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COST COMPARISON OF ORAL ANTIDIABETIC AGENTS AND INSULIN: EVALUATING AFFORDABILITY AND THE SHIFT TO INSULIN THERAPY IN RESOURCE-LIMITED SETTINGS

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Abstract

Introduction: The economic burden of type 2 diabetes treatment poses significant challenges, particularly in resource-limited settings. This study aimed to compare the cost variations between oral antidiabetic drugs (OADs) and insulin formulations in India, with a focus on affordability and the potential shift to insulin therapy in patients with inadequate glycemic control on dual OADs.

Methods: Price data for commonly prescribed OADs—including metformin, teneligliptin, voglibose, vildagliptin, sitagliptin, repaglinide, tolbutamide, miglitol, pioglitazone, acarbose, glibenclamide, gliclazide, glimepiride, glipizide, linagliptin, and dapagliflozin—were collected from the Current Index of Medical Specialties (CIMS) and verified online sources. Cost per unit and 30-day treatment costs were calculated. Similarly, prices of insulin formulations such as NPH, regular insulin, and biphasic insulin were analyzed for economic feasibility.

Results: OADs displayed wide cost variability. Metformin remained the most affordable (INR 20.7–297), while newer agents like linagliptin (INR 225–1545) and dapagliflozin (INR 150–900) were significantly more expensive. Teneligliptin, vildagliptin, voglibose, and other sulfonylureas also showed substantial price ranges. In contrast, insulin formulations, particularly NPH and regular insulin, were relatively affordable, with prices ranging from INR 129.84 to 490 per 10 mL vial. Insulin delivery devices were inexpensive (INR 4.60–4.70 per unit).

Conclusion: Insulin therapy offers a more cost-effective alternative for patients failing dual OAD therapy. Shifting to insulin could improve affordability and adherence, especially in low-income populations. Policy-level interventions like price regulation and improved access are crucial for effective diabetes management.

Keywords: Affordability, Cost variation, Diabetes management, Insulin, Oral antidiabetic agents, Pharmacoeconomics, Type 2 diabetes

INTRODUCTION

Diabetes mellitus, particularly type 2 diabetes, has become one of the most pressing public health concerns worldwide—and India is no exception [1-10]. With its rapidly rising diabetic population and increasing life expectancy, managing this chronic condition effectively and affordably is a major challenge, especially in resource-limited settings where economic constraints often dictate treatment choices more than clinical guidelines do [11-13].

Oral antidiabetic drugs (OADs) form the backbone of initial diabetes management. However, as the disease progresses, many patients fail to achieve adequate glycemic control with dual OAD therapy alone, necessitating a shift to insulin. Despite clinical recommendations supporting this transition, real-world practice is often hindered by the perceived cost, complexity, and stigma associated with insulin therapy [14].

What is frequently overlooked is that the prolonged use of newer and more expensive OADs—such as DPP-4 inhibitors (e.g., linagliptin, vildagliptin), SGLT-2 inhibitors (e.g., dapagliflozin), and other novel agents—can impose a substantial financial burden on patients. In contrast, certain insulin formulations like Neutral Protamine Hagedorn (NPH) and regular human insulin remain relatively affordable and widely available [15].

This study aims to compare the cost variations between commonly prescribed OADs and insulin formulations in India [16]. By evaluating the monthly treatment costs of both drug categories, we seek to understand whether switching to insulin therapy might actually be a more economical and sustainable approach for patients failing dual OAD therapy [17]. The findings are especially relevant for low-income populations, where affordability often determines access, adherence, and ultimately, outcomes in diabetes care [18].

MATERIALS AND METHODS

Study Design

This was a cross-sectional pharmacoeconomic study conducted to compare the cost of oral antidiabetic agents (OADs) and insulin formulations available in the Indian pharmaceutical market. The primary objective was to assess price variations and affordability from the perspective of monthly therapy costs, particularly in settings with limited healthcare resources.

