economic data are complex including direct and indirect costs and measuring the impact of a single pharmacist is challenging; thirdly focus group members priorised measuring quality and safety QIs.

To collect the information needed to compose the QIs and to benchmark, the tool consists of four documents (Electronic Supplementary Material):

1. An instruction manual
2. An encoding form
3. A context form
4. A form for non patient-centered activities.

The three forms collect the data needed to compose the QIs, to describe the working context, and to perform the benchmarking process. The clinical pharmacy activities monitored for the benchmarking tool were divided into two categories: patient-centered activities (e.g. monitoring patients hospitalised in intensive care, monitoring patients on anticoagulants, or monitoring patients suffering from cystic fibrosis) and non patient-centered activities (e.g. developing procedures).

Instruction manual

The instruction manual explains the purpose of the tool, how to complete and use the different forms, and how to compose the QIs using the data collected.

"Encoding" form

The "Encoding" form is used to collect the information needed to obtain the 10 QIs. It contains the definitions of the terms used in the QIs. This form serves to analyse patient-centered clinical pharmacy activities. One form needs to be completed for each clinical pharmacy project. If several pharmacists are working on the same project or program, only one form has to be completed. During the encoding period, the pharmacists must monitor three administrative procedures (admissions, transfers, and discharges) and quantify 10 clinical pharmacy activities. The information collected allows calculating the QIs once the encoding phase is complete.

"Context" form

The "Context" form relates to patient-centered clinical pharmacy activities. It allows a description of each pharmacist's working context to be obtained. It must be completed once for each clinical pharmacy project. The 38 contextual factors included in this form will help place the results of the QIs in perspective.

"Non patient-centered activities" form

This form relates to clinical pharmacy activities that do not involve a single patient. It only needs to be completed once for each hospital because it allows to collect information on general projects for the promotion of good medication practice developed in each hospital.

Discussion

We have developed and validated a benchmarking tool for clinical pharmacy activities in French-speaking Belgian hospitals. Ten QIs on which consensus was reached were included in the tool, as well as 38 contextual factors. These 10 QIs represent 6 clinical pharmacy activities that demonstrated to improve patient outcomes: medication reconciliation on admission, patient monitoring during hospitalisation, information provided to the health care team, patient

Table 2 Clinical pharmacy activities and quality indicators evaluated during the validation phases

