HTA Austria
Austrian Institute for
Health Technology Assessment
GmbH

Structured Medication Review for Polypharmacy

Systematic Review

Final report

AIHTA Project Report No.: 175 | ISSN: 1993-0488 | ISSN-online: 1993-0496

HTA Austria
Austrian Institute for
Health Technology Assessment
GmbH

Structured Medication Review for Polypharmacy

Systematic Review

Vienna, February 2026

Project Team

Project leader: Dr. med. univ. Reinhard Jeindl

Authors: Dr. med. univ. Reinhard Jeindl
Julia Kern-Kim, MSc

Project Support

Systematic literature search: Tarquin Mittermayr, BA(Hons), MA

Hand search: Dr. med. univ. Reinhard Jeindl
Julia Kern-Kim, MSc

Internal review: Christoph Strohmaier, MSc
Dr. rer. soc. oec. Ingrid Zechmeister-Koss, M.A

External review: Univ.-Prof. Dr. med. Christiane Muth, MPH, Head of General Practice and Family Medicine, Medical School OWL, Bielefeld University
Svetlana Puzhko, MD, MSc, PhD, Head of Research, General Practice and Family Medicine, Medical School OWL, Bielefeld University
Priv.-Doz. Dr. Claudia Langebrake, Hospital Pharmacy, Department of Stem Cell Transplantation, University Medical Center Hamburg Eppendorf

Acknowledgements: Generative AI (ChatGPT 5.0 and ChatGPT 5.1) was used to assist with several tasks such as drafting and formatting. The authors remain fully responsible for all content.

Correspondence: reinhard.jeindl@aihta.at

This report should be referenced as follows:
Jeindl R, Kern-Kim J. Structured Medication Review for Polypharmacy: A Systematic Review. AIHTA Project Report No.: 175; 2026. Vienna: HTA Austria – Austrian Institute for Health Technology Assessment GmbH.

Conflict of interest

All authors and the reviewers involved in the production of this report have declared they have no conflicts of interest in relation to the technology assessed according to the Uniform Requirements of Manuscripts Statement of Medical Journal Editors (www.icmje.org).

Disclaimer

The external reviewers did not co-author the scientific report and do not necessarily all agree with its content.
Only the AIHTA is responsible for errors or omissions that could persist. The final version and the policy recommendations are under the full responsibility of the AIHTA.

IMPRINT

Publisher:
HTA Austria – Austrian Institute for Health Technology Assessment GmbH
Josefstädter Straße 39 | 1080 Vienna – Austria
https://www.aihta.at/

Responsible for content:
Dr. rer. soc. oec. Ingrid Zechmeister-Koss, MA, managing director

AIHTA Project Reports do not appear on a regular basis and serve to publicize the research results of the Austrian Institute for Health Technology Assessment.

AIHTA Project Reports are only available to the public via the Internet at http://eprints.aihta.at/view/types/hta_report.html.

AIHTA Project Report No.: 175

ISSN 1993-0488

ISSN online 1993-0496

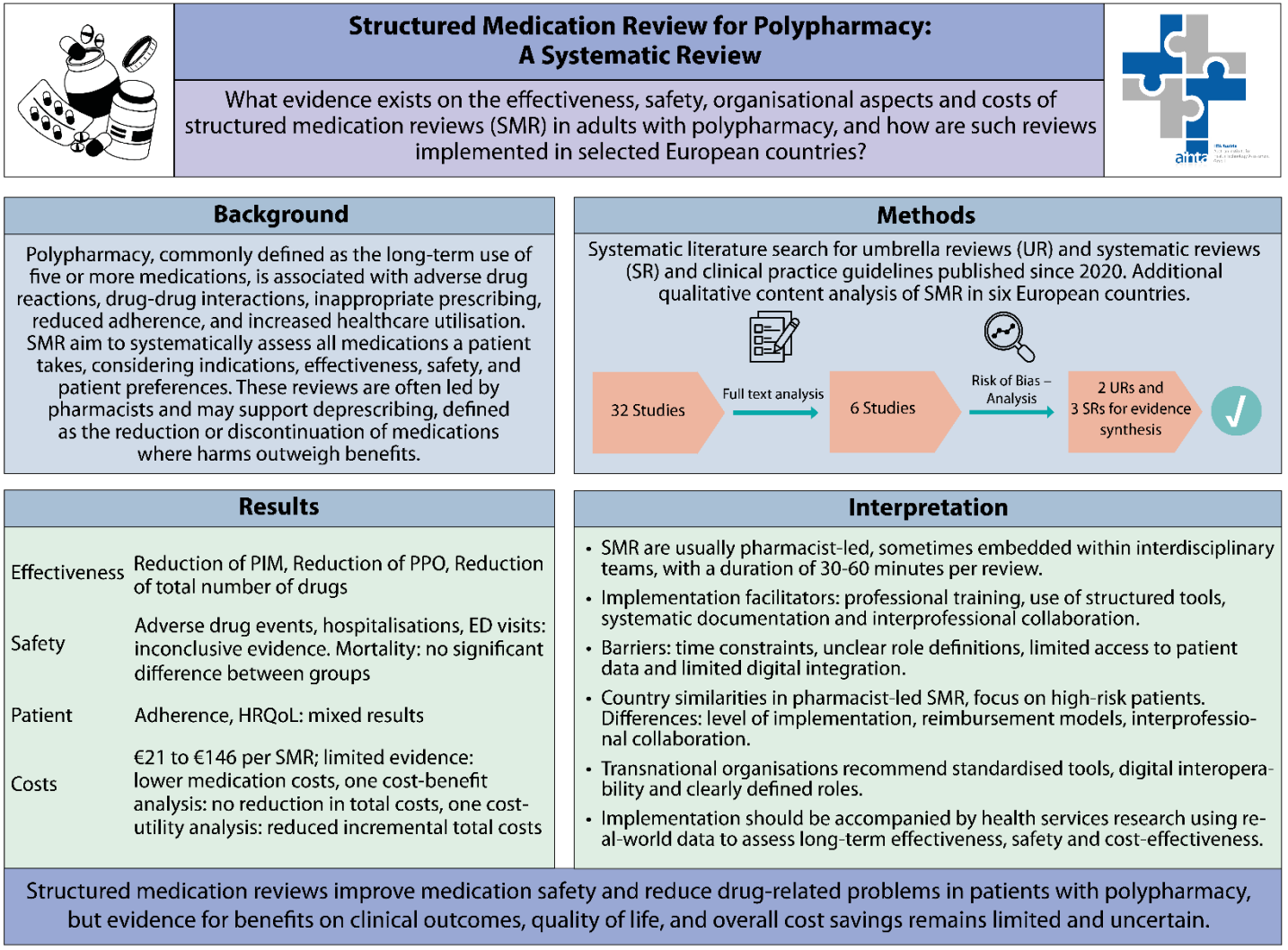
Content

List of tables

List of abbreviations

95% CI ..... 95% Confidence Interval
ABDA..... Bundesvereinigung Deutscher Apothekerverbände e.V.
AGREE II ..... Appraisal of Guidelines for Research and Evaluation II
AMSTAR II ..... A Measurement Tool to Assess Systematic Reviews, version 2
APB ..... Association Pharmaceutique Belge
AWMF ..... Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften e.V.
CMR..... Comprehensive Medication Review
DRP..... Drug Related Problem
EDQM..... European Directorate for the Quality of Medicines & HealthCare
ELGA ..... Elektronische Gesundheitsakte
EU ..... European Union
GIN..... Guidelines International Network
GROOVE ..... Graphical Representation of Overlap for OVErviews
HTA ..... Health Technology Assessment
IQWiG..... Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen
LoE..... Level of Evidence
MAI ..... Medication Appropriateness Index
NHS..... National Health Service
OECD ..... Organisation for Economic Co-operation and Development
OSF ..... Open Science Framework
PCN-DES ..... Primary Care Network Directed Enhanced Service
PCNE ..... Pharmaceutical Care Network Europe
PHIL ..... Pharmaceutical Information Library
PICO ..... Population, Intervention, Control, Outcome
PIM ..... Potentially Inappropriate Medication
PIP..... Potentially Inappropriate Prescribing
PPO ..... Potential Prescribing Omission
RCT..... Randomised Controlled Trial
ROBIS ..... Risk Of Bias In Systematic Reviews
RQ ..... Research Question
SD..... Standard Deviation
SF-36..... Short Form-36
SMD ..... Standardised Mean Difference
START criteria..... Screening Tool to Alert Doctors to Right Treatment
STOPP criteria ..... Screening Tool of Older People's Prescriptions
STRIP criteria ..... Systematic Tool to Reduce InappropriatePrescribing
TRIP..... Turning Research into Practice Medical Database
UK..... United Kingdom
VAS ..... Visual Analogue Scale
WHO ..... World Health Organisation

Visual Abstract



ED – Emergency department; HRQoL – Health-related quality of life; PIM – Potentially inappropriate medication; PPO – Potentional prescribing omissions; SMR – Structured medication review; SR – Systematic review; UR – Umbrella review

Executive Summary

Introduction

Polypharmacy, generally defined as the long-term use of five or more medicines, is a prevalent and growing challenge in ageing populations and among individuals with multimorbidity. It is associated with an increased risk of drug-related problems, including adverse drug events, drug-drug interactions, inappropriate prescribing, reduced adherence, increased healthcare utilisation and hospitalisations.

polypharmacy: the long-term use of five or more medicines

Structured medication reviews have been proposed as a systematic approach to optimise medication use and improve medication safety in people with polypharmacy. This report assesses the available evidence on the effectiveness, safety, organisational aspects, and costs of structured medication reviews, and describes their implementation in selected European countries, with the aim of supporting decision-making in Austria.

structured medication reviews (SMR) as a systematic approach to optimise medication use and improve safety

project aim: evidence synthesis to support decision-making

Methods

A systematic search was conducted for umbrella reviews, systematic reviews, and clinical guidelines published since 2020. The focus was on adults with polypharmacy receiving structured medication reviews in any healthcare setting. Outcomes of interest included medication-related process outcomes, clinical outcomes, patient-relevant outcomes, organisational aspects, and economic outcomes. Risk of bias and methodological quality were assessed using ROBIS and AGREE II.

systematic search for umbrella reviews, systematic reviews and guidelines

risk of bias assessment using ROBIS and AGREE II

To analyse the implementation of structured medication reviews in selected countries, a qualitative content analysis was undertaken for Austria, Belgium, Germany, the Netherlands, Switzerland, and the United Kingdom, based on targeted document searches and country profiles. This component focused on organisational characteristics, remuneration, and practical implementation rather than effectiveness.

qualitative content analysis for selected European countries

Results

The evidence base comprised two umbrella reviews and three systematic reviews of randomised controlled trials. The included studies showed high heterogeneity in interventions, populations, settings and outcome definitions. The included umbrella reviews and systematic reviews showed an overall low risk of bias. In contrast, the quality of the evidence at the level of the included primary studies was predominantly low to very low.

2 umbrella reviews (UR) and 3 systematic reviews (SR) included

UR and SR with low risk of bias, but (very) low quality of evidence for included primary studies

Evidence on effectiveness and safety

Across reviews, structured medication reviews consistently demonstrated beneficial effects on medication-related process outcomes. These included reductions in potentially inappropriate medications, prescribing omissions, and, in several reviews, improved medication adherence. Meta-analyses showed small but statistically significant reductions in the number of potentially inappropriate medications and total medication counts.

effective in reducing potentially inappropriate medications and prescribing omissions

may improve medication adherence

In contrast, evidence for patient-relevant clinical outcomes was limited and inconsistent. No statistically significant reduction in all-cause mortality was demonstrated across reviews. Effects on hospitalisations and emergency department visits were mixed: reductions were observed primarily in higher-intensity or well-implemented interventions, while low-intensity interventions showed null effects or, in some cases, increased utilisation. For falls and adverse drug events, results were largely neutral, with no consistent indication of harm attributable to the intervention.

no significant reduction in mortality
hospitalisations and emergency department visits with mixed effects
no indication for adverse harms caused by SMR

Health-related quality of life was assessed in several studies but showed no consistent or clinically meaningful improvement compared with usual care. Where positive effects were observed, they were generally small and uncertain to sustain.

quality of life with mixed results, no clinically meaningful improvement shown

Organisational and economic aspects

Most structured medication reviews were pharmacist-led, either alone or as part of multidisciplinary teams. On average, 30-60 minutes are required per structured medication review. Implementation facilitators were professional training, the use of structured tools, systematic documentation, and interprofessional collaboration. Implementation barriers were time constraints, unclear role definitions, limited access to patient data and limited digital integration. Reported implementation rates of recommendations from structured medication reviews varied widely.

most SMR pharmacist-led, sometimes by multidisciplinary teams

Economic evidence was limited. The cost per structured medication review ranged from €21 to €146. Some studies reported reductions in medication costs and healthcare utilisation, and a small number of economic evaluations suggested potentially favourable cost-effectiveness. However, findings were heterogeneous and insufficient to draw firm conclusions on cost-effectiveness.

limited economic evidence with heterogeneous findings

Guidelines and implementation

Clinical guidelines from Germany and Italy consistently recommend regular, structured medication reviews for people with multimorbidity and polypharmacy, particularly in primary care. These recommendations are largely consensus-based and emphasise patient involvement and, where feasible, multidisciplinary collaboration.

SMR recommended by German and Italian guidelines (consensus-based)

Country comparisons showed that structured medication reviews are implemented and reimbursed in several European countries. Country similarities were shown in being pharmacist-led, focusing on high-risk patients. Countries showed variation in the level of implementation, reimbursement models and interprofessional collaboration. Transnational organisations recommend standardised tools, digital interoperability and clearly defined roles. In Austria, structured medication reviews are legally anchored as a pharmacist-led service but are not yet established as a routinely reimbursed benefit.

reimbursement in several European countries, with differences in scope, remuneration and integration

Discussion and conclusions

The available evidence indicates that structured medication reviews can improve medication-related process outcomes, particularly the identification and reduction of potentially inappropriate prescribing. However, evidence for improvements in mortality, hospitalisations, falls, or health-related quality of life remains limited and inconsistent. The effectiveness of structured medication reviews appears to depend strongly on intervention intensity, implementation quality, and interprofessional collaboration.

From a health technology assessment perspective, structured medication reviews can be regarded primarily as an intervention to improve medication safety and quality of care rather than as a measure with proven effects on major clinical endpoints. This report does not provide an implementation plan or a cost-effectiveness assessment, but rather it provides an evidence-based foundation for policy decision-support.

If the demonstrated outcomes are judged sufficient for introducing a reimbursed, structured medication review, priority should be given to clearly defined target populations, standardised intervention components, structured communication pathways between pharmacists and prescribers, and the use of digital medication records. Particular emphasis should be placed on high-risk patients with polypharmacy and multimorbidity, and on ensuring high implementation rates of medication review recommendations. Implementation should be accompanied by health services research using real-world data to assess long-term effectiveness, safety and cost-effectiveness.

medication-related process outcomes can be improved, but inconsinstent findings for mortality, hospitalisations, quality of life

improved medication safety, but no proven effects on major clinical endpoints

in case of implementation, priority on:
- clearly defined high-risk patients with polypharmacy
- structured communication pathways,
- standardised intervention components
- digital medication records
- health services research

Zusammenfassung

Einleitung

Polypharmazie ist als die dauerhafte, gleichzeitige Einnahme mehrerer Medikamente (meist ≥5) definiert. Sie ist insbesondere bei älteren Menschen und Personen mit Multimorbidität weit verbreitet und stellt eine zentrale Herausforderung für die Arzneimitteltherapiesicherheit dar. Sie ist mit einem erhöhten Risiko für arzneimittelbezogene Probleme wie unerwünschte Arzneimittelwirkungen, Arzneimittelinteraktionen, potenziell inadäquate Verordnungen, verminderte Adhärenz, sowie erhöhte Inanspruchnahme von Gesundheitsleistungen verbunden.

Polypharmazie: die dauerhafte, gleichzeitige Einnahme von ≥5 Medikamenten

Strukturierte Medikationsreviews werden als systematische Maßnahme eingesetzt, um die Angemessenheit von Arzneimitteltherapien zu überprüfen und Medikationsrisiken zu reduzieren. Ziel dieses Berichts war es, die Evidenz zu Wirksamkeit, Sicherheit, organisatorischen Aspekten und Kosten strukturierter Medikationsreviews darzustellen sowie deren Implementierung in ausgewählten europäischen Ländern zu beschreiben und damit eine evidenzbasierte Entscheidungsgrundlage für Österreich bereitzustellen.

strukturierte Medikationsreviews (SMR) als systematische Maßnahme, um Medikationsrisiken zu reduzieren

Projektziel: Evidenzsynthese als Entscheidungsgrundlage

Methoden

Es wurde eine systematische Literaturrecherche nach Umbrella Reviews, systematischen Reviews und Leitlinien durchgeführt. Eingeschlossen wurden Publikationen ab dem Jahr 2020, die strukturierte Medikationsreviews bei Erwachsenen mit Polypharmazie untersuchten. Bewertet wurden medikationsbezogene Prozessendpunkte, klinische Endpunkte, patient:innenbezogene Endpunkte sowie organisatorische und ökonomische Aspekte. Die methodische Qualität wurde mit ROBIS und AGREE II beurteilt.

systematische Suche nach Umbrella Reviews, Systematische Reviews und Leitlinien

Risk-of-Bias mittels ROBIS und AGREE II

Anhand von Länderprofilen wurden Implementierungsmodelle, Vergütungssysteme und organisatorische Rahmenbedingungen strukturierter Medikationsreviews für Österreich, Belgien, Deutschland, Niederlande, Schweiz und das Vereinigtes Königreich beschrieben und miteinander verglichen. Eine Bewertung der Wirksamkeit erfolgte in diesem Ländervergleich nicht.

qualitative Inhaltsanalyse zu ausgewählten europäischen Ländern

Ergebnisse

Die Evidenzbasis umfasste zwei Umbrella Reviews und drei systematische Reviews randomisierter kontrollierter Studien. Die eingeschlossenen Studien zeigten eine hohe Heterogenität der Interventionen, Settings und Endpunkte. Die eingeschlossenen Umbrella Reviews und systematischen Reviews wiesen insgesamt ein niedriges Verzerrungsrisiko auf. Demgegenüber war die Evidenzqualität auf Ebene der eingeschlossenen Primärstudien überwiegend niedrig bis sehr niedrig.

2 Umbrella Reviews (UR) und 3 Systematische Reviews (SR) eingeschlossen

UR und SR mit niedrigem Verzerrungsrisiko, aber eingeschlossene Primärstudien mit (sehr) niedriger Evidenzqualität

Wirksamkeit und Sicherheit

Konsistent zeigten strukturierte Medikationsreviews positive Effekte auf medikationsbezogene Prozessparameter. Dazu zählen insbesondere Reduktionen potenziell inadäquater Medikation und Verbesserungen in Bezug auf indizierte, aber fehlende Medikation. In mehreren Reviews wurden auch Verbesserungen der Therapieadhärenz berichtet. Meta-Analysen zeigten kleine, aber statistisch signifikante Reduktionen der Anzahl potenziell inadäquater Arzneimittel und der Gesamtzahl eingenommener Medikamente.

wirksam in der Reduktion von potenziell inadäquater Medikation sowie von fehlender, indizierter Medikation; könnte Therapieadhärenz verbessern

Demgegenüber war die Evidenz für patient:innenrelevante klinische Endpunkte begrenzt und inkonsistent. Für die Gesamtmortalität konnte kein signifikanter Unterschied zwischen Interventions- und Kontrollgruppen gezeigt werden. Hinsichtlich Krankenhausaufenthalte und Notaufnahmen ergaben sich gemischte Ergebnisse: Reduktionen wurden vor allem bei höher-intensiven und gut implementierten Interventionen beobachtet, während niedrigintensive Interventionen keinen Nutzen oder sogar eine erhöhte Inanspruchnahme zeigten. Für Stürze und unerwünschte Arzneimittelwirkungen ergaben sich überwiegend neutrale Effekte ohne Hinweise auf relevante Sicherheitsrisiken.

keine signifikante Reduktion der Mortalität

Hospitalisierungen, Notaufnahmen: gemischte Ergebnisse

keine Hinweise auf Sicherheitsrisiken durch SMR

Die gesundheitsbezogene Lebensqualität wurde in mehreren Studien untersucht, zeigte jedoch keine konsistenten oder klinisch bedeutsamen Verbesserungen im Vergleich zur Standardversorgung.

Lebensqualität: gemischte Ergebnisse, keine klinisch bedeutsamen Verbesserungen im Vergleich zur Standardversorgung

Organisatorische und ökonomische Aspekte

Strukturierte Medikationsreviews wurden überwiegend von Apotheker:innen durchgeführt, teilweise im Rahmen interdisziplinärer Teams. Im Durchschnitt werden 30-60 Minuten pro strukturiertem Medikationsreview benötigt. Die Implementierung ist begünstigt durch professionelle Schulungen, Einsatz standardisierter Tools, systematische Dokumentation und interprofessionelle Zusammenarbeit. Hindernisse für die Implementierung waren Zeitmangel, unklare Rollenverteilungen, eingeschränkter Zugang zu Patient:innendaten und begrenzte digitale Interoperabilität. In den eingeschlossenen Studien variierte die tatsächliche Umsetzungsrate der Empfehlungen aus einem strukturiertem Medikationsreview stark.

meist von Apotheker:innen durchgeführt, teilweise interdisziplinäre Teams

Die ökonomische Evidenz war begrenzt. Die Kosten pro strukturiertem Medikationsreview lagen bei €21 bis €146. Einzelne Studien berichteten über reduzierte Arzneimittelkosten oder geringere Nutzung von Gesundheitsleistungen. Belastbare Aussagen zur Kosteneffektivität sind aufgrund der geringen Anzahl und Heterogenität der eingeschlossenen Studien nicht möglich.

begrenzte ökonomische Evidenz mit gemischten Ergebnissen

Leitlinien und Implementierung

Deutsche und italienischem Leitlinien empfehlen regelmäßige strukturierte Medikationsreviews bei Patient:innen mit Multimorbidität und Polypharmazie, insbesondere im hausärztlichen Setting. Diese Empfehlungen beruhen überwiegend auf Expert:innenkonsens und indirekter Evidenz.

