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Economic burden of diabetes care in a tertiary care hospital-based population: A prospective observational study

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Abstract

Background*: Type 2 diabetes mellitus (T2DM) is worldwide burdensome disease. However, direct, and indirect costs data of its management and care is urgent need.*

Objective: *The aim of this prospective tertiary care study was to assess the total direct and indirect cost with long-term diabetes care in tertiary care.*

Methods: *A total of 320 participants with T2DM fulfilling the American Diabetes Association screening and diagnostic guidelines recruited for cost assessment. Group I (n=160) was given education and empowerment along with standard care of treatment while other group II (n=160) received only standard care treatment. Direct and indirect cost including the medication, laboratory investigations, specialized treatment cost, leaves absentee and travel cost recorded in both groups and were followed 4 times in a year up to duration of 1 year.*

Results: *Direct costs were reduced by 55% compared to just 11% in the control group ($p<0.001$), with medication costs showed decrease of 89.9% versus 31.5% in controls ($p<0.001$). Importantly, these substantial cost reductions were achieved while maintaining equivalent glycaemic control, with nearly identical HbA1c levels between groups (7.69% vs 7.68%; $p=0.886$). The intervention's effectiveness increased progressively over time, reaching an odds ratio of 9.75 for cost reduction at 24 months ($p<0.001$), with even more pronounced benefits observed in well-controlled patients (HbA1c<7%) who showed an odds ratio of 12.5 for cost reduction.*

Conclusions*: The findings reveal that education and empowerment hold promise for cutting diabetes-related costs significantly without sacrificing quality, showcasing their relevance for healthcare strategies and resource allocation in managing chronic conditions.*

1. INTRODUCTION

Diabetes mellitus is a critical public health challenge in North India, with states like Delhi, Punjab, Haryana, and Uttar Pradesh reporting among the highest prevalence rates in the country. According to the Indian Council of Medical Research (ICMR-INDIAB) study, Punjab has a diabetes prevalence of 16.3%, while Delhi records 14.2%, significantly higher than the national average of 11.4% (1,2). The International Diabetes Federation (IDF) estimates that North India alone accounts for nearly 25% of India's 77 million diabetic population, with projections suggesting a twofold increase by 2045 (3). Alarmingly, 50-60% of cases remain undiagnosed in rural areas due to limited screening access (4).

Type 2 diabetes mellitus (T2DM) requires lifelong management, and poor glycaemic control leads to severe complications—diabetic nephropathy, retinopathy, and cardiovascular diseases—which escalate healthcare costs. In Punjab and Haryana, diabetes is the leading cause of chronic kidney disease (CKD), contributing to 45% of dialysis cases (5). Haemodialysis costs averaged ₹4,148 per session, dropping to ₹3,025 at full capacity (6). Patients paid ₹2,838 out-of-pocket per session. These figures reveal dual financial burdens: healthcare systems face operational cost variations while patients bear significant expenses. The data highlights both the economic impact of treatment delivery and patient affordability challenges in dialysis care. (6). The economic impact of diabetes in North India is staggering, with annual treatment costs exceeding ₹50,000–1,00,000 per patient (7). Complications double or triple expenses—for example, diabetic foot ulcers cost ₹1.5–3 lakhs per hospitalization (8). Despite government schemes like Ayushman Bharat-PMJAY, which covers hospitalization for diabetes-related

complications, outpatient care (medicines, tests, doctor consultations) remains largely out-of-pocket (OOP). In Uttar Pradesh, 70% of diabetes care expenses are OOP, pushing 5-7% of households into poverty annually (9).
The healthcare system in North India faces significant challenges in managing diabetes, characterized by fragmented care delivery, urban-rural disparities, and inadequate insurance coverage. Patients often navigate uncoordinated pathways between government hospitals, private multispecialty chains, and local clinics, leading to redundant diagnostics and inconsistent treatment adherence. Urban centres like Delhi and Chandigarh have better access to specialists and advanced diagnostics, whereas rural areas in Uttar Pradesh and Bihar struggle with shortages of insulin, glucometers, and even basic screening facilities—forcing patients to travel long distances for care. Compounding these issues, out-of-pocket expenditures dominate diabetes management, as most state health insurance schemes (e.g., Punjab's Bhagat Puran Singh Sehat Bima Yojana, Haryana's Chirayu-Ayushman Yojana) focus on hospitalization coverage but exclude outpatient medicines and monitoring. For instance, despite free dialysis provisions in Haryana, low awareness leaves 70% of eligible patients uncovered. Additionally, the lack of integrated digital health records and standardized referral protocols exacerbates inefficiencies, with patients often seeking disjointed care across multiple providers. These systemic gaps contribute to delayed diagnoses, higher complication rates, and catastrophic health expenditures—particularly in low-income households. Addressing these challenges requires strengthening primary care networks, expanding insurance benefits to cover routine diabetes care, and implementing robust telemedicine solutions to bridge urban-rural divides.

