

Identifying Medication Review Topics to be Documented in a Structured Form in Electronic Health Record Systems: A Delphi Consensus Survey

Tanja Patricia Lindholm, Noora Hannele Lias, Kirsi Maarit Katariina Kvarnström, Anna-Riia Holmström, Terhi Maria Toivo, Marjo Anneli Uusitalo, Harri Petteri Nurmi, Marja Sisko Anneli Airaksinen

Submitted to: Journal of Medical Internet Research
on: December 19, 2024

Disclaimer: © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on its website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressly prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Original Manuscript..... 5

Supplementary Files..... 53

 Figures 54

 Figure 1..... 55

 Figure 2..... 56

 Figure 3..... 57

 Multimedia Appendixes 58

 Multimedia Appendix 1..... 59

Identifying Medication Review Topics to be Documented in a Structured Form in Electronic Health Record Systems: A Delphi Consensus Survey

Tanja Patricia Lindholm¹ MSc; Noora Hannele Lias¹ MSc; Kirsi Maarit Katariina Kvarnström^{1, 2, 3} PhD; Anna-Riia Holmström¹ PhD; Terhi Maria Toivo^{1, 4} PhD; Marjo Anneli Uusitalo^{5, 6} MSc; Harri Petteri Nurmi⁷ MSc; Marja Sisko Anneli Airaksinen¹ PhD

¹Clinical Pharmacy Group, Division of Pharmacology and Pharmacotherapy Faculty of Pharmacy University of Helsinki Helsinki FI

²HUS Pharmacy Helsinki University Hospital Helsinki FI

³HUS Internal Medicine and Rehabilitation Helsinki University Hospital Helsinki FI

⁴Hospital Pharmacy, Wellbeing Services County of Pirkanmaa Tampere University Hospital Tampere FI

⁵Innovation and Development Unit Istekki Ltd Kuopio FI

⁶Faculty of Medicine and Health Technology Tampere University Tampere FI

⁷Finnish Medicines Agency Fimea Helsinki FI

Corresponding Author:

Tanja Patricia Lindholm MSc
Clinical Pharmacy Group, Division of Pharmacology and Pharmacotherapy
Faculty of Pharmacy
University of Helsinki
Viikinkaari 5 E
P.O. Box 56
Helsinki
FI

Abstract

Background: Poor data transfer between electronic health record (EHR) systems has been a challenge hindering availability and usability of patient information in clinical practice and evidence-based decision making. To improve data transfer, patient information should be documented in a structured format. This also applies to medication-related patient information and results of the interventions, such as medication reviews (MRs), to individually optimize medication regimens, especially in older adults.

Objective: The aim of this study was to identify what information obtained from MRs should be documented in a structured form in EHRs at a national and organizational level.

Methods: The study was conducted as a three-round Delphi consensus survey in 2020. The electronic survey was based on a comprehensive inventory of international and national MR procedures in various settings. Expert panelists (n=41) independently assessed which topics should be documented in a structured form in EHRs. The interprofessional panel (n=41) consisted of 12 physicians, 13 pharmacists, 10 nurses, and six information management professionals (participation rate 66-76% in rounds 1-3, consensus limit set at 80%). The responses were analyzed quantitatively and qualitatively.

Results: Consensus was reached on 108/111 of predetermined topics to be documented in a structured form in EHRs. Of them, 39 concerned the MR process, 25 potentially drug-induced symptoms, 11 burden of risks for adverse drug effects, 12 laboratory tests and other test results, 12 medication adherence and nine use of intoxicants. The patient's blood pressure (mean 4.85 ± 0.53 on a Likert scale 1–5), kidney function (4.81 ± 0.56) and risk of bleeding (4.81 ± 0.56) were ranked as the three most important topics to be documented in a structured form. The panel reached a consensus that the information obtained from MRs should be made available to all healthcare professionals in the national digital repository for patient data and to patients to some extent.

Conclusions: The interprofessional expert panel strongly agreed on the results of the MRs that should be documented in a structured form in EHRs and made available both to health professionals involved in care teams and to patients themselves.

(JMIR Preprints 19/12/2024:70133)

DOI: <https://doi.org/10.2196/preprints.70133>

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain visible to all users.

Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <http://www.jmir.org/>

No. Please do not make my accepted manuscript PDF available to anyone.

Original Manuscript

Original Paper

Identifying Medication Review Topics to be Documented in a Structured Form in Electronic Health Record Systems: A Delphi Consensus Survey

Tanja Patricia Lindholm^{a,*} (MSc), Noora Hannele Lias^a (MSc), Kirsi Maarit Katariina Kvarnström^{a,b,c} (PhD), Anna-Riia Holmström^a (PhD), Terhi Maria Toivo^{a,d} (PhD), Marjo Anneli Uusitalo^{e,f} (MSc), Harri Petteri Nurmi^g (MSc) and Marja Sisko Anneli Airaksinen^a (PhD)

^a Clinical Pharmacy Group, Division of Pharmacology and Pharmacotherapy, Faculty of Pharmacy, University of Helsinki, Viikinkaari 5 E, P.O. Box 56, 00014 University of Helsinki, Finland

^b HUS Pharmacy, Helsinki University Hospital and University of Helsinki, 00029 Helsinki, Finland

^c HUS Internal Medicine and Rehabilitation, Helsinki University Hospital and University of Helsinki, 00029 Helsinki, Finland

^d Hospital Pharmacy, Wellbeing Services County of Pirkanmaa, Tampere University Hospital, P.O. Box 272, FI-33101, Tampere, Finland

^e Istekki Ltd., Innovation and Development Unit, P.O. Box 4000, FI-70601 Kuopio, Finland

^f Faculty of Medicine and Health Technology, Tampere University, FI-33014 Tampere University, Finland

^g Finnish Medicines Agency Fimea, P.O. Box 55, FI-00034 Fimea, Finland

*Corresponding author: address: Ampiaisentie 2a, 01490 Vantaa, Finland, email: tanja.p.lindholm@helsinki.fi, phone: +358505252889

E-mail addresses: tanja.p.lindholm@helsinki.fi (T Lindholm), noora.lias@helsinki.fi (N Lias), kirsi.kvarnstrom@hus.fi (K Kvarnström), anna-riia.holmstrom@helsinki.fi (A-R Holmström), terhi.toivo@pirha.fi (T Toivo), marjo.uusitalo@istekki.fi (M Uusitalo), harri.nurmi@fimea.fi (H Nurmi), marja.airaksinen@helsinki.fi (M Airaksinen)

Authors' contributions:

TL: study concept and design, data analysis, data interpretation, and drafting and revision of the manuscript for important intellectual content. NL: study concept and design, data analysis, data interpretation, and revision of the manuscript for important intellectual content. KK, ARH, TT, MU, HN and MA: study concept and design, data interpretation, and revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

Identifying Medication Review Topics to be Documented in a Structured Form in Electronic Health Record Systems: A Delphi Consensus Survey

Abstract

Background: Poor data transfer and interoperability between electronic health record (EHR) systems has been a challenge hindering availability and usability of patient information in clinical

practice and evidence-based decision making. To improve data transfer and interoperability, patient information should be documented in a structured format. This also applies to medication-related patient information and results of the interventions, such as medication reviews (MRs), to individually optimize medication regimens, especially in older adults.

Objective: The aim of this study was to identify what information obtained from medication reviews should be documented in a structured form in EHRs at a national and organizational level.

Methods: The study was conducted as a three-round Delphi consensus survey in 2020. The electronic survey was based on a comprehensive inventory of international and national MR procedures in various settings. Expert panelists (n=41) independently assessed which topics should be documented in a structured form in EHRs. The interprofessional panel (n=41) consisted of 12 physicians, 13 pharmacists, 10 nurses, and six information management professionals (participation rate 66-76% in rounds 1-3, consensus limit set at 80%). The responses were analyzed quantitatively and qualitatively.

Results: Consensus was reached on 108/111 of predetermined topics to be documented in a structured form in EHRs. Of them, 39 concerned the MR process, 25 potentially drug-induced symptoms, 11 burden of risks for adverse drug effects, 12 laboratory tests and other test results, 12 medication adherence and nine use of intoxicants. The patient's blood pressure (mean 4.85 ± 0.53 on a Likert scale 1–5), kidney function (4.81 ± 0.56) and risk of bleeding (4.81 ± 0.56) were ranked as the three most important topics to be documented in a structured form. The panel reached a consensus that the information obtained from MRs should be made available to all healthcare professionals in the national digital repository for patient data and to patients to some extent.

Conclusion: The interprofessional expert panel strongly agreed on the results of the MRs that should be documented in a structured form in EHRs and made available both to health professionals involved in care teams and to patients themselves.

Keywords: medication review; documentation; information management; electronic health record; patient information; medication information; medical informatics

Introduction

Healthcare across the world is undergoing digitalization with the goal of well-integrated systems leading to improved work efficiency and patient safety [1,2]. However, the transition phase towards well-functioning digital systems is characterized by fragmented immature medical records that have become a major challenge and patient safety risk in various healthcare functions and settings [3-9]. The key issue is that patient information is collected and documented in numerous local and national data systems that do not communicate or enable data access or data transfer between social and healthcare organizations or even within an organization. This siloed, fragmented information is difficult to share, blurring the overall picture of the treatment and making it difficult for any care team member to take full responsibility for the patient's care coordination [4,10]. Thus, standardized terminology and operating models are needed for documenting patient information in a structured format to enable data transfer and interoperability between healthcare units, regardless of the organization and/or EHR system [11-17]. This would also enable the secondary use of patient data when estimating the effectiveness of care or future need for healthcare services.

The same kind of challenges with fragmented patient information apply to documenting patient information on medication regimens to EHRs which has led to shortcomings and safety risks in managing and obtaining up-to-date medication information [18]. In medication risk management, medication reviews (MRs), i.e., a structured evaluation of a patient's medication regimen with the aim of optimizing medicines use and improving health outcomes, are an important strategy for identifying and solving medication-related risks and problems [19-23]. Traditionally, MRs have been a physician's duty, but practices where other care team members, including pharmacists, contribute to MRs have become more common globally [24-26]. Collaborative MRs have increased the need

for a common electronic platform, where MR information can be documented in such a way that it is up-to-date and available to all healthcare professionals involved in the medication use process [1,27,28].

Structured documentation offers a possible solution to these issues [12-14,16]. To implement structured documentation of medication information, an understanding of what MR information should be available in a structured form is needed. However, no previous studies were found that defined MR information necessary to be documented in a structured form. Therefore, this study aimed at identifying what patient information obtained from MRs should be documented in a structured form in EHRs at a national and organizational level.

Methods

Context

The Finnish healthcare system serves a population of 5.5 million inhabitants and is mainly based on public healthcare, complemented by private and occupational healthcare [29]. The services are divided into primary and specialized healthcare services. The social and healthcare system is undergoing a major reform that officially started at the beginning of 2023 after a long preparatory phase [30]. Since then, 21 wellbeing services counties, the City of Helsinki, and the HUS Group^{aa} have been responsible for organizing public social and healthcare services. The key objective of the reform is improving the availability and accessibility of social and health services, e.g., through digitalization of care pathways and patient information. The reform also concerns structures and processes needed for ensuring rational pharmacotherapy as part of patient care [29,31]. Availability of up-to-date electronic medication information and information transfer have been prioritized as the most important issues to be developed in this respect [29-32].

^{aa} The joint authority for Helsinki and Uusimaa responsible for organizing specialized healthcare in the Uusimaa region [30].

Use of information technology in prescribing medicines, processing prescriptions, and making medicines information available has been a routine practice in Finland since the 1980s when the first technology-based solutions were launched and nationally implemented [33-35]. The deployment of the national digital repository for electronic patient data Kanta since 2010 is one of the most prominent milestones towards electronic patient and medication information management in a closed-loop manner [29,33,36,37]. It enables electronic prescribing and centralized archiving of electronic patient data and data transfer between different healthcare providers regardless of local EHR. Electronic prescribing became mandatory by law in 2017 [38]. The Finnish Institute for Welfare and Health (THL) is nationally responsible for the definition, distribution, and harmonization of the structures of patient information [39,40]. Thus, it has played a crucial role in the development and harmonization of medication information management in EHRs by describing the target state of medication information documentation which has emphasized the importance of structured documentation. Structured documentation is also increasingly adopted in Kanta and EHRs to address shortcomings regarding data transfer and interoperability as patient and medication information is still stored in hundreds of separate systems [39-41].

Among the driving forces for the ongoing health and social services reform in Finland are the challenges in meeting the service needs of one of the fastest aging populations in the world [29,42]. Aging has increased multimorbidity and complexity of medication treatments, also increasing medication-related risks and problems [4,20,43-48]. Therefore, collaborative MR practices have been developed in Finland since 2005 as a measure to optimize medication treatments individually and to avoid preventable risks and harms [20,23,48-50]. As a result, the medication management process has become increasingly interprofessional, extending the need to share medication-related information from electronic prescriptions to follow up information on the implementation of the medication regimen.

The Delphi consensus method

This study applied the Delphi consensus method, which is a qualitative survey-based method gathering views of experts with the aim of reaching consensus on the studied topic [51-54]. The expertise and anonymity of the expert panelists, the iteration of research arguments, and the feedback given to the experts on the results of the previous round are the method's key characteristics. The method has been widely utilized in health services research for developing treatment recommendations, quality standards and indicators, risk-management tools and integrating health service systems [21,55-65]. For the present study, three Delphi rounds were carried out as electronic surveys in September-December 2020 using the eDelfoi software [66]. The process was led by an 8-member research group consisting of experienced pharmacy professionals familiar with healthcare information systems, EHR development, IT architecture and collaborative MRs in various operating environments, having also expertise in Delphi research methodology. The study is reported in alignment with the Recommendations for the Conducting and REporting of Delphi Studies (CREDES) (Multimedia Appendix 1).

