

Prices of Anti-Diabetic Drugs Sold in Private Pharmacies in Côte d'Ivoire, 2023: A Secondary Analysis

Akissi Régine Attia Konan^{1,2}, Kouamé Koffi¹, Emeline Annita Hounsa Alla^{1,3},
Anicet Jean Marc Sindé¹, Julie Ghislaine Sackou Kouakou^{1,2}

¹Department of Analytical Sciences and Public Health, Pharmaceutical and Biological Sciences Training and Research Unit-University of Félix Houphouët Boigny, Abidjan, Côte d'Ivoire; ²Center for research and Studies in Population, Policy, and health Systems, National Institute of Public Health, Abidjan, Côte d'Ivoire; ³Department of Health Information and Health Infrastructure Mapping, Health Information Directorate, Abidjan, Côte d'Ivoire

Correspondence: Akissi Régine Attia Konan, University of Félix Houphouët Boigny, BP V34 Abidjan, Abidjan, Côte d'Ivoire, Tel +2250709886212, Email attiaregci@gmail.com

Background: Anti-diabetic drugs help reduce premature diabetes-related mortality. However, their prices constitute a barrier to accessing diabetes treatment. The aim of this study was to analyze the price of antidiabetic drugs sold in private pharmacies in Côte d'Ivoire.

Methods: All anti-diabetic drugs listed in the Côte d'Ivoire drug registration database were selected, and wholesale prices were collected. The median price of insulins was calculated per 1000 units of active ingredient, and that of oral antidiabetics was calculated per 30 days of treatment, based on the maximum daily dose (MDD). Prices were compared with corresponding 2015 International Medical Products Price Guide by calculating the median price ratio.

Results: A total of 138 drugs were identified (123 oral antidiabetics and 15 insulins and analogs). Median prices ranged from US\$39.5 for rapid-acting insulins to US\$245.6 for analogs (Degluteq). Median prices for oral antidiabetics ranged from US\$4.5 to US\$11.3 for Metformin 500mg, from US\$1 (Glibenclamid 5mg) to US\$27.7 (Glimepiride 1mg) for Sulfonylureas, from US\$13.9 (Sitagliptin 50mg) to US\$26.3 (Vidagliptin 50mg) for DDP-4 inhibitors and from US\$24.2 (Empaglifozin 25mg) to US\$39.4 (Empaglifozin 10mg) for SGLT-2 inhibitors. The median price ratio ranged from 7.016 (Human regular) to 38.427 (NPH70/30) for insulins group and from 2.375 (Metformin 500mg) to 26.7 (Glimepirid 4mg) for oral antidiabetics.

Conclusion: Prices of antidiabetic drugs were higher than the international references prices. The development of a pricing policy emphasizing added value and price referencing, together with the development of a local generics industry, could guarantee prices that are accessible to the population and bearable by universal health coverage.

Keywords: accessibility, price, medicines, antidiabetics, Côte d'Ivoire

Introduction

Diabetes mellitus has emerged as a significant public health challenge in Africa, with its prevalence escalating rapidly in recent decades. The number of diabetics is rising steadily, particularly in Africa. In sub-Saharan Africa, in 2021, the number of diabetics was estimated at 24 million, according to the International Diabetes Federation (IDF), which forecasts a 134% increase in the diabetic population to 33 million in 2030, then 55 million in 2045.¹ Diabetes is one of the world's top 10 causes of death, with an increasing risk of premature death.^{2,3} Therapeutic management therefore appears to be a challenge to be overcome. Access to medicines is a prerequisite for achieving the global target of reducing premature mortality from non-communicable diseases (NCDs), including diabetes, by one-third by 2030, as outlined in Sustainable Development Goal (SDG) 3. Back in 2011, the UN Declaration on NCDs committed States to ensuring equitable access to medicines for effective treatment.⁴ Similarly, the WHO Global Action Plan 2013–2020,



extended to 2030, recommended the availability and affordability of 80% of essential medicines (including generics) in the fight against NCDs.⁵ However, in most countries, and particularly in low- and middle-income countries, barriers to access persist; barriers linked mainly to the high price of medicines.^{6–8}

Global estimates reveal that one in two people living with type 2 diabetes do not have access to insulin.⁶ This number is higher in Africa, with 86% of diabetic individuals lacking access to the insulin they need.⁹ Several studies have shown that the cost of treatment with oral antidiabetics is also inaccessible (greater than 1 day's work for the least qualified public employee).^{10,11} The cost of medicines has an impact on patients' ability to pay for their treatment. Pharmaceutical expenditure generated in this way cannot be financed by poor households or by those who do not benefit from a social protection system.

