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Adapting Global Diabetes Management Guidelines for Low Resource Settings: Pragmatic Approaches to Care Delivery in north Africa and Beyond"

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is increasing rapidly in low- and middle-income countries (LMICs), where limited resources often restrict the implementation of international diabetes management guidelines. Adapting these recommendations to local healthcare systems is essential to improve patient outcomes.

Objective: To evaluate the applicability of current diabetes management guidelines in low-resource settings and identify practical strategies that balance clinical effectiveness with affordability and accessibility.

Methods: A narrative review of international guidelines and published literature was conducted to compare evidence-based recommendations with the realities of diabetes care in LMICs. The review focused on treatment efficacy, safety, cost-effectiveness, medication accessibility, and healthcare delivery models.

Results: Metformin remains the preferred first-line therapy because of its proven efficacy, safety, and affordability. Second-generation sulfonylureas continue to provide a practical and cost-effective second-line option where access to newer agents is limited. Although SGLT2 inhibitors and GLP-1 receptor agonists offer important cardiovascular and renal benefits, their high cost limits widespread use. Strengthening primary care, ensuring access to essential medicines, implementing simplified treatment protocols, and expanding community-based care can substantially improve diabetes management.

Conclusion: Diabetes care in LMICs requires pragmatic adaptation of international guidelines. Prioritizing affordable therapies and context-specific care models can improve glycemic control, reduce complications, and support sustainable diabetes management.

I) INTRODUCTION:

In 2015, diabetes mellitus was directly responsible for an estimated 1.6 million deaths, underscoring its role as a major global health threat. Just two years later, in 2017, the toll had risen dramatically, with approximately 4 million deaths attributed to diabetes and its complications. Current estimates suggest that more than 425 million individuals worldwide are living with diabetes, and projections indicate that this figure will increase to nearly 629 million by 2045. These statistics highlight the urgent need for effective, resource-appropriate strategies to manage diabetes, particularly in low- and middle-income countries (LMICs), where the burden is rising most rapidly (11,12,13,14,17,22).

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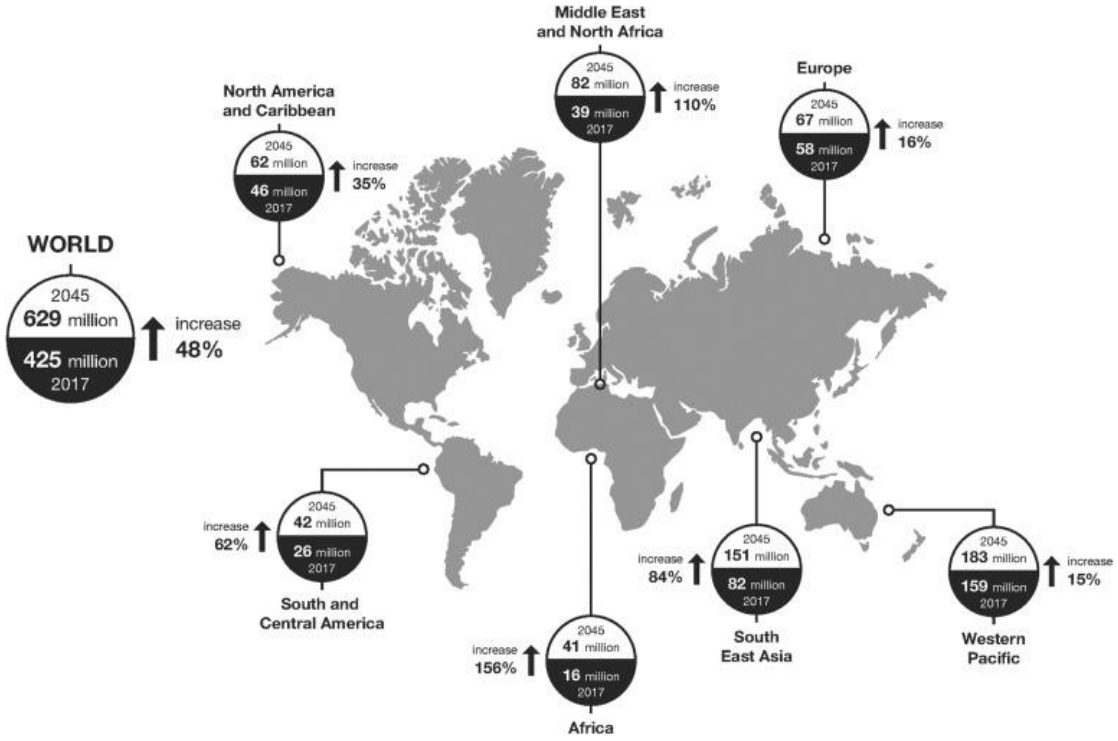


Fig, 1-Number of people with diabetes worldwide and per region in 2017 and 2045 (aged 20–79 years) [2].