Expert panel

The interprofessional expert panel consisted of the following 41 members recruited by the research group from different parts of Finland: 12 physicians, 13 pharmacists, 10 nurses, and six information management professionals. The recruitment had characteristics of snowball sampling, as the selected experts were invited to recommend other professionals as potential members of the expert panel. The primary criterion for the experts was MR expertise. The recruited experts needed to have experience of using patient and medication information in practice, enter MR information into data systems, and understand the possibilities and limitations of structured documentation in EHRs.

Another primary target group of the study were information management professionals (n=6) from different national authorities who had experience in developing EHR systems or other national health

information systems. Many of them also had been working as healthcare professionals, and therefore, understood the importance of structured documentation in EHR systems, bringing invaluable insights to this study. The physicians (n=12) came from various healthcare organizations and specialties (e.g., geriatrics, acute medicine, and oncology), national authorities, and organizations developing EHR systems. The pharmacists (n=13) came from various healthcare organizations, national authorities, universities, community and hospital pharmacies, as well as from organizations specialized in developing EHR systems. Likewise, the nurses (n=10) were from different areas of healthcare, working in emergency and geriatric care, some having special expertise in patient safety as well as developing EHRs and closed-loop medication processes.

EHR vendors were excluded from this study as the researchers did not want commercial interests or conflict of interests influencing the results. Furthermore, this study was primarily aimed at representing the mindset of public sector healthcare professionals who conduct MRs because public healthcare is the mainstay in Finland.

Identifying MR topics for the first Delphi round

MR topics for the first electronic Delphi round survey were identified by comprehensively reviewing literature on national and international MR definitions, procedures, practices, and inventories in various settings [20,22,24-26,48,50,67-80] (Figure 1). In addition, internationally recognized and most widely used criteria of potentially inappropriate medications (PIMs) for older adults and drug-related problems (DRPs) were utilized [55,56,81-86]. A validated tool for assessing risks for DRPs to be used by practical nurses caring for home-dwelling older adults, and a validated checklist for medication-related risk factors (LOTTA) to be self-assessed by older adults were also utilized [21,49,87]. The identified MR topics were inductively divided into six categories: 1) MR process topics, 2) potentially drug-induced symptoms, 3) the burden of risks for adverse drug effects, 4) laboratory tests and other test results, 5) medication adherence, and 6) the use of intoxicants.

The first Delphi round's survey instrument was piloted by 19 experts other than panel members before the actual round to ensure the face and content validity and usability of the survey [88]. The results of the pilot were analyzed and compared by the two main researchers who then presented their findings to the research group. Based on the pilot, a few minor changes were made to the survey. Examples of liver function tests (ALAT, ASAT and GT), examples of electrolytes (potassium and sodium) and the orthostatic test were added to laboratory tests and other test results. In addition, the wording of one item was modified (*The medicine user is afraid of possible adverse effects* was modified into *The medicine user expresses concern about possible adverse effects*).

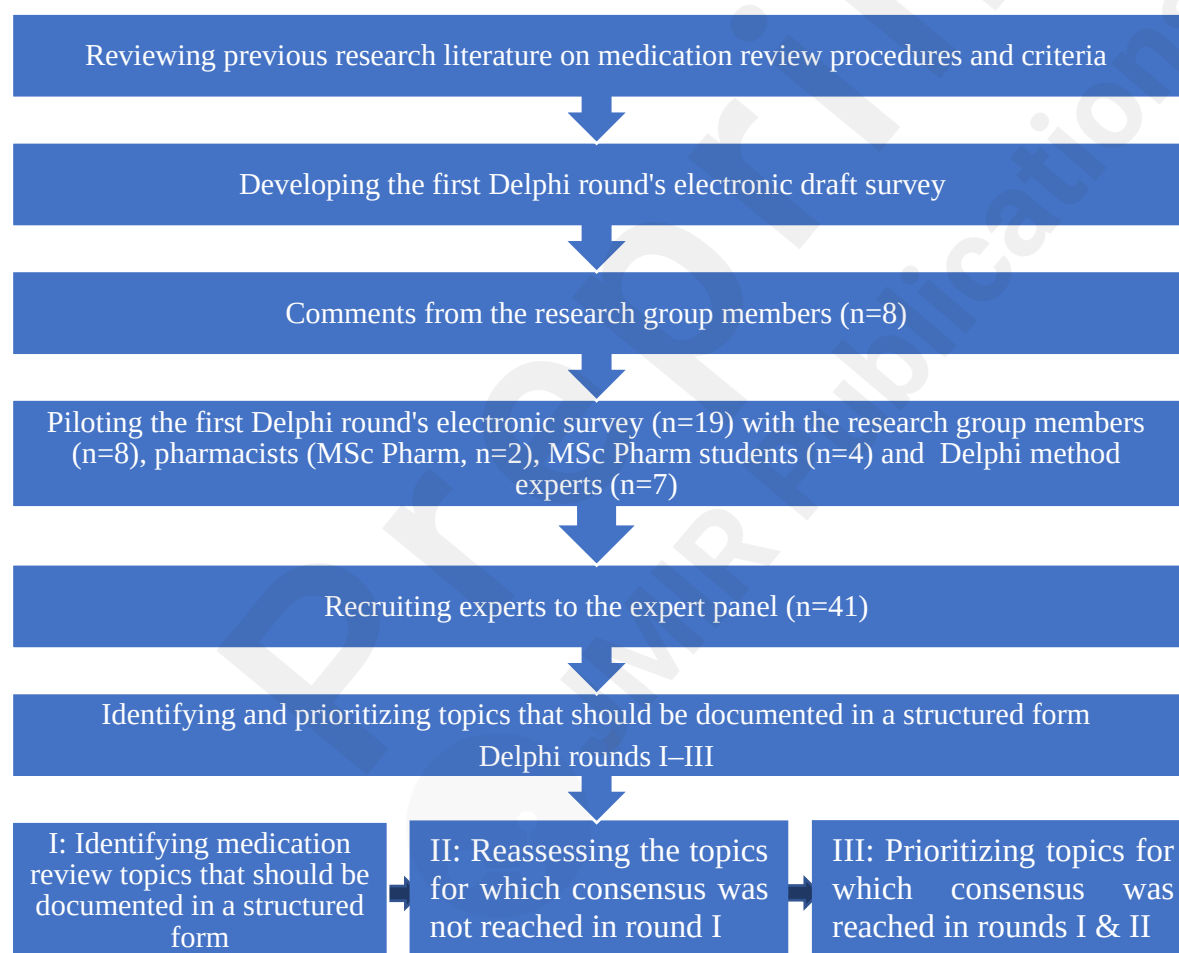


Figure 1. The study outline aimed at identifying medication review topics to be documented in a structured form in EHRs.

The panelists could choose from the following structured answer options when assessing each of the presented topics during Rounds 1 and 2: 1) Yes, as presented, 2) Yes, but modified, 3) Not at all, and 4) Cannot say. In each round, the panelists were asked to justify their answer in an open comment

field if they chose to answer with option 3) Not at all. The panelists were asked to comment and suggest changes if the presented topic was suitable but after modifications. The panelists were encouraged to provide comments and justifications for their choices in the open comment fields and to suggest new additional potentially missing topics.

Delphi round 1

During the first Delphi round, the panelists were asked to assess which MR-related patient information and other patient data (n=104) should be documented in a structured form in EHRs (Figure 2).

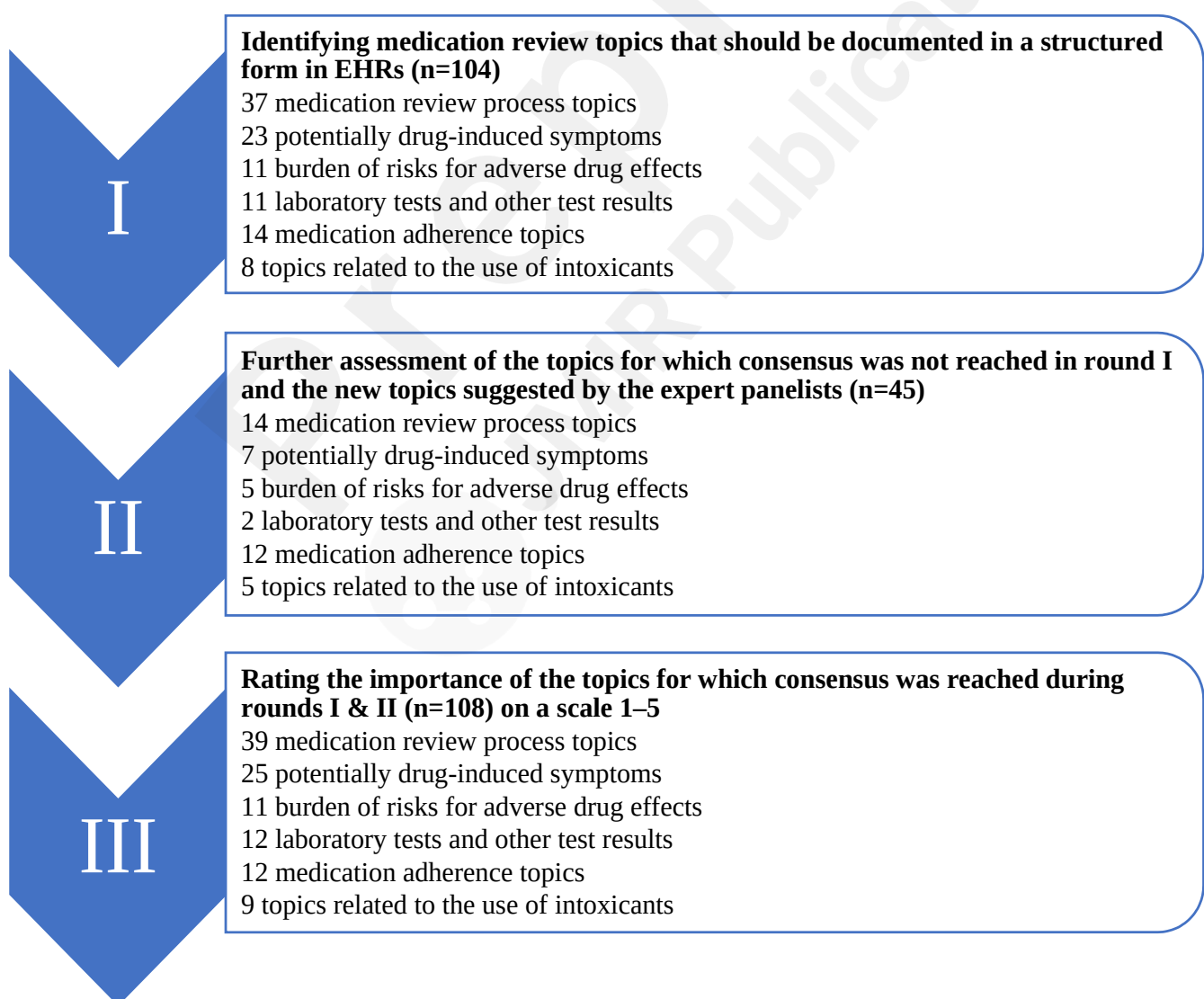


Figure 2. The distribution of medication review topic input by category for Delphi rounds I–III. Rating the importance of the topics in the third Delphi round was conducted on a Likert scale 1–5 (5: important topic, 4: moderately important topic, 3: cannot say, 2: moderately unimportant and 1: unimportant topic).

Delphi round 2

The second Delphi round consisted of the topics for which consensus was not reached during the first round. New topics suggested by the panelists during the first round were also added. Thus, a total of 45 MR topics were presented to the expert panelists during the second round (Figure 2). In addition, the expert panelists were asked to assess if MR-related information should be available in the national Kanta and MyKanta services^b.

Delphi round 3

During the third round, the expert panelists were asked to rate the importance of each of the topics for which consensus was reached during the first and second rounds (n=108) on a Likert scale from 1–5 (Figure 2). The importance of prioritization was emphasized, as not all topics can be structured at the same time. In addition, the expert panelists were asked to take the context into consideration, as not every topic is appropriate for every patient.

Data analysis

The responses from each Delphi round were analyzed with Microsoft Excel[®] by the two main researchers who then compared their findings. The results were presented to and discussed with the whole research group that also resolved possible disagreements and approved the survey instrument to be sent for the next Delphi round. The results were reported using descriptive analysis with the main parameters being frequencies and percentages with standard deviations. Responses to the open-ended questions were analyzed qualitatively using inductive content analysis to modify the

^{bb} MyKanta is an online service part of the Kanta services through which citizens can access their health information, patient data, prescriptions, and laboratory test results documented by healthcare providers [89,90].

topics for the next round [91]. The consensus limit was set at 80% [54,92].

Results

The results of the study consist of the MR topics for which consensus was reached during the three Delphi rounds. The response rates for all respondents (n=41) were 66–76% during all three Delphi rounds (Table 1).

Table 1. The number of experts participating in the three Delphi rounds, the number of respondents, and response rates in each round. Response rates varied depending on the question as answering all questions was not mandatory.

