

## Impact of hypertension and diabetes on epidemiology of coronary artery disease

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### Abstract

This study investigates the epidemiological impact of hypertension and diabetes on coronary artery disease (CAD) in a sample of 391 patients from Jodhpur, India. Focusing on the prevalence, duration, and combined effects of these conditions, we assessed their relationships with overall quality of life, treatment satisfaction, and confidence in disease management. The correlation analysis indicated no statistically significant relationships between the duration of hypertension, diabetes, or CAD and quality of life or treatment satisfaction, suggesting