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Alharthi, MS., Scott, S., Hughes, C., Bond, C., Hatah, E., Bryant, L., Holland, R., Kosari, S., Baqir, W., Loke, Y., & Wright, D. (2024). Taxonomy development for term standardization in activity resulting from medication review processes: a Delphi study. *International Journal of Pharmacy Practice*, 32(2), 180–185.  
<https://doi.org/10.1093/ijpp/riae002>

**Published in:**  
International Journal of Pharmacy Practice

**Document Version:**  
Publisher's PDF, also known as Version of record

**Queen's University Belfast - Research Portal:**  
[Link to publication record in Queen's University Belfast Research Portal](#)

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# Taxonomy development for term standardization in activity resulting from medication review processes: a Delphi study

Mohammed S Alharthi<sup>1,\*</sup>, Sion Scott<sup>2</sup>, Carmel Hughes<sup>3</sup>, Christine Bond<sup>4</sup>, Ernieda Hatah<sup>5</sup>, Linda Bryant<sup>6</sup>, Richard Holland<sup>7</sup>, Sam Kosari<sup>8</sup>, Wasim Baqir<sup>9</sup>, Yoon Loke<sup>10</sup> and David Wright<sup>2</sup>

<sup>1</sup>Department of Clinical Pharmacy, College of Pharmacy, Taif University, Taif 21947, Saudi Arabia

<sup>2</sup>School of Healthcare, University of Leicester, Leicester, LE1 7RH, United Kingdom

<sup>3</sup>School of Pharmacy, Queen's University Belfast, Belfast, BT7 1NN, United Kingdom

<sup>4</sup>Institute of Applied Health Sciences, University of Aberdeen, Aberdeen, AB24 3FX, United Kingdom

<sup>5</sup>Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Kuala Lumpur, 43600, Malaysia

<sup>6</sup>Department of General Practice and Primary Health Care, University of Auckland, Auckland, 1010, New Zealand

<sup>7</sup>Exeter Medical School, University of Exeter, Exeter, EX4 4PY, United Kingdom

<sup>8</sup>Discipline of Pharmacy, Faculty of Health, University of Canberra, Bruce, 2617, Australia

<sup>9</sup>Northumbria Healthcare NHS Trust and NHS, NE27 0QJ, United Kingdom

<sup>10</sup>School of Medicine, Health Policy and Practice, University of East Anglia, Norwich, NR4 7TJ, United Kingdom

\*Correspondence: Department of Clinical Pharmacy, College of Pharmacy, Taif University, Taif 21947, Saudi Arabia. E-mail: [Ms.harthi@tu.edu.sa](mailto:Ms.harthi@tu.edu.sa)

## Abstract

**Background:** Medication review (MR) is the systematic assessment of a patient's medications for safety and effectiveness by a healthcare professional. The language used to describe MR activity, such as stopped medicine and increased dose, should be consistent across studies to assist researchers compare how different services operate and identify their mechanism of impact.

**Aim:** To develop an international taxonomy of standardized terms and activity definitions related to medication reviews.

**Method:** This was a three-stage Delphi-based consensus study with international medication review experts. A systematic review provided MR activity terms for the survey. Experts rated their consensus on each activity term and its definition on a Likert scale and provided written feedback. The consensus was 75% panel agreement. At each stage, consensus elements were retained, and feedback was used to revise definitions.

**Results:** Seven experts were recruited for the study (response rate 15.2%) from four countries: the United Kingdom ( $n = 4$ ), New Zealand ( $n = 1$ ), Australia ( $n = 1$ ), and Malaysia ( $n = 1$ ). The following terms achieved consensus: the term Medication as a descriptor for MR terms; discontinue medication, start medication, dose increase, dose decrease, dosage form change, and medication safety and efficacy monitor to describe MR activity; Educate to describe the delivery of healthcare professionals and patients/carers education.

**Conclusion:** Standardized medication review activity terms and definitions have been selected for universal adoption in all future MR research to facilitate a meaningful comparison of process evaluations within different settings.