SMR von Leitlinien aus Deutschland und Italien empfohlen (konsensbasiert)

Der Ländervergleich zeigt, dass strukturierte Medikationsreviews in mehreren Ländern etabliert und vergütet sind. Ähnlichkeiten zwischen den Ländern zeigten sich darin, dass die strukturierten Medikationsreviews meist von Apotheker:innen durchgeführt werden, und auf Hochrisikopatient:innen fokussieren. Die Länder wiesen Unterschiede hinsichtlich der Implementie-

in mehreren europäischen Ländern refundiert, mit Unterschieden bei Umfang, Vergütung und Implementierung

rung, der Erstattungsmodelle, und der interprofessionellen Zusammenarbeit auf. Transnationale Organisationen empfehlen standardisierte Tools, digitale Interoperabilität und klar definierte Rollen. In Österreich sind strukturierte Medikationsreviews rechtlich als pharmazeutische Tätigkeit verankert, jedoch bislang nicht flächendeckend als erstattete Regelleistung implementiert.

Diskussion und Schlussfolgerungen

Zusammenfassend zeigt die verfügbare Evidenz, dass strukturierte Medikationsreviews zu Verbesserungen medikationsbezogener Prozessendpunkte führen können, insbesondere zur Reduktion potenziell inadäquater Medikation. Für zentrale patient:innenrelevante Endpunkte wie Mortalität, Hospitalisierungen, Stürze oder Lebensqualität ist die Evidenz jedoch begrenzt und uneinheitlich. Der Nutzen strukturierter Medikationsreviews scheint stark von Intensität, Kontext und Qualität der Implementierung abhängig zu sein.

Aus HTA-Sicht sind strukturierte Medikationsreviews daher primär als Intervention zur Verbesserung der Arzneimitteltherapiesicherheit und der Versorgungsqualität einzuordnen, nicht jedoch als Maßnahme mit gesicherten Effekten auf wesentliche klinische Endpunkte. Der Bericht liefert keine Implementierungsanleitung und keine Kosten-Effektivitäts-Bewertung, sondern eine evidenzbasierte Grundlage für gesundheitspolitische Entscheidungsprozesse.

Wenn die nachgewiesenen Effekte als ausreichend für die Einführung einer erstatteten, strukturierten Medikationsanalyse beurteilt werden, sollte die Priorität auf klar definierte Zielgruppen, standardisierte Interventionsbestandteile, strukturierte Kommunikationswege zwischen Apotheker:innen und verordnenden Ärzt:innen sowie die Nutzung digitaler Medikationsdaten gelegt werden. Besonderes Augenmerk sollte auf Hochrisikopatient:innen mit Polypharmazie und Multimorbidität sowie auf eine hohe Umsetzungsrate der Empfehlungen gelegt werden. Eine Implementierung sollte von Versorgungsforschung begleitet werden, die anhand Real-World Daten die langfristige Wirksamkeit, Sicherheit und Kosteneffektivität untersucht.

medikationsbezogene Endpunkte mit Verbesserungen, aber gemischte Ergebnisse für Mortalität, Hospitalisierungen und Lebensqualität

verbesserte Medikationssicherheit, aber keine gesicherten Effekte auf wesentliche klinische Endpunkte

im Fall einer Implementierung, Priorität auf:
- klar definierte Hochrisikopatient:innen
- strukturierte Kommunikationswege
- standardisierte Komponenten
- Nutzung digitaler Medikationsdaten
- begleitende Versorgungsforschung

1 Introduction

1.1 Definitions and Scope

Polypharmacy is broadly defined by the World Health Organisation (WHO) as "the administration of many drugs at the same time or the administration of an excessive number of drugs. Synonyms for polypharmacy are polymedication or multimedication. However, the term has not yet reached consensus regarding its definition, with recent publications revealing great heterogeneity in approaches [1, 2].

Polypharmazie: gleichzeitige Einnahme mehrerer Medikamente

The most common definition of polypharmacy is the simultaneous use of five or more medicines. For ten or more medicines, the term "**hyperpolypharmacy**" has been introduced [3-5]. However, some studies use different medication count-based thresholds for the term (e.g. four or more medicines). Further, there is no agreement on whether to consider over-the-counter drugs or herbal and alternative medications in the total number as well. A second approach for defining polypharmacy is tailored more towards the individual, with a focus on clinical indications and effects of a given drug regimen, regardless of the number of medications used. With this approach, polypharmacy implies that more medications are used or prescribed than those that are clinically indicated. Another point of heterogeneity in definitions is the time window to measure exposure to medications (simultaneous, cumulative or continuous use) [2].

häufigste Definition: gleichzeitige Einnahme von ≥5 Medikamenten

Hyperpolypharmazie: ≥10 Medikamente

The problems of polypharmacy include amongst others adverse drug reactions, increased risk for drug interactions, ineffectiveness, taking medications without indication, inappropriate dosages, prescribing omissions, lack of adherence to therapy, increased healthcare utilisation, falls, cognitive impairment and mortality. Drug-related problems are defined as an "event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes" [6]. They are a common occurrence with polypharmacy, especially in older patients with multimorbidity. While polypharmacy may be appropriate in some older people, there are concerns regarding these drug-related problems [3, 4, 7]. In a systematic review of reviews, the most common association of polypharmacy was inappropriate prescribing with increased hospitalisations as an outcome. Further, polypharmacy rates are increasing due to disease-specific prescribing guidelines, rising levels of multimorbidity due to population ageing, and a lack of evidence to support deprescribing approaches [3, 8, 9].

negative Effekte von Polypharmazie: unerwünschte Arzneimittelwirkung, erhöhtes Risiko von Interaktionen, Einnahme ohne Indikation, niedrige Adhärenz

A careful **medication review** is therefore considered for most people with polypharmacy. A clinical medication review was first defined by Zermansky et al. (2002) as "the process where a health professional reviews the patient, the illness, and the drug treatment during a consultation [10]. It involves evaluating the therapeutic efficacy of each drug and the progress of the conditions being treated. Other issues, such as compliance, actual and potential adverse effects, interactions, and the patient's understanding of the condition and its treatment are considered when appropriate. The outcome of the review will be a decision about the continuation (or otherwise) of the treatment" [11].

Medikationsanalyse gegen Polypharmazie: sorgfältige Untersuchung der eingenommenen Medikamente auf ihre Wirksamkeit & andere Faktoren

A medication review can involve a structured conversation with patients to identify any problems with use, knowledge of the indications, side effects or lack of adherence to treatment [12]. Propositions and solutions are then developed for relevant drug-related problems, e.g. dose adjustments, medication changes or structured discontinuation of medications for the sake of drug safety [1, 7].

strukturiertes Gespräch mit Patient:innen & Entwicklung von Lösungsansätzen

There are three main types of medicines reviews [11]:

1. Prescription review (usually without the patient present). Scope: Practical medicines management issues that can improve the clinical and cost-effectiveness of medicines and patient safety.
2. Compliance and concordance review (with patient present). Scope: Explore medicine taking including the patient's pattern of medicine taking and beliefs about medicines.
3. Clinical medication review (with patient present and with access to patient's medical notes and laboratory test results). Scope: Consider treatment in the context of the patient's underlying condition and symptoms.

3 Arten von Medikationsanalysen:
- Rezeptüberprüfung
- Überprüfung der Therapietreue
- klinisches Medikationsreview

The Pharmaceutical Care Network Europe makes a further distinction: Medication review type 1 (including the medication history), medication review type 2a (including the medication history and patient interview), medication review type 2b (including medication history and clinical data), and medication review type 3 (the most advanced level of review, including medication history, patient interview, and clinical data) [13].

weitere Differenzierung: Medikationsanalyse Typ 1, 2a, 2b & 3

Medication reviews can be regarded as diagnostic interventions aiming to identify problems to act on by the prescriber and/or the patient, or as educational interventions to support patient knowledge and adherence. In practice, the balance of diagnostic and educational elements varies and the boundaries between the three types of medication review are not clear-cut [11].

Auslegung als diagnostische und/oder pädagogische Intervention

Deprescribing, as opposed to the term medication review, refers particularly to the process of identifying and reducing or discontinuing medications with harms that outweigh the benefits [14, 15]. Still, there are inconsistencies in how trials define deprescribing, as well as how these trials report the interventions and outcomes. The process of deprescribing (including the identification of potentially inappropriate medications) as well as the specific method of withdrawal (abrupt versus tapered) are often poorly reported in primary studies [16]. Generally, deprescribing should be aligned with the patient's goals, function, values and preferences. In the UK, a national overprescribing review report found that approximately 10% of all medications are overprescribed, contributing to preventable medication-related harms and increased costs for the healthcare system [16].

Deprescribing = Reduktion von Medikamenten

A variety of tools have been developed to identify potentially inappropriate medications (PIMs) or support structured deprescribing processes with as many as 44 or even 76 distinct tools identified by different reviews [17, 18]. Most frequently the Beers Criteria and the STOPP/START criteria (Screening Tool of Older People's Prescriptions/Screening Tool to Alert Doctors to Right Treatment), the latter which can also identify prescribing omissions, are applied [17]. For German speaking countries, specific tools, such as the EURO-FORTA [19], PRISCUS [20] or the EU-7-PIM list [21] can be used. Furthermore, different tools might detect different PIMs, and an overarching, standardised tool is still to be developed [22].

min. 44 verschiedene Werkzeuge zur Identifikation von potenziell inadäquater Medikation (z.B., STOPP/START Kriterien)

explizite und implizite Werkzeuge zur Medikationsbewertung

Tools can be categorised as explicit or implicit [23]. While "explicit criteria" tools, such as the Beers Criteria, typically list medications or combinations considered potentially inappropriate for older persons, related to pharmacokinetic or pharmacodynamic risks [24], implicit tools (e.g., the Medication Appropriateness Index - MAI) [25] rely on a clinician's judgment and experience to make judgment about medication appropriateness [23]. In parallel, structured deprescribing tools have been developed that guide the process of medication reduction or cessation. A scoping review of deprescribing tools for older patients found differences in target population, development design, setting of application, and variables used in each tool, with both criterion-based and algorithm-based tools described [26].

STOPP/START-Kriterien zur Identifikation inadäquater Verordnungen

The STOPP/START criteria are an explicit tool for people aged 65 and older [27]. The criteria are designed for European populations to both identify and deprescribe inappropriate medication (STOPP) as well as identify potential prescribing omissions (START). Currently, the 3rd update features 190 STOPP, and 57 START criteria [28]. The criteria are arranged by relevant physiological systems, concentrating on commonly prescribed medications for older people [28, 29].

STOPPFrail: Deprescribing bei Gebrechlichkeit (Frailty)

The STOPPFrail is an explicit tool specifically designed for older adults with frailty and limited life expectancy and can be used in all healthcare settings [30]. It was developed, in part, because general tools for older people (e.g. STOPP/START) have a limited applicability in this cohort. Its focus is specifically on deprescribing of medicines with potential harm or limited benefit, while considering continuing health-related quality of life. The current, second version features 25 criteria [31]. Like STOPP/START, the tool is arranged according to physiological systems. Furthermore, the first two items address drugs without a clear indication and failure to take drugs despite education [30].

MAI: implizites Werkzeug zur Beurteilung der Verordnungsangemessenheit

The MAI is an implicit tool consisting of ten questions ought to assess the appropriateness of prescribed drugs [25]. The questions address, among other criteria, the practicality and correctness of directions, the cost or length of therapy, and the existence of an indication. Importantly, MAI does not address any specific drugs nor potential prescribing omissions [29].

STRIP-Methode: kombiniertes, patient:innenzentriertes Medikationsreview; Kooperation zwischen Hausärzt:innen und Apotheker:innen

The STRIP method (Systematic Tool to Reduce Inappropriate Prescribing) [32] combines implicit prescribing tools with the explicit STOPP/START tool. It was designed to assess potentially inappropriate prescribing (PIP) criteria in older people and features a web-application STRIP assistant. Although the method can also be used in hospital settings, the aim of the method was to improve the collaboration between general practitioners (GPs) and pharmacists. Furthermore it features active patient involvement. The method consists of five steps: (1) Medication assessment – which consists of gaining knowledge of all medications used and the patient's goals; (2) Pharmacotherapy review – in which the STOPP/START tool is applied; (3) Drafting of a pharmaceutical care plan; (4) Shared decision-making with the patient; and (5) Follow-up and monitoring.

In Austria, about 500,000 people are affected by polypharmacy [33]. In a co-operation project between the Umbrella Organisation of Austrian Social Insurances, the Austrian Chamber of Pharmacists and the Medical University of Vienna, a structured medication review was piloted and evaluated on 198 patients using a randomised controlled trial (RCT) [34]. The results indicated a possible 70% reduction of drug-related problems. In the study, drug-related problems were assessed as a composite outcome comprising multiple predefined categories, including adherence-related problems, health-literacy issues, dosing errors, duplicate prescriptions, potential drug-drug interactions and other medication-related problems. The reported 70% reduction refers to the overall composite drug-related problems count at follow-up and cannot be attributed to a single outcome domain [35]. Based on these results, efforts are being made in Austria to establish structured medication reviews as a standardised, reimbursed intervention [36]. In Germany, the costs of structured medication reviews for patients with polypharmacy have been covered by health insurance since 2022. The costs are covered once a year, or in the event of a significant change in medication [37].

~ 500.000 Menschen in Österreich (Ö) von Polypharmazie betroffen

randomisierte Studie (RCT) zu Polypharmazie aus Wien zeigte eine Reduktion von 70 % arzneimittelbezogener Probleme (N=198)

1.2 Legal aspects of medication reviews in Austria

Medication reviews can take place in different settings and by different professional groups. One relevant setting for medication reviews in Austria are pharmacies. Other settings are primary care, hospitals and nursing homes.

Medikationsanalysen in unterschiedlichen Versorgungssettings

In Austria, the term medication review or medication analysis has a specific legal meaning when used in the context of pharmacy law. The most relevant legal basis for pharmacies in Austria is the Pharmacy Act (*Apothekengesetz)*, which regulates the personnel and factual requirements for the operation and establishment of pharmacies [38]. In addition, the pharmacy operating regulations (*Apothekenbetriebsordnung*) regulate the operation of all pharmacies in Austria and describe in §1 the statutory services which have to be provided by public pharmacies [39]. The main tasks of a pharmacy are the delivery of prescribed and non-prescribed drugs, the production of medications, the procurement of drugs from abroad, the provision of information and guidance for patients and practitioners about drugs, the consultation on health and nutrition and the giving of information regarding health education and awareness with the goal of betterment of a healthy lifestyle [40].

Apothekengesetz & Apothekenbetriebsordnung definieren u.a. die Tätigkeitsbereiche von Apotheker:innen

The consultation of medications is a task that pharmacies must provide, and which is reserved for them [39]. They must provide consultations when it is required because of drug safety, if the consultation is necessary because of other reasons or if the consultation is demanded. Yet, a structured medication review goes beyond simple guidance on medications as it is separately defined as a task reserved for pharmacists in the Pharmaceutical Professionals Regulation (*Pharmazeutische Fachkräfteverordnung*). There it is stated under §2 (1) 5 that clinical pharmacy (including medication management and medication reviews) is reserved for and can only be conducted by pharmaceutical

Medikationsanalysen als eigenständige, von Beratungen differenzierte Tätigkeit, die Pharmazeut:innen vorbehalten ist

professionals in pharmacies[1]. Thus, clinical pharmacy is separated from the task defined in §2 (1) 3 [41], which defined the pharmaceutical task of guidance and information about medications and medical products [42]. This division is also apparent in the Pharmacy Act §5 (1), which also separates Point 2 (**Clinical pharmacy** including medication management and medication analysis) and Point 4 (**Guidance** (German: Beratung) and information about medicine/drugs)[43]. Points: 1, 3 and 5 of the Pharmacy Act are not included here, as they are not relevant for medication analysis/review.

Medikationsanalysen beinhalten die Analyse aller Medikamente die Patient:innen einnehmen

Structured medication reviews as defined in the Pharmacy Act refer to a pharmaceutical service reserved for pharmacists in pharmacies, and cannot be conducted by other pharmaceutical professionals (other pharmacy personnel or pharmaceutical sales representatives). This does not preclude physicians from reviewing and adjusting patients' medication as part of medical diagnosis and treatment, which is regulated separately under medical law. The difference between medication reviews and general consultations about medications is that medication reviews involve the analysis of all of a patient's medications with following consultations in form of medication managements. However, pharmacists do not have the right to diagnose or make therapy recommendations. These tasks are reserved for physicians. No direct mentions of structured medication reviews were found in the Austrian Medical practitioner Act 1998 (*Ärztegesetz 1998*) [44], the Health and Care Act (*Gesundheits- und Krankenpflegegesetz*) [45], the Medical Education Ordinance (*Ärzte-Ausbildungsverordnung 2015*) [46], the Prescription Requirement Act (*Rezeptpflichtgesetz*) [47], or in the Medicinal Products Act (*Arzneimittelgesetz*) [48], amongst others (IA 3868/A 27. GP)[2].

Unterschied zum ärztlichen Tätigkeitsfeld: Diagnose & Therapieempfehlungen Mediziner:innen vorbehalten

1.3 Project aims and research questions

Projektziele: systematisches Review zur Evidenz von Polypharmazie & Überblick zum Stand in anderen Ländern

The aim of the project was to create a systematic review of the evidence regarding structured medication reviews in adults with polypharmacy. For this, we assessed several health technology assessment domains (effectiveness, safety, organisational, patient, economic), accompanied by a guideline search, for structured medication reviews conducted in any setting by any professional. A further aim was to give an overview of similar projects in selected European countries in order to provide a knowledge base for decision-making.

keine Kosteneffektivitäts-Analyse oder detaillierter Implementierungsplan

The aim of this study is not to carry out a cost-effectiveness analysis, or to develop a detailed implementation plan for structured medication analysis in Austria.

2 Forschungsfragen (FF)

Two research questions (RQ) will be answered:

RQ1: What evidence on the benefits, safety, organisational aspects and costs of structured medication review is described in the literature?

RQ2: How are structured medication review programmes organised, implemented and reimbursed in selected countries?

[1] This legal definition refers to the provision of medication reviews as a pharmaceutical service and does not regulate medication review activities conducted by physicians as part of medical diagnosis and treatment.

[2] Based on an an expert consultation with the Austrian Federal Ministry of Labor, Social Affairs, Health, Care, and Consumer Protection, Section VI, Medical Law and Health Telematics.

2 Methods

The research questions and project protocol were pre-registered on the Open Science Framework (OSF) [49]. The two research questions were answered using the following methods:

Vorabregistrierung des Projektprotokolls & der FF auf dem Open Science Framework (OSF)

2.1 Research question 1: Evidence on effectiveness, safety, organisational aspects and costs of structured medication reviews

A systematic search for umbrella reviews, systematic reviews and meta-analyses was conducted to overview the evidence on effectiveness, safety, organisational aspects and costs of structured medication reviews for patients with polypharmacy. Regarding the setting, no restriction was applied – as such, pharmacies, primary care settings, hospitals, nursing homes and further possible settings were considered relevant. This systematic search was accompanied by a hand search for guidelines relating to structured medication reviews.

Übersicht der Evidenz zur Wirksamkeit, Sicherheit, organisatorischen Aspekten und Kosten

systematische Suche nach systematischen Übersichtsarbeiten und Meta-Analysen in 4 Datenbanken

The systematic search was conducted on June 26th, 2025 in the following four databases to identify relevant studies:

- Ovid Medline (PubMed)
- The Cochrane Library
- Epistemonikos
- INAHTA Database (HTA reports)

The search strategy for each database is provided on OSF [49].

The title and abstract screening was performed in Rayyan [50] by two researchers (RJ, JKK). The full-text screening was carried out by one researcher (RJ or JKK) and reviewed by a second researcher (JKK or RJ). The literature selection followed predefined inclusion and exclusion criteria (see Table 2-1). In addition to these criteria, we excluded articles in which polypharmacy or medication review was not explicitly listed within the studies' inclusion criteria (e.g., within studies that broadly assessed "pharmaceutical interventions" for polypharmacy without explicitly mentioning medication reviews). A list of articles that were excluded for this reason is provided in the Appendix (see Appendix Table A-1). Further, we excluded country-specific analyses or scoping reviews. Umbrella reviews were included as standalone evidence sources and were subject to less strict inclusion criteria and, as a result, broader interventions (e.g. any type of polypharmacy intervention) were accepted.

