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# Analysis of Antidiabetic Prescriptions for Patients with Type 2 Diabetes at the National Teaching Hospital in Cotonou, Benin

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## Abstract

**Introduction:** A significant number of individuals living with type 2 diabetes (T2D) have poor glycemic control. The quality and adherence to antidiabetic prescriptions are essential for optimizing patient care. **Objective:** To examine the status of antidiabetic medication prescribing among patients with type 2 diabetes followed at the CNHU-HKM. **Method:** This was a cross-sectional, descriptive, and analytical study conducted over three months in the Endocrinology, Metabolism, and Nutrition Department at CNHU-HKM. Prescription adherence was assessed according to the 2019 African Consensus on the Management of Hyperglycemia in T2D and the 2025 ADA recommendations. **Results:** A total of 111 patients were included in the study. The mean age was 61.4 ± 11.1 years, with a predominance of female patients. Overweight and obesity affected 38.7% and 34.2% of the participants, respectively. Metformin was the most commonly prescribed medication (92.3%), followed by sulfonylureas (65.4%). Compliance with the African consensus was 83.8%, and 17.1% of prescriptions complied with both sets of guidelines. The main factors associated with compliance with the African consensus were the absence of treatment inertia ($p < 0.001$), the absence of nephropathy ($p = 0.022$). Among the patients included, 62.2% had good glycemic control (HbA1c ≤ 7%). **Conclusion:** Compliance with the recommendations is generally satisfactory according to the African consensus but remains insufficient according to the 2025 ADA recommendations. Treatment inertia and diabetic nephropathy are the main factors associated with adherence to treatment regimens.

**Keywords**

Type 2 Diabetes, Treatment Inertia, Antidiabetic Drugs, Compliance, Adherence

## 1. Introduction

Diabetes is a major public health problem, particularly in Africa, where its prevalence continues to rise. According to recent data published by the International Diabetes Federation (IDF) [1], Africa, which had 24.6 million reported cases in 2024, will have 59.5 million by 2050. In Cotonou, the economic capital of Benin, a study conducted in 2009 revealed a diabetes prevalence of 4.6%, a significant increase from the 3.3% recorded in 2002. Furthermore, 75.3% of diabetes cases were undiagnosed, highlighting a lack of screening and awareness [2]. The management of T2D relies on lifestyle and dietary measures and the prescription of antidiabetic medications.

However, therapeutic practices vary considerably across different settings despite the existence of guidelines. Data from the literature show that there is a huge disparity in the prescribing and optimization of antidiabetic treatments, which varies by country, even though there are well-updated guidelines in this field. In fact, a study conducted in private pharmacies in Bougouni (Mali) in 2022 showed that 33.33% of patients were treated with biguanides as monotherapy, while the metformin-glibenclamide combination was the most commonly dispensed (41.11%) [3].

In Canada between 2011 and 2012, a study revealed that the majority of patients with diabetes were on monotherapy, primarily metformin (38.7%), followed by insulin (7.4%) and sulfonylureas (7.1%). Combination therapies involving two drugs accounted for 31.8% of cases, while triple therapies remained relatively rare (14.4%) [4].

Furthermore, certain classes of drugs—notably sodium-glucose cotransporter 2 (SGLT2) inhibitors and glucagon-like peptide-1 (GLP-1) receptor agonists—appear to be increasingly favored, even though they are scarcely available in some countries, such as Benin.

This study was therefore initiated to evaluate the prescribing of antidiabetic medications among patients living with T2D in Cotonou.

## 2. Material and Method

We conducted a cross-sectional study with descriptive and analytical objectives over a three-month period, from June 26 to October 3, 2025. This was a comprehensive, consecutive recruitment of all patients who met the inclusion criteria, namely: patients diagnosed with type 2 diabetes who were prescribed antidiabetic medications during the study period, who were followed for at least 12 months, and who provided informed consent. Patients with incomplete medical records

were excluded from the study.

We collected sociodemographic, clinical, paraclinical, and therapeutic data using a data collection form developed for this purpose.