Data Collection

Price data for both OADs and insulin products were collected during April–July 2024 using the following sources:

- Current Index of Medical Specialties (CIMS), Volume 46, April–July 2024 edition
- Reputed and accredited online pharmacy platforms for cross-verification of retail prices

Drug Class	Drugs
Biguanides	Metformin
Dipeptidyl Peptidase-4 (DPP-4) Inhibitors	Teneligliptin, Vildagliptin, Sitagliptin, Linagliptin
Alpha-Glucosidase Inhibitors	Voglibose, Acarbose, Miglitol
Meglitinides (Glinides)	Repaglinide
Sulfonylureas	Tolbutamide, Glibenclamide, Gliclazide, Glimepiride, Glipizide
Thiazolidinediones (Glitazones)	Pioglitazone
Sodium-Glucose Cotransporter-2 (SGLT-2) Inhibitors	Dapagliflozin

Insulin Class	Insulin Examples
Intermediate-acting Insulin	NPH Insulin (Insugen-N, Human Insulin-N)
Short-acting Insulin	Regular Insulin (Actrapid, Insugen-R, Human Actrapid)
Premixed Insulin	Biphasic Insulin (Wosulin 30/70)
Long-acting Zinc Suspension	Insulin Zinc Suspension (Lentard-R)
Delivery Devices	B-D Micro-Fine syringes

Data Analysis

1. **Unit Cost Assessment:** The cost per tablet (for OADs) or per mL/vial (for insulin) was recorded for both the lowest- and highest-priced brands.
2. **Monthly Treatment Cost:**
    - For OADs: Calculated as the cost of 30 tablets (assuming once-daily or appropriate dosing).
    - For insulin: Cost per 10 mL vial was used; based on typical insulin needs (assuming 40 IU/day), monthly usage was estimated to be 3 vials for most patients.
3. **Affordability Comparison:** The data was tabulated to reflect:
    - Minimum and maximum monthly cost for each drug
    - Cost-effective vs. high-cost options within each class
    - Cost differences between continuing dual OAD therapy vs. switching to insulin

Inclusion Criteria

- Only FDA-approved or DCGI-listed drugs available in India were considered.
- Both branded and generic drug variants were included for a broader cost spectrum.

Exclusion Criteria

- Fixed-dose combinations (FDCs) were excluded to maintain standardization.
- Drugs not listed in CIMS or unavailable for online purchase were omitted.

RESULTS

This study analyzed the cost variability of oral antidiabetic agents (OADs) and insulin formulations available in the Indian pharmaceutical market, focusing on affordability and implications for therapy decisions in resource-limited settings.

1. Cost Variation Among Oral Antidiabetic Drugs (OADs)

A wide range of price differences was observed among brands of the same molecule:

Drug Class	Drug Name	Lowest Cost (INR/30 tabs)	Highest Cost (INR/30 tabs)
Biguanides	Metformin	13.2	297
DPP-4 Inhibitors	Teneligliptin	165	652.5
DPP-4 Inhibitors	Vildagliptin	105	600
DPP-4 Inhibitors	Linagliptin	225	1545
SGLT-2 Inhibitors	Dapagliflozin	150	900
Alpha-glucosidase Inhibitors	Voglibose	63	405
Sulfonylureas	Glimepiride	19.8	486
Sulfonylureas	Gliclazide	37.8	390
Meglitinides	Repaglinide	66	374.4
Others	Pioglitazone	31.5	273.99

- **Metformin** was consistently the most affordable agent.
- **Linagliptin** and **dapagliflozin** were the most expensive OADs.
- Significant intra-drug price variations (over 5x for some drugs) indicate the impact of brand selection on affordability.

2. Cost of Insulin Formulations

The price of commonly used insulin types was notably more consistent and generally lower in comparison to newer OADs.

Insulin Type	Brand Examples	Cost (INR/10 mL vial)
NPH Insulin	Insugen-N, Human Insulin-N	154 – 490
Regular Insulin	Actrapid, Human Actrapid	148.38 – 471.80
Biphasic Insulin	Wosulin 30/70	158.40 – 239.50
Zinc Suspension	Lentard-R	129.84
Syringes (per unit)	B-D Micro-Fine	4.60 – 4.70

- **NPH and regular insulin** emerged as cost-effective options for long-term diabetes management.
- **Delivery devices** remained low-cost, minimizing the additional burden of insulin use.

