CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	How are prescribing cascades defined in the literature? A scoping review
Authors	Dalton, Kieran;Evrard, Perrine;Moriarty, Frank;O'Mahony, Aislinn;Horan, Rachael;Byrne, Stephen;McCarthy, Lisa M.
Publication date	2025-07-12
Original Citation	Dalton, K., Evrard, P., Moriarty, F., O'Mahony, A., Horan, R., Byrne, S. and McCarthy, L. M. (2025) 'How are prescribing cascades defined in the literature? A scoping review', Research in Social and Administrative Pharmacy. https://doi.org/10.1016/j.sapharm.2025.07.001
Type of publication	Article (peer-reviewed);journal-article
Link to publisher's version	10.1016/j.sapharm.2025.07.001
Rights	© 2025, the Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/). - https://creativecommons.org/licenses/by/4.0/
Download date	2026-11-06 01:02:55
Item downloaded from	https://hdl.handle.net/10468/17750



University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Research in Social and Administrative Pharmacy xxx (xxxx) xxx

Contents lists available at ScienceDirect

Research in Social and Administrative Pharmacy

journal homepage: www.elsevier.com/locate/rsap

How are prescribing cascades defined in the literature? A scoping review

Kieran Dalton [a,*], Perrine Evrard [a], Frank Moriarty [b], Aislinn O'Mahony [a], Rachael Horan [a], Stephen Byrne [a], Lisa M. McCarthy [c,d,e]

[a] Pharmaceutical Care Research Group, School of Pharmacy, University College Cork, Pharmacy Building, College Road, Cork, Ireland
[b] School of Pharmacy and Biomolecular Sciences, RCSI University of Medicine and Health Sciences, First Floor, Ardilaun House (Block B), 111 St Stephen's Green, Dublin 2, Ireland
[c] Leslie Dan Faculty of Pharmacy and Temerty Faculty of Medicine, University of Toronto, 144 College Street, Toronto, ON, M5S 3M2, Canada
[d] Institute for Better Health, Trillium Health Partners, 100 Queensway West, Clinical and Administrative Building, Mississauga, ON, Canada
[e] Women's College Research Institute, Women's College Hospital, 76 Grenville Street, Toronto, ON, M5S 1B2, Canada

A B S T R A C T

Introduction: Prescribing cascades are important medication-related issues to be aware of, particularly for multimorbid older adults with polypharmacy. These cascades were initially defined as phenomena where side effect misinterpretation results in the prescribing of additional medications. This definition has been debated though, particularly on whether side effects may be misinterpreted or recognised/unrecognised, and consequently whether cascades are intentional/unintentional. Given these inconsistencies, this scoping review aimed to map how prescribing cascades have been defined and described in the published literature.
Methods: Seven electronic databases were searched from inception to October 2024. Full-text publications in English that mentioned prescribing cascade (or a synonym) in the title or abstract and provided a prescribing cascade definition/description in the full text were included. Specific terminology and images used to define/describe prescribing cascades were extracted, and the findings were narratively synthesised.
Results: Of the 139 included publications, less than half directly aligned with the original definition by containing descriptions of prescribing cascades that indicated side effect misinterpretation (48.9%). One quarter indicated side effects could be recognised or unrecognised (24.5%), 37.4% addressed cascade appropriateness or inappropriateness, and 8.6% referenced their intentional or unintentional nature. One fifth (20.9%) included an image or map to describe a prescribing cascade.
Conclusion: This review has uniquely mapped how prescribing cascades have been described in the literature, finding substantial heterogeneity between publications. By highlighting this inconsistent terminology use, this review emphasises the need to develop consensus definitions to aid in the future recognition, measurement, education, and prevention of prescribing cascades.

1. Introduction

The term 'prescribing cascade' is typically attributed to Paula Rochon and Jerry Gurwitz, where in 1995 they described the phenomenon as occurring when the "*misinterpretation of an adverse reaction as another medical condition may lead to the prescription of additional medications with their own potential to cause side effects*".[1] In subsequent publications by these authors in 1997 and 2017,[2,3] similar definitions were given, stating that a prescribing cascade arises from a medication side effect being misinterpreted. However, a 2019 publication, which included Paula Rochon as an author, suggested that the concept of a prescribing cascade could be broadened, i.e. prescribing cascades may not just occur when a side effect is misinterpreted, but that the subsequent prescribing of a second medication may occur when a side effect is 'recognised', rendering the cascade 'intentional', as opposed to an 'unrecognised' side effect and an 'unintentional' cascade.[4] Prescribing cascades have also been described as 'appropriate' (where potential benefits outweigh risks) or 'inappropriate'/'problematic' (where potential risks outweigh benefits).[4] Importantly, prescribing cascades are dynamic in nature, and their classification as appropriate or inappropriate may evolve over time with the patient clinical status. For instance, a patient prescribed mirabegron to treat increased urinary frequency caused by a cholinesterase inhibitor may be initially 'appropriate' if it aligns with the patient's goals and preferences; if the patient then began to experience mirabegron-induced urinary tract infections, the prescribing cascade may then be inappropriate as mirabegron's risks exceed its benefits.[4] These nuances with the terminology demonstrate that prescribing cascades can be quite complex. This is further emphasised by Rochon and Gurwitz expanding on the definition by suggesting that prescribing cascades may involve over-the-counter medications being used to manage side effects – i.e. not just 'prescribed' medications.[3] This extension of the definition added more diversification and further

* Corresponding author. Pharmacy Building, University College Cork, College Road, Cork, Ireland.
E-mail addresses: kieran.dalton@ucc.ie (K. Dalton), pevrard@ucc.ie (P. Evrard), frankmoriarty@rcsi.ie (F. Moriarty), aomahony234@gmail.com (A. O'Mahony), rachaelhoran18@gmail.com (R. Horan), stephen.byrne@ucc.ie (S. Byrne), lisa.mccarthy@utoronto.ca (L.M. McCarthy).

https://doi.org/10.1016/j.sapharm.2025.07.001
Received 1 June 2025; Received in revised form 10 July 2025; Accepted 10 July 2025
Available online 12 July 2025
1551-7411/© 2025 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

highlights that there are many concepts associated with the term 'prescribing cascade', without current consensus on its definition.

In the literature, prescribing cascades have been shown to promote polypharmacy,[5] perpetuate further adverse drug reactions,[6–8] exacerbate existing conditions,[9] increase patients' medication burden,[3,10] and augment the risk of drug-drug interactions.[11,12] Prescribing cascades also increase the strain placed on patients' caregivers[5] and the wider public by contributing substantially to economic, ethical, and legal burdens.[13–15] Preventing and resolving prescribing cascades is therefore an important step towards improving quality of care and patients' outcomes. While some lists or tools have been developed to aid prescribing cascade recognition,[10,16] healthcare professionals have reported difficulties in their identification and management.[10,17,18] The large number of potential prescribing cascades, together with the lack of a consensus definition can make this issue more difficult. From the patient's perspective, several qualitative studies revealed that patients overall were not aware of the term 'prescribing cascade'; even if they were, they had difficulties understanding its concept.[19,20] To support efforts to expand awareness of prescribing cascades and further research efforts for their evolution and impact, a clear and universal definition of a prescribing cascade is needed.

