



OPEN ACCESS

# Development and Delphi validation of a Best Possible Medication History form

Camille Hoornaert ,<sup>1</sup> Stéphanie Pochet,<sup>2</sup> Sophie Lorent<sup>3</sup>

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/ejhpharm-2021-003095>).

<sup>1</sup>Camille Hoornaert, Pharmacy Department, Hôpital Erasme, Bruxelles, Belgium

<sup>2</sup>Unité de recherche en Pharmacologie,

Pharmacothérapie et suivi pharmaceutique (PPSP), ULB, Bruxelles, Bruxelles, Belgium

<sup>3</sup>Pharmacy Department, Hôpital Erasme, Bruxelles, Belgium

## Correspondence to

Dr Camille Hoornaert, Pharmacy Department, Hôpital Erasme, 1070 Bruxelles, Belgium; [camille.hoornaert@erasme.ulb.ac.be](mailto:camille.hoornaert@erasme.ulb.ac.be)

Received 7 October 2021

Accepted 14 March 2022

Published Online First

12 April 2022

EAFP Statement 4: Clinical Pharmacy Services.

## ABSTRACT

**Objective** To develop and validate a standardized Best Possible Medication History (BPMH) form that could be used by clinical pharmacists.

**Methods** The draft version was presented to a focus group and was adapted following their comments. A three-rounds e-Delphi method was used to validate content, usability and face validity of the BPMH form. We supplemented the quantitative analysis with a qualitative analysis of comments for each Delphi round.

**Results** The draft BPMH form contained 23 items grouped into eight tabs. Refinement of these tabs and items by the focus group resulted in 7 tabs and 21 items, which were included in the Delphi survey. The consensus was obtained for all tabs within the second round ( $p=0.072$ ). Consensus was reached on 76% (16/21) of items in the third round. 20 items were included following the qualitative analysis of the experts' comments in the third round.

**Conclusions** The findings of this study provide data on the content of the BPMH form. This form can be used to help clinical pharmacists to collect a complete and accurate medication list on admission. It could have an impact on inpatient safety and improve inpatient management. Studies with an international e-Delphi should be conducted for wider use

hospital in patients 65 years of age and older had at least one medication error.<sup>6</sup> Involvement of a clinical pharmacist in performing the BPMH on admission has significant potential for reducing medication discrepancies and improving quality of patients' healthcare. Clinical pharmacists are well equipped to record the BPMH as they are familiar with prescription and non-prescription medications actually taken by the patient, including drug name, dosage, frequency and administration route.<sup>3</sup> A Belgian study including 215 patients highlighted that clinical pharmacists identified 1564 drugs while physicians only identified 1303 drugs.<sup>8</sup> Creating a BPMH form should involve the use of a systematic process and verifying medication information with more than one source. The systematic achievement of a BPMH has reduced the proportion of patients with one or more discrepancies in their admission treatment from 62% to 32%.<sup>8,9</sup> A BPMH is difficult to obtain for multiple reasons: poor patient understanding of the home medication regimen, inadequate or fragmented health information systems, and the time-consuming nature of the process.<sup>10</sup>

According to WHO, a BPMH should be documented in a purpose designed form to improve accuracy and efficiency of the required information, and a standardised form must be developed by the organisation conducting the BPMH.<sup>4</sup> There is scarce literature about the development of BPMH standardised forms.<sup>11</sup> Hospitals should thus collaborate to develop an accurate and standardized BPMH form. The aim of this study is to develop and validate a standardized BPMH form that could be used in hospitals. This BPMH form could be a reference on the one hand to create admission medication orders and to realise the medication reconciliation at admission, and on the other hand at the end of each episode of care to create the Best Possible Medication Discharge Plan. Improving medication safety is fundamental for patient safety and is a priority target for healthcare systems.

## BACKGROUND

Medication errors are a major cause of morbidity, with clinical and economic consequences for society and patients.<sup>1</sup> An inaccurate medication history may be the cause of up to 85% of medication errors on admission.<sup>2</sup> Moreover, these errors are usually not detected later in normal clinical practice.<sup>1-3</sup> This may be in part due to poor communication between primary and hospital healthcare professionals and the lack of a complete, updated and accessible medication history. The Best Possible Medication History (BPMH) is defined by WHO as

'a medication history obtained by a clinician which includes a thorough history of all regular medication use (prescribed and non-prescribed, included medication names, dose, frequency, route of administration and patient adherence), using a number of different sources of information'.<sup>4</sup>

The BPMH represents an accurate and complete list of all medications taken before admission, which may differ from what is contained in their clinical records.<sup>4,5</sup> Numerous studies have been conducted on discrepancies between the patient's current medications and the medications recorded in the patient's clinical record.<sup>3,6,7</sup> A study conducted by emergency physicians revealed that 87% of medication histories on admission to the

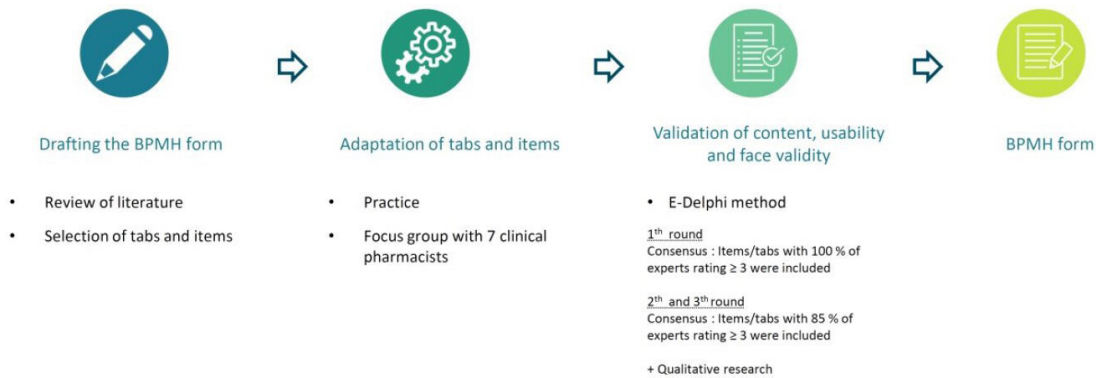
## METHODS

The BPMH form was developed and refined by the research group comprising two clinical pharmacists with 5 years of expertise in BPMH. The role of this research group was to supervise the project and to create tabs and items for the draft version of the BPMH form (figure 1). The starting point for items and tabs development was based on practice and literature review.<sup>2,4,9</sup> The draft version was presented to a focus group with seven clinical pharmacists and was adapted following their comments. Classic focus group methodology was followed. The e-Delphi method was used to validate content, usability and face validity of the BPMH form



