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Review Article

Barriers and Enablers for Deprescribing Glucose-Lowering Treatment in Older Adults: A Systematic Review



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ABSTRACT

Keywords:

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Objectives: Overtreatment with glucose-lowering treatment (GLT) is frequent and a source of high morbidity and mortality in older adults with type 2 diabetes mellitus (T2DM). This study aimed to identify and synthesize barriers and enablers for deprescribing GLT in older adults (≥ 65 years) with T2DM.

Design: Systematic review of qualitative and mixed-methods studies.

Setting and Participants: Older adults with T2DM, any participants [patients, health care providers (HCPs), caregivers], any settings.

Methods: Two researchers (and a referred third researcher at all stages) independently screened original articles reporting qualitative and mixed-methods studies exploring barriers and enablers for deprescribing GLT in older adults published during 2010–2023, identified from MEDLINE, Embase, CINAHL, and gray literature. Quality of the included studies was assessed with the Mixed-Methods Appraisal Tool. Verbatim statements on barriers and enablers were extracted, and determinants of behaviors were identified with the Theoretical Domains Framework (TDF) version 2, and related intervention functions (targets for future interventions) were proposed according to the Behavior Change Wheel (BCW).

Results: We identified only 4 studies from 2 countries (United States and the Netherlands), all recently published (2019–2023), that primarily reported barriers to GLT deprescribing from interviews or focus groups of patients or HCPs practicing outpatient medicine. Knowledge, fear, poor communication, inertia, and trust with HCPs were the main determinants of behaviors that influenced deprescribing, and education, training, persuasion and environmental restructuring were the main intervention functions for proposing future interventions. Studies did not cover financial aspects, physician characteristics, or caregiver and family viewpoints.

Conclusions and Implications: The use of a behavioral theory and a validated implementation framework provided a comprehensive approach to identifying barriers and enablers for deprescribing GLT in older adults (≥ 65 years) with T2DM. The behavioral determinants identified may be useful in tailoring interventions to improve the implementation of GLT deprescribing in older adults in ambulatory settings.

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Type 2 diabetes mellitus (T2DM) is a chronic condition characterized by hyperglycemia, and its prevalence is highest in older age groups, with more than 25% of adults aged ≥ 75 years affected by diabetes (20% in Europe and 27% in North America).^{1–3}

The treatment of T2DM relies on, among other things, restoring appropriate glycemic control to avoid the acute and chronic consequences of hyperglycemia that increase morbidity (eg, kidney disease, retinopathy, neuropathy, peripheral artery disease, and foot ulceration) and mortality^{4,5} with the use of glucose-lowering treatment (GLT).⁶ Glucose-lowering drug classes include nonhypoglycemic drugs (ie, biguanides, alpha glucosidase inhibitors, thiazolidinediones, dipeptidyl peptidase 4 inhibitors, glucagon-like peptide 1 agonists, and sodium glucose cotransporter 2 inhibitors) and hypoglycemic drugs [HDs; ie, sulfonylureas, glinides (oral HDs), and insulins (injectable HDs)⁶] that may cause hypoglycemia. Hypoglycemia is harmful in older patients and is associated with increased risk of mortality, frailty, falls, hospitalizations, and cognitive and functional decline, which worsens the well-being of patients and generates excess costs for health care systems.^{7,8} GLT has been implicated in one-quarter of emergency hospitalizations for adverse drug events in older adults in the United States, nearly all for hypoglycemia.⁹ Finally, in some older patients, the risk of morbidity and mortality due to short- and medium-term hypoglycemia outweigh the benefits of glucose-lowering drugs.¹⁰ Tailoring glycemic management in older adults with T2DM, by individualizing the goals of GLT [ie, glycemic control, expressed as a glycated hemoglobin (HbA_{1c}) target window] according to the patient's health status (ie, presence of comorbidities and cognitive and functional status), has become the gold standard practice in recent years. Diabetes guidelines increasingly recommend relaxing glycemic targets in older patients with T2DM: HbA_{1c} proportion $\geq 7.0\%$ and $< 7.5\%$ in healthy patients, $\geq 7.5\%$ and $< 8.0\%$ in patients with intermediate health, and $\geq 8.0\%$ and $< 8.5\%$ in patients with poor health.¹⁰ This individualization aims to avoid overtreatment with GLT (ie, leading to a too-high risk of hypoglycemia) but also useless treatment. Yet, Lipska et al¹¹ reported in 2015 that 61.5% of older adults with T2DM in the United States were overtreated, with an HbA_{1c} proportion $< 7\%$. In the same way, Lega et al³ reported among 108,620 older adults with T2DM in Ontario, Canada, that intensive glycemic control (HbA_{1c} proportion $< 7\%$) with high-risk agents (HDs) was associated with nearly 50% increased risk of emergency department visits, hospitalizations, or death within 30 days.

For all these reasons, scientific societies recommend deprescribing glucose-lowering drugs (ie, reducing the total dose or the number of GLT agents, including total discontinuation of the treatment¹¹), in particular limiting the use of HDs, for various profiles of older patients with T2DM (eg, those with high risk of hypoglycemia, those with uncertain benefit of glucose-lowering drugs, and those unable to provide self-care).¹² However, despite these recommendations,^{10,12} GLT deprescribing rates among eligible older people ranges from 14% to 27%.¹³ Improving knowledge about the barriers and enablers for deprescribing GLT is key to developing effective interventions to support deprescribing in older adults with T2DM, along with understanding the determinants that influence this behavior. Behavioral theories can inform the design of behavior-change interventions, defined as coordinated sets of activities designed to change specified behavior patterns.¹⁴ The Theoretical Domains Framework (TDF),^{15,16} developed in 2005 by a collaboration of behavioral scientists and implementation researchers to provide a comprehensive, theory-informed approach to identify determinants of behavior, and its link to the Behavior Change Wheel (BCW), an implementation framework, is an example of a behavioral theory.¹⁴

Research on deprescribing barriers and enablers has been conducted in different settings, for different drugs and from different participant perspectives [ie, patients', health care providers' (HCPs'), and caregivers'].^{17–19} To our knowledge, no systematic review has explored and compared the barriers and enablers for deprescribing GLT in older people with T2DM.

The primary objective of this systematic review was to identify and synthesize barriers and enablers (behavioral determinants)

for deprescribing GLT in older patients with T2DM. The secondary objective, using the BCW framework, was to identify potential interventions targeted to these behavioral determinants to improve the implementation of GLT deprescribing in this population.

Methods

This systematic review followed the PRISMA (Preferred Reporting Items for Systematic review, 2020) guidelines²⁰ (checklist available in [Supplementary Table S1](#)). The study protocol was registered in PROSPERO (CRD42023401978).

Inclusion and Exclusion Criteria

We sought to include qualitative and mixed-methods studies exploring barriers and enablers for deprescribing GLT in older adults (≥ 65 years) with T2DM that focused on any participants, in any settings, and were published in English or French. We excluded studies published before 2010 because major developments occurred during the last decade in terms of clinical guidance or GLT availability, so focusing the search after 2010 was more relevant.^{10,12} Reviews were not included, but their reference lists were checked for studies that might have been missed by the database search.

Barriers were defined as participant perspectives that may create a challenge for deprescribing GLT in older patients, and enablers were defined as participant perspectives that may facilitate deprescribing of GLTs in older patients.²¹

Quantitative studies that met the inclusion criteria, except for the type of study, were set aside and used for a sensitivity analysis to enrich the discussion. Barrier and enabler themes identified in these studies were extracted and compared to our main results to identify potential new ones.

Search and Selection Strategy

We comprehensively searched the complete MEDLINE, Embase, and CINAHL. We also checked gray literature, searching on [ClinicalTrials.gov](#) and conference abstracts from the American Diabetes Association, the European Association for the Study of Diabetes, the International Conference on Deprescribing, and the European Geriatric Medicine Society from 2020 to 2022. Specific search equations designed for each database used synonyms of the domains “older adults,” “glucose-lowering treatments,” “barriers,” “enablers,” “deprescribing” [AND] “qualitative or mixed method study.” Three researchers (L.Z., A.C., T.M.) developed the search strategy with the help of a medical librarian. The search strategy was informed with a previously developed deprescribing search filter²² and inspired by multiple references.^{17,19,23} The final search was conducted on April 26, 2023. Search equations are detailed in [Supplementary Material S1](#).

After removing duplicates, 2 independent researchers (M.M. and L.J.) screened all articles with a 2-step strategy using Covidence systematic review software.²⁴ First, noneligible articles were excluded after screening titles and abstracts, then full texts of the remaining articles were reviewed to exclude those not meeting all the inclusion criteria (see above). At each step, all conflicts between the 2 independent researchers were discussed with and adjudicated by a third researcher (L.Z.) if necessary.

Quality Assessment

Two independent researchers (M.M. and L.J.) assessed the quality of the included studies by using the Mixed-Methods Appraisal Tool (MMAT) version 2018,²⁵ with disagreements resolved by a third

researcher (L.Z.). The MMAT is a critical appraisal tool designed for the appraisal stage of systematic mixed-methods studies reviews.²⁵ The latest version of the MMAT includes 2 screening questions and 25 items for appraising the methodological quality of 5 categories of studies: qualitative studies, quantitative randomized and non-randomized controlled trials, quantitative descriptive studies, and mixed-methods studies. This tool assesses whether studies have an appropriate approach and adequate data collection to address the research questions; whether the findings have been adequately derived from the data; and whether the interpretation of results is sufficiently substantiated by the data. Each item is rated on a categorical scale (yes, no, and cannot tell), but calculating an overall score from the ratings of each criterion is discouraged. Instead, providing a more detailed presentation of the ratings of each criterion is encouraged to better inform the quality of the included studies.

Data Extraction and Synthesis

The data extraction included general information of the study (author, year, country), the type of study (qualitative or mixed methods), the inclusion and exclusion criteria of the study, the population included, the setting, the themes explored, and the definition used for GLT deprescribing. One researcher (L.J.) extracted the data

into an extraction table, and the other 2 researchers (M.M. and L.Z.) checked the data for accuracy. The data extraction form is available in [Supplementary Material S2](#).

For each article, we then extracted verbatim statements corresponding to GLT deprescribing in order to guide our analysis and classify the different barriers and enablers. We used the TDF version 2^{15,16} to analyze, classify, and synthesize data on barriers and enablers. The TDF comprises 33 theories divided into 14 domains: Knowledge; Skills; Social/Professional Role and Identity; Beliefs about Capabilities; Optimism; Beliefs about Consequences; Reinforcement; Intentions; Goals; Memory, Attention, and Decision Processes; Environmental Context and Resources; Social Influences; Emotions; and Behavioral Regulation.¹⁶ Two independent researchers (M.M. and L.J.) deductively encoded the extracted data into TDF domains. Coding disagreements were resolved by discussion with and intervention from a third researcher (L.Z.).