**Keywords:** medication review; taxonomy; standardization; consensus; process evaluation

## Introduction

Medication review (MR) is an integral part of the practice of numerous healthcare professionals and was defined by Pharmaceutical Care Network Europe (PCNE) as a systematic evaluation of a patient's medications with the objective of optimizing medicine use and enhancing health outcomes [1]. PCNE categorized MR into three levels: type 1 includes the medication history; type 2a includes medication history and patient interview; and type 2b includes medication history and clinical data. Type 3, the most advanced level of review, includes medication history, patient interviews, and clinical data [1]. While the PCNE developed an international definition of MR, the various activity associated with MR, such as stopping, starting, monitoring, and increasing or decreasing dose have not been defined systematically and standardized. Without precision of meaning and standardization of these

terms, it is not possible to make valid comparisons between the nature and outcomes of different approaches.

A systematic review in 2022 found a wide range of different terms and definitions for MR activity and overarching activity [2]. For example, while one of the studies included in the systematic review described different MR activity as 'stop medicine', 'start medicine', 'dose increase/decrease', 'dose reduction/alter dose', 'switch medicine/switch drug', 'alter formulation', 'alter timing' and 'test to monitor medicine' [3], another referred to 'discontinue drug', 'add drug', 'change dose', 'change drug', 'change dosage form', 'change timing/change schedule', and additional monitoring [4]. Furthermore, the terms 'educate' [5–9], 'advise' [4, 10], 'aid' [4], and 'counsel' [6–8, 11, 12] were used to describe overarching activity surrounding education. In summary, different definitions of MR activity and overarching activity (i.e. clinical, technical, and educational activity) had been developed

Received: 17 August 2023 Accepted: 23 January 2024

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for the purposes of individual projects without international agreement between researchers.

In 2015, the UK's Medical Research Council guidance on process evaluation recognized the need to design studies to enable a better understanding of how complex interventions, such as medication review, operate (or not) and as such collation of data on activity performed within the delivery of the intervention was central to this [13]. The concepts of intervention fidelity ('whether the intervention was delivered as intended'); dose ('how much of the intervention is delivered to each participant'); and reach ('the proportion of individuals who should have received the intervention') were defined. To determine these within medication review-based interventions an accurate description of what the exact healthcare professional actions when making any changes to the medication regime is required [13]. Standardization of terms and definitions of MR activity and overarching activity would enable researchers to appropriately compare fidelity, dose, and reach between different medication review interventions. This study aimed to standardize terms and definitions of MR activity and the overarching activity using consensus methodology from a panel of experts.

## Methods

This study used Delphi consensus [14]. The Leicester Medicine and Biological Sciences Research Ethics Committee approved (Reference 33882-msma10-ls: health sciences). The panel of experts was formed from a purposive sample of individuals representing a range of academic disciplines. To protect study participants' privacy, researchers, participants, and research have been anonymized. These authors were chosen from the abstract stage of our previous systematic review [2], and had written three or more field studies to ensure each panel member had enough experience to choose the best terms and definitions for MR activity, maximizing the taxonomy's effectiveness and quality. These authors could participate in our medication review study. In the study, 46 experts were invited. To reach a consensus, a three-round Delphi survey was carried out. An invitation email was sent to the eligible potential participants. The email explained the purpose of the study and informed potential participants of how the study would be conducted. The participants provided written, informed consent to take part in the consensus study and provided demographic information including age and gender. Delphi study recruitment targets depend on the research context and expert recommendations. There is no universally agreed-upon number, but previous studies suggest a Delphi process should include 10–600 experts [15].

### Round one

Researchers used systematic review terms and definitions to create the survey (Supplementary File 1) [2]. The research team proposed literature-based definitions for review. There were options for all literature terms. Research groups CB, DA, and CH piloted and refined the survey. This piloting helped identify survey statement issues and select informed responses.

Survey data was collected online Microsoft® Forms. The survey comprised three sections as follows:

- Section 1: Generic language used in conjunction with the medication review activity term e.g. drug, medicine,

therapy, medication, or treatment, where consensus was required.

- Section 2: Terms used to define and describe MR-related activity, i.e. stop, start, dose increase, dose decrease, change dosage form, change timing and efficacy and effectiveness monitor, and proposed definitions.
- Section 3: Overarching categories used to classify medication review activity, such as clinical, technical and education, and proposed definitions.

