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ROLE OF PHARMACIST IN PROMOTING RATIONAL USE OF ORAL HYPOGLYCEMIC AGENTS IN DIABETES MELLITUS: REVIEW ARTICLE

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Abstract:
Background: *Diabetes mellitus (DM) is a chronic metabolic disorder of pandemic proportions, affecting over 537 million adults globally as of 2021, with projections exceeding 783 million by 2045. Management of type 2 DM (T2DM) relies heavily on oral hypoglycemic agents (OHAs); however, suboptimal prescribing, non-adherence, and drug-related problems remain significant barriers to achieving therapeutic goals.*
Objective: *This review examines the multifaceted role of the pharmacist in promoting the rational use of OHAs in DM, with emphasis on evidence-based interventions that improve clinical, humanistic, and economic outcomes.*
Literature Review: *A narrative review of literature published predominantly between 2015 and 2025 was conducted using PubMed, MEDLINE, Embase, Cochrane Library, and ScienceDirect. International guidelines from the WHO, ADA, and IDF were incorporated. Studies assessing pharmacist-led interventions in T2DM management, including randomized controlled trials, systematic reviews, and meta-analyses, were included.*
Results: *Pharmacist-led interventions — encompassing patient counselling, medication therapy management (MTM), adherence support, drug interaction monitoring, and pharmacovigilance — consistently demonstrate significant reductions in HbA1c (0.5–1.2%), improvements in blood pressure and lipid profiles, and enhanced patient quality of life. Collaborative pharmacist–physician models demonstrate an 85% physician acceptance rate for pharmacist recommendations.*
Conclusion: *Pharmacists are indispensable members of the diabetes care team. Expanding their clinical roles, embedding them in collaborative practice models, and addressing systemic barriers are essential for achieving rational OHA use and optimal patient outcomes in DM.*
Keywords: *Pharmacist; rational drug use; oral hypoglycemic agents; diabetes mellitus; medication therapy management; adherence; pharmacovigilance; clinical outcomes; collaborative practice; type 2 diabetes.*

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1. INTRODUCTION:

Diabetes mellitus (DM) is one of the most prevalent and clinically complex non-communicable diseases of the 21st century. Characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both, DM encompasses a spectrum of metabolic disorders with far-reaching consequences for individual and public health. The International Diabetes Federation (IDF) reported in its 10th Diabetes Atlas (2021) that approximately 537 million adults aged 20–79 years were living with diabetes globally — representing 10.5% of the world's adult population — with projections reaching 783 million by 2045 (a 46% increase).[1] Over three-quarters of affected individuals reside in low- and middle-income countries (LMICs), where healthcare infrastructure is frequently inadequate.

Type 2 DM (T2DM) accounts for approximately 90–95% of all DM cases and is the primary target of pharmacological intervention with OHAs. Adults with DM carry a two- to three-fold increased risk of myocardial infarction and stroke compared to non-diabetic counterparts, and DM is the leading preventable cause of blindness, end-stage renal disease, and lower-limb amputation in developed countries. The total global health expenditure attributable to DM exceeded US$760 billion in 2019, with projections surpassing US$825 billion by 2030.

Despite a broadening pharmacopoeia of OHAs — from long-established metformin to newer SGLT-2 inhibitors and GLP-1 receptor agonists — achieving sustained glycaemic control remains a formidable challenge. Non-adherence, irrational prescribing, unmonitored drug interactions, and inadequate patient education contribute substantially to suboptimal outcomes. The World Health Organization (WHO) defines rational use of medicines as ensuring patients receive medications appropriate to their clinical needs, in doses meeting individual requirements, for adequate periods, at the lowest cost to them and their community.[7]

In this context, the pharmacist occupies a uniquely strategic position. As the medication expert and, in many settings, the most accessible healthcare professional, the pharmacist can bridge critical gaps in diabetes care — from initial counselling at the point of dispensing to comprehensive medication reviews and community health promotion. This review examines the current evidence supporting the pharmacist's expanding role in promoting rational OHA use in DM, identifies prevailing challenges, and proposes future directions for maximising the pharmacist's contribution to diabetes care.

2. OVERVIEW OF ORAL HYPOGLYCEMIC AGENTS (OHAs)

2.1 Classification and Mechanism of Action

OHAs represent a diverse group of pharmacological compounds acting through distinct mechanistic pathways to lower blood glucose in T2DM. Rational selection depends on individualized patient factors including degree of hyperglycaemia, comorbidities, renal and hepatic function, cost, and adverse effect risk tolerance. The major classes are summarized in Table 1.