Behavior-Change Interventions

Then, using the BCW framework, 2 researchers (A.C., L.Z.) linked the theoretical domains (behavioral determinants) identified with the TDF to the 9 intervention functions (ie, targets for future interventions: education, persuasion, incentivization, coercion, training, restriction, environmental restructuring, modeling, enablement)¹⁴

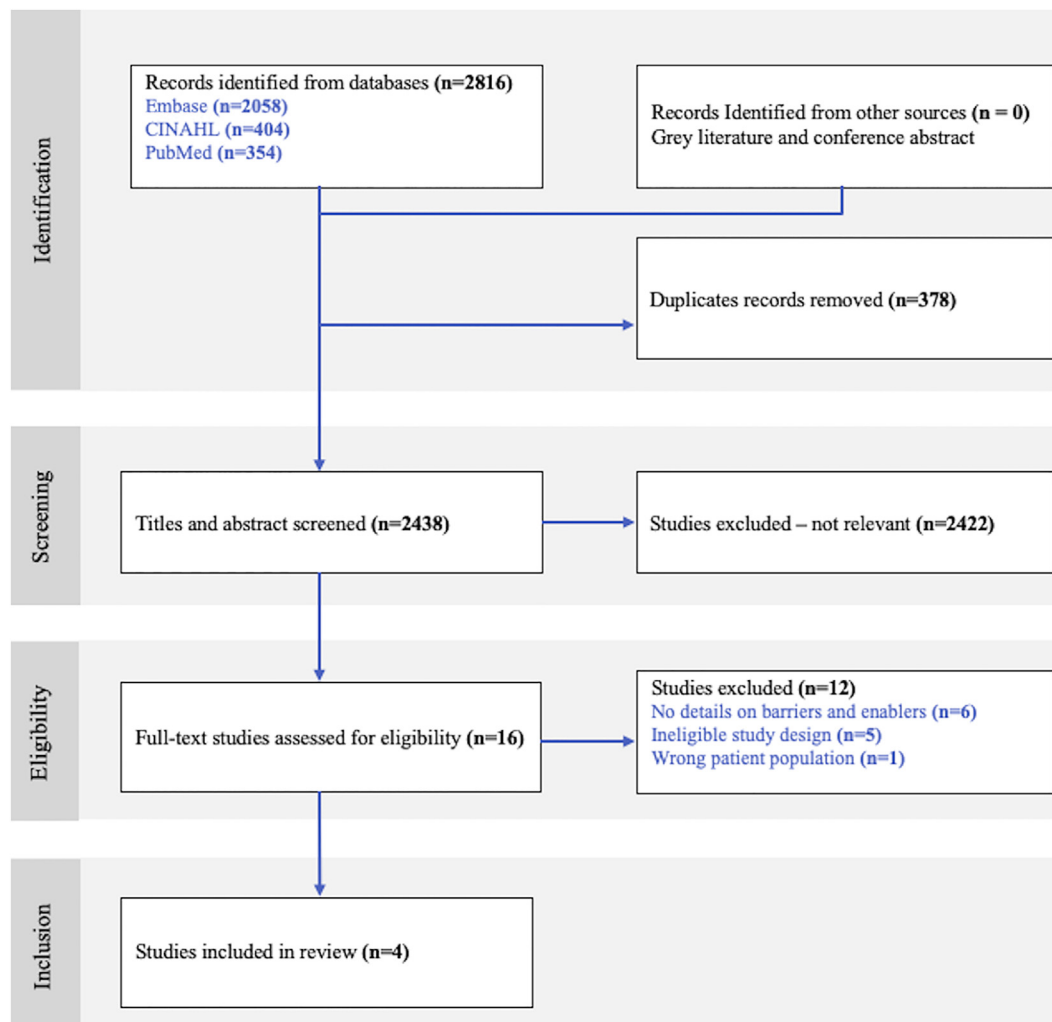


Fig. 1. PRISMA flow diagram of the selection of articles.

Table 1
Characteristics of Included Studies and Their Significant Results

Author, Year	Country	Type of Study	Inclusion and Exclusion Criteria	Population, Setting, Dates	Measures/Themes Explored	GLT Deprescribing Definition
Pilla, 2023 ²⁷	USA	Qualitative	Inclusion criteria: - Community-dwelling adults aged ≥ 65 y with T2DM taking one or more diabetes medication(s) and $HbA_{1c} < 7.5\%$ (most recent value within the past 12 mo) Exclusion criteria: - Being a patient of the investigator conducting interviews - Being unable to speak or understand English or having significant cognitive or communication impairment determined by electronic health record review, report of the patients' HCP, or from the patient or caregiver during screening	- 24 patients - Clinics - 2021	Explaining the concept of deprescribing Participants' perspectives: the appropriateness of deintensification, feelings and beliefs about deintensification, and the process of deintensification	Stopping or reducing the dose of diabetes medications if it can prevent harm, including polypharmacy, hypoglycemia, and other adverse drug effects
Abou, 2022 ²⁹	Netherlands	Qualitative	Inclusion criteria: - HCPs with at least 2 y of experience with care for older patients with chronic diseases, in 3 large cities across the Netherlands Exclusion criteria: - NA	- 20 people (GPs, community pharmacist, nurse practitioner, geriatrician, specialist in elder care) - Conference center and medical health care center - 2018–2019	A general question about the participants' ideas about deprescribing and an open question asking for any additional aspects that had not been covered in the discussion	Systematic reduction or withdrawal of medication that may cause harm or no longer contributes to an individual's health status
Rowe, 2021 ²⁸	USA	Qualitative	Inclusion criteria: - Physicians who primarily performed at and above the overall median of all physicians one of the following: (1) PSA screening in men aged ≥ 76 y, (2) urinalysis or urine culture testing in women aged ≥ 65 y without specific genitourinary or infectious signs or symptoms, and (3) oral hypoglycemic medication or insulin prescription in adults aged ≥ 75 y with diabetes and a $HbA_{1c} < 7.0\%$. Exclusion criteria: - Physicians with fewer than 10 eligible patients	- 14 Physicians - Primary care clinics - From 2017 to 2018	Interviews began by asking physicians how they would approach clinical scenarios that address the topics of interest, then to explain the thought process behind their actions	Not reported

(continued on next page)

Table 1 (continued)

Author, Year	Country	Type of Study	Inclusion and Exclusion Criteria	Population, Setting, Dates	Measures/Themes Explored	GLT Deprescribing Definition
Hart, 2019 ²⁶	Netherlands	Mixed methods	Inclusion criteria: - Individuals aged ≥ 70 y with T2DM who were previously identified as being possibly overtreated for their T2DM, meaning that patients with a personalized HbA_{1c} target of 58 (7.5%) or 64 (8%) mmol/mol reached an HbA_{1c} < 53 (7%) mmol/mol - Diabetes care providers Exclusion criteria: - NA	- 4 GPs, 4 NPs, 64 patients - Primary care center - Data in 2017	Topics discussed, as listed by the research team, included facilitators and barriers in the management of older patients with T2DM and the received notification of possible overtreatment and opinions of patients about their treatment	Discontinuing or lowering the dosage of any glucose-lowering medication during the index period, including changing to another agent with less risk of hypoglycemia

CP, community pharmacist; GP, general practitioner; NA, not available; NP, nurse practitioner; PSA, prostate-specific antigen.

that should serve to alleviate barriers to and promote enablers of GLT deprescribing. The synthesis was then validated by all authors.

Results

We identified 2816 articles, all from major databases. After removing duplicates, 2438 articles were screened, and 16 articles were retained for a full-text reading. Of these, we included 4 articles in the review^{26–29} (6 articles did not detail barriers and enablers for GLT deprescribing, 5 were quantitative studies, and 1 did not target older people) (Figure 1).

Study Characteristics

Study characteristics are presented in Table 1. One study was conducted with a mixed-methods design²⁶ and the remaining studies used qualitative designs.^{27–29} All included studies were published from 2019 to 2023. Two were conducted in Europe (specifically in the Netherlands)^{27,28} and 2 in the United States.^{26,29} Two studies included patient input in addition to that of other participants.^{26,27} Participants interviewed were primarily general practitioners, nurse practitioners, community pharmacists, geriatricians, specialists in the care of older people and patients. No caregivers or families were interviewed. The studies were conducted in health care centers or clinic settings. No study was conducted in a nursing home setting.

Quality Assessment

The 4 included studies obtained good quality scoring according to the MMAT criteria. We scored each item, for each study, with a yes on the categorical scale.²⁵ The full quality assessment following the MMAT is detailed in [Supplementary Material S3 \(Tables S2 and S3\)](#).

Classifying barriers and enablers for GLT deprescribing in older adults with T2DM and identifying potential intervention functions.

We identified barriers and enablers for GLT deprescribing in older adults with T2DM across 13 different TDF domains (no verbatim was identified for the Behavioral Regulation domain), based on different subthemes identified from the verbatim. For example, HCPs' ignorance of GLT drug-drug interactions (subtheme) was a barrier related to the Knowledge TDF domain, the lack of communication skills between patients and HCPs (subtheme) was a barrier related to the Skills

TDF domain, and HCPs' beliefs in deprescribing benefits (subtheme) was an enabler related to the Optimism TDF domain. Using subthemes, we identified 15 barriers and 7 enablers for GLT deprescribing; 2 subthemes corresponded to both barriers and enablers. Then, from identified barriers and enablers, we were able to link appropriate intervention functions using the BCW framework.

A brief definition of each TDF domain, all different subthemes identified from the verbatim and according to participants, and identified intervention functions are detailed in [Supplementary Table S4](#). We detail below (summarized in Table 2) what we believe to be the most important barriers and enablers from patients and HCPs' perspectives, complemented by possible intervention functions.

Patient Perspectives

From patients' perspectives, the main barriers identified to GLT deprescribing were mainly a lack of knowledge about the concept of deprescribing and therefore its potential benefits: "How would stopping medication help with poor health? Wouldn't it simply make matters worse without the medication?"²⁷ Patients reported anxiety about the possible changes to be made, especially in their lifestyle, to be able to stop these treatments, without consequences: "I mean, ideally, I'd love to be off medication, but I don't think that's realistic. Not . . . without really drastically changing my diet to the point where it's probably intolerable." The related intervention functions identified were Education (increasing knowledge or understanding about deprescribing) and Incentivization (creating expectation of reward: improvement of quality of life), such as developing more therapeutic education actions, at the time of first deprescribing and then during follow-up (dedicated consultation, written documents). To facilitate the deprescribing process, older patients reported that a relationship of trust with their physicians, underlying an involvement in the therapeutic decision, would be of great help. "I trust the doctors; I trust the professionals. So . . . [they] have to just explain it to me exactly what benefit it would be for me or to me."²⁷ Thus, the related intervention functions identified were persuasion (using communication to stimulate deprescribing) and modeling (providing an example for people to aspire to), by providing emotionally compelling information about health consequences and quality of life of deprescribing (speaking group, brochures).