Diabetes, once regarded as a disease of affluence, now disproportionately affects LMICs, where nearly 80% of cases occur, predominantly type 2 diabetes mellitus (T2DM). Its prevalence is increasing most rapidly in Africa, the Middle East, South-East Asia, and Central America. Population aging, unhealthy lifestyle changes, genetic susceptibility, and obesogenic environments characterized by sedentary behavior and diets rich in sugar and fat all contribute to this growing epidemic. Furthermore, unique patient phenotypes—including earlier disease onset, higher HbA1c levels, and the development of T2DM at lower levels of obesity, particularly among South Asian populations—present additional management challenges (1,2,4,15,16,19,20,21).

Despite the increasing burden of disease, diabetes care in resource-restricted settings remains suboptimal. Access to medications is often limited, with many patients paying out of pocket. Rising comorbidities and expanding patient populations place additional strain on already scarce healthcare resources. Health systems are frequently fragmented, lacking integrated information systems and coordinated chronic care delivery. Delayed diagnosis further worsens outcomes, as many patients present with established complications at the time of diagnosis (22,23,26,27,28).

A shortage of resource-specific guidelines further compounds these challenges. A recent systematic review highlighted that poorly adapted guidance undermines diabetes care for patients, healthcare providers, policymakers, and payers in LMICs. Moreover, guidelines developed for North American and European populations cannot always be directly translated to resource-limited settings because of differences in patient phenotypes, healthcare infrastructure, and socioeconomic conditions. The World Health Organization (WHO) has therefore developed recommendations that recognize these limitations and better reflect the realities of LMICs, where most people living with type 2 diabetes reside (3,5,6,7,25,28,29,30,31).

II) Search Strategy and Selection Criteria

References for this review were identified through a structured search of PubMed for articles published between January 2015 and November 2018. Search terms included: Cost, Cost effectiveness, Health economics,Low income, Middle income, Maturing country, Low resource, Glycaemic control, Access, Affordability, Treatment initiation, and Treatment persistence. Therapies of interest comprised sulfonylureas, DPP 4 inhibitors (DPP4i), SGLT2 inhibitors (SGLT2i), and GLP 1 receptor agonists (GLP 1RA). Articles retrieved through these searches, along with relevant references cited within them, were reviewed to ensure comprehensive coverage of the available evidence (8,9,10,31,32,33,34).

III) Methods

This project begins with a systematic review that compares the recommendations of the ADA, WHO, and IDF guidelines with the realities of diabetes care in low- and middle-income countries. The review will highlight where global standards align with or diverge from actual practice, providing a foundation for understanding gaps in implementation. Building on this, a survey will be conducted among physicians, nurses, and community health workers to capture frontline perspectives on current practices, barriers, and opportunities for improvement. To assess the economic dimension, a cost effectiveness analysis will compare ADA/EASD based regimens with WHO PEN based regimens, examining both clinical outcomes and affordability in resource constrained settings. Finally, a pilot intervention will be implemented using simplified management protocols, where metformin is the first line therapy, sulfonylurea is introduced as the second line option, and human insulin is used when necessary. This intervention will be supported by structured follow up from community health workers, ensuring continuity of care and patient adherence. Together, these components form a comprehensive approach that integrates evidence synthesis, real world perspectives, economic evaluation, and practical implementation, aiming to generate actionable insights for strengthening diabetes care in LMICs.

IV) GLYCAEMIC CONTROL

Glycaemic control remains the cornerstone of management. The latest ADA/EASD consensus and ADA Standards of Care emphasize individualized treatment, incorporating both established agents (metformin, sulfonylureas) and newer therapies such as SGLT2 inhibitors, DPP 4 inhibitors, and GLP 1 receptor agonists. While these newer agents provide proven benefits, their use in LMICs is constrained by affordability, accessibility, side effects, and patient preferences. Consequently, a pragmatic approach is required—one that balances efficacy, safety, and outcomes with cost and availability (11,12,35,36,37,38,39,40).