This scoping review sought to describe how the term 'prescribing cascade' has been defined or conceptualised in the published literature. This is a necessary step to support debate about the scope of the concept and development of a consensus definition for 'prescribing cascade' going forward.

2. Methods

2.1. Study design and reporting

Scoping review methodology was chosen as it enables mapping out the primary sources and types of evidence available, the major concepts used to define and describe prescribing cascades, and detection of gaps in existing knowledge to guide future research.[21]

This scoping review was conducted in accordance with the Joanna Briggs Institute scoping review methodology.[21] The review protocol was published on Open Science Framework (https://osf.io/ysqbt/). Study reporting was informed by the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews checklist (Appendix A).[22]

2.2. Search strategy and selection criteria

A systematic search of published articles was conducted in seven databases: PubMed, Embase, Web of Science, ProQuest Central, Scopus, CINAHL, and Google Scholar. One author (KD) created preliminary search terms in PubMed, with insights from previous research on prescribing cascades,[23,24] combining the term 'prescribing cascade' together with related keywords and synonyms, as there was no medical subject heading (MeSH) term for prescribing cascades. The search terms were evaluated by two other authors (LM, FM) for their appropriateness, and adapted for other included databases (Appendix B). Searches were run on 13th January 2023 and updated on 11th October 2024. No specific limits (e.g., article type, language, year of publication) were applied for any database. Lastly, references of included publications were hand-searched to identify any additional relevant publications.

The identified records were uploaded to Covidence® and duplicate articles were identified and removed. Full-text English-language research publications were eligible, including primary original research studies (quantitative, qualitative, or mixed-methods), literature reviews (e.g. systematic, scoping, narrative), letters, editorials, and commentaries. Included publications had to mention 'prescribing cascade' or an associated synonymous term (e.g. 'prescription sequence') in the publication title or abstract, and had to provide a definition or description of a prescribing cascade in the full text. Publications describing prescribing cascades in a context other than when a medication is prescribed to manage the adverse effect(s) of another medication in humans only (e.g. for veterinary purposes) were excluded. Unpublished or grey literature, as well as conference abstracts, were not eligible for inclusion.

Based on the criteria above, two independent reviewers (among PE, AOM, RH, and KD) screened references based on their title and abstracts initially, and thereafter their full texts. Any disagreement between reviewers was resolved by discussion (± with an additional reviewer).

2.3. Data extraction

Data extraction was completed by two independent reviewers (KD plus PE, AOM, or RH) using a predefined template developed on Covidence®. Where any conflicts arose, this was discussed between the two reviewers or, where required, with additional input from at least one other team member. Extracted data included any prescribing cascade definition/description, authors details, study design, if the publication included citation to the seminal Rochon and Gurwitz publications alongside the definition/description,[1–3] and prescribing cascade definition characteristics/details (mention of a side effect being misinterpreted, of side effect recognition, of the cascade's intentional/unintentional nature, of cascade appropriateness, of cascade clinical importance, and provision of an image or map to describe a prescribing cascade).

Where a publication contained more than one definition/description, each definition/description was numbered and collated for that publication in the predefined template (as shown in Appendix C). The extracted characteristics were based at a publication level, not at a definition level; for example, if a publication contained two definitions where one mentioned appropriateness and the other did not, then this publication was overall deemed to have mentioned appropriateness.

2.4. Data analysis

Extracted prescribing cascade definitions were analysed using descriptive statistics, allowing presentation of the prevalence of some definition characteristics. Potential associations were evaluated between the definition characteristics and publication characteristics, using a Fisher's exact test or Chi-Pearson test (with or without continuity correction). The publication characteristics evaluated for association were the:

i. Date of publication (categorised in two classes: 1997–2019; 2020–2024). This was done to evaluate if the prescribing cascade definition/description evolved with time, with the year groupings selected due to the 2019 McCarthy et al. paper that highlighted several of the terms being extracted (e.g. intentional/unintentional and appropriate/problematic).[4]
ii. Authorship of Paula Rochon and/or Jerry Gurwitz, as they are typically attributed with first describing the term 'prescribing cascade' in the literature,[1] and
iii. The citation to any of the seminal papers from Rochon and Gurwitz describing prescribing cascades[1–3] when the included article provided any definition/description.

All statistical analyses were conducted using SPSS 29.0.2.0™ from IBM Co.® (Armonk, NY, USA) on a Windows 11 Enterprise™ operating system from Microsoft Co.® (Redmond, WA, USA). A p-value below 0.05 was considered statistically significant.

No quality appraisal was performed as the review aim was not to assess the publication quality, as this may have no impact on the prescribing cascade definition itself.

3. Results

3.1. Search results

From the seven searched databases, 1599 records were identified. After duplicate removal, 658 records were screened, 340 full texts were assessed, and 129 records were initially included. Ten additional records were identified from the references of included publications. This led to a total of 139 records included in this scoping review. The PRISMA flow diagram for publication inclusion is presented in Fig. 1, and the complete list of included publications is in Appendix C. Fig. 1 shows that sixty publications identified through database searching mentioned 'prescribing cascade' or a synonym in the abstract, but not in their full text. Meanwhile, twenty-eight publications at that stage mentioned 'prescribing cascade' in the full text, but an associated definition was absent.

Characteristics of included publications are presented in Table 1. The most common publication type was quantitative studies (n = 49, 35.3%), followed by literature reviews (n = 29, 20.9%). The lead authors of the included references were from countries in North America (n = 81, 58.3%), followed by European countries (n = 29, 20.9%).

Fig. 2 shows how the number of included publications has increased over time, with more than half published in 2020 or after (n = 82, 59.0 %).

3.2. Prescribing cascade definitions and terminology used

Characteristics of prescribing cascade definitions are presented in Table 2. Other than 'prescribing cascade', the only synonyms included in these definitions were 'prescription cascade' and 'prescriptive cascade'.

Less than half of the included publications (n = 68, 48.9%) stated that a prescribing cascade *definitively* arose from a side effect being misinterpreted. Twenty-two (15.8%) additional publications mentioned that prescribing cascades *may* be attributed to side effect misinterpretation, whilst three publications (2.2%) stated that prescribing cascades both *are* or *may* be attributed to side effect misinterpretation. The remainder (n = 46, 33.1%) did not mention or discuss side effect misinterpretation in the definition. The vocabulary used to describe this misinterpretation was subject to variation, with the following terms also being used: *'incorrectly interpreted'*,[25] *'misidentified'*,[26] *'misdiagnosis'*,[11,27–30] *'misdiagnosed'*,[13,31–34] *'mistakenly diagnosed'*,[35] *'misattribution'*,[6,8] *'misattributed'*,[36] *'falsely attributed'*,[37] *'wrongly attributed'*,[38] *'misconstrued'*,[39] *'attributed'*,[17] *'in the wrong idea'*,[5] *'mistaken'*,[15,40] *'mistaking'*,[41] and *'inaccurately assessing'*.[12]