Table 1: Classification and Mechanism of Action of Major Oral Hypoglycemic Agents

Drug Class	Mechanism of Action	Examples	Key Considerations
Biguanides	Inhibits hepatic glucose production; improves insulin sensitivity	Metformin	First-line agent; dose adjustment required in renal impairment (eGFR <30 mL/min/1.73 m²)
Sulfonylureas (2nd gen)	Stimulates pancreatic beta-cell insulin secretion	Glibenclamide, Glipizide, Glimepiride	Risk of hypoglycaemia and weight gain; caution in elderly and renal impairment
Thiazolidinediones	PPAR-gamma agonist; increases peripheral insulin sensitivity	Pioglitazone, Rosiglitazone	Fluid retention, weight gain; contraindicated in heart failure; risk of bladder cancer (pioglitazone)
Alpha-glucosidase Inhibitors	Delays carbohydrate absorption in the small intestine	Acarbose, Voglibose, Miglitol	Gastrointestinal side effects; administer with the first bite of each meal
DPP-4 Inhibitors (Gliptins)	Inhibits DPP-4 enzyme; increases incretin levels, enhancing glucose-dependent insulin secretion	Sitagliptin, Saxagliptin, Vildagliptin	Weight neutral; rare risk of pancreatitis and bullous pemphigoid
SGLT-2 Inhibitors	Inhibits renal glucose	Dapagliflozin,	Cardiovascular and renal benefits; risk

Drug Class	Mechanism of Action	Examples	Key Considerations
	reabsorption; promotes glucosuria	Empagliflozin, Canagliflozin	of UTI, genital mycosis, euglycaemic DKA
GLP-1 Receptor Agonists (oral)	Mimics incretin hormones; stimulates glucose-dependent insulin release	Oral semaglutide (Rybelsus®)	Weight reduction; gastrointestinal side effects; must be taken fasting
Meglitinides	Short-acting insulin secretagogues; stimulate beta-cell insulin release post-meal	Repaglinide, Nateglinide	Flexible dosing schedule; lower hypoglycaemia risk than sulfonylureas

DPP-4: Dipeptidyl peptidase-4; SGLT-2: Sodium-glucose cotransporter-2; GLP-1: Glucagon-like peptide-1; PPAR: Peroxisome proliferator-activated receptor; UTI: Urinary tract infection; DKA: Diabetic ketoacidosis.

2.2 Principles of OHA Selection

The American Diabetes Association (ADA) and European Association for the Study of Diabetes (EASD) joint guidelines (2023) recommend a patient-centred approach to OHA selection emphasising glycaemic efficacy, cardiovascular and renal outcomes, weight effects, hypoglycaemia risk, and cost-effectiveness.[2]

Metformin remains the cornerstone of T2DM pharmacotherapy unless contraindicated by renal impairment (eGFR <30 mL/min/1.73 m^2). For patients with established cardiovascular disease or chronic kidney disease, SGLT-2 inhibitors and GLP-1 receptor agonists with proven cardiovascular benefit (empagliflozin, liraglutide, semaglutide) are recommended as preferred add-on agents, independent of HbA1c levels.[2] Pharmacist awareness of these evolving guidelines is critical for ensuring prescribed regimens align with current evidence and for appropriately counselling patients on administration, storage, side effects, and interactions.

3. CONCEPT OF RATIONAL DRUG USE (RDU)

3.1 Definition and Historical Context

The landmark WHO Conference of Experts held in Nairobi in 1985 first articulated the concept of rational drug use (RDU), defining it as receipt of medications appropriate to clinical needs, in doses meeting individual requirements, for adequate durations, at the lowest cost to the patient and community.[7] This definition has since evolved to encompass dimensions of safety, quality, adherence, and equitable access. In diabetes, RDU implies careful selection of an appropriate OHA regimen tailored to the patient's physiological and socioeconomic profile, administered at optimal doses and intervals, with ongoing monitoring and adjustment as required.