Consistent with ADA/EASD recommendations, a patient-centered approach is essential. Treatment decisions must weigh glycaemic efficacy, reduction of vascular complications, safety, adherence, and barriers such as cost and access. In resource-restricted settings, metformin remains the first-line therapy, with sulfonylureas as the most accessible second-line option (48,49,51,53).

This review will therefore examine the evidence for efficacy, outcomes, availability, and accessibility of these treatment options, with a focus on pragmatic strategies for managing type 2 diabetes in restricted-resource environments. Maintaining tight glycaemic control remains a cornerstone of type 2 diabetes management, as it is essential for preventing both microvascular and macrovascular complications. Evidence demonstrates that early intensive glycaemic control—achieving an HbA1c of ≤7.0%—reduces renal complications compared with standard regimens and is safe with respect to cardiovascular outcomes, underscoring its importance in long-term disease prevention (41,42,43,44,45).

In many developing countries, however, opportunities for early intensive intervention are limited. Patients are often diagnosed late, with markedly elevated HbA1c levels, and diabetes is frequently recognized only after serious complications have emerged. This delay contributes to high morbidity

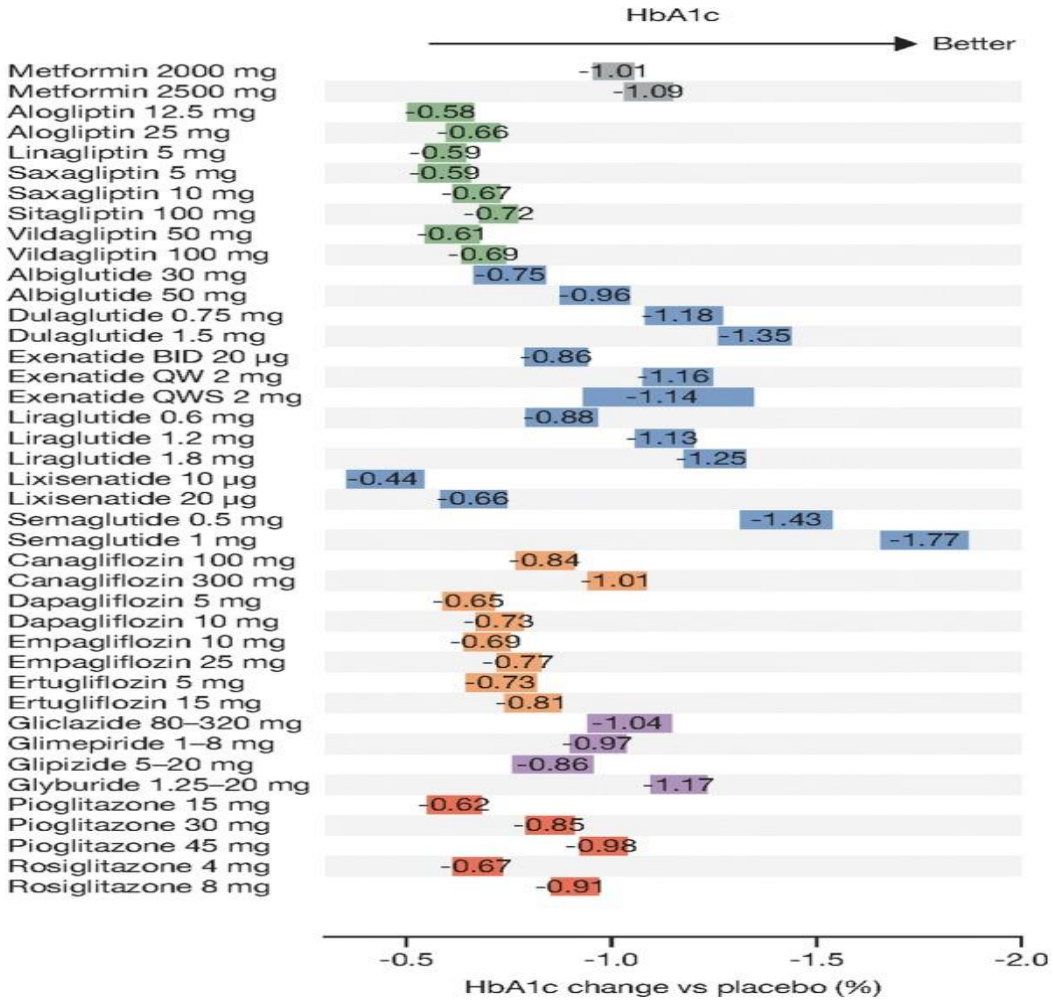
and mortality rates, highlighting the urgent need for accessible and effective glucose-lowering therapies (50,57,58,59,60).