Approximately one quarter of publications (n = 34, 24.5%) mentioned the recognition, or lack of recognition, of a side effect. Used synonyms included *'difficulty recognizing'*,[42] *'failure to recognize'*,[27,43,44] *'unrecognised'*,[45] *'undetected'*,[46] *'unaware'*,[47] *'acknowledged'*,[48] *'identified'*,[49] and *'failure to identify'*.[50]

Twelve publications (8.6%) mentioned the intentionality of the prescribing cascade, while 52 (37.4%) mentioned its appropriateness or inappropriateness. Other terms used for this concept included *'unnecessary'* (with some examples referenced),[6,11,13,18–20,23,30,32,35,39,51] *'problematic'* (with some examples referenced),[4,18,19,37,48] *'detrimental'*,[9] *'deleterious'*,[52] *'therapeutically beneficial'*,[4] *'risk/benefit balance'*,[4,16,24,53] *'additional risk'*,[43] *'avoidable'*,[54] and *'suboptimal'*.[55] Only three publications (2.2%) mentioned about a cascade's clinical importance/relevance.[10,56,57]

Over two thirds of publications (n = 96, 69.1%) cited at least one of the Rochon and Gurwitz publications[1–3] as a reference for the prescribing cascade definition, the most common being the 1997 publication.[2]

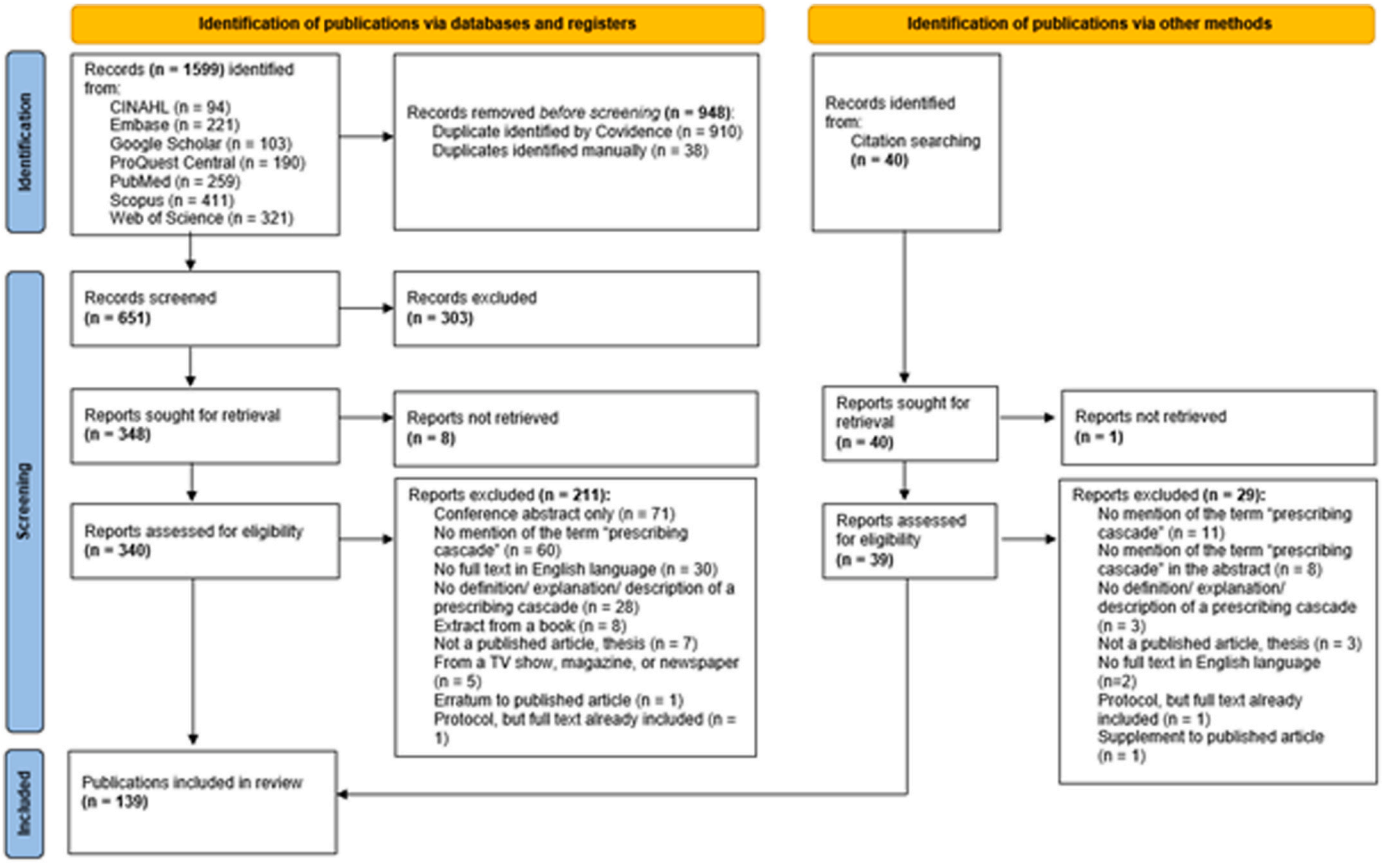


Fig. 1. PRISMA Flow Diagram.
Caption: Flow Diagram showing the number of publications identified, reasons for exclusion through the screening process, and number of included publications.

Table 1
Description of included references.

Reference Characteristics	Number of publications (N = 139)
Country of the lead author's affiliation	
United States of America	54 (38.8)
Canada	27 (19.4)
Australia	7 (5.0)
United Kingdom	7 (5.0)
Italy	6 (4.3)
India	5 (3.6)
Germany	4 (2.9)
Ireland	4 (2.9)
Japan	4 (2.9)
The Netherlands	4 (2.9)
Argentina	2 (1.4)
Israel	2 (1.4)
Taiwan	2 (1.4)
Belgium	1 (0.7)
China	1 (0.7)
Denmark	1 (0.7)
Malaysia	1 (0.7)
Nepal	1 (0.7)
Portugal	1 (0.7)
South Korea	1 (0.7)
Switzerland	1 (0.7)
The Philippines	1 (0.7)
Canada and New Zealand[a]	1 (0.7)
International editorial board (*Drug and Therapeutics Bulletin Team)*	1 (0.7)
Date of publication	
1997–2009	9 (6.5)
2010–2014	16 (11.5)
2015–2019	32 (23.0)
2020–2024	82 (59.0)
Reference type	
Quantitative	49 (35.3)
➢ Prescription Sequence Symmetry Analysis ($n = 16$)	
Literature Review	29 (20.9)
➢ Narrative reviews ($n = 23$)	
➢ Systematic reviews ($n = 3$)	
➢ Scoping reviews ($n = 3$)	
Case Report	14 (10.1)
Commentary	12 (8.6)
Editorial	6 (4.3)
Letter	5 (3.6)
Qualitative	5 (3.6)
Survey	2 (1.4)
Case series	1 (0.7)
Mixed-methods	1 (0.7)
Other	15 (10.8)
Was Paula Rochon and/or Jerry Gurwitz an author?	
Yes	21 (15.1)
No	118 (84.9)

[a] Two lead authors.