Expert panel	Round I
Experts participating in the study (n)	
All professional groups	41
Physicians	12
Pharmacists	13
Nurses	10
Information management professionals	6
Experts who answered in each round (n, %)	
All professional groups	30–31 (73–76%)
Physicians	8 (67%)
Pharmacists	13 (100%)
Nurses	5–6 (50–60%)
Information management professionals	4 (67%)

The expert panelists reached consensus on 108 of 111 topics during the three Delphi rounds (Figure 3; Table 2). During the first Delphi round, consensus was reached for 67 of 104 (64%) MR topics that the expert panelists assessed should be documented in a structured form in EHRs. Topics (n=37) for which consensus was not reached during the first Delphi round were modified and, if necessary, clarified based on the expert panelists' comments. For consensus to be reached during the first Delphi round, it was determined based on the number of respondents (n=30–31) that 24 (77%) of the experts had to accept the presented MR topic. The expert panelists reached a consensus on 42 out of 45 (93%) MR topics during the second Delphi round (Figure 3; Table 2). Depending on the varying response rate (n=27–29) for each question during the second Delphi round it was determined that

21–22 (77 %) of the experts had to accept the presented topic for consensus to be reached. A clear consensus was also reached regarding that the MR-related information should be available in the national Kanta (n=29, 100%) and MyKanta services (n=25, 86%).

During the final third round, the expert panelists rated the structured documentation of most of the topics for which consensus had been reached during the previous rounds as important or somewhat important with 92 of the 108 topics (85%) reaching a mean of at least 4.0 (Figure 3; Table 2). The 10 most important topics according to the experts are presented in Table 3.

Table 2. The identified medication review (MR) topics (n=108) that should be documented in a structured form in the electronic health record and the MR topics (n=3) for which consensus was not reached. The topics are presented in a descending order of the mean ratings and standard deviations (SD) for each topic as established in the third Delphi round on a Likert scale 1–5 (5: important topic, 4: moderately important topic, 3: cannot say, 2: moderately unimportant topic and 1: unimportant topic), and consensus percentages established in rounds I and II.

Medication review topic that should be documented in a structured form	Mean (SD)	Consensus (%)	Consensus (%)
	Round III	Round I	Round II
Medication review process topics (n=40)			
Date of medication reconciliation	4.78 (0.51)	97	
Drug-drug interactions	4.78 (0.51)	81	
Therapeutic duplication	4.74 (0.53)	74	96
Appropriateness of medication dosage	4.74 (0.59)	77	
Age	4.71 (0.85)	94	
Potential adverse drug effects	4.63 (0.56)	81	
Making a deprescribing note	4.63 (0.63)	90	
Contraindications	4.63 (0.63)	74	93
Review of the patient's complete medication list when prescribing (including medications from all specialties)	4.63 (0.88)	84	
Weight	4.61 (0.69)	94	
Medicines that require special monitoring (e.g., concentration monitoring)	4.59 (0.93)	87	
Medicines that have been tried for the patient but found to be unsuitable (+ reason)	4.56 (0.58)	77	
Potentially inappropriate medication for older patients (PIMs)	4.56 (0.64)	71	93
Planned deprescribing schedule	4.52 (0.75)	87	
Drug and excipient allergies	4.52 (0.89)	87	
Confirmation of suitability of off-label use ^a	4.44 (0.70)	-	89
Clinically significant drug-food interactions	4.44 (0.75)	55	86
Performed medication reconciliation	4.41 (0.97)	77	
Suggested medication changes ^b	4.37 (0.79)		
Desired therapeutic effects of medicines	4.33 (0.78)	77	
Suitability of medication for children (< 12 years	4.33 (0.83)	65	93

old)			
Medicines that have been tried to the patient but did not have the desired effect	4.33 (0.83)	81	
Suitability of the administration route	4.33 (0.96)	65	93
Possible overmedication compared to treatment recommendations	4.26 (1.02)	84	
Monitoring schedule ^a	4.26 (1.06)	-	93
Whether or not monitoring has been carried out	4.19 (1.11)	77	
Dosing schedule	4.15 (0.99)	77	
Height	4.11 (0.99)	94	
Possible undermedication compared to treatment recommendations	4.07 (1.04)	81	
Suitability of the dosage form	4.07 (1.11)	68	100
Clinically significant unwanted effects of drugs on laboratory test results	3.96 (0.94)	58	89
Body surface area ^c	3.86 (1.01)	42	82
Date of the patient interview or the person responsible for the medication	3.85 (1.20)	94	
Pharmacogenomic factors	3.81 (1.04)	55	86
Review of the patient's medication list when prescribing (reviewing only medications of one's own specialty)	3.81 (1.33)	65	89
Body mass index	3.75 (1.14)	65	86
Gender	3.75 (1.38)	94	
Healthcare professional who interviewed the patient/person responsible for the medication	3.30 (1.30)	87	
Healthcare professional who has carried out the monitoring	3.30 (1.32)	77	
Duration of the medication treatment ^d		77	
Potentially drug-induced symptoms (n=25)			
Inexplicable bruises/ nose bleeds/ dark stools	4.78 (0.58)	84	
Hypotension (systolic < 110mmHg)	4.74 (0.59)	84	
Repeated falls in the past 12 months	4.70 (0.61)	84	
Urinating difficulties: urinary hesitancy ^{a,e}	4.63 (0.63)	77	100
Whether or not the symptom is new	4.63 (0.79)	87	
Mental confusion	4.63 (0.79)	84	
Edemas	4.59 (0.64)	77	
Extreme fatigue	4.56 (0.64)	81	
Rash	4.52 (0.64)	77	
Visual impairments	4.52 (0.80)	81	
Nausea	4.48 (0.80)	81	
Dizziness when standing up (orthostatism)	4.48 (0.94)	81	
Memory difficulties	4.44 (0.93)	81	
Dizziness	4.41 (0.80)	84	
Diarrhea	4.37 (0.79)	81	
Prolonged sleeping difficulties	4.37 (0.79)	74	89
Walking difficulties	4.37 (1.04)	74	89
Muscle pains	4.30 (0.87)	74	89
Rigidity	4.30 (0.91)	77	
Sleepiness (sedation)	4.30 (0.91)	81	

Constipation	4.26 (0.90)	81	
Itching	4.19 (0.83)	74	81
Urinating difficulties: urinary incontinence ^{a,e}	4.15 (0.86)	77	93
Dry mouth	4.07 (0.96)	77	
Sexual function disorders ^a	3.93 (1.07)	-	85
Burden of risks for adverse drug effects (n=11)			
Risk of bleeding	4.81 (0.56)	77	
Sedation	4.78 (0.58)	75	100
Renal toxicity	4.78 (0.58)	71	100
Anticholinergic effect	4.70 (0.61)	74	100
Risk of seizures	4.67 (0.62)	77	
QT-prolongation	4.67 (0.68)	77	
Potassium balance	4.63 (0.63)	81	
Orthostatism	4.63 (0.69)	74	96
Sodium balance	4.59 (0.64)	81	
Serotonergic effect	4.56 (0.70)	77	
Constipation	4.41 (0.84)	71	96
Laboratory tests and other test results (n=12)			
Blood pressure	4.85 (0.53)	97	
Kidney function	4.81 (0.56)	93	
Blood glucose	4.78 (0.58)	93	
International normalized ratio (INR)	4.78 (0.58)	87	
Electrolytes (e.g., sodium and potassium)	4.70 (0.61)	93	
Hemoglobin	4.70 (0.61)	93	
Liver function (ALAT, ASAT, GT)	4.59 (0.64)	90	
Cholesterol	4.48 (0.80)	80	
Orthostatism	4.44 (0.93)	90	
Phosphate	4.33 (0.78)	73	86
Mini-mental state examination (MMSE) ^a	4.30 (0.95)	-	82
Calcium	4.22 (0.89)	80	
Medication adherence topics (n=12)			
The medicine user does not follow the given medication instructions because they do not understand the instructions	4.50 (0.92)	74	89
The medicine user does not follow the given medication instructions because they do not remember to take the medicine	4.46 (0.92)	77	
Difficulties with swallowing the medicine	4.46 (1.04)	81	
The medicine user does not follow the given medication instructions knowingly/intentionally	4.43 (0.88)	74	93
Difficulties with drug dosing	4.39 (1.03)	74	86
The medicine user expresses concern about possible adverse effects	4.25 (1.11)	68	89
The medicine user does not feel that the medicine has any therapeutic effect	4.21 (1.10)	65	89
Financial problems in purchasing medicines ^c	4.07 (1.12)	55	79
The medicine user does not know the purpose of the medication	4.04 (1.04)	58	79
Difficulties with opening the medicine packages ^c	3.93 (1.30)	61	79
Difficulties splitting tablets in half	3.86 (1.30)	65	79

The medicine user does not follow the given medication instructions because the dosing schedule does not fit the daily routines	3.75 (1.21)	61	82
Topics related to the use of intoxicants (n=9)			
Knowledge/suspicion of drug use disorder	4.57 (0.74)	90	
AUDIT-C scores for alcohol consumption ^a	4.43 (0.79)	-	86
Information on what other intoxicants the person is using	4.36 (0.73)	77	
Information on smoking and snuff use: quantity/day	4.14 (0.97)	81	
Alcohol use: alcohol doses per week	4.04 (1.07)	77	
Information on how often other intoxicants are used	3.93 (0.98)	71	82
Information on the quantity of use of other intoxicants	3.89 (0.96)	71	82
Performed AUDIT-C	3.89 (1.13)	87	
Alcohol use: distribution of alcohol consumption according to weekdays	3.29 (1.18)	55	86
Topics for which consensus was not reached (n=3)			
Entitlement to reimbursement of medicine expenses		64	64
Drug shortages		61	64
Number of emergency department visits related to the use of intoxicants, if reliable information is not available in any other way ^a		-	61

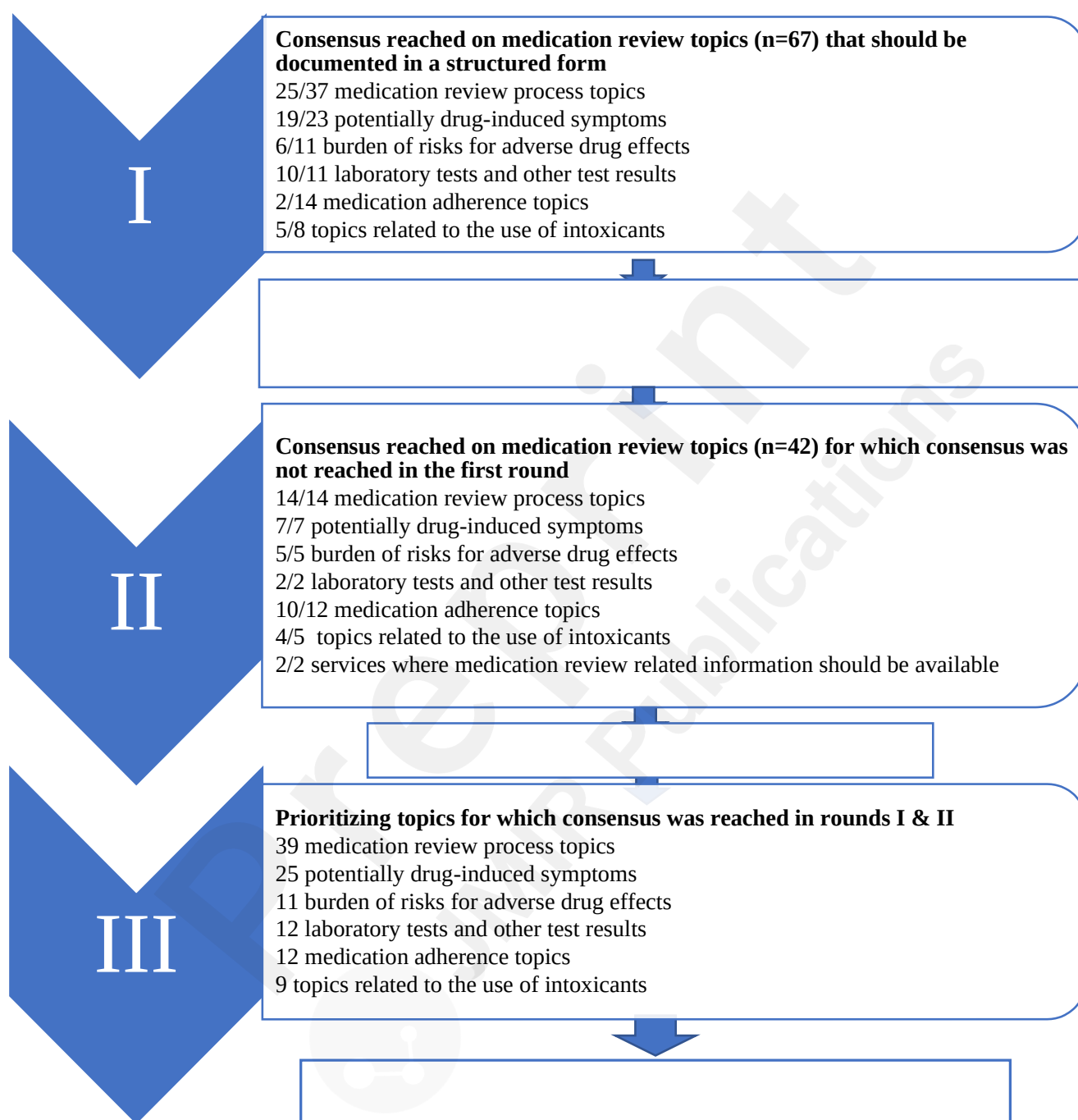


Figure 3. A summary of the results of the Delphi rounds I-III. One of the medication review process topics (duration of drug treatment) was not prioritized in the third round due to technical issues.

Table 3. The 10 most important medication review items that should be documented in a structured form in the electronic health records. The items are presented in a descending order of the mean ratings and standard deviations (SD) for each item as established in the third Delphi round on a

Likert scale 1–5 (5: important topic, 4: moderately important topic, 3: cannot say, 2: moderately unimportant topic and 1: unimportant topic).