3. Comparison Between OADs and Insulin Therapy

- Patients on dual high-cost OAD therapy (e.g., dapagliflozin + linagliptin) could be spending INR 2000–2500/month, whereas insulin-based regimens (NPH or regular insulin) cost approximately INR 500–800/month, including syringes.
- The monthly cost savings from switching to insulin could be as high as 60–70%, making insulin a financially sustainable option in many cases of OAD failure.

DISCUSSION

Effective diabetes management in India is increasingly being shaped by a combination of clinical efficacy and economic feasibility. According to the Indian Council of Medical Research (ICMR) Guidelines for Type 2 Diabetes Management (2018) [19], patients failing to achieve target glycemic control with dual oral therapy are advised to either initiate triple oral therapy or transition to insulin therapy. However, in real-world practice, especially in resource-limited settings, cost becomes a decisive factor in determining therapeutic choices.

Our study highlights a wide variation in the cost of oral antidiabetic drugs (OADs), particularly among the newer agents. For example, linagliptin, a DPP-4 inhibitor, was priced as high as INR 1545 per month, while dapagliflozin, an SGLT-2 inhibitor, reached up to INR 900 per month. In contrast, metformin, the cornerstone of first-line therapy, remained the most affordable option, with some brands priced as low as INR 13.2 for a 30-day supply.

These findings are supported by earlier pharmacoeconomic studies in India. A study by Saju et al. (2021) conducted in a tertiary care hospital concluded that the cost of OAD therapy varies significantly based on the drug class and brand, often leading to poor compliance among patients from lower-income backgrounds [20]. Similarly, Tandon et al. (2019) compared the cost-effectiveness of dual therapies and found that metformin + glimepiride was more cost-effective compared to combinations involving newer agents like teneligliptin [21].

Insulin therapy, particularly with NPH and regular insulin, emerged as a more affordable alternative in our study. The average monthly cost of insulin treatment, including delivery devices, was between INR 500–800, making it significantly cheaper than the prolonged use of expensive dual or triple OAD regimens. These findings align with the pharmacoeconomic analysis by Rojas et al. (2021), which demonstrated that switching to insulin in poorly controlled patients may reduce long-term treatment costs [22].

Despite its affordability, insulin use remains limited due to patient reluctance, fear of injections, and lack of education. These psychological and systemic barriers must be addressed through better patient counseling, education programs, and community health support.

Another major concern revealed in our study was the high inter-brand price variability across nearly all drug classes. For instance, the cost of teneligliptin ranged from INR 165 to INR 652.5 per month depending on the brand. Such discrepancies highlight the need for greater regulation, rational prescribing of generics, and public access to price information to empower patients and prescribers.

CONCLUSION

According to the ICMR Guidelines for Type 2 Diabetes Management (2018), patients who fail to achieve target glycemic control with dual oral antidiabetic therapy should either advance to triple oral therapy or transition to insulin therapy. This recommendation underscores the importance of timely and effective treatment intensification to prevent long-term complications.

Our analysis reveals that significant price variations exist among oral antidiabetic drugs (OADs) and insulin formulations, which directly impact treatment affordability—especially in low-resource settings. While metformin continues to be the most accessible and cost-effective OAD, newer agents such as linagliptin and dapagliflozin are priced substantially higher, limiting their use among economically disadvantaged populations.

In contrast, insulin therapy—particularly with NPH and regular insulin—offers a reliable, clinically effective, and economically feasible alternative for patients who require intensified glycemic control. The relatively stable pricing of insulin and its wide availability make it a practical option when dual OAD regimens fail.

Encouraging a shift toward cost-effective insulin therapy, when clinically appropriate, can help reduce the overall financial burden on patients while improving long-term diabetes outcomes. To support this transition, policy-level interventions such as price control, availability of generics, and improved supply-chain mechanisms must be prioritized. These steps are essential to ensure equitable access, better treatment adherence, and ultimately, enhanced quality of care for people living with diabetes.

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