Indeed, at individual level, it is a question of not being exposed to catastrophic health expenses, impoverishment and maintaining compliance with treatment to avoid complications, premature death etc.^{6,12} At the collective level, control of diabetes-related healthcare expenditure must be guaranteed in order to limit excessive and inefficient consumption of healthcare system resources.⁶ In Africa, the price of anti-diabetic drugs varies by a factor of three between generic and branded medicines. These differences are greater in the private sector.^{11,13} In addition, insurance systems are underdeveloped.

The issue of affordability to essential medicines is particularly acute in Côte d'Ivoire. In 2016, 67% of pharmaceutical expenditure was financed by households through direct payments.¹⁴ Over 90% of drug needs are imported, and pricing policies are insufficiently enforced.¹⁵ Drug prices are regulated by a system of total control, and a drug approval procedure is in force.^{16,17} The pharmaceutical sector in Côte d'Ivoire is composed of two primary segments: the private sector, which accounts for the majority of activity (approximately three-quarters of total sales volumes), and the public sector. Policy of generics has been adopted since 1994 following the devaluation of the local currency to improve access to medicines.¹⁸ In the private market, medicine prices are set with the approval of the Ivorian Pharmaceutical Regulation Authority for each brand/company. The Drug Registration Commission is responsible for evaluating both the quality and the pricing of pharmaceutical products. Following the commission's assessment, a marketing authorization is issued. Prices are the classic mechanism for adapting the market to supply and demand,¹⁹ but in Côte d'Ivoire, formal measures to control medicines prices are virtually non-existent as in low- and middle-income countries, and high prices are sometimes observed.²⁰ All medicines are exempt from taxation and thereby this system ensuring uniform pricing of medicines nationwide. Elsewhere, the Ivorian government has introduced a compulsory health insurance system, known as Couverture Maladie Universelle (CMU), instituted by Law N°2014-131 of March 24, 2014, which is part of a framework to reduce health inequalities. Moreover, it was only in 2023 that diabetes care was included in the CMU activity package. The sustainability of funding is therefore a key issue for this insurance system, given that the diabetic population is constantly on the rise, and in 2023 reached 6.2% of people aged between 20 and 79.¹⁶ One of the major constraints is to guarantee a balance in drug expenditure in order to ensure continuity of service. This implies controlling expenditure, which can be achieved through drug prices. The aim of this study was therefore to analyze the wholesale prices of anti-diabetic drugs sold in private pharmacies in Côte d'Ivoire.

Methods

Study Design and Setting

This is a database analysis carried out from March 1 to 31, 2023 on the prices of anti-diabetic drugs registered in Côte d'Ivoire by the Ivorian Pharmaceutical Regulation Authority. This database is freely accessible at the address https://med.airpci.net/liste_des_produits_de_sante. The database comprises 6586 pharmaceutical entries and contains information on the marketing authorization number, the date of acquisition and expiration, the trade name, and the international nonproprietary name. It is systematically updated by the national pharmaceutical regulatory authority whenever a new drug is registered or an existing authorization is renewed. The wholesale prices were extracted from the TEDIS PHARMA database, one of the four national wholesale distributors, following authorization, given that wholesale prices is fixed by the Ivorian Pharmaceutical Regulation Authority and applied nationwide. This database contains wholesale prices, brand-name drugs and international nonproprietary names, as well as dosages and packaging.

Selection of Medicines

All anti-diabetic drugs registered in the database of the Ivorian Pharmaceutical Regulation Authority were included. Combination products were excluded from the list (27 registered in the database as 17% of total antidiabetics registered), as median international prices and Maximum Daily Dose (MDD) were not available. Products with no wholesale price were not included in the study. The molecules listed were classified according to the ATC classification:

- Insulins and analogs (A10A), 15 in number;
- 123 oral antidiabetics (A10B).

None of the drugs belonged to the Other drugs used subgroup (A10X).