Metformin continues to be the first-line agent worldwide due to its strong efficacy, favorable safety profile, low cost, and broad availability. When metformin alone is insufficient or poorly tolerated, additional options include sulfonylureas, insulin, and newer agents such as SGLT2 inhibitors, DPP 4 inhibitors, and GLP 1 receptor agonists. While these newer therapies offer benefits—particularly in patients with cardiovascular disease—their widespread use in resource-restricted settings is constrained by cost, limited availability, and side-effect profiles.

Table 1- HbA1c reduction by molecule and dosage (drug-naive population with a baseline HbA1c of 8.0% and a baseline weight of 90 kg, after 26 weeks of treatment) (3,6,9,10)

Given these realities, second-generation sulfonylureas (e.g., gliclazide, glimepiride) remain highly relevant. Landmark trials and systematic reviews confirm their ability to lower HbA1c by 1.5–1.6% as monotherapy or in combination with metformin, with proven long-term outcomes. Despite their affordability and effectiveness, sulfonylureas are underutilized, partly due to concerns about hypoglycaemia and cardiovascular safety. Nevertheless, when used appropriately, they represent a pragmatic and cost-effective option for achieving glycaemic targets in low-resource environments.

V) Durability Of Glycaemic Response



Sulfonylureas are well recognized for their ability to achieve rapid and substantial improvements in glycaemic control, often maintaining efficacy for extended periods without the need for immediate add-on therapy. However, evidence suggests that the durability of their response may differ compared with other oral agents (61,62,63).

The TOSCA.IT and RECORD trials, which evaluated sulfonylureas versus thiazolidinediones as add-on therapy to metformin over approximately five years, reported only a modest but statistically significant faster rise in HbA1c with sulfonylureas compared to thiazolidinediones. Similarly, a meta-analysis of 66 randomized controlled trials found that while sulfonylureas were highly effective in the short term, their long-term durability was inferior to sodium–glucose cotransporter 2 inhibitors (SGLT2i), which maintained efficacy for up to two years (64,65,66,67,68).

Evidence regarding dipeptidyl peptidase 4 inhibitors (DPP4i) is mixed. A meta-analysis of eight randomized controlled trials suggested that DPP4i provided more durable glycaemic control than sulfonylureas over 104 weeks. In contrast, a large retrospective cohort study of over 20,000 patients found that DPP4i users required treatment intensification earlier than those on sulfonylureas or thiazolidinediones, with mean time to treatment failure of 1.6 years for DPP4i, 2.4 years for sulfonylureas, and 3.3 years for thiazolidinediones. Furthermore, another meta-analysis of 12 long-term trials indicated that the HbA1c-lowering effect of DPP4i declined during the second year of therapy (69,70,71,72,73,74,75).

Interestingly, a retrospective study of 325 patients aged ≥90 years, with a mean diabetes duration of 23 years, found that sulfonylureas—mainly gliclazide and glimepiride—were the predominant therapy (64.9%), compared with 43.9% in matched patients aged 50–60 years. These findings suggest that sulfonylureas can remain effective and safe even in very long-term survivors of type 2 diabetes (66,76,77,80).

Ultimately, diabetes management often requires treatment intensification over time, regardless of the initial agent. More evidence is needed to fully clarify inter-class differences in durability. The ongoing GRADE trial (Glycemia Reduction Approaches in Diabetes: A Comparative Effectiveness study) is expected to provide valuable insights by directly comparing sulfonylureas, DPP4i, GLP1 receptor agonists, and basal insulin as add-on therapy to metformin over four years in patients with recent-onset type 2 diabetes (78,79,81,82,83,84,85).

VI) Managing Macro and Microvascular Complications

Reducing both macrovascular events (such as cardiovascular death, non-fatal myocardial infarction, and non-fatal stroke) and microvascular events (including nephropathy and retinopathy) is fundamental to improving long-term outcomes in type 2 diabetes, particularly when intervention occurs early in the disease course (86,87).

A Macrovascular complications

Concerns about the cardiovascular safety of sulfonylureas have been addressed by multiple studies, which consistently show no significant difference in the risk of major adverse cardiovascular events or all-cause mortality between second-generation sulfonylureas and other oral glucose-lowering agents (88,89,90,91).