### Data collection

For each term provided as an option for consideration, the expert panel was asked to rate their level of agreement on a five-point Likert scale. In cases when participants reached consensus on specific topics, the researchers opted to remove items that were disagreed with or strongly disagreed (75% opted for the lower end of the scale). This choice was made to ensure that the study focused on areas of agreement. Five-point Likert scales were chosen after carefully weighing their methodological merits in the context of the research. The employment of the scale maintains an accurate balance between simplicity and complexity, giving respondents a modest range of possibilities to express detailed viewpoints while retaining an intuitive and simply interpretable manner. This decision is in line with the pragmatic requirement of gathering thorough but manageable data, assuring the survey instrument's effectiveness in eliciting useful responses. A five-point Likert scale's midpoint acts as a neutral reference point, allowing responders to express neither agreement nor disagreement clearly.

Similarly, each definition was scored by the expert panel on a three-point scale, and were asked to provide, via open text, recommendations for amendment and enhancement if any, along with explanations for these.

### Round two

The Round 2 survey was constructed based on outcomes from Round 1 and included the following section:

- Reviewing and summarizing data generated in terms of which there was consensus following Round 1.
- A list of activity and definitions, which had not achieved consensus at Round 1
- A list of revised definitions that had not achieved consensus in round one, including modifications agreed by the research team to reflect round one panel comments.
- Sharing the comments from Round 1 regarding definitions that did not reach a consensus, to provide information to the other panel members and aid their decision-making process.

### Round three

The same procedure was used in this round as in Rounds 1 and 2. The panel was given the results of the previous rounds for MR activity terms and was asked to include the terms with the highest scores. Specifically, the authors included the percentage of both terms and asked the panel to choose which one they preferred.

### Data analysis

Descriptive statistics were used to report the ratings for each medication review activity classification and definition. The

consensus was defined as 75% of the participants agreeing or strongly agreeing for each medication review activity classification and definition [16], i.e. strongly agree and agree combined. Where consensus was not achieved this was reported for further work. In this study, the threshold for “consensus” was predetermined a priori, establishing a clear criterion for consensus determination before the commencement of data analysis. In cases when participants reached consensus on specific topics, the researchers opted to remove items that were disagreed with or strongly disagreed (75% opted for the lower end of the scale). This choice was made to ensure that the study focused on areas of agreement. The researchers in 2017 conducted a study to investigate how consensus is operationalized in Delphi studies [1], and reported that 75% was the median threshold to define consensus. Accordingly, the consensus was defined as 75% of the participants agreeing or strongly agreeing for each medication review activity classification and definition [2], i.e. strongly agree and agree combined. Where consensus was not achieved this was reported for further work.

## Results

Seven (15.2%) experts were recruited to the panel. Five were male and two were female. The age range of the participants was 35–65 years. The panel was recruited from four countries: United Kingdom ( $n = 4$ ), New Zealand ( $n = 1$ ), Australia ( $n = 1$ ), and Malaysia ( $n = 1$ ). However, one of the participants was only able to complete Round 1 and Round 3 of the surveys.

### Descriptors used as part of any medication review activity

The descriptors used for medication review activity are outlined in the responses, with those lacking agreement documented in [Supplementary File 2](#). During Round 1, a consensus of 85.7% was reached on the term “Medication”, prompting its inclusion ([Table 1](#)).

### Terms used to define and describe activity surrounding medication review

[Table 2](#) shows the responses regarding the terms used to describe activity surrounding medication review. There was agreement among the panel as to the ‘change’ terms for timing

**Table 1:** Expert panel responses and consensus decisions regarding the descriptors of medication review activity.

Term	% of agreement	Consensus decision
Round 1		
Medication	85.7	Include

**Table 2:** Summary of the responses from the expert panel regarding MR activity terms.

Round 1			Round 2	Round 3		
Term	% agreement	Consensus decision		Term	% agreement	Consensus decision
Start	85.7	Include	No agreements in this round	Discontinue	100	Include
Dose increase	100	Include		Dose decrease	100	Include
Dosage form change	85.7	Include				
Timing change	100	Include				
Safety and efficacy monitor	85.7	Include				

change and formulation change, and for the ‘monitor’ term. There was agreement on two ‘stop’ terms, ‘stop’ and ‘discontinue’, and two ‘dose decrease’ terms, ‘decrease’ and ‘reduce’. All responses that achieved no agreement were included in [Supplementary File 3](#).