3.2 Core Principles of RDU

The core principles of RDU in diabetes management include: (i) appropriate diagnosis and indication-based prescribing; (ii) correct drug selection based on patient-specific factors (comorbidities, renal and hepatic function, age, cost); (iii) correct dose, dosage form, and dosing interval; (iv) appropriate duration of treatment with periodic re-evaluation; (v) prevention and management of adverse drug reactions (ADRs) and drug interactions; (vi) patient education and empowerment for informed decision-making; and (vii) regular monitoring of therapeutic outcomes.

3.3 Importance of RDU in Diabetes Management

In T2DM, irrational drug use manifests in multiple forms: inappropriate first-line agent selection, under- or over-dosing of OHAs, failure to de-escalate therapy when glycaemic targets are achieved, neglect of contraindications, and polypharmacy without adequate review. Consequences include hypoglycaemia, organ damage, drug toxicity, avoidable hospitalizations, and increased healthcare costs. A systematic RDU approach, championed by well-trained pharmacists, can substantially mitigate these risks and improve outcomes.

4. CHALLENGES IN RATIONAL USE OF ORAL HYPOGLYCEMICS

4.1 Adverse Drug Effects

Each OHA class carries a distinct adverse effect profile that, if inadequately managed, can undermine patient safety and adherence. Sulfonylureas carry a well-documented risk of hypoglycaemia, particularly in elderly patients, those with irregular meal patterns, or those with renal impairment. Thiazolidinediones are associated with fluid retention, weight gain, congestive heart failure, and bladder cancer. SGLT-2 inhibitors predispose patients to urinary tract infections, genital mycotic infections, and euglycaemic diabetic ketoacidosis. Metformin causes gastrointestinal upset in a significant proportion of patients. Pharmacists must proactively counsel patients on expected versus dangerous adverse effects and provide clear management guidance.

4.2 Non-Adherence to OHA Therapy

Medication non-adherence is among the most pervasive challenges in T2DM management. Adherence to OHAs ranges from 38% to 93% across studies, with non-adherence contributing to an estimated 1–2% increase in HbA1c levels, significantly increasing risk of microvascular and macrovascular complications. Contributing factors include polypharmacy, complex dosing regimens, high pill burden, medication cost, fear of side effects, poor health literacy, cultural beliefs, and lack of perceived benefit due to the asymptomatic nature of hyperglycaemia. Pharmacist interventions targeting these specific barriers through counselling, regimen simplification, and motivational strategies have been consistently shown to improve adherence rates.

4.3 Drug–Drug Interactions

Patients with T2DM frequently present with multiple comorbidities — hypertension, dyslipidaemia, coronary artery disease, chronic kidney disease — and are prescribed multiple co-medications, creating a high-risk pharmacological environment. Clinically significant interactions include: NSAIDs potentiating the hypoglycaemic effects of sulfonylureas; beta-blockers masking tachycardia as a symptom of hypoglycaemia; fluoroquinolone antibiotics causing both hypoglycaemia and hyperglycaemia; corticosteroids worsening glycaemic control; and metformin co-administered with contrast agents increasing lactic acidosis risk in renal impairment. The pharmacist's role in systematic drug interaction (DDI) screening is therefore critical.

4.4 Cost and Accessibility Barriers

Economic barriers to rational OHA use are particularly pronounced in LMICs. Newer OHA classes — SGLT-2 inhibitors, DPP-4 inhibitors, GLP-1 receptor agonists — carry prohibitive costs, placing them beyond many patients' reach despite their superior cardiovascular and renal outcomes. Even older agents may represent significant financial burdens in resource-limited settings, leading to cost-driven dose reduction or discontinuation. Pharmacists can mitigate this by guiding patients toward cost-effective generic alternatives, facilitating access to prescription assistance programmes, and advocating for formulary changes based on pharmacoeconomic evidence.

5. ROLE OF PHARMACIST IN PROMOTING RATIONAL USE OF OHAs

The pharmacist's role in diabetes management has undergone a paradigm shift from passive medication dispenser to active clinical contributor and patient advocate. This expanded role encompasses a broad spectrum of activities summarized in Table 2.