The ADVANCE trial demonstrated that intensification of gliclazide modified-release therapy not only achieved effective glycaemic control but also conferred long-term benefits on microvascular endpoints, including reduced progression of nephropathy and retinopathy. Furthermore, a network meta-analysis of 13 studies found that later-generation sulfonylureas, such as gliclazide and glimepiride, were associated with lower cardiovascular-related mortality compared with older agents, reinforcing their safety profile (91,92,93).

Additional reassurance comes from the TOSCA.IT trial, a large investigator-initiated study in which sulfonylureas (primarily gliclazide and glimepiride) were compared with pioglitazone as add-on therapy to metformin. Over the follow-up period, cardiovascular event incidence was similar between the two groups, supporting the cardiovascular safety of second-generation sulfonylureas.

B Cardiovascular outcomes with newer agents

Several large cardiovascular outcomes trials (CVOTs)—including EMPA REG, CANVAS, LEADER, SUSTAIN 6, and ELIXA—have provided strong evidence that GLP 1 receptor

agonists (GLP1RA) and sodium–glucose cotransporter 2 inhibitors (SGLT2i) confer additional cardiovascular benefits in patients with type 2 diabetes. However, results have varied within each drug class, underscoring the need for careful interpretation.

Notably, SGLT2 inhibitors consistently demonstrate reductions in cardiovascular death and heart failure across a broad spectrum of patients, regardless of whether established cardiovascular disease is present. These findings suggest that the benefits of SGLT2i extend across the continuum of cardiovascular risk. Importantly, in most CVOTs, patients were already receiving metformin, and many were also treated with sulfonylureas, meaning that the observed cardiovascular benefits were achieved on top of these essential therapies (7,14,22,33).

Until recently, direct comparisons between newer agents and sulfonylureas were lacking. The CAROLINA trial addressed this gap by evaluating glimepiride versus the DPP4 inhibitor linagliptin in more than 6,000 adults with type 2 diabetes over six years. The study found no difference in cardiovascular risk between the two groups, providing reassuring evidence of the cardiovascular safety of sulfonylureas. Consistent with prior data, however, hypoglycaemia was more frequent in the glimepiride group compared with linagliptin. Overall, the CAROLINA trial supports the continued use of sulfonylureas, particularly in resource-restricted settings where cost considerations are paramount. Their cardiovascular safety profile, combined with affordability, makes them a pragmatic option when newer agents are unavailable or unaffordable.

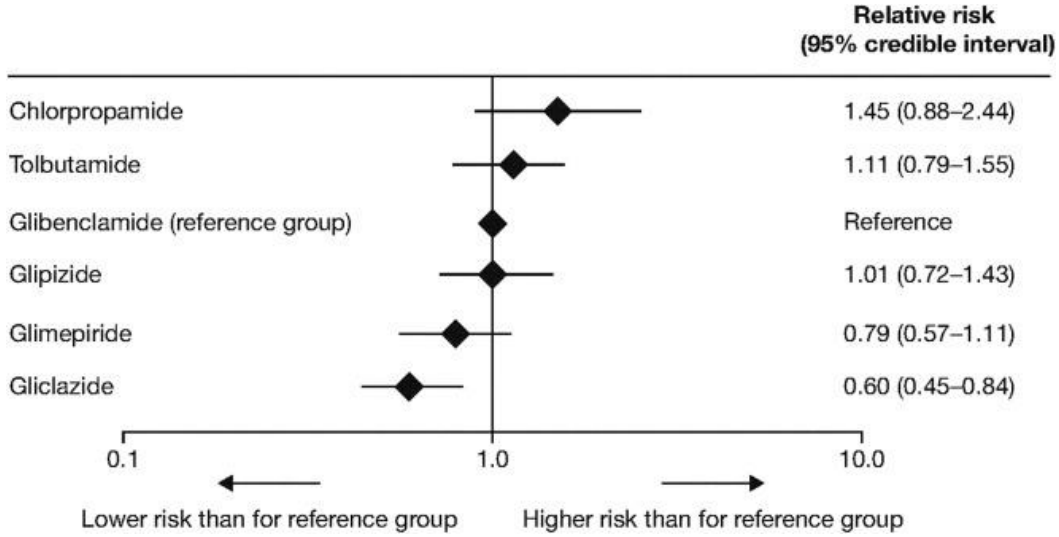


Table 2. Cardiovascular-related mortality risk associated with sulfonylureas [38].