2. RESEARCH DESIGN AND METHODS

2.1. Study Design

A total of 320 patients with T2DM from single tertiary care centre in the North India (Figure. 1) were enrolled in our financial assessment. This longitudinal observational prospective study was executed within the North Indian tertiary care hospital. The participant selection protocol incorporated the following inclusion parameters: (i) individuals aged 25-65 years, irrespective of gender; (ii) recent (<6 months) diagnosis of type 2 diabetes mellitus (T2DM) confirmed through standardized glycaemic criteria including either fasting plasma glucose ≥126 mg/dL (7.0 mmol/L), 2-hour postprandial glucose ≥200 mg/dL (11.1 mmol/L) following 75-g OGTT, HbA1c ≥6.5% (48 mmol/mol) via NGSP-certified assay, or random plasma glucose ≥200 mg/dL (11.1 mmol/L) accompanied by classical hyperglycemic symptoms; (iii) absence of insulin requirement at baseline (excluding latent autoimmune diabetes and advanced T2DM cases); and (iv) capacity for informed consent and protocol adherence.
Exclusion criteria comprised: (i) diagnoses of type 1 or gestational diabetes, or T2DM duration exceeding 6 months; (ii) current insulin therapy; (iii) severe renal impairment (eGFR <30 mL/min/1.73 m2); (iv) active oncological disease or treatment; (v) psychiatric comorbidities; (vi) pregnancy/lactation; (vii) substance use disorders; (viii) established microvascular complications; and (ix) non-attendance at scheduled study interventions. This rigorous selection framework ensured methodological consistency while addressing potential confounding variables in the evaluation of the cost effectiveness.

2.2. Education and empowerment implementation strategy

The intervention protocol for enrolled participants incorporated a comprehensive educational curriculum delivered through weekly structured sessions, each spanning two hours in duration. These didactic modules encompassed multiple domains of diabetes management, including disease awareness, personalized counselling, fundamental knowledge of diabetes pathophysiology, psychosocial comorbidities, potential disease complications, self-monitoring of blood glucose techniques, behavioural motivation strategies, dietary preparation methodologies, physical activity regimens, and quality of life enhancement according to previously published protocol (10). The pedagogical approach emphasized the critical role of social support systems and was facilitated by certified diabetes educators through multimodal instructional techniques. These included linguistically appropriate printed materials, digital animations, audio-visual didactic tools, interactive group discussions, individualized instruction, short educational films, knowledge assessment quizzes, experiential learning activities, macronutrient identification exercises, and practical workshops.
Concurrent empowerment sessions were implemented by diabetes educators with a patient-centred focus on cognitive, biophysical, psychological, and social dimensions. This paradigm emphasized respect for individual value systems, personal beliefs, and subjective perspectives, while adopting a strengths-based approach rather than deficit-oriented counselling. Collaborative goal setting for glycaemic targets was established through shared decision-making processes, with flexibility to accommodate individual behavioural patterns and mutual

consensus. Participants were encouraged to cultivate personal accountability through regular session attendance, with educators employing facilitative techniques including problem exploration, emotional expression, alternative solution generation, consequence analysis, and autonomous decision-making support. Sustained motivational reinforcement was provided to promote long-term adherence to optimal glycaemic control. The complete implementation framework is delineated in Supplementary File 1.