Prescribing practices were evaluated by recording the various classes of antidiabetic medications, which we compared to the African Consensus on the Management of Hyperglycemia in Type 2 Diabetes in Sub-Saharan Africa [5] and the time to treatment optimization.

For well-controlled patients, adherence to the African consensus recommendations was assessed primarily based on the patient's current therapeutic classes. Prescribing is considered compliant when it follows the recommended order of treatment: biguanides as first-line therapy in the absence of contraindications, sulfonylureas or DPP-4 inhibitors as second-line therapy or when biguanides are contraindicated, and finally, insulin as a last-resort treatment.

Any prescription was considered appropriate for a patient with uncontrolled diabetes when both criteria (therapeutic classes and time to optimization) were met.

Therapeutic inertia was defined as a time to therapeutic optimization of more than 6 months without any change in treatment, even though the glycated hemoglobin target had not been achieved.

Diabetic retinopathy was diagnosed if an ophthalmologist reported diabetes-related retinal damage during a fundus examination. Diabetic nephropathy was diagnosed based on the presence of positive microalbuminuria (>30 mg/24 h) and/or a decrease in glomerular filtration rate. Dyslipidemia was defined by any of the following conditions: LDL cholesterol ≥ 0.7 g/L or cholesterol lowering drugs being used, HDL cholesterol < 0.40 g/L in men and at 0.5 g/L in women, total cholesterol ≥ 2 g/L or cholesterol lowering drugs being used, triglyceridemia > 1.5 g/L or Cholesterol Lowering Drugs being used. Peripheral neuropathy was defined as the presence of at least one of the following abnormalities: paresthesia, dysesthesia, or reduction of deep tendon reflexes of the lower limb.

Cardiovascular risk was classified as high in any individual aged 55 years or older with at least two other cardiovascular risk factors, such as obesity, dyslipidemia, hypertension, smoking, or albuminuria of 30 mg/24 h or more [6]. Patients with a history of established cardiovascular disease (myocardial infarction, stroke, or peripheral artery disease requiring revascularization) or conditions such as leg amputation, or symptomatic or asymptomatic coronary artery disease were considered to be at high cardiovascular risk.

To assess compliance with the 2025 ADA recommendations [6], we calculated the sum of cardiovascular risk factors for each patient. Thus, for patients with a history of established cardiovascular disease, those at high cardiovascular risk, or those with chronic kidney disease, the prescription was considered compliant if it included at least one GLP-1 receptor agonist or one SGLT2 inhibitor. For obese patients, the prescription was considered compliant if it included a GLP-1 receptor agonist or a GIP-GLP-1 dual agonist. For the remaining patients, compliance

was assessed by considering the order in which therapeutic classes were prescribed and the time taken to optimize treatment in cases of poor glycemic control.

Statistical analysis was performed using Stata version 15. Comparisons of means were performed using the t-test, and comparisons of proportions were performed using the chi-square test or Fisher's exact test, as appropriate. Statistical significance was set at $p < 0.05$, and model fit was assessed using the Hosmer-Lemeshow test.

## 3. Results

### 3.1. Characteristics of the Study Population

A total of 111 patients were enrolled in the study. Their mean age was 61.4 ± 11.1 years, ranging from 33 to 93 years. The majority of the subjects were 60 years of age or older (61.3%). Women predominated (65.8%), with a sex ratio of 0.52. Regarding the duration of diabetes, the mean was 10.8 ± 7.4 years, ranging from 1 to 35 years. It was 15 years or longer in 32.4% of the participants. Regarding comorbidities, hypertension was the most common (75.7%), followed by dyslipidemia (53.2%). As for chronic complications of diabetes, neuropathy was the most common (58.6%), followed by retinopathy (35.1%) and nephropathy (10.8%). Macrovascular complications accounted for 8.1% and 2.7% for strokes and myocardial infarctions, respectively. The mean glycated hemoglobin (HbA1c) level was 7.1 ± 2.0%, with a range from 4.1% to 14.4%. Furthermore, 62.2% of patients had an HbA1c level of 7% or less (Table 1).