© European Association of Hospital Pharmacists 2023. Re-use permitted under CC BY-NC. No commercial re-use. Published by BMJ.

**To cite:** Hoornaert C, Pochet S, Lorent S. *Eur J Hosp Pharm* 2023;**30**:77–85.



**Figure 1** Method. BPMH, Best Possible Medication History. Created by the authors

(online supplemental appendix 1).<sup>12</sup> Anonymity of experts was maintained throughout the study. Reminder emails were sent as necessary to encourage participation and a deadline was given for completion.

### Selection of experts

Due to a lack of guidelines concerning the ideal number of experts required to constitute a Delphi panel, it was decided that the chosen panel would contain at least 20 experts.<sup>13 14</sup> The experts of the Delphi panel were enrolled within our own network. They received an email to participate from the forum of the professional association. They were Belgian clinical pharmacists with at least 6 months of clinical experience. We used the SurveyMonkey® website to facilitate the Delphi survey.

### First round

The Delphi questionnaire contained three sections. The first section collected background and demographic information: gender, teaching status of hospital, region, type of practice and experience. The second section asked the experts the level of agreement for each of the tabs/items. The third section evaluated usability of the BPMH form.

### Level of agreement

Experts were invited to answer a questionnaire in which they rated their level of agreement for each individual tab and item of the BPMH form. Rating was done using a 5-point Likert Scale: 0-strongly disagree; 1-disagree; 2-neither agree nor disagree; 3-agree; 4-strongly agree. Each tab was rated according to visual aspect (clarity of presentation, sufficient space, line count) and written expression (syntax, language and vocabulary, etc). The same scale was used to rate each item according to usefulness, relevance, and answer to the request of hospital pharmacists or other care providers (according to the hospital pharmacist perception). A blank space was included for comments, change in wording of item/tab or underlying reasons of the rating. At the end of the first round, experts were encouraged to provide opinions and suggestions for content that was not included in the BPMH form. Items and tabs with 100% of expert rating  $\geq 3$  were retained for the final version of the BPMH form.<sup>15-17</sup> Items and tabs with a lower percentage of experts' agreement were subjected to the second round. Following the comments of the experts, some items or tabs were deleted. After receiving the first round of survey responses, one research team member analysed each result. Comments were discussed with the research team.

### Usability evaluation

The usability was measured with the statements of the USE (Usefulness, Satisfaction and Ease) questionnaire by Lund.<sup>18</sup> The usability rating has not been used to exclude items or tabs. The layout of the BPMH form was assessed according to its adequacy, legibility, choice of colours and ease of use.

### Second round

Experts who responded entirely in the first round were given a new questionnaire containing the results of round 1 (mean values, median, Q1: 25th percentile, Q3: 75th percentile, the distribution of ratings, their own ratings). Experts confirmed or re-rated their level of agreement on a Likert scale for each item or tab and they commented on their position if they re-rated or if they had a deviating note.<sup>13</sup> The note was considered deviating if it was not between the 25th and 75th percentile. Consensus was defined in the first round as 100% of experts rating items/tabs as  $\geq 3$ . Consensus was defined in the second and third round as 85% of experts rating items/tabs as  $\geq 3$ .<sup>15 16</sup> Experts' comments were collated and analysed to improve the items and tabs and to refine the wording.<sup>16</sup>

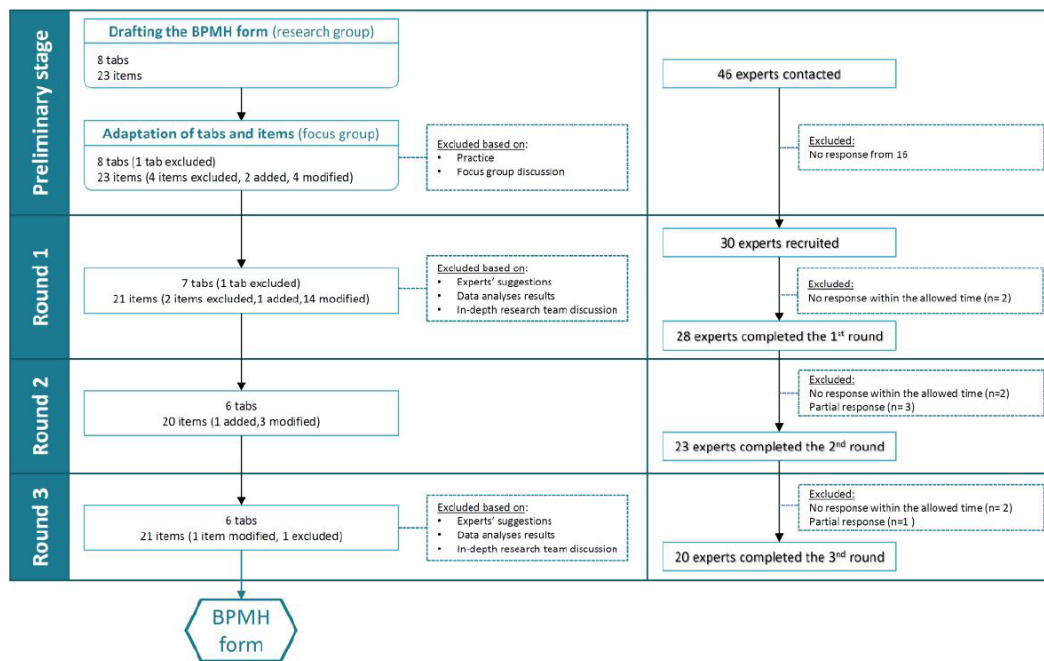
Additionally, new items based on experts' suggestions were added to the questionnaire and were rated by experts.