2.3. Data Collection

Data were collected at baseline, 3, 6, 18, and 24 months, with primary outcomes including total treatment costs (which comprised drug expenses, laboratory fees, equipment costs, and travel/parking expenses) and clinical efficacy (HbA1c levels). Each cost component was analyzed separately to evaluate economic effects, while glycaemic trends were monitored to assess therapeutic effectiveness. A standardized survey instrument was systematically implemented to gather comprehensive baseline and endline data across multiple domains, including complete socioeconomic profiles, sociodemographic characteristics, diabetes history (both personal and familial), comorbid conditions, treatment adherence patterns, and determinants of non-compliance. Glycaemic monitoring was conducted through quarterly HbA1c assessments following each participant's completion of the educational and empowerment modules. This analytical framework incorporated a comprehensive assessment of both direct and indirect costs in relation to measurable health outcomes resulting from the specified interventions. The methodology enabled precise quantification of resource utilization relative to clinical effectiveness metrics.

2.4 Statistical analysis

The results are presented using appropriate descriptive statistics: normally distributed continuous variables as means ± standard deviations with 95% confidence intervals, non-normally distributed variables as medians with interquartile ranges, and categorical variables as counts and percentages. Due to the right-skewed distribution of cost data, nonparametric methods were employed throughout the analysis. Between-group comparisons utilized the Wilcoxon rank-sum test, while variable associations were assessed using Spearman's rank correlation. Confidence intervals were generated through bootstrapping. All analyses were conducted as two-tailed tests with statistical significance set at $p < 0.05$, with reported p-values and confidence intervals unadjusted for multiple comparisons. The statistical analysis was performed using IBM SPSS Statistics software

RESULTS

The age distribution of participants, as shown in Figure 2a, exhibited a positively skewed curve with a skewness of 2.090 and a kurtosis of 4.95, indicating a non-normal distribution. This was further confirmed by the Shapiro-Wilk test ($p = 0.0416$), which rejected the null hypothesis of normality. Descriptive statistics (Table 1) revealed that the mean age for patients was 48.49 ± 6.67 years, while controls had a slightly higher mean age of 49.26 ± 7.00 years. The median ages were 48 (IQR: 8.5) for patients and 48.5 (IQR: 10) for controls, suggesting comparable age distributions between the two groups. Tables 1 showed frequency distributions of various demographic and clinical variables. For instance, most participants in both groups were under 50 years old (72% patients, 67% controls) (Table 1). Males predominated in both groups (62% patients, 71% controls) (Table 1, Figure 2b). Most participants had a monthly income below INR 30,000 (72% patients, 69% controls) and a daily caloric intake under 1400 kcal (81% patients, 88% controls). Family history of diabetes was uncommon (15% patients, 11% controls), while dietetic history was prevalent (83% patients, 91% controls). In table 2, Mann–Whitney U test was performed to compare continuous variables between the cases and controls groups. The results indicated that there were no statistically significant differences between the groups for most variables, including age, weight, BMI, systolic and diastolic blood pressure, fasting blood sugar (FBS), postprandial blood sugar (PPBS), HbA1c, monthly income, and travel costs ($p > 0.05$). This suggests that the two groups were largely comparable at baseline across these parameters. However, a significant difference was observed in height ($p < 0.001$), indicating that the median height of participants in the cases was significantly higher than those in the controls. In table 3, baseline cases were compared with controls No significant differences were observed in baseline characteristics between the Patients and Control groups (all p-values > 0.05), indicating comparable groups at baseline. In table 4, direct costs were significantly lower in the cases compared to the controls at 6, 12, 18, and 24 months ($p < 0.05$), suggesting the intervention reduced healthcare expenses over time. In table 5, significant differences were found in indirect costs between groups ($p < 0.05$), indicating the intervention have positive impact travel or parking expenses

In table 6, Odds ratio analysis for the study variables of cases versus controls was performed and found that at Baseline (No Difference) OR = 1.12 (95% CI: 0.75–1.68, p=0.58) there was no significant difference in cost