1st validation phase	2nd validation phase
Monitoring *(priority: 4,88 – specificity: 4,38)*	**Monitoring** *(priority: 4,71 – specificity: 4,43)*
Number of patients with a pharmaceutical record / Total number of patients admitted *(relevance:4,63 - ease of measurement:4,63)*	Number of patients with a pharmaceutical record / (Number of patients present at the beginning of recording period + number of new patients admitted) *(relevance:3,60 - ease of measurement:3,50)*
Number of interventions accepted and put into practice / Total number of interventions within the health care team *(relevance:4,63 - ease of measurement:3,75)*	/
Total number of interventions within the health care team / Total number of patients admitted *(relevance:4,13 - ease of measurement:3,75)*	Number of interventions accepted and put into practice / Number of patients with a pharmaceutical record *(relevance:3,00 - ease of measurement:3,57)*
Number of interventions accepted that resolve a problem of unsuitable administration of medication / Total number of patients admitted *(relevance:4,00 - ease of measurement:3,00)*	/
Safety *(priority: 4,75 – specificity: 4,35)*	**Safety** *(priority: 4,17 – specificity: 3,50)*
Number of interventions accepted to prevent, detect, assess, manage, report, and/or document an adverse drug reaction / Total number of patients admitted *(relevance:4,33 - ease of measurement:3,13)*	Number of interventions accepted and activities performed to prevent, detect, assess, manage, report, and/or document an adverse drug reaction / Number of patients with a pharmaceutical record *(relevance:3,25 - ease of measurement:3,33)*
Patient education *(priority: 4,25 – specificity: 4,50)*	**Patient education** *(priority: 3,43 – specificity: 3,29)*
Number of patients who have received therapeutic education (apart from discharges) / Total number of patients admitted *(relevance:4,38 - ease of measurement:4,38)*	Number of patients who have received therapeutic education (apart from discharges and transfers) / (Number of patients present at the beginning of recording period + number of new patients admitted) *(relevance:3,57 - ease of measurement:3,83)*
Discharge letters *(priority: 4,75 – specificity: 4,00)*	**Discharge and transfer medication counselling** *(priority: 3,71 – specificity: 3,57)*
Number of patients who have received written information about their medication on discharge from the hospital / Total number of patients admitted *(relevance:4,63 - ease of measurement:4,57)*	Number of patients who have received written information about their medication on discharge or transfer from the service / Number of patients discharged or transferred from the service *(relevance:3,86 - ease of measurement:4,50)*
Number of GPs who have received written information about their patient's medication on discharge from the hospital / Total number of patients admitted *(relevance:4,13 - ease of measurement:4,43)*	Number of GPs, specialists, and/or community pharmacists who have received written information about their patient's medication on discharge from the service / Number of patients discharged or transferred from the service *(relevance:3,57 - ease of measurement:4,14)*
Number of patients who have received oral information about their medication before discharge / Total number of patients admitted *(relevance:4,25 - ease of measurement:3,75)*	Number of patients who have received oral information about their medication before discharge or transfer from the service / Number of patients discharged or transferred from the service *(relevance:3,43 - ease of measurement:4,00)*
Medication reconciliation at admission *(priority: 4,25 – specificity: 3,75)*	**Medication reconciliation at admission** *(priority: 3,57 – specificity: 3,29)*
Number of interventions related to medication reconciliation on admission / Total number of interventions within the health care team *(relevance:3,88 - ease of measurement:3,75)*	New patients admitted for whom the pharmacist checked that all the stages of medication reconciliation have been adequately performed within 24 hours of admission / Number of new patients admitted *(relevance:4,29 - ease of measurement:4,14)*

Table 2 (continued)

Economic factors *(priority: 4,00 – specificity: 4,00)*	/
Number of interventions accepted involving the cessation of medication + dose reductions + formulary switches + intravenous to oral switches + switches to a less expensive but equally effective molecule + cessations of parenteral nutrition / Total number of interventions *(relevance:4,00 - ease of measurement:3,25)*	/
Information provided to the health care team *(priority: 4,13 – specificity: 3,75)*	/
Number of responses to questions from the health care team/ Number of weeks *(relevance:4,13 - ease of measurement:3,75)*	/
Multidisciplinary meetings *(priority: 4,00 – specificity: 3,43)*	/
Number of times participated in multidisciplinary meetings or medical and nursing rounds / Number of weeks *(relevance:3,50 - ease of measurement:4,13)*	/
More general activities *(priority: 3,88 – specificity: 3,25)*	/
Number of working hours devoted to activities that focus on individual patients / Number of working hours devoted to more general activities *(relevance:3,29 - ease of measurement:3,14)*	/
Medication history *(priority: 4,88 – specificity: 4,38)*	/
Number of patients who have a complete medication history within 24 hours of admission / Total number of patients admitted *(relevance:4,00 - ease of measurement:4,25)*	/

The clinical pharmacy activities are detailed in the shaded lines. QIs which are likely to measure one of these activities are listed under the activity line. Results of Delphi method are specified in brackets. They represent the mean of Likert scale scores (1. Strongly disagree, 2. Disagree, 3. Partly agree, 4. Agree, 5. Strongly agree) assigned by pharmacists to each clinical activities according to its priority status for clinical pharmacy and its specificity to the legal role of the pharmacist. The QIs were assessed according to their relevance and ease of measurement in terms of availability and time

education, discharge and transfer medication counselling, and adverse drug reaction monitoring. Only process indicators were selected, since outcome indicators depend on a variety of factors and are not specific to the quality of clinical pharmacy practice [27, 28]. Contextual factors on the other hand, provide information on what could be regarded as structural indicators. The tool measures the quality, not just the quantity, of patient-centered clinical pharmacy activities and more general activities for the promotion of good medication practice.