3.3. Images and/or maps provided to describe a prescribing cascade

Approximately one fifth of publications included an image or map to describe a prescribing cascade ($n = 29$, 20.9%). Of these, 21 (72.4%) provided a straightforward arrow-based diagram showing the sequence of events using arrows connecting one occurrence to the next, with seven publications describing a generic cascade (i.e. drug A→ side effect → drug B)[2,3,53,58–61] and 14 publications depicting a specific cascade example within their publication's context.[5,15,18,20,25,45,56,62–68] Among these straightforward arrow-based diagrams, one indicated multiple contributing drugs (i.e. more than one 'Drug A'),[58] whilst another presented the concept of an associated 'vicious cycle' of medication use.[5]

Five publications presented the timeline in which they considered a sequence of events involving a prescribing cascade in the context of their research,[32,48,53,69,70] noting that Becerra et al. provided a timeline as well as a separate straightforward arrow-based diagram.[53]

For the remaining publications:

- Hoang et al. provided an arrow-based diagram with detection signals for drugs and adverse effects from social media.[9]
- McCarthy et al. mapped out how appropriate and problematic prescribing cascades are propagated depending on clinicians' interpretations and actions.[4]
- Ponte et al. provided a scoring system for defining prescribing cascades.[14]
- Vouri et al. graphically depicted the sequence of events from diagnosis of the condition for which drug A was prescribed to the prescription of drug B relative to a timeline pre and post drug A initiation.[71]

3.4. Association between definition characteristics and Paula Rochon and/or Jerry Gurwitz authorship

Twenty-one included publications (15.1%) had Paula Rochon and/or Jerry Gurwitz as an author. The characteristics of the prescribing cascades definitions depending on this authorship are presented in Table 3. Authorship by Paula Rochon and/or Jerry Gurwitz was positively associated with the definition mentioning a side effect being misinterpreted ($p < 0.001$), and with the definition mentioning the appropriateness or inappropriateness of the cascade ($p = 0.003$). No significant association was found between authorship and any other prescribing cascade definition characteristic.

3.5. Association between definition characteristics and citation of any of the seminal references by Paula Rochon and Jerry Gurwitz

Of the included publications, 96 (69.1%) cited at least one of the seminal references by Rochon and Gurwitz to accompany the prescribing cascade definition/description. The characteristics of the prescribing cascade definitions/descriptions depending on this citation are presented in Table 3. The citation to any of these seminal publications by Rochon and Gurwitz was positively associated with the definition mentioning a side effect being misinterpreted ($p = 0.02$). No significant association was found between these citations and any other prescribing cascade definition characteristic.

3.6. Association between definition characteristics and publication date

Among the included publications, 57 (41.0%) were published between 1997 and 2019, whilst 82 (59.0%) were published between 2020 and 2024. The characteristics of the prescribing cascades definitions depending on publication date are presented in Table 3. No significant association was found between the publication date and any of the prescribing cascade definition characteristics. It is worth noting that the first included publication to mention the intentional or unintentional nature of a prescribing cascade as part of the definition/description was published in 2017.[51]

4. Discussion

This is the first scoping review to map out the definitions and descriptions of prescribing cascades available in the published literature. This review found important variabilities in prescribing cascade definitions across the 139 included publications, with less than half (48.9%) of them being in direct alignment with the original definition stating that a prescribing cascade arises from the misinterpretation of a side effect.[1,2] This review included research across various geographical regions and has highlighted a surge in publications related to prescribing cascades in recent times, with almost 60% of the included references published in 2020 or after. Within this context, a consensus definition is needed sooner rather than later, to provide a common lexicon for researchers working to advance understanding about how and why

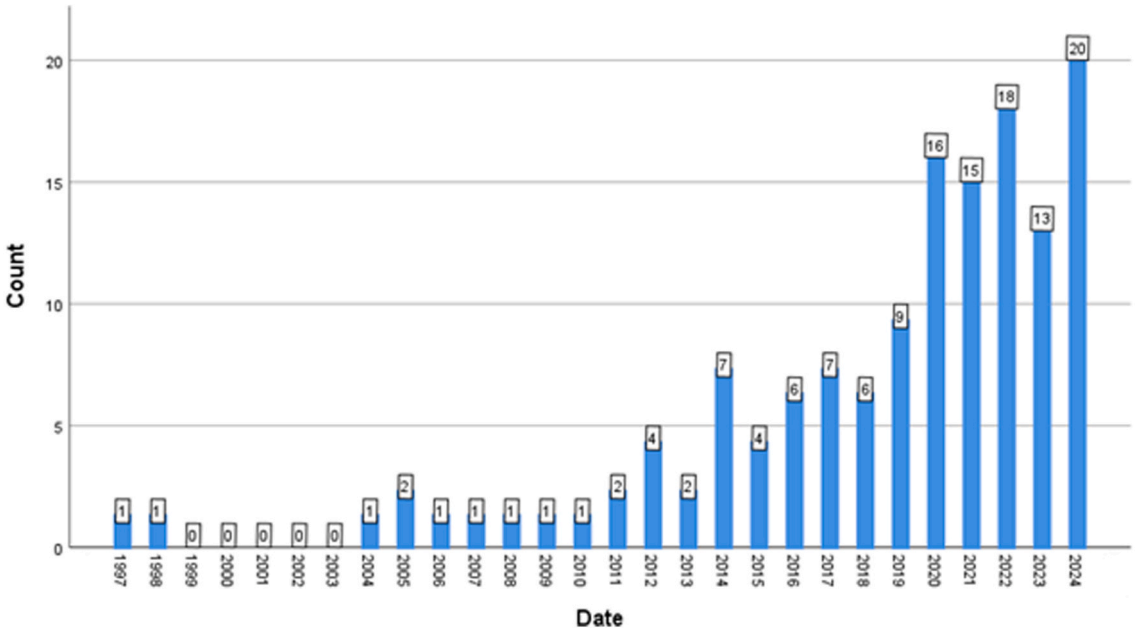


Fig. 2. Number of included references per publication year
Caption: Histogram chart of the number of included references per publication year.
Note: There was no included reference published before 1997. The seminal 1995 publication from Rochon and Gurwitz did not mention 'prescribing cascade' in the title/abstract.

Table 2
Description of prescribing cascade definitions identified in included references.