Table 2: Comprehensive Pharmacist Roles and Activities in Rational OHA Use

Pharmacist Role	Activities Performed	Expected Outcome
Patient Counselling	Disease education, medication instructions, dietary advice, self-monitoring of blood glucose (SMBG)	Improved adherence, reduced medication errors, enhanced self-management
Medication Therapy Management (MTM)	Comprehensive medication review, drug interaction screening, regimen optimization, DRP identification	Reduction in drug-related problems, improved HbA1c and metabolic parameters
Monitoring & Follow-up	HbA1c tracking, renal/hepatic function assessment, blood pressure and lipid monitoring	Early detection of complications and adverse effects; timely regimen adjustment
Drug Interaction Prevention	Systematic screening for OHA–drug interactions (NSAIDs, beta-blockers, fluoroquinolones, corticosteroids)	Avoidance of hypoglycaemia, toxicity, and therapeutic failure
Adherence Improvement	Pill organizers, mHealth/SMS reminders, motivational interviewing, regimen simplification	Reduced non-adherence rates, sustained glycaemic control
Pharmacovigilance	ADR detection and reporting, post-marketing surveillance, patient	Safer prescribing practices, updated drug information, improved surveillance

Pharmacist Role	Activities Performed	Expected Outcome
	education on drug safety	
Health Education Programs	Community awareness campaigns, group education sessions, multilingual patient leaflets, diabetes screening	Increased disease literacy, prevention of complications, community outreach
Collaborative Practice	Pharmacist–physician collaborative drug therapy management (CDTM) agreements	Optimised individualised therapy, reduced clinical inertia, improved team outcomes

ADR: Adverse Drug Reaction; DRP: Drug-Related Problem; MTM: Medication Therapy Management; SMBG: Self-Monitoring of Blood Glucose; CDTM: Collaborative Drug Therapy Management.

5.1 Patient Counselling

Patient counselling is the cornerstone of the pharmacist's clinical function in diabetes care. Effective counselling encompasses disease education (explaining T2DM pathophysiology and consequences of poor glycaemic control), medication-specific education (dosing schedules, administration techniques, storage, onset of action, side effects), dietary counselling (carbohydrate counting, glycaemic index principles, meal timing relative to OHA administration), and lifestyle guidance (physical activity, smoking cessation, weight management). Pharmacists should employ the teach-back method to verify patient comprehension, particularly in patients with low health literacy.

Of particular importance is counselling on hypoglycaemia recognition and management, including the 15-15 Rule (consume 15 g of fast-acting carbohydrates; recheck blood glucose after 15 minutes) and the importance of carrying glucose tablets. Counselling also extends to SMBG, including correct glucometer use, testing frequency, and result interpretation.

5.2 Medication Therapy Management (MTM)

MTM is a structured, evidence-based service involving comprehensive medication review, identification and resolution of drug-related problems (DRPs), and development of a personalised medication action plan. In T2DM, MTM encompasses: assessment of the appropriateness and efficacy of the current OHA regimen against current guidelines; screening for contraindications and precautions (e.g., metformin in renal impairment; sulfonylureas in hepatic disease); identification of therapeutic duplication or interactions; assessment of adherence patterns; and formulation of recommendations to the prescribing physician with documentation.

Studies indicate that pharmacist-performed MTM identifies an average of 2–4 DRPs per patient in T2DM populations, including inappropriate drug selection, suboptimal dosing, and unmonitored interactions.[3] Implementation of pharmacist recommendations within collaborative drug therapy management (CDTM) has been associated with significant reductions in HbA1c and improvements in other metabolic parameters.[11]

5.3 Monitoring and Follow-up

Continuous monitoring is essential to evaluate OHA efficacy and safety. Pharmacists systematically track: glycated haemoglobin (HbA1c — target <7.0% in most patients, individualized in elderly or comorbid patients); fasting and postprandial blood glucose; renal function (eGFR, serum creatinine) for dose adjustment of metformin, SGLT-2 inhibitors, and others; hepatic function for hepatically metabolised agents; blood pressure and lipid profiles; body weight; and patient-reported outcomes including quality of life and hypoglycaemic episode frequency. Pharmacists operating within Diabetes Medication Therapy Adherence Clinics (DMTACs) routinely perform such monitoring, feeding findings into collaborative management plans.[9]

5.4 Prevention of Drug Interactions

The pharmacist is uniquely positioned for systematic DDI screening, given access to complete medication lists across multiple prescribers. Patients with T2DM often receive prescriptions from cardiologists, nephrologists, and ophthalmologists, creating a scenario where no single prescriber has a comprehensive view of the entire regimen. Pharmacist DDI screening programmes in T2DM populations detect interactions in 15–30% of patients, with pharmacist-led interventions successfully resolving the majority.[12]