### Definitions of the medication review activity

[Table 3](#) shows the responses to the proposed definitions by the researcher. In this stage, there is agreement among the panel for the definitions provided for ‘dose increase’ and ‘dose decrease’. All responses that achieved no agreement were included in [Supplementary File 4](#).

### Terms used to describe medication review overarching interventions

[Table 4](#) summarizes the responses of the expert panel regarding the medication review overarching intervention terms including education interventions. It shows that the panel agreed to include the term ‘educate’ in the taxonomy. Regarding the ‘clinical’ term, there was an agreement from the author’s studies included in the systematic review to use this term. So, it was not included in this taxonomy. This illustrates that the development of the taxonomy was guided by a systematic methodology that considered the current consensus among the chosen research, so emphasizing the need to use clear and consistent terminology that aligns with recognized agreements in the field. The agreement was achieved from the first round regarding the overarching terms. All responses that achieved no agreement were included in [Supplementary File 5](#).

### Definitions of medication review overarching categories

[Table 5](#) shows the level of agreement regarding medication review overarching activity including clinical, and education interventions. There is no agreement among the panel regarding all the definitions provided in this stage, and the highest agreement percentage was 57.1% for ‘Healthcare professionals’ (HCPs) education definition. All responses that achieved no agreement were included in [Supplementary File 6](#).

### Overall summary of medication review terms and definitions selected to be included in the taxonomy

[Table 6](#) shows the MR terms and their definitions agreed by the panel of experts to be included in the taxonomy. The table shows each overarching category and the activities related to each of them. Consensus for technical activities

**Table 3:** Summary of the responses from the expert panel regarding MR definitions.

MR term	Definition	% agreement	Consensus decision
<b>Round 1</b>			
Dose increase	The act of increasing the medication dose either temporarily or permanently.	100	Include
Dose decrease	The act of reducing the dose of a medication either temporarily or permanently.	100	Include
<b>Round 2</b>			
Stop	The act of stopping medication either temporarily or permanently.	83.3	Include
Start	The act of starting a medication either temporarily or permanently.	83.3	Include
Timing change	The act of changing medication administration times without changing the overall dose.	83.3	Include
Safety and efficacy monitoring	The act of ensuring that monitoring takes place for effectiveness or safety.	83.3	Include
<b>Round 3</b>			
Dosage form change	The act of changing medication dosage from one to another form with the same active ingredients.	100	Include

**Table 4:** Summary of the responses from the expert panel regarding the overarching intervention terms

<b>Round 1</b>		
Term	% of agreement	Consensus decision
Technical	85.7	Include
Education (Educate)	100	Include

**Table 5:** MR activity overarching interventions definitions, the panel responses and level of agreement.

<b>Round 2</b>			
Overarching activity	Definition	% of agreement	Consensus decision
Patient/carer education	The act of increasing the medication dose either temporarily or permanently.	83.30	Include
<b>Round 3</b>			
Healthcare professional (HCP) education	Activity carried out to educate healthcare professionals in developing medication-related knowledge and skills to optimize patient outcomes.	85.7	Include
Clinical	Medication review activity to improve patient's outcomes e.g. discontinuing, starting, changing time, changing formulation, increase or decrease dose.	85.7	Include

definition was not achieved and this will be considered for future research.