Table 2
Identified Intervention Functions Targeting Identified Barriers and Enablers for Deprescribing Glucose-Lowering Treatment

TDF Domains			Subthemes Identified	Intervention Functions (BCW Framework)	Examples
Patients' Perspectives	Knowledge		Ignorance of the concept of deprescribing	Education	Consultation dedicated to therapeutic education and deprescribing, based on written documents (brochure, algorithm)
	Beliefs about consequence		Fears in deprescribing deleterious effects	Education Incentivization	
	Memory, attention, and decision processes		Involvement in medical decisions	Modeling	
	Social influences		Trust relationship with their physicians	Persuasion	
HCPs' perspectives	Knowledge		Good knowledge of new guidelines	Education Training	Offering to HCPs training in deprescribing, therapeutic education and diabetes in older patients (university diploma, Massive Open Online Course [MOOC], etc)
	Memory, attention, and decision processes		Inertia to change medication		
	Skills		Communication skills between patients and HCPs		
	Environmental context and resources		Setting influence, time, and financial aspects	Environmental restructuring Enablement	
	Social/professional role and identity		Multidisciplinary task and legitimacy		
Enablers	Barriers	Both			Creating multidisciplinary consultation meeting, teleconsultation with easily reachable specialists, dedicated time to deprescribing, follow-up with experienced nurse practitioners Providing computer-based educational support (online materials, deprescribing algorithms) to help HCPs initiate deprescribing, with a nearby support network

HCP Perspectives

From HCPs' perspectives, the main enabler identified to GLT deprescribing was a good knowledge of guidelines,^{26,28,29} in particular the individual objectives of treatments according to patient profiles: "There are the new guideline targets and there you have 70-plus and more than 10 years diabetes, that you have to use different targets" (nurse practitioner),²⁹ "I believe that the new guidelines state that a HbA_{1c} [level] up to 8 [percent] is acceptable" (primary care physician).²⁸ However, HCPs were not inclined to change GLT agents and continued the prescription as identical (inertia) because of fear of the consequences and sometimes lack of legitimacy: "It is easier to say I do nothing because then . . . I am not the one who takes the risk" (geriatrician).²⁹ "If there has been no information transfer about the initial indication for a medication, I would—also as a GP—be afraid to just stop it" (general practitioner).²⁹ The intervention functions identified were Education and Training (imparting skills), by offering HCPs training in deprescribing, therapeutic education and diabetes in older patients [university diploma, Massive Open Online Course (MOOC), etc], and reminding them of patient empowerment. Thus, promoting teamwork, exchanges between professionals, and dedicated time would be essential enablers for GLT deprescribing: "Indeed, I think that we—being different HCPs—can complement each other" (specialist in the care of older people).²⁹ "It is nice to discuss this together, that you are on the same page. We have our geriatric meetings, where the pharmacist also joins us. Yes, you tell the same thing, why something can be stopped" (specialist in the care of older people).²⁹ "You cannot stop (cardiovascular medication) at once, you often have to take several steps, and those steps take a lot of effort. . . . A [general practitioner] actually may not have sufficient time for this" (geriatrician).²⁹ Indeed, multiple participants voiced a need for

environmental restructuring (changing the physical or social context), such as having a multidisciplinary consultation meeting, teleconsultation with easily reachable specialists, time (particularly in terms of financial cost) dedicated to deprescribing and exchanges about the objectives, and follow-up with experienced nurse practitioners. Another intervention function identified was Enablement (reducing barriers to increase deprescribing), for example, by providing computer-based educational support (online materials, deprescribing algorithms) to help HCPs initiate deprescribing, with a nearby support network.

GLT Deprescribing Intervention: An Example

According to the identified barriers and enablers for GLT deprescribing in older adults with T2DM and the potential intervention functions, we propose an example of an intervention that could allow for better implementation of GLT deprescribing in ambulatory settings, summarized in Figure 2. This intervention should be evaluated to assess its effectiveness and feasibility.

Sensitivity Analyses

We identified 5 relevant quantitative studies of GLT deprescribing, 3 from the United States,^{30–32} 1 from Spain,³³ and 1 from Indonesia,³⁴ that used cross-sectional,^{30,34} retrospective,^{31,32} and mixed survey designs.³³ Except for 1 study, which was published in 2015,³⁰ these studies were published from 2019 to 2023.^{31–34} Only 1 study³² highlighted a supplemental subtheme, developing the idea that the likelihood of GLT deprescribing may be related to the type of treatment: "link between type of treatment and deprescribing." Indeed, Niznik et al³² reported that the likelihood of deprescribing was increased

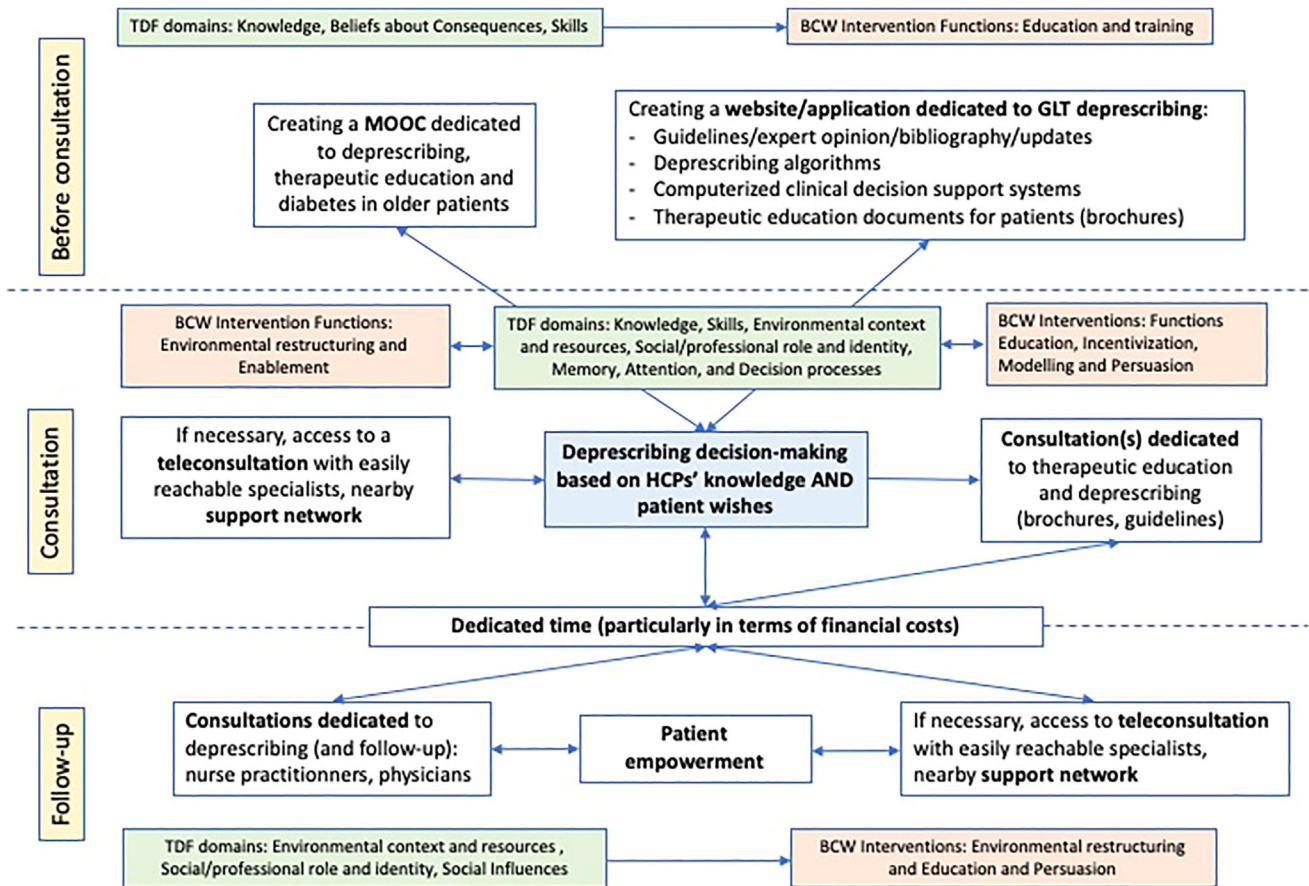


Fig. 2. Intervention for glucose-lowering treatment (GLT) deprescribing: an example. MOOC, Massive Open Online Course.

with treatment regimens other than non-sulfonylurea oral agents, with the sole exception of basal insulin, which was associated with lower probability of deprescribing. All characteristics and main results are presented in [Supplementary Table S5](#).

Discussion

From an original systematic review of qualitative and mixed-methods studies, we extracted verbatim statements on barriers and enablers for deprescribing GLT in older adults with T2DM and identified determinants of behaviors with the TDF, version 2, and proposed related intervention functions (targets for future interventions) according to the BCW. We identified only 4 studies, from only 2 countries (United States and the Netherlands), all recently published (2019–2023), that reported mainly barriers for deprescribing. Knowledge, fear, poor communication, inertia, and trust with HCPs were the main determinants of behaviors that influenced deprescribing, and education, training, persuasion, and environmental restructuring were the main intervention functions for proposing future interventions.