Definition Characteristics	Number of publications (N = 139) (%)
Does it mention about a side effect being misinterpreted?	
Yes – Definitive	68 (48.9)
Yes – Possibly	22 (15.8)
Yes – Both definitive and possibly	3 (2.2)
No	46 (33.1)
Mentions recognition of side effect (or lack of)	34 (24.5)
Mentions recognition of side effect only	4 (2.9)
Mentions lack of recognition of side effect only	25 (18.0)
Mentions both recognition and lack of recognition of side effect	5 (3.6)
Mentions the cascade being intentional (or unintentional)	12 (8.6)
Mentions about the cascade being intentional only	2 (1.4)
Mentions about the cascade being unintentional only	1 (0.7)
Mentions about both the cascade being intentional and unintentional	9 (6.5)
Mentions appropriateness or inappropriateness (or 'problematic' nature) of the cascade	52 (37.4)
Mentions appropriateness of the cascade only	0
Mentions inappropriateness of the cascade only	41 (29.5)
Mentions both appropriateness and inappropriateness of the cascade	11 (7.9)
Mentions about the clinical importance or clinical relevance of the cascade	
Yes	3 (2.2)
No	136 (97.8)
Image or map provided to describe a prescribing cascade	
Yes	29 (20.9)
No	110 (79.1)
Prescribing cascade definition/description with a citation to a seminal Rochon/Gurwitz paper	
1995 Rochon/Gurwitz paper	25 (18.0)
1997 Rochon/Gurwitz paper	59 (42.4)
2017 Rochon/Gurwitz paper	40 (28.8)

cascades occur, to aid consistency between studies (e.g. to ensure measurement of the same thing), and to aid in designing interventions to address them. The possible indexing of the term 'prescribing cascade', for example through a MeSH term (which does not currently exist), would also be helpful in retrieving related publications in electronic databases for future research needs.

This review found that the concepts addressed in prescribing cascade definitions (e.g. side effect misinterpretation, intentionality, appropriateness) varied greatly between the publications, which also included intra-author variations.[2,4,72] Additionally, the wording used for the same concept was different between publications. It is possible that these terminology variations may be partially explained by the need for authors to change wording for plagiarism concerns. Twenty-five of the included publications had a prescribing cascade description that did not mention the 'misinterpreted' side effect concept whilst also citing one of the seminal Rochon and Gurwitz papers to accompany their description. Whilst there may be several reasons for this, such as simple re-wording to avoiding plagiarism and/or ensuring Rochon and Gurwitz receive acknowledgement for the original conceptualisation, it generates unnecessary complexity. As shown in Appendix C, some extracted definitions were even contradictory; for instance, Becerra et al. (2021) said "*a prescribing cascade is a process by which an adverse drug effect is misinterpreted as a new medical condition, resulting in a new, potentially unnecessary, medication being prescribed to treat this new condition*",[53] which does not align with the definition of an intentional prescribing cascade by McCarthy et al. (2019), who described "a *sequence of events that begins when an adverse drug event occurs, is recognised and attributed to the offending drug, and a subsequent drug is then intentionally prescribed to combat the adverse drug event*".[4] Overall, this high variability can cause confusion for healthcare professionals, patients, and for future research on prescribing cascades. From a practical perspective, the heterogeneity in prescribing cascade definitions could contribute to differences in healthcare professionals training, and thus in patients' treatment. It could also lead to interventions targeting prescribing cascade minimisation being implemented differently across settings. These considerations further emphasise the need for consistency in defining the term. It should then be ensured that a consensus definition is widely

Table 3
Prescribing cascade definition characteristics depending on i) authorship by Rochon and/or Gurwitz, ii) whether a seminal Rochon and Gurwitz paper was cited, and iii) publication date.

Definition characteristic *n (%)*	Authorship by Paula Rochon and/or Jerry Gurwitz			Citation of a seminal Rochon and Gurwitz paper			Publication date		
	Yes (N = 21)	No (N = 118)	*p*-value	Yes (N = 96)	No (N = 43)	*p*-value	1995–2019 (N = 57)	2020–2024 (N = 82)	*p*-value
Mentions the prescribing cascade arising from a side effect being misinterpreted			**<0.001***			**0.02***			0.235
Yes – Definitive	18 (85.7)	50 (42.4)		54 (56.3)	14 (32.6)		29 (50.9)	39 (47.6)	
Yes – Possibly	2 (9.5)	20 (16.9)		14 (14.6)	8 (18.6)		5 (8.8)	17 (20.7)	
Yes – Both definitive and possibly	1 (4.8)	2 (1.7)		3 (3.1)	0 (0)		1 (1.8)	2 (2.4)	
No	0 (0)	46 (39.0)		25 (26.0)	21 (48.8)		22 (38.6)	24 (29.3)	
Mentions the recognition (or lack of recognition) of a side effect	4 (19.0)	30 (25.4)	0.531	24 (25.0)	10 (23.3)	0.825	15 (26.3)	19 (23.2)	0.671
Mentions the cascade being intentional (or unintentional)	2 (9.5)	10 (8.5)	1	11 (11.5)	1 (2.3)	0.148	2 (3.5)	10 (12.2)	0.137
Mentions appropriateness or inappropriateness (or 'problematic' nature) of the cascade	14 (66.7)	38 (32.2)	**0.003***	40 (41.7)	12 (27.9)	0.447	20 (35.1)	32 (39.0)	0.524
Mentions the clinical importance or clinical relevance of the cascade	1 (4.8)	2 (1.7)	0.391	3 (3.1)	0 (0)	0.552	0 (0)	3 (3.7)	0.269

* statistically significant *p*-value.

communicated to health system leaders, such as those in universities and other educational institutions, hospitals, and primary care organisations, to help homogenise prescribing cascade education and management.

This review found that publications which had Paula Rochon and/or Jerry Gurwitz as authors were significantly more likely to have definitions that mentioned i) side effect misinterpretation and ii) appropriateness/inappropriateness. This is perhaps not surprising, given that side effect misinterpretation aligns with the propagation of an inappropriate prescribing cascade. In contrast, references which i) did not have Paula Rochon and/or Jerry Gurwitz as authors and ii) did not cite one of the seminal Rochon and Gurwitz papers alongside their prescribing cascade descriptions were significantly less likely to align to the original definition's concept involving side effect misinterpretation. This may suggest that some authors did not cite the seminal Rochon and Gurwitz papers because they did not agree with the 'misinterpreted' concept and may prefer a less constrained definition.

Even though this review did not find any statistically significant difference between publication date and definition characteristics, this does not mean that the definition has not evolved with time. Indeed, since the original definition was published, new terms and concepts have been associated with prescribing cascades.[4,72] For example, a paper by McCarthy et al. from 2019 – which included Paula Rochon as an author – highlighted the concept of intentional prescribing cascades,[4] which has then been discussed in subsequent papers.[16,19,24,37] An intentional prescribing cascade is incompatible with the original definition stating that a prescribing cascade arises from side effect misinterpretation. With that in mind, researchers and clinicians should probably use a broader 'prescribing cascade' definition which does not refer to side effect misinterpretation (e.g. *a prescribing cascade is where one drug is prescribed to manage the side effect of another drug*). However, it should be acknowledged that there are examples of prescribing cascades in the literature which include more than one drug contributing to the side effect, more than one drug being used to manage the side effect, and even involving more than one side effect.[1,17,19,58,73] Therefore, to be even more specific and potentially enhance its usefulness in some realms (e.g. research), it may be that an operational definition accommodates the potential involvement of multiple drugs and/or multiple adverse effects. An operational definition encompassing these criteria could be: *a prescribing cascade is where at least one drug is prescribed to manage at least one side effect of at least one other drug*.