Literaturauswahl orientierte sich an der best-verfügbaren und rezentesten Literatur

Table 2-1: Pre-defined inclusion and exclusion criteria (PICO)

	Inclusion	Exclusion
Population	■ Persons with polypharmacy (long-term, simultaneous use of at least five active ingredients)	■ Persons without polypharmacy
Intervention	■ Structured medication review in any setting (e.g. pharmacies, primary care settings, hospitals, nursing homes, etc.)	■ Indication- and/or drug-specific interventions ■ Clinical decision-support systems, of which the medication analysis is only a part of the intervention
Comparator	■ Usual care or standard approaches ■ Comparing two or more types of medication reviews ■ No comparative intervention	-
Outcomes	■ Drug-related problems (e.g., adverse effects, interactions) ■ Morbidity ■ Mortality ■ Hospital admissions ■ Adherence to therapy ■ Health literacy ■ Quality of life Further aspects of interest: ■ Organisational aspects (professional groups involved, setting, time required) ■ Influence on the relationship between patients, pharmacists and healthcare providers ■ Costs (direct and indirect)	■ Clinical parameters, surrogate endpoints
Publication type	■ Systematic reviews, Umbrella reviews, HTA reports, Guidelines	■ Narrative reviews, Primary studies, Conference abstracts, Editorials, Opinions
Languages	■ English, German	■ All other languages
Publication period	■ Published since 2020 (Rationale: Evidence published within the last five years is deemed more likely to be relevant for current clinical and policy decisions).	■ Published before 2020

Realist reviews in Diskussion beschrieben

Realist reviews are a methodology that helps establish when, how, for whom and to what extent complex interventions can work by defining the programme theory for a particular intervention [51]. Realist reviews were excluded for the first research question, but informed policy and research implications (see Discussion 4.1.3).

32 Studien zur Volltextanalyse, davon 6 Studien ausgewählt (3 systematische Übersichtsarbeiten (SRs), 3 Umbrella Reviews (URs))

Umbrella reviews and systematic reviews for the first research question were selected through an iterative process. After screening 492 abstracts, 32 articles were selected for full-text analysis. After full-text analysis, three systematic reviews and three umbrella reviews were identified as relevant for the research question [52-57]. This approach was chosen because the aim of RQ1 was to synthesise existing evidence on structured medication reviews at a higher level, and several umbrella reviews provided a comprehensive and methodologically transparent synthesis of multiple systematic reviews. Regarding the

umbrella reviews, systematic reviews included within these were not extracted separately; only the umbrella review synthesis was considered.

ein SR definierte Polypharmazie als ≥4 Medikationen (anstatt ≥5)

Regarding study selection, one of the included systematic reviews [57] defined polypharmacy as ≥4 medications rather than ≥5. As the population still represented patients with polypharmacy and the review met all other inclusion criteria, it was retained in the synthesis. This deviation from the inclusion criterion was judged not to affect the relevance of the findings.

Studienbewertung: Ausschluss eines Umbrella Reviews aufgrund eines hohen Verzerrungsrisikos

The potential risk of bias was assessed using ROBIS [58] by one researcher (RJ or JKK) and reviewed by a second researcher (JKK or RJ). The ROBIS domains effectiveness and safety (with a descriptive analysis of the organisational and economic domains) were assessed. We excluded one umbrella review due to high risk of bias. This was due to only one database being searched, no other search methods provided, unspecified selection criteria, and no information on the screening process. Further, the excluded umbrella review did not use a risk of bias assessment using standardised tools [54]. The final literature selection was based on these predefined inclusion criteria and risk-of-bias assessment: two umbrella reviews [52, 55] and three systematic reviews [53, 56, 57] had low risk of bias and were included in the presentation of the results.

URs schlossen SRs mit Meta-Analysen oder narrativer Evidenzsynthese ein

Systematic reviews included in the umbrella reviews applied either quantitative meta-analysis or narrative synthesis, depending on data availability and heterogeneity. Reviews included within umbrella reviews using narrative synthesis were systematic in design and differed from non-systematic narrative reviews in terms of their methodological approach [52, 55].

Evidenzsynthese auf Review-Ebene (URs und SRs)

Data from umbrella reviews [52, 55] were extracted and synthesised at the level of the umbrella review, based on the pooled or narratively synthesised findings reported by the review authors, and were not deconstructed into individual primary studies. The three further included systematic reviews [53, 56, 57] were analysed at the same review level and synthesised alongside the umbrella reviews to ensure comprehensive coverage of the available evidence without re-analysing primary study data.

Datenextraktion: weitere Kategorien iterativ zu den vorab definierten hinzugefügt

The data extraction of the umbrella reviews was conducted by one researcher (JKK) and checked by another (RJ). The systematic reviews were extracted by one researcher (RJ) and checked by another (JKK). The full set of predefined data extraction domains is presented in Table 2-2 and includes study characteristics, intervention characteristics, patient and organisational domains, clinical outcomes, economic aspects, and implementation factors. In addition to these predefined categories, the following extraction categories were added iteratively: risk of bias in included primary studies (as assessed by the authors of the umbrella and systematic reviews), change in number of drugs or dose, prescribed potentially inappropriate medications, potential prescribing omissions, differentiation of adverse drug events, emergency department visits, composite outcomes, healthcare costs, cost analyses, implementation factors, and author conclusions.

Table 2-2: Data extraction categories

	Data Extraction
Study methods	■ Title ■ Study design ■ Population ■ Intervention ■ Comparator ■ Outcomes ■ Setting ■ Included study type ■ Additional inclusion and exclusion criteria ■ Systematic search period ■ Study conclusion
Characteristics of included studies	■ Number of included studies per study type ■ Risk of bias in included studies ■ Total of included participants ■ Patient characteristics ■ Intervention characteristics ■ Setting ■ Follow-up
Effectiveness	■ Drug-related problems (adverse effects, interactions) identified with the intervention ■ Change in number of drugs or dose ■ Potentially inappropriate medications ■ Potential prescribing omissions
Safety	■ Morbidity ■ Adverse drug events and adverse drug withdrawal events due to the intervention ■ Mortality ■ Hospitalisations ■ Emergency department visits ■ Composite outcomes
Organisational domain	■ Professional groups involved ■ Time requirements ■ Influence on the relationship between healthcare providers
Patient domain	■ Adherence to therapy ■ Health literacy ■ Health-related quality of life ■ Influence on the relationship between patients and healthcare providers
Economic domain	■ Healthcare costs ■ Cost analyses
Implementation factors	■ Facilitators ■ Barriers

Erhebung der sich überlappenden Primärstudien

In addition, we used the GROOVE tool (Graphical Representation of Overlap for OVErviews) [59] to assess primary study overlap within reviews included in systematic reviews in the form of a citation matrix (see Appendix Figure A-3 and Figure A-4). Further, we manually checked whether systematic reviews included in our analysis were also included in the umbrella reviews selected for analysis.

Leitliniensuche in 3 Datenbanken und ergänzende Handsuche

The search for guidelines was conducted on July 21st, 2025 using the search terms polypharmacy, medication review and deprescribing. The search was performed in the following three databases:

- AWMF (Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften e.V.)
- GIN (Guidelines International Network)
- TRIP (Turning Research into Practice) Medical Database

In addition, a hand search for guidelines on medication review for polypharmacy was conducted through Google search.

The guideline hand search was executed by one researcher (RJ), while the selection was performed by two researchers (RJ, JKK). For guideline selection, only guidelines in English or German were included, while guidelines published before 2020 were excluded. Guidelines that did not report their methodology were excluded from the analysis, but we provide a brief narrative description of these guidelines in Results 3.1. A total of six guidelines were included in our analysis [60-65]. The quality of the guidelines was assessed using AGREE II [66]. We focused the quality assessment on domains 2 (Stakeholder involvement), 3 (Rigour of development) and 6 (Editorial independence), as recommended by the general methods of the Institute for Quality and Efficiency in Healthcare (German: Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen, IQWiG) [67]. Finally, the recommendations in included guidelines were extracted by one researcher (RJ or JKK). For searching for relevant information within guideline documents, we used large language models (Anthropic Claude Sonnet 4, Google Gemini 2.5 Pro) before manually extracting the information. We chose this approach based on evidence that large language models can accurately identify and extract pre-specified data elements from documents when combined with human validation [68].

Auswahl von 6 Leitlinien; Bewertung der Qualität der Leitlinien mittels standardisiertem Tool (Erhebung von Stakeholder-Involvement, Methodik und redaktionelle Unabhängigkeit)

2.2 Research question 2: Implementation and reimbursement of structured medication review in selected countries

This part of the study constitutes a descriptive qualitative content analysis rather than a systematic review. Based on country profiles, we analysed organisational characteristics, remuneration structures, and practical implementation procedures of structured medication review programmes in selected countries to assess their potential transferability to the Austrian context.

FF2: qualitativer Ländervergleich

We based our country selection on the European survey "Characterisation, implementation and remuneration of community pharmacist-led medication review procedures across Europe" (2020), as this publication represents the only comprehensive cross-country comparison of remuneration models for structured medication review programmes currently available in Europe. The focus on pharmacist-led services in this survey does not reflect a restriction of our report to pharmacist-led interventions, but rather the fact that, in European healthcare systems, formal reimbursement models for structured medication reviews are predominantly linked to pharmacist-led services. The survey was therefore used as a pragmatic sampling frame to identify countries with established, reimbursed programmes for structured medication reviews [69].

Auswahl an Ländern mit etablierter Medikationsanalyse

For our analysis, we aimed to select countries with established programmes for structured medication reviews. Following this framework, we included:

- Countries with remuneration and high implementation level: England, Northern Ireland, Switzerland, Netherlands

- Countries with remuneration but limited implementation: Austria[3], Belgium, Germany

For this report, England and Northern Ireland were grouped as the United Kingdom. Therefore, the countries selected for our report are Austria, Belgium, Germany, the Netherlands, Switzerland, and the United Kingdom. In addition, we included documents from transnational organisations (WHO, OECD, EU) to provide a broader policy context and international benchmarks.

Auswahl: Ö, Belgien (BEL), Deutschland (D), Niederlande (NLD), Schweiz, UK; außerdem: WHO, OECD, EU

To identify documents from the selected countries and transnational organisations, we conducted a structured hand search on websites of health ministries, websites of professional pharmacy associations and evaluation reports of pilot projects. Searches were complemented by Google web search and ChatGPT (Version 5) assisted document retrieval to identify the most recent publicly available information. Recent evidence suggests that while large language models do not currently achieve the high recall of traditional systematic search methods, they can serve as complementary tools in information retrieval, supplementing structured hand searches by identifying additional potentially relevant documents when used alongside established search strategies and with human oversight [70]. The search terms used were polypharmacy; structured medication review; polymedication check; pharmacist-led review, and deprescribing. Two researchers (RJ, JKK) conducted the hand search between September and October 2025.

strukturierte Handsuche mit Unterstützung von ChatGPT (Version 5) zur Dokumentenidentifikation

For data extraction, we defined preliminary data extraction categories (see Table 2-3). During data extraction, three further categories were added iteratively: medication review type, remuneration, and implementation notes (see Appendix 1.1.2 and Appendix 1.1.3). The data extraction was conducted by one researcher (RJ) and verified by another researcher (JKK). Given the descriptive nature of this research question, no quality or risk-of-bias assessment of included documents was performed. The focus was on processes and organisational characteristics, rather than effectiveness or clinical outcomes (addressed under RQ1). All country profiles were analysed using qualitative content analysis to identify common themes, differences, and contextual factors. The country profiles were then summarised narratively and synthesised into recommendations for Austria (see Results 3.2).

Datenextraktion nach vordefinierten Kriterien & 3 zusätzliche Kategorien

[3] In the 2020 European survey by Imfeld-Isenegger et al., Austria was classified as a country with reimbursed medication review. However, this categorisation appears to have been based on pilot-level or project-specific remuneration rather than a nationwide reimbursed service. As of 2025, Austria has no permanent reimbursement model under statutory health insurance; structured medication reviews remain limited to pilot studies and research projects.

Table 2-3: Preliminary data extraction categories

Category	Data to be extracted
Setting	■ E.g., pharmacies, hospitals, doctor's office, home environment, nursing homes, etc.
Process	■ Duration of the patient consultation, frequency
Patient selection	■ Usage of selection criteria
Methods	■ Questionnaires used (e.g. Medication Appropriateness Index (MAI), Screening Tool of Older Persons Potentially Inappropriate Prescriptions (STOPP), Screening Tool to Alert Doctors to Right Treatment (START) criteria)
Programme components	■ Clinical components (e.g. analysis of contraindications, interactions, dosages, duration of therapy, identification of drugs without indication, identifications of indications without drugs) ■ Patient-centred components (e.g. therapy adherence, analysis of administration technique) ■ System-related components (e.g. identification of generic drugs as more cost-effective alternatives)
Workforce requirements	■ Professional groups involved ■ Qualifications, additional training
Digital tools	■ Digital documentation ■ Link to electronic health records ■ Automated detection of drug interactions and other drug-related problems
Costs	■ Costs per intervention ■ Savings potential (potentially fewer medication prescriptions or hospital stays)

3 Results

3.1 Evidence on effectiveness, safety, organisational aspects and costs of structured medication review

3.1.1 Study characteristics

eingeschlossene Literatur: 2 URs & 3 SRs

This synthesis contains evidence from two umbrella reviews [52, 55] and three systematic reviews [53, 56, 57]. The two umbrella reviews [52, 55] included systematic reviews with either meta-analyses or narrative syntheses of results. The three systematic reviews [53, 56, 57] included randomised controlled trials.

Studienpopulation und Definition von Polypharmazie in eingeschlossener Literatur

Across all studies, adults with polypharmacy were the included population. Two systematic reviews [56, 57] further specified the population to adults 65 years or older. The third systematic review focused the analysis on hospitalised patients [53]. While one systematic review defined polypharmacy as taking four or more prescribed medications [57], the other included studies defined polypharmacy as taking five or more prescribed medications [52, 53, 55, 56]. Mean participant ages ranged from 53 to 87.7 years [52, 53]. The mean medication burden was reported in one systematic review, with nine medications per patient (range 7 to 16) [53].

URs: von 1.925 bis 61.006 Teilnehmer:innen in eingeschlossenen Studien

The total number of participants varied, with one umbrella review reporting participant ranges from 1,925 to 61,006 across included studies [52], while these numbers were not reported in the other umbrella review [55]. Within the three systematic reviews included in our report there was a total of 4,633 participants [57], 8,813 participants [56] and 15,076 participants [53] across included RCTs respectively.

UR-Fokus auf verschiedene Interventionen gegen Polypharmazie

Interventions varied considerably in complexity and approaches. While the umbrella reviews investigated a broader set of interventions for adults living with polypharmacy, the systematic reviews focused on medication reviews and deprescribing interventions for adults with polypharmacy [53, 56, 57]. The interventions within the umbrella reviews comprised a range of multicomponent approaches aimed at medication optimisation and deprescribing. These included medication optimisation clinics, deprescribing as an explicit intervention goal implemented through components such as patient education and counselling, healthcare professional education, interdisciplinary case conferences, decision aids or computerised decision-support systems to support deprescribing or optimisation, use of explicit or implicit tools and guidelines, pharmacogenomic approaches, polypharmacy questionnaires, and pharmacist-led medication reviews [52, 55].

SR mit Fokus auf Medikationsanalysen bzw. Deprescribing Interventionen

Werkzeuge STOPP/START und STOPPFrail am häufigsten im Einsatz

Deprescribing häufig für Anticholinergika, Protonen-pumpenhemmer, Thrombozyten-aggregationshemmer

Across the three included systematic reviews [53, 56, 57], the interventions primarily consisted of medication reviews compared with standard care, comparisons between different types of medication reviews, or comparisons between two medication review approaches. In most studies, medication reviews were embedded within multi-component interventions and were frequently accompanied by co-interventions, such as patient counselling, discharge counselling, written communication to primary care physicians, or other forms of follow-up. With regard to content, medication reviews were most often non-criteria-based, relying on clinical assessment of drug-related problems. A smaller number of studies applied explicit decision support tools, including STOPP/START criteria, STOPPFrail criteria, Beers criteria, and computerised decision-support systems such as the SENATOR software, STRIP software, or web-based tools. According to one systematic review, the interventions most frequently targeted anticholinergics, proton pump inhibitors, and antiplatelet drugs, with STOPP/START or STOPPFrail criteria being the most frequently used decision-support tools [56].

verschiedene betrachtete Settings in den UR

Settings fokussierter in den SRs

Regarding settings, the umbrella reviews included the full spectrum of healthcare environments (community-based settings, primary care, outpatient settings, hospital settings, nursing homes or long-term care facilities) [52, 55] while the three systematic reviews showed a more specific focus on the setting. One systematic review examined the inpatient hospital setting (medication reviews were conducted during hospitalisation, with healthcare utilisation outcomes assessed after discharge during follow-up) [53], while another systematic review concentrated solely on community pharmacy settings [57]. The third systematic review focused exclusively on deprescribing and allowed a variety of settings, including primary care, outpatient care, nursing homes, and community pharmacies [56]. The geographic distribution varied across reviews, including studies from European nations, Canada, the United States, South Korea, Brazil, New Zealand, and multinational studies [53, 57].

Vergleichsintervention: Standardtherapie

Comparator groups were generally consistent across reviews, with most studies comparing to usual care or standard approaches to medication management [52, 53, 57]. In addition, one systematic review included RCTs that compared different types of medication reviews [53].

breites Spektrum an Endpunkten in den URs: Mortalität, Krankenhausaufenthalte, unerwünschte Arzneimittelwirkungen, gesundheitsbezogene Lebensqualität ...

The umbrella reviews [52, 55] assessed a broad range of outcomes, including:

- all-cause mortality,
- hospitalisation,
- adverse medication events (e.g., adverse drug reactions, drug-drug interactions, falls),
- health-related quality of life,
- medication adherence,
- medication burden,
- disease-specific risk factors (e.g. cognitive functioning, blood pressure control, mobility and falls).

Einordnung der Endpunkte in einem UR in 4 Kategorien

One of the umbrella reviews [55] further structured these outcomes into four categories:

- medication-related process outcomes, e.g. reduction in PIMs or potential prescribing omissions (PPOs),
- clinical and functional outcomes,
- healthcare use and economic outcomes,

- acceptance of interventions among patients and clinicians.

Only one systematic review explicitly defined a primary outcome (all-cause mortality) [53]. In contrast, the remaining systematic reviews [56, 57] and both umbrella reviews [52, 55] reported multiple outcomes without explicitly distinguishing between primary and secondary outcomes. The systematic review on the hospital-based intervention selected all-cause mortality as the primary outcome, with adverse drug events, hospital readmissions, emergency department contacts, and health-related quality of life as secondary outcomes [53]. The systematic review on deprescribing required studies to measure both drug reduction attempts and additional clinical or economic outcomes [56], whereas the systematic review on community pharmacists focused on hospitalisation, emergency department visits, quality of life, and adherence [57].

Endpunkte in den SRs: Mortalität, Versuche der Medikamentenreduktion, Krankenhausaufenthalte, Notaufnahmen...

3.1.2 Included study designs and quality assessment

One umbrella review included five systematic reviews (three meta-analyses and two systematic analyses with narrative synthesis) and the other umbrella review included 14 (seven meta-analyses and seven systematic reviews) [52, 55], while the systematic reviews included four, 14 and 25 RCTs respectively [53, 56, 57]. Both umbrella reviews used AMSTAR 2 to assess the quality of the included systematic reviews. While one umbrella review rated the quality of the five included systematic reviews as low (3 reviews), moderate (1 review) and high (1 review) [52], the other umbrella review only reported a mean quality score of 10.8 (SD 2.8) out of 16 across the 14 systematic reviews, without providing individual quality ratings [55]. All systematic reviews included in the two umbrella reviews (including the three low quality ones) were retained in the data synthesis. In both umbrella reviews, the evidence quality as assessed within included systematic reviews was consistently rated as low to very low across outcomes [52, 55].

eingeschlossene Studien
URs: 5 & 14
SRs: 4, 14 & 25

Evidenzqualität zwischen Reviews: niedrig - sehr niedrig

In the three included systematic reviews, the overall quality of the underlying evidence from randomised controlled trials was assessed as low to very low. The most common risk of bias was the inability to blind personnel to the intervention (performance bias), reflecting the nature of medication review interventions that require active implementation by healthcare professionals. Additional sources of bias included inadequate or insufficiently reported randomisation procedures, lack of blinded outcome assessment for subjective outcomes (such as adverse drug events or health-related quality of life), and substantial loss to follow-up with different dropout rates between intervention and control groups [53, 56, 57].

häufige Verzerrungsquellen in Interventionsstudien Unverblindbarkeit, unklare Randomisierung, fehlende Outcome-Verblindung und Drop-outs als zentrale Bias-Risiken.

One umbrella review further reported study overlap among the 179 unique primary studies included across their 14 systematic reviews, with 20% of primary studies appearing in multiple systematic reviews [55].

20 % Überlappung der Primärstudien laut einem UR

Based on our ROBIS assessments, the two umbrella reviews [52, 55] and three systematic reviews [53, 56, 57] included in the analysis of this report showed low risk of bias across all assessment domains (see Appendix Figure A-2).

niedriges Verzerrungsrisiko in den eingeschlossenen Reviews

The assessment of study overlap within the three included systematic reviews using the GROOVE tool [59] showed no overlap [53, 57], slight overlap (2.6%) [53, 56], and moderate overlap (5.9%) [56, 57] (see Appendix Figure A-3 and Figure A-4). Regarding the inclusion of the three included systematic reviews

keine bis moderate Überschneidung der Primärstudien

within the two included umbrella reviews, we found that two systematic reviews were not included [53, 56], whereas one systematic review was included in both umbrella reviews [57].