Indeed, regarding HCPs' perspectives, the main identified barrier for GLT deprescribing was poor communication, fragmentation of care with unclear responsibilities between HCPs, and experiences of legitimacy. These barriers are not specific to GLT deprescribing and have been frequently reported in other studies of other drug deprescribing,^{18,19,35} mainly in older patients, connected with multimorbidity, and the resulting multiple prescribers. Identifying how professional hierarchies act as psychological barriers to effective communication seems to be the first step for successful deprescribing, which highlights the challenge of the distribution of tasks and

responsibilities in older patients' care. Interprofessional approaches, such as a multidisciplinary team meetings or collaborative care between general practitioners and pharmacists,^{35,36} would be opportunities for the role definition process, to promote communication and information sharing, which would encourage collaboration and deprescribing behaviors.^{19,35–37} The involvement of geriatricians in the decision-making process could be proposed for deprescribing GLT, whose specificity, as compared with other drug classes, is the choice of therapies according to the patient's health status (comorbidities, cognitive and functional status).^{10,12}

Regarding patients' perspectives, the main identified barrier for GLT deprescribing was communication and shared decision making between the patient and HCPs to promote deprescribing. This domain has also been well described in deprescribing studies in other fields.^{17–19,37} Encouraging a patient, along with their beliefs and perspectives, to participate in decisions helped HCPs deprescribe.¹⁹ For example, experiencing an adverse reaction to a medication could influence older adults' willingness to have a medication deprescribed.^{38,39} Rather than assuming, prescribers need to discuss the patient's attitudes toward their treatments and the possibility of deprescribing, to reach their current goals of care.^{17,40} Empowering older adults to initiate a deprescribing conversation with the HCP has been shown to be an effective implementation strategy to reduce the use of potentially inappropriate medications.⁴¹ Clinical decision-support tools, as well as patient education materials, may be of help to support the implementation of deprescribing.^{41,42} Provision of patient education materials, such as the EMPOWER brochure in a person-centered educational intervention, has been shown to increase patient-initiated deprescribing conversations and improve the success

of deprescribing benzodiazepines.⁴³ In addition, a recent study showed that the use of evidence-based guidelines supported with algorithms for deprescribing proton pump inhibitors, benzodiazepine receptor agonists, and antipsychotics increased HCPs' self-efficacy in implementing a plan to reduce or discontinue such medication.⁴⁴ These tools, brochures, or communication strategies could, in the same way, be used in the context of GLT. However, this move would require targeted research because the context of care, treatment goals, and deprescribing are different for each of these treatments.

Research Gaps and Perspectives

The main gaps identified in the literature were the small number of published studies that were from 2 countries only, which reported interviews or focus groups of patients or HCPs practicing only outpatient medicine, without referring to the TDF framework to guide the interviews. Hence, generalizing the results to other countries and other settings is difficult, and the findings probably underestimate barriers and enablers. No study took place in a nursing home residence, yet the place of living of frail patients with frequently cognitive dysfunctions for whom deprescribing should clearly be prioritized.¹² No study reported barriers and enablers from the viewpoint of caregivers and families, who are frequently involved in patients' daily life (physician appointments, meal preparation, grocery shopping, etc) and do influence patients' behaviors and expectations. No study reported barriers and enablers for deprescribing GLT according to physician characteristics (age, sex, type of practice, etc) or financial aspects (medicine costs).

Further research is needed to explore other settings (nursing homes, geriatric departments, emergency departments, etc), in other countries, with other participants' profiles (caregivers).

Strengths and Limitations

To our knowledge, this is the first evidence synthesis investigating barriers and enablers for GLT deprescribing behaviors in older patients with T2DM. This review involved 2 independent researchers and a referred third researcher at all stages, and the findings were reported in accordance with PRISMA guidelines. The analysis and synthesis involved using the TDF, going beyond the description of the data to link these behaviors to intervention functions from the BCW framework and proposing an example of an intervention that could allow for better implementation of GLT deprescribing in ambulatory settings (behavioral theory). This process increased the relevance of identified barriers to and enablers of real-life practice. In addition, Linsky et al⁴⁵ recently described a new conceptual framework for comprehensive deprescribing that included patient, prescriber, and system factors, most identified in this systematic review. Indeed, patient factors included the risks and benefits of each medication they are taking in the context of their health condition and their past experience (perceived benefits, side effects, burden, expense, and prior deprescribing). However, we did not find “the financial toxicity of treatment and out-of-pocket drug expenses”⁴⁵ in this review. We also identified prescriber factors, including rational (based on knowledge, skills, preferences) and nonrational components (based on tacit knowledge, inertia) in this review. Finally, system factors that affect the feasibility of deprescribing were mainly identified by complementing the use of TDF with the use of the BCW: resources (eg, time for shared decision making, availability of multidisciplinary staff), institutional goals, deprescribing culture, and incentives.⁴⁵ Hence, the use of the TDF is probably more relevant when conducting primary research than when applying it to systematic or scoping reviews.

As explained previously, one of the main limitations of this systematic review study was the small number of articles identified, which limited the data and their interpretation. In addition, a

commonly reported limitation to qualitative systematic reviews is the difficulty in retrieving all eligible studies because of the poorly established indexing system for qualitative reviews.¹⁹ To limit this bias, we did not use a methodological search filter focused on qualitative research.

Conclusions and Implications

This original systematic review of qualitative and mixed-methods studies exploring barriers and enablers for deprescribing GLT in older adults with T2DM and using behavioral theory revealed knowledge, fear, poor communication, inertia, and trust with HCPs as the main determinants of behaviors that influence deprescribing as well as education, training, persuasion, and environmental restructuring as the main intervention functions for proposing future interventions. Further research is needed to explore other settings (nursing homes, geriatric departments, emergency departments, etc), in other countries, with other participants' profiles (caregivers).

Disclosure

The authors declare no conflicts of interest.

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References

1. Sinclair A, Saeedi P, Kaundal A, Karuranga S, Malanda B, Williams R. Diabetes and global ageing among 65–99-year-old adults: findings from the International diabetes Federation diabetes Atlas, 9th edition. *Diabetes Res Clin Pract.* 2020;162:108078.
2. International Diabetes Federation. IDF Diabetes ATLAS 10th edition 2021. 2019. diabetesatlas.org
3. Lega IC, Campitelli MA, Austin PC, et al. Potential diabetes overtreatment and risk of adverse events among older adults in Ontario: a population-based study. *Diabetologia.* 2021;64:1093–1102.
4. Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. *Diabetes Care.* 2012;35:2650–2664.
5. Huang ES, Laiteerapong N, Liu JY, John PM, Moffet HH, Karter AJ. Rates of complications and mortality in older patients with diabetes mellitus: the diabetes and aging study. *JAMA Intern Med.* 2014;174:251–258.
6. Buse JB, Wexler DJ, Tsapas A, et al. 2019 update to: management of hyperglycemia in type 2 diabetes, 2018. A consensus report by the American diabetes association (ADA) and the European association for the study of diabetes (EASD). *Diabetes Care.* 2020;43:487–493.
7. Zoungas S, Patel A, Chalmers J, et al. Severe hypoglycemia and risks of vascular events and death. *N Engl J Med.* 2010;363:1410–1418.
8. Abdelhafiz AH, Rodríguez-Mañas L, Morley JE, Sinclair AJ. Hypoglycemia in older people – a less well recognized risk factor for frailty. *Aging Dis.* 2015;6:156–167.
9. Budnitz DS, Lovegrove MC, Shehab N, Richards CL. Emergency hospitalizations for adverse drug events in older Americans. *N Engl J Med.* 2011;365:2002–2012.
10. Christiaens A, Henrard S, Zerah L, Dalleur O, Bourdel-Marchasson I, Boland B. Individualisation of glycaemic management in older people with type 2 diabetes: a systematic review of clinical practice guidelines recommendations. *Age Ageing.* 2021;50:1935–1942.
11. Lipska KJ, Ross JS, Miao Y, Shah ND, Lee SJ, Steinman MA. Potential overtreatment of diabetes mellitus in older adults with tight glycemic control. *JAMA Intern Med.* 2015;175:356–362.
12. Christiaens A, Henrard S, Sinclair AJ, Tubach F, Bonnet-Zamponi D, Zerah L. Deprescribing glucose-lowering therapy in older adults with diabetes: a systematic review of recommendations. *J Am Med Dir Assoc.* 2023;24:400–402.
13. Oktora MP, Kerr KP, Hak E, Denig P. Rates, determinants and success of implementing deprescribing in people with type 2 diabetes: a scoping review. *Diabet Med.* 2021;38:e14408.
14. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci.* 2011;6:42.
15. Wong A. Closing the gap: applying the theoretical domains framework to improve knowledge translation. *Can J Anesth.* 2017;64:569–573.