C Microvascular Complications

Effective therapies for type 2 diabetes that also improve renal outcomes are critical, as up to half of patients will develop diabetic kidney disease during their lifetime. Recent cardiovascular outcomes trials (CVOTs) have highlighted potential renal benefits of newer agents, particularly SGLT2 inhibitors and GLP1 receptor agonists.

The CREDENCE trial, for example, demonstrated that canagliflozin reduced the relative risk of end-stage kidney disease by 30% compared with placebo. Despite these promising results, uptake of such therapies remains limited in resource-restricted settings due to high cost, low accessibility, intolerance to injectable agents, and the need for close monitoring of renal function.

Sulfonylureas, however, have long been associated with microvascular benefit. The UKPDS trial showed that intensive glucose control with sulfonylureas reduced the risk of microvascular complications by 25%. Long-term follow-up confirmed that early intensive therapy protected against progression to end-stage renal disease. Similarly, the ADVANCE

study demonstrated that gliclazide modified-release reduced new-onset microalbuminuria, promoted regression to normoalbuminuria, and lowered progression to renal failure. These findings reinforce the role of sulfonylureas as cost-effective agents with proven renal benefits (7,12,33,55).

VII) Hypoglycaemia, Weight Gain and Other Adverse Events

When selecting therapy, clinicians must balance efficacy with safety. Across all glucose-lowering agents—including metformin, insulin, sulfonylureas, SGLT2 inhibitors, DPP 4 inhibitors, and GLP 1 receptor agonists—adverse events such as hypoglycaemia, weight gain, infections, and gastrointestinal disturbances must be considered.

Sulfonylureas have a well-established safety profile, having been in use for more than six decades. Their mechanism of stimulating insulin secretion predisposes to hypoglycaemia and weight gain, though risks vary significantly between first- and second-generation agents. Older sulfonylureas such as glibenclamide are long-acting and produce active metabolites, increasing the risk of prolonged hypoglycaemia. In contrast, later agents such as gliclazide and glimepiride have more favorable pharmacological profiles, with gliclazide associated with a lower risk of hypoglycaemia. Meta-analyses confirm these intra-class differences, consistently reporting reduced hypoglycaemia rates with second-generation sulfonylureas.

The GUIDE trial directly compared gliclazide and glimepiride, showing lower hypoglycaemia risk with gliclazide. In the ADVANCE trial, intensive glucose lowering with gliclazide MR achieved an HbA1c target of ≤6.5% with only a modest increase in severe hypoglycaemia (2.7% vs. 1.5% in the standard-control group), and importantly, risk did not vary across levels of kidney function. Hypoglycaemia remains clinically significant, associated with falls, arrhythmias, confusion, and increased healthcare utilization. Severe hypoglycaemia is also a recognized risk factor for cardiovascular disease. However, with appropriate patient education, careful dose adjustment, and preference for later-generation sulfonylureas, these risks can be minimized while maintaining effective glycaemic control (16,27,43,61,77).

A Hypoglycaemia

- Higher risk with older sulfonylureas (e.g., glibenclamide).
- Lower risk with later agents (gliclazide, glimepiride).
- GUIDE and ADVANCE trials confirm safety when used appropriately.

B Evidence-Based Practice and Special Circumstances

Clinical practice should ideally be guided by evidence, yet prescribing patterns do not always reflect current recommendations. A recent study of general practitioners in England revealed continued use of older sulfonylureas such as tolbutamide and glibenclamide, despite guidance advising against their routine use in type 2 diabetes. This highlights that intra-class differences among sulfonylureas may not be sufficiently emphasized in clinical communication.

Special circumstances, such as fasting during Ramadan—observed by 80–90% of Muslims with diabetes—require careful consideration when prescribing glucose-lowering therapies due to heightened risk of hypoglycaemia. A randomized trial comparing gliclazide with the DPP 4 inhibitor vildagliptin found no significant differences in hypoglycaemic events when combined with metformin, provided patients received Ramadan-specific education and close physician follow-up. These findings support the safe use of both agents in this context (18,19,23,55).

C Weight Gain

Weight gain is a recognized adverse effect of sulfonylurea therapy, though variability exists within the class. In the UKPDS trial, glibenclamide was associated with approximately 4 kg

of weight gain over three years. By contrast, the ADVANCE study reported less than 1 kg of weight gain with gliclazide-based intensive therapy. More recently, the CAROLINA trial showed that sulfonylurea-associated weight gain was relatively modest, with glimepiride producing only a small difference compared to the "weight-neutral" DPP 4 inhibitor linagliptin (between-group difference −1.5 kg). These findings suggest that later-generation sulfonylureas are associated with less weight gain than older agents (75,81,91,92).