### Third round

Results of the second round were provided to experts at the beginning of the third round survey. Each expert confirmed or re-rated their level of agreement and argued the deviant comments.

### Data analysis

The Delphi survey responses were analysed using the software SPSS version 25. For each outcome, the mean agreement rating, and the percentage of experts who rated each item or tab  $\geq 3$ , were calculated. Level of agreement with the ranking in round 1 and 2 was measured using the Wilcoxon signed-rank test. The triangulation method was used to reduce potential bias due to a single person doing all the data management with the confirmation of the research group. We supplemented the quantitative analysis with a qualitative analysis of comments for each Delphi round to integrate all suggestions for content for the BPMH form, reasons underlying the rating and possible redraft of the wording of tabs or items.<sup>17 19 20</sup> Before the analysis began, irrelevant or non-specific comments were removed (eg, 'nothing to report' or comments regarding level of agreement). Comments were coded according to an open and inductive procedure by the



**Figure 2** Delphi flowchart. BPMH, Best Possible Medication History. Created by the authors.

first author.<sup>20–22</sup> The research group agreed on the meaning of the codes.<sup>23</sup> Differences regarding wording were discussed and agreed on together.

## RESULTS

The draft BPMH form contained 23 items grouped into eight tabs (figure 2). The focus group excluded the tab *‘to be completed by the care provider’* containing the item *‘sources used during the realisation of the BPMH’*. This item merged into the tab *‘general information’*. Participants added two items: one concerning lifestyle (tobacco, alcohol, drugs use) and one concerning self-medication. The wording was changed for four items (medication management; patients’ personal treatment, sources, Morisky Medication Adherence Scale).

A total of 46 experts were invited to participate, of which 30 agreed. The number of experts ranged from 28 for the first round to 23 for the second round and finally 20 for the third round (figure 2). Of the 20 experts completing all three rounds, five (25%) were specialists in geriatrics, three (15%) in antibiotic stewardship, and three (15%) in general clinical pharmacy. The specialty of the other nine experts and the characteristics of the Delphi panel of experts are described in the table 1.

### First round

Expert panellists individually rated seven tabs and 21 items. Three tabs met the consensus criteria for inclusion in the BPMH form (table 2).

Consensus was not reached for tab *‘remarks’* (82%) which was supported by the qualitative analysis of the experts’ comments (online supplemental appendix 2). The experts deemed this tab as unnecessary (14%) and repetitive because they already have the opportunities to comment in each tab or item. As depicted in table 3, item *‘medication available in the hospital’s formulary’* was excluded (the level of agreement was 92%) after the first round because the experts considered the wording was not clear and not useful. For experts, this step is not part of the medication history but of the medication reconciliation. Moreover,

computerised prescription software allows automatic substitutions to be made (for drugs of the same pharmaceutical class available in the hospital’s formulary). This item also took too much space in the table (14% of experts removed it and 21% reduced the size of the column). This was also the same for item *‘comments’* (the level of agreement was 65%) and according to the expert’s comments (11% of experts removed it; this item was not clear and useful). Following those removals, columns *‘medication’* and *‘remarks’* were enlarged and the item *‘chronic and acute/on demand medication’* was added to the BPMH form for inclusion in the second round of Delphi. The other suggestions were not considered relevant for this study.

According to comments received in the first round, modifications were made to 14 items included in the second round to clarify wording, re-draft items, and add more detail or specificity to items. The item *‘self-medication’* has been divided into two parts following the experts’ comments. One part was integrated in the table of *‘medication’* tab and the other part was moved to tabs *‘questions about medication’*. This part *‘self-medication’* was renamed *‘are you taking any medication other than those prescribed by your physician?’* to integrate self-medication, over the counter medication but also drugs recommended/delivered by a third party. Several experts provided comments indicating a lack of clarity in the description of item *‘sources’*, *‘medication in the form of’* and *‘medication for’*. The descriptions of these items were subsequently clarified during the second round.

The BPMH form was rated positively in the USE questionnaire with average scores higher than 3 (out of 4) for all three dimensions.

### Second round

Rating expert panellists individually rated four tabs and 20 items. As shown in table 2, consensus was obtained for tabs 1, 2, 3, 4 within the second round ( $p=0.072$ ). Furthermore, consensus was reached in the second round for 80% (16/20) of items according to the validation rule for this round (for all items  $p<0.001$  except for item 1, 14, 21 and 22) (table 3). The item