A broader definition, such as the one we proposed, that avoids mentioning misinterpretation, would encompass a greater variety of case scenarios, as now presented in the literature. To help with the description of these scenarios, it may be useful to have a framework of the different types of prescribing cascades, which could also aid in reconciling the different terms that have been associated with prescribing cascade definitions and are sometimes contradictory. It has been previously flagged that a prescribing cascade is considered a 'dynamic' entity – whereby, for example, a cascade may initially be considered appropriate but this may change alongside the patient's clinical circumstances.[24] This also emphasises the potential value in having a prescribing cascade framework, whereby a prescribing cascade can potentially evolve from one category to another.

In 2017, Rochon and Gurwitz expanded the prescribing cascade concept to include over-the-counter medications and medical devices being used to manage side effects.[3] However, over-the-counter products are often self-selected by patients and are not always prescribed by clinicians. These therefore do not fall under the original 'prescribing cascade' concept described in the 1990s, but perhaps instead align with 'medication cascades'. Veloso and Cambao also suggested an expansion of the concept to include diagnostic prescribing cascades, where drug side effects lead to further diagnostic tests.[74] Whilst this review only included references that provided a prescribing cascade description in the context of when a medication is prescribed to manage the adverse effect(s) of another medication, these suggested expansions perhaps highlight the need to define additional cascade types, beyond 'prescribing cascades'.

4.1. Strengths and limitations

This review involved a robust search of seven major databases coupled with reference list searching of eligible articles. To optimise comprehensiveness, the review included a wide variety of reference types, from empirical studies to letters to the editor to literature reviews, thus allowing a comprehensive overview of available prescribing cascade descriptions. However, publications with no full text available in English were excluded. Given this review's focus on the wording of definitions, the team opted to focus on literature published in English to avoid meaning distortion after translation.

Other limitations are that grey literature was not included in the search and this review only included publications that had 'prescribing cascade' or a synonymous term in the abstract. Whilst some prescribing cascade definitions were likely missed as a result, this search strategy allowed the inclusion of publications that were more focused on prescribing cascades. As such, the review may include descriptions from authors who are more familiar with the term (e.g. compared to those who simply refer to it in the full text only as part of a publication with a

different focus). Lastly, the extraction of definition characteristics (e.g. mention of intentionality, appropriateness) may have been subject to the research team's interpretation at times. To limit the impact of researchers' subjectivity, a predefined data extraction form was used and data extraction was conducted by two independent reviewers – similar to publication screening and selection steps.

5. Conclusion

This scoping review has not only shown the surge of publications on prescribing cascades in recent years, but has also demonstrated the substantial degree of heterogeneity with which the term 'prescribing cascade' has been described in the literature.

Ultimately, inappropriate prescribing cascades are a contributor to problematic prescribing and patient harm. Lack of a consistent definition of the concept hampers efforts to further study how and why they occur and develop interventions to address them. Therefore, it is vital that we get greater clarity and consensus in defining this phenomenon in the near future to help in prescribing cascade prevention, identification, education, quantification, and management.

CRediT authorship contribution statement

Kieran Dalton: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Perrine Evrard:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Frank Moriarty:** Writing – review & editing, Methodology, Conceptualization. **Aislinn O'Mahony:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Rachael Horan:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Stephen Byrne:** Writing – review & editing, Methodology. **Lisa M. McCarthy:** Writing – review & editing, Methodology, Conceptualization.

Funding information

This study received no external funding.

Conflicts of interest

The authors have no conflict of interest to declare.

Appendices

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sapharm.2025.07.001.