Guideline / Source	Key Recommendations	Challenges in Low-Resource Countries	Pragmatic Adaptations
ADA/EASD Consensus	Individualized therapy; early use of SGLT2 inhibitors or GLP-1 receptor agonists for patients with cardiovascular/renal risk; HbA1c monitoring every 3–6 months	High cost of newer agents; limited availability; HbA1c often unavailable; shortage of endocrinologists	Prioritize metformin as first-line; use sulfonylureas as affordable second-line; rely on fasting glucose for monitoring
National Guidelines (varies)	Often mirror ADA/EASD or WHO recommendations	Lack of enforcement; fragmented health systems; out-of-pocket payments	Develop context-specific protocols; integrate diabetes care into primary health services
WHO PEN Protocols	Essential medicines list metformin, sulfonylureas, human insulin; focus on primary care delivery	Stock-outs of essential drugs; weak supply chains; limited training of primary care staff	Strengthen procurement; nurse-led/community health worker models; simplified treatment algorithms
IDF Global Guideline	Emphasizes affordability, lifestyle modification, culturally sensitive interventions; recommends stepwise intensification	Cultural dietary barriers; limited patient education resources; poor adherence	Adapt lifestyle advice to local food practices; use mobile health tools for education and follow-up

Table 3. Comparison of Global Diabetes Guidelines vs. Low-Resource Adaptation

VIII) Affordability And Accessibility

Cost is a critical determinant of treatment choice in both developing and developed countries. For a widespread condition such as diabetes, defining cost effective approaches is essential. Newer agents—including insulin analogues, SGLT2 inhibitors, DPP 4 inhibitors, and GLP 1 receptor agonists—are substantially more expensive than metformin and sulfonylureas. In India, Daily treatment costs are approximately 7–8 rupees for glimepiride and gliclazide, compared with 44 rupees for vildagliptin. With 80% of patients paying out of pocket, this difference imposes a significant burden. In Thailand, the annual costs are reported as US$465 for DPP 4 inhibitors, US$15 for metformin, and only US$4.50 for sulfonylureas. In UK, One year of treatment costs £17–50 for metformin and £34–173 for sulfonylureas, compared with £391–482 for thiazolidinediones, £414–434 for DPP 4 inhibitors, and £830–1432 for GLP 1 receptor agonists. Independent cost effectiveness analyses consistently conclude that sulfonylureas remain the most economical second line therapy. Threshold analyses suggest that newer agents would need price reductions of 60–70% to match sulfonylureas' cost effectiveness. The WHO and IDF guidelines therefore recommend metformin, short acting sulfonylureas, and human insulin as the backbone of therapy in LMICs, reserving newer agents for specific indications. However, industry funded studies often report more favorable cost

effectiveness for newer agents, creating disparities in the literature. Independent analyses, particularly in low resource settings, continue to support sulfonylureas as the most accessible and pragmatic option.

Region / Country	Metformin	Sulfonylureas	Insulin (human)	Notes on Access & Affordability
Brazil (LMIC)	Widely available, free distribution	Widely available, free distribution	Widely available, free distribution	National policy ensures free access in pharmacies; strong example of equitable distribution
India (LMIC)	Available, but out-of-pocket	Available, low cost (7–8 Rp/day)	Available, but affordability varies	~80% of patients pay out of pocket; affordability remains a major barrier
Thailand (LMIC)	Affordable (US$15/year)	Very affordable (US$4.5/year)	Available, cost varies	DPP-4i much higher cost (US$465/year), highlighting affordability gap
UK (HIC)	Low cost (£17–50/year)	Low cost (£34–173/year)	Available	Newer agents (DPP-4i, GLP-1RA) markedly more expensive (£400–1400/year)
Global (PURE study)	Variable	Variable	Variable	Availability and affordability poor in many LMICs; affordability defined as <20% of household income after food expenditure

Table 3. Availability and Affordability of Essential Diabetes Medicines Across Regions.