To our knowledge, three other published studies conducted in Canada and New Zealand focused on QI development in clinical pharmacy [5, 8, 12]. Yet these studies have not developed a benchmarking tool. Some clinical pharmacy activities and QIs selected in these studies are similar to the ones included our study. For example, medication reconciliation at admission, therapeutic education, discharge counselling and patient monitoring during hospitalisation were selected in at least one of these projects. However our QIs "information provided to the health care team" and "adverse drug reaction management" have not been included in other studies, although the latter was part of the core set of Bond's studies [23, 24]. The QI "information provided to the health care team" is interesting for settings where the number of clinical pharmacists is limited. Since pharmacists can not review all admitted patients, doctors are used to contact them directly for specific questions.

In Canada, Beauchesne and al. selected QIs related to core clinical pharmacy activity as well as QIs specific to diseases or drugs [8]. Ng and al did the same for warfarin and aminoglycosides [12]. In line with Fernandes and al [5], we did not select disease or drug-specific QIs because our main purpose was to select QIs to allow benchmarking; hence the QIs had to be usable for any kind of clinical pharmacy

Table 3 Validation phases: comments of the pharmacists and modifications of the tool

	Comments of the pharmacists	Modifications of the tool
1st validation phase	Quantify the time allocated to everyday time-consuming activities (e.g. meetings and the supervision of interns)	Time-consuming activities were included in the contextual factors. These are no activities with major added value for the quality of care, but taking them into account makes it possible to place the QIs in perspective
	The 24-hour deadline post-admission for the drawing up of a medication history is too short	This QI was modified (Table 2)
	Need to clarify some terms and definitions.	The definitions were revised
	QI related to more general activities is inadequate and unclear	An additional form to deal with clinical pharmacy activities that are not focused on an individual patient was drafted [29, 30]. It obtains information on general projects, developed in hospitals that promote the correct use of medication (i.e., tools for the care team and the patients)
	Fear of being evaluated and compared	The clinical pharmacy projects or programs were compared instead of comparing pharmacists (e.g. if two pharmacists work together in acute geriatric, they will complete the benchmarking tool just once, in order to analyse their joint project or program in geriatric care)
2nd validation phase	Suggestion of additional clinical pharmacy activities or QIs: information provided to the health care team in response to questions, the time spent on drawing up procedures and reading articles, the type and the total number of interventions, the percentage of interventions accepted	One activity added: Information provided to the health care team in response to questions
	Need for better definition of certain terms used in the QIs (e.g. the pharmaceutical record)	The definitions were revised
	The 24-hour post-admission deadline for verification of medication reconciliation is too short	The post-admission deadline was extended to 24 working hours, given that in Belgium pharmaceutical care is not provided at weekends and on public holidays
	A computerised tool would be more practical for the encoding and calculation of the QIs	No modification was made because it was not possible during the study, however computerization of the tool is a future perspective

Table 4 Clinical pharmacy activities and quality indicators included in the benchmarking tool