3.1.3 Effectiveness

Potentially Inappropriate Medications (PIMs):

2 URs: signifikante (sig.) Reduktion der potenziell inadäquaten Medikation

Both umbrella reviews reported evidence that structured polypharmacy interventions (primarily medication review-based approaches, including deprescribing approaches, delivered alone or as part of multi-component interventions) were associated with reductions of PIMs compared to usual care [52, 55]. The first umbrella review reported significant reductions of PIMs across all five included systematic reviews [52]. The second umbrella review found that two meta-analyses showed significant reductions in the number of PIMs (standardised mean difference -0.22; 95% CI -0.38 to -0.05, and mean difference -0.49; 95% CI -0.70 to -0.28). However, there was no significant difference in the proportion of patients with at least one PIM (risk ratio 0.79; 95% CI 0.61 to 1.02), and three included systematic reviews provided mixed effects [55]. In addition, six systematic reviews assessed medication appropriateness using heterogeneous measures (including clinical judgement or validated tools such as MAI), with four reviews reporting improvements in medication appropriateness in the intervention groups compared with usual care, while two reported mixed effects. These reviews reported direction of effect, without providing standardised effect sizes or pooled effect estimates. The remaining systematic reviews included in that umbrella review did not report PIM-related outcomes [55].

1 SRs: 58 – 91 % der Medikationsanalysen führen zur Empfehlung einer Medikationsänderung

The hospital-based systematic review reported that, across five RCTs, between 58% and 91% of conducted medication reviews were associated with recommendations for at least one medication change following a structured medication review. However, this review did not report whether these recommendations were implemented and resulted in a reduction of potentially inappropriate medications [53]. The other systematic reviews did not report on this outcome [56, 57].

Empfehlung zur Medikationsreduktion von ø 4.5 vs. tatsächliche Reduktion von ø 1.5

In the deprescribing systematic review, reviewers recommended discontinuation of an average of 4.5 medications per patient; however, only 1.5 medications were actually discontinued on average, indicating partial uptake of deprescribing recommendations [56].

Potential Prescribing Omissions (PPOs):

1 UR: sig. Reduktion von Verschreibungsunterlassungen

One umbrella review identified two systematic reviews addressing this outcome, with one meta-analysis showing significant reductions in both the number of PPOs (standardised mean difference -0.81; 95% CI -0.98 to -0.64) and the proportion of patients with at least one PPO (risk ratio 0.40; 95% CI 0.18 to 0.85), associated with multi-faceted pharmaceutical care-based approaches (medication review and prescribing optimisation activities, often supported by validated prescribing tools). Another systematic review also included one study in which PPOs decreased [55].

The systematic reviews did not report on this outcome [53, 56, 57].

Changes in Number of Drugs or Dose:

One umbrella review reported one meta-analysis showing a reduction in total number of medications (mean difference -0.99; 95% CI -1.38 to -0.14), associated with medication review and deprescribing interventions compared with usual care. However, the same umbrella review included four systematic reviews with mixed results (mixed effects in two, reduction in one and null effect in one study) [55].

1 UR: Reduktion der Medikamentenanzahl in 1 SR, 4 systematische Reviews mit gemischten Ergebnissen

The systematic review with a focus on deprescribing found that 12 of 14 studies showed greater drug reductions in the intervention groups compared to the control groups, with statistical significance in ten studies. However, pooled effect estimates and corresponding 95% confidence intervals were not reported in the review. One of the two remaining studies showed a statistically non-significant reduction in drug dose. The other remaining study reported recruitment difficulties and showed no statistically significant difference between groups [56].

1 SR: größere Medikamentenreduktion in der Interventionsgruppe (IG) in 12/14 Primärstudien

Differences in reported effectiveness

Both umbrella reviews [52, 55] and two of the systematic reviews [53, 56] noted that differences in reported effectiveness were partly explained by organisational characteristics of the interventions, particularly the degree of interprofessional collaboration, the intensity of the intervention, and the extent to which medication review recommendations were implemented by prescribers. For results regarding the organisational domain, see chapter 3.1.5.

Unterschiede in der berichteten Wirksamkeit aufgrund organisatorischer Aspekte der Intervention

3.1.4 Safety

Morbidity:

Neither the umbrella nor the systematic reviews reported on morbidity [52, 53, 55-57].

Endpunkt Morbidität in keiner Studie berichtet

Adverse drug events and adverse drug withdrawal events associated with deprescribing or other components of the intervention:

Both umbrella reviews reported on this outcome, with one showing no significant difference in adverse drug events (in three systematic reviews) [52], and the other showing variable results for drug-related problems (three reviews showing reductions, four mixed effects, and one showing null effects) [55].

unerwünschte Ereignisse (UE)
2 URs: Reduktion & gemischte Ergebnisse

Two of three systematic reviews included in our report reported on this outcome. The hospital-based systematic review reported no statistically significant difference between groups from one study (risk ratio 1.08, 95% CI 0.53 to 2.18) [53]. Within the deprescribing systematic review, one RCT reported adverse drug withdrawal events (i.e., clinically significant symptoms or recurrence of underlying conditions triggered by medication discontinuation) in 1.81% of participants, requiring the restart of medications. Six RCTs also reported on the need to restart deprescribed medications, with results ranging from 9.6% to 34.3% (proportion of participants in the intervention group who had at least one deprescribed medication restarted during follow-up, due to adverse effects or symptom recurrence) [56].

2 SRs: keine statistische Reduktion & Notwendigkeit einer Wiederaufnahme der Medikation in 10-34 % der Patient:innen

Intervention effects on falls were reported as safety outcome (rather than effectiveness outcome). Polypharmacy and PIMs are known risk factors for falls, while medication review and deprescribing may either reduce fall risk by optimising pharmacotherapy or, conversely, increase risk through withdrawal effects or symptom recurrence. For falls, one umbrella review reported results from several meta-analyses, none of which demonstrated a statistically significant reduction in fall-related outcomes associated with the intervention. The systematic reviews using narrative synthesis included in the umbrella review showed reductions in falls due to the intervention in two reviews, mixed effects in one review and null effects in two reviews [55]. Two of three systematic reviews included in our report reported on falls, with the hospital-based systematic review showing a non-significant reduction in falls (risk ratio 0.69; 95% CI 0.33 to 1.46) and falls with non-vertebral fractures (risk ratio 0.23, 95% CI 0.03 to 1.95) [53]. The deprescribing systematic review showed no statistically significant difference in falls between groups in five RCTs, and a statistically significant decrease in falls in the intervention group in one RCT, without reporting effect estimates [56]. In the included studies that reported on falls, medication review or deprescribing was often embedded within multi-component interventions, which limits attribution of observed effects on falls to medication review alone [53, 55, 56].

Stürze:
2 URs mit gemischten Ergebnissen o. keiner Reduktion;

2 SRs ohne sig. Reduktion in den meisten Studien

Across the two included umbrella reviews [52, 55] and the three included systematic reviews [53, 56, 57], falls were the only adverse outcome consistently reported in relation to deprescribing or other components of structured medication review interventions. Falls were considered either adverse drug events associated with ongoing pharmacotherapy or adverse drug withdrawal events potentially related to medication discontinuation or modification. No other specific adverse events attributable to medication review or deprescribing were reported across the included reviews.

neben Stürzen keine weiteren explizit genannten unerwünschte Ereignisse in eingeschlossenen Studien genannt

Mortality:

Evidence generally showed no significant difference in mortality between medication review interventions and usual care. Both umbrella reviews reported on mortality, with one reporting no difference across three systematic reviews (of these, one showing a trend toward reduced mortality with longer follow-up) [52]. The second umbrella review included five narratively synthesised reviews and found null effects in four and mixed effects in one. Further, the second umbrella review included two meta-analyses without statistical significane: one meta-analysis showing an odds ratio of 1.02 in all studies examining all-cause mortality (95% CI, 0.84 to 1.23), the other meta-analysis showed an odds ratio of 0.82 (95% CI: 0.61 to 1.11)) among randomised studies and a protective effect (odds ratio of 0.32 (95% CI: 0.17 to 0.60)) among non-randomised studies [55].

Mortalität:
2 URs:
studienübergreifend keine signifikante Differenz

The hospital-based systematic review provided the most detailed mortality analysis, showing no significant difference (risk ratio 0.96; 95% CI 0.87 to 1.05) with low certainty evidence. However, the same review also calculated illustrative risks[4] showing that in high-risk populations, medication reviews might prevent six deaths per 1,000 patients, while in very high-risk populations, this increased to 12 deaths per 1,000 patients [53]. In the deprescribing systematic review, including mortality as a secondary outcome, most included

2 SRs:
ebenfalls keine sig. Ergebnisse zu Mortalität

[4] The systematic review calculated "illustrative risks" by assuming baseline risk of the outcome under usual care, used together with the pooled relative effect (e.g., risk ratio), to estimate the corresponding absolute risk under the intervention.

studies showed no statistically significant difference between groups (nine RCTs). However, in one RCT, there were significantly fewer deaths in the intervention group [56].

Hospitalisations:

Krankenhausaufenthalte: 1 UR mit gemischter Evidenz

Regarding reducing hospitalisations, the evidence was mixed. One umbrella review provided results from two meta-analyses. The first showed an increased risk for hospitalisations for low-intensity interventions (risk ratio 1.22; 95% CI: 1.07 to 1.38) but reductions for high-intensity interventions (risk ratio 0.86; 95% CI: 0.79 to 0.95). In this umbrella review, intervention intensity reflected differences in the scope and delivery of polypharmacy interventions, with high-intensity interventions typically comprising multicomponent medication reviews with repeated follow-up and interdisciplinary collaboration. The second meta-analysis showed a null effect (risk ratio 0.88; 95% CI, 0.78 to 1.00). The same umbrella review included eight systematic reviews, with mixed effects in five, null effects in two, and a decrease in hospitalisations in one [55].

1 SR mit sign. Reduktion (Intervention stationär durchgeführt); 2 SRs: meist keine sig. Reduktion

One of the included systematic reviews reported a pooled effect estimate and found a significant reduction in all-cause hospital readmissions among hospitalised patients receiving the intervention (risk ratio 0.93; 95% CI: 0.89 to 0.98) with moderate certainty evidence [53]. However, the deprescribing systematic review assessed hospitalisations as a primary outcome, with four RCTs showing no statistically significant differences between groups, and one RCT showing a statistically significant decrease in the intervention group. Effect estimates for RCTs were not reported in this systematic review [56]. The systematic review analysing community pharmacy medication reviews demonstrated a possible trend towards reduced hospitalisation risk with borderline statistical significance (risk ratio 0.88; 95% CI: 0.78 to 1.00) with no heterogeneity between studies [57].

Emergency department visits:

Reduktion der Notaufnahmen in den meisten Studien

Emergency department visits were reported as an outcome in one umbrella review [55] and three independently included systematic reviews [53, 56, 57]. Most studies (two systematic reviews included in one umbrella review [55], two independently included systematic reviews [53, 57]) showed a decrease in emergency department visits after a medication review, but results did not consistently reach statistical significance across studies, with some also showing null- or mixed effects [55, 56].

1 UR mit 4 SRs: sig. Reduktion in 2, Nulleffekt in 1 & gemischte Ergebnisse in 1 Primärstudie

Four systematic reviews from one umbrella review reported on this outcome. Within these, one provided a meta-analysis and showed a statistically significant reduction in emergency department visits within the intervention group (risk ratio 0.68; 95% CI, 0.48 to 0.96). The other three systematic reviews showed a reduction without statistical significance, no difference between intervention and control groups, or mixed-effects respectively. This umbrella review did not report categorical quality ratings for individual systematic reviews and interventions across reviews varied substantially (different types of medication reviews, deprescribing approaches, patient education, interdisciplinary case conferences, and the use of clinical decision support tools) [55].

3 SRs: sig. Reduktion, o. Nulleffekte, je nach Primärstudie

Within the systematic reviews included in our report, the hospital-based systematic review (in which medication reviews were conducted during inpatient stays, with post-discharge follow-up) found that medication reviews were associated with a reduction of emergency department contacts, although the finding was statistically not significant (risk ratio 0.84, 95% CI 0.68 to 1.03;

heterogeneity I^2 = 31%; low certainty evidence) [53]. The deprescribing systematic review included three RCTs reporting on this outcome, with two RCTs showing no statistically significant differences between groups and one RCT showing statistically significant fewer emergency department visits in the intervention group [56]. The community-pharmacist systematic review found a statistically significant pooled reduction in emergency department visits (risk ratio 0.68, 95% CI 0.48 to 0.96) from two studies, though with substantial heterogeneity (I^2 = 76.3%) [57].

Composite outcomes:

zusammengesetzte Endpunkte:
1 UR: Reduktion (Notfall)-Aufnahmen in 2/4 SRs

Regarding composite outcomes, one umbrella review combined hospitalisations with emergency department admissions. Two of four included systematic reviews reported a benefit of structured medication reviews compared with usual care, in terms of fewer hospitalisations and emergency department admissions. However, the umbrella review did not report pooled effect estimates, confidence intervals, or measures of statistical significance for this composite outcome [52].

2 SRs:
keine stat. sig. Differenzen in den zusammengesetzten Endpunkten

Another composite outcome combined hospital readmissions and hospital emergency department admissions in the hospital-based systematic review, with two RCTs showing no statistically significant difference between groups [53].The deprescribing systematic review combined mortality and hospitalisations as a composite, primary outcome. In the two included RCTs, no statistically significant difference between groups was observed [56].

3.1.5 Organisational domain

2 URs und 2 SRs:
organisatorische Aspekte beeinflussen Wirksamkeit der Intervention

Both umbrella reviews [52, 55] and two systematic reviews [53, 56] indicate that organisational characteristics, such as interprofessional collaboration, intervention intensity, and the implementation of recommendations by prescribers, influenced the reported effectiveness of structured medication reviews. However, the included reviews did not allow for a systematic comparison of outcomes by professional group.

Professional groups involved:

beteiligte Berufsgruppen:
URs: zumeist Apotheker:innen, ansonsten Mediziner:innen, o. gemischte Teams

Although medication reviews were most commonly delivered by pharmacists across all included reviews, pharmacist involvement was not limited to community pharmacy settings. Across the included reviews, pharmacists delivered or contributed to interventions in community pharmacies, primary care practices, hospitals, and nursing homes, often as part of multidisciplinary teams. In one umbrella review, two of five included reviews limited their foci to pharmacist-led interventions. Besides pharmacists, physician-led or multidisciplinary team-led interventions (involving general practitioners, geriatricians, pharmacists, and residential care staff) were reported [52]. The other umbrella review reported pharmacist-led medication reviews in twelve studies, physician-led in six, nurse-led in three, and multidisciplinary interventions in six studies [55].

The hospital-based systematic reviews also reported on pharmacist involvement in 13 of 25 studies. In two of the 25 studies, the intervention was delivered by a team of pharmacists and pharmacy technicians. Physicians delivered the intervention in four of 25 studies, and in three studies, the intervention was delivered by a pharmacist and/or a physician specialised in clinical pharmacology. Further reported professions for delivering the intervention included teams of cardiovascular pharmacy residents and cardiologists, trained research physicians or pharmacists, or pharmacists who collaborated with a physician and sometimes a nurse (each one of 25 studies) [53]. In the deprescribing systematic review, pharmacists played a key role in analysing the presence of PIMs in a variety of settings (hospital, nursing home and pharmacy-based studies) [56].

SRs: Krankenhausstudie: 13/25 Studien mit Pharmazeut:innen, 4/25 mit Mediziner:innen

Deprescribing-SR: hauptsächlich Beteiligung von Pharmazeut:innen

The included systematic review on community pharmacists stated that pharmacists were trained to ensure comparative competency in providing medication reviews to study patients in four RCTs. Collaboration with general practitioners was included in the intervention protocols of two RCTs. The training for the pharmacists differed across studies. It consisted of a structured pharmaceutical care program (one RCT), full accreditation as a comprehensive pharmaceutical care practitioner with completion of at least five of the 20 care plans (one RCT), or a 90-minute training on the study background and methods (one RCT) [57].

SR zu Gemeinde-Apotheker:innen: Training der Apotheker:innen für die Medikationsanalyse, jedoch sehr heterogen zwischen Studien

Time requirements:

The umbrella reviews did not report on time requirements for delivering the intervention [52, 55]. However, two systematic reviews reported on intervention frequency, with only limited data available on time requirements per session [56, 57].

URs: keine Informationen zur benötigten Zeit

The reported time requirements primarily referred to the delivery of medication reviews, although in several studies these reviews were embedded within broader, multi-component interventions that included follow-up, counselling, or communication with prescribers. In the deprescribing systematic review, the intervention was performed either once (13 RCTs) or continuously with follow-ups throughout the study period (one RCT) [56]. In the other systematic review, community pharmacists provided the intervention only once in the first month for 30 to 60 minutes (one RCT), two times (at study begin and at three months) without reporting the duration of minutes per intervention (one RCT), or six times for 44.6 (SD ±29.8) minutes per intervention during the 6-month study period (one RCT) [57].

1 SR: Intervention einmalig (13 RCTs) o. kontinuierlich (1 RCT)

1 SR: einmalige Intervention (1 RCT), 2 Treffen (1 RCT), o. 6 Treffen (1 RCT)

Acceptance of medication review recommendations and modes of collaboration:

The umbrella reviews did not report on this outcome [52, 55]. The systematic reviews reported on the percentage of recommendations from the medication reviews that were subsequently implemented. These ranged from 15% to 93% across 16 RCTs [53]. Similarly, the level of acceptance by general practitioners towards medication review recommendations by pharmacists ranged from 24.3% to 87.8% across 6 RCTs [56]. For collaboration between healthcare professionals, different modes were described in the community-pharmacist systematic review, including a meeting between the pharmacist and the general practitioner, rationalising and simplifying drug regimens in collaboration with the patient's general practitioner, or by sending a list of drug-related problems to the physician via a standard facsimile form or telephone [57].

Einfluss auf die Beziehung verschiedener Versorger: keine Informationen in den URs

SRs: Implementierung der Empfehlungen: 15-93% (16 RCTs)
Akzeptanz der Empfehlungen: 24 - 88% (6 RCTs)

3.1.6 Patient domain

häufig mit Beratung, gesundheitlicher Aufklärung und Nachsorge kombiniert

Both umbrella reviews [52, 55] and the three systematic reviews [53, 56, 57] describe interventions in which medication reviews were frequently combined with additional components such as patient counselling, education and follow-up, which should be considered when interpreting patient-related outcomes.

Adherence to therapy:

Therapieadhärenz: gemischte Ergebnisse URs: Verbesserung in 7/10 SRs

SRs: nur in 1 mit sig. Verbesserung berichtet

Results for medication adherence were mixed. Across ten included reviews in the umbrella reviews, seven found an improved medication adherence. However, three reviews reported mixed effects [52, 55]. Among the systematic reviews included in this report, only the community-pharmacist systematic review reported this outcome, with a statistically significant higher change from nonadherence to adherence in the intervention group compared to the control group (15.2% vs. 12.2%, p=0.028) [57].

Health literacy:

keine Ergebnisse zur Gesundheitskompetenz

Neither the umbrella reviews nor the systematic reviews reported on this outcome [52, 53, 55-57].

Health-related quality of life:

gesundheitsbezogene Lebensqualität: 2 URs mit unzureichenden Ergebnissen aus 13 SRs

The evidence was insufficient to demonstrate quality of life improvements. The umbrella reviews included 13 systematic reviews reporting on this outcome, with nine systematic reviews showing no significant improvements and four reporting mixed effects [52, 55].

SRs: gemischte Ergebnisse in einer Studie, positive in der 2ten & keine stat. sig. in einer 3ten Studie

The RCTs included in the systematic reviews provided very low certainty evidence. The community-pharmacist systematic review reported mixed results: while there were no significant differences in one RCT between groups in any of the eight SF-36 dimensions over time, another RCT reported statistically significant lower scores in the intervention group for two domains of the SF-36 (emotional role and social functioning), indicating worse health-related quality of life in these specific domains. Regarding the differences in visual analogue scale (VAS) and utility score, one RCT found statistically significant differences between the groups, favouring the intervention group: 0.0550 (SD ±0.01) in the utility score (95% CI: 0.0306 to 0.0794), 5.87±0.85 in the VAS score (95% CI 4.20 to 7.54) [57]. The deprescribing systematic review found that four of five RCTs used health-related quality of life as a primary outcome, reporting statistically significant positive impacts (however, numeric effect estimates were not provided within the systematic review) [56]. However, the hospital-based intervention did not reach statistical significance (SMD 0.10; 95% CI: -0.10 to 0.30) [53].

Influence on the relationship between patients and healthcare providers:

Beziehung zwischen Patient:in & Gesundheitspersonal: 2 SRs in 1 UR: starke Varianz der Akzeptanz 16-99%

There was limited evidence of the intervention's impact on the relationship between patients and healthcare providers. Two systematic reviews included in one umbrella review reported on outcomes assessing the acceptability of the intervention among patients and clinicians. One review found high acceptability rates, while the other reported a wide variation of intervention adoption rates (16%-99%) [55]. Regarding collaboration with the patient, in the community-pharmacist systematic review, the pharmacist suggested interventions to patients and/or general practitioners [57].