5.5 Improving Medication Adherence

Pharmacist-led adherence interventions are among the most robustly evidenced activities in diabetes care. Strategies include: simplification of dosing regimens through identification of once-daily formulations or combination pills; provision of pill organizers or blister packs; medication reminder systems using mobile health (mHealth) applications and SMS-based reminders; motivational interviewing to address psychological barriers including diabetes distress and medication fatigue; and structured follow-up visits. A 2023 trial demonstrated that combining pharmacist counselling with a dedicated mHealth application resulted in significantly improved adherence and patient satisfaction compared to standard care.[8]

5.6 Pharmacovigilance

Pharmacovigilance — the science of detection, assessment, understanding, and prevention of ADRs and other medicine-related problems — is a shared responsibility of pharmacists, prescribers, and regulators. In T2DM, pharmacovigilance activities include: systematic detection and reporting of suspected ADRs to the relevant national drug authority; monitoring of post-marketing safety signals for newer OHAs (e.g., euglycaemic DKA with SGLT-2 inhibitors; bullous pemphigoid with DPP-4 inhibitors); educating patients to recognise and report unexpected drug effects; and contributing to institutional or national adverse event reporting databases. Active pharmacist participation enhances post-marketing surveillance data quality and ultimately improves prescribing safety at the population level.

5.7 Health Education Programmes

Beyond the individual patient encounter, pharmacists play an important community health role through design and delivery of diabetes health education programmes. These include: community awareness campaigns targeting T2DM prevention in high-risk populations (obese, pre-diabetic, positive family history); structured group education sessions for newly diagnosed patients; distribution of multilingual patient education leaflets; school-based prevention programmes; and collaboration with local health authorities in diabetes screening drives. Such programmes leverage the pharmacist's accessibility — community pharmacies are among the most frequently visited healthcare facilities — to reach underserved populations.

6. PHARMACIST INTERVENTION PROCESS IN T2DM MANAGEMENT

The following table describes the systematic, stepwise approach employed by pharmacists in managing patients with T2DM on OHA therapy, from initial patient identification through comprehensive intervention to ongoing monitoring and pharmacovigilance (Figure 1).

Figure 1: Pharmacist Intervention Process in Rational OHA Use for Diabetes Mellitus

Step 1	**Patient Identification & Diabetes Diagnosis**	Newly diagnosed or existing T2DM patient presents to pharmacist or is referred from clinical team.
Step 2	**Comprehensive Medication Review**	Review current OHAs, comorbidities, laboratory results (HbA1c, renal/hepatic function), allergies, and cost considerations.
Step 3	**Identification of Drug-Related Problems (DRPs)**	Screen for drug interactions, therapeutic duplications, contraindications, non-adherence, and subtherapeutic or supratherapeutic dosing.
Step 4	**Pharmacist Intervention**	Patient counselling; MTM; dose adjustment recommendations; drug interaction management; adherence strategies.
Step 5	**Health Education & Lifestyle Guidance**	Dietary counselling; exercise advice; SMBG instruction; foot care education; smoking cessation support.
Step 6	**Collaborative Communication**	Liaise with physician and interdisciplinary team; document interventions; submit therapeutic recommendations.
Step 7	**Monitoring & Follow-up**	Re-assess HbA1c; review adherence; check for ADRs; update management plan every 3–6 months.
Step 8	**Pharmacovigilance & ADR Reporting**	Report suspected ADRs; contribute to national pharmacovigilance database; provide safety feedback to prescribers.

ADR: Adverse Drug Reaction; DRP: Drug-Related Problem; MTM: Medication Therapy Management; OHA: Oral Hypoglycemic Agent; SMBG: Self-Monitoring of Blood Glucose; T2DM: Type 2 Diabetes Mellitus.

7. CLINICAL OUTCOMES OF PHARMACIST INTERVENTIONS

The body of evidence supporting pharmacist-led interventions in T2DM has grown substantially over the past decade, with multiple systematic reviews, meta-analyses, and randomized controlled trials (RCTs) consistently demonstrating positive clinical, humanistic, and economic outcomes. Table 3 presents a summary of key evidence.