16. Atkins L, Francis J, Islam R, et al. A guide to using the theoretical domains framework of behaviour change to investigate implementation problems. *Implementation Sci.* 2017;12:77.
17. Reeve E, To J, Hendrix I, Shakib S, Roberts MS, Wiese MD. Patient barriers to and enablers of deprescribing: a systematic review. *Drugs Aging.* 2013;30:793–807.
18. Evrard P, Péteïn C, Beuscart JB, Spinewine A. Barriers and enablers for deprescribing benzodiazepine receptor agonists in older adults: a systematic review of qualitative and quantitative studies using the theoretical domains framework. *Implement Sci.* 2022;17:41.
19. Heinrich CH, Hurley E, McCarthy S, McHugh S, Donovan MD. Barriers and enablers to deprescribing in long-term care facilities: a “best-fit” framework synthesis of the qualitative evidence. *Age Ageing.* 2022;51:afab250.
20. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* 2021;372:n71.
21. Rasmussen AF, Poulsen SS, Oldenburg LK, Vermehren C. The barriers and facilitators of different Stakeholders when deprescribing benzodiazepine receptor agonists in older patients-A systematic review. *Metabolites.* 2021;11:254.
22. Morel T, Nguyen-Soenen J, Thompson W, Fournier JP. Development and validation of search filters to identify articles on deprescribing in Medline and Embase. *BMC Med Res Methodol.* 2022;22:79.
23. Morel T, Heinrich CH, Zerah L, Hurley E, Christiaens A, Fournier JP. Use of deprescribing search filters in systematic review search strategies: a case study. *Basic Clin Pharmacol Toxicol.* 2024;134:116–120.
24. Better systematic review management. Covidence. 2023. Accessed April 26, 2023. www.covidence.org
25. Hong QN, Pluye P, Fàbregues S, et al. *Mixed Methods Appraisal Tool (MMAT), version 2018*. Registration of Copyright (#1148552), Canadian Intellectual Property Office, Industry Canada; 2018.
26. Hart HE, Ditzel K, Rutten GE, et al. De-intensification of Blood glucose lowering medication in people identified as being Over-Treated: a mixed methods study. *Patient Prefer Adherence.* 2019;13:1775–1783.
27. Pilla SJ, Meza KA, Schoenborn NL, Boyd CM, Maruthur NM, Chander G. A qualitative study of perspectives of older adults on Deintensifying diabetes medications. *J Gen Intern Med.* 2023;38:1008–1015.
28. Rowe TA, Brown T, Doctor JN, Linder JA, Persell SD. Examining primary care physician rationale for not following geriatric choosing wisely recommendations. *BMC Fam Pract.* 2021;22:95.
29. Abou J, Crutzen S, Tromp V, et al. Barriers and enablers of healthcare providers to deprescribe Cardiometabolic medication in older patients: a focus group study. *Drugs Aging.* 2022;39:209–221.
30. Caverly TJ, Fagerlin A, Zikmund-Fisher BJ, et al. Appropriate prescribing for patients with diabetes at high risk for hypoglycemia: National survey of veterans Affairs health care professionals. *JAMA Intern Med.* 2015;175:1994–1996.
31. Schoenborn NL, Crossnohere NL, Bridges JFP, Pollack CE, Pilla SJ, Boyd CM. Patient perceptions of diabetes guideline frameworks for individualizing glycemic targets. *JAMA Intern Med.* 2019;179:1642–1649.
32. Niznik JD, Hunnicutt JN, Zhao X, et al. Deintensification of diabetes medications among veterans at the end of life in VA nursing homes. *J Am Geriatr Soc.* 2020;68:736–745.
33. Gómez-Huelgas R, Gómez-Peralta F, Cos FX. Evaluation of knowledge, barriers, and attitudes in the management of type 2 diabetes in elderly patients: a Delphi study on primary and hospital care. *Rev Clin Esp.* 2022;222:385–392.
34. Oktora MP, Yuniar CT, Amalia L, Abdulah R, Hak E, Denig P. Attitudes towards deprescribing and patient-related factors associated with willingness to stop medication among older patients with type 2 diabetes (T2D) in Indonesia: a cross-sectional survey study. *BMC Geriatr.* 2023;23:21.
35. Gerlach N, Michiels-Corsten M, Viniol A, et al. Professional roles of general practitioners, community pharmacists and specialist providers in collaborative medication deprescribing - a qualitative study. *BMC Fam Pract.* 2020;21:183.
36. Bardet JD, Vo TH, Bedouch P, Allenet B. Physicians and community pharmacists collaboration in primary care: a review of specific models. *Res Social Adm Pharm.* 2015;11:602–622.
37. Anderson K, Stowasser D, Freeman C, Scott I. Prescriber barriers and enablers to minimising potentially inappropriate medications in adults: a systematic review and thematic synthesis. *BMJ Open.* 2014;4:e006544.
38. Weir K, Nickel B, Naganathan V, et al. Decision-making preferences and deprescribing: perspectives of older adults and companions about their medicines. *J Gerontol B Psychol Sci Soc Sci.* 2018;73:e98–e107.
39. Holmes HM, Todd A. The role of patient preferences in deprescribing. *Clin Geriatr Med.* 2017;33:165–175.
40. Reeve E, Gnjdic D, Long J, 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;80:1254–1268.
41. Ailabouni NJ, Rebecca Weir K, Reeve E, Turner JT, Wilson Norton J, Gray SL. Barriers and enablers of older adults initiating a deprescribing conversation. *Patient Educ Couns.* 2022;105:615–624.
42. Wu H, Kouladjian O'Donnell L, Fujita K, Masnoon N, Hilmer SN. Deprescribing in the older patient: a narrative review of challenges and Solutions. *Int J Gen Med.* 2021;14:3793–3807.
43. Tannenbaum C, Martin P, Tamblyn R, Benedetti A, Ahmed S. Reduction of inappropriate benzodiazepine prescriptions among older adults through direct patient education: the EMPOWER cluster randomized trial. *JAMA Intern Med.* 2014;174:890–898.
44. Farrell B, Richardson L, Raman-Wilms L, de Launay D, Alsabbagh MW, Conklin J. Self-efficacy for deprescribing: a survey for health care professionals using evidence-based deprescribing guidelines. *Res Social Adm Pharm.* 2018;14:18–25.
45. Linsky A, Gellad WF, Linder JA, Friedberg MW. Advancing the science of deprescribing: a Novel comprehensive conceptual framework. *J Am Geriatr Soc.* 2019;67:2018–2022.

Supplementary Material S1: Search Equations for Each Database

PubMed

("older people"[tiab] OR "older person"[tiab] OR "older subject"[tiab] OR "older patient"[tiab] OR "older age"[tiab] OR "older adult"[tiab] OR "older man"[tiab] OR "older men"[tiab] OR "older male"[tiab] OR "older woman"[tiab] OR "older women"[tiab] OR "older female"[tiab] OR "older veterans"[tiab] OR "older population"[tiab] OR "elder"[tiab] OR "senior"[tiab] OR "old patient"[tiab] OR "old age"[tiab] OR "frail"[tiab] OR "aged"[mh] OR "geriatric"[tiab] OR "geriatrics"[mh] OR "ageing"[TIAB] OR "aging"[TIAB] OR "aging"[MESH] OR "frail elderly"[MESH]) AND ("anti hypergl"[tiab] OR "hypoglycemic agents"[mh] OR "antihypergl"[tiab] OR "glucose lower"[tiab] OR "GLT"[tiab] OR "antidiab"[tiab] OR "hypoglycemic"[tiab] OR "hypoglycaemic"[tiab]) AND ("deprescriptions"[mh] OR "deprescription"[tiab] OR "deprescrib"[tiab] OR "de-prescrib"[tiab] OR "stop medication"[tiab] OR "medication decrease"[tiab] OR "drug decrease"[tiab] OR "dose decrease"[tiab] OR "dosage reduction"[tiab] OR "dose reduction"[tiab] OR "deintensification"[tiab] OR "withdrawal"[tiab] OR "taper"[tiab] OR "discontinuation"[tiab] OR "cessation"[tiab] OR "withholding treatment"[mh] OR "withdrawing"[tiab] OR "medication review"[tiab] OR "inappropriate prescribing"[tiab] OR "inappropriate medication"[tiab] OR "inappropriate prescribing"[mh]) AND ("attitude"[tiab] OR "attitude"[mh] OR "behaviour"[tiab] OR "behavior"[tiab] OR "behavior"[mh] OR "preference"[tiab] OR "perspective"[tiab] OR "determinant"[tiab] OR "barrier"[tiab] OR "facilitator"[tiab] OR "promot"[tiab] OR "enabler"[tiab] OR "experience"[tiab] OR "perception"[tiab] OR "thought"[tiab] OR "view"[tiab] OR "willingness"[tiab] OR "predictor"[tiab] OR "opinion"[tiab] OR "belief"[tiab] OR "insight"[tiab] OR "implement"[tiab] OR "factor"[tiab] OR "motivation"[mh] OR "motivation"[tiab] OR "Qualitative research"[mh] OR "Qualitative research"[tiab] OR "focus group"[tiab] OR "interview"[tiab] OR "interviews as topic"[Mesh] OR "focus groups"[Mesh] OR "narration"[Mesh] OR "personal narratives as topic"[Mesh] OR "fieldwork"[TIAB] OR "field work"[TIAB] OR "key informant"[TIAB] OR "mixed method"[tiab]) AND ("english"[Language] OR "french"[Language]) AND (2010/01/01:2024/12/31[Date - Publication])

Embase

('older people':ab,ti,kw OR 'older person':ab,ti,kw OR 'older subject':ab,ti,kw OR 'older patient':ab,ti,kw OR 'older age':ab,ti,kw OR 'older adult':ab,ti,kw OR 'older man':ab,ti,kw OR 'older men':ab,ti,kw OR 'older male':ab,ti,kw OR 'older woman':ab,ti,kw OR 'older women':ab,ti,kw OR 'older female':ab,ti,kw OR 'older veterans':ab,ti,kw OR 'older population':ab,ti,kw OR 'elder':ab,ti,kw OR 'senior':ab,ti,kw OR 'old patient':ab,ti,kw OR 'old age':ab,ti,kw OR 'frail':ab,ti,kw OR 'geriatric':ab,ti,kw OR 'aged'/exp OR 'geriatrics'/exp OR 'ageing':ab,ti,kw OR 'aging':ab,ti,kw OR 'aging'/exp OR 'frail elderly'/exp) AND ('anti hypergl':ab,ti,kw OR 'antihypergl':ab,ti,kw OR 'glucose lower':ab,ti,kw OR 'glf':ab,ti,kw OR 'antidiab':ab,ti,kw OR 'hypoglycemic':ab,ti,kw OR 'hypoglycaemic':ab,ti,kw OR 'antidiabetic agent'/exp) AND ('deprescription':ab,ti,kw OR 'deprescrib':ab,ti,kw OR 'deprescrib':ab,ti,kw OR 'stop medication':ab,ti,kw OR 'medication decrease':ab,ti,kw OR 'drug decrease':ab,ti,kw OR 'dose decrease':ab,ti,kw OR 'dosage reduction':ab,ti,kw OR 'dose reduction':ab,ti,kw OR 'withdrawal':ab,ti,kw OR 'taper':ab,ti,kw OR 'discontinuation':ab,ti,kw OR 'cessation':ab,ti,kw OR

'deintensification':ab,ti,kw OR 'withdrawing':ab,ti,kw OR 'medication review':ab,ti,kw OR 'inappropriate prescribing':ab,ti,kw OR 'inappropriate medication':ab,ti,kw OR 'inappropriate prescribing'/exp OR 'deprescription'/exp OR 'treatment withdrawal'/exp) AND ('attitude'/exp OR 'behaviour'/exp OR 'qualitative research'/exp OR 'attitude':ab,ti,kw OR 'behaviour':ab,ti,kw OR 'behavior':ab,ti,kw OR 'preference':ab,ti,kw OR 'perspective':ab,ti,kw OR 'determinant':ab,ti,kw OR 'barrier':ab,ti,kw OR 'facilitator':ab,ti,kw OR 'promot':ab,ti,kw OR 'enabler':ab,ti,kw OR 'experience':ab,ti,kw OR 'perception':ab,ti,kw OR 'thought':ab,ti,kw OR 'view':ab,ti,kw OR 'willingness':ab,ti,kw OR 'predictor':ab,ti,kw OR 'opinion':ab,ti,kw OR 'belief':ab,ti,kw OR 'insight':ab,ti,kw OR 'implement':ab,ti,kw OR 'factor':ab,ti,kw OR 'motivation':ab,ti,kw OR 'qualitative research':ab,ti,kw OR 'focus group':ab,ti,kw OR 'interview':ab,ti,kw OR 'mixed method':ab,ti,kw OR 'interviews as topic'/exp OR 'focus groups'/exp OR 'narration'/exp OR 'personal narratives as topic'/exp OR 'fieldwork':ab,ti,kw OR 'field work':ab,ti,kw OR 'key informant':ab,ti,kw) AND [2010-2023]/py AND ([english]/lim OR [french]/lim)