3.1.7 Economic domain

Healthcare costs:

Gesundheitskosten:
2 URs: 6/7 SRs berichten eine Kostenreduktion

In general, the evidence suggested reductions in specific cost components associated with medication review interventions, rather than consistent net cost savings. Of the seven systematic reviews included in the umbrella reviews, six found a reduction in the use of healthcare resources associated with polypharmacy interventions (particularly medication costs and, in some cases, hospital admissions or emergency department visits), while one systematic review found no significant change in studies examining this outcome [52, 55].

2 SRs:
Kosten der Medikationsanalyse: 21-146 €
3/4 niedrigere Medikationskosten in der IG

Within the systematic reviews, the estimated cost of a medication review ranged from €21 to €146 ($24 to $170) per participant across 4 RCTs [53]. Across four RCTs included in two systematic reviews, three found lower medication cost in the intervention group compared to the control group [56]. One RCT found no difference in overall societal cost between the groups in its formal health economic analysis, with the authors concluding that intervention costs (additional time spent on medication reviews, patient interviews and follow-ups) outweighed savings from reduced readmissions [53].

Health economic evaluations:

begrenzte Evidenz zur Kosteneffektivität:
1 SR: Cost per QALY 13.466-36.805€

1 RCT: Reduktion von ø Gesamtkosten & Zunahme von ø QALYs

Limited evidence from full economic evaluations was identified. Within the umbrella reviews, one systematic review estimated the cost per quality-adjusted life-year gained from the intervention to range from €13,466 to €36,805 (£11,885 to £32,466) in the UK and Ireland. The cost per PIM avoided was estimated at €1,269 (95% CI, €−1,400 to €6,302) [55]. One systematic review included a RCT providing a cost-utility analysis estimating the incremental cost-effectiveness ratio, showing a reduction in the mean incremental total cost and an increase in the mean incremental quality adjusted life years. The systematic review did not report the magnitude of the mean cost difference or the incremental cost-effectiveness ratio; therefore, these values could not be extracted within this assessment [56].

3.1.8 Implementation factors

Implementierungsfaktoren per CFIR-Werkzeug oder narrativ beschrieben

Implementation factors were synthesised using different approaches across the included reviews. One systematic review [56] explicitly applied the Consolidated Framework for Implementation Research (CFIR) to categorise barriers and facilitators of deprescribing interventions, whereas the umbrella reviews [52, 55] reported implementation aspects narratively without applying a formal implementation framework.

Facilitators:

The systematic review using the CFIR framework provided the most comprehensive analysis of implementation factors. Key facilitators included: interprofessional collaboration to reach consensus on medications to be deprescribed; ensuring active patient involvement to medication decisions; providing reassurance that medications could be restarted if adverse events occurred; follow-up with patients; patient goal-focused approaches; and pre-education for staff. Further facilitators were clinical examination and test results (e.g. renal function, blood pressure, laboratory parameters) to guide the deprescribing, and the pharmacist reviewing or developing the recommendation. The brown bag medication review was identified as a facilitator for implementation. In this approach, patients bring all their current medications to the consultation (rather than relying solely on a medication list) allowing the reviewer to systematically assess each medication for appropriateness (such as potential interactions, duplications) and adherence issues [56]. One umbrella review highlighted the need to assess the feasibility and practicality of implementation in primary care settings and effective models for interprofessional teamwork [52].

Facilitatoren:
1 SR: interprofessionelle Kollaboration & Konsensus für Verschreibungen, aktive Patient:innenbeteiligung, Gewissheit zur Möglichkeit der Wiederaufnahme bei Nebenwirkungen...

1 UR: Machbarkeit und Praktikabilität müssen vor Implementierung geprüft werden

Barriers:

Barriers were described in one included umbrella review and one included systematic review [52, 56]. Within the umbrella review, in studies examining pharmacist-led interventions, a lack of an effective operationalised pathway for teamwork or communication between health professionals conducting medication reviews and the prescriber may have hindered the effects. These interprofessional barriers were a lack of information sharing (i.e., access to patients' clinical information), a lack of collaboration across multidisciplinary teams, particularly for pharmacist-led interventions where the pharmacists' recommendations were at times not implemented by corresponding healthcare providers. This umbrella review included studies applying the STOPP/START criteria, and similarly concluded that the effectiveness of these tools depended heavily on implementation characteristics such as integration into clinical workflows and interprofessional collaboration [52].

Barrieren:
1 UR: Mangel eines operationalisierten Pfades für Teamwork & Kollaboration zw. verschiedenen Gesundheitsberufen

The most common barriers according to the systematic review that used the CFIR framework were clinician time constraints, reluctance among patients and providers to adopt recommendations and incomplete interprofessional team involvement. Further barriers included: failure to reach interprofessional consensus, a lack of physician acceptance and adaptability, the complexity of the intervention, patient frailty, patient resistance, lack of interprofessional collaboration, lack of knowledge, lack of self-efficacy and lack of evaluating the intervention. In a primary study included in this systematic review, a computerised decision support system for physicians was part of the intervention. However, the study reported limited uptake and implementation of the system's recommendations by physicians. This was interpreted as a barrier related to the integration of decision support into clinical practice rather than as a facilitator [56].

1 SR:
häufigste Barrieren waren zeitliche Beschränkungen bei Kliniker:innen, Widerwillen Empfehlungen anzunehmen, fehlendes Wissen bei Kliniker:innen & unvollständige interprofessionelle Zusammenarbeit

3.1.9 Guideline recommendations

Overview of included guidelines

6 Leitlinien zu Medikationsanalysen bei Polypharmazie

Überblick über Herkunft, Zeitraum, Zielgruppen und Versorgungssettings der analysierten Leitlinien

Six clinical practice guidelines addressing medication management in patients with multimorbidity and/or polypharmacy were identified and analysed [60-65]. The guidelines were published between 2021 and 2025. Five guidelines were developed by German medical societies *(Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin (DEGAM), Deutsche Gesellschaft für Innere Medizin (DGIM), and Deutsche Gesellschaft für Geriatrie (DGG)) [60-64]*, and one by Italian guideline developers [65]. Most guidelines were living guidelines and primarily targeted adult or older patients with multimorbidity and polypharmacy in primary care settings, with some addressing hospital or cross-sectoral care.

strukturierte Medikationsreviews werden anerkannt, aber unterschiedlich benannt und konkretisiert

Across all six guidelines, systematic or structured evaluation of medication regimens was consistently recognised as a relevant strategy for managing polypharmacy. However, the terminology used (e.g. medication review, medication analysis, systematic medication evaluation), the degree of operationalisation, and the strength and evidentiary basis of recommendations varied substantially. For an overview of guideline recommendations on structured medication review, see Table 3-1. For our data extraction of guideline recommendations in more detail, see Appendix section 1.1.4.

Table 3-1: Overview of guideline recommendations on structured medication review

Guideline (Country, Year, Reference)	Medication review explicitly recommended	Target population specified	Strength of recommendation; Evidence certainty
S3 Hausärztliche Leitlinie: Multimedikation (Germany, 2021 [60])	Yes	Yes (≥ 5 medications and multimorbidity; event-based)	Strength of recommendation: moderate Evidence certainty: "Level of evidence V"[5]
Italian Guidelines on Multimorbidity & Polypharmacy (Italy, 2022 [65])	Implicit	Yes (frailty-based risk stratification)	Strength of recommendation: strong Evidence certainty: not graded
S2e Schutz vor Über- und Unterversorgung (Germany, 2025 [62])	Yes	No specific recommendation (polypharmacy defined as ≥ 2 medications)	Strength of recommendation: Strong Evidence certainty: "Level of evidence V"[5]
S3 Multimorbidität (Germany, 2024 [61])	Implicit	Broad	Strength of recommendation: consensus-based Evidence certainty: not graded

[5] Level of evidence V: Recommendations with the least evidence based on systematic research (expert opinion, consensus conferences; extrapolation of basic research results).

S2k Arzneimitteltherapie bei Multimorbidität (Germany, 2023 [64])	Implicit	No specific recommendation	Strength of recommendation: not reported Evidence certainty: not graded
S3 Umfassendes Geriatrisches Assessment (Germany, 2024 [63])	Implicit	Not reported	Strength of recommendation: strong consensus Evidence certainty: not graded

Recommendations for structured medication review

Empfehlung (explizit oder implizit) zur strukturierten Medikationsanalyse in allen 6 Leitlinien

All six guidelines either explicitly recommended structured medication review (or medication analysis) or implicitly endorsed regular, systematic evaluation of drug therapy as part of routine care for patients with multimorbidity and polypharmacy. The strongest and most detailed recommendations were provided by the German S3 Guideline *Hausärztliche Leitlinie: Multimedikation* (2021) [60] and the Italian guidelines (2022) [65], both of which clearly positioned structured medication review as a core intervention.

teilweise Einbettung in umfassendere Versorgungskonzepte statt eigenständiger Intervention

In contrast, the German S2k Guideline *Arzneimitteltherapie bei Multimorbidität* (2023) [64] and the S3 Guideline *Umfassendes Geriatrisches Assessment* (2024) [63] did not define medication review as a standalone intervention, but embedded medication evaluation within broader care concepts (e.g. disease management, geriatric assessment).

Target population and patient selection

unterschiedliche Kriterien zur Patient:innenselektion

konkrete Schwellenwerte nur in S3-Leitlinie Multimedikation definiert

All guidelines addressed patients with multimorbidity and polypharmacy, but the specificity of patient selection criteria differed markedly. The German S3 Guideline *Hausärztliche Leitlinie: Multimedikation* (2021) [60] provided the most concrete criteria, recommending at least annual structured medication review for patients with ≥ 5 long-term medications and ≥ 3 chronic conditions, as well as event-based reviews following falls or hospitalisations.

andere Leitlinien mit breiteren Definitionen und Risikostratifizierungen

Other guidelines applied broader definitions. For example, the German S2e Guideline *Schutz vor Über- und Unterversorgung* (2025) [62] defined polypharmacy as the use of two or more medications (including self-medication), without specifying thresholds for intervention. The Italian guidelines (2022) [65] emphasised frailty-based risk stratification and recommended validated tools (e.g. Frailty Index, Clinical Frailty Scale, Multidimensional Prognostic Index) to identify patients at risk of adverse outcomes or limited life expectancy.

Intervention characteristics and professional roles

Ablauf und Instrumente des Medikationsreviews: mehrstufiger Prozess mit Einsatz validierter Tools

Structured medication review was generally described as a multi-step process involving medication reconciliation, evaluation of appropriateness, identification of potentially inappropriate medications, undertreatment, interactions, and adherence issues, followed by medication optimisation or deprescribing where appropriate. Several guidelines recommended the use of validated tools such as the Medication Appropriateness Index, STOPP/START, or other explicit criteria.

Most guidelines positioned general practitioners as the primary coordinators of medication review, particularly in primary care. Explicit recommendations on pharmacist involvement were limited to the German S3 Guideline *Hausärztliche Leitlinie: Multimedikation* (2021) [60], which strongly recommended structured collaboration with community pharmacies, including shared communication pathways and the concept of a "home pharmacy"[6]. The Italian guidelines (2022) [65] recommended a multidisciplinary approach but did not assign specific professional roles in detail.

Rollenverteilung: Hausärzt:innen als Hauptverantwortliche, uneinheitliche Einbindung von Apotheker:innen

Strength of recommendations, certainty of evidence, and consistency

The strength of recommendations varied across guidelines. Strong recommendations were explicitly reported in the Italian guidelines (2022) [65], particularly for multidisciplinary interventions to reduce polypharmacy and for fall risk reduction, and in parts of the German S3 *Hausärztliche Leitlinie: Multimedikation* (2021) [60], especially regarding collaboration with pharmacies.

starke Empfehlungen v. a. in italienischen Leitlinien und der deutschen S3 Multimedikation

However, across most guidelines, recommendations for structured medication review were predominantly consensus-based, with low or ungraded certainty of evidence (often level of evidence (LoE) V). Only selected recommendations (e.g. pharmacy collaboration in the German S3 *Multimedikation* guideline) [60] were explicitly supported by higher-level evidence (LoE Ia). Despite these differences, there was high consistency across guidelines in endorsing medication review as a relevant and necessary component of care for patients with multimorbidity and polypharmacy, even where the exact implementation and evidence base differed.

überwiegend konsensbasierte Empfehlungen

Settings of care

Primary care was the central setting for structured medication review across all guidelines. Several guidelines additionally addressed cross-sectoral care, highlighting the importance of coordination between primary care, pharmacies, hospitals, and nursing care. The German S3 Guideline *Umfassendes Geriatrisches Assessment* (2024) [63] focused specifically on hospital emergency departments, recommending review of polypharmacy and patient preferences as part of acute geriatric assessment. The German S2k Guideline *Arzneimitteltherapie bei Multimorbidität* (2023) [64] addressed both ambulatory and inpatient settings but provided limited setting-specific implementation guidance.

Versorgungssettings und sektorübergreifende Aspekte

Primärversorgung im Fokus, mit ergänzender Berücksichtigung stationärer und sektorübergreifender Versorgung.

Guideline quality

The AGREE-II quality assessment revealed variable guideline quality, with Domain 2 (Stakeholder Involvement) scores ranging from 92 to 97%, Domain 3 (Rigour of Development) scores between 71% and 97%, and Domain 6 (Editorial Independence) scores between 67 and 100%. The German S3-Leitlinie Hausärztliche Leitlinie: Multimedikation (2021) [60] and S3-Leitlinie Umfassendes Geriatrisches Assessment (2024) [63] demonstrated the highest overall quality scores. Other guidelines had reduced scores due to incomplete description of systematic evidence search methods, limited documentation of evidence selection criteria, insufficient detail on how recommendations were

variable Leitlinienqualität nach AGREE-II

S3-Leitlinien "Hausärztliche Leitlinie: Multimedikation" & „Umfassendes Geriatrisches Assessment" mit den besten Scores

[6] Refers to a pharmacy where the patient fills most of their prescriptions and also goes for self-medication ("trusted pharmacy"). The home pharmacy is the counterpart to the family doctor.

formulated, and missing information about how conflicting evidence was handled. Further reductions were due to insufficient documentation of the independence of funding bodies, incomplete reporting of competing interests, and limited evidence that editorial decisions were free from funding body influence (see Appendix Table A-6).

Evidence from guideline reviews

1 Scoping Review mit 8 Leitlinien zu Polypharmazie: Medikationsanalysen als die am häufigsten empfohlene Strategie

In addition to the direct assessment of individual clinical practice guidelines, one scoping review (2025) synthesising guideline recommendations on medication management in patients with polypharmacy in primary care was identified [71]. Within this scoping review, eight guidelines (published between 2012 and 2021) were included, and the most common recommended strategy was a medication review, performed by a general practitioner and/or a community pharmacist. Most of the guidelines recommended involving the patient in the process (to capture patients experiences and treatment goals). The authors state, however, that few guidelines included guidance on how to implement the recommendations [71].

Additional guidance documents

weitere Guidance-Dokumente identifiziert, die aber aufgrund fehlender Methodenbeschreibung nicht als Leitlinien eingeordnet werden konnten

We identified further documents that we classified as guidance documents (rather than guideline documents), due to their format and/or missing methodology. These included a person-centred approach to polypharmacy and medication review by the Specialist Pharmacy Service of the National Health Service in England [72], Guidelines for Comprehensive Medication Management Reviews by the Pharmaceutical Society of Australia [73], Guidelines on Medication Review by the European Directorate for the Quality of Medicines & HealthCare [74], Polypharmacy Review and Treatment Optimisation: Resource Pack by the Greater Manchester Medicines Management Group [75], Managing polypharmacy through medication review tools – pros and cons [76] and a guidance article on deprescribing by UpToDate® [7]. In addition, we identified three documents published by the Federal Union of German Associations of Pharmacists (Bundesvereinigung Deutscher Apothekerverbände e.V., ABDA), namely a policy paper on medication analysis and medication management (Grundsatzpapier zur Medikationsanalyse und zum Medikationsmanagement) [12], a guideline of the federal chamber of pharmacists on quality assurance: medication analysis (Leitlinie der Bundesapothekerkammer zur Qualitätssicherung: Medikationsanalyse) [77], as well as a commentary on the federal chamber of pharmacists guideline on quality assurance (Kommentar zur Leitlinie der Bundesapothekerkammer zur Qualitätssicherung) [78]. The three documents by the ABDA are included in the next chapter (Implementation of structured medication reviews in selected countries, Results 3.2.2).

3.2 Implementation of structured medication review in selected countries, recommendations for Austria

For this research question, seven country profiles were developed: Austria, Belgium, Germany, the Netherlands, Switzerland, and the United Kingdom, as well as one section on transnational organisations (WHO, OECD, and EU-level initiatives). The included documents and full data extraction can be found in the Appendix (see Appendix 1.2).

Entwicklung von 7 Länderprofilen zur Beantwortung der FF2

3.2.1 Document characteristics

Documents were primarily sourced from official health ministry and pharmacy association websites, pilot project evaluations, and national guideline frameworks published between 2020 and 2025. The documents varied in scope and depth, ranging from formally evaluated national programmes (e.g. the *NHS England's Structured Medication Review* or the Belgian *Medicatienazicht*), to pilot schemes (Austria), and formerly reimbursed programmes (Switzerland). Transnational policy documents by WHO, OECD and EDQM were included to contextualise European and international standards for medication reviews, medication safety and deprescribing.

Suche nach Dokumenten auf Regierungswebseiten, Webseiten pharmazeutischer Gesellschaften, wie auch Evaluationsberichte von Pilotprojekten & nationale Leitfäden

3.2.2 Country profiles

Austria

Austria is currently in a pilot phase of implementing structured medication reviews (*Medikationsanalyse type 2a*). A randomised, controlled trial across 14 community pharmacies in Vienna (2025) [34] examined the feasibility of a structured, pharmacist-led process. The intervention included patient interviews, the identification of drug-related problems (DRPs) using the Pharmaceutical Care Network Europe (PCNE) framework, and automated interaction screening using a specific software that automatically provided pharmacists with a list of potential drug-drug interactions, including a severity grading.

Ö. in der Pilotphase: 1 RCT mit insgesamt 14 Apotheken in Wien

Professional involvement was limited to pharmacists, although cooperation with physicians was recommended, but not systematically implemented. The Austrian Chamber of Pharmacists offers training programmes and advocates the integration of structured medication review as a reimbursed public service. So far, no health insurance coverage exists, but policy discussions are ongoing (see Appendix 1.2.1).

Beteiligung ausschließlich von Apotheker:innen; Fortbildungsangebot durch die ö. Apothekengesellschaft

Belgium

Belgium has fully integrated structured medication reviews into its primary care framework through the *"Medicatienazicht"* service introduced for home-dwelling patients taking ≥ five reimbursed medicines. The service is delivered by the patient's designated *"huisapotheker"* (community pharmacist).

BEL: Medikationsanalysen in der Primärversorgung integriert

Medication reviews can be performed every two years, with additional reviews reimbursed upon a general practitioner prescription.

The consultations take place in community pharmacies, supported by national templates and the Pharmaceutical Information Library (PHIL) guideline by the Association Pharmaceutique Belge (APB). Screening tools, such as STOPP/START criteria, are recommended, particularly for older adults. Pharmacists must communicate findings to general practitioners, ensuring they are integrated into the patient's medical record. The service is fully reimbursed at €98.63 per review (as of 2025) (see Appendix 1.2.2).

Konsultation in Apotheken, Ergebnisse müssen Allgemeinmediziner:innen kommuniziert werden
Kosten: € 98.63/Analyse

Germany

Germany introduced a reimbursed structured medication review (*Medikationsanalyse*) as part of the pharmaceutical services framework of statutory health insurance. Eligible patients are those taking five or more long-term medications. The service is provided once per year, or earlier if three or more new long-term prescriptions are initiated within four weeks.

D: erstattete Medikationsanalyse etabliert;
Population: ≥5 Langzeitmedikamente

Pharmacists conduct the review independently but are expected to communicate recommendations to physicians. While no specific clinical tool (e.g., MAI or STOPP/START) is mandated, the process follows the ABDA standard with a "Brown Bag Review" approach. The intervention typically takes 30-60 minutes. The service provided by outpatient community pharmacies is fully reimbursed at €90.00 per completed service (see Appendix 1.2.3).

Empfehlungen sollen Ärzt:innen kommuniziert werden
Kosten: € 90/Analyse

Netherlands

The Netherlands operates the *Comprehensive Medication Review*, using the STRIP method (*Systematic Tool to Reduce Inappropriate Prescribing*)[7]. Reviews are jointly performed by pharmacists and general practitioners and target older adults (≥ 75 years), those using ≥ 10 medications, or frail patients.

NLD: gemeinsame Medikationsanalysen durch Apotheker:innen & Allgemeinmediziner:innen

The *Comprehensive Medication Review* (CMR) includes goal-setting with patients, structured clinical assessment, and joint therapy adjustment. The STRIP assistant software and *"medicatiebewaking"* (medication monitoring) modules support digital documentation and safety alerts. Reimbursement occurs selectively via health insurance contracts, with the cost per intervention not reported in included documents. A nationwide survey (2024) reported a mean of ~56 CMRs/pharmacy (range 0–300) (see Appendix 1.2.4).

STRIP-Methode

Kosten variieren je nach Versicherung

Switzerland

Switzerland previously offered a nationally reimbursed *Polymedikations-Check*, enabling pharmacists to review the medication regimens of patients taking four or more long-term medications. Consultations lasted approximately 37 minutes and focused on adherence support, correct medication use, and counselling. The service was removed from the basic insurance in 2019 (due to not meeting effectiveness, appropriateness and cost-effectiveness criteria) and is now offered only on a voluntary or self-paid basis (see Appendix 1.2.5).