**Table 1** Characteristics of the Delphi panel of experts. Created by the authors

	Round 1	Round 2	Round 3
	N (%)	N (%)	N (%)
Teaching status of hospital			
University hospital	13 (46.4%)	11 (47.8%)	10 (50.0%)
Non-university hospital	15 (53.6%)	12 (52.2%)	10 (50.0%)
Region			
Brussels	8 (28.6%)	8 (34.8%)	7 (35.0%)
Liège	9 (32.1%)	4 (17.4%)	3 (15.0%)
Hainaut	5 (17.9%)	5 (21.7%)	5 (25.0%)
Walloon Brabant	2 (7.1%)	2 (8.7%)	2 (10.0%)
Namur	3 (10.7%)	3 (13.0%)	2 (10.0%)
Luxembourg	1 (3.6%)	1 (4.3%)	1 (5.0%)
Sex			
Male	2 (7.1%)	2 (8.7%)	2 (10.0%)
Female	26 (92.9%)	21 (91.3%)	18 (90.0%)
Experience as clinical pharmacist			
≤1 year	4 (14.3%)	3 (13.0%)	3 (15.0%)
≤5 years	11 (39.3%)	9 (39.1%)	6 (30.0%)
≤10 years	9 (32.1%)	8 (34.8%)	8 (40.0%)
>10 years	4 (14.3%)	3 (13.0%)	3 (15.0%)
Clinical pharmacy programmes covered			
Geriatrics	8 (28.6%)	5 (21.7%)	5 (25.0%)
Antibiotic stewardship	4 (14.3%)	4 (17.4%)	3 (15.0%)
General	3 (10.7%)	3 (13.0%)	3 (15.0%)
Anticoagulation	1 (3.6%)	1 (4.3%)	1 (5.0%)
Emergency	1 (3.6%)	1 (4.3%)	1 (5.0%)
HIV/hepatitis C	1 (3.6%)	1 (4.3%)	1 (5.0%)
ICU	1 (3.6%)	1 (4.3%)	1 (5.0%)
Internal medicine	1 (3.6%)	1 (4.3%)	1 (5.0%)
Oncology	4 (14.3%)	3 (13.0%)	1 (5.0%)
Oncogeriatrics	1 (3.6%)	1 (4.3%)	1 (5.0%)
Pain	1 (3.6%)	1 (4.3%)	1 (5.0%)
Surgery	2 (7.1%)	1 (4.3%)	1 (5.0%)

ICU, intensive care unit.

'chronic and acute/on demand medication' introduced after the first round achieved consensus (92%). One expert's comment from the second round suggested that the term 'drug' (item 5) could be misleading as experts might omit non-prescribed drugs, dietary supplements, essential oils, etc. The wording was changed from 'drug' to the broader term 'medication'. This modification was specifically mentioned in the third-round questionnaire. The experts considered the question 'are you taking any medication other than those prescribed by your physician?' important but redundant with the self-medication column in the table of 'medication' tab. As a result, this question was changed into a checkbox in the item 'medication for' (ie, medication over the counter, drug recommended, given, purchased on the internet). Item 'terms of use' was moved from tab 'medication' to tab 'questions about medication'. Additionally, an item 'vaccination' was added after experts' input. For tab 'home medication management', the items 'use of a pill dispenser' and 'home treatment' were revised to 'assistance in medication management' and 'did you bring your personal treatment to the hospital?' because their descriptions were not easy to understand. Both were well validated in the second round of Delphi. A statistically significant level of convergence occurred between the two rounds of rating across all items and tabs ( $p < 0.001$ ).

Conversely, consensus was not reached for several items: item 'sources' for its repetitive nature, item 'assistance in medication management' was not considered relevant for care providers, item 'terms of use' and 'Morisky Medication Adherence Scale' were not considered relevant for hospital pharmacists.

### Third round

Consensus was reached on 76% (16/21) of items in the third round. Consensus was not reached on the same items as in round 2 ('sources', 'assistance in medication management', 'Morisky Medication Adherence Scale'). The item 'vaccination' was included, being regarded as useful by experts but being considered as difficult to answer by patients and time-consuming for the hospital pharmacists. In general, the patient does not know his or her vaccination schedule and the hospital pharmacist will have to do some research. In the third round, the item was changed from a closed to an open question (ie, 'are you up to date on your vaccinations?' to 'during the last 2 years, have you been vaccinated?'). That allows the patient to answer without being limited or influenced by predefined answers

### DISCUSSION

This is one of the first studies to develop a standardised BPMH form. The BPMH form is the first step for medication reconciliation across the continuum of care, but getting a complete picture of the patient's current medication is a particularly difficult challenge. A major reason for this difficulty is that the multi-disciplinary healthcare team may not have access to an accurate and complete medication list at patient admission.<sup>24</sup> Several studies proved the BPMH improves the continuity of care and decreases medication errors by allowing better medication data sharing and better communication between hospital healthcare and extramural healthcare providers.<sup>24,25</sup> Moreover, this process is part of the Joint Commission International Patient safety goals list for the hospitals' accreditation.<sup>26</sup> According to the WHO, the BPMH form should be documented in a standardised form developed and designed by the organisation that prompts for the information required to improve accuracy and efficiency.<sup>4</sup> The development of a structured BPMH form contributes to ensure a systematic approach for collecting medication history. Moreover, as demonstrated by Henneman *et al*, when a structured and systematic approach was used by nursing students, the accuracy of BPMH increased from 74% to 87%.<sup>27</sup> A variety of methods have been attempted to improve the process of collecting the BPMH, but there is a lack of information in the literature regarding the tools used to collect the data and whether and how they have been validated.<sup>5,24,28</sup> Our study combines the development of a BPMH form by the research group, its adaptation by the focus group and its validation according to the Delphi method. The BPMH form was specifically designed and validated by the targeted audience (ie, clinical pharmacists). The application of the Delphi method within this research context is ideal because it is designed to explore topics where minimal information exists. It is also ideal for the introduction and integration of viewpoints and opinions of experts.<sup>17,19,20</sup>

The final BPMH includes 20 items arranged under six tabs: 'general information', 'medication', 'home medication management', 'questions about medication', 'allergies/side effects' and 'medication adherence'.