Clinical pharmacy activities	Quality indicators
Medication reconciliation at admission	New patients admitted for whom the pharmacist checked that all stages of medication reconciliation were adequately performed within 24 working hours of admission/Number of new patients admitted
Monitoring	Number of interventions accepted and partially or completely applied by the health care team/Total number of interventions within the health care team
	Number of interventions accepted and partially or completely applied by the health care team/Number of patients with a pharmaceutical record
	Number of patients with a pharmaceutical record/(Number of patients present at the beginning of recording period + Number of new patients admitted)
Information provided to the health care team	Number of answers to questions from the health care team/Number of weeks
Patient education	Number of patients who received therapeutic education (apart from discharges and transfers)/(Number of patients present at the beginning of recording period + Number of new patients admitted)
Discharge and transfer medication counselling	Number of patients who have received oral information about their medication before their discharge or transfer from the service/Number of patients discharged or transferred from the service
	Number of patients who received written information about their medication on discharge or transfer from the service/Number of patients discharged or transferred from the service
	Number of GPs, specialists, and/or community pharmacists who received written information about their patient's medication on discharge from the service/Number of patients discharged or transferred from the service
Adverse drug reaction monitoring	Number of interventions accepted and activities performed to prevent, detect, assess, manage, report, and/or document adverse drug reactions/Number of patients with a pharmaceutical record

program. We therefore only focused on pharmacist QIs which are specific to care processes. Our study differs from previously published studies on QI development in clinical pharmacy [5, 8, 12]; the latter included more than one QI about medication reconciliation, while we focused only on the admission medication reconciliation. The underlying reason is that we aimed to target a variety of clinical pharmacy activities, but we kept only a limited selection of QIs in order not to be too time-consuming. Moreover, in our admission medication reconciliation QIs, we extended the deadline for carrying out medication reconciliation to within "24 working hours of admission" since clinical pharmacy services are currently not operational during weekends in Belgium.

Our project combines the selection of QIs for clinical pharmacy with the development and validation of a practical data collection tool. This tool was designed and validated by and for clinical pharmacists. No benchmarking tools were created in three previously published studies on QI [5, 8, 12], which were limited to selection of QIs. Fernandes et al. and Ng et al. used a Delphi method to reach consensus after identification of QIs in the literature [5, 12]. The Delphi panel in the study of Ng et al. included 3 pharmacists; whereas Fernandes et al. utilized an expert panel of 26 hospital pharmacists representing frontline hospital pharmacists, hospital pharmacy leaders, and academia. The aim of the New Zealand project was stakeholder feedback on the relevance and measurability of 52 QIs, whereas the study by Fernandes et al. aimed to develop national QIs to advance clinical pharmacy practice and improve patient care. In Beauchesne's project, only eight pharmacists participated in selecting QIs but, in line with our project, they succeeded in producing a practical evaluation of QIs and obtaining the first results that described practice [8]. Taking into account contextual factors is unique to our project. Yet taking into account the working context is essential for interpreting the results of the QIs as accurately as possible. Besides patient-centered activities, the originality of our project is lies in the fact that we also highlight general projects for the promotion of good medication practice developed in each hospital.

The information provided in the literature used for the development of our benchmarking tool provides an external validation. The use of the Delphi consensus method among a representative group of 15 clinical pharmacists is a strength of our study. Moreover, the final tool has been tested in practice. However, there are some limitations to our project. It has been validated by a small group of French-speaking Belgian pharmacists. A wider validation by other pharmacists in our country or abroad and by other healthcare professionals, for example quality managers and doctors, would have provided additional insights and help to translate evidence into practice. The involvement of the latter could even help to promote clinical pharmacy activities to non pharmacist key stakeholders. Focus groups were used to have an insight and thorough qualitative method was not used. The a priori

definition of the Delphi consensus was not respected and needed to be adapted. There is a wide variation in clinical pharmacy practice within and between hospitals which influence the choice of the items as well as the priority given to them. Therefore we needed to change the a priory cut-off of 3.5 into a ranking order. Even if some low ranked items could be interesting in some situations, choices needed to be made for practical reasons.