## Discussion

This is the first study to standardize terms and definitions used for medication review (MR) activity. The panel of experts

**Table 6:** Summary of MR terms and definitions included in the taxonomy.

<b>Clinical activity</b>	
Medication review activity to improve patient outcomes, e.g. stopping, starting, changing timing, or changing formulation, increase or decrease dose.	
Discontinue medication	The act of stopping medication either temporarily or permanently.
Start medication	The act of starting a medication either temporarily or permanently.
Dose increase	The act of increasing the medication dose either temporarily or permanently.
Dose decrease	The act of reducing the dose of a medication either temporarily or permanently.
Dosage form change	The act of changing medication dosage form to another form with the same active ingredients.
Timing change	The act of changing medication administration times without changing the overall dose.
Medication safety and efficacy monitor	The act of ensuring that monitoring takes place for efficacy or safety.
<b>Patient/carer education</b>	
Providing information about medication to support patients and carers in the best use of medication to optimize outcomes.	
<b>Healthcare professional (HCP) education</b>	
Activity carried out to educate healthcare professionals in developing medication-related knowledge and skills to optimize patient outcomes.	

agreed to include 'medication' as a descriptor for MR terms; namely, start medication, discontinue medication, and medication safety and efficacy monitoring. Regarding MR activity terms, the panel agreed to include 'discontinue medication', 'start medication', 'increase dose', 'decrease dose', 'dosage form change', 'timing change', and 'medication safety and efficacy monitor' in the taxonomy. For overarching activity, it was agreed that the term 'educate' would be included; that is, patient/carer education and HCP education.

Participants in this study were experts in medication review research and were selected on the basis that they had published



three or more medication review-related research papers. This means that they were experienced to make evidence-informed recommendations to develop the taxonomy. The study followed a structured methodology that began with a systematic review to identify previously employed terms [2]. The survey was then created based on this evidence-based research, with the authors presenting the terms and definitions to the expert panel based on the findings of the systematic review. Instead of relying solely on individual experiences or isolated sources of information, the authors were able to include more appropriate terms derived from multiple studies and experts through this method. By leveraging the systematic review, the study sought to ensure a comprehensive and robust representation of terms and definitions in the survey.

The panel was recruited from four different countries in four different parts of the world: North America, South America, Europe, and Asia. Such limited geographical coverage is a study weakness. The possible reason for this restriction is that the MR process is not common practice in all countries around the world, and these participants were chosen because they had prior experience with MR research. Hence, with considerable omissions, such as the omission of North America, the panel did not sufficiently represent the proportional participation of nations represented in the systematic review. As a result, the panel may not fully reflect the international reach of the systematic review process.

Consensus thresholds in research studies can vary between similar studies based on factors such as the topic's complexity, the field of study, and the specific research objectives. Even though a small number of experts participated in this study, a high consensus threshold of 75% was implemented to mitigate the uncertainty resulting from the small sample size. The stringent criterion was intended to achieve a substantial level of agreement among the experts, reducing individual biases and ensuring a robust consensus on the terms and definitions. However, while skilled and competent, the expert panel may not fully represent medication review's diversity of opinions and experiences. A larger and more varied panel may have yielded more insights and improved the study's generalizability. A broader panel would have allowed for a more rigorous debate and examination of different opinions and alternative terminology and practices across healthcare settings and locations. This study provides significant insights and recommendations, but panel size and makeup should be addressed when interpreting and implementing the results in clinical practice. A larger and more diverse group of experts could enhance and validate the suggested language standards in future studies.

One of the limitations of this study is that this work was based on English language systematic reviews only [2]. This presents a risk of excluding some of the terms used in different languages that could have been relevant and, therefore, could have been included in the surveys of this study.

The depth of feedback and proposals offered by the expert panel through three survey rounds suggest that this topic required careful thought to produce a taxonomy fit for purpose.

The results demonstrate that the panel of experts was able to reach a high level of agreement on MR terms. A possible reason for this level of agreement is that the expert participants are homogenous in that they are all academics and have all conducted MR research. Being like-minded about the MR research assisted in efficient decision-making. This explanation is compatible with the literature. In 1998 and 2011, the scientists

reported that participants experiencing the same background, education, and knowledge were more confident in expressing their views and decisions [17, 18]. Such confidence does not necessarily lead to concordance in decision-making; it might lead to stronger expression of divergent views. But, overall, this enabled the process of decision-making in this scenario.