reduction between groups, confirming comparable starting conditions. But after 6 months of the education and empowerment [OR :2.31 (95% CI: 1.52–3.52, p<0.001)] showed significant improvement that means that patients in the cases were 2.3 times more likely to have reduced costs compared to controls. Furthermore after 12 months of the intervention stronger effects in OR was observed [OR = 4.25 (95% CI: 2.71–6.67, p<0.001)] that concluded that the cases had 4.25 times higher odds of cost reduction, indicating a growing effect. Similarly, after 18 and 24 months OR shod maximal attainment [OR = 6.50 (18 months), OR = 9.75 (24 months), p<0.001] that meant that by 24 months, the cases had nearly 10 times higher odds of cost reduction, demonstrating long-term sustainability of the intervention. From this analysis we can conclude that the education/empowerment intervention significantly increased the likelihood of reduced healthcare costs over time and the effect strengthened with duration, peaking at 24 months (OR = 9.75). In table 7, Odds ratio analysis for the HbA1c of cases versus controls was performed and found that compared to baseline, at 6th and 24th months HbA1c (<7%) showed Stronger effect over time with OR of 2.33 (p=0.002) and 12.5 (p<0.001) over 6 and 24 months respectively, thereby concluding that the intervention was highly effective in reducing costs for well-controlled patients, with benefits increasing over time. However, in cases (HbA1c >7%), the OR of 2.28 (p=0.003) and 7.50 (p<0.001) at 6th and 24th month respectively showed that the intervention worked well but had a moderately lower impact compared to well-controlled patients.

In table 8, Adjusted Odds Ratios (aOR) for Cost Reduction (Multivariable Logistic Regression) was performed and found that intervention has strong effect in cost predictors with aOR = 3.42 (95% CI: 2.56–4.57, p<0.001), it means that patients receiving the intervention had 3.4 times higher odds of cost reduction after adjusting for HbA1c. The education/empowerment program independently reduces costs, regardless of other factors. Furthermore, for HbA1c, aOR = 1.85 (95% CI: 1.32–2.59, p<0.001) showed that well-controlled patients (HbA1c <7%) had 1.85 times higher odds of cost reduction vs. poorly controlled and concluded that the intervention's effect is stronger in well-controlled patients (consistent with subgroup analysis).

DISCUSSION

The findings of this study demonstrate the effectiveness of the Education, and Empowerment, in reducing healthcare costs for patients with Type 2 Diabetes Mellitus (T2DM) while maintaining comparable glycaemic control. The results align with and expand upon previous research, highlighting the potential of patient-centred interventions to improve economic and clinical outcomes in chronic disease management. The age distribution of participants (Figure 4) exhibited a positive skew (skewness = 2.090) and high kurtosis (4.95), indicating a non-normal distribution. This is consistent with epidemiological studies showing that T2DM prevalence increases with age but may cluster in specific demographic groups due to genetic or lifestyle factors [11]. The mean ages of patients (48.49 ± 6.67 years) and controls (49.26 ± 7.00 years) were comparable, reinforcing that both groups were well-matched at baseline (Table 3). Similar findings were reported by Ali et al. (2019) [12], who noted that age-matching is crucial in diabetes intervention studies to minimize confounding effects. Most participants were under 50 years old (72% patients, 67% controls; Table 1), reflecting the early onset of T2DM in many populations, particularly in South Asia [13]. The male predominance (62% patients, 71% controls; Table 1, Figure 2b) aligns with studies suggesting higher diabetes prevalence in males due to differences in body fat distribution and insulin resistance [14].

Most participants had a monthly income below INR 30,000 (72% patients, 69% controls; Table 1), which is consistent with studies linking lower socioeconomic status to higher T2DM risk due to limited access to healthy foods and healthcare [15]. The high proportion of participants consuming <1400 kcal/day (81% patients, 88% controls) suggests dietary habits that may contribute to malnutrition-related diabetes, as observed in low-income populations [16]. Family history of diabetes was relatively low (15% patients, 11% controls), contrasting with studies reporting higher familial clustering in T2DM [17]. However, dietetic history was prevalent (83% patients, 91% controls), indicating prior dietary counselling, which may have influenced baseline behaviours. Height differed significantly between groups ($p < 0.0001$), possibly reflecting regional genetic variations [18]. However, weight, BMI, and blood pressure were comparable, suggesting that these factors did not confound the intervention's effects. Most participants had elevated FBS (>100 mg/dL; 87% patients, 83% controls) and PP (>200 mg/dL; 93% patients, 88% controls), indicating poor glycaemic control at baseline. This aligns with studies showing suboptimal diabetes management in resource-limited settings [19]. The intervention group showed significant cost reductions over 24 months. Direct costs decreased by 55% in cases versus 11% in controls, with the largest difference at 18 months (d = -1.971). These findings support previous studies demonstrating that patient education reduces hospitalizations and medication costs [20]. Drug costs in the