Throughout each round, item 'sources' in tab 'general information' and item 'sources table' in the table of 'medication' tab presented a problem because they were considered redundant by some of the experts. The qualitative analysis showed

**Table 2** Agreement ratings per tab per round. Created by the authors

Tabs	Round 1			Round 2		Round 3		P value
	N (% agreement)	Median (Q1–Q3)	Included or excluded (100% of experts ratings $\geq 3$ were included)	N (% agreement)	Median (Q1–Q3)	Included or excluded (85% of experts ratings $\geq 3$ were included)	Included or excluded (85% of experts ratings $\geq 3$ were included)	
<b>Tab 1: general information</b>	28 (98%)	4 (3.75–4)		23 (98%)	4 (4–4)			
Visual aspect	27 (96%)	4 (3.75–4)		22 (96%)	4 (4–4)	Included 2nd round	Included 2nd round	
Written expression	28 (100%)	4 (3.75–4)	Included 1st round			Included 1st round	Included 1st round	
<b>Tab 2: medication</b>	24 (84%)	3 (3–4)		22 (96%)	3.5 (3–4)			0.180
Visual aspect	20 (71%)	3 (2–4)		21 (91%)	4 (3–4)	Included 2nd round	Included 2nd round	
Written expression	27 (96%)	3.5 (3–4)		23 (100%)	3 (3–4)			
<b>Tab 3: home medication management</b>	27 (95%)	3 (3–4)		23 (100%)	3 (3–4)			0.180
Visual aspect	27 (96%)	3 (3–4)		23 (100%)	3 (3–4)	Included 2nd round	Included 2nd round	
Written expression	26 (93%)	3 (3–4)		23 (100%)	3 (3–4)			
<b>Tab 4: questions about medication</b>	26 (91%)	4 (3–4)		22 (93%)	4 (3–4)			0.655
Visual aspect	23 (82%)	3.5 (3–4)		21 (91%)	3 (3–4)	Included 2nd round	Included 2nd round	
Written expression	28 (100%)	4 (3–4)		22 (96%)	4 (3–4)			
<b>Tab 5: allergies/side effects</b>	28 (100%)	4 (4–4)						
Visual aspect	28 (100%)	4 (4–4)	Included 1st round			Included 1st round	Included 1st round	
Written expression	28 (100%)	4 (4–4)						
<b>Tab 6: medication adherence</b>	28 (100%)	4 (3–4)						
Visual aspect	28 (100%)	4 (3–4)	Included 1st round			Included 1st round	Included 1st round	
Written expression	28 (100%)	4 (3.75–4)						
<b>Tab 7: remarks</b>	23 (82%)	4 (3–4)						
Visual aspect	23 (82%)	4 (3–4)	Excluded 1st round			Excluded 1st round	Excluded 1st round	
Written expression	23 (82%)	4 (3–4)						

that out of 11 experts who commented, 35% (7/20) felt that the item ‘sources’ should be retained and 20% (4/20) felt that it was redundant. Following a literature review and the experts’ comments, the research team included this item. The High 5 s project about medication reconciliation specifies in the definition of BPMH that different sources of information should be used and that the medication information should be checked with more than one source as appropriate.<sup>4,23</sup> The recommendation of international peak bodies was to use at least two sources to acquire a reliable medication history because it is the gold standard. According to the experts’ comments, item ‘sources’ increased the accuracy of the medication history because it provided the advantage of detailing the sources and providing an overview of the possibilities of sources used. By contrast, item ‘sources table’ provided an overview of the sources used for each medication. Following the experts’ suggestions, the proposals were added in the item ‘sources’: call to the family physician and institution, pharmacist’s medication plan and institution’s treatment sheet. In addition, with the evolution of e-health, the various Belgian platforms allowing the exchange of computerised health documents between healthcare providers have been introduced in item ‘sources’.

The item ‘drug’ was replaced by ‘medication’. Medicinal plants, homeopathy, dietary supplements and essential oils are not part of the legislation on medicinal products. After a review of the literature and drug legislation, several terms were proposed to the experts to modify the term ‘drug’ in the table of ‘medication’ tab: drug; medication; drug, dietary supplement, medical

devices; drug and other health product; drug and product for human use.

Tabs and items validated by the expert panel are similar to the definition of the tasks involved in medication history by Penn *et al.*<sup>29</sup> Additional concepts were included such as the item ‘lifestyle’, ‘patients’ personal treatment’ and the tab ‘questions about medication’. For tab ‘questions about medication’, items ‘medication in the form of’ and ‘medication for’ were considered relevant memory-aids/ checklist to help all health professionals to avoid forgetting medication. Several factors specific to the care unit complicate the collection of the medication history with the patient: unconscious or confused patient, limited time, acute pathology, and the fact that some patients have little involvement in their therapeutic management and others may have cognitive impairment. Moreover, some medications are considered unimportant by patients, for example, sleeping pills, vitamins, etc. It is important to specifically ask them this question during the medication history.<sup>30</sup> Following the experts’ request to add proposed answers for item ‘medication in the form of’, the number of galenic forms before round 1 was enhanced from six to eight (ie, syrup, suppository). In order to clarify this item, checkboxes have been introduced as for the item ‘medication for’. The item ‘medication for’ is a checklist to review the different organ systems to ensure all hospital pharmacists are asking pertinent questions regarding the patient’s medications. To clarify this item, the existing prefilled answers were divided into three points: systems of the human body, types of medication, and frequencies of administration.