Medication review item	Mean (SD)
Blood pressure	4.85 (0.53)
Kidney function tests	4.81 (0.56)
Risk of bleeding	4.81 (0.56)
Date of medication reconciliation	4.78 (0.51)
Drug-drug interactions	4.78 (0.51)
Inexplicable bruises/ nose bleeds/ dark stools	4.78 (0.58)
Blood glucose level	4.78 (0.58)
International normalized ratio (INR)	4.78 (0.58)
Sedative burden	4.78 (0.58)
Renal toxicity burden	4.78 (0.58)

Discussion

Principal Results

A large and committed interprofessional expert panel was obtained for this Delphi study, which enabled the identification and prioritization of MR topics that should be documented in a structured form in EHRs. To our knowledge, this is the first reported study aimed at systematically identifying these topics at the national level. Interprofessional studies involving professionals participating in patient care are essential when developing EHR systems and defining their contents. This approach ensures the views of different professional groups are integrated, enhancing the usability and compatibility of systems. The Delphi method proved to be suitable for this purpose. The structured documentation of MR topics in EHRs was perceived as important or somewhat important in most of the presented topics, including basic information about the patient's health status, medication regimen, outcomes of the MR process, potentially drug-induced symptoms, burden of risks for adverse drug effects, results of laboratory tests and other tests, adherence, and the use of intoxicants such as alcohol.

Based on the results, the patient's blood pressure, kidney function and risk of bleeding were clearly

considered the three most important topics to be documented in a structured form (Table 3). Supported by previous research, the experts raised their concern that especially the eGFR value is often ignored even though it essentially affects the drug and dosage choices especially in older patients [93-96]. The structured documentation of the kidney function could also enable the utilization of electronic decision support systems in medication management in older adults [97,98]. Our results are in line with the increasing body of evidence indicating the importance of taking the kidney function into account in medicines optimization [99]. However, the eGFR value is not yet routinely and easily available to all care team members involved in the implementation of the drug therapy [27,100,101].

Until now, a major portion of EHR data has consisted of unstructured elements [102,103]. Structured data has typically included patient demographics, vital signs, laboratory results, diagnostic codes, medication prescriptions, dosages and administration methods, whereas elements such as clinical notes and discharge summaries have been unstructured. However, our results indicate a trend towards EHR systems that facilitate individual optimization of drug treatments. Updating standard terminology within coding systems such as LOINC and RxNORM, so that they would enable embedding the identified MR items with HL7[®] FHIR[®] solutions would thereby be essential [104-106]. Even though many of the clinical observations related to MRs and basic information about the patient and medicines in use are currently expressed and documented in standard terminology, there is still a lack of specific terminology for medication use aspects. Such aspects include confirming the patient specific therapeutic suitability and the appropriateness of medications, dosage regimen, administration route, and discontinuation of the medication (deprescribing). Once embedded within FHIR profiles the exchange and use of more patient-specific MR data would be enabled and made electronically available to care team members, ideally also to community pharmacists while dispensing, counselling and reviewing medications or contributing in any way to the appropriate and safe medication use [107-109]. This is particularly

important considering aging populations leading to increased comorbidity, polypharmacy and complex treatments that needs to be managed in clinical practice [20,43-48,110-112].

Medication adherence topics were rated slightly less important to be documented compared to other datasets. This may be explained by the fact that medication adherence can be considered difficult to measure as it is usually based on patient reporting or claims-based evaluations as proportion of days covered in comparison to more easily measured markers of clinical effect, such as blood pressure or blood coagulation risk [113-116]. On the other hand, adherence as a behavioral issue may be considered complicated to measure due to a lack of valid and reliable measures feasible to be used in routine clinical practice or to be integrated in EHRs or electronic care pathways [117-121]. The adherence items identified in this study address behavioral factors related to knowledge and skills in taking medication, beliefs about consequences in taking medication and negative emotion and beliefs about capabilities in taking medication [122]. These items could serve as a short set of questions integrated into the EHR to help assess patients' medication taking behaviors and screen for adherence status. This kind of integrated measure could help to identify contributing factors or even root causes to nonadherence and to help plan effective customized physician communication, which is one of the main factors influencing medication adherence [123]. Medication adherence is a significant factor affecting real-life effectiveness of drug therapies, as only about 50% of patients treat their long-term condition according to instructions [124,125]. It would be useful to integrate medication adherence items with other treatment related adherence measures, such as diet, physical activity or other lifestyle changes. This extension may provide a more holistic understanding of adherence and disease management problems, enabling also differentiation of medication adherence issues from other treatment adherence issues. In this respect, EHRs should be developed to enable the documentation and monitoring of adherence status and self-management of the treatment to identify problems that should be solved together with the patient [123,126,127].

The expert panel strongly agreed on having structured MR information in the national Kanta patient

information repository, while they commented on several aspects to be taken into consideration if the information was made accessible to patients in the MyKanta service. One of the concerns that emerged was the risk of the patients starting independently implementing suggested medication changes without consulting a physician. This concern is in line with physicians' previous concerns that the patients' access to their own health information, especially if there is not a physician available to interpret the information, may upset patients and cause wrong interpretations [128-132]. Therefore, previous studies have concluded that not all information should be real-time and that healthcare professionals should have time to interpret the obtained results and prepare the treatment plans [128,133,134]. However, our results indicate that healthcare professionals have internalized the positive effects achieved by enabling patient access to their own information. The experts commented that the availability of information in MyKanta could increase the transparency of healthcare functions and increase a sense of trust. They recommended that the patient could see the final result or a summary of the MR in the MyKanta service, but not the possible intermediate stages. These aspects need to be considered when further developing the Kanta and MyKanta services.

Structuring the identified MR topics could further promote the uniformity and standardization of the MR process and its documentation, which have been called for [15,79,135-137]. Organized and easily accessible documentation helps to create an overall picture of the patient's situation so that those participating in the care provision can more easily make use of the previously collected essential information and notice changes or trends in the patient's condition making it easier to plan further treatment and discharge [138]. Enhancing the electronic communication between care providers has also proven to be crucial for the large-scale implementation of collaborative MRs [139,140]. Moreover, structured documentation of patient information could contribute to the secondary use: assessing reliably the effectiveness and cost-effectiveness of MRs, and thereby, possibly supporting their large-scale implementation into the routine clinical practice [139,141].

It is, however, important to recognize that although MR practices can benefit from standardization, it is still crucial to maintain flexibility in individualizing MRs according to the context, medical and patient needs, and available resources [25,141,142]. As medication use seldom is black and white, the need for maintaining flexibility also applies to the documentation of MRs. Thus, a combination of free-form text and structured documentation has been called for [143,144]. To capture clinical and contextual information and interpretations about aspects such as complexity, severity or uncertainty, a text box for entering a free-form narrative of the clinical note might be included in an EHR to supplement the structured information [145-147]. This may apply to parts of MRs where a significant degree of variation occurs hindering the use of a predefined template. Such areas could be explaining the reasons behind nonadherence and self-management problems, describing how identified adherence issues have been resolved or describing the patient's past medical history or the history of the present illness/treatment. Furthermore, EHR design aspects such as labeling structured MR items so that the structured fields are easy to understand and find and consequently used as intended, ensuring that the data entry processes in EHRs are aligned with the clinical workflow of healthcare professionals, optimal user interfaces and interoperability, need to be addressed when moving forward with structuring the identified MR items [147-150].

Strengths and limitations

Our research addresses a very current issue related to the shortcomings of electronic patient information management, particularly information related to medication treatments. The two main researchers thoroughly reviewed previous literature, MR practices, and criteria when preparing for the first Delphi round survey to identify topics that should be documented in a structured form. This was important, because the comprehensiveness and quality of the first round's survey is critical for a successful Delphi study [51-54]. The comprehensiveness of the preparatory work is supported by the fact that the expert panel proposed only a few new topics and found the presented topics appropriate. To avoid important items being excluded in the case of non-consensus or the

assumption that consensus would automatically imply the correct answer, the results of the study were continuously compared to scientific evidence and the clinical expertise of the research group that ultimately had the final say.

The expert panel was committed and large in number with a geographical and interprofessional representation. The participation rates remained high throughout the Delphi survey, reflecting commitment and interest in the subject. Of the healthcare professionals involved, pharmacists were most active, possibly making the results slightly pharmacist oriented. However, due to the strong consensus of the expert panelists, it can be assumed that no great distortion occurred. The lack of patients' perspective can be considered a limitation of this study. However, this was a conscious choice made by the researchers at this point as patients cannot be expected to be able to assess the clinical relevance and importance of the MR items presented in the survey in its current form. Because members of the research group who ultimately possessed the final say, had experience in IT architecture and EHR development, we believe that the absence of EHR vendors in the expert panel did not affect the quality of our research. Even though the Delphi method has proven to be suitable for these kinds of medication safety and risk management studies, the typical methodological limitations of the Delphi method remain [51-54]. This means that the results represent the views of the expert panel and are dependent on the selection criteria and study process. Because the panel consisted of Finnish experts working in the Finnish context, the results as such cannot be directly generalized beyond Finland, but they can be indicative for other countries and their EHR development.

Practical implications

Digital patient information management applications play an increasingly important role in the planning, implementation, monitoring and optimizing of pharmacotherapies, among other

healthcare services. In this study, a carefully built comprehensive list of MR topics was developed based on international literature. This gives EHR developers and clinicians a starting point for further prioritization of topics suitable for different operating settings for both primary and secondary use, even though MR processes in different countries differ in terms of the available patient data, patient involvement and the purpose of the MR. Such a prioritization has not yet been internationally conducted to any greater extent [136]. Our study can contribute to expanding the scope of the more traditionally reviewed MR topics towards a more comprehensive patient-centered direction as well as standardizing the MR process and its documentation.

Structuring the MR process could also contribute to the effectiveness of MRs and identifying patients benefitting from MRs, thus, supporting the large-scale integration of MRs into the standard care [139]. Especially the topics related to drug treatment monitoring could prove significant in this regard, as these often represent components that influence outcomes of MRs [138]. This combined with the fast advances in integrating AI tools for Natural Language Processing (NLP) of free text into EHRs would significantly enhance the MR process [151]. This will extend the function of the medication-related documentation in EHRs from a technical data repository towards a prospective clinical decision-support system and medication risk management system. The results of this study clarify the issues encountered during the implementation of drug treatments, identify the components of MRs, and highlight which of these components represent critical measures that should be monitored in the patients' condition during treatment. In a well-organized information system, these identified factors are quite likely to improve therapeutic outcomes, reduce risks and problems, and increase the efficiency of drug treatment implementation processes.

Further research

In this study, a strong consensus emerged for the structured documentation of a large number of MR topics. The next step in ensuring the clinical feasibility and practical implementation of structured documentation is to define how the information identified in this study should be structured in

practice so that the documentation does not become too laborious and time-consuming. Therefore, automated clinical documentation and AI applications should be developed in such a way that compiling and interpreting the information is automated, reliable and covers the essential information regarding medication treatments [136,152]. Since not all information can be structured at once, further prioritization is needed. This would enable the utilization of the structured information for secondary purposes such as identifying patients at risk of developing DRPs and thus benefit from MRs by developing alerts and utilizing AI in automatic screening. Starting with the most prioritized information related to blood pressure, eGFR and the risk of bleeding would seem logical. Involving patients and EHR vendors is an essential prerequisite to ensure that the perspectives and priorities of patients, especially what comes to adherence items, are taken into account in the further development and practical implementation of the structured documentation of MR items. Furthermore, it must be defined which MR information should be made available to patients and what information the patients themselves could document in electronic patient information systems. However, pilots are needed to test new kinds of digital documentation and their use in the medication management system.

Conclusions

The committed interprofessional expert panel had a strong consensus on a wide range of medication review related information that should be structurally documented in electronic patient information systems. Further prioritization of the information identified in this study is needed. The expert panel also had a consensus that the MR information should be available to all healthcare professionals involved in a care team and the patients themselves with some reservations.

Acknowledgments

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Open access funded by Helsinki University Library.

Authors' Contributions

TL: study concept and design, data analysis, data interpretation, and drafting and revision of the manuscript for important intellectual content. NL: study concept and design, data analysis, data interpretation, and revision of the manuscript for important intellectual content. KK, ARH, TT, MU, HN and MA: study concept and design, data interpretation, and revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

Conflicts of Interest

None declared.

Research Ethics

The study was conducted in accordance with the national guidelines for responsible conduct of research and procedures for handling allegations of misconduct in Finland by the Finnish Advisory Board on Research Integrity [153]. The ethical principles of research with human participants and ethical review in the human sciences in Finland by the Finnish National Board on Research Integrity were followed [154]. According to the guidelines, a review by the research ethics committee and their approval were not required for this study. Participating in the expert panel was voluntary and written informed consent was received from all expert panelists. The expert panelists were aware that their responses would be treated anonymously and used for research purposes only. The research material is stored in accordance with current regulations, considering the General Data Protection Regulation of the European Union (GDPR) [155].