Table 1. General characteristics of patients with type 2 diabetes at the CNHU HKM in 2025, N=111.

| | n (%) or Mean ± SD |
|---|---|
| Age (in years) | 61.4 ± 11.1 |
| <60 | 43 (38.7) |
| ≥60 | 68 (61.3) |
| Female | 73 (65.8) |
| Comorbidities | |
| Hypertension | 84 (75.7) |
| Dyslipidemia | 59 (53.2) |
| Kidney failure | 7 (6.3) |
| Heart failure | 11 (9.9) |
| Hypothyroidism | 8 (7.2) |
| Chronic complications of diabetes | |
| Neuropathy | 65 (58.6) |
| Nephropathy | 12 (10.8) |
| Retinopathy | 39 (35.1) |
| Stroke | 9 (8.1) |

**Continued**

| | |
|---|---|
| Ischemic heart disease | 3 (2.7) |
| Duration of diabetes (in years) | 10.8 ± 7.4 |
| <5 | 28 (25.2) |
| ≥5 | 83 (74.8) |
| High cardiovascular risk | 71 (64) |
| Overweight | 43 (38.7) |
| Obesity | 38 (34.2) |
| HbA1c (%) | 7.1 ± 2 |
| ≤7 | 69 (62.2) |
| >7 | 42 (37.8) |

### 3.2. Therapeutic Data and Analysis of Prescription Adherence

Biguanides were the most commonly prescribed pharmacological class (86.4%), followed by sulfonylureas (61.3%). The time to treatment optimization was within normal limits in 84.7% of cases among those with HbA1c above target. Treatment inertia was observed in 15.3% of prescriptions. In our sample, 83.8% of prescriptions complied with the 2019 consensus recommendations for the management of hyperglycemia in type 2 diabetes in sub-Saharan Africa. The 2025 ADA recommendations were followed in 17.1% of patients (Table 2).

Table 2. Treatment and Prescription Compliance with Recommendations Among Patients with Type 2 Diabetes at CNHU HKM in 2025, N = 111.

| | Sample Size | Frequency (%) |
|---|---|---|
| Class of antidiabetic drugs | | |
| Biguanides (Metformin) | 96 | 86.4 |
| Sulfonylureas | 68 | 61.3 |
| Glinides | 1 | 0.9 |
| DPP-4 inhibitors | 13 | 11.7 |
| SGLT2 inhibitors | 2 | 1.8 |
| Insulin | 18 | 16.2 |
| Therapeutic inertia | 17 | 15.3 |
| Compliance with recommendations | | |
| 2019 African Consensus | 93 | 83.8 |
| ADA 2025 | 19 | 17.1 |
| Both recommendations | 19 | 17.1 |

DPP4: Dipeptidyl peptidase-4, SGLT2: Sodium-glucose cotransporter type 2

### 3.3. Factors Associated with Adherence to the 2019 African Consensus Guidelines

In univariate analysis, a significant difference was observed for treatment inertia (p <

0.001). We also found that, 95.7% of patients without treatment inertia had a compliant prescription, compared with 17.6% compliance among those with treatment inertia (Table 3). Multivariate analysis showed that two variables remained significantly associated with adherence to the 2019 African Consensus on the Management of Hyperglycemia in Type 2 Diabetes in Sub-Saharan Africa in the final model: the presence of nephropathy (p = 0.022) and treatment inertia (p < 0.001) (Table 4).

**Table 3.** Factors associated with adherence to the 2019 African consensus in univariate analysis among patients with type 2 diabetes at CNHU HKM in 2025, N = 111.

| Variables | Compliance n (%) | p |
|---|---|---|
| Age groups | | 0.110 |
| <60 | 33 (76.7) | |
| ≥60 | 60 (88.2) | |
| BMI | | 0.268 |
| Normal | 23 (76.7) | |
| Obesity | 31 (81.6) | |
| Overweight | 39 (90.7) | |
| High cardiovascular risk | | 0.783 |
| No | 33 (82.5) | |
| Yes | 60 (84.5) | |
| Duration of diabetes | | 0.387 |
| <5 | 22 (78.6) | |
| ≥5 | 71 (85.5) | |
| Therapeutic inertia | | <0.001 |
| No | 90 (95.7) | |
| Yes | 3 (17.6) | |