References

1. Rochon PA, Gurwitz JH. Drug therapy. *Lancet Lond Engl.* 1995;346(8966):32–36. https://doi.org/10.1016/s0140-6736(95)92656-9.
2. Rochon P, Gurwitz J. Optimising drug treatment for elderly people: the prescribing Cascade. *BMJ.* 1997;315(7115). https://doi.org/10.1136/bmj.315.7115.1096.
3. Rochon PA, Gurwitz JH. The prescribing Cascade revisited. *Lancet.* 2017;389 (10081):1778–1780. https://doi.org/10.1016/S0140-6736(17)31188-1.
4. McCarthy LM, Visentin JD, Rochon PA. Assessing the scope and appropriateness of prescribing cascades. *J Am Geriatr Soc.* 2019;67(5):1023–1026. https://doi.org/10.1111/jgs.15800.
5. Bagchi C, Majumder B, Pal J. Prescribing cascade—what, when, how and the ways to mitigate. *J Indian Med Assoc.* 2022;120(9):39–43.
6. Savage RD, Visentin JD, Bronskill SE, et al. Evaluation of a common prescribing Cascade of calcium channel blockers and diuretics in older adults with hypertension. *JAMA Intern Med.* 2020;180(5):643–651. https://doi.org/10.1001/jamainternmed.2019.7087.
7. Read SH, Giannakeas V, Pop P, et al. Evidence of a gabapentinoid and diuretic prescribing cascade among older adults with lower back pain. *J Am Geriatr Soc.* 2021;69(10):2842–2850. https://doi.org/10.1111/jgs.17312.
8. Gill SS, Mamdani M, Naglie G, et al. A prescribing cascade involving cholinesterase inhibitors and anticholinergic drugs. *Arch Intern Med.* 2005;165(7):808–813. https://doi.org/10.1001/archinte.165.7.808.
9. Hoang T, Liu J, Pratt N, et al. Detecting signals of detrimental prescribing cascades from social media. *Artif Intell Med.* 2016;71:43–56. https://doi.org/10.1016/j.artmed.2016.06.002.
10. McCarthy LM, Savage R, Dalton K, et al. ThinkCascades: a tool for identifying clinically important prescribing cascades affecting older people. *Drugs Aging.* 2022;39(10):829–840. https://doi.org/10.1007/s40266-022-00964-9.
11. Petrone K, Katz P. Approaches to appropriate drug prescribing for the older adult. *Prim Care Clin Pr.* 2005;32(3 SPEC. ISS.):755–775. https://doi.org/10.1016/j.pop.2005.06.011.
12. Dixit SM. The prescribing cascade-spotting and aborting it. *J Kathmandu Med Coll.* 2019;8(4):175–177.
13. Messerschmidt K, Riedesel A. Pharmacology focus: prescribing cascades: when less is more. *S D Med J S D State Med Assoc.* 2020;73(11):542–544.
14. Ponte ML, Wachs L, Wachs A, Serra HA. Prescribing cascade. A proposed new way to evaluate it. *Medicina (Mex).* 2017;77(1):13–16.
15. Kalisch LM, Caughey GE, Roughead EE, Gilbert AL. The prescribing cascade. *Aust Prescr.* 2011;34(6):162–166. https://doi.org/10.18773/austprescr.2011.084.
16. Dreischulte T, Shahid F, Muth C, Schmiedl S, Haefeli WE. Prescribing cascades: how to detect them, prevent them, and use them appropriately. *Dtsch Arztebl Int.* 2022;119(44):745–752. https://doi.org/10.3238/arztebl.m2022.0306.
17. Farrell B, Galley E, Jeffs L, Howell P, McCarthy LM. "Kind of blurry": deciphering clues to prevent, investigate and manage prescribing cascades. *PLoS One.* 2022;17(8 August). https://doi.org/10.1371/journal.pone.0272418.
18. Piggott KL, Mehta N, Wong CL, Rochon PA. Using a clinical process map to identify prescribing cascades in your patient. *BMJ.* 2020;368. https://doi.org/10.1136/bmj.m261.
19. Farrell BJ, Jeffs L, Irving H, McCarthy LM. Patient and provider perspectives on the development and resolution of prescribing cascades: a qualitative study. *BMC Geriatr.* 2020;20(1). https://doi.org/10.1186/s12877-020-01774-7.
20. Bloomstone S, Anzuoni K, Cocoros N, et al. Prescribing cascades in persons with Alzheimer's disease: engaging patients, caregivers, and providers in a qualitative evaluation of print educational materials. *Ther Adv Drug Saf.* 2020;11. https://doi.org/10.1177/2042098620968310.
21. Munn Z, Pollock D, Price C, et al. Investigating different typologies for the synthesis of evidence: a scoping review protocol. *JBI Evid Synth.* 2023;21(3):592–600. https://doi.org/10.11124/JBIES-22-00122.
22. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med.* 2018;169(7):467–473. https://doi.org/10.7326/M18-0850.
23. Brath H, Mehta N, Savage RD, et al. What is known about preventing, detecting, and reversing prescribing cascades: a scoping review. *J Am Geriatr Soc.* 2018;66(11):2079–2085. https://doi.org/10.1111/jgs.15543.
24. Doherty AS, Shahid F, Moriarty F, et al. Prescribing cascades in community-dwelling adults: a systematic review. *Pharmacol Res Perspect.* 2022;10(5). https://doi.org/10.1002/prp2.1008.
25. Hickman E, Gillies C, Khunti K, Seidu S. Deprescribing, polypharmacy and prescribing cascades in older people with type 2 diabetes: a focused review. *J Indian Inst Sci.* 2023;103(1):191–204. https://doi.org/10.1007/s41745-022-00352-7.
26. Burrell A. Yonder Prescribing cascades, teacher wait time, online services for mental health conditions, and community deep vein thrombosis pathways. *Br J Gen Pract.* 2024;74(746):420. https://doi.org/10.3399/bjgp24X739341.
27. Patel I, Trinh S, Phan T, Johnson M. Prescription cascading in developmentally disabled individuals. *Indian J Pharmacol.* 2016;48(3):334–335. https://doi.org/10.4103/0253-7613.182893.
28. Wright SA, Bardolia C, Bankes D, Amin NS, Turgeon J. Angiotensin converting enzyme (ACE) inhibitor-induced cough resulting in prescribing Cascade. *J Clin Case Rep.* 2020;10(7). https://www.hilarispublisher.com/open-access/angiotensin-converting-enzyme-ace-inhibitorinduced-cough-resulting-in-prescribing-cascade-45354.html. Accessed April 18, 2025.
29. Huh Y, Kim DH, Choi M, et al. Metoclopramide and levosulpiride use and subsequent levodopa prescription in the Korean elderly: the prescribing cascade. *J Clin Med.* 2019;8(9). https://doi.org/10.3390/jcm8091496.
30. Greenleaf Brown L. Untangling polypharmacy in older adults. *Medsurg Nurs.* 2016;25(6):408–411.
31. Onder G, Bonassi S, Abbatecola AM, et al. High prevalence of poor quality drug prescribing in older individuals: a nationwide report from the Italian Medicines Agency (AIFA). *J Gerontol Ser Biol Sci Med Sci.* 2014;69(4):430–437. https://doi.org/10.1093/gerona/glt118.
32. Nguyen DD, Trinh QD, Bhojani N. Combination of Tadalafil and finasteride for the treatment of urinary tract symptoms related to benign prostatic hyperplasia: commercialization of the prescribing Cascade. *Eur Urol.* 2022;81(4):323–324. https://doi.org/10.1016/j.eururo.2022.01.009.
33. Ribo Z., Ribo A.A. Ertapenem-induced neuropsychiatric symptoms in an elderly patient with chronic kidney disease resulting to a prescribing cascade. J Pharmacovigil. 2014;2(6). 10.4172/2329-6887.1000152. https://www.walshmedicalmedia.com/archive/jp-volume-2-issue-6-year-2014.html.
34. Sederstrom J. Psychotropics for children. *Drug Top.* 2019;163(8):32–33.
35. Marras C, Herrmann N, Fischer HD, et al. Lithium use in older adults is associated with increased prescribing of parkinson medications. *Am J Geriatr Psychiatr.* 2016;24(4):301–309. https://doi.org/10.1016/j.jagp.2015.11.004.
36. Mohammad D, Chan P, Bradley J, Lanctôt K, Herrmann N. Acetylcholinesterase inhibitors for treating dementia symptoms - a safety evaluation. *Expet Opin Drug Saf.* 2017;16(9):1009–1019. https://doi.org/10.1080/14740338.2017.1351540.
37. Morris EJ, Brown JD, Manini TM, Vouri SM. Differences in health-related quality of life among adults with a potential dihydropyridine calcium channel blocker–loop