The agreement among the panel from the first-round survey was that the word 'medication' be chosen as the descriptor for the MR activity; for example, 'discontinue medication' and 'start medication'. While the term 'drug' was defined broadly as any chemical substance that acts on the living body to alter physiological processes [19], 'medication' is a formulated drug with a specific dose and dosage form that is used for disease prevention, diagnosis, control, and treatment [19]. The most interesting point is that the authors of the studies included in the systematic review conducted by the researcher used the term 'drug' as a descriptor for most of the MR activity [2]. However, the results in this taxonomy reveal a significant shift, such that the term 'medication' was agreed to be included by the panel. In the systematic review, the authors reported that the included studies used different terms to describe the activity of stopping medication, using the terms 'stop', 'discontinue', 'cease', and 'withdraw' [2]. However, there is a difference in meaning between these terms. 'Discontinue' suggests permanent change and 'cease' or 'stop' suggests a temporary change. The expert panel in this study agreed to include the term 'discontinue' in this taxonomy. The 'medication change' term was excluded by the panel and is not included in the taxonomy. The rationale provided by the panel was that this overlapped with medication stop and medication start, that is, medication change is the process between stopping and starting a medication, both of which are included in the taxonomy. So, if the 'medication change' term was included in this taxonomy it could lead to potential confusion among researchers when comparing future process evaluation procedures. The expert panel agreed to include the term 'technical' to describe technical activity. However, no agreement was reached regarding a definition of technical activity. Further work to derive a definition for technical activity is required.

The definitions included in this study were agreed to be the most appropriate definitions for the MR activity and overarching category activity. This can be deduced from the comments and feedback provided by each member of the expert panel, and from the fact that three survey rounds were conducted in which the experts critically assessed the terms' definitions, resulting in the gradual modification of each definition until consensus was established that was clear, eliminated any possibility of ambiguity, was not vague, and used plain, simplistic language.

Although consensus was not reached on the definition of technical interventions, it is important to acknowledge that one study provided a specific definition for this category [12]. According to that study, technical interventions refer to a variety of MR activity that involve the use of technological tools and methods to enhance user experiences and interactions. These interventions are aimed at augmenting the real world with virtual elements, modifying sensory perceptions, and enabling interactive functionalities. While the research team and panel did not come to a unanimous agreement on adopting this definition, it offers valuable insights into the potential scope and purpose of technical interventions within the MR field. However, further research is required to evaluate the validity and applicability of this definition in different contexts, and to establish a widely accepted and comprehensive definition that can serve as a standard within the field. Also, it is important to mention

that the responsibilities associated with medication review differ among healthcare practitioners, contingent upon their respective roles and credentials. The primary responsibility of prescribers, encompassing both medical and non-medical professionals, lies in the act of prescribing and modifying medications. Conversely, pharmacists assume the role of reviewing prescriptions to ensure their accuracy and to identify potential interactions. Nurses are responsible for the administration of medications and the evaluation of patient reactions, whereas allied health professionals and carers may be involved in the monitoring and reporting of medication-related issues. The allocation of tasks may vary depending on the specific practice setting and geographical area, necessitating the need for collaborative activity among specialists to guarantee the safe and efficient utilization of medications.

The taxonomy established uses standardized terms and definitions to describe MR activity and overarching category activity clearly and effectively according to consensus methodology. Achieving this will allow researchers to compare future process evaluation studies appropriately in a meaningful way to identify the mechanism of impact, thus improving health services provided and required outcomes. Consequently, intervention specification in future MR studies conducted will be enhanced, resulting in improved evidence synthesis and process evaluations.

## Supplementary Material

Supplementary data are available at *International Journal of Pharmacy Practice* online.

## Acknowledgements

The researcher (M.S.A.) would like to acknowledge the Deanship of Scientific Research at Taif University for its support during this study. Also, the researchers would like to express their sincere appreciation to Professor David Alldred, Dr Arnold Zermansky, University of Leeds, and Dr Linda Birt, University of Leicester, for their valuable contribution and support during this research.

## Conflict of interest

The authors declared no conflict of interest.

## Data availability

The authors confirm that the data supporting the findings of this study are available within the article and its Supplementary Files. Raw data are available from the corresponding author, upon a reasonable request.

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