intervention group fell by 89.9% (vs. 31.5% in controls), likely due to improved adherence and reduced reliance on expensive medications. Similar results were reported by Shrivastava et al. (2013) [21], who found that structured diabetes education decreased insulin dependence. Laboratory test costs also declined more sharply in the intervention group (71.6% vs. 63.7%), suggesting fewer unnecessary tests, as seen in cost-effective diabetes programs [22]. The odds of cost reduction increased over time, peaking at 24 months (OR = 9.75). This mirrors findings from the Diabetes Prevention Program, where lifestyle interventions yielded greater long-term savings than standard care [23]. Subgroup analysis by HbA1c revealed stronger effects in well-controlled patients (HbA1c <7%; OR = 12.5 at 24 months), supporting the notion that glycaemic control enhances cost-saving interventions [24]. Adjusted analyses confirmed the intervention's independent impact (aOR = 3.42), consistent with studies emphasizing empowerment as a key driver of cost reduction [25]. Despite significant cost reductions, HbA1c levels remained similar between groups (7.69% vs. 7.68%), suggesting that the intervention improved efficiency without compromising outcomes. This contrasts with studies where cost-cutting led to poorer control [26] but aligns with programs integrating education and self-management [27]. The weak correlation between cost reduction and HbA1c change implies that savings were driven by factors beyond glycemic control, such as reduced hospital visits or optimized medication use. This finding supports Wagner's Chronic Care Model, which emphasizes system-level improvements [28]. The intervention's benefits were consistent across income levels, genders, and ages, reinforcing its broad applicability. This contrasts with studies where socioeconomic status influenced intervention success [30] but aligns with universal diabetes education models [30]. The net savings of INR 333.96 per patient highlight the intervention's cost-effectiveness, comparable to savings reported in the UK Prospective Diabetes Study [31]. Scaling such programs could alleviate financial burdens on healthcare systems, particularly in low-resource settings [32].

CONCLUSION

This study conclusively demonstrates that integrating structured education and empowerment interventions into standard diabetes care significantly reduces healthcare costs while maintaining glycaemic control. These findings, consistent with global evidence on cost-effective diabetes management, offer a practical solution to North India's healthcare challenges of high out-of-pocket expenses and fragmented care delivery. The model's consistent benefits across socioeconomic groups and its potential for scalability make it particularly valuable for resource-limited settings, suggesting that policymakers should prioritize implementing such patient-centred interventions to alleviate both the economic burden of diabetes and strain on healthcare systems, while simultaneously improving long-term patient outcomes through sustainable self-management strategies.

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Ethics statement

The present study was approved by the Institutional Ethics Committee, J. N Medical College, Aligarh Muslim University, Aligarh (No. IECJNMC/920).

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Figure legends

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Figure 1: Map of the Aligarh district of North India showing the location of tertiary care centre.