CINAHL

(TI(older people OR older person OR older subject* OR older patient* OR older age* OR older adult* OR older man OR older men OR older male* OR older woman OR older women OR older female* OR older veterans OR older population OR elder* OR senior* OR old patient* OR old age OR frail* OR geriatric* OR ageing OR aging) OR AB(older people OR older person OR older subject* OR older patient* OR older age* OR older adult* OR older man OR older men OR older male* OR older woman OR older women OR older female* OR older veterans OR older population OR elder* OR senior* OR old patient* OR old age OR frail* OR geriatric* OR ageing OR aging) OR MH("aging+" OR "frail elderly+" OR "aged+" OR "geriatrics+")) AND (TI(anti hypergl* OR antihypergl* OR glucose lower* OR GLT OR antidiab* OR hypoglycemic OR hypoglycaemic) OR AB(anti hypergl* OR antihypergl* OR glucose lower* OR GLT OR antidiab* OR hypoglycemic OR hypoglycaemic) OR MH("hypoglycemic agents+")) AND (TI(deprescription* OR deprescrib* OR de-prescrib* OR stop medication* OR medication decrease OR drug decrease OR dose decrease OR dosage reduction* OR dose reduction* OR withdrawal* OR taper* OR discontinuation OR deintensification* OR cessation OR withdrawing OR medication review* OR inappropriate prescribing OR inappropriate medication*) OR AB(deprescription* OR deprescrib* OR de-prescrib* OR stop medication* OR medication decrease OR drug decrease OR dose decrease OR dosage reduction* OR deintensification* OR dose reduction* OR withdrawal* OR taper* OR discontinuation OR cessation OR withdrawing OR medication review* OR inappropriate prescribing OR inappropriate medication*) OR MH("deprescribing+" OR "Inappropriate Prescribing" OR "Treatment Withdrawal")) AND (TI(attitude* OR behaviour* OR behavior* OR preference* OR perspective* OR determinant* OR barrier* OR facilitator* OR promot* OR enabler* OR experience* OR perception* OR thought* OR view OR willingness OR predictor* OR opinion* OR belief* OR insight* OR implement* OR factor* OR motivation* OR Qualitative research* OR focus group* OR interview* OR fieldwork OR field work OR key informant OR mixed method*) OR AB(attitude* OR behaviour* OR behavior* OR preference* OR perspective* OR determinant* OR barrier* OR facilitator* OR promot* OR enabler* OR experience* OR perception* OR thought* OR view OR willingness OR predictor* OR opinion* OR belief* OR insight* OR implement* OR factor* OR motivation* OR Qualitative research* OR focus group* OR interview* OR fieldwork OR field work OR key informant OR mixed method*) OR MH("attitude+" OR "behaviour+" OR "motivation+" OR "qualitative studies+" OR "interviews+" OR "focus groups" OR "narratives+")) AND (PY 2010-2024) AND (LA(English OR French))

Supplementary Material S2: Data Extraction Form

General information:

- First author
- Publication year
- Journal of publication
- Title
- Fundings
- Objectives
- Type of study (qualitative or mixed-methods)
- Study context: country, setting, year
- Population: Inclusion criteria, exclusion criteria, recruitment
- GLT Information: GLT considered (ATC), GLT deprescribing definition

Qualitative information:

- Population: Who? (Patients, GPs, etc), number, age, sex
- Methods: Data collection type, development of interview guide and questionnaires, themes of the interview, analysis type
- Results: Themes (key messages)

Or quantitative information (sensitivity analysis):

- Population: Who? (Patients, GPs, etc), number, age
- Methods: Type of quantitative study, intervention if any, measures
- Results

General information:

- Discussion (relevant points)
- Conclusion

GLT, glucose-lowering treatment; GP, general practitioner.

Supplementary Table 1
PRISMA Checklist 2020

Section and Topic	Item #	Checklist Item	Location Where Item is Reported
Title			
Title	1	Identify the report as a systematic review.	Title page
Abstract			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Pages 1-2
Introduction			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pages 3-4, Introduction section
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 5, Introduction section
MWS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Inclusion and exclusion criteria paragraph, Methods section, pages 5-6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Search and selection strategy paragraph, Methods section, page 6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplement 2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Search and selection strategy paragraph, Methods section, page 6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Search and selection strategy paragraph, Methods section, page 6 + data extraction and synthesis paragraph, Methods section, pages 7-8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (eg, for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Data extraction and synthesis paragraph, Methods section, pages 7-8
	10b	List and define all other variables for which data were sought (eg, participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Data extraction and synthesis paragraph, Methods section, pages 7-8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Search and selection strategy paragraph, quality assessment paragraph, data extraction and synthesis paragraph, Methods section, pages 6-8
Effect measures	12	Specify for each outcome the effect measure(s) (eg, risk ratio, mean difference) used in the synthesis or presentation of results.	NA

(continued on next page)

Supplementary Table 1 (continued)

Section and Topic Title	Item #	Checklist Item	Location Where Item is Reported
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (eg, tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Data extraction and synthesis paragraph, Methods section, pages 7-8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Data extraction and synthesis paragraph, Methods section, pages 7-8
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	NA
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Data extraction and synthesis paragraph + Behavior change interventions, Methods section, pages 7-8
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (eg, subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Inclusion and exclusion criteria paragraph, Methods section, pages 5-6
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
Results Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1 Results section, pages 8-9
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	Studies characteristics paragraph; Results section, Pages 8-9 Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (eg, confidence/credible interval), ideally using structured tables or plots.	NA

(continued on next page)

Supplementary Table 1 (continued)

Section and Topic Title	Item #	Checklist Item	Location Where Item is Reported
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Classifying barriers and enablers for GLT deprescribing in older adults with T2DM and identifying potential intervention functions paragraph, Results section; pages 9–11 + GLT deprescribing intervention: an example paragraph, page 12 Tables 1 and 2 Figure 2 Supplement 5 NA
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (eg, confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	NA
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Sensitivity analyses paragraph, Results section; page 12
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
Discussion Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Discussion section, pages 12–12
	23b	Discuss any limitations of the evidence included in the review.	Strengths paragraph, Discussion section, pages 15–16
	23c	Discuss any limitations of the review processes used.	Strengths paragraph, Discussion section, pages 15–16
	23d	Discuss implications of the results for practice, policy, and future research.	Perspectives paragraph, Discussion section, pages 14–15
Other IS Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	PROSPERO (CRD42023401978), Methods section, page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	PROSPERO (CRD42023401978), Methods section, page 5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 16
Competing interests	26	Declare any competing interests of review authors.	Page 16 + cover letter
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NA

From Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. <https://doi.org/10.1136/bmj.n71>.

For more information, visit: <http://www.prisma-statement.org/>

Supplementary Material S3: Quality Assessment of Studies Included in the Systematic Review

Supplementary Table 2

Quality Assessment of the Qualitative Studies Included in the Review

Questions From the Mixed Methods Appraisal Tool (MMAT), Version 2018					
Included studies	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis, and interpretation?
Abou, 2022	Yes	Yes	Yes	Yes	Yes
Pilla, 2023	Yes	Yes	Yes	Yes	Yes
Rowe, 2021	Yes	Yes	Yes	Yes	Yes

Supplementary Table 3

Quality Assessment of the Mixed-Methods Studies Included in the Review

Questions From the Mixed-Methods Appraisal Tool (MMAT), Version 2018, for the Qualitative Part					
Included studies	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis, and interpretation?
Hart, 2019	Yes	Yes	Yes	Yes	Yes
Questions From the Mixed-Methods Appraisal Tool (MMAT), Version 2018, Regarding Mixed Method Design					
	Is there an adequate rationale for using a mixed methods design to address the research question?	Are the different components of the study effectively integrated to answer the research question?	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Hart, 2019	Yes	Yes	Yes	Can't tell	Yes

Abou J, Crutzen S, Tromp V, et al. Barriers and enablers of healthcare providers to deprescribe cardiometabolic medication in older patients: a focus group study. *Drugs Aging*. 2022;39(3):209–221. <https://doi.org/10.1007/s40266-021-00918-7>.

Pilla SJ, Meza KA, Schoenborn NL, Boyd CM, Maruthur NM, Chander G. A qualitative study of perspectives of older adults on deintensifying diabetes medications. *J Gen Intern Med*. 2023;38(4):1008–1015. <https://doi.org/10.1007/s11606-022-07828-3>.

Rowe TA, Brown T, Doctor JN, Linder JA, Persell SD. Examining primary care physician rationale for not following geriatric choosing wisely recommendations. *BMC Fam Pract*. 2021;22(1):95. <https://doi.org/10.1186/s12875-021-01440-w>.

Hart HE, Ditzel K, Rutten GE, et al. De-intensification of blood glucose lowering medication in people identified as being over-treated: a mixed methods study. *Patient Prefer Adherence*. 2019;13:1775–1783. <https://doi.org/10.2147/PPA.S208947>.

Supplementary Table 4

Enablers and Barriers to Glucose-Lowering Treatment Deprescribing From Theoretical Domains Framework (TDF, Version 2) Domains and Their Link to the Intervention Functions From the Behavior Change Wheel (BCW)

TDF Domains	Subthemes Identified	Verbatims	Barriers and Enablers	Intervention Functions (BCW Framework)
1. Knowledge (An awareness of the existence of something) Participants' knowledge about GLT deprescribing	Good knowledge of new guidelines	"We've always known to be a little more lenient for elderly patients because of their risk of hypoglycemia." Interview of a primary care physician (Rowe, 2021) "I believe that the new guidelines state that a HbA_{1c} up to 8 is acceptable." Interview of a primary care physician (Rowe, 2021) "I am totally satisfied with a HbA_{1c} in the 7–7.5 range. I don't think there is any evidence of benefit below that." Interview of a primary care physician (Rowe, 2021) "There are the new guideline targets and there you have 70-plus and more than 10 years diabetes, that you have to use different targets." Nurse practitioner, focus group (Abou, 2022) "Yes, it is interesting, because I never thought of it that way. We are always focused on more stringent control. It is a good wake-up call, that you can also think of it the other way around." Care provider—ambulatory settings (Hart, 2019)	Enablers	Education
	Ignorance of GLTs' drug-drug interactions	"These newer drugs (for diabetes and cardiovascular diseases) change so rapidly. Which combinations are allowed or not?" Community pharmacist, focus group (Abou, 2022) "(There are) a lot of interactions of medication that I don't know about, so I appreciate the input of the CP, especially in a medication review." GP, focus group (Abou, 2022)	Barriers	Education

Ignorance of the concept of
deprescribing

“How would stopping medication help with poor health? Wouldn't it simply make matters worse without the medication?” Interview of older patient, ambulatory setting (Pilla, 2023)