**Table 3** Agreement ratings per item per round. Created by the authors

Items	Round 1	Round 2	Round 3	P*
	N (% agreement)	N (% agreement)	N (% agreement)	
<b>Item 1: medication chronic and acute/on demand</b>		21 (92%)		
Usefulness	Added 2nd round	22 (96%)	Included 2nd round	
Relevance		21 (91%)		
Care provider		20 (87%)		
Hospital pharmacist		22 (96%)		
<b>Item 2: lifestyle</b>	23 (83%)	21 (90%)		0.066
Usefulness	24 (86%)	21 (91%)	Included 2nd round	
Relevance	24 (86%)	21 (91%)		
Care provider	22 (79%)	20 (87%)		
Hospital pharmacist	23 (82%)	21 (91%)		
<b>Item 3: sources</b>	21 (76%)	21 (89%)		0.068
Usefulness	22 (79%)	22 (96%)	Included 2nd round	
Relevance	22 (79%)	21 (91%)		
Repetitive	20 (71%)	17 (74%)	<b>13 (65%)</b>	
Hospital pharmacist	21 (75%)	22 (96%)	Included 2nd round	
<b>Item 4: sources table</b>	26 (94%)	23 (99%)		0.109
Usefulness	26 (93%)	22 (96%)	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 5: medication</b>	27 (96%)	23 (99%)		0.180
Usefulness	28 (100%)	Included 1st round	Included 2nd round	
Relevance	27 (96%)	22 (96%)		
Care provider	25 (89%)	23 (100%)		
Hospital pharmacist	27 (96%)	23 (100%)		
<b>Item 6: dosage</b>	27 (96%)	23 (100%)		0.102
Usefulness	28 (100%)	Included 1st round	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	26 (93%)	23 (100%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 7: remarks</b>	27 (95%)	23 (99%)		0.102
Usefulness	28 (100%)	Included 1st round	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	24 (86%)	22 (96%)		
Hospital pharmacist	27 (96%)	23 (100%)		
<b>Item 8: self-medication</b>	22 (78%)	20 (86%)		0.068
Usefulness	22 (79%)	20 (87%)	Included 2nd round	
Relevance	23 (82%)	21 (91%)		
Care provider	19 (68%)	22 (96%)		
Hospital pharmacist	23 (82%)	22 (96%)		
<b>Item 9: medication management</b>	26 (92%)	23 (98%)		0.660
Usefulness	27 (96%)	23 (100%)	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	23 (82%)	21 (91%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 10: assistance in medication management</b>	24 (84%)	20 (88%)		0.660
Usefulness	26 (93%)	22 (96%)	Included 2nd round	
Relevance	26 (93%)	22 (96%)		
Care provider	17 (61%)	15 (65%)	<b>13 (65%)</b>	
Hospital pharmacist	25 (89%)	22 (96%)	Included 2nd round	
<b>Item 11: patients' personal treatment</b>	27 (95%)	22 (97%)		0.102
Usefulness	28 (100%)	Included 1st round	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	24 (86%)	21 (91%)		
Hospital pharmacist	27 (96%)	23 (100%)		
<b>Item 12: medication in the form of</b>	26 (93%)	21 (91%)		0.157
Usefulness	26 (93%)	21 (91%)	Included 2nd round	
Relevance	26 (93%)	21 (91%)		
<b>Item 13: medication for</b>	27 (95%)	21 (91%)		0.317
Usefulness	27 (96%)	22 (96%)	Included 2nd round	
Relevance	26 (93%)	20 (87%)		
<b>Item 14: vaccination</b>			16 (80%)	

Continued

Table 3 Continued

Items	Round 1	Round 2	Round 3	P*
	N (% agreement)	N (% agreement)	N (% agreement)	
Usefulness	Added 3rd round		17 (85%)	
Relevance			17 (85%)	
Hospital pharmacist			14 (70%)	
<b>Item 15: change in your medication</b>	27 (95%)	23 (98%)		0.180
Usefulness	28 (100%)	Included 1st round	Included 2nd round	
Relevance	28 (100%)			
Care provider	24 (86%)	22 (96%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 16: antibiotic</b>	26 (94%)	22 (96%)		0.109
Usefulness	27 (96%)	23 (100%)	Included 2nd round	
Relevance	27 (96%)	22 (96%)		
Care provider	25 (89%)	21 (91%)		
Hospital pharmacist	26 (93%)	22 (96%)		
<b>Item 17: swallowing difficulties</b>	26 (93%)	23 (99%)		0.066
Usefulness	27 (96%)	23 (100%)	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	24 (86%)	22 (96%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 18: terms of use</b>	23 (83%)	20 (86%)		0.102
Usefulness	24 (86%)	20 (87%)	Included 2nd round	
Relevance	24 (86%)	20 (87%)		
Hospital pharmacist	22 (79%)	19 (83%)	18 (90%)	
<b>Item 19: allergies</b>	27 (95%)	23 (100%)		0.063
Usefulness	27 (96%)	23 (100%)	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	26 (93%)	23 (100%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 20: side effects</b>	26 (93%)	23 (98%)		0.066
Usefulness	27 (96%)	23 (100%)	Included 2nd round	
Relevance	27 (96%)	23 (100%)		
Care provider	24 (86%)	21 (91%)		
Hospital pharmacist	26 (93%)	23 (100%)		
<b>Item 21: medication available in the hospital's formulary</b>	26 (92%)			
Usefulness	26 (93%)	Excluded	Excluded	
Relevance	26 (93%)			
Care provider	24 (86%)			
Hospital pharmacist	27 (96%)			
<b>Item 22: comments</b>	18 (65%)			
Usefulness	20 (71%)	Excluded	Excluded	
Relevance	20 (71%)			
Care provider	13 (46%)			
Hospital pharmacist	20 (71%)			
<b>Item 23: Morisky Medication Adherence Scale</b>	21 (75%)	17 (73%)	15 (76%)	0.066
Usefulness	22 (79%)	18 (78%)	17 (85%)	
Relevance	21 (75%)	16 (70%)	14 (70%)	
Care provider	19 (68%)	15 (65%)	13 (65%)	
Hospital pharmacist	22 (79%)	18 (78%)	17 (85%)	
<b>Layout of the document</b>	23 (81%)	21 (91%)		
Legible	27 (96%)	23 (100%)	Included 2nd round	
Choice of colours	21 (75%)	22 (96%)		
Easy-fill	20 (71%)	17 (74%)	16 (80%)	
Adequate	23 (82%)	22 (96%)	Included 2nd round	

Data in bold show the items that did not achieve consensus.

\*The table presents the distribution of Wilcoxon signed-rank test of second round versus first round.

In the same tab, the items 'were there any recent changes in your treatment?' and 'have you taken any antibiotics recently?' were revised to 'in the last 2 months, were there any changes in your treatment?' and 'in the last 2 months, have you taken any antibiotics/anti-virals/antifungals?'. This change was made because the experts wanted to clarify what is meant by 'recently'.