The first stages of the benchmarking process described by Fowler et al. i.e. the analysis of processes by identifying the principal clinical pharmacy activities with considerable added value, and the selection of QIs, have been performed [4]. The benchmarking tool has been publicized and is available for use in all French-speaking Belgian hospitals. Our team has been using the tool 4 weeks per year for the last 2 years. Feedback shows that it is easy to use, and takes approximately 15 min per day per pharmacist to do the recording. The tool has been promoted at the general meeting of the Association Francophone des Pharmaciens Hospitaliers de Belgique, and was discussed during a national day for the promotion of clinical pharmacy in Belgium. Moreover, our QIs were included in the official clinical pharmacy report to be submitted to the Belgian government to illustrate clinical pharmacy activities developed in 2018. Our benchmarking tool has been translated into Dutch and English. The next step is to perform data collection for benchmarking. However, prospects for improvement of the tool still have to be explored. For example, how to utilise contextual factors to put the results into perspective remains to be worked out; some could for instance be linked to the QIs. A computerised version of the tool should be developed to facilitate its use and data sharing. The "Encoding form" can easily be converted in a spreadsheet for use in everyday practice. The content and form of the tool will have to be re-evaluated at certain time intervals. Finally, the implementation and feasibility of our tool on a large scale and its impact on clinical pharmacy practice and patient outcomes will have to be determined.

Conclusion

A benchmarking tool was developed and validated. This tool includes a selection of QIs for clinical pharmacy activities that are applicable to various clinical pharmacy projects, and a selection of contextual factors which allows to place the QIs results in perspective. The validated benchmarking tool allows a comparative analysis of clinical pharmacy activities in hospitals. The tool can be used to perform three types of audits: (1) Identifying strengths and weaknesses of a clinical pharmacy program and determining points of improvement; (2) Analysing the evolution of clinical pharmacy performance over time; (3) Evaluating the level of performance in comparison with other partner hospitals (benchmarking).

The benchmarking tool can serve to create an overview of current clinical pharmacy practices and to identify the most efficient practices, as well as their enablers and barriers.

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References

1. Ettorchi-Tardy A, Levif M, Michel P. Benchmarking: a method for continuous quality improvement in health. Healthc Policy. 2012;7(4):e101–19.
2. Murphy JE. Using benchmarking data to evaluate and support pharmacy programs in health systems. Am J Health Syst Pharm. 2000;57(Suppl 2):S28–31.
3. DiPiro JT. Benchmarking for quality improvement. Am J Pharm Educ. 2010;74(8):158.
4. Fowler ACD. Benchmarking and performance management in clinical pharmacy. Int J Oper Prod Manag. 2001;49:656–69.
5. Fernandes O, Gorman SK, Slavik RS, Semchuk WM, Shalansky S, Bussieres JF, et al. Development of clinical pharmacy key performance indicators for hospital pharmacists using a modified Delphi approach. Ann Pharmacother. 2015;49(6):656–69.
6. Australian Commision on Safety and Quality in Health Care and New South Wales. National Quality Use of Medicines Indicators for Australian Hospitals. 2014. https://www.safetyandquality.gov.au/wp-content/uploads/2014/11/SAQ127_National_QUM_Indicators_V14-FINAL-D14-39602.pdf. Accessed 22 June 2018.
7. Mosel D, Gift B. Collaborative benchmarking in health care. Jt Comm J Qual Improv. 1994;20(5):239–49.
8. Beauchesne M-F. Elaboration et évaluation d'indicateus de la qualité ds soins pharmaceutiques en médecine interne au CHUS. Pharmactuel. 2013;46:184–91.
9. Nigam R, Mackinnon NJ, David U, Hartnell NR, Levy AR, Gurnham ME, et al. Development of canadian safety indicators for medication use. Healthc Q. 2008;11(3 Spec No.):47–53.
10. Hospital Pharmacy in Canada Editorial Board Hospital Pharmacy in Canada 2013/2014. 2015. http://www.lillyhospitalsurvey.ca/hpc2/content/2015_report/FULL-2015.pdf. Accessed 22 June 2018.
11. Ryan M. Benchmarking and hospital pharmacy. Private Hospital. 2014; Spring.
12. Ng JHJ. Key performance indicators for clinical pharmacy services in New Zealand public hospitals: stakeholder perspectives. J Pharm Health Serv Res. 2010;1:75–84.
13. Berenholtz SM, Dorman T, Ngo K, Pronovost PJ. Qualitative review of intensive care unit quality indicators. J Crit Care. 2002;17(1):1–12.
14. Pronovost PJ, Berenholtz SM, Ngo K, McDowell M, Holzmueller C, Haraden C, et al. Developing and pilot testing quality indicators in the intensive care unit. J Crit Care. 2003;18(3):145–55.
15. Service public fédéral santé publique, sécurité de la chaine alimentaire et environnement. Direction générale Soins de Santé, Federal