“If I could take less medication, I would say [*agreeing sound*]. But I think it's weird, . . . , that they're now telling it (author: the HbA_{1c} value) can be higher. Is this a result from research?” Patient—ambulatory settings (Hart, 2019)

“I would want to know after 25 years of telling me to lower my blood sugar, why is [my doctor] suggesting something that would have the effect of raising it? It would be counterintuitive to everything he's been saying for 25 years. I would say, 'Well can I gain some weight also?' It's a hypothetical that I just can't relate to.” Interview of older patient, ambulatory setting (Pilla, 2023)

“To me it would be more like hastening your death. Um, as opposed to um, I think your oath is just about the opposite, isn't it?” Interview of older patient, ambulatory setting (Pilla, 2023)

“I think it's malpractice. I think he'd wind up being sued and I wouldn't want to be his insurance company.” Interview of older patient, ambulatory setting (Pilla, 2023)

“I would not wanna venture off into any kind of adventure at this point.” Interview of older patient, ambulatory setting (Pilla, 2023)

Barriers

Education

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Supplementary Table 4 (continued)

TDF Domains	Subthemes Identified	Verbatims	Barriers and Enablers	Intervention Functions (BCW Framework)
2. Skills (an ability or proficiency acquired through practice) Participants' skills to determine which medications are low-value and how they should perform GLT deprescribing	Communication skills between patients and HCPs	"I guess the doctor would have to have a solid discussion, an in-depth discussion with the patient, as to whether reducing or terminating the diabetes treatment is gonna shorten their lifespan. And then it's up to the patient. My mother was diagnosed with terminal lung cancer, and they offered her all sorts of treatments, chemo, radiation—could probably extend her life a few months, and she said no." Interview of older patient, ambulatory setting (Pilla, 2023) "I agree with that (difficult conversation with patients). You have to have a good story for this, not giving up on somebody. Recently, I had a lady that did not want it. Whereas she used a lot of unnecessary drugs." CP, focus group (Abou, 2022) "Better communication skills, for me, I have to do it (for the conversation with patients on deprescribing)." GP, focus group (Abou, 2022)	Barriers	Education Training
	Deprescribing implementation	"Using day-time glucose values, you first may consider which dosage of fast working insulin could be diminished, very carefully, with 2 international units of insulin at a time." Care provider—ambulatory settings (Hart, 2019) "Then the dosage is halved, and then it goes back to the full dosage again. Then I think to myself, what is the right thing to do?" Patient—ambulatory settings (Hart, 2019)	Barriers and Enablers	Education Training

3. Social/professional role and identity (a coherent set of behaviors and displayed personal qualities of an individual in a social or work setting) Participants' perception of their own role in the deprescribing process	Multidisciplinary task	"(There are) a lot of interactions of medication that I don't know about, so I appreciate the input of the CP, especially in a medication review." GP, focus group (Abou, 2022) "Given the complexity of these medications, the amount of possible inaccuracies in medical files, I see an important role for the CP." GP, focus group (Abou, 2022) "What I find very difficult is, is the responsibility only with me as GP or with the CP? The patient has no idea what the choice is. They want to stop." GP, focus group (Abou, 2022) "It is the question who has the first conversation with the patient. I do not know how you (NP) think about this, but I can imagine that the NP does this when the time is there and then involves the other professionals—either the specialist in elderly care when it is too complicated or the pharmacist to explain it further." GP, focus group (Abou, 2022) "It is nice to discuss this together, that you are on the same page. We have our geriatric meetings, where the pharmacist also joins us. Yes, you tell the same thing, why something can be stopped." Specialist in elderly care, focus group (Abou, 2022) "Yes, exactly (a cardiologist is top level) and you are just GP." GP, focus group (Abou, 2022) "You often hear patients saying, the cardiologist has said that I have to use (the medication) my whole life. . . . You cannot touch it." GP, focus group (Abou, 2022) "Indeed, I think that we—being different HCPs—can complement each other." Specialist in elderly care, focus group (Abou, 2022) "If there has been no information transfer about the initial indication for a medication, I would—also as a GP— be afraid to just stop it." GP, focus group (Abou, 2022)	Barriers and enablers	Education Training Environmental restructuring
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Supplementary Table 4 (continued)

TDF Domains	Subthemes Identified	Verbatims	Barriers and Enablers	Intervention Functions (BCW Framework)
4. Beliefs about capabilities (acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use) Participants' confidence to initiate deprescribing and the problems they face	Deprescribing challenge	"I would not say that it is an impossible task, but you just need . . . to feel that you have enough expertise that you are able, can, dare to stop." GP, focus group (Abou, 2022) "It is easier to say I do nothing because then . . . I am not the one who takes the risk." Geriatrician, focus group (Abou, 2022) "Then you are going to check which target value someone has, which is now the one without sulphonylureas (author: after discontinuing sulphonylureas), which means that he/she is under treated. . . . So, you keep going back and forth. (author: between target values)." Care provider—ambulatory settings (Hart, 2019) "You need such an instrument, because if I stop this (a cardiometabolic) medicine, I have no idea what the risks are for the individual patient." GP, focus group (Abou, 2022)	Barriers	Education Training Environmental restructuring Modeling
5. Optimism (the confidence that things will happen for the best or that desired goals will be attained) Participants' confidence in likelihood of deprescribing success	Beliefs in deprescribing benefits	"I know that—that stopping of medication is better than simply continuing it, that is my conviction." Geriatrician, focus group (Abou, 2022)	Enablers	Education Persuasion

6. Beliefs about consequence (acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation Participants' fears regarding GLT deprescribing	Fears in deprescribing deleterious effects	"Irreversible illness like poor circulation and the need for amputation—that frightens me more than anything." Interview of older patient, ambulatory setting (Pilla, 2023) "It caused my blood sugar to go way up, and then the only . . . solution is the needle." Interview of older patient, ambulatory setting (Pilla, 2023) "I'd be hospitalized. A physician would be so close by that if anything untoward were to happen, I could be saved immediately." Interview of older patient, ambulatory setting (Pilla, 2023) "If the glucose value isn't good in the long term, it's not going well. You choose what's best to live a healthy life for as long as possible." Patient—ambulatory settings (Pilla, 2023) "I often experienced that they are afraid of any changes in (their parents') medication, because this may not go well for their father or mother." CP, focus group (Abou, 2022) "[My diabetes medication] affects my whole being. And . . . all the other major parts of my body, you know? Organs. . . . May as well sign up to be an organ donor, well, I am that anyway, but. Be prepared to give them up . . . I can't even envision it." Interview of older patient, ambulatory setting (Pilla, 2023) "I mean, ideally I'd love to be off medication, but I don't think that's realistic. Not . . . without really drastically changing my diet to the point where it's probably intolerable." Interview of older patient, ambulatory setting (Pilla, 2023) ". . . a patient who has heart failure (amongst other things) and is at risk for developing wounds. Then I think to myself, her glucose value is easily manageable. . . . If she develops a complication such as a wound, then at least she's better regulated (author: in order to heal faster)." Care provider—ambulatory settings (Hart, 2019)	Barriers	Education Training Environmental restructuring Modeling
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Supplementary Table 4 (continued)

TDF Domains	Subthemes Identified	Verbatims	Barriers and Enablers	Intervention Functions (BCW Framework)
7. Reinforcement (increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus) Influence of participants' past experiences with GLT deprescribing	Fears in deprescribing deleterious effects	"There are people where you have changed something (in the past), which did not go well. In that case, the GP and the patient do not want to change it (the medication), ever. . . . This can be something that happened when they were 40 (years of age) and now they are 70 years." CP, focus group (Abou, 2022)	Barriers	Education Training Environmental restructuring Modeling Persuasion Incentivization Coercion
8. Intention (a conscious decision to perform a behavior or a resolve to act in a certain way) How likely are participants to carry out a GLT deprescription	Deprescribing implementation and challenge	"With diabetes, I would not stop if somebody of 80 is fit. . . . I would not think of stopping such medication if somebody still has 3 years to live." GP, focus group (Abou, 2022) "In the end we are treating patients, not numbers." Care provider—ambulatory settings (Hart, 2019) "You know, protocols for the care of patients with diabetes have brought us a lot. . . . But in the end, you have to make the translation back to personal care and to what this patient need." Care provider—ambulatory settings (Hart, 2019) "Part of it depends on different types of 80. Some are more like 60-year-olds" Interview of a primary care physician (Rowe, 2021)	Barriers	Education Training Environmental restructuring Modeling Persuasion Incentivization Coercion
9. Goals (mental representations of outcomes or end states that an individual wants to achieve) How participants see GLT deprescribing as a means to achieve their goals	Reduction in the number of treatments	"It will be wonderful in the sense that I don't have to be poking myself too often. It would be great. I keep dreaming of that day." Interview of older patient, ambulatory setting (Pilla, 2023) "I'm a great believer in the less stuff you put in your body, the better." Interview of older patient, ambulatory setting (Pilla, 2023) "I mean, ideally, I'd love to be off medication, but I don't think that's realistic. Not . . . without really drastically changing my diet to the point where it's probably intolerable." Interview of older patient, ambulatory setting (Pilla, 2023) "If I knew that I had a couple of weeks to live, I'd stop all medication, not just diabetes medication." Interview of older patient, ambulatory setting (Pilla, 2023)	Enablers	Education Modeling Enablement

10. Memory, attention, and decision processes (the ability to retain information, focus selectively on aspects of the environment and choose between 2 or more alternatives) Habits factors and decision process regarding GLT deprescribing	Patient involvement in medical decisions	“I guess the doctor would have to have a solid discussion, an in-depth discussion with the patient, as to whether reducing or terminating the diabetes treatment is gonna shorten their lifespan. And then it's up to the patient. My mother was diagnosed with terminal lung cancer, and they offered her all sorts of treatments, chemo, radiation—could probably extend her life a few months, and she said no.” Interview of older patient, ambulatory setting (Pilla, 2023) “I trust the doctors; I trust the professionals. So . . . we have to just explain it to me exactly what benefit it would be for me or to me.” Interview of older patient, ambulatory setting (Pilla, 2023) “If they're going up beyond A_{1c} over seven, somebody would really have to explain to me why I shouldn't go back to where I was.” Interview of older patient, ambulatory setting (Pilla, 2023) “If she takes me off the Humalog and my sugar is still the same level as it is, I'm fine with that. If she takes me off and my sugar goes up, I'm going back on the Humalog.” Interview of older patient, ambulatory setting (Pilla, 2023)	Enablers	Education Modeling Enablement
	Inertia to change medication	“I mean, ideally, I'd love to be off medication, but I don't think that's realistic. Not . . . without really drastically changing my diet to the point where it's probably intolerable.” Interview of older patient, ambulatory setting (Pilla, 2023) “It is easier to say I do nothing because then . . . I am not the one who takes the risk.” Geriatrician, focus group (Abou, 2022) “If this patient is doing well, I might leave it alone.” Interview of a primary care physician (Rowe, 2021) “I wouldn't shoot for a HbA_{1c} <6.7, but I wouldn't necessarily change it.” Interview of a primary care physician (Rowe, 2021)	Barriers	Education Training Modeling Enablement