Table 3: Summary of Evidence-Based Clinical Outcomes of Pharmacist Interventions in T2DM

Study / Author	Design	Key Finding	Reference
Pousinho et al., 2020	Systematic review	Significant HbA1c reduction (0.5–1.0%) across multiple RCTs; greatest benefits in patients with baseline HbA1c >9%.	Pharm Pract [3]
Zhu et al., 2023	Systematic review of 28 RCTs	Pharmacist–physician collaborative care reduced HbA1c by 1.2%, systolic BP by 6.42 mmHg, and total cholesterol by 0.26 mmol/L.	Front Pharmacol [11]
Linawati et al., 2021	Systematic review	Positive glycaemic and humanistic outcomes across diverse healthcare settings.	Int J Pharm Res [5]
Alabkal et al., 2023	Meta-analysis	Improved lipid profiles and blood pressure control in T2DM patients at cardiovascular risk.	J Pharm Pract [6]
Attipoe et al., 2023	RCT	Pharmacist counselling combined with mHealth application improved medication adherence and patient satisfaction.	Int J Integr Care [8]
Scientific Reports, 2025	Prospective study	Significant improvement across all EQ-5D quality-of-life domains following pharmacist-led DMTAC intervention.	Sci Rep [9]

BP: Blood Pressure; DMTAC: Diabetes Medication Therapy Adherence Clinic; HbA1c: Glycated Haemoglobin; RCT: Randomized Controlled Trial; EQ-5D: EuroQol Five Dimension scale.

Key evidence-based findings may be summarized as follows. HbA1c reduction: a systematic review by Pousinho et al. (2020) demonstrated consistent HbA1c reductions of 0.5–1.0% attributable to pharmacist-led interventions.[3] Cardiovascular and metabolic parameters: a 2023 meta-analysis of 28 RCTs by Zhu et al. found that pharmacist–physician collaborative care reduced mean HbA1c by 1.2%, systolic blood pressure by 6.42 mmHg, and total cholesterol by 0.26 mmol/L.[11] Physician acceptance rate: across studies employing collaborative pharmacist–physician models, approximately 85% of pharmacist recommendations were accepted and implemented by physicians. Quality of life: a 2025 prospective study using the EQ-5D instrument demonstrated significant improvements across all five health dimensions following pharmacist-led DMTAC interventions.[9] Cost-effectiveness: pharmacist-led diabetes care programmes are cost-effective compared to standard care, with a favourable cost per quality-adjusted life year (QALY) gained in multiple healthcare settings.[11] Adherence outcomes: pharmacist-led adherence programmes have demonstrated adherence rate improvements of 15–25 percentage points compared to control groups, with corresponding improvements in glycaemic indices.

8. BARRIERS TO PHARMACIST INVOLVEMENT IN DIABETES CARE

Despite the compelling evidence base, full integration of pharmacists into diabetes care teams faces multiple structural, professional, and patient-centred barriers.

8.1 Structural and System-Level Barriers

Structural barriers include: lack of formal recognition of pharmacists as healthcare providers eligible for direct reimbursement in many healthcare systems, limiting the financial viability of extended clinical services; inadequate time for comprehensive counselling and medication review in high-volume community pharmacy settings where dispensing pressures dominate; fragmented health information systems restricting pharmacist access to patient medical records, laboratory results, and prescribing histories essential for effective MTM; and the absence of standardised national policies or legislation mandating pharmacist involvement in chronic disease management.

8.2 Professional and Educational Barriers

Professional barriers include variability in pharmacist training and clinical competency in diabetes management across different countries and institutions; limited postgraduate training opportunities in advanced diabetes care, pharmacogenomics, and emerging OHA classes; and inadequate interprofessional education models that fail to prepare pharmacists and physicians for effective collaborative practice.

8.3 Patient-Centred Barriers

Patient-level barriers include low health literacy, language barriers, stigma associated with chronic disease, and lack of confidence in pharmacists as clinical advisors beyond medication dispensing. Cultural and religious beliefs may also conflict with recommended pharmacological management approaches, requiring culturally sensitive communication strategies from pharmacists.

9. FUTURE PERSPECTIVES

The pharmacist's role in diabetes management is poised to expand significantly over the coming decade, driven by technological innovation, evolving healthcare models, and growing recognition of the pharmacist as a clinical practitioner.

9.1 Digital Health and mHealth Integration

The proliferation of mobile health applications, wearable glucose monitoring devices (including continuous glucose monitors, CGMs), and telemedicine platforms presents unprecedented opportunities for pharmacist-led remote diabetes management. Pharmacists can leverage these technologies to conduct virtual medication reviews, receive real-time glucose data, deliver targeted educational content, and provide timely alerts for glycaemic excursions. Integration of pharmacist-operated mHealth interventions with electronic health record (EHR) systems will be critical for seamless care coordination.