Two months was established arbitrarily by the research team as no data about this period were found in the literature.

The item 'Morisky Medication Adherence Scale' was not included by the research group because two parameters (relevance, answer to the request of other care providers) did not achieve consensus. A thorough analysis of the topics and the

reasons for the experts' reluctance was conducted. The first reason identified was a lack of knowledge. The other reasons were the impression that patients will feel judged and that there is a lack of time to perform this adherence test. Some experts proposed to reduce the number of questions but it was not possible because the Morisky score was validated in that form. The choice of adherence scale is left to the clinical pharmacist's discretion performing the BPMH.

In this study, outcomes that did not achieve consensus support following the third round of the Delphi were not always excluded from the BPMH form for several reasons. The first reason is that there are currently no guidelines for the most appropriate pre-defined consensus of Delphi.<sup>17</sup> The second reason is that the research group has understood some 'lower' ratings thanks to the experts' comments. The third reason is that all the proposals that did not reach consensus on any of the parameters are part of the definition of the tasks involved in the medication history by Penm *et al.*<sup>29</sup> The fourth reason is that in the second round, the experts were asked to give a rating for the importance of each proposal from very important to not very important. The majority of experts have always given the important or even very important rating.

The high rate of agreement obtained on most questions in this survey indicates that a strong consensus has emerged. A statistically significant level of convergence occurred between the two rounds of rating across all items ( $p < 0.001$ ) and items and tabs ( $p < 0.001$ ). All the tabs did not reach a statistically significant difference because the percentage of agreement is between 84% and 100% for round 1 and 93% and 100% for round 2 which represents a deviation that is too small.

This research has several limitations. It has been validated by a small group of French-speaking Belgian clinical pharmacists, which may affect the wider generalisability of the results. Following the comments of the experts, some items or tabs were deleted. Researcher bias may have affected the outcome of this study. Tabs and items were refined by the research team based on the panels' comments. This may allow the researchers to place more emphasis on concepts that aligned with their own beliefs. However, to minimise the risk of researcher bias, all modifications provided by the research team were distributed to the expert panel after each round. Moreover, categories of some items ('sources', 'assistance in medication management', 'vaccination') that had not achieved consensus following the third round were included in the BPMH form.<sup>15-17</sup>

One of the highlights of the study is the large volume of qualitative data generated from rounds 1 and 2 which allowed us to give a detailed qualitative feedback to experts. This qualitative analysis is not always a component of Delphi studies and is likely to have resulted in more robust findings.<sup>17 19 20</sup> Furthermore, the online survey kept the experts from interacting with each other, which is an advantage to prevent biases resulting from more vocal or senior experts dominating the views of the group.<sup>31</sup>

The next step is to test this new tool. Another project might be to integrate this tool through medical records to assist physicians, nurses and hospital pharmacists in their practice. Another step would be to disseminate this tool to Belgian hospital pharmacists (either via the hospital pharmacists' association or by contacting the SPF public health). A computerised version of the tool has been developed for ease of use in everyday practice. Finally, such a BPMH form could help hospital pharmacists to increase safety and ensure the continuity of treatment. Ensuring that patients receive the correct medications throughout the inpatient stay should be a collaborative and ongoing effort between patients, family members and healthcare providers.

## CONCLUSION

This study provides the BPMH form, including 20 items arranged under six tabs. The systematic use of a standardized BPMH form can be used to help clinical pharmacists to collect a complete and accurate medication list on admission. It could have an impact on inpatient safety and improve inpatient management. The BPMH collecting process is the starting point for the medication reconciliation process which has the ability to reduce such medication errors. An international e-Delphi should be conducted for wider use of the BPMH form.

## Key messages

### What is already known on this topic

⇒ An inaccurate medication history may be the cause of up to 85% of medication errors on admission. The process of collecting a medication history can be facilitated by using a structured Best Possible Medication History (BPMH) form.

### What this study adds

⇒ This study provided data on the content of the structured BPMH form.

### How this study might affect research, practice and/or policy

⇒ This form can be used to help clinical pharmacists to collect a complete and accurate medication list on admission.  
 ⇒ The standardised BPMH form is available to various healthcare providers (pharmacists, nurses, physicians). It could have an impact on inpatient safety and improve inpatient management.

**Acknowledgements** A particularly warm thank you goes to the Delphi panels. Published with the support of the University Foundation of Belgium

**Contributors** CH is the guarantor.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient consent for publication** Not applicable.

**Ethics approval** Not applicable (Belgian law 7 May 2004, chapter II, article 3).

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** All data relevant to the study are included in the article or uploaded as supplementary information. Data is included within the article and uploaded as supplementary information.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, an indication of whether changes were made, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

## ORCID iD

Camille Hoornaert <http://orcid.org/0000-0003-0283-4757>

## REFERENCES

- Cornish PL, Knowles SR, Marchesano R, *et al.* Unintended medication discrepancies at the time of hospital admission. *Arch Intern Med* 2005;165:424-9.