Abbreviations

DRP: drug-related problem

EHR: electronic health record

eGFR: estimated glomerular filtration rate

INR: international normalized ratio

MR: medication review

PIM: potentially inappropriate medication

Data Availability

The data sets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

References

1. Keller ME, Kelling SE, Cornelius DC, Oni HA, Bright DR. Enhancing Practice Efficiency and Patient Care by Sharing Electronic Health Records. *Perspect Health Inf Manag.* 2015;12(Fall):1b. PMID: 26604871
2. Delice E, Polatlı LÖ, Jbara KA, Tozan H, Ertürk A. Digitalization in Healthcare: A Systematic Review of the Literature. *Proceedings.* 2023;85(1):26. doi: 10.3390/proceedings2023085026
3. Kallio S, Kumpusalo-Vauhkonen A, Järvensivu T, Mäntylä A, Pohjanoksa-Mäntylä M, Airaksinen M. Towards inter-professional networking in medication management of the aged: current challenges and potential solutions in Finland. *Scand J Prim Health Care.* 2016; 34(4):368-376. doi: 10.1080/02813432.2016.1249055
4. Kaipio J, Lääveri T, Hyppönen H, Vainiomäki S, Reponen J, Kushniruk A, et al. Usability problems do not heal by themselves: National survey on physicians' experiences with EHRs in Finland. *Int J Med Inform.* 2017;97(1):266-281. doi: 10.1016/j.ijmedinf.2016.10.010
5. Quinn M, Forman J, Harrod M, Winter S, Fowler KE, Krein SL, et al. Electronic health records, communication, and data sharing: challenges and opportunities for improving the diagnostic process. *Diagnosis (Berl).* 2019;6(3):241-248. doi: 10.1515/dx-2018-0036
6. Payne TH, Zhao LP, Le C, Wilcox P, Yi T, Hinshaw J, et al. Electronic health records contain dispersed risk factor information that could be used to prevent breast and ovarian cancer. *J Am Med Inform Assoc.* 2020;27(9):1443-1449. doi: 10.1093/jamia/ocaa152
7. Warren L, Clarke J, Darzi A. Measuring the Scale of Hospital Health Record System Fragmentation in England. *Health Serv Res.* 2020;55(S1):43-44. doi: [10.1111/1475-6773.13386](https://doi.org/10.1111/1475-6773.13386)
8. Li E, Clarke J, Ashrafian H, Darzi A, Neves AL. The Impact of Electronic Health Record

- Interoperability on Safety and Quality of Care in High-Income Countries: Systematic Review. *J Med Internet Res.* 2022;24(9):e38144. doi: 10.2196/38144
9. Steinkamp J, Kantrowitz JJ, Airan-Javia S. Prevalence and Sources of Duplicate Information in the Electronic Medical Record. *JAMA Network Open.* 2020;5(9):e2233348. doi: 10.1001/jamanetworkopen.2022.33348
 10. Atasoy H, Greenwood BN, McCullough JS. The digitization of patient care: A review of the effects of electronic health records on health care quality and utilization. *Annu Rev Public Health.* 2019;40(1):487-500. doi: 10.1146/annurev-publhealth-040218-044206
 11. Häyrynen K, Saranto K, Nykänen P. Definition, structure, content, use and impacts of electronic health records: A review of the research literature. *Int J Med Inform.* 2008;77(5):291-304. doi: 10.1016/j.ijmedinf.2007.09.001
 12. Kalra F, Fernando B, Morrison Z, Sheikh A. A review of the empirical evidence of the value of structuring and coding of clinical information within electronic health records for direct patient care. *J Innov Health Inform.* 2013;20(3):171-180. doi: 10.14236/jhi.v20i3.22
 13. Wells BJ, Nowacki AS, Chagin K, Kattan MW. Strategies for handling missing data in electronic health record derived data. *EGEMS (Wash DC)*2013;1(3):7. doi: 10.13063/2327-9214.1035
 14. Forsvik H, Voipio V, Lamminen J, Doupi P, Hyppönen H, Vuokko R. Literature review of patient record structures from the physician's perspective. *J Med Syst.* 2017;41(2):1-10. doi: 10.1007/s10916-016-0677-0
 15. Vuokko R, Mäkelä-Bengs P, Hyppönen H, Lindqvist M, Doupi P. Impacts of structuring the electronic health record: Results of a systematic literature review from the perspective of secondary use of patient data. *Int J Med Inform.* 2017;97:293-303. doi: 10.1016/j.ijmedinf.2016.10.004
 16. Ferrão JC, Duarte Oliveira M, Janela F, Martins HMG, Gartner D. Can structured EHR data

- support clinical coding? A data mining approach. *Health Syst.* 2020;1-24. doi: 10.1080/20476965.2020.1729666
17. Fennelly O, Cunningham C, Grogan L, Cronin H, O'Shea C, Roche M, et al. Successfully implementing a national electronic health record: a rapid umbrella review. *Int J Med Inform.* 2020;144:104281. doi: [10.1016/j.ijmedinf.2020.104281](https://doi.org/10.1016/j.ijmedinf.2020.104281)
18. Manskow US, Kristiansen TT. Challenges Faced by Health Professionals in Obtaining Correct Medication Information in the Absence of a Shared Digital Medication List. *Pharmacy (Basel).* 2021;9(1):46. doi: 10.3390/pharmacy9010046
19. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm.* 1990;47(3):533-542. PMID: 2316538
20. Leikola S, Tuomainen L, Peura S, Laurikainen A, Lyles A, Savela E, et al. Comprehensive medication review: development of a collaborative procedure. *Int J Clin Pharm.* 2012;34(4):510-514. doi: 10.1007/s11096-012-9662-y
21. Dimitrow SM. Development and validation of a drug-related problem risk assessment tool for use by practical nurses working with community dwelling aged [Doctoral dissertation]. University of Helsinki, Finland; 2016. Available from: <http://urn.f/URN:ISBN:978-951-51-2618-4> [accessed Oct 9, 2024]
22. Griesse-Mammen N, Hersberg K, Messerli M, Leikola S, Horvat N, Foppe van Mil JW, et al. PCNE definition of medication review: reaching agreement. *Int J Clin Pharm.* 2018;40(5):1199-1208. doi: 10.1007/s11096-018-0696-7
23. Schepel L, Aronpuro K, Kvarnström K, Holmström A-R, Lehtonen L, Lapatto-Reiniluoto O, et al. Strategies for improving medication safety in hospitals: Evolution of clinical pharmacy services. *Res Social Adm Pharm.* 2019;15(7):873-882. doi: 10.1016/j.sapharm.2019.02.004
24. Bulajeva A, Labberton L, Leikola S, Pohjanoksa-Mäntylä M, Geurts MME, de Gier JJ, et al.

- Medication review practices in European countries. *Res Social Adm Pharm.* 2014;10(5):731-740. doi: 10.1016/j.sapharm.2014.02.005
25. Kiiski A, Airaksinen M, Mäntylä A, Desselle S, Kumpusalo-Vauhkonen A, Järvensivu T, et al. An inventory of collaborative medication reviews for older adults – evolution of practices. *BMC Geriatr.* 2019;19(1):321. doi: 10.1186/s12877-019-1317-6
26. Imfeld-Isenegger TL, Soares IB, Makovec UN, Horvat N, Kos M, Foppe van Mil, et al. Community pharmacist-led medication review procedures across Europe: characterization, implementation and remuneration. *Res Social Adm Pharm.* 2020;16(8):1057-1066. doi: [10.1016/j.sapharm.2019.11.002](https://doi.org/10.1016/j.sapharm.2019.11.002)
27. Kallio SE, Kiiski A, Airaksinen MSA, Mäntylä AT, Kumpusalo-Vauhkonen AEJ, Järvensivu TP, et al. Community Pharmacists' Contribution to Medication Reviews for Older Adults: A Systematic Review. *J Am Geriatr Soc.* 2018;66(8):1613-1620. doi: 10.1111/jgs.15416
28. Mercer K, Burns C, Guirguis L, Chin J, Dogba MJ, Dolovich L, et al. Physician and pharmacist medication decision-making in the time of electronic health records: mixed-methods study. *JMIR Hum Factors.* 2018;5(3):e24. doi: 10.2196/humanfactors.9891
29. Keskimäki I, Tynkkynen L-K, Reissell E, Koivusalo M, Syrjä V, Vuorenkoski L, et al. Finland: Health system review. *Health Systems in Transition* 2019;21:2. Available from: <https://apps.who.int/iris/bitstream/handle/10665/327538/HiT-21-2-2019-eng.pdf> [accessed Oct 12, 2024]
30. Health and Social Services Reform in Finland. Official Website. Available from: <https://soteuudistus.fi/en/frontpage> [accessed Nov 13, 2024]
31. Ministry of Social Affairs and Health. Rational Pharmacotherapy Action Plan – Final Report. Reports and Memorandums of the Ministry of Social Affairs and Health 19/2018. <http://urn.fi/URN:ISBN:978-952-00-3930-1> [accessed May 3, 2024]
32. Ministry of Social Affairs and Health. Points of views on need for changes in medication

- and distribution system of medicines. Reports and Memorandums of the Ministry of Social Affairs and Health 5/2019. Available from: http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161340/STM_Rap_5_2019.pdf [accessed Aug 19, 2024]
33. Jormanainen, V. Large-scale implementation and adoption of the Finnish national Kanta services in 2010–2017: a prospective, longitudinal, indicator-based study. *Finnish Journal of EHealth and EWelfare*. 2018;10(4):381-395. doi: [10.23996/fjhw.74511](https://doi.org/10.23996/fjhw.74511)
34. Mononen N. From Paper to Cyber: Medicines Information as a strategic goal in Finland and the European Union [Doctoral dissertation]. University of Helsinki, Finland; 2020. Available from: <http://urn.fi/URN:ISBN:978-951-51-5883-3> [accessed Aug 2, 2024]
35. Kallio S. Community Pharmacists' Contribution to Prospective Medication Risk Management for Older Adults in the Context of Network Theory [Doctoral dissertation]. University of Helsinki, Finland; 2021. Available from: <http://urn.fi/URN:ISBN:978-951-51-7606-6> [accessed Sept 14, 2024]
36. Heponiemi T, Hyppönen H, Vehko T, Kujala S, Aalto A-M, Vänskä J, et al. Finnish physicians' stress related to information systems keeps increasing: a longitudinal three-wave survey study. *BMC Med Inform Decis Mak*. 2017;17(1):147. doi: 10.1186/s12911-017-0545-y
37. Kanta. Official website. Available from: <https://www.kanta.fi/en/> [accessed May 30, 2024]
38. Finnish Government. Electronic Prescription Act 61/2007 (in Finnish). Available from: <https://www.finlex.fi/fi/laki/ajantasa/2007/20070061> [accessed Dec 17, 2024]
39. Hyppönen H, Vuokko R, Doupi P, Mäkelä-Bengs P (Eds.). Structuring of the electronic patient record. Methods, assessment practices and impacts. National Institute for Health and Welfare. Report 31/2014. (abstract in English). Helsinki, 2014. Available from: https://www.julkari.fi/bitstream/handle/10024/125442/URN_ISBN_978-952-302-381-9.pdf?

[sequence=1](#) [accessed May 27, 2024]

40. Finnish Institute for Health and Welfare. The concept of medication treatment information management. The Finnish Institute for Health and Welfare (in Finnish). Available from: <https://urn.fi/URN:NBN:fi-fe2020063046391> [accessed Dec 2, 2024]
41. Kaipio J, Kuusisto A, Hyppönen H, Heponiemi T, Lääveri T. Physicians' and nurses' experiences on EHR usability: Comparison between the professional groups by employment sector and system brand. *Int J Med Inform.* 2020;134:104018. doi: 10.1016/j.ijmedinf.2019.104018
42. Finnish Institute for Health and Welfare. Statistical Yearbook on Social Welfare and Health Care 2021. Vantaa, Finland, 2021. Available from: <https://urn.fi/URN:ISBN:978-952-343-786-9> [accessed Aug 18, 2024]
43. Pitkälä KH, Juola AL, Hosia H, Teramura-Grönblad M, Soini H, Savikko, N, et al. Eight-year trends in the use of opioids, other analgesics, and psychotropic medications among institutionalized older people in Finland. *J Am Med Dir Assoc.* 2015;16(11): 973-8. doi: 10.1016/j.jamda.2015.06.009
44. Juola AL, Pylkkänen S, Kautiainen H, Bell JS, Björkman MP, Finne-Soveri H, et al. Burden of potentially harmful medications and the association with quality of life and mortality among institutionalized older people. *J Am Med Dir Assoc.* 2016;17(3):276.e9- 14. doi: 10.1016/j.jamda.2015.12.011
45. Auvinen K, Räisänen, J, Merikoski M, Mäntylä A, Kumpusalo-Vauhkonen A, Enlund H, et al. The Finnish Interprofessional Medication Assessment (FIMA): baseline findings from home care setting. *Aging Clin Exp Res.* 2019;31(10):1471-79. doi: 10.1007/s40520-018-1085-8
46. Jalava S, Pohjanoksa-Mäntylä M, Puustinen J, Airaksinen M, Dimitrow M. Use of antipsychotics among older adults in Finland – a systematic review (abstract in English).