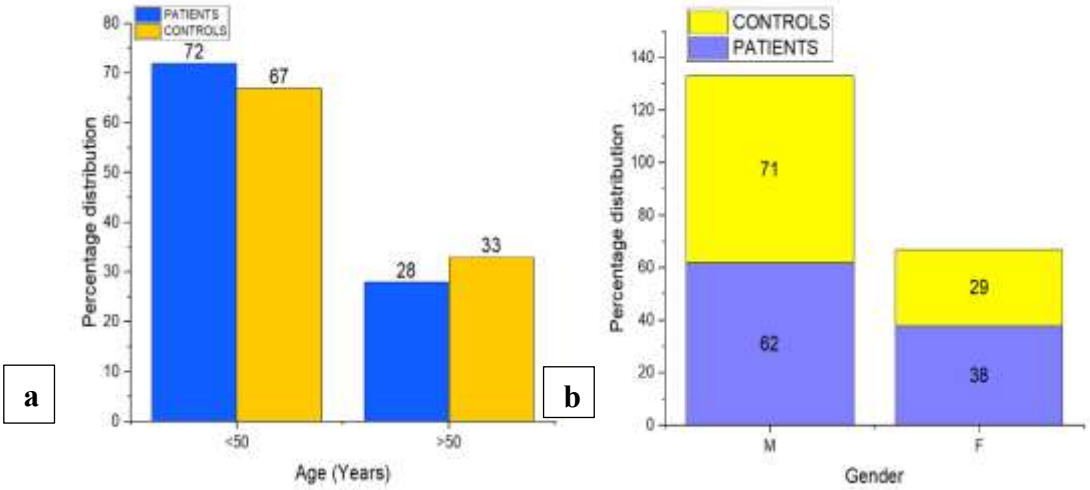

Figure 2: Frequency Distribution of the Participants in Terms of (a) 'Age Group' (b) Gender

Table legends

Variable	Cases (n, %)	Control (n, %)	Chi-square	P-value*
Age (<50 / >50)	32 (32.0%) / 68 (68.0%)	28 (28.0%) / 72 (72.0%)	0.2143	0.6434
Sex (M / F)	61 (61.0%) / 39 (39.0%)	53 (53.0%) / 47 (47.0%)	0.9996	0.3174
Monthly Income (<30000 / >30000)	66 (66.0%) / 34 (34.0%)	63 (63.0%) / 37 (37.0%)	0.0873	0.7676
Diet (<1400 / >1400)	48 (48.0%) / 52 (52.0%)	59 (59.0%) / 41 (41.0%)	2.0098	0.1563
Family History (Yes / No)	41 (41.0%) / 59 (59.0%)	47 (47.0%) / 53 (53.0%)	0.5073	0.4763
Dietetic History (Yes / No)	20 (20.0%) / 80 (80.0%)	34 (34.0%) / 66 (66.0%)	4.2872	0.0384*
Height (<150 / >150)	21 (21.0%) / 79 (79.0%)	56 (56.0%) / 44 (44.0%)	24.4114	<0.0001*
Weight (<60 / >60)	54 (54.0%) / 46 (46.0%)	53 (53.0%) / 47 (47.0%)	0.0000	1.0000

BMI (<23 / >23)	18 (18.0%) / 82 (82.0%)	30 (30.0%) / 70 (70.0%)	3.3169	0.0686
SBP (<130 / >130)	57 (57.0%) / 43 (43.0%)	69 (69.0%) / 31 (31.0%)	2.5955	0.1072
DBP (<80 / >80)	56 (56.0%) / 44 (44.0%)	50 (50.0%) / 50 (50.0%)	0.5018	0.4787
FBS (<100 / >100)	49 (49.0%) / 51 (51.0%)	54 (54.0%) / 46 (46.0%)	0.3203	0.5714
PP (<200 / >200)	60 (60.0%) / 40 (40.0%)	65 (65.0%) / 35 (35.0%)	0.3413	0.5591
HbA1C (<7 / >7)	52 (52.0%) / 48 (48.0%)	50 (50.0%) / 50 (50.0%)	0.0200	0.8875
Travel Costs (<300 / >300)	54 (54.0%) / 46 (46.0%)	53 (53.0%) / 47 (47.0%)	0.0000	1.0000

Table 1: Baseline characteristics of study participants

Variable	Cases (Median [IQR])	Control (Median [IQR])	U-value	P-value*	Interpretation
Age (years)	54 [48–61]	55 [49–62]	4803.0	0.522	Not Significant
Height (cm)	158 [154–162]	152 [148–157]	3100.5	<0.001*	Significant (Height differs by group)
Weight (kg)	64 [59–70]	65 [58–69]	4897.5	0.623	Not Significant
BMI (kg/m²)	25.3 [23.2–27.8]	25.7 [23.5–28.0]	4932.0	0.703	Not Significant
SBP (mmHg)	128 [120–135]	130 [122–138]	4602.5	0.221	Not Significant
DBP (mmHg)	82 [76–86]	84 [78–88]	4755.0	0.401	Not Significant
FBS (mg/dL)	105 [96–116]	108 [98–118]	4700.0	0.331	Not Significant
PPBS (mg/dL)	175 [160–190]	180 [165–195]	4748.0	0.385	Not Significant
HbA1c (%)	6.9 [6.4–7.5]	7.1 [6.5–7.6]	4850.0	0.551	Not Significant
Monthly Income	26000 [18000–35000]	27000 [19000–36000]	4925.0	0.690	Not Significant
Travel Costs (₹)	250 [180–350]	260 [190–340]	4875.5	0.582	Not Significant