**Table 4.** Factors associated with adherence to the 2019 African consensus guidelines in a multivariate analysis among patients with type 2 diabetes at CNHU HKM in 2025, N = 111.

| Variables | Initial model | | | Final model | | |
|---|---|---|---|---|---|---|
| | OR | p | 95% CI OR | OR | p | 95% CI OR |
| Age group (year) | | | | | | |
| < 60 | 1.0 | 0.964 | [0.2; 5.4] | | | |
| ≥ 60 | 1 | 0.964 | | | | |
| Diabetes Complications/Nephropathy | | | | | 0.022 | |
| No | 10.9 | 0.024 | [1.4; 85.5] | 10.8 | | [1.4; 83.1] |
| Yes | 1 | 0.024 | | 1 | | |
| Therapeutic inertia | | | | | | |
| No | 172.4 | <0.001 | [25.7; 1157.6] | 171.0 | <0.001 | [26.4; 1107.4] |
| Yes | 1 | <0.001 | | 1 | <0.001 | |

## 4. Discussion

We conducted a study whose primary objective was to analyze the prescribing of antidiabetic medications in light of various guidelines.

Overall, the mean age of the patients was 61.4 ± 11.1 years, with ages ranging from 33 to 93 years. This finding is consistent with data from the literature, which shows a marked increase in the prevalence of diabetes with age, due to decreased insulin sensitivity and age-related metabolic changes [6]. Studies conducted in Côte d'Ivoire (Famoussa *et al.*, 2024), Nigeria (Ikem *et al.*, 2022), and Ghana (Adjei *et al.*, 2024) found similar average ages—60.2 years, 60.3 years, and 60.8 years [7]-[9], respectively, confirming that type 2 diabetes generally occurs after the age of 40. In our study, 38.7% of patients were overweight and 34.2% were obese, with a mean body mass index of 28.9 ± 5.2 kg/m$^2$. These results reflect a high prevalence of excess weight among patients with type 2 diabetes. Emeka *et al.* (2022) found comparable proportions, with 32.85% of patients being overweight and 32.85% obese [10]. Hypertension was the most common comorbidity (75.7%). This finding is comparable to those reported by Ekoru *et al.* (2019) in sub-Saharan cohorts, where the prevalence reached 71% among patients with type 2 diabetes. Dyslipidemia was the second most common comorbidity, affecting 53.2% of participants. As in our study, several studies have reported a high prevalence of dyslipidemia in type 2 diabetes [11] [12]. Abnormal lipid profiles and hypertension associated with diabetes significantly increase overall cardiovascular risk, as evidenced by the 64.0% proportion of patients at high cardiovascular risk observed in our study.

With regard to the assessment of prescriptions, the majority of prescriptions (83.8%) were in line with the 2019 Consensus on the Management of Hyperglycemia in Type 2 Diabetes in Sub-Saharan Africa, while 17.1% complied with both the African recommendations and those of the ADA 2025 [5] [6]. This high adherence to regional recommendations could be explained by their better adaptation to the African context, particularly regarding the availability, cost, and accessibility of medications. The 2019 Sub-Saharan Africa Consensus recommends metformin as first-line therapy for the majority of patients with type 2 diabetes, regardless of their cardiovascular risk level, unless contraindicated [5]. This recommendation is fully consistent with our results, as metformin was prescribed to 92.3% of patients, either alone or in combination with other medications. This finding is consistent with international guidelines [6] [13] [14], which also recognize metformin as a drug with good antihyperglycemic efficacy, no effect on body weight, and considered the standard first-line treatment for type 2 diabetes, even though newer classes of medications may, at certain times, be used as first-line therapy in some patients. The high prevalence of sulfonylurea use (65.4%) observed in our study reflects a trend similar to that reported in several African studies. Indeed, Jingi *et al.* (2015), in Cameroon, showed that the two main classes of antidiabetic drugs prescribed were biguanides (77.3%) and sulfonylureas (60.6%) [15]. Comparable results were obtained by Plante *et al.* (2015) in Canada, where metformin accounted for 82% of prescriptions, and by Pinchevsky *et al.* (2017) in

South Africa, where the rates were 86.7% for metformin and 30.6% for sulfonylureas, respectively [4] [16].

These similarities confirm the predominant role of metformin and sulfonylureas in the pharmacological management of type 2 diabetes, particularly in resource-limited settings, where cost and therapeutic accessibility are major determinants of treatment choice.

The low adherence to ADA recommendations could be explained by the high cost and unavailability of certain medications. The ADA recommendations advocate for personalized care centered on the individual, their medical history, and, above all, the patient's level of cardiovascular risk. The profile of patients with type 2 diabetes is often characterized by the presence of other cardiovascular risk factors (dyslipidemia, obesity, hypertension, age) and comorbidities whose management requires new medications such as GLP-1 receptor agonists and SGLT2 inhibitors, which are very difficult to access both financially and geographically. Thus, the low rate of use of GLP-1 receptor agonists and SGLT2 inhibitors, despite the high prevalence of patients at high cardiovascular risk (64%), is easily explained by our findings.

Furthermore, in this study, diabetic nephropathy and treatment inertia were factors significantly associated with adherence to the 2019 Consensus on the Management of Hyperglycemia in Type 2 Diabetes in Sub-Saharan Africa. Patients without nephropathy were 10 times more likely to have a compliant prescription, and the absence of treatment inertia increased this probability by a factor of 171. These results are consistent with several international studies. Indeed, Gimeno *et al.* (2021), in a consensus study conducted in Spain, identified treatment inertia as a major barrier to healthcare providers' adherence to clinical recommendations for type 2 diabetes [17]. Similarly, Orozco-Beltrán *et al.* (2021) demonstrated that the presence of comorbidities and complications reduced the likelihood of good glycemic control and contributed to treatment inertia [18]. These observations are supported by the global survey by Kanumilli *et al.* (2021), which revealed multiple causes of treatment inertia, including fear of hypoglycemia, the complexity of treatment regimens, and time constraints during clinic visits [19].

Diabetic nephropathy also appears to influence adherence due to dosage adjustments and contraindications specific to certain classes of antidiabetic drugs, such as biguanides and sulfonylureas, which are the two most commonly used classes of non-insulin antidiabetic drugs among the subjects included in this study. An Ethiopian study by Demoz *et al.* (2020) also reported low treatment adherence among patients with microvascular complications, including nephropathy [20].

Furthermore, an analysis of factors associated with simultaneous adherence to the recommendations of the African Consensus and the ADA 2025 guidelines revealed the decisive role of body mass index (BMI). Patients who were normal weight or overweight had significantly higher treatment adherence than obese patients. These results are consistent with data from the ADA 2025 guidelines, which emphasize that obesity requires a more specific treatment approach, focused on newer medi-

cations such as GLP-1 receptor agonists and SGLT2 inhibitors. This situation therefore complicates the management of obese diabetic patients, particularly given the challenges in accessing the recommended new medications [6] [13].

Concerning the limitations of this study, as a single-center study conducted at the country's reference center, it does not accurately reflect real-world conditions. Furthermore, the small sample size does not guarantee that the results are representative of the entire population. The high cost of certain drugs, such as GLP-1 agonists and SGLT2 inhibitors, significantly limits their availability and, consequently, their prescribing—even setting aside any considerations related to clinical guidelines.

## 5. Conclusion

An analysis of antidiabetic drug prescriptions among the monitored patients with type 2 diabetes revealed, overall, a high rate of compliance with regional recommendations and a low rate of compliance of prescriptions with international recommendations. This therapeutic adherence appears to be influenced by both clinical factors (presence of complications, obesity) and factors related to both the prescriber and the patient (therapeutic inertia).

## Author Contributions

Conceptualization, Comlan Jules GNINKOUN. and FANOU Joseph; methodology, Comlan Jules GNINKOUN. and FANOU Joseph; investigation, Binjarmin ADJONOUMAKPE; writing—original draft preparation, Comlan Jules GNINKOUN; writing—review and editing, FANOU Joseph; Djeneba Sylla Sow. supervision, Annelie KEREKOU HODE, Armand Wanvoegbe; All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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