- Finnish Medical Journal (Suom Lääkäril). 2018;73(33):1743-1749. Available from: <https://www.laakarilehti.fi/pdf/2018/SL332018-1743.pdf> [accessed May 3, 2024]
47. Kurko TA, Saastamoinen LK, Tuulio-Henriksson A, Taiminen T, Tiisonen J, Airaksinen M, Hietala J. Trends in the long-term use of benzodiazepine anxiolytics and hypnotics: A national register study for 2006 to 2014. *Pharmacoepidemiol Drug Saf.* 2018;27:674-682. doi: 10.1002/pds.4551
48. Toivo T, Airaksinen M, Dimitrow M, Savela E, Pelkonen K, Kiuru V, et al. Enhanced coordination of care to reduce medication risks in older home care clients in primary care: a randomized controlled trial. *BMC Geriatr.* 2019;19(1):332. doi: 10.1186/s12877-019-1353-2
49. Dimitrow MS, Mykkänen SI, Leikola SNS, Kivelä S-L, Lyles A, Airaksinen MSA. Content validation of a tool for assessing risks for drug-related problems to be used by practical nurses caring for home-dwelling clients aged ≥ 65 years: a Delphi survey. *Eur J Clin Pharmacol.* 2014;70(8):991-1002. doi: 10.1007/s00228-014-1699-5
50. The National Coordination Group of Professional Development of Pharmacy Services (AATE). Medication review competence recommendations for pharmacists working in community pharmacies and other health care settings (English summary). *Dosis.* 2017; 33:199-209. Available from: https://dosis.fi/wp-content/uploads/2018/03/Dosis_3_2017.pdf [accessed Dec 16, 2024]
51. Dalkey N, Helmer O. An Experimental Application of the DELPHI Method to the Use of Experts. *Manage Sci.* 1963;9:458-467. doi: [10.1287/mnsc.9.3.458](https://doi.org/10.1287/mnsc.9.3.458)
52. Campbell SM, Cantrill JA. Consensus methods in prescribing research. *J Clin Pharm Ther.* 2001;26(1):5-14. doi: 10.1046/j.1365-2710.2001.00331.x
53. Okoli C, Pawlowski SD. The Delphi method as a research tool: An example, design considerations and applications. *Information and Management.* 2004;42:15-29. doi: 10.1016/j.im.2003.11.002

54. Hsu CC, Sandford BA. The Delphi Technique: Making Sense of Consensus. Practical Assessment, Research, and Evaluation. 2007;12:10. doi: 10.7275/pdz9-th90
55. Beers MH, Ouslander JG, Rollinger I, Reuben DB, Brooks J, Beck JC. Explicit criteria for determining inappropriate medication use in nursing home residents. UCLA Division of Geriatric Medicine. Arch Intern Med. 1991;151:1825-1832. PMID: 1888249
56. Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly. An update. Arch Intern Med. 1997;157:1531-1536. PMID: 9236554
57. McLeod PJ, Huang AR, Tamblyn RM, Gayton DC. Defining inappropriate practices in prescribing for elderly people: a national consensus panel. Can Med Assoc J. 1997;1:385-391. PMID: 9033421
58. Naugler CT, Brymer C, Stool P, Arcese ZA. Development and validation of an improving prescribing in the elderly tool. Can J Clin Pharmacol. 2000;37:103-107. PMID: 10958706
59. Fick DM, Cooper JW, Wade WE, Waller JL, Maclean JR, Beers MH. Updating the beers criteria for potentially inappropriate medication use in older adults results of a US consensus panel of experts. Arch Intern Med. 2003;163:2716–2724. doi: [10.1001/archinte.163.22.2716](https://doi.org/10.1001/archinte.163.22.2716)
60. Gallagher P, Ryan C, Byrne S, Kennedy J, O'mahony D. STOPP (screening tool of older person's prescriptions) and START (screening tool to alert doctors to right treatment). Consensus validation. Int J Clin Pharm Ther. 2008;46:72–83. doi: [10.5414/cpp46072](https://doi.org/10.5414/cpp46072)
61. Rognstad S, Brekke M, Fetveit A, Spigset O, Wyller TB, Straand J. The Norwegian general practice (NORGE) criteria for assessing potentially inappropriate prescriptions to elderly patients. Scand J Prim Health Care. 2009;27:153–159. doi: [10.1080/02813430902992215](https://doi.org/10.1080/02813430902992215)
62. Maaskant JM, Eskes A, Van Rijn-Bikker P, Bosman D, Van Aalderen W, Vermeulen H. High-alert medications for pediatric patients: an international modified Delphi study. Expert Opin Drug Saf. 2013;12:805–814. doi: [10.1517/14740338.2013.825247](https://doi.org/10.1517/14740338.2013.825247)
63. Pouliot A, Vaillancourt R, Stacey D, Suter P. Defining and identifying concepts of

- medication literacy: an international perspective. *Res Soc Adm Pharm.* 2018;14: 797–804. doi: [10.1016/j.sapharm.2017.11.005](https://doi.org/10.1016/j.sapharm.2017.11.005)
64. Penm J, Vaillancourt R, Pouliot A. Defining and identifying concepts of medication reconciliation: an international pharmacy perspective. *Res Soc Adm Pharm.* 2019; 15:632–640. doi: [10.1016/j.sapharm.2018.07.020](https://doi.org/10.1016/j.sapharm.2018.07.020)
65. Watson KE, Singleton JA, Tippet V, Nissen LM. Defining pharmacists' roles in disasters: a Delphi study. *PLoS One.* 2019;14, e0227132. doi: [10.1371/journal.pone.0227132](https://doi.org/10.1371/journal.pone.0227132)
66. Metodix Ltd. Delphi Method Software. eDelphi 2023. Available from: <https://www.edelphi.org/> [accessed Aug 12, 2024]
67. American Pharmacists Association (APhA) and the National Association of Chain Drug Stores (NACDS) Foundation. Medication therapy management in pharmacy practice. Core elements of an MTM service model. Version 2.0. *J Am Pharm Assoc.* 2008;48(3):341-53. doi: 10.1331/JAPhA.2008.08514
68. Clyne W, Blenkinsopp A, Seal R. A Guide to Medication Review 2008. National Health Service (NHS); 2008. Available from: <https://www.cff.org.br/userfiles/52%20-%20CLYNE%20W%20A%20guide%20to%20medication%20review%202008.pdf> [accessed Oct 15, 2024]
69. Lamantia MA, Scheunemann LP, Viera AJ, Busby-Whitehead J, Hanson LC. Interventions to improve transitional care between nursing homes and hospitals: A systematic review. *J Am Geriatr Soc.* 2010;58:777-782. doi: 10.1111/j.1532-5415.2010.02776.x
70. Loganathan M, Singh S, Franklin BD, Bottle A, Majeed A. Interventions to optimise prescribing in care homes: Systematic review. *Age Ageing.* 2011;40:150-162. doi: 10.1093/ageing/afq161
71. Blenkinsopp A, Bond C, Raynor DK. Medication reviews. *Br J Clin Pharmacol.* 2012;74:573-580. doi: 10.1111/j.1365-2125.2012.04331.x

72. Kwint HF, Bermingham L, Faber A, Gussekloo J, Bouvy ML. The relationship between the extent of collaboration of general practitioners and pharmacists and the implementation of recommendations arising from medication review: A systematic review. *Drugs Aging*. 2013;30:91-102. doi: 10.1007/s40266-012-0048-6
73. Patterson SM, Cadogan CA, Kerse N, Cardwell CR, Bradley MC, Ryan C, et al. Interventions to improve the appropriate use of polypharmacy for older people. *Cochrane Database Syst Rev*. 2014;10:e009235. doi: 10.1002/14651858.CD008165.pub3
74. National Institute for Health and Care Excellence. Medicines Optimisation: The Safe and Effective Use of Medicines to Enable the Best Possible Outcomes. NICE Guideline 5; 2015. Available from: <https://nice.org.uk/guidance/ng5> [accessed May 26, 2024]
75. Chen TF. Pharmacist-Led Home Medicines Review and Residential Medication Management Review: The Australian Model. *Drugs Aging*. 2016;33:199-204. doi: 10.1007/s40266-016-0357-2
76. Jokanovic N, Tan ECK, van den Bosch D, Kirkpatrick CM, Dooley MJ, Bell JS. Clinical medication review in Australia: A systematic review. *Res Social Adm Pharm*. 2016;12:384-418. doi: 10.1016/j.sapharm.2015.06.007
77. Kiiski A, Kallio S, Pohjanoksa-Mäntylä M, Kumpusalo-Vauhkonen A, Järvensivu T, Airaksinen M, et al. Rationalization of Pharmacotherapy for the Elderly as an Inter-Professional Collaboration. Systematic Review (in Finnish). The Ministry of Social Affairs and Health, 2016. Available from: <http://urn.fi/URN:ISBN:978-952-00-3704-8> [accessed May 26, 2024]
78. Duncan P, Cabral C, McCahon D, Guthrie B, Ridd MJ. Efficiency versus thoroughness in medication review: a qualitative interview study in UK primary care. *Br J Gen Pract*. 2019;69(680): 190–198. doi: 10.3399/bjgp19X701321
79. Rose O, Cheong VL, Dhaliwall S, Eisalge K, Erzkamp S, Jorgenson D, et al. Standards in

- medication review: An international perspective. *Can Pharm J (Ott)*. 2020;153:215-223. doi: 10.1177/1715163520929665
80. Lias N, Lindholm T, Pohjanoksa-Mäntylä M, Westerholm A, Airaksinen M. Developing and piloting a self-assessment tool for medication review competence of practicing pharmacists based on nationally set competence criteria. *BMC Health Serv Res*. 2021;21:1274. doi: [10.1186/s12913-021-07291-6](https://doi.org/10.1186/s12913-021-07291-6)
81. Hanlon JT, Schmader KE, Samsa GP, Weinberger M, Uttech KM, Lewis IK, et al. A method for assessing drug therapy appropriateness. *J Clin Epidemiol*. 1992;45(10):1045-1051. doi: 10.1016/0895-4356(92)90144-c
82. American Geriatrics Society. American Geriatrics Society 2019 updated AGS Beers Criteria® for potentially inappropriate medication use in older adults. *J Am Geriatr Soc*. 2019;67(4): 674-694. doi: 10.1111/jgs.15767
83. Strand LM, Morley PC, Cipolle RJ, Ramsey R, Lamsam GD. Drug-related problems: their structure and function. *DICP*. 1990;24:1093-1109. doi: 10.1177/106002809002401114
84. Cipolle R, Strand L, Morley P. *Pharmaceutical Care Practice. The Clinician's Guide*. 2nd edition. McGraw-Hill Medical Publishing Division, New York, 2004.
85. Cipolle R, Strand L, Morley P. *Pharmaceutical Care Practice. The Clinician's Guide*. 3rd edition. McGraw-Hill Medical Publishing Division, New York, 2012.
86. Pharmaceutical Care Network Europe Association. Drug-related problem classification V9.00, 2019. Available from: https://www.pcne.org/upload/files/410_PCNE_classification_V9-0m.pdf [accessed May 5, 2024]
87. Kanninen J-C, Puustinen J, Airaksinen M, Kautiainen H, Koivisto A-L, Hietasalo P, et al. Self-assessed medication risk factors as part of comprehensive health screening in home-dwelling older adults. *Health Sci Rep*. 2023;6(4):e1196. doi: [10.1002/hsr2.1196](https://doi.org/10.1002/hsr2.1196)

88. Ranganathan P, Caduff C, Frampton CMA. Designing and validating a research questionnaire - Part 2. *Perspect Clin Res*. 2024;15:42-45. PMID: [38282630](#)
89. Jormanainen V, Lindgren M, Keskimäki I, Kaila M. Use of My Kanta in Finland 2010-2022. *Stud Health Technol Inform*. 2023;305:448-451. doi: 10.3233/SHTI230528
90. MyKanta. Official website. Available from: <https://www.kanta.fi/en/my-kanta-pages> [accessed Sept 7, 2024]
91. Elo S, Kyngäs H. The qualitative content analysis process. *J Adv Nurs*. 2008;62:107-115. doi: 10.1111/j.1365-2648.2007.04569.x
92. Diamond IR, Grant RC, Feldman BM, Pencharz PB, Ling SC, Moore AM, et al. Defining consensus: A systematic review recommends methodologic criteria for reporting of Delphi studies. *J Clin Epidemiol*. 2014; 67:401-409. doi: 10.1016/j.jclinepi.2013.12.002
93. Elinder C-G, Bárány P, Heimbürger O. The Use of Estimated Glomerular Filtration Rate for Dose Adjustment of Medications in the Elderly. *Drugs Aging*. 2014;31:493-99. doi: 10.1007/s40266-014-0187-z
94. Dörks M, Allers K, Schmiemann G, Herget-Rosenthal S, Hoffmann F. Inappropriate Medication in Non-Hospitalized Patients With Renal Insufficiency: A Systematic Review. *J Am Geriatr Soc*. 2017;65:853-862. doi: 10.1111/jgs.14809
95. Tesfaye WH, Castelino R, Wimmer B, Zaidi ST. Inappropriate prescribing in chronic kidney disease: A systematic review of prevalence, associated clinical outcomes and impact of interventions. *Int J Clin Pract*. 2017;71:e12960. doi: 10.1111/ijcp.12960
96. Ibrahim J, Hazzan AD, Mathew AT, Sakhiya V, Zhang M, Halinski C, et al. Medication discrepancies in late-stage chronic kidney disease. *Clin Kidney J*. 2018;11(4):507-12. doi: 10.1093/ckj/sfx135
97. Koskela T, Sandström S, Mäkinen J, Liira H. User perspectives on an electronic decision-support tool performing comprehensive medication reviews - a focus group study with

- physicians and nurses. BMC Med Inform Decis Mak. 2016;16:6. doi: 10.1186/s12911-016-0245-z
98. Alagiakrishnan K, Wilson P, Sadowski CA, Rolfson D, Ballermann M, Ausford A, et al. Physicians' use of computerized clinical decision supports to improve medication management in the elderly – the Seniors Medication Alert and Review Technology intervention. Clin Interv Aging. 2016;11:73–81. doi: 10.2147/CIA.S94126
99. Modig S, Lannering C, Östgren CJ, Mölsted S, Midlöv P. The assessment of renal function in relation to the use of drugs in elderly in nursing homes; a cohort study. BMC Geriatr. 2011;11:1. doi: [10.1186/1471-2318-11-1](https://doi.org/10.1186/1471-2318-11-1)
100. Kallio S, Eskola T, Pohjanoksa-Mäntylä M, Airaksinen M. Medication risk management in routine dispensing in community pharmacies. Int J Environ Res Public Health. 2020;17(21):8186. doi: 10.3390/ijerph17218186
101. Ellinger LK, Bursua A, Galanter W, Schiff GD, Lambert BL. Empowering pharmacists with data: Steps toward proactive medication safety and quality improvement. J Am Coll Clin Pharm. 2024;8:824-31. doi: 10.1002/jac5.2002
102. Bush RA, Kuelbs CL, Ryu J, Jian W, Chiang GJ. Structured Data Entry in the Electronic Medical Record: Perspectives of Pediatric Specialty Physicians and Surgeons. J Med Syst. 2017;41:75. doi: 10.1007/s10916-017-0716-5
103. Shah SM, Khan RA. Secondary Use of Electronic Health Record: Opportunities and Challenges. IEEE Access. 2020;8:136947-136965. doi: 10.1109/ACCESS.2020.3011099
104. Regenstrief Institute. SearchLOINC. Available from: <https://loinc.org/search/> [accessed Mar 1, 2025]
105. National Library of Medicine. RxNORM. Available from: <https://www.nlm.nih.gov/research/umls/rxnorm/index.html> [accessed Feb 28, 2025]
106. Health Level 7. FHIR. Available from: <https://www.hl7.org/fhir/index.html> [accessed