Data Collection

A reading grid was used to collect data on the name of the specialty registered on the AIRP site (database of medicines registered in Côte d'Ivoire for free access), the international non-proprietary name, the dosage, the pack size, the pharmaceutical form, the retail price and the brand of the product (originator or generic). Finally, we collected median international buyer unit price from the Management Science for Health website (2015 International Medical Products Price Guide in open access).²¹ Prices were converted to USD (1 USD = 605.69XOF in 2023).

Data Analysis

The median price of insulins was calculated per 1000 units of active ingredient, taking into account the pharmaceutical form and specific dosage. Median prices for oral antidiabetics were calculated for 30 days of treatment, based on the maximum daily dose (MDD) according to formula (1), in order to eliminate the considerable heterogeneity in product presentation between countries and enable comparisons.

Median public price = median unit price x number of doses needed to obtain the maximum daily dose x 30 (1)

Where products were listed alone or with a single price, the median price was listed alone.

Local median public prices were compared with international median prices by calculating the median price ratio using the formula (2):

Median price ratio (MPR) = (Local median unit price) / (median international buyer unit price) (2)

Ethics Statement

This article contains no human or animal studies. The database of medicines registered in Côte d'Ivoire is openly accessible. A request for authorization to use retail price data has been obtained from one of the private wholesaler-distributors.

Results

1- Anti-diabetic drugs registered in Côte d'Ivoire

The list of anti-diabetic drugs registered in Côte d'Ivoire, excluding combinations, is presented in [Table 1](#).

On the private sector pharmaceutical market, the Sulfonylurea and Biguanides chemical subgroups account for over 70% of the supply of anti-diabetic drugs registered in Côte d'Ivoire (excluding combinations). Insulins and analogues account for just 11%.

Median Public Prices of Anti-Diabetic Drugs Sold in Côte d'Ivoire

Median public prices calculated for the insulin and analogues and oral anti-diabetic drugs groups are summarized in [Tables 2 and 3](#).

Short-acting insulins are the least expensive (\$39.5). Analogs are the most expensive among insulins sold on the private market (3 to 12 times more expensive than short-acting insulins).

The median prices of Glibenclamide, Gliclazide, and Metformin are the lowest within the group of antidiabetic medicines, estimated at US\$1 for a monthly treatment of Glibenclamide, between US\$5.8 (Gliclazide 80mg) and US\$9.9

Table 1 Distribution of Antidiabetic Drugs Registered in Côte d'Ivoire by ATC Subgroup, 2023 (N=138)

Chemical Subgroup		Number	Percentage (%)
Insulins and Analogs	Short-acting	5	3.6
	Intermediate-acting	2	1.4
	Rapid-acting analogs	2	1.4
	Basal analogs	3	2.2
	Pre-mixed products	3	2.2
	Total	15	10.8
Blood glucose lowering drugs, excl. insulin	Biguanides	47	34.1
	Sulfonylureas	52	37.7
	Dipeptidyl peptidase 4 (DPP4) inhibitors	20	14.5
	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4	2.9
	Total	123	89.2

Table 2 Median Public Prices of Insulins Sold Privately in Côte d'Ivoire, 2023

Insulins	Compound(s)	Dosage form/ Product	Median Public Price (max, min)
Short-acting	Human regular	U-100 vial	\$39.5 (\$75.5, \$23.5)
Intermediate-acting	Human NPH	U-100 vial	\$84.8
		U-100 pre-filled pen	\$98.2
Rapid-acting analogs	Glulisine	U-100 3mL cartridges	\$153.5
	Aspart	U-100 3mL cartridges	\$491.3
Pre-mixed products	NPH regular 70/30	U-100 vial	\$95.3 (\$125.7, \$75.5)
Basal analogs	Glargine	U-100 pre-filled pen	\$112.6
	Degludec	U-100 pre-filled pen	\$245.6
	Detemir	U-100 pre-filled pen	\$159.6

(Gliclazide 60 mg), and between US\$4.5 (Metformin 500mg) and US\$7.8 (Metformin 850mg). The higher the dosage, the lower the price, except for Metformin and Sitagliptin. There is considerable price variability within the same chemical class. In the Sulfonylureas class, the price of Glimepiride medicine is 4 to 10 higher than that of other drugs in the same pharmacological class.