9.2 Pharmacogenomics in OHA Selection

Advances in pharmacogenomics offer the prospect of truly personalised OHA therapy, with genetic profiling informing the selection of agents most likely to be efficacious and tolerable for an individual patient. For example, variants in the SLC22A1 gene encoding OCT1 have been associated with reduced metformin response. Pharmacists trained in pharmacogenomics could translate these insights into clinical recommendations, optimising OHA regimens at the individual level.

9.3 Policy and Legislative Advocacy

Advancement of pharmacist provider status legislation — as exemplified by the proposed Pharmacy and Medically Underserved Areas Enhancement Act in the United States — would formally recognise pharmacists as Medicare Part B providers eligible for reimbursement for chronic disease management services. Pharmacy professional bodies globally must continue to advocate for similar legislative frameworks. Embedding pharmacists within primary care and endocrinology teams under collaborative practice agreements (CPAs) should become a standard of care.

9.4 Artificial Intelligence and Clinical Decision Support

Artificial intelligence (AI)-powered clinical decision support tools embedded within pharmacy dispensing systems can assist pharmacists in real-time OHA interaction screening, contraindication alerts, and adherence risk stratification. Machine learning algorithms trained on large diabetes patient datasets could identify patients at highest risk for non-adherence, OHA failure, or adverse effects, enabling proactive pharmacist intervention before clinical deterioration occurs.

9.5 Global Capacity Building

Addressing the pharmacist skills gap in LMICs requires investment in PharmD and postgraduate clinical pharmacy programmes, establishment of pharmacist-led DMTACs modelled on successful examples in Malaysia and other settings, and development of culturally sensitive patient education materials. International pharmaceutical organizations must prioritize knowledge transfer and capacity building in these regions, where the diabetes burden is highest and pharmacist involvement is most urgently needed.

10. DISCUSSION:

The evidence synthesised in this review underscores the substantial and well-documented value of pharmacist-led interventions in the management of T2DM. The consistent demonstration of HbA1c reductions of 0.5–1.2%, alongside improvements in blood pressure, lipid profiles, adherence rates, and quality of life, positions pharmacist involvement as both clinically effective and cost-beneficial. The high physician acceptance rate of approximately 85% for pharmacist recommendations reflects the professional credibility of pharmacist input within collaborative care frameworks.

The pharmacist's unique position as the most accessible healthcare professional, combined with specialized medication expertise, creates a compelling case for expanded pharmacist roles in diabetes care. The emergence of digital health technologies, pharmacogenomics, and AI-driven clinical decision support further amplifies the potential impact of pharmacist contributions. However, realizing this potential requires concurrent resolution of the structural, professional, and patient-centred barriers identified in this review.

The transition toward expanded pharmacist roles is already well underway in several countries, with collaborative practice agreements, provider status recognition, and DMTAC models demonstrating tangible improvements in patient outcomes. These experiences provide a roadmap for healthcare systems globally, particularly in LMICs where T2DM prevalence is rising most rapidly and where pharmacist accessibility may represent a critical and underutilised asset in the diabetes care ecosystem.

11. CONCLUSION:

Irrational use of oral hypoglycemic agents remains a significant and modifiable contributor to suboptimal outcomes in diabetes mellitus. Pharmacists, by virtue of their unique expertise, accessibility, and patient-centred approach, are exceptionally well positioned to champion rational OHA use across the entire spectrum of diabetes care — from community pharmacy dispensing to hospital clinical pharmacy and ambulatory care.

The evidence reviewed consistently supports the value of pharmacist-led interventions in improving HbA1c, blood pressure, lipid profiles, adherence rates, and patient quality of life. Collaborative pharmacist–physician models achieve high recommendation acceptance rates and demonstrate cost-effectiveness. Yet significant barriers — structural, professional, and patient-centred — continue to limit the pharmacist's full integration into diabetes care teams globally.

Realising the pharmacist's potential as a key agent of rational OHA use will require coordinated action across multiple domains: legislative recognition and reimbursement frameworks, educational investment in clinical pharmacy training, adoption of digital health tools, expansion of collaborative practice models, and sustained advocacy from the pharmacy profession. As T2DM continues its global rise, the imperative to fully harness the pharmacist's clinical capabilities has never been more urgent.

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