Mar 2, 2025]

107. Salgado TM, Correr CJ, Moles R, Benrimoj SI, Fernandez-Llimos F. Assessing the implementability of clinical pharmacist interventions in patients with chronic kidney disease: an analysis of systematic reviews. *Ann Pharmacother*. 2013;47(11):1498-506. et al. doi: 10.1177/1060028013501802
108. Pourrat X, Sipert A-S, Gatault P, Sautenet B, Hay N, Guinard F, et al. Community pharmacist intervention in patients with renal impairment. *Int J Clin Pharm*. 2015;37(6):1172-9. doi: 10.1007/s11096-015-0182
109. Mongaret C, Aubert L, Lestrille A, Albaut V, Kreit P, Herlem E, et al. The Role of Community Pharmacists in the Detection of Clinically Relevant Drug-Related Problems in Chronic Kidney Disease Patients. *Pharmacy*. 2020;8(2):89. doi: 10.3390/pharmacy8020089
110. Gao L, Maidment I, Matthews FE, Robinson L, Brayne C. Medication usage change in older people (65+) in England over 20 years: findings from CFAS I and CFAS II. *Age Ageing*. 2018;47(2):220-25. doi: [10.1093/ageing/afx158](https://doi.org/10.1093/ageing/afx158)
111. Young EH, Pan S, Yap AG, Reveles KR, Bhakta K. Polypharmacy prevalence in older adults seen in United States physician offices from 2009 to 2016. *PLoS ONE*. 2021;16(8):e0255642. doi: [10.1371/journal.pone.0255642](https://doi.org/10.1371/journal.pone.0255642)
112. Delara M, Murray L, Jafari B, Bahji A, Goodarzi Z, Kirkham J, et al.. Prevalence and factors associated with polypharmacy: a systematic review and meta-analysis. *BMC Geriatr*. 2022;22:601. doi: [10.1186/s12877-022-03279-x](https://doi.org/10.1186/s12877-022-03279-x)
113. Tarn DM, Mattimore TJ, Bell DS, Kravitz RL, Wenger NS. Provider views about responsibility for medication adherence and content of physician-older patient discussions. *J Am Geriatr Soc*. 2012;60(6):1019-26. doi: 10.1111/j.1532-5415.2012.03969
114. Kjeldsen LJ, Nielsen TRH, Olesen C. The challenges of outcome research. *Int J Clin Pharm*. 2016;38(3):705-8. doi: 10.1007/s11096-016-0293-6

115. Berra E, Azizi M, Capron A, Høieggen A, Rabbia F, Kjeldsen SE, et al. Evaluation of Adherence Should Become an Integral Part of Assessment of Patients With Apparently Treatment-Resistant Hypertension. *Hypertension*. 2016;68(2):297–306. doi: 10.1161/HYPERTENSIONAHA.116.07464
116. Kekäle M, Talvensaaari K, Koskenvesa P, Porkka K, Airaksinen M. Chronic myeloid leukemia patients' adherence to peroral tyrosine kinase inhibitors compared with adherence as estimated by their physicians. *Patient Prefer Adherence*. 2017;4;8:1619-1627. doi: 10.2147/PPA.S70712
117. Nieuwlaat R, Wilczynski N, Navarro T, Hobson N, Jeffery R, Keenanasseril A, et al. Interventions for enhancing medication adherence. *Cochrane Database Syst Rev*. 2014;11:CD00001. doi: 10.1002/14651858.CD000011.pub4
118. Lam WY, Fresco P. Medication Adherence Measures: An Overview. *Biomed Res Int*. 2015;2015:217047. doi: 10.1155/2015/217047
119. Bokhour BG, Berlowitz DR, Long JA, Kressin NR. How do providers assess antihypertensive medication adherence in medical encounters? *J Gen Intern Med*. 2006;21(6):577-583. doi: 10.1111/j.1525-1497.2006.00397.x
120. Curtis JR, Cai Q, Wade SW, Stolshek BS, Adams JL, Balasubramanian A, et al. Osteoporosis medication adherence: Physician perceptions vs. patients' utilization. *Bone*. 2013;55(1):1-6. doi: 10.1016/j.bone.2013.03.003
121. Heeb RM, Kreuzberg V, Grossmann V. Physicians' Assessment of Medication Adherence: A Systematic Review. *J Pharma Care Health Sys*. 2019;6:1. doi: 10.4172/2376-0419.1000202
122. De Tran V, Vo TML, Vo QLD, Nguyen MT, Nguyen MC, Dewey RS, Nguyen THY. Behavioral factors associated with medication adherence among hypertensive patients using the theoretical domains framework. *Explor Res Clin Soc Pharm*. 2024;16:100510. doi:

[10.1016/j.rcsop.2024.100510](https://doi.org/10.1016/j.rcsop.2024.100510)

123. Kvarnström K, Westerholm A, Airaksinen M, Liira H. Factors Contributing to Medication Adherence in Patients with a Chronic Condition: A Scoping Review of Qualitative Research. *Pharmaceutics*. 2021; 13(7):1100 doi: 10.3390/pharmaceutics13071100
124. World Health Organization. Medication Without Harm – Global Patient Safety Challenge. 2017. Available from: <https://apps.who.int/iris/bitstream/handle/10665/255263/WHO-HIS-SDS-2017.6-eng.pdf;jsessionid=7101003388F62C8E9B433E7D11C77940?sequence=1> [accessed May 23, 2024]
125. Mohammed MA, Moles RJ, Chen TF. Medication-related burden and patients' lived experience with medicine: a systematic review and metasynthesis of qualitative studies. *BMJ Open*. 2016;6:e010035. doi: 10.1136/bmjopen-2015-010035
126. Bailey SC, Wallia A, Wright S, Wismer GA, Infanzon AC, Curtis LM, et al. Electronic Health Record–Based Strategy to Promote Medication Adherence Among Patients With Diabetes: Longitudinal Observational Study. *J Med Internet Res*. 2019;21(10):e13499. doi: 10.2196/13499
127. Blecker S, Schoenthaler A, Martinez TR, Belli HM, Zhao Y, Wong C, et al. Leveraging Electronic Health Record Technology and Team Care to Address Medication Adherence: Protocol for a Cluster Randomized Controlled Trial. *JMIR Res Protoc*. 2023;12:e47930. doi: 10.2196/47930
128. Beard L, Schein R, Morra D, Wilson K, Keelan J. The challenges in making electronic health records accessible to patients. *J Am Med Inform Assoc*. 2012;19(1):116-120. doi: 10.1136/amiajnl-2011-000261
129. Giardina TD, Menon S, Parrish DE, Sittig DF, Singh H. Patient access to medical records and healthcare outcomes: a systematic review. *J Am Med Inform Assoc*.

- 2014;21(4):737-741. doi: 10.1136/amiajnl-2013-002239
130. de Lusignan S, Mold F, Sheikh A, Majeed A, Wyatt JC, Quinn T, et al. Patients' online access to their electronic health records and linked online services: a systematic interpretative review. *BMJ Open*. 2014;4(9):e006021-e006021. doi: 10.1136/bmjopen-2014-006021
131. Mold F, de Lusignan S, Sheikh A, Majeed A, Wyatt JC, Quinn T, et al. Patients' online access to their electronic health records and linked online services: a systematic review in primary care. *Br J Gen Pract*. 2015;65(632):e141-151. doi: 10.3399/bjgp15X683941
132. D'Costa SN, Kuhn IL, Fritz Z. A systematic review of patient access to medical records in the acute setting: practicalities, perspectives and ethical consequences. *BMC Med Ethics*. 2020;21:18. doi: 10.1186/s12910-020-0459-6
133. Grossman LV, Choi SW, Collins S, Dykes PC, O'Leary KJ, Rizer M, et al. Implementation of acute care patient portals: recommendations on utility and use from six early adopters. *J Am Med Inform Assoc*. 2018;25(4):370-379. doi: 10.1093/jamia/ocx074
134. Hammer A, Wagner A, Rieger MA, Manser T. Assessing the quality of medication documentation: development and feasibility of the MediDocQ instrument for retrospective chart review in the hospital setting. *BMJ Open*. 2019;9(11):e034609. doi: 10.1136/bmjopen-2019-034609
135. Armistead LT, Cruz A, Levitt JM, McClurg MR, Blanchard CM. Medication therapy problem documentation and reporting: A review of the literature and recommendations. *J Am Coll Clin Pharm*. 2021;4(10):1337-47. doi: 10.1002/jac5.1502
136. Al-Diery T, Freeman H, Page AT, Cross AJ, Hawthorne D, et al. What types of information do pharmacists include in comprehensive medication management review reports? A qualitative content analysis. *Int J Clin Pharm*. 2023;45(3):712-721. doi:

10.1007/s11096-023-01561-5

137. Elliott RA, Tan Y, Chan V, Richardson B, Tanner F, Dorevitch MI. Pharmacist–Physician Collaboration to Improve the Accuracy of Medication Information in Electronic Medical Discharge Summaries: Effectiveness and Sustainability. *Pharmacy (Basel)*. 2019;8(1):2. doi: 10.3390/pharmacy8010002
138. Craske ME, Hardeman W, Steel N, Twigg MJ. Components of pharmacist-led medication reviews and their relationship to outcomes: a systematic review and narrative synthesis. *BMJ Qual Saf*. 2024;33(12):808-822. doi: 10.1136/bmjqs-2024-017283
139. Husband A, Robinson-Barella A. Integration and connection: the key to effectiveness of large-scale pharmacist-led medication reviews? *BMJ Qual Saf*. 2024;33(12):765-768. doi: 10.1136/bmjqs-2024-017740
140. Saranto K, Kinnunen UM, Liljamo P, Mykkänen M, Kuusisto A, Kivekäs E. (2022). Interprofessional Structured Data: Supporting the Primary and Secondary Use of Patient Documentation. In: Hübner, U.H., Mustata Wilson, G., Morawski, T.S., Ball, M.J. (eds) *Nursing Informatic. Health Informatics*. Springer, Cham. doi: 10.1007/978-3-030-91237-6_14
141. Toivo T, Dimitrow M, Puustinen J, Savela E, Pelkonen K, Kiuru V, et al. Coordinating resources for prospective medication risk management of older home care clients in primary care: procedure development and RCT study design for demonstrating its effectiveness. *BMC Geriatr*. 2018;18(1):74. doi: 10.1186/s12877-018-0737-z
142. Toivo T. Prospective medication risk management in primary care: Enhancing coordination of care and community pharmacists' participation [Doctoral dissertation]. University of Helsinki, Finland; 2020. Available from: <http://urn.fi/URN:ISBN:978-951-51-6464-3> [accessed Nov 2, 2024]
143. Johnson SB, Bakken S, Dine D, Hyun S, Mendonca E, Morrison F, Bright T, Van

- Vleck T, Wrenn J, Stetson P. An Electronic Health Record Based on Structured Narrative. *J Am Med Inform Assoc.* 2008;15:54-64. doi: [10.1197/jamia.M2131](https://doi.org/10.1197/jamia.M2131)
144. Tayefi M, Ngo P, Chomutare T, Dalianis H, Salvi E, Budrionis A, Godtliebsen F. Challenges and opportunities beyond structured data in analysis of electronic health records. *WIREs Comput Stat.* 2021;13:e1549. doi: 10.1002/wics.1549
145. de Lusignan S, Wells SE, Hague NJ, Thiru K. Managers See the Problems Associated with Coding Clinical Data as a Technical Issue whilst Clinicians also See Cultural Barriers. *Methods Inf Med.* 2003;42:416-422. doi: 10.1055/s-0038-1634239
146. Ebberts T, Kool RB, Smeele LE, Dirven R, den Besten CA, Karssemakers LHE, Verhoeven T, Herruer JM, van den Broek GB, Takes RP. The Impact of Structured and Standardized Documentation on Documentation Quality; a Multicenter, Retrospective Study. *J Med Syst.* 2022;46:46. doi: 10.1007/s10916-022-01837-9
147. Kazi S, Handley JL, Milicia AP, Ratwani RM, Adams KT, Jones R, Krevat S. Free Text as Part of Electronic Health Record Orders: Context or Concern?. *Patient Saf.* 2024;6. doi: 10.33940/001c.118587
148. Skentzos S, Shubina M, Plutzky J, Turchin A. Structured vs. Unstructured: Factors Affecting Adverse Drug Reaction Documentation in an EMR Repository. *AMIA Annu Sym Proc.* 2011:1270-9.
149. Ebberts T, Takes RP, Smeele LE, Kool RB, van den Broek GB, Dirven R. The implementation of a multidisciplinary, electronic health record embedded care pathway to improve structured data recording and decrease electronic health record burden. *Int J Med Inform.* 2024;184:105344. doi: [10.1016/j.ijmedinf.2024.105344](https://doi.org/10.1016/j.ijmedinf.2024.105344)
150. Cahill M, Cleary BJ, Cullinan. The influence of electronic health record design on usability and medication safety: systematic review. *BMC Health Serv Res.* 2025;25:31. doi: 10.1186/s12913-024-12060-2

151. Khosravi B, Rouzrokh P, Erickson BJ. Getting More Out of Large Databases and EHRs with Natural Language Processing and Artificial Intelligence. The Future Is Here. J Bone Joint Surg Am. 2022; 104(Suppl 3):51-55. doi: 10.2106/JBJS.22.00567
152. Falcetta FS, de Almeida FK, Lemos JCS, Goldim JR, da Costa CA. Automatic documentation of professional health interactions: A systematic review. Artif Intell Med. 2023;137:102487. doi: 10.1016/j.artmed.2023.102487.
153. Finnish Advisory Board on Research Integrity (TENK). Responsible Conduct of Research and Procedures for Handling Allegations of Misconduct in Finland. Guidelines of the Finnish Advisory Board on Research Integrity, 2012. Available from: http://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf [accessed May 15, 2024]
154. Finnish National Board on Research Integrity TENK. The Ethical Principles of Research with Human Participants and Ethical Review in the Human Sciences in Finland. Finnish National Board on Research Integrity TEKN Guidelines 2019, 2019. Available from: https://tenk.fi/sites/default/files/2021-01/Ethical_review_in_human_sciences_2020.pdf [accessed May 15, 2024]
155. Office of a Data Protection Ombudsman. Scientific research and data protection. 2020. Available from: <https://tietosuoja.fi/en/scientific-research-and-data-protection> [accessed May 15, 2024]

^a Topics (n=8) suggested by expert panelists and added to the second Delphi round.