- 2 Gleason KM, McDaniel MR, Feinglass J, et al. Results of the medications at transitions and clinical handoffs (MATCH) study: an analysis of medication reconciliation errors and risk factors at hospital admission. *J Gen Intern Med* 2010;25:441–7.
- 3 Vasileff HM, Whitten LE, Pink JA, et al. The effect on medication errors of pharmacists charting medication in an emergency department. *Pharm World Sci* 2009;31:373–9.
- 4 World Health Organisation. The high 5S project-standard operating protocol, 2015. Available: <https://www.who.int/patientsafety/implementation/solutions/high5s/h5s-sop.pdf?ua=1> [Accessed 6 Dec 2019].
- 5 Standards of Practice for Clinical Pharmacy Services - The Society of Hospital Pharmacists of Australia - Chapter 1: Medication Reconciliation, 2013. Available: [https://www.shpa.org.au/sites/default/files/uploaded-content/website-content/SOP/sop\\_clinical\\_pharmacy\\_s6-s12\\_chapter1.pdf](https://www.shpa.org.au/sites/default/files/uploaded-content/website-content/SOP/sop_clinical_pharmacy_s6-s12_chapter1.pdf) [Accessed 6 Dec 2019].
- 6 Doerper S, Morice S, Piney D. La conciliation des traitements médicamenteux : logigramme d'une démarche efficace pour prévenir ou intercepter les erreurs médicamenteuses l'admission du patient hospitalisé. /data/revues/22111042/v48i3/S2211104213000520/ 2013.
- 7 Tam VC, Knowles SR, Cornish PL, et al. Frequency, type and clinical importance of medication history errors at admission to hospital: a systematic review. *CMAJ* 2005;173:510–5.
- 8 Steurbaut S, Leemans L, Leysen T, et al. Medication history reconciliation by clinical pharmacists in elderly inpatients admitted from home or a nursing home. *Ann Pharmacother* 2010;44:1596–603.
- 9 Haute Autorité de Santé. Mettre en œuvre la conciliation des traitements médicamenteux en établissement de santé - Sécuriser la prise en charge médicamenteuse du patient lors de son parcours de soins, 2018. Available: [https://www.has-sante.fr/upload/docs/application/pdf/2017-01/dir1/guide\\_conciliation\\_des\\_traitements\\_medicamenteux\\_en\\_etablissement\\_de\\_sante.pdf](https://www.has-sante.fr/upload/docs/application/pdf/2017-01/dir1/guide_conciliation_des_traitements_medicamenteux_en_etablissement_de_sante.pdf) [Accessed 6 Dec 2019].
- 10 Sadasivaiah S, Smith DE, Goldman S, et al. Improving best possible medication history with vulnerable patients at an urban safety net academic hospital using pharmacy technicians. *BMJ Open Qual* 2017;6:e000102.
- 11 MacDonald N, Manuel L, Brennan H, et al. Reliability of best possible medication histories completed by non-admitted patients in the emergency department. *Can J Hosp Pharm* 2017;70:263–9.
- 12 Dalkey N, Helmer O. An experimental application of the Delphi method to the use of experts. *Manage Sci* 1963;9:458–67.
- 13 Rowe G, Wright G. The Delphi technique as a forecasting tool: issues and analysis. *Int J Forecast* 1999;15:353–75.
- 14 Okoli C, Pawlowski SD. The Delphi method as a research tool: an example, design considerations and applications. *Inf Manage* 2004;42:15–29.
- 15 Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. *J Clin Epidemiol* 2014;67:401–9.
- 16 Desnoyer A, Blanc A-L, Pourcher V, et al. PIM-Check: development of an international prescription-screening checklist designed by a Delphi method for internal medicine patients. *BMJ Open* 2017;7:e016070.
- 17 Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique: Delphi survey technique. *J Adv Nurs* 2000;32:1008–15.
- 18 Lund AM. Measuring usability with the use questionnaire, 2001. Available: [http://tecfa.unige.ch/tecfa/teaching/LMRI41/Utilisabilite\\_Questionnaires.pdf](http://tecfa.unige.ch/tecfa/teaching/LMRI41/Utilisabilite_Questionnaires.pdf) [Accessed 6 Dec 2019].
- 19 Glaser B, Strauss A. The discovery of Grounded theory: strategies for qualitative research. *Chic Aldine* 1967.
- 20 Patton MQ. Enhancing the quality and credibility of qualitative analysis. *Health Serv Res* 1999;34:1189–208.
- 21 Raskind IG, Shelton RC, Comeau DL, et al. A review of qualitative data analysis practices in health education and health behavior research. *Health Educ Behav* 2019;46:32–9.
- 22 Thomson R, Lewalle P, Sherman H, et al. Towards an international classification for patient safety: a Delphi survey. *Int J Qual Health Care* 2009;21:9–17.
- 23 Chen HH, Taylor SE, Harding AM, et al. Accuracy of medication information sources compared to the best possible medication history for patients presenting to the emergency department. *Emerg Med Australas* 2018;30:654–61.
- 24 Kwan Y, Fernandes OA, Nagge JJ, et al. Pharmacist medication assessments in a surgical preadmission clinic. *Arch Intern Med* 2007;167:1034–40.
- 25 Pippins JR, Gandhi TK, Hamann C, et al. Classifying and predicting errors of inpatient medication reconciliation. *J Gen Intern Med* 2008;23:1414–22.
- 26 The Joint Commission. National patient safety goals effective January 2020 - hospital accreditation program. Available: [https://www.jointcommission.org/assets/1/6/NPSG\\_Chapter\\_HAP\\_Jan2020.pdf](https://www.jointcommission.org/assets/1/6/NPSG_Chapter_HAP_Jan2020.pdf) [Accessed 6 Dec 2019].
- 27 Henneman EA, Tessier EG, Nathanson BH, et al. An evaluation of a collaborative, safety focused, nurse-pharmacist intervention for improving the accuracy of the medication history. *J Patient Saf* 2014;10:88–94.
- 28 Tessier EG, Henneman EA, Nathanson B, et al. Pharmacy-nursing intervention to improve accuracy and completeness of medication histories. *Am J Health Syst Pharm* 2010;67:607–11.
- 29 Penm J, Vaillancourt R, Pouliot A. Defining and identifying concepts of medication reconciliation: an international pharmacy perspective. *Res Social Adm Pharm* 2019;15:632–40.
- 30 Pérennes M, Carde A, Nicolas X. Conciliation médicamenteuse : une expérience innovante dans un service de médecine interne pour diminuer les erreurs d'anamnèse médicamenteuses 2012;41:77–86.
- 31 Millar AN, Daffu-O'Reilly A, Hughes CM, et al. Development of a core outcome set for effectiveness trials aimed at optimising prescribing in older adults in care homes. *Trials* 2017;18:175.