diuretic prescribing Cascade. *Drugs Aging*. 2021;38(7):625–632. https://doi.org/10.1007/s40266-021-00868-0.
38. Woodford HJ. Calcium channel blockers Co-prescribed with loop diuretics: a potential marker of poor prescribing? *Drugs Aging*. 2020;37(2):77–81. https://doi.org/10.1007/s40266-019-00730-4.
39. Petrovic M, O'Mahony D, Cherubini A. Inappropriate prescribing: hazards and solutions. *Age Ageing*. 2022;51(2). https://doi.org/10.1093/ageing/afab269.
40. San Filippo S, Yuan M, Gu E, Siddiqui S, Patel S. Utilization of drug decision support strategies including drug characteristics to reduce the risk of iatrogenesis in advanced Age. *Curr Pharmacol Rep*. 2023;9(1):32–42. https://doi.org/10.1007/s40495-022-00310-y.
41. Iype MSM, Raj K, Reghu R. Dexamethasone induced psychosis: an archetype of prescription Cascade. *Int J Pharmaceut Sci Rev Res*. 2017;43(2):238–239.
42. Kwan D, Farrell B. Polypharmacy: optimizing medication use in elderly. *CGS J CME*. 2014;4(1):21–27.
43. Jennings AA, Doherty AS, Clyne B, et al. Stakeholder perceptions of and attitudes towards problematic polypharmacy and prescribing cascades: a qualitative study. *Age Ageing*. 2024;53(6). https://doi.org/10.1093/ageing/afae116.
44. Woroch RA, Shinnick MA. Can simulation prevent prescribing cascades? A pilot study. *J Nurse Pract*. 2023;19(10). https://doi.org/10.1016/j.nurpra.2023.104758.
45. Borhani P, Rochon PA, Carrieri B, et al. Exploring physician gender bias in the initiation of prescribing cascades for older men and women: a qualitative clinical vignette study protocol. *BMJ Open*. 2023;13(7). https://doi.org/10.1136/bmjopen-2022-070405.
46. Vouri SM, Morris EJ, Walsh M, et al. High-throughput screening for prescribing cascades among real world statin initiators. *Pharmacoepidemiol Drug Saf*. 2023;32(7):773–782. https://doi.org/10.1002/pds.5607.
47. Manirajan P, Sivanandy Palanisamy. Drug utilisation review among geriatric patients with noncommunicable diseases in a primary care setting in Malaysia. *Healthcare*. 2023;11(12):1665. https://doi.org/10.3390/healthcare11121665.
48. Hendrix MRS, Yasar M, Mohammad AK, et al. Prescription sequence symmetry analysis (PSSA) to assess prescribing cascades: a step-by-step guide. *BMC Med Res Methodol*. 2024;24(1):1–10. https://doi.org/10.1186/s12874-023-02108-y.
49. Sharp CN, Linder MW, Valdes Jr R. Polypharmacy: a healthcare conundrum with a pharmacogenetic solution. *Crit Rev Clin Lab Sci*. 2020;57(3):161–180. https://doi.org/10.1080/10408363.2019.1678568.
50. Brueckle MS, Thomas ET, Seide SE, et al. Adverse drug reactions associated with amitriptyline - protocol for a systematic multiple-indication review and meta-analysis. *Syst Rev*. 2020;9(1). https://doi.org/10.1186/s13643-020-01296-8.
51. Vouri SM, Reckenberg KA. Drug-induced adverse events and prescribing cascades in older adults: pharmacy stakeholder survey. *Innov Pharm*. 2017;8(2). https://doi.org/10.24926/iip.v8i2.524.
52. Marzolini C, Livio F. Prescribing issues in elderly individuals living with HIV. *Expet Rev Clin Pharmacol*. 2019;12(7):643–659. https://doi.org/10.1080/17512433.2019.1627200.
53. Becerra A, Boch M, Al-Mezrakchi Y. Ropinirole-associated orthostatic hypotension as cause of a prescribing Cascade in an elderly man. *Cureus*. 2021;13(6). https://doi.org/10.7759/cureus.15506.
54. Anderson TS, Steinman MA. Antihypertensive prescribing cascades as high-priority targets for deprescribing. *JAMA Intern Med*. 2020;180(5):651–652. https://doi.org/10.1001/jamainternmed.2019.7082.
55. Page AT, Potter K, Naganathan V, et al. Polypharmacy and medicine regimens in older adults in residential aged care. *Arch Gerontol Geriatr*. 2023;105. https://doi.org/10.1016/j.archger.2022.104849.
56. Wahler RG, Olbrich CL, McCarthy LM. Preventing prescribing cascades: ensuring medication safety for older adults. *J Gerontol Nurs*. 2024;50(9):7–11. https://doi.org/10.3928/00989134-20240809-03.
57. Vouri SM, Possinger MC, Usmani S, Solberg LM, Manini T. Evaluation of the potential acetylcholinesterase inhibitor-induced rhinorrhea prescribing Cascade. *J Am Geriatr Soc*. 2020;68(2):440–441. https://doi.org/10.1111/jgs.16224.
58. Von Ferber L. Recommendations for treating adult geriatric patients multimedication. *Int J Clin Pharmacol Ther*. 2014;52:S1–S55. https://doi.org/10.5414/CPP52S001.
59. McLendon AN, Shelton PS. New symptoms in older adults: disease or drug? *Generations*. 2011;35(4):25–30.
60. Rochon P, Pratt M, Rawdat R. The impact of sex and gender on prescribing cascades in older adults. *Healthc Q*. 2023;25(4):6–9. https://doi.org/10.12927/hcq.2023.27025.
61. Ponte M, Serra A, Wachs A. Prescription in Cascade. *Prensa Med Argent*. 2013;99(7):509–512.
62. Salazar JA, Poon I, Nair M. Clinical consequences of polypharmacy in elderly: expect the unexpected, think the unthinkable. *Expet Opin Drug Saf*. 2007;6(6):695–704. https://doi.org/10.1517/14740338.6.6.695.
63. Gromek KR, Thorpe CT, Aspinall SL, Hanson LC, Niznik JD. Anticholinergic co-prescribing in nursing home residents using cholinesterase inhibitors: potential deprescribing cascade. *J Am Geriatr Soc*. 2022. https://doi.org/10.1111/jgs.18066. Published online.
64. Cattaneo D, Minisci D, Formenti T, Negri C, Rizzardini G, Gervasoni C. The prescribing cascade 3.0: a case for recreational drugs in HIV. *AIDS*. 2020;34(8):1253–1255. https://doi.org/10.1097/QAD.0000000000002547.
65. Geller AI, Nopkhun W, Dows-Martinez MN, Strasser DC. Polypharmacy and the role of physical medicine and rehabilitation. *Pharm Manag PM R*. 2012;4(3):198–219. https://doi.org/10.1016/j.pmrj.2012.02.012.
66. Hofmann A, Khalid A, Mao YH, et al. Prescribing cascade in mental health: the older person at risk. *Prog Neurol Psychiatr*. 2020;24(2):17–20. https://doi.org/10.1002/pnp.665.
67. Pepa P, Langley-DeGroot M, Rule O. Prescribing cascade in a geropsychiatric patient: a slippery slope. *J Geriatr Ment Health*. 2018;5(1):62–64. https://doi.org/10.4103/jgmh.jgmh_17_17.
68. Samajdar SS, Mukherjee S, Sarkar S, et al. Prescribing Cascade complicating a geriatric patient. *J Indian Acad Geriatr*. 2024;20(1):40–42.
69. Singh S, Cocoros NM, Haynes K, et al. Antidopaminergic-antiparkinsonian medication prescribing Cascade in persons with alzheimer's disease. *J Am Geriatr Soc*. 2021;69(5):1328–1333. https://doi.org/10.1111/jgs.17013.
70. Singh S, Cocoros NM, Haynes K, et al. Identifying prescribing cascades in Alzheimer's disease and related dementias: the calcium channel blocker-diuretic prescribing cascade. *Pharmacoepidemiol Drug Saf*. 2021;30(8):1066–1073. https://doi.org/10.1002/pds.5230.
71. Vouri SM, Morris EJ, Jiang X, et al. Evaluation of a beta-blocker-edema-loop diuretic prescribing Cascade: a prescription sequence symmetry analysis. *Am J Hypertens*. 2022;35(7):601–609. https://doi.org/10.1093/ajh/hpac013.
72. O'Mahony D, Rochon P. Prescribing cascades: we see only what we look for, we look for only what we know. *Age Ageing*. 2022;51(7). https://doi.org/10.1093/ageing/afac138.
73. Nguyen PVQ, Spinelli C. Prescribing cascade in an elderly woman. *Can Pharm J*. 2016;149(3):122–124. https://doi.org/10.1177/1715163516640811.
74. Veloso TS, Cambão MS. Migraine treatment: a chain of adverse effects. *SpringerPlus*. 2015;4:409. https://doi.org/10.1186/s40064-015-1206-1.