Schweiz: erstattetes "Polymedikationscheck" ist seit 2019 nur auf freiwilliger Basis, ohne Erstattung, möglich; davor Erstattung

[7] The STRIP method integrates the principles of STOPP/START and the POM (Pharmacotherapeutic Objectives Method) within a structured medication review process.

United Kingdom

In the United Kingdom, the structured medication review is a core element of the National Health Service (NHS) Primary Care Network Directed Enhanced Service (PCN-DES) contract. The intervention is risk-stratified and pharmacist-led, focusing on high-priority patient groups (frailty, ≥ 10 medications, recent hospitalisation, nursing home residents). Structured medication reviews are integrated into general practice teams. where general practitioners are involved in the collaborative care process and in the acceptance and implementation of medication review recommendations.

UK: risikostratifizierte Medikationsanalyse durch Apotheker:innen geleitet

Reviews are tailored to patient goals, covering clinical appropriateness, adherence, and deprescribing opportunities. No fixed review frequency is mandated; instead, practices prioritise high-risk cohorts. Invitations to structured medication reviews must explain the purpose of the intervention to the patient. The service is fully funded within the NHS and delivered under the PCN-DES contract, with no per-intervention tariff stated in the documents (see Appendix 1.2.6).

keine Angaben zur Häufigkeit, Auswahl nach Risiko

vollständig erstattet, jedoch keine Angabe zu Kosten

Transnational organisations

The WHO's "Medication Without Harm" campaign, OECD's medication safety indicators, and EDQM policy documents collectively highlight structured medication review as a cornerstone of medication safety strategies. They recommend implementing national programmes with:

WHO-Kampagne "Medikamente ohne Schaden": bestimmte Empfehlungen zu Charakteristika von Medikationsanalysen

- Multidisciplinary, person-centred reviews across care transitions,
- Prioritising patients at higher risk in polypharmacy for review,
- Standardised processes and validated tools,
- Digital interoperability of medication data,
- Defined professional competencies for pharmacists and physicians,
- Shared decision-making (involvement of patients and caregivers),
- Routine evaluation and outcome monitoring.

In particular, the EDQM guideline provides a structured process and documentation elements for selecting patients for structured medication reviews.

weitere Leitlinien durch die EDQM

These transnational recommendations provide a policy framework for aligning national structured medication review initiatives with international safety goals (see Appendix 1.2.7).

3.2.3 Comparison across countries

Across the six analysed countries, the implementation level of structured medication review varied from pilot stage to full integration. Only Belgium, Germany, and the United Kingdom currently provide full reimbursement through public insurance. The Netherlands offers partial reimbursement through selective contracts, while Switzerland and Austria lack regular funding. In Switzerland, previously established reimbursement of medication reviews was discontinued. Table 3-2 gives an overview of implementation, reimbursement and collaboration models across the countries selected for analysis.

Ländervergleich: Implementierungslevel variiert zwischen Pilotierung (Ö) & vollständiger Erstattung (BEL, D, UK)

Table 3-2: Implementation, reimbursement and collaboration models of countries selected for analysis

Country	Implementation stage	Reimbursement	Collaboration model
Austria	Pilot (Type 2a)	None	Pharmacist only
Belgium	National rollout	Full	Pharmacist in collaboration with physician
Germany	National rollout	Full	Pharmacist only (recommendations sent to physicians)
Netherlands	Nationwide, selective	Partial	Physician in collaboration with pharmacist
Switzerland	Discontinued	None	Pharmacist only
United Kingdom	Fully implemented (PCN-DES)	Full	Integrated primary care team

Abbreviations: PCN-DES - Primary Care Network Directed Enhanced Service

The following characteristics are **common features** shared across the analysed countries:

Gemeinsamkeiten:

am häufigsten von Apotheker:innen geleitet, Fokus auf Hochrisiko-Patient:innen, werkzeugbasierte Methoden, Fokus auf patientenorientierte Komponente, digitale Dokumentationssysteme

- Pharmacist-led approaches are more common, with growing interprofessional collaboration (between pharmacists and physicians, or among integrated primary care teams).
- Patient selection based on high-risk polypharmacy (≥ 5-10 long-term medications, multimorbidity, frailty).
- Tool-based methods (e.g. STOPP/START criteria, STRIP criteria, STOPPFrail criteria).
- Focus on patient-centred components (adherence, goal setting).
- Digital documentation systems linking medication data with clinical records.

Features that **differ** across the analysed countries include *frequency of reviews*, *digital interoperability*, and *collaboration models*. While structured medication reviews are offered annually in Germany, the frequency in Belgium is biennial. The United Kingdom and the Netherlands, in contrast, review in risk-based intervals. Regarding digital interoperability, Austria's ELGA and Netherlands' STRIP assistant offer high interoperability on a national level, while other countries have localised digital support. Professional collaboration is described as structured interprofessional collaboration between pharmacists and physicians in Belgium, Germany and the Netherlands, and as part of general practice teams in the United Kingdom. In contrast, the documents included for Switzerland and Austria did not describe formal involvement of general practitioners in the structured medication review process.

Unterschiede: Häufigkeit der Medikationsanalysen, Ausmaß der digitalen Interoperabilität & Art der Kollaborationsmodelle

4 Discussion

The aim of this report was to systematically review the evidence on structured medication reviews for patients with polypharmacy. This was complemented by a summary of comparable initiatives in selected European countries to support evidence-based decision-making in Austria.

Berichtsziel: SR der Evidenz zu Medikationsanalysen

4.1.1 Summary of findings

The evidence on effectiveness, safety, organisational aspects and costs of structured medication reviews was gathered from umbrella reviews [52, 55] and systematic reviews [53, 56, 57]. Across this body of evidence, structured medication reviews showed a reduction of potentially inappropriate medications [52, 55] and a trend towards improved medication adherence [52, 55, 57], indicating benefits in prescribing quality and medication management. While some individual primary studies reported reductions in mortality, these findings were not confirmed in pooled analyses, and overall evidence showed no consistent effect on mortality [52, 53, 55, 56]. Health-related quality of life did not show measurable improvement. The included studies did not directly report on morbidity (e.g., disease complications, symptom burden, progression of severity). For hospitalisations, the evidence showed a tendency for reduced admission rates, though this finding was not consistent across all studies [52, 53, 55-57]. Contacts with emergency departments, however, showed significantly reduced rates, indicating a positive effect of the intervention on utilisation of the acute care sector [52, 53, 55-57].

Effektivität: Reduktion unangemessener Medikamente & Verbesserung der Therapietreue, Tendenz zu weniger Aufnahmen; keine sig. Ergebnisse bei der Mortalität, o. gesundheitsbezogener Lebensqualität

Regarding safety outcomes, the intervention did not lead to an increase in adverse drug withdrawal events or other negative outcomes. The studies showed that deprescribing and medication optimisation can be conducted safely when the intervention is implemented in a structured way. In the organisational domain, the included studies reported that medication reviews were most often pharmacist-led, sometimes embedded within multidisciplinary teams including physicians, geriatricians, and nursing staff. On average, the time required for a medication review ranged from 30 to 60 minutes, with some studies indicating the need for follow-up sessions. Some studies reported adequate training and professional qualifications as prerequisites for conducting the intervention and advocated for standardised training programmes [52, 53, 55-57].

Sicherheit: keine Erhöhung der unerwünschten Arzneimittelwirkungen, o. anderer negativer Ereignisse

Intervention meist durch Pharmazeut:innen & 30-60 Minuten

The economic impact of structured medication reviews was assessed within several systematic reviews. The estimated cost per review ranged from €21 to €146 ($24 to $170) per participant, depending on the setting and intervention intensity. Although the evidence base for cost analyses was limited, all but one review reported reductions in healthcare resource utilisation. In contrast, one systematic review found no significant change in healthcare costs in nearly all of its included studies, which demonstrates that the impact of medication reviews on resource use is currently unclear. The question remains whether the reported reductions in healthcare utilisation may be outweighed by the intervention cost [52, 53, 55, 56].

ökonomische Aspekte: Kosten per Medikationsanalyse je nach Review €21-€146

Ergebnisse zur Reduktion der Inanspruchnahme von Gesundheitsleistungen noch uneindeutig

Regarding health economic analyses, a hospital-based cost-benefit-analysis reported no net reduction in total costs, as the additional staff time required for conducting reviews, interviews, and follow-ups outweighed the savings from reduced hospital readmissions. One study conducted a formal cost-utility analysis, showing reduced incremental total costs and increased quality-adjusted life years, indicating cost-effectiveness. However, the authors of the analysis note that given the small number of studies in this area, it is important to investigate the economic effects of deprescribing further.

1 Cost-Benefit Analyse: keine Verringerung der Gesamtkosten
1 Cost-Utility Analyse: Reduktion der inkrementellen Gesamtkosten

Implementation aspects across studies were reported as challenging due to time constraints, insufficient interprofessional communication, unclear role definitions, limited access to patient data and limited digital integration. The key facilitators for successful implementation included professional training, the use of structured tools (such as STOPP/START and STRIP), standardised documentation processes, collaboration between pharmacists and healthcare providers, and reimbursement [52, 56].

Implementierung meist als herausfordernd berichtet; unterstützende Faktoren: Training, Nutzung von Werkzeugen, Dokumentation & Kollaboration

In terms of international examples, we selected Austria, Belgium, Germany, the Netherlands, Switzerland and the United Kingdom for analysis. Similarities across the analysed countries included pharmacist-led interventions following standardised processes and tools, as well as a focus on high-risk patients with polypharmacy. Differences among the analysed countries were observed regarding to the implementation, remuneration and organisational aspects. The analysis showed that structured medication reviews are established nationwide in Belgium, Germany, and the United Kingdom. The Netherlands provides partial implementation. Interestingly, the remuneration for medication reviews was discontinued in Switzerland in 2019 after being introduced for reimbursement in 2010, because the service was unable to meet the effectiveness, appropriateness and cost-effectiveness criteria that must be fulfilled under the health insurance act [79]. However, no publicly available documents detailing the exact reasons for discontinuation were identified.

Ländervergleich: Ähnlichkeiten in der Leitung durch Pharmazeut:innen & Fokus auf Risikopatient:innen

Unterschiede im Implementierungsausmaß, Erstattung & Organisation

Transnational organisations (such as the WHO, OECD and EDQM) highlight structured medication reviews as an intervention to improve medication safety and reducing preventable harm. Their policy frameworks advocate for standardised review processes, digital medication data with interoperability, and defined responsibilities for pharmacists and physicians. Medication reviews are described as a component of broader medication-safety and quality-of-care initiatives [74, 80-84].

transnationale Organisationen plädieren für standardisierte Vorgänge, Interoperabilität & definierte Verantwortlichkeiten

Austria is currently in the early stages regarding structured medication reviews. The randomised controlled trial in Vienna (2024) [34] demonstrated the feasibility and acceptability of pharmacist-led medication reviews using the PCNE framework and the ELGA e-Medikation system for prescription list access and documentation. So far, no formal reimbursement has been established. Systemic integration into primary care remains incomplete due to limited collaboration between pharmacists and healthcare providers.

Ö: Frühstadium der Implementierung, derzeit ohne Erstattung & limitierter Kollaboration

4.1.2 Interpretation

Evidenz deutet auf die Komplexität der Intervention mit dem Potential Arzneimittelsicherheit zu verbessern

The findings of this report indicate that structured medication reviews are a complex intervention, given the multitude of intervention components, the number of people involved, the behaviours and amount of knowledge required and allotted flexibility in its delivery. This complex intervention has the potential to improve medication safety for patients with polypharmacy. Across the included studies, structured medication reviews were associated with reductions in drug-related problems and inappropriate medications. However, effects on clinical outcomes (hospitalisation, mortality), effects on quality of life, and effects on economic parameters were variable.

eingeschlossene Reviews von hoher Qualität, aber Primärstudien mit (sehr) niedriger Evidenzqualität

There was a high heterogeneity in interventions, populations, settings and outcome definitions in the included studies. The included umbrella reviews [52, 55] and systematic reviews [53, 56, 57] showed an overall low risk of bias. In contrast, the quality of the evidence at the level of the included primary studies was predominantly low to very low.

Evidenz aus 2 Cochrane Reviews: Unsicherheit dazu, ob Medikationsreviews zu positiven Effekten führen

Interventionen & Settings jedoch zwischen Studien sehr heterogen

Wirksamkeit in Abhängigkeit von organisatorischen Faktoren und Implementierungsaspekten

According to a broad Cochrane systematic review of interventions (not limited to medication review) to reduce polypharmacy, it is unclear whether polypharmacy interventions can actually lead to clinically significant improvements. Nevertheless, the authors emphasise that interventions are increasingly being implemented by multidisciplinary teams, and the number of studies on potential prescribing errors has increased [85]. According to another Cochrane systematic review (specific to medication reviews, included in our analysis), the evidence suggests that medication reviews in hospital patients have little to no effect on mortality but can likely reduce emergency department contacts and readmissions [53]. The mixed findings could be caused by the heterogeneity of intervention components and diversity of healthcare settings in which the intervention was studied. In four of the reviews included in this report [52, 53, 55, 56], differences in effectiveness were repeatedly linked to organisational and implementation characteristics of the interventions. Reviews highlighted that interventions with higher intensity (e.g. repeated follow-up rather than single reviews), structured interprofessional collaboration between pharmacists and prescribers, active implementation of medication review recommendations, and strong patient involvement (e.g. counselling, adherence support, brown bag reviews) were more likely to show effects.

Betonung der Kollaboration & Multidisziplinarität, besonders bezüglich der Empfehlungen

Nutzung strukturierter Werkzeuge ebenfalls häufige Empfehlung

In addition to the evidence from included studies, the insights from documents from the country comparison pointed towards greatest benefit when medication reviews are embedded in a multidisciplinary, collaborative way, rather than as isolated pharmacy services. The findings and recommendations from a structured medication review should be shared with all relevant professionals (pharmacists, physicians, nurses, geriatricians), so that recommendations can be acted upon. Countries with well-defined collaboration demonstrated more advanced and stable implementation models compared to programs where pharmacists offer the intervention in isolation. Another key recommendation is the use of standardised tools (e.g. STOPP/START, STRIP, PCNE) combined with digital infrastructure for documentation and information sharing.

strukturierte Medikationsreviews sind meist nur im ambulanten Setting vergütet

The evidence synthesised in this report includes studies conducted in both ambulatory and hospital care settings. In Germany, however, structured medication reviews are currently reimbursed exclusively in the ambulatory sector as a pharmaceutical service. A comparison with other European countries

analysed in this report shows a similar pattern: remuneration of structured medication reviews is primarily located in the ambulatory or primary care setting. Although structured medication reviews are well established in hospital settings in several countries and are frequently performed by hospital pharmacists as part of interprofessional care, they are typically financed through hospital budgets or integrated care models rather than as separately reimbursed services. At the same time, evidence from hospital-based studies demonstrates that structured medication reviews in this setting can substantially reduce drug-related problems and contribute to patient safety [86-88].

1 Realist Review (RR) zu Medikationsanalysen: Herausforderungen aus verschiedenen Perspektiven müssen beachtet werden

As deprescribing interventions/medication reviews can be considered a complex intervention, their effectiveness will likely be dependent on a myriad of context and interaction factors [89]. Realist reviews are a methodology that helps establish when, how, for whom and to what extend complex interventions can work by defining the programme theory for a particular intervention [51]. In a realist review on deprescribing medicines in older people living with multimorbidity and polypharmacy a best practice framework for tailored deprescribing was developed. The authors highlighted that factors on the **organisational-/system level**, the **health-care provider level** and the **patient level** may pose some challenging contexts that need to be considered if a deprescribing intervention ought to be implemented. Following is a short summary of these challenges, followed by their proposed good practice framework [90].

organisatorische Aspekte: schwierig Empfehlungen zum Medikationsmanagment zu argumentieren, fehlende Anreize & Information zwischen verschiedenen Anbieter:innen, Unklarheit über Verantwortlichkeiten

On the **organisational-/systems level** it needs to be considered that guidelines on medication management are often directed towards single conditions and based on evidence gathered from younger populations. Since patients with polypharmacy, are likely older and additionally suffer from multimorbidity, healthcare providers might find it more challenging to make defensible recommendations. In addition, the lack of incentive structures and administrative rules regarding deprescribing may make it difficult to allocate the necessary time for the deprescribing process. Furthermore, patients with polypharmacy are more likely to be in conversation with multiple healthcare providers, making it difficult to access all required patient information to understand the current medication regimen and make decisions about deprescribing. Lastly, a lack of clarity about roles and responsibilities concerning the deprescribing process among different healthcare providers poses a further barrier in taking the incentive to deprescribe [90].

Entscheidung über Medikationsanalysen hängen von Erfahrung, vorhandenen Informationen & Priorisierungsprozessen ab

Whether **healthcare providers** engage with deprescribing depends on their (perceived) skills and experiences. Providers who made first experiences with the deprescribing process are more comfortable with further deprescribing. Again, since patients with polypharmacy are likely to suffer from comorbidities, healthcare providers may lack information on why certain medications have been prescribed and, therefore, hesitate to deprescribe. Lastly, considering healthcare practitioners' set consultation times, deprescribing in patients with polypharmacy, whose health condition is perceived as relatively stable, could be regarded as low priority [90].

aus Patient:innensicht könnte eine Empfehlung mit Medikamenten aufzuhören, als eine Verweigerung der Versorgung angesehen werden

Finally, some challenges for **patients** are, that they might associate their medications with an expected outcome resulting from the interaction with their healthcare provider(s). They might further attribute their medication regimen to an improvement in symptoms and as something, that they actively can do to improve their own health. Therefore, deprescribing could be viewed as a withdrawal of care and resources they need for survival. In addition, concerned family members or carers might also be engaged in the patient's

medication management and so would need to be aware of why the medication might need to change [90].

weitere mögliche Herausforderungen bei Versorger:innen & Patient:innen

Comparing the findings from this realist review with two systematic reviews on enablers and barriers for deprescribing and minimising potentially inappropriate medications, some further challenges become apparent: First of all, healthcare providers might be unaware, that their prescription might be inappropriate, patients might be lacking adequate, non-drug treatment options and explicitly scheduled treatment plans might be missing [91]. Further possible patient-related challenges include patients not knowing how to stop taking medications, feeling pressured to continue taking them, or having had negative experiences (e.g., withdrawal symptoms) when stopping medications in the past. In addition, patients might fear a worsening of their health or might simply not want to alter their habits [92].

4.1.3 Good practice framework

Funktionieren komplexer Interventionen hängt von ihrem Kontext ab

Depending on the circumstances in which a medication review is implemented, different outcomes can be expected [89]. The success of complex interventions always depends on the circumstances in which they are ought to be implemented [51].

5 Konzepte aus einem Realist-Review für Politik & Praxis

According to the results of the beforementioned realist review, five high-level concepts can help inform policy and practice [90]:

- Providing an enabling infrastructure,
- Consistent access to high-quality, relevant patient data,
- Creating a shared understanding of the meaning and purpose of medications,
- Trial and learn,
- Building trust.

gute Leitlinien für das Absetzen von Medikamenten notwendig

zusätzlich zugängliche Informationen dazu, wieso ein bestimmtes Medikament verschrieben wurde

Supportive guidance on deprescribing that limits the fear of harming a patient through the withdrawal of medicines needs to go beyond the deprescribing process itself to also include guidance on organisational components, such as clarity on responsibility, guidance on allotted time and resources and on how feedback is provided. Such guidelines could further help legitimise the boundary spanning role of deprescribing and clarify whose responsibility it is to undertake deprescribing. Further, high quality patient and prescription data is needed to provide deprescribing. Importantly, the data needs to go beyond indicating that a certain medication has been prescribed, to also include information on *why*. Shared prescription data can eliminate conflicting information between providers and further support shared-decision making [90].

weiterer RR behandelt Medikationsanalysen-prozess & nötige Bildung bei Versorger:innen & Patient:innen

The above presented challgenges and good practice framework largely align with a slightly more recent realist review by Radcliffe et al. (2023) while specifically concentrating on medication reviews and deprescribing interventions in older people in primary care [93]. Beyond the points already mentioned in the realist review described above, the author's further address the need for healthcare professional training and education, provide information on the specific format of medication reviews and describe the need of the involvement and education of patients as well as informal carers.

For this aim, medications need to be linked with a clinical indication, therapeutic objective, and the duration of use. Without this information, it is difficult to assess whether a prescribing cascade has occurred. Further, this approach helps avoid the continuity of therapy whose original rationale has become invalid. The digital documentation infrastructure should enable the provision of these reasons for each medication directly within the medication list template.

Informationen zu Medikationen sollten zusätzlich die Indikation, Therapieziele & Einnahmedauer enthalten

Automatic screening tools and clinical decision support systems can flag and alert for drug-drug interactions, drug-disease contraindications and dosage problems. Recent reviews suggest these automated systems can reduce prescribing errors when embedded in clinical workflows. Interoperability of these tools with shared digital medication lists is critical [94]. However, the effectiveness of decision support systems is dependent not only on the quality of the underlying clinical logic, but also on usability and workflow integration. When certain conditions are not met (e.g. actionable alerts, right timing), warnings may be ignored, known as alert fatigue. High override rates and clinician frustration with non-actionable or poorly timed alerts have been identified as barriers to effective use of clinical decision-support systems in prescribing and deprescribing interventions [95].