Platform of Pharmaceutical Care. Optimisation de la pharmacie Clinique dans les hôpitaux belges. Ancrage des conditions de base pour une pratique strcutrée de la pharmacie clinique. Rapport d'activités pharmacie clinique 2015. 2017. https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/rapport_pharmacie_clinique_2015.pdf. Accessed 22 June 2018.
16. Kitzinger J. Qualitative research. Introducing focus groups. BMJ. 1995;311(7000):299–302.
17. Moreau A. Méthode de recherche: s'approprier la méthode du focus group. La revue du praticien - Médecine générale. 2004;18(645):382–4.
18. West D. Survey research methods in pharmacy practive. Pharmacotherapy Self-Assessment Program. 2007;6e ed.:67–82.
19. Onwuegbuzie AJ, Dickinson WB, Leech NL, Zoran AG. A qualitative framework for collecting and analysing data in focus group research. Int J Qual Methods. 2009;8(2):1–21.
20. Bruchet N, Loewen P, de Lemos J. Improving the quality of clinical pharmacy services: a process to identify and capture high-value "quality actions". Can J Hosp Pharm. 2011;64(1):42–7.
21. Huntington N. Benchmarking in health-system pharmacy: experience at Glens Falls Hospital. Am J Health Syst Pharm. 2000;57(Suppl 2):S21–4.
22. Schentag JJ, Paladino JA, Birmingham MC, Zimmer G, Carr JR, Hanson SC. Use of benchmarking techniques to justify the evolution of antibiotic management programs in healthcare systems. J Pharm Technol. 1995;11(5):203–10.
23. Bond CA, Raehl CL. Clinical pharmacy services, pharmacy staffing, and hospital mortality rates. Pharmacotherapy. 2007;27(4):481–93.
24. Bond CA, Raehl CL, Patry R. Evidence-based core clinical pharmacy services in United States hospitals in 2020: services and staffing. Pharmacotherapy. 2004;24(4):427–40.
25. Kaboli PJ, Hoth AB, McClimon BJ, Schnipper JL. Clinical pharmacists and inpatient medical care: a systematic review. Arch Intern Med. 2006;166(9):955–64.
26. Mysak TM, Rodrigue C, Xu J. Care providers' satisfaction with restructured clinical pharmacy services in a tertiary care teaching hospital. Can J Hosp Pharm. 2010;63(2):105–12.
27. Brown C, Hofer T, Johal A, Thomson R, Nicholl J, Franklin BD, et al. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. Qual Saf Health Care. 2008;17(3):170–7.
28. Kirwin J, Canales AE, Bentley ML, Bungay K, Chan T, Dobson E, et al. Process indicators of quality clinical pharmacy services during transitions of care. Pharmacotherapy. 2012;32:338–47.
29. American Society of Health-System Pharmacists. Pharmacy Pratice Model Initiative Hospital Self-Assessment Worksheet. http://hsaassessment.org/docs/assessment_questions.pdf. Accessed 22 June 2018.
30. Société Française de Pharmacie Clinique. Programme MED'SETH. Pilotage des actions d'amélioration. Qualité et sécurité de la thérapeutique médicameuteuse dans le parcours de soins du patient. 2013. http://sfpc.eu/fr/item1/summary/34-documents-sfpc-public/985-sfpc-suivi-mesures-ameliorations-pecm-programme-med-seth-v1.html. Accessed 22 June 2018.