^b Topic added by the research group to the third Delphi round.

^c Based on the research group's decision, "Yes, but modified" responses (n=3) were included in consensus reached responses.

^d Due to technical issues, this topic was not prioritized in the third Delphi round.

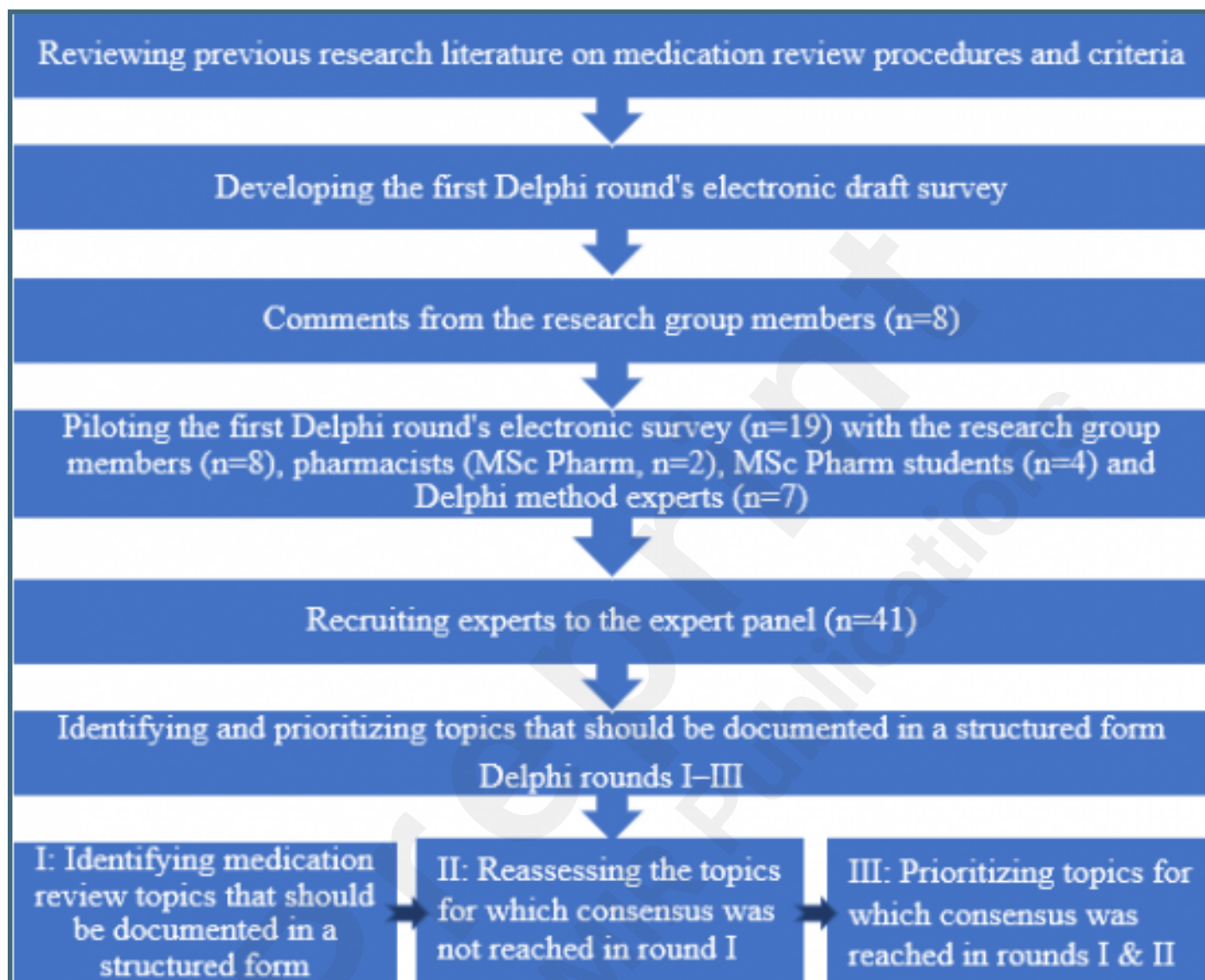
^e The topic was specified and divided into two topics and repeated in the second round even though consensus was reached in the first round.



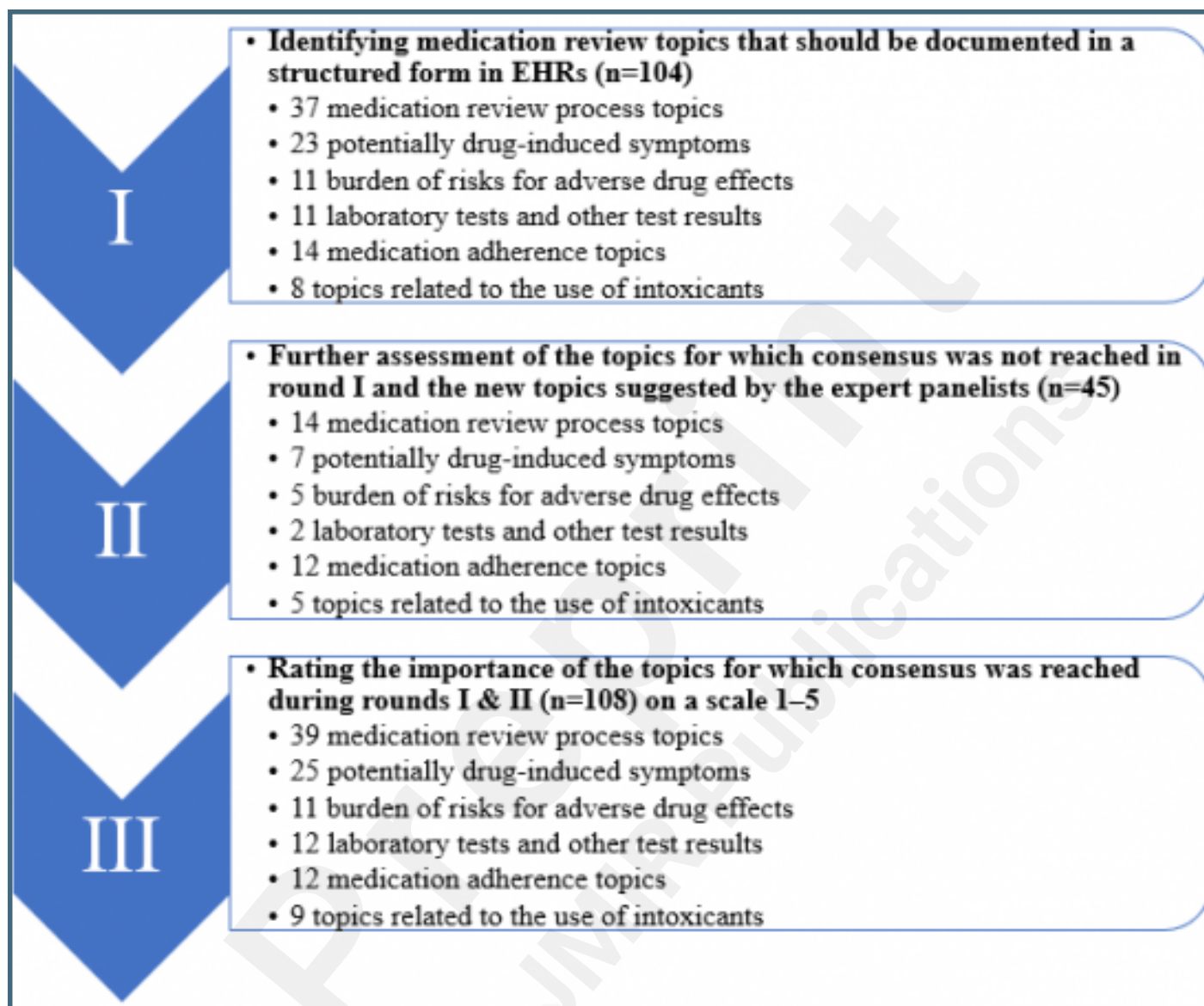
Supplementary Files

Figures

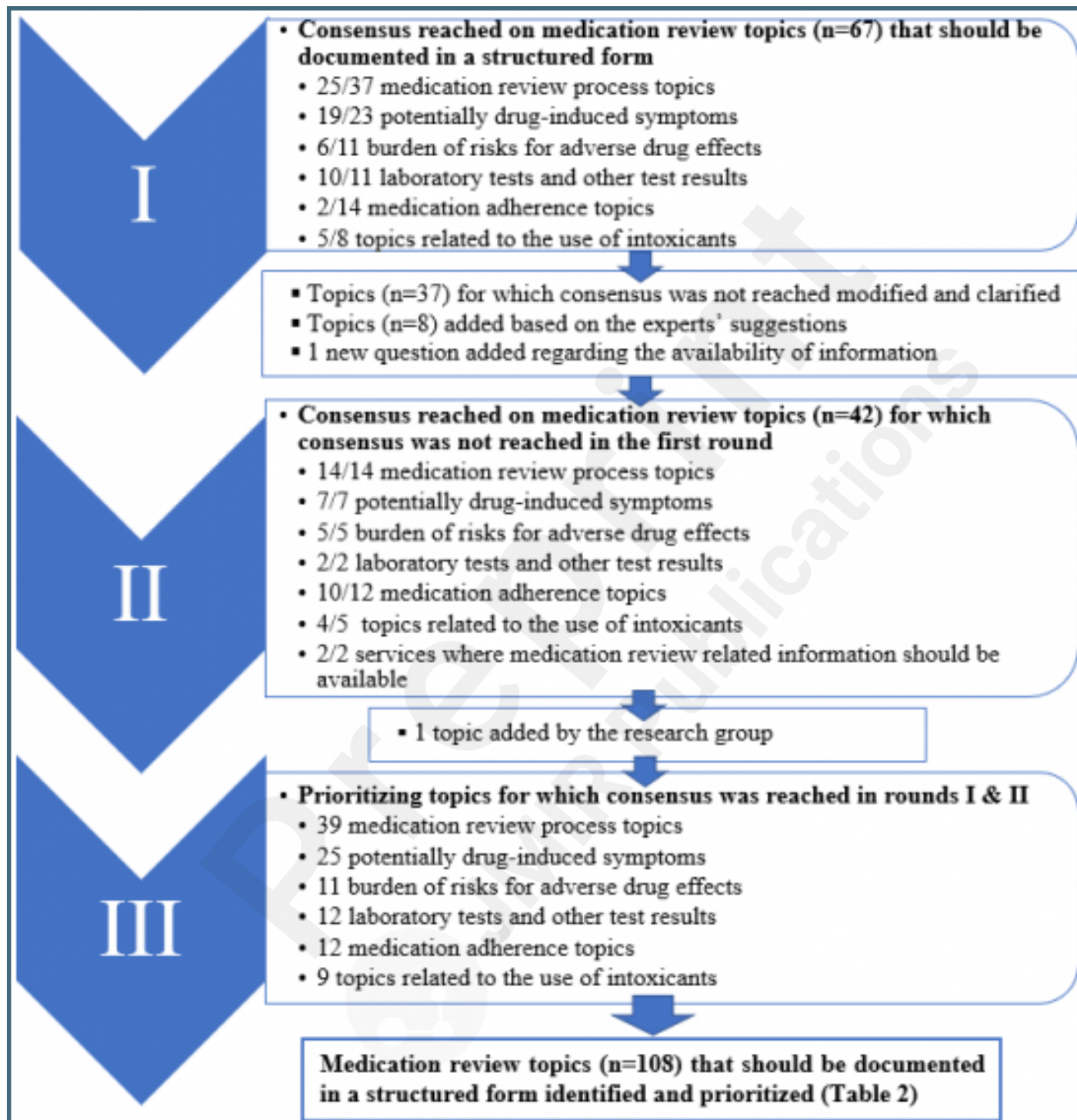
The outline of the study aimed at identifying medication review topics that should be documented in a structured form in EHRs.



The distribution of medication review topic input by category for Delphi rounds I–III. Rating the importance of the topics was conducted on a Likert scale 1–5 (5: important topic, 4: moderately important topic, 3: cannot say, 2: moderately unimportant and 1: unimportant topic).



A summary of the results of the Delphi rounds I–III. One of the medication review process topics (duration of drug treatment) was not prioritized in the third round due to technical issues.



Multimedia Appendixes

Recommendations for the Conducting and REporting of Delphi Studies (CREDES).
URL: <http://asset.jmir.pub/assets/755513811fc3e27a30fa463f9c957d56.pdf>