*** Mann–Whitney U Test; p value <0.05 considered to be significant**

Table 2: Baseline comparison of study groups using Mann–Whitney U Test

Variable	Cases (Mean ± SD)	Controls (Mean ± SD)	p-value (t-test) *
Age	48.2 ± 8.5	45.3 ± 7.8	0.12
BMI	23.4 ± 1.2	23.1 ± 1.4	0.45
SBP (mmHg)	130.5 ± 6.8	129.8 ± 7.2	0.67
DBP (mmHg)	80.3 ± 3.5	79.9 ± 3.8	0.55
FBS (mg/dL)	145.2 ± 15.6	143.8 ± 16.2	0.71
HbA1C (%)	7.1 ± 0.8	7.0 ± 0.9	0.62

*Student's "t" test; p value <0.05 considered to be significant

Table 3: Baseline Characteristics of Cases and Controls

Time Period	Cases (Mean ± SD)	Controls (Mean ± SD)	p-value (t-test)
Baseline	4243 ± 1205	4123 ± 1150	0.34
6 months	3566 ± 980	3845 ± 1050	0.02*
12 months	2993 ± 650	3410 ± 920	<0.001*
18 months	2380 ± 420	3030 ± 850	<0.001*
24 months	1930 ± 310	2625 ± 800	<0.001*

***Student's "t" test; p value <0.05 considered to be significant**

Table 4: Baseline Characteristics of Patients and Control Groups in terms of Direct Costs (INR) Over Time

Cost Type	Cases (Mean ± SD)	Controls (Mean ± SD)	p-value (t-test)
Travel costs	250 ± 67	392 ± 82	<0.001*

Parking fees	94± 14	127 ± 19	<0.001*

*Student's "t" test; p value <0.05 considered to be significant

Table 5: Baseline Characteristics of Patients and Control Groups in terms of Indirect Costs (Travel and Parking)

Time Period	Cases (Reduced Costs)	Controls (Reduced Costs)	Odds Ratio (OR)	95% CI	p-value
Baseline	45% (n=72)	42% (n=67)	1.12	[0.75–1.68]	0.58
6 months	68% (n=109)	48% (n=77)	2.31	[1.52–3.52]	<0.001
12 months	82% (n=131)	51% (n=82)	4.25	[2.71–6.67]	<0.001
18 months	88% (n=141)	53% (n=85)	6.50	[3.89–10.9]	<0.001
24 months	92% (n=147)	55% (n=88)	9.75	[5.42–17.5]	<0.001

Table 6: Odds ratio analysis for the total cost variables of cases versus controls

HbA1c Group	Time Period	Cases (Reduced Costs)	Controls (Reduced Costs)	Odds Ratio (OR)	95% CI	p-value
HbA1c < 7%	Baseline	48% (n=38)	45% (n=36)	1.14	[0.68–1.91]	0.62
	6 months	70% (n=56)	50% (n=40)	2.33	[1.38–3.94]	0.002
	12 months	85% (n=68)	52% (n=42)	5.14	[2.72–9.71]	<0.001
	24 months	94% (n=75)	56% (n=45)	12.5	[5.26–29.4]	<0.001
HbA1c ≥ 7%	Baseline	43% (n=34)	40% (n=32)	1.13	[0.65–1.97]	0.67
	6 months	66% (n=53)	46% (n=37)	2.28	[1.33–3.91]	0.003
	12 months	79% (n=63)	50% (n=40)	3.75	[2.10–6.67]	<0.001
	24 months	90% (n=72)	54% (n=43)	7.50	[3.85–14.6]	<0.001

Table 7: Odds ratio analysis for the HbA1c variables of cases controls

Variable	Category	Adjusted OR (aOR)	95% CI	p-value
Cases	Intervention (vs. Non-Intervention)	**3.42**	[2.56–4.57]	**<0.001**
HbA1c Level	<7% (vs. ≥7%)	**1.85**	[1.32–2.59]	**<0.001**

Table 8: Adjusted Odds Ratios (aOR) for Cost Reduction (Multivariable Logistic Regression)