Screening-Tools sollten Probleme automatisch melden können

Implementierungsfaktoren von Screening-Tools beeinflussen deren Wirksamkeit

Medication reviews should routinely capture problematic non-prescription substances, as clinically relevant interactions are known for certain herbal products and foods. For example, St John's Wort (Johanniskraut) or grapefruit have potent interactions with certain medications (through CYP3A4 induction and transporter effects [96, 97]). Considering the effects of these non-prescription substances is essential for medication safety.

rezeptfreie Medikamente sollten ebenfalls regelmäßig evaluiert werden

Individual genetic variability (e.g. CYP2D6, CYP2C19, ultra-rapid or poor metaboliser phenotypes) can significantly alter efficacy of medications for individual patients and adverse event risk. Where available, linking pharmacogenetic (PGx) results to medication reviews can help identify the cause of a drug-related problem, guiding dose adjustments or suitable alternative therapies. Implementation guidance for PGx exists, and linking PGx data to automated systems is increasingly feasible [98, 99].

auch genetische Informationen könnten automatischen Systemen beigefügt werden

Shared decision-making between a healthcare provider and a patient regarding the patient's medication regimen helps acknowledge the patient's experience and knowledge. It mitigates some of the complexity by setting context-sensitive treatment priorities. Further, through shared-decision making healthcare practitioners can become aware of the patient's beliefs and goals regarding their medicines. It also provides the healthcare practitioner with an opportunity to share the responsibilities of deprescribing and allows for making defensible decisions [90].

gemeinsame Entscheidungsfindung hilft es zu Priorisieren & Verantwortungen zu verteilen

Continuity of care, defined as an ongoing relationship between a patient and healthcare providers, which progresses smoothly across different healthcare settings, can have an influence on the patient's trust towards the healthcare provider. Up-to-date patient information can inform decisions in medication management and help tailor the decisions to the patient's needs. The establishment of a monitoring system can further support continuity of care and reassure patients that deprescribing does not signal a withdrawal of care and that potential harms will be recognised and managed when needed. Further, monitoring provides an opportunity to incorporate patient perspectives [90].

Versorgungskontinuität mithilfe gültiger Patient:innendaten begünstig Vertrauen in die Versorger:innen

Working in multi-disciplinary teams allows healthcare practitioners to draw on expertise from specialist fields. This can further reassure them in deprescribing decisions and provide a basis for justifying them, given the lack of appropriate guidelines. Finally, working in multidisciplinary teams also supports continuity of care and sharing of responsibility and workload associated with deprescribing [90].

Multidisziplinarität kann Deprescribing Entscheidungen untermauern

Because the deprescribing process is inherently uncertain and complex, small incremental changes to a patient's medication regime with follow-up and continuity of care can help mitigate some of the inertia associated with the fear of inflicting harm through deprescribing. Further, a continuous process can enhance patient's trust and make it more likely that they might consider changing their medicines. Trust from different participants is required during the deprescribing process. For healthcare practitioners, trusting their own decisions can be supported through the right guidance and for patient's trust towards their healthcare provider's advice can be supported through the provision of tailored explanations. Further, trust between different healthcare providers can be encouraged through consistency of care. Finally, planned follow-up and the willingness to amend, when necessary, can further support the building of trust as well as minimise potential harm [90].

kleine, inkrementelle Änderungen der Medikation in einem kontinuierlichen Prozess, können Vertrauen in die Versorgung begünstigen

Beyond the deprescribing process itself, patients need to integrate their changed medication routines into their daily lives. This involves interaction between patients, caregivers, and healthcare professionals to identify, modify, continue, and review medications. This process depends on the development of routines and shared decision-making. Two interventions can facilitate medication management: (1) risk identification—to pinpoint patients and carers who need additional support, such as a medication review; and (2) individualised information—accessible, co-produced reference materials that allow sharing of information beyond single diagnoses and treatments [100].

Empfehlungen der Medikationsänderungen müssen anschließend in den Alltag der Patient:innen integriert werden

For implementation, it is advisable to focus the intervention on high-risk patients (≥ 5-10 long-term medications, multimorbidity, frailty), while staying aware of additional factors that can increase the risk for polypharmacy. A systematic review and meta-analysis found that individuals with lower education, lower wealth, and lower social class were more likely to experience polypharmacy, indicating the presence of socioeconomic inequalities in its occurrence. Given these inequities, efforts to address polypharmacy should also consider underlying social determinants and inequalities in access to care [4].

Implentierungsfokus auf Hochrisikopatient:innen: ≥5-10 Langzeitmedikamente, Multimorbidität & Gebrechlichkeit

Finally, structured medication reviews should be viewed alongside prescribing nudges that aim to prevent overprescribing in the first place. Evidence is growing that well-designed, clinician-directed feedback can reduce overuse and complement deprescribing efforts provided by structured medication reviews. In 2025, the AIHTA conducted an analysis on nudges to optimise prescriber behaviour of physicians [101].

zusätzliche Nudges, um über Überverschreibung zu verhindern

4.1.4 Research implications

Implementierung einer Medikationsanalyse sollte mit weiterer Erforschung einhergehen

Despite growing evidence, important knowledge gaps exist, in particular regarding the long-term clinical and economic effects of structured medication reviews. Implementation should be accompanied by health services research with relevant quality indicators. For several outcomes (hospitalisations, emergency department visits, medication adherence, health-related quality of life) the evidence is currently still mixed and of low-certainty. Future reviews should further standardise both terminology of the intervention and outcome parameters, and increase reporting quality (e.g. better differentiating between withdrawal reactions versus disease relapse) [16]. Future studies of interventions dealing with polypharmacy should better report medication classes and comorbidities to better identify the medication combinations with the greatest risk of adverse outcomes [3].

zusätzlich braucht es eine Standardisierung der Terminologie & bessere Berichterstattung in den Studien

standardisiete Tools im Ländervergleich betont

From the available evidence and included documents for country comparison, the use of a standardised tools (e.g. STOPP/START, STRIP, PCNE criteria) was emphasised, although no tool in particular was recommended over others. Additional research will be necessary to identify which tool works best in which setting and can thus achieve the highest effectiveness and safety.

weitere Forschung zu Kosteneffektivität notwendig

Future research will be required to study potential cost savings and cost-effectiveness of structured medication reviews in more detail. Implementing additional components of the intervention, e.g. using the structured medication review for identification of generic drugs as more cost-effective alternatives, could further influence the cost-effectiveness.

5 Vorschläge zu Polypharmazie auf dem Systemlevel aus Kanada

In addition to the intervention provided by pharmacists and healthcare providers on an individual level, general information initiatives on the system-level can be provided. Canada's Drug Agency (together with deprescribing.org) developed five general tips to manage polypharmacy for clinicians. These relate to documenting the reasons for use when prescribing a medication, asking themselves whether a new problem could be caused by a medication, supporting patients to maintain and share a list of their medications, conducting medication reviews with patients or connecting them to a trusted healthcare provider, and deprescribing and simplifying to reduce medication burden [102].

zusätzliche Informationsbroschüren für Patient:innen, um eine gemeinsame Entscheidungsfindung zu begünstigen

Additionally, information leaflets were developed for patients, e.g. a five questions handout by Canada's Drug Agency to help make shared decisions. These questions relate to the purpose of each (of the patient's) medication, potential of side effects or drug interactions, reflection on lifestyle changes that could also improve well-being, questioning whether all medications are actually needed, and other information that the patients should know about their medications [103].

zukünftige Medikationsanalysen sollten auch Möglichkeiten für nichtmedikamentöse Behandlungen identifizieren

Future structured medication reviews should not only optimise pharmacotherapy but also identify opportunities for non-drug treatments as part of a coordinated, interprofessional process. In case of drug-related problems that require deprescribing, non-drug interventions (such as physical activity programmes, dietary adjustments, or behavioural therapies) may support symptom control. The HANDI (Handbook of Non-Drug Interventions) project provides an example of how non-drug options can be systematically catalogued and integrated into shared care planning [104]. In addition, patients might benefit from social prescribing, to identify fitting non-drug interventions through the consultation with a link worker [105].

4.1.5 Limitations

Limitationen:

This report has several limitations that should be considered when interpreting the findings.

heterogene Terminologie

A primary limitation is based on differences in terminology (e.g. “medication review”, “medication analysis”, “polypharmacy check”), which may affect literature search results (including legislative documents), and comparability across studies. While we used “medication review” for both research questions, “medication analysis” and “polypharmacy check” were used only in research question two (after completion of the first research question). In addition, one included systematic review [57] used a slightly different operational definition of polypharmacy (≥4 medications). While this deviates from the predefined inclusion criterion, the population remains comparable to typical polypharmacy definitions and the review was therefore retained.

sehr weite Inklusionskriterien in den URs

In addition, umbrella reviews in this analysis did not exclude indication-specific systematic reviews. Consequently, some results from studies focusing on specific indications of the intervention may have limited applicability to the general patient population, which is characterised by a heterogeneity of indications.

teilweise überlappende Evidenz

A partial overlap of evidence was identified across the included reviews. One systematic review [57] was included in both umbrella reviews, while the other two systematic reviews [53, 56] were not part of the umbrella reviews and were included separately. In addition, an assessment of primary study overlap across the three included systematic reviews indicated no overlap between two reviews, slight overlap between one pair, and moderate overlap between another pair. While this indicates some duplication of underlying evidence, results in this report were synthesised narratively at the review level rather than quantitatively pooled. The potential influence of this overlap on the overall conclusions is therefore considered limited. Another limitation is that more recent systematic reviews may have failed to include all relevant primary studies, potentially limiting completeness of results.

rezenteste Primärstudien womöglich nicht in URs und SRs eingeschlossen

Generalisierung der Ergebnisse durch Länderauswahl nicht möglich

Furthermore, the selection of countries included in this report may restrict the generalisability of the findings to other regions. The analysis of further countries could have provided additional insights relevant for evidence-based decision-making in regard to structured medication reviews.

fehlende Qualitätsbewertung der Dokumente in der 2ten FF

Another limitation is the absence of expert consultations, in particular concerning the preparation of the country analysis. The reliance on publicly available grey literature could limit data completeness and introduce reporting bias. Additionally, the lack of a formal quality assessment of the included documents for the second research question limits the ability to determine the strength of the evidence.

es wurde keine Vergleichsanalyse für die verschiedene Werkzeuge durchgeführt

Further, no comparative analysis of individual electronic clinical decision-support tools was conducted. Interventions in which medication review represented only one component of broader electronic clinical decision-support systems were excluded from the evidence analysis. As a result, differences in functionality, interoperability, and usability between specific tools could not be evaluated. Future research should systematically assess the comparative effectiveness and feasibility of these tools within the Austrian healthcare context.

Finally, the cost analysis presented in this report is based solely on the data described in the included systematic and umbrella reviews. We relied on data as reported in the included umbrella reviews and systematic reviews; numeric economic outcomes from individual primary studies were not extracted where they were not explicitly reported in the reviews. No additional hand-searching for specific cost-effectiveness studies was performed, which may limit the comprehensiveness of the economic evaluation.

Ergebnisse zu Kosteneffektivität limitiert auf die inkludierten SRs & URs

4.1.6 Conclusion and Recommendations for Austria

Structured medication reviews can improve medication safety, reduce drug-related problems, and contribute to more rational pharmacotherapy for patients with polypharmacy. However, we found insufficient evidence that the intervention results in improved clinical and quality of life benefit for patients. Furthermore, while some healthcare resources may be used less (e.g. emergency departments), these savings may be outweighed by the intervention costs. Yet, economic outcomes are highly uncertain due to sparse data within included umbrella reviews and systematic reviews.

Fazit: Medikationsanalysen können Medikationsprobleme verbessern, jedoch viele Endpunkte noch nicht genügend untersucht

Based on international findings and comparison with evidence from Austria's pilot the following recommendations can be concluded from the analysis:

- If the demonstrated outcomes are judged sufficient for introducing a reimbursed, structured medication review, priority should be on high-risk patients (≥ 5-10 long-term medications, multimorbidity, frailty).
- Enabling structured collaboration and exchange between pharmacists and physicians, including clear role definitions and secure communication tools.
- Standardising procedures and documentation, adopting validated tools (e.g. STOPP/START, STRIP or STOPPFrail), and the use of clear quality indicators.
- Integrating structured medication reviews into the existing ELGA e-Medikation system, ensuring interoperability through shared, cross-sector access to medication lists and prescribing data from both ambulatory and hospital care.
- Considering both ambulatory and hospital care settings as relevant contexts for structured medication reviews.
- Further developing accredited training programmes for pharmacists and physicians.
- In terms of transferability (comparable health system structure), the models from Germany and the Netherlands could serve as templates to guide the implementation of structured medication reviews.
- Implementation should be accompanied by expert consultations and health services research, to assess long-term effectiveness, cost-effectiveness, and real-world data evaluations, allowing iterative adaptation of the intervention.

Falls Medikationsanalysen in Ö implementiert werden sollten:

- Fokus auf Risikogruppen,
- Unterstützung einer kollaborativen Kommunikation zw. Versorger:innen,
- standardisiertes Vorgehen,
- Integration in das ELGA e-Medikationssystem,
- sowohl ambulantes als auch stationäres Versorgungssetting relevant
- weitere Entwicklung von Ausbildungsprogrammen,
- Orientierung an D & NLD,
- zusätzliche Begleitforschung

5 References

[1] Pschyrembel Online. Polypharmazie. 2025 [cited 22.04.2025]. Available from: https://www.pschyrembel.de/Polypharmazie/P038B.

[2] Taghy N., Cambon L., Cohen J. M. and Dussart C. Failure to reach a consensus in polypharmacy definition: An obstacle to measuring risks and impacts—results of a literature review. Therapeutics and Clinical Risk Management. 2020;16:57-73. DOI: 10.2147/TCRM.S214187.

[3] Davies L. E., Spiers G., Kingston A., Todd A., Adamson J. and Hanratty B. Adverse Outcomes of Polypharmacy in Older People: Systematic Review of Reviews. Journal of the American Medical Directors Association. 2020;21(2):181-187. DOI: 10.1016/j.jamda.2019.10.022.

[4] Iqbal A., Richardson C., Iqbal Z., O'Keefe H., Hanratty B., Matthews F. E., et al. Are there socioeconomic inequalities in polypharmacy among older people? A systematic review and meta-analysis. BMC Geriatrics. 2023;23(1):149. DOI: 10.1186/s12877-023-03835-z.

[5] Rochon P. A., Petrovic M., Cherubini A., Onder G., O'Mahony D., Sternberg S. A., et al. Polypharmacy, inappropriate prescribing, and deprescribing in older people: through a sex and gender lens. The Lancet Healthy Longevity. 2021;2(5):e290-e300. DOI: 10.1016/S2666-7568(21)00054-4.

[6] Pharmaceutical Care Network Europe. PCNE Classification for Drug-Related Problems V9.1. 2020 [cited 01.02.2026]. Available from: https://pcne.org/wp-content/uploads/2026/02/PCNE_Working-Groups-Classification_V9-1_final.pdf.

[7] UpToDate. Deprescribing. 2025 [cited 22.04.2025]. Available from: https://www.uptodate.com/contents/deprescribing.

[8] Wang Z., Liu T., Su Q., Luo H., Lou L., Zhao L., et al. Prevalence of Polypharmacy in Elderly Population Worldwide: A Systematic Review and Meta-Analysis. Pharmacoepidemiol Drug Saf. 2024;33(8):e5880. DOI: 10.1002/pds.5880.

[9] Pan S., Li S., Jiang S., Shin J. I., Liu G. G., Wu H., et al. Trends in Number and Appropriateness of Prescription Medication Utilization Among Community-Dwelling Older Adults in the United States: 2011-2020. J Gerontol A Biol Sci Med Sci. 2024;79(7). DOI: 10.1093/gerona/glae108.

[10] Zermansky A. G., Petty D. R., Raynor D. K., Lowe C. J., Freemantle N. and Vail A. Clinical medication review by a pharmacist of patients on repeat prescriptions in general practice: a randomised controlled trial. Health Technol Assess. 2002;6(20):1-86. DOI: 10.3310/hta6200.

[11] Blenkinsopp A., Bond C. and Raynor D. K. Medication reviews. Br J Clin Pharmacol. 2012;74(4):573-580. DOI: 10.1111/j.1365-2125.2012.04331.x.

[12] Bundesvereinigung Deutscher Apothekerverbände. Grundsatzpapier zur Medikationsanalyse und zum Medikationsmanagement. 2014 [cited 28.04.2025]. Available from: https://www.abda.de/fileadmin/user_upload/assets/Medikationsmanagement/Grundsatzpapier_MA_MM_GBAM.pdf.

[13] Alharthi M., Wright D., Scott S. and Blacklock J. Terms used to describe and define activities undertaken as a result of the medication review process: Do they require standardisation? A systematic review. Int J Clin Pharm. 2023;45(2):304-319. Epub 20221121. DOI: 10.1007/s11096-022-01494-5.

[14] Scott I. A., Hilmer S. N., Reeve E., Potter K., Le Couteur D., Rigby D., et al. Reducing inappropriate polypharmacy: the process of deprescribing. JAMA Intern Med. 2015;175(5):827-834. DOI: 10.1001/jamainternmed.2015.0324.

[15] Reeve E., Gnjidic D., Long J. and Hilmer S. A systematic review of the emerging definition of 'deprescribing' with network analysis: implications for future research and clinical practice. Br J Clin Pharmacol. 2015;80(6):1254-1268. DOI: 10.1111/bcp.12732.

[16] Gnjidic D., Johansson M., Meng D. M., Farrell B., Langford A. and Reeve E. Achieving sustainable healthcare through deprescribing. Cochrane Database of Systematic Reviews. 2022;10:ED000159. DOI: 10.1002/14651858.ED000159.

[17] Mose K., Lundby C., Rasmussen L. and Pottegård A. Tools for Evaluating Potentially Inappropriate Medication Use in Older Adults: A Scoping Review Assessing Suitability for Register-Based Research. Basic Clin Pharmacol Toxicol. 2025;137(4):e70094. DOI: 10.1111/bcpt.70094.

[18] Pazan F., Kather J. and Wehling M. A systematic review and novel classification of listing tools to improve medication in older people. Eur J Clin Pharmacol. 2019;75(5):619-625. Epub 20190126. DOI: 10.1007/s00228-019-02634-z.

[19] Pazan F., Weiss C. and Wehling M. The EURO-FORTA (Fit fOR The Aged) List: International Consensus Validation of a Clinical Tool for Improved Drug Treatment in Older People. Drugs Aging. 2018;35(1):61-71. DOI: 10.1007/s40266-017-0514-2.

[20] Holt S., Schmiedl S. and Thürmann P. A. Potentially inappropriate medications in the elderly: the PRISCUS list. Dtsch Arztebl Int. 2010;107(31-32):543-551. Epub 20100809. DOI: 10.3238/arztebl.2010.0543.

[21] Renom-Guiteras A., Meyer G. and Thürmann P. A. The EU(7)-PIM list: a list of potentially inappropriate medications for older people consented by experts from seven European countries. Eur J Clin Pharmacol. 2015;71(7):861-875. Epub 20150514. DOI: 10.1007/s00228-015-1860-9.

[22] Krüger C., Schäfer I., van den Bussche H., Bickel H., Dreischulte T., Fuchs A., et al. Comparison of FORTA, PRISCUS and EU(7)-PIM lists on identifying potentially inappropriate medication and its impact on cognitive function in multimorbid elderly German people in primary care: a multicentre observational study. BMJ Open. 2021;11(9):e050344. Epub 20210917. DOI: 10.1136/bmjopen-2021-050344.

[23] Spinewine A., Schmader K. E., Barber N., Hughes C., Lapane K. L., Swine C., et al. Appropriate prescribing in elderly people: how well can it be measured and optimised? Lancet. 2007;370(9582):173-184. DOI: 10.1016/s0140-6736(07)61091-5.

[24] Vukoja M. and Mimica S. Comparison of explicit criteria for potentially inappropriate drug prescribing among the elderly: a narrative review. Discover Health Systems. 2024;3(1):62. DOI: 10.1007/s44250-024-00102-9.

[25] Hanlon J. T., Schmader K. E., Samsa G. P., Weinberger M., Uttech K. M., Lewis I. K., 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.

[26] Mejías-Trueba M., Fernández-Rubio B., Rodríguez-Pérez A., Bernabeu-Wittel M. and Sánchez-Fidalgo S. Identification and characterisation of deprescribing tools for older patients: A scoping review. Research in Social and Administrative Pharmacy. 2022;18(9):3484-3491. DOI: https://doi.org/10.1016/j.sapharm.2022.03.008.

[27] O'Mahony D., O'Sullivan D., Byrne S., O'Connor M. N., Ryan C. and Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. Age Ageing. 2015;44(2):213-218. Epub 20141016. DOI: 10.1093/ageing/afu145.

[28] O'Mahony D., Cherubini A., Guiteras A. R., Denkinger M., Beuscart J. B., Onder G., et al. STOPP/START criteria for potentially inappropriate prescribing in older people: version 3. Eur Geriatr Med. 2023;14(4):625-632. Epub 20230531. DOI: 10.1007/s41999-023-00777-y.

[29] Gallagher P., Ryan C., Byrne S., Kennedy J. and 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 Pharmacol Ther. 2008;46(2):72-83. DOI: 10.5414/cpp46072.