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Supplementary Table 4 (continued)

TDF Domains	Subthemes Identified	Verbatims	Barriers and Enablers	Intervention Functions (BCW Framework)
11. Environmental context and resources (any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior) Influence of the environment on participants' behavior	Setting influence	“(We should) have a better transfer (from the hospital) to primary care, to the GP and the CP and the patient. . . . There (in the hospital) is the trend of giving a lot of information in a short period . . . , but people afterwards do not remember it well (information about medication changes).” Geriatrician, focus group (Abou, 2022) “If someone is in a nursing home with food being brought to them at regular times, then that's a safer situation than when someone is alone at home.” Care provider—ambulatory settings (Hart, 2019)	Barriers	Environmental restructuring
	Time and financial aspects	“You cannot stop (cardiovascular medication) at once, you often have to take several steps, and those steps take a lot of effort . . . A GP actually may not have sufficient time for this.” Geriatrician, focus group (Abou, 2022) “This costs me a lot of time I think it is my responsibility . . . but it does not help because I get less and less financial compensation from the insurance companies.” CP, focus group (Abou, 2022) “I think that a lot will change in the pharmacy world, I hope that we do not have to think it that way anymore (worry about getting less income when you stop medication).” CP, focus group (Abou, 2022)	Barriers	Environmental restructuring Enablement Persuasion Incentivization
12. Social influences (those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors) How others influence participants' behavior	Trust relationship	“I don't think I'd try to [deintensify]. Um, I think I trust my doctors, for one thing. And um, she, she's been very good. And . . . I don't think I'd want my blood sugars to get any higher.” Interview of older patient, ambulatory setting (Pilla, 2023) “I trust the doctors, I trust the professionals. So . . . we have to just explain it to me exactly what benefit it would be for me or to me.” Interview of older patient, ambulatory setting (Pilla, 2023)	Enablers	Persuasion Modeling

13. Emotion (a complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event) How participants feel about GLT deprescribing	Fears in deprescribing deleterious effects	"Irreversible illness like poor circulation and the need for amputation—that frightens me more than anything." Interview of older patient, ambulatory setting (Pilla, 2023) "I would not wanna venture off into any kind of adventure at this point." Interview of older patient, ambulatory setting (Pilla, 2023) "I often experienced that they are afraid of any changes in (their parents') medication, because this may not go well for their father or mother." CP, focus group. (Abou, 2022)	Barriers	Education Training
	Lack of legitimacy	"If there has been no information transfer about the initial indication for a medication, I would—also as a GP— be afraid to just stop it." CP, focus group (Abou, 2022)	Barriers	Education Training Persuasion Environmental restructuring Modeling Enablement

CP, community pharmacist; GP, general practitioner; GLT, glucose-lowering treatment; HCP, health care provider; HbA_{1c}, glycated hemoglobin; NP, nurse practitioner.
 Abou J, Crutzen S, Tromp V, et al. Barriers and enablers of healthcare providers to deprescribe cardiometabolic medication in older patients: a focus group study. *Drugs Aging*. 2022;39(3):209-221. <https://doi.org/10.1007/s40266-021-00918-7>.
 Pilla SJ, Meza KA, Schoenborn NL, Boyd CM, Maruthur NM, Chander G. A qualitative study of perspectives of older adults on deintensifying diabetes medications. *J Gen Intern Med*. 2023;38(4):1008-1015. <https://doi.org/10.1007/s11606-022-07828-3>.
 Rowe TA, Brown T, Doctor JN, Linder JA, Persell SD. Examining primary care physician rationale for not following geriatric choosing wisely recommendations. *BMC Fam Pract*. 2021;22(1):95. <https://doi.org/10.1186/s12875-021-01440-w>.
 Hart HE, Ditzel K, Rutten GE, et al. De-intensification of blood glucose lowering medication in people identified as being over-treated: a mixed methods study. *Patient Prefer Adherence*. 2019;13:1775-1783. <https://doi.org/10.2147/PPA.S208947>.

Supplementary Table 5

Sensitivity Analysis: Description of Characteristics of Related Quantitative Studies and Significant Results

Author, Year, Country, Type of Study	Inclusion and Exclusion Criteria	Population, Setting, Dates	Measures/Themes Explored	Primary Outcome	GLT Deprescribing Definition	Subthemes Identified
Oktora, 2023 Indonesia ²⁹ Cross-sectional survey	Inclusion criteria: - >60 y old, receiving GLT, literate and able to complete a questionnaire, who gave informed consent Exclusion criteria: - NA	- 196 Patients - Primary care centers - 2021-2022	Evaluation about the participant characteristics, the scores on Patient Attitudes Toward Deprescribing Questionnaire, the individual statements in 4 domains (burden, appropriateness, concerns about stopping, and involvement), and the appropriateness and concerns statements of specific medicines (sulfonylurea, blood pressure-lowering medicines, and lipid-lowering medicines).	- Attitudes of Indonesian older people with T2DM toward deprescription - Willingness to stop medicines when recommended by HCPs - Attitudes toward deprescribing of different cardiometabolic medicines - Factors associated with willingness to stop medicines.	Process of reducing or stopping medication to improve patient outcomes in a well-planned process with supervision of HCP	- Patient involvement in medical decisions - Trust relationship between patients and their physicians - Patients' fears in deprescribing deleterious effects
Gomez-Huelgas, 2022 Spain ²⁸ Mixed-survey	Inclusion criteria: - Primary care and hospital care physicians whose routine practice include T2DM management Exclusion criteria: - NA	- 296 and 293 primary care and hospital care specialists - Primary care and hospital care - 2020	Mixed Delphi method/opinion, attitude, and behavior survey by means of anonymous online questionnaires. Level of agreement on the Delphi statements evaluated via a 5-point Likert scale	Analyze the knowledge, barriers, and attitudes in the management of older patients with T2DM and/or comorbidities among primary care and hospital care specialists	Not reported	HCP: - Good knowledge of new guidelines - Inertia to change medication - Setting influence, time, and financial aspects - Communication skills between patients and HCPs - Multidisciplinary task and legitimacy

Niznik, 2020 USA ²⁷ Retrospective cohort	Inclusion criteria: - Diabetic residents with <6 mo life expectancy or advanced dementia Exclusion criteria: - <65 y old at admission - Lengths of stay <7 d	- 6960 Veterans - VA Community Living Centers - 2009–2015	Evaluation about the treatment deintensification among residents who were potentially overtreated (HbA_{1c} ≤7.5% and receiving hypoglycemic medications) Competing risk models assessed 90-d cumulative incidence of deintensification	Quantify: 1. The prevalence of potential diabetes overtreatment among older adults with limited life expectancy or advanced dementia residing in VA nursing homes 2. The extent to which potentially overtreated residents had their regimens deintensified 3. Association of resident-level characteristics with deintensification	Decreasing the dose or completely discontinuing a non-insulin agent and/or stopping a type of insulin with no addition of new agents or dose increase of a non-insulin agent	HCP: Good knowledge of new guidelines
Schoenborn, 2019 ²⁶ USA Retrospective cohort	Inclusion criteria: - >65 y old, English speaker, diabetes patients Exclusion criteria: - NA	- 818 Patients - Knowledge Panel (nationally representative, probability-based online survey panel) - 2018–2019	Survey about the perceived importance of 7 factors in the decision to add or remove a diabetes medication and the perceived effect of each factor on the aggressiveness of diabetes treatment	How older adults perceive and prioritize the factors used to individualize diabetes treatment in clinical practice guidelines	Stop use of a diabetes medication	Patient involvement in medical decisions
Caverly, 2015 USA ²⁵ Cross-sectional survey	Inclusion criteria: - Physicians, nurse practitioners, and physician assistants from a national random sample of practicing nontrained VA Exclusion criteria: - NA	- 594 physicians, nurse practitioners, physician assistants - Department of Veterans Affairs - 2014	Questions about practice characteristics, performance incentives, beliefs about decreasing use of inappropriate services, and demographics Barriers to and facilitators of medication deintensification were identified using statements answered on a 4-point scale	Beliefs of primary care HCPs about recommendations of diabetes management in older adults	Not reported	HCP: - Good knowledge of new guidelines - Inertia to change medication - Multidisciplinary task and legitimacy

GLT, glucose-lowering treatment; HbA_{1c}, glycated hemoglobin; HCP, health care practitioners; NA, not available; T2DM, type 2 diabetes mellitus; VA, US Department of Veterans Affairs.

Oktora MP, Yuniar CT, Amalia L, Abdulah R, Hak E, Denig P. Attitudes towards deprescribing and patient-related factors associated with willingness to stop medication among older patients with type 2 diabetes (T2D) in Indonesia: a cross-sectional survey study. *BMC Geriatr*. 2023;23(1):21. <https://doi.org/10.1186/s12877-022-03718-9>.

Gómez-Huelgas R, Gómez-Peralta F, Cos FX. Evaluation of knowledge, barriers, and attitudes in the management of type 2 diabetes in elderly patients: A Delphi study on primary and hospital care. *Rev Clin Esp*. 2022;222(7):385–392. <https://doi.org/10.1016/j.rceng.2021.11.007>.

Niznik JD, Hunnicutt JN, Zhao X, et al. Deintensification of diabetes medications among Veterans at the end of life in VA nursing homes. *J Am Geriatr Soc*. 2020;68(4):736–745. <https://doi.org/10.1111/jgs.16360>.

Schoenborn NL, Crossnohere NL, Bridges JFP, Pollack CE, Pilla SJ, Boyd CM. Patient perceptions of diabetes guideline frameworks for individualizing glycemic targets. *JAMA Intern Med*. 2019;179(12):1642–1649. <https://doi.org/10.1001/jamainternmed.2019.3806>.

Caverly TJ, Fagerlin A, Zikmund-Fisher BJ, et al. Appropriate prescribing for patients with diabetes at high risk for hypoglycemia: national survey of Veterans Affairs health care professionals. *JAMA Intern Med*. 2015;175(12):1994–1996. <https://doi.org/10.1001/jamainternmed.2015.5950>.