The 2018 WHO guidelines on pharmacological management of diabetes in low resource settings emphasized that sulfonylureas remain more affordable than newer oral agents for patients who pay out of pocket, making them more accessible. This observation is consistent with the South Asia consensus, which highlights cost as a critical factor in regions where most patients lack medical insurance. As a result, sulfonylureas are often the preferred oral glucose lowering agents in these countries. Their oral administration, once daily dosing, and availability in fixed dose combinations further support adherence. Evidence from India demonstrates that extended release, single pill combinations of metformin and a second-generation sulfonylurea are effective, well tolerated, and associated with low hypoglycaemia risk. Such combinations may even provide pharmacodynamic synergy, with metformin's weight neutral or weight reducing effect offsetting sulfonylurea associated weight gain, though this requires further study. The link between medication cost and adherence is well established. Nonadherence rates remain high worldwide, with estimates of ~40% in India and ~50% in Malaysia. In Nigeria, where most patients pay out of pocket, cost (20.2%) and drug non availability (10%) were reported as major barriers to adherence. Even in high income countries, out of pocket costs can deter initiation of essential therapies, as shown in a California cohort study. Recognizing these realities, the WHO Model List of Essential Medicines includes five diabetes related drugs: short acting insulin, intermediate insulin, metformin, glucagon, and sulfonylureas (specifically gliclazide). This designation underscores their critical role in meeting global healthcare needs and highlights the importance of prioritizing affordable, evidence-based therapies in both low- and high-income settings. Recognizing these realities, the WHO Model List of Essential Medicines includes five diabetes related drugs: short acting insulin, intermediate insulin, metformin, glucagon, and sulfonylureas (specifically gliclazide). This designation underscores their critical role in meeting global healthcare needs (19,34,46,56)

IX) Discussion

The findings of this study show how global diabetes guidelines must be interpreted carefully in the context of low- and middle-income countries. The ADA/EASD recommendations focus on individualized care and the early use of newer agents such as SGLT2 inhibitors and GLP 1 receptor agonists, which have proven cardiovascular and renal benefits. In contrast, the WHO PEN protocols emphasize affordability, essential medicines, and simplified monitoring, which are more practical in resource limited settings. This difference highlights the need for tailoring global guidance to local realities rather than adopting Western standards directly.

Policy implications are clear. Health systems must strengthen procurement to ensure a steady supply of essential medicines like metformin, sulfonylureas, and human insulin. Training programs should expand task shifting to nurses and community health workers, while simplified monitoring and mobile health tools can help overcome the lack of laboratory facilities. These strategies make diabetes care more scalable and sustainable in LMICs. Several barriers remain. High drug costs, frequent stock outs, limited laboratory infrastructure, and cultural dietary practices all reduce the effectiveness of care. Out of pocket payment models directly link affordability to adherence, and many patients struggle to maintain treatment. Fixed dose combinations, such as metformin with sulfonylureas, can improve adherence and balance side effects, offering a practical solution. Clinical evidence supports the continued use of sulfonylureas. Trials such as UKPDS and ADVANCE demonstrate their benefits in reducing microvascular complications. However, prescribing practices in some regions still rely on outdated agents like glibenclamide, showing gaps in communication of guideline updates. Provider education is needed to highlight safer intra class alternatives such as gliclazide.

While newer agents offer strong benefits, their high cost and limited availability restrict their use in LMICs. A balanced approach is required: introducing these drugs selectively for high-risk patients while maintaining sulfonylureas as the backbone of therapy. Strengthening supply chains, improving insurance coverage, and reducing out of pocket burdens will further support equitable access.

If these strategies are implemented, the expected outcomes include better glycemic control, fewer complications, and significant cost savings for health systems. Overall, the study underscores that effective diabetes care in LMICs depends on prioritizing essential medicines, promoting adherence, and adapting global guidelines to local realities.

X) Conclusion

This study highlights the urgent need to adapt global diabetes guidelines to the realities of low- and middle-income countries. While ADA/EASD recommendations promote early use of newer agents, their high cost and limited availability make them impractical for widespread use in resource-constrained settings. The WHO PEN protocols, with their focus on affordability and simplified monitoring, provide a more feasible framework. To strengthen diabetes care, health systems should prioritize the consistent availability of essential medicines such as metformin, sulfonylureas, and human insulin; promote fixed-dose combinations to improve adherence; and expand task-shifting to nurses and community health workers. Mobile health tools can support follow-up where laboratory facilities are limited. Selective introduction of newer agents for high-risk patients should be balanced against equity concerns, ensuring that sulfonylureas remain the backbone of therapy. By improving procurement, supply chains, and insurance coverage, LMICs can reduce out-of-pocket burdens, enhance adherence, and achieve better glycemic control. The result will be fewer complications, lower costs, and more sustainable diabetes care models tailored to local realities.

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