[30] Lavan A. H., Gallagher P., Parsons C. and O'Mahony D. STOPPFrail (Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy): consensus validation. Age Ageing. 2017;46(4):600-607. DOI: 10.1093/ageing/afx005.

[31] Curtin D., Gallagher P. and O'Mahony D. Deprescribing in older people approaching end-of-life: development and validation of STOPPFrail version 2. Age Ageing. 2021;50(2):465-471. DOI: 10.1093/ageing/afaa159.

[32] Drenth-van Maanen A. C., Leendertse A. J., Jansen P. A. F., Knol W., Keijsers C., Meulendijk M. C., et al. The Systematic Tool to Reduce Inappropriate Prescribing (STRIP): Combining implicit and explicit

prescribing tools to improve appropriate prescribing. J Eval Clin Pract. 2018;24(2):317-322. Epub 20170804. DOI: 10.1111/jep.12787.

[33] Dachverband der Sozialversicherungsträger. Vorsicht Wechselwirkung! : 2020 [cited 22.04.2025]. Available from: https://www.sozialversicherung.at/cdscontent/?contentid=10007.844500.

[34] Bischof T., Schmidt-Ilsinger A., Hoppel M., Kreuzer A., Briganser S., Saiko P., et al. Effects of a community pharmacy-based structured medication review on drug-related problems in all-comers with polypharmacy: a randomized, controlled, double-blind, parallel-group trial. Front Med (Lausanne). 2025;12:1656595. Epub 20250903. DOI: 10.3389/fmed.2025.1656595.

[35] Österreichische Apothekerkammer. Medikationsanalyse Ergebnisse Studie. 2025 [cited 22.04.2025]. Available from: https://www.apothekerkammer.at/aktuelles/aktuelle-themen/medikationsanalyse-ergebnisse-studie.

[36] Österreichische Apothekerkammer. Alle Arzneimittel im Blick: Pilotprojekt Medikationsanalyse. 2025 [cited 22.04.2025]. Available from: https://www.apothekerkammer.at/oesterreichs-apothekerinnen/fort-und-weiterbildung/pilotprojekt-medikationsanalyse.

[37] Verbraucherzentrale NRW e.V. Medikationsanalyse: Apotheken prüfen, ob sich die Medikamente vertragen. 2024 [cited 22.04.2025]. Available from: https://www.verbraucherzentrale.de/wissen/gesundheit-pflege/medikamente/medikationsanalyse-apotheken-pruefen-ob-sich-die-medikamente-vertragen-76005.

[38] Österreichische Apothekerkammer. Gesetzliche Rahmenbedingungen der österreichischen Apotheken (Version 2025). 2025 [cited 10.09.2025]. Available from: https://www.apothekerkammer.at/infothek/rechtliche-hintergruende/allgemeine-informationen-und-formulare/gesetzliche-rahmenbedingungen-der-oesterreichischen-apotheken.

[39] Salcher-Konrad M., Knoll V. and Vogler S. Leistungsspektrum der öffentlichen Apotheken im österreichischen Gesundheitssystem – Bestandsaufnahme, Analyse und Ausblick. 2023 [cited 10.09.2025]. Available from: https://ppri.goeg.at/system/files/inline-files/Apothekenleistungen_Endbericht_Final_barrierefrei.pdf.

[40] Bundesministerium Arbeit S., Gesundheit, Pflege und Konsumentenschutz,. Apotheken. 2023 [cited 05.06.2025]. Available from: https://www.sozialministerium.gv.at/Themen/Gesundheit/Medizin-und-Gesundheitsberufe/Medizin/Apotheken.html;%20Accessed:%2005.06.2025.

[41] Rechtsinformationssystem des Bundes. Bundesrecht konsolidiert: Gesamte Rechtsvorschrift für Pharmazeutische Fachkräfteverordnung. 2025 [cited 01.09.2025]. Available from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010207.

[42] Bundesgesetzblatt für die Republik Österreich. Änderung der Apothekenbetriebsordnung 2005, der Arzneimittelbetriebsordnung 2009 und der Pharmazeutische Fachkräfteverordnung. 2025 [cited 01.09.2025]. Available from: https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2025_II_2/BGBLA_2025_II_2.html.

[43] Bundesgesetzblatt für die Republik Österreich. Änderung des Apothekengesetzes, des Apothekerkammergesetzes 2001 sowie des Gehaltskassengesetzes 2002. 2024 [cited 05.06.2025]. Available from: https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2024_I_22/BGBLA_2024_I_22.html.

[44] Rechtsinformationssystem des Bundes. Gesamte Rechtsvorschrift für Ärztegesetz 1998, Fassung vom 19.11.2025. 2025 [cited 19.11.2025]. Available from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011138.

[45] Rechtsinformationssystem des Bundes. Gesamte Rechtsvorschrift für Gesundheits- und Krankenpflegegesetz, Fassung vom 19.11.2025. 2025 [cited 19.11.2025]. Available from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011026.

[46] Rechtsinformationssystem des Bundes. Gesamte Rechtsvorschrift für Ärztinnen-/Ärzte-Ausbildungsordnung 2015 , Fassung vom 19.11.2025. 2025 [cited 19.11.2025]. Available from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20009186.

[47] Rechtsinformationssystem des Bundes. Gesamte Rechtsvorschrift für Rezeptpflichtgesetz, Fassung vom 19.11.2025. 2025 [cited 19.11.2025]. Available from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010351.

[48] Rechtsinformationssystem des Bundes. Gesamte Rechtsvorschrift für Arzneimittelgesetz, Fassung vom 19.11.2025. 2025 [cited 19.11.2025]. Available from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010441.

[49] Jeindl R., Kern J. and Strohmaier C. Structured Medication Review for Polypharmacy. 2025 [cited 01.02.2026]. Available from: https://osf.io/kg5nh/overview.

[50] Ouzzani M., Hammady H., Fedorowicz Z. and Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. Systematic Reviews. 2016;5(1):210. DOI: 10.1186/s13643-016-0384-4.

[51] ESRC Research Methods Programme University of Manchester. Realist synthesis: an introduction 2004 [cited 10.09.2025]. Available from: https://www.betterevaluation.org/sites/default/files/RMPmethods2.pdf.

[52] Ali M. U., Sherifali D., Fitzpatrick-Lewis D., Kenny M., Lamarche L., Raina P., et al. Interventions to address polypharmacy in older adults living with multimorbidity: Review of reviews. Canadian Family Physician. 2022;68(7):e215-e226. DOI: https://dx.doi.org/10.46747/cfp.6807e215.

[53] Bülow C., Clausen S. S., Lundh A. and Christensen M. Medication review in hospitalised patients to reduce morbidity and mortality. Cochrane Database of Systematic Reviews. 2023(1). DOI: 10.1002/14651858.CD008986.pub4.

[54] Japelj N., Horvat N., Knez L. and Kos M. Deprescribing: An umbrella review. Acta Pharmaceutica. 2024;74(2):249-267. DOI: https://dx.doi.org/10.2478/acph-2024-0011.

[55] Keller M. S., Qureshi N., Mays A. M., Sarkisian C. A. and Pevnick J. M. Cumulative Update of a Systematic Overview Evaluating Interventions Addressing Polypharmacy. JAMA Network Open. 2024;7(1):e2350963. DOI: https://dx.doi.org/10.1001/jamanetworkopen.2023.50963.

[56] Omuya H., Nickel C., Wilson P. and Chewning B. A systematic review of randomised-controlled trials on deprescribing outcomes in older adults with polypharmacy. International Journal of Pharmacy Practice. 2023;31(4):349-368. DOI: https://dx.doi.org/10.1093/ijpp/riad025.

[57] Tasai S., Kumpat N., Dilokthornsakul P., Chaiyakunapruk N., Saini B. and Dhippayom T. Impact of Medication Reviews Delivered by Community Pharmacist to Elderly Patients on Polypharmacy: A Meta-analysis of Randomized Controlled Trials. Journal of patient safety. 2021;17(4):290-298. DOI: https://dx.doi.org/10.1097/PTS.0000000000000599.

[58] Whiting P., Savović J., Higgins J. P., Caldwell D. M., Reeves B. C., Shea B., et al. ROBIS: A new tool to assess risk of bias in systematic reviews was developed. J Clin Epidemiol. 2016;69:225-234. Epub 20150616. DOI: 10.1016/j.jclinepi.2015.06.005.

[59] Pérez-Bracchiglione J., Meza N., Bangdiwala S. I., Niño de Guzmán E., Urrútia G., Bonfill X., et al. Graphical Representation of Overlap for OVErviews: GROOVE tool. Res Synth Methods. 2022;13(3):381-388. Epub 20220322. DOI: 10.1002/jrsm.1557.

[60] DEGAM - Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin e.V. S3-Leitlinie Hausärztliche Leitlinie: Multimedikation. 2021 [cited 23.07.2025]. Available from: https://register.awmf.org/assets/guidelines/053-043l_S3_Multimedikation_2021-08.pdf.

[61] DEGAM - Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin e.V. S3-Leitlinie: Multimorbidität - Living guideline. 2024 [cited 23.07.2025]. Available from: https://register.awmf.org/assets/guidelines/053-047l_S3_Multimorbiditaet_2024-11.pdf.

[62] DEGAM - Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin e.V. S2e-Leitlinie Living Guideline: Schutz vor Über- und Unterversorgung - gemeinsam entscheiden. 2025 [cited 23.07.2025]. Available from: https://register.awmf.org/assets/guidelines/053-045LGl_S3_LG_Schutz_vor_Ueber_und_Unterversorgung_2025-06.PDF.

[63] Deutsche Gesellschaft für Geriatrie (DGG). S3-Leitlinie: Umfassendes Geriatrisches Assessment (Comprehensive Geriatric Assessment, CGA) bei hospitalisierten Patientinnen und Patienten. 2024 [cited 23.07.2025]. Available from: https://register.awmf.org/assets/guidelines/084-003l_S3_Umfassendes-Geriatrisches-Assessment-Comprehensive-Geriatric-Assessment-CGA-bei-hospitalisierten-PatientInnen_2024-06.pdf.

[64] DGIM - Deutsche Gesellschaft für Innere Medizin e.V. S2k-Leitlinie Arzneimitteltherapie bei Multimorbidität - Living Guideline 2023 [cited 23.07.2025]. Available from: https://register.awmf.org/assets/guidelines/100-001l_S2k_Arzneimitteltherapie-bei-Multimorbiditaet_2024-08-abgelaufen.pdf.

[65] Onder G., Vetrano D. L., Palmer K., Trevisan C., Amato L., Berti F., et al. Italian guidelines on management of persons with multimorbidity and polypharmacy. Aging Clinical and Experimental Research. 2022;34(5):989-996. DOI: 10.1007/s40520-022-02094-z.

[66] AGREE Next Steps Consortium. The AGREE II Instrument [Electronic Version]. 2017 [cited 22.04.2025]. Available from: https://www.agreetrust.org/wp-content/uploads/2017/12/AGREE-II-Users-Manual-and-23-item-Instrument-2009-Update-2017.pdf.

[67] IQWiG - Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen. Allgemeine Methoden - Version 7.0. 2023 [cited 04.08.2025]. Available from: https://www.iqwig.de/methoden/allgemeine-methoden_version-7-0.pdf.

[68] Konet A., Thomas I., Gartlehner G., Kahwati L., Hilscher R., Kugley S., et al. Performance of two large language models for data extraction in evidence synthesis. Res Synth Methods. 2024;15(5):818-824. Epub 20240619. DOI: 10.1002/jrsm.1732.

[69] Imfeld-Isenegger T. L., Soares I. B., Makovec U. N., Horvat N., Kos M., van Mil F., et al. Community pharmacist-led medication review procedures across Europe: Characterization, implementation and remuneration. Research in Social and Administrative Pharmacy. 2020;16(8):1057-1066. DOI: https://doi.org/10.1016/j.sapharm.2019.11.002.

[70] Klerings I. Uses for large language models in systematic literature searching – an overview of the evidence. 2025 [cited 01.02.2026]. Available from: https://journals.publisso.de/index.php/en/journals/mbi/volume25/mbi000638.

[71] Engels L., van den Akker M., Denig P., Stoffers H., Gerger H., Bohnen J., et al. Medication Management in Patients With Polypharmacy in Primary Care: A Scoping Review of Clinical Practice Guidelines. J Evid Based Med. 2025;18(1):e70015. DOI: 10.1111/jebm.70015.

[72] NHS UK Specialist Pharmacy Service. A person-centred approach to polypharmacy and medication review. 2025 [cited 10.09.2025]. Available from: https://www.sps.nhs.uk/articles/a-person-centred-approach-to-polypharmacy-and-medication-review/.

[73] Pharmaceutical Society of Australia. Guidelines for Comprehensive Medication Management Reviews. 2020 [cited 10.09.2025]. Available from: https://my.psa.org.au/s/article/guidelines-for-comprehensive-mmr.

[74] European Directorate for the Quality of Medicines & HealthCare. Guidelines on Medication Review. 2024 [cited 10.09.2025]. Available from: https://www.pcne.org/upload/files/557_EDQM_-guidelines-on-medication-review_2024.PDF.

[75] Greater Manchester Medicines Management Group. Polypharmacy Review and Treatment Optimisation: Resource Pack. 2025 [cited 10.09.2025]. Available from: https://gmmmg.nhs.uk/wp-content/uploads/2025/03/GMMMG-Polypharmacy-resource-pack-v-4.0-for-GMMMG-website.pdf.

[76] Gavazova E., Staynova R. and Grekova-Kafalova D. Managing polypharmacy through medication review tools – pros and cons. Folia Medica. 2024;66(2). DOI: 10.3897/folmed.66.e117783.

[77] Bundesapothekerkammer (BAK). Leitlinie der Bundesapothekerkammer zur Qualitätssicherung: Medikationsanalyse. 2023 [cited 10.09.2025]. Available from: https://www.abda.de/fileadmin/user_upload/assets/Praktische_Hilfen/Leitlinien/Medikationsanalyse/LL_MedAnalyse.pdf.

[78] Bundesapothekerkammer (BAK). Kommentar zur Leitlinie der Bundesapothekerkammer zur Qualitätssicherung: Medikationsanalyse. 2023 [cited 10.09.2025]. Available from: https://www.abda.de/fileadmin/user_upload/assets/Praktische_Hilfen/Leitlinien/Medikationsanalyse/LL_MedAnalyse_Kommentar.pdf.

[79] News Service Bund Das Portal der Schweizer Regierung. Der Bundesrat genehmigt zwei Tarifverträge über die Apothekerleistungen. 2019 [cited 03.11.2025]. Available from: https://www.news.admin.ch/de/nsb?id=75580.

[80] World Health Organization. Medication Without Harm – WHO Global Patient Safety Challenge. 2017 [cited 2026-02-05]. Available from: https://www.who.int/initiatives/medication-without-harm.

[81] World Health Organization. Medication Safety in Polypharmacy – Technical Report. 2019 [cited 2026-02-05]. Available from: https://www.who.int/publications-detail-redirect/medication-safety-in-polypharmacy-technical-report.

[82] World Health Organization. WHO Technical Series on Safer Primary Care: Medication Safety. 2023 [cited 2026-02-05]. Available from: https://www.who.int/publications/i/item/9789240062764.

[83] Organisation for Economic Co-operation and Development. The Economics of Medication Safety. 2022 [cited 2026-02-05]. Available from: https://www.oecd.org/en/publications/2022/09/the-economics-of-medication-safety_e79d5329.html.

[84] Organisation for Economic Co-operation and Development. Living with Multiple Chronic Conditions. 2025 [cited 2026-02-05]. Available from: https://www.oecd.org/en/publications/2025/02/does-healthcare-deliver_978507f1/full-report/living-with-multiple-chronic-conditions_0275c435.html.

[85] Cole J. A., Gonçalves-Bradley D. C., Alqahtani M., Barry H. E., Cadogan C., Rankin A., et al. Interventions to improve the appropriate use of polypharmacy for older people. Cochrane Database Syst Rev. 2023;10(10):Cd008165. Epub 20231011. DOI: 10.1002/14651858.CD008165.pub5.

[86] Langebrake C., Hohmann C., Lezius S., Lueb M., Picksak G., Walter W., et al. Clinical pharmacists' interventions across German hospitals: results from a repetitive cross-sectional study. International Journal of Clinical Pharmacy. 2022;44(1):64-71. DOI: 10.1007/s11096-021-01313-3.

[87] Berger V., Sommer C., Boje P., Hollmann J., Hummelt J., König C., et al. The impact of pharmacists' interventions within the Closed Loop Medication Management process on medication safety: An analysis in a German university hospital. Frontiers in Pharmacology. 2022;Volume 13 - 2022.

[88] Langebrake C., Ihbe-Heffinger A., Leichenberg K., Kaden S., Kunkel M., Lueb M., et al. Nationwide Evaluation of Day-to-Day Clinical Pharmacists' Interventions in German Hospitals. Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy. 2015;35(4):370-379. DOI: https://doi.org/10.1002/phar.1578.

[89] Skivington K., Matthews L., Simpson S. A., Craig P., Baird J., Blazeby J. M., et al. Framework for the development and evaluation of complex interventions: gap analysis, workshop and consultation-informed update. Health Technol Assess. 2021;25(57):1-132. DOI: 10.3310/hta25570.

[90] Reeve J., Maden M., Hill R., Turk A., Mahtani K., Wong G., et al. Deprescribing medicines in older people living with multimorbidity and polypharmacy: the TAILOR evidence synthesis. Health Technol Assess. 2022;26(32):1-148. DOI: 10.3310/aafo2475.

[91] Anderson K., Stowasser D., Freeman C. and Scott I. Prescriber barriers and enablers to minimising potentially inappropriate medications in adults: a systematic review and thematic synthesis. BMJ Open. 2014;4(12):e006544. Epub 20141208. DOI: 10.1136/bmjopen-2014-006544.

[92] Reeve E., To J., Hendrix I., Shakib S., Roberts M. S. and Wiese M. D. Patient barriers to and enablers of deprescribing: a systematic review. Drugs Aging. 2013;30(10):793-807. DOI: 10.1007/s40266-013-0106-8.

[93] Radcliffe E., Servin R., Cox N., Lim S., Tan Q. Y., Howard C., et al. What makes a multidisciplinary medication review and deprescribing intervention for older people work well in primary care? A realist review and synthesis. BMC Geriatr. 2023;23(1):591. Epub 20230925. DOI: 10.1186/s12877-023-04256-8.

[94] Ng Y., Hsu J. T. Y., Ng N. N. E., Ong J. Z. E., Hsu J. L. J., Sulaimi F., et al. Evaluating the role of clinical decision support systems in medication safety for older people: a systematic review. Age Ageing. 2025;54(7). DOI: 10.1093/ageing/afaf206.

[95] van der Sijs H., Aarts J., Vulto A. and Berg M. Overriding of drug safety alerts in computerized physician order entry. J Am Med Inform Assoc. 2006;13(2):138-147. Epub 20051215. DOI: 10.1197/jamia.M1809.

[96] Chrubasik-Hausmann S., Vlachojannis J. and McLachlan A. J. Understanding drug interactions with St John's wort (Hypericum perforatum L.): impact of hyperforin content. Journal of Pharmacy and Pharmacology. 2019;71(1):129-138. DOI: https://doi.org/10.1111/jphp.12858.

[97] FDA. Grapefruit Juice and Some Drugs Don't Mix. 2021 [cited 06.11.2025]. Available from: https://www.fda.gov/consumers/consumer-updates/grapefruit-juice-and-some-drugs-dont-mix.

[98] Kabbani D., Akika R., Wahid A., Daly A. K., Cascorbi I. and Zgheib N. K. Pharmacogenomics in practice: a review and implementation guide. Front Pharmacol. 2023;14:1189976. Epub 20230518. DOI: 10.3389/fphar.2023.1189976.

[99] Clinical Pharmacogenetics Implementation Consortium. Guidelines. 2025 [cited 06.11.2025]. Available from: https://cpicpgx.org/guidelines/.

[100] Maidment I. D., Lawson S., Wong G., Booth A., Watson A., McKeown J., et al. Health Services and Delivery Research. Medication management in older people: the MEMORABLE realist synthesis. Southampton (UK)2020.

[101] Hofer V. and Pleyer J. A. Nudging interventions to optimise physician prescribing behaviour. HTA-Projektbericht 168.: 2025 [cited 01.02.2026]. Available from: https://eprints.aihta.at/1593/.

[102] Canada's Drug Agency. 5 Tips to Manage Polypharmacy. 2025 [cited 06.11.2025]. Available from: https://www.cda-amc.ca/sites/default/files/corporate/corp_committees/Expert_Panel-Appropriate_Use/5_Tips_Handout_EN.pdf.

[103] Canada's Drug Agency. 5 Questions to Ask About My Multiple Medications. 2025 [cited 06.11.2025]. Available from: https://www.cda-amc.ca/sites/default/files/corporate/corp_committees/Expert_Panel-Appropriate_Use/5Questions-Multiple-Medications-Handout.pdf.

[104] The Royal Australian College of General Practitioners (RACGP). About HANDI - What is the HANDI project? : 2025 [cited 11.11.2025]. Available from: https://www.racgp.org.au/clinical-resources/clinical-guidelines/handi/about-handi/about-handi.

[105] Kern J. and Schönegger R. Social Prescribing in Primary Care – Development of an Austrian programme theory based on realist evidence. HTA-Projektbericht 173.: 2025 [cited 06.02.2025]. Available from: https://eprints.aihta.at/1581/.

HTA Austria
Austrian Institute for
Health Technology Assessment
GesmbH