3- Comparison of local public prices with their international reference price

Table 4 shows comparisons of median unit prices between originator and generic products and the corresponding international buyer reference price.

The Median Price Ratio values are all above 1, indicating that local prices are substantially higher than those observed at the international level. Median price ratios range from 2.375 for Metformin 500mg to 38.427 for NPH insulin. The Biguanides group with Metformin recording the lowest ratios, followed by Glibenclamide (3.2) in the sulfonylureas group.

Table 3 Median Monthly Prices per Maximum Daily Dose in the Subgroup of Oral Antidiabetics Sold in the Private Sector in Côte d'Ivoire, 2023

Class	Compounds	Dosage Strength /Product (mg) (If Applicable)	Median Price (\$) (Max, Min)	Maximum Daily Dose (mg)
Biguanides	Metformin	500 (IR)	4.5 (13.2, 3.4)	2000
		500 (ER)	11.3	2000
		850 (IR)	7.8 (10.9, 5.4)	2550
		1000 (IR)	4.8 (7.7, 4.1)	2000
		1000 (ER)	6.4 (8, 5.2)	2000
Sulfonylureas	Glimepiride	1	27.7 (34.9, 25.4)	8
		2	20.3 (26.1, 6.8)	8
		3	18.9 (31.9, 12.6)	8
		4	16 (29.8, 8.4)	8
	Glicazide	60	9.9 (15.3, 6.1)	60
		80	5.8 (6.8, 4.7)	60
	Glibenclamide	5	1	10
DDP-4 inhibitors	Vidagliptin	50	26.3 (26.7, 15.7)	100
	Sitagliptin	50	13.9 (36.5, 9.2)	100
		100	18.1 (36.7, 7.5)	100
SGLT-2 inhibitors	Empaglifozin	10	39.4 (45.2, 33.4)	25
		25	24.2 (25, 23.4)	25

Abbreviations: IR, Immediate release; ER, Extended release.

Table 4 Comparison of the Median Unit Price with the International Reference Price of Antidiabetics Registered on the Private Market in Côte d'Ivoire (USD)

Compounds	International Median Price	Median Unit Price	Median Price Ratio
Human regular	0.563	3.95	7.016
NPH regular 70/30	0.248	9.53	38.427
Glargine	1.108	11.26	10.16
Metformin 500 mg	0.016	0.038	2.375
Metformin 850 mg	0.015	0.086	5.733
Glimepiride 2mg	0.013	0.169	13.0
Glimepiride 4mg	0.010	0.267	26.7
Glibenclamide 5mg	0.005	0.016	3.2

Notes: International median price concern 2015 MSH International Medical Product Price.

Discussion

Our findings show that the prices of all medicines were higher than the median international buyer price, particularly for the insulin group, reflecting a barrier to their accessibility. Because medicines are not ordinary goods, the development of price regulation policies is of crucial importance for low- and middle-income countries. Worldwide, it is estimated that one in two people do not have access to the insulin they need, with monthly treatment costs as high as US\$100 in Nigeria.² One of the challenges in making insulin accessible is the lack of transparency in pricing.^{2,6} Indeed, pricing is a sensitive issue as it involves the financial interests of pharmaceutical companies and drug accessibility objectives.¹⁹ In Africa, several studies have revealed that drug prices are high,^{22,23} compared with international reference prices^{23–25} as observed in this work. Several factors explain the levels of wholesale prices charged, such as the research process for a drug molecule, regulatory policy and the distribution system that differ inside countries.

Drug prices are significantly influenced by various stages of the research and development (R&D) process, including pre-clinical trials, production, and post-marketing factors.²⁶ In addition, patents granted to originator drugs are often justified as a mechanism to recoup the substantial investments required. Yet, in the case of insulin—discovered more than a century ago in 1921—these costs have long since been recovered.²⁷ Despite this, insulin prices have continued to rise, largely due to product modifications that serve commercial rather than therapeutic interests. The shift from animal insulin to human insulin, and subsequently to analogues marketed as innovations, has resulted in significantly higher costs without proportional improvements in clinical outcomes for many patients.^{8,27} Furthermore, the widespread introduction of prefilled pens and cartridges, while offering convenience, has contributed to making insulin even more expensive and less affordable for vulnerable populations. In Côte d'Ivoire, for example, prices for rapid acting analogs ranged from US\$ 153.5 to 491.3, compared with US\$39.5 for human insulin.

The second factor playing an important role in setting prices is pharmaceutical regulation policy. The weakness of regulatory bodies has often been criticized in Africa.²² In Côte d'Ivoire, public prices are regulated and set by a fixed margin system by a national commission.²⁸ A system where profit margins are fixed from the basic cost of the drug favors the distribution of drugs at high prices.²⁹ As a result, all anti-diabetic drugs sold in the private sector are priced well above their international reference price. Although these regulatory bodies have improved the quality and safety of imported drugs, the way in which drugs are registered contributes to higher prices.³⁰

The drug distribution system also contributes to price increases.²⁹ The public price corresponds to the cost of acquiring medicines, the cost of distribution and the system for financing consumption. In Côte d'Ivoire, drug distribution is highly regulated. In the private sector, only wholesale distributors are authorized to distribute to dispensing pharmacies throughout the country.²⁶ The real costs of distribution are difficult to define, and in practice are spread across all the products distributed. The prices of medicines sold in the private sector are generally very high because, at each stage of the supply chain, intermediaries, often numerous, add their margin on the acquisition price, which can be up to 30% higher.¹⁹ The additional margin for branded products can range from 25% to 500%, with an average of 260%.³⁰ The situation is exacerbated by the weakness of local production covering less than 10% of national needs.¹⁵

Another issue of persistently high price of medicines in low- and middle-income countries, is the contribution to the expansion of black markets. When essential drugs remain unaffordable in formal supply chains, patients may resort to informal or unregulated sources to meet their therapeutic needs.^{31,32} This situation has been documented in Côte d'Ivoire, where about 400 tons of counterfeit medicines were seized over two years. Street vendors and informal markets (eg Roxy in Abidjan) reportedly supply 30–40% of all medicines bought off the streets.³³ This dynamic not only exacerbates inequalities in access to healthcare but also poses significant risks to patient safety, given the high likelihood of substandard or falsified products circulating in such markets. Consequently, the interaction between elevated pharmaceutical prices and the proliferation of black market channels highlights the importance of effective price regulation, transparent procurement mechanisms, and strengthened regulatory oversight to safeguard both affordability and quality of medicines.

However, high prices may encourage pharmaceutical companies to invest in innovation, even though populations have difficulty in accessing medicines. This raises the question of the right price. Lower prices can be offset by higher drug consumption. Thus, public insurance can contribute to better accessibility by negotiating prices and guaranteeing an

optimal level of consumption.¹⁹ However, our study did not take into account price changes over time. Indeed, prices generally decrease with the presence of generic drugs on the market.⁸ Given these high prices, prescribing less expensive antidiabetics such as Metformin in the initial treatment of diabetes could facilitate access to treatment. Indeed, the use of Metformin in 1st line treatment is recommended by the IDF given that the molecule used alone or in combination is linked to low HbA1C levels.³⁴

Limitations

The comparison of median prices with international reference price was conducted using 2015 data, while the present study is based on 2023 data. The 2015 MSH International Medical Product Price Guide has not been updated since 2015 but it's still used for scientific research.³⁵ The data often rely on supplier catalogues or donor procurement prices, which may not accurately reflect actual transaction prices at the country level. Moreover, in Côte d'Ivoire, pharmaceutical prices have shown limited variation over time, as profit margins have remained fixed and maximum price levels are regulated by the government. An over limit is that changes in prices across different time periods were not accounted for this study.

Conclusion

Analysis of wholesale prices of anti-diabetic drugs sold in the private sector reveals high prices, reflecting their financial inaccessibility and a barrier to achieving universal health coverage. Pharmaceutical policy should therefore address the optimization of drug prices while maximizing the well-being of the population, in order to ensure sustainable access to medicines and the financial sustainability of the supply system. Periodic price reviews, taking into account the introduction of generic drugs on the market, would help to reduce the price of anti-diabetic drugs. These measures cannot be achieved without strengthening the capacities of national regulatory agencies in drug pricing mechanisms, to meet the profit requirements of pharmaceutical companies and the accessibility of anti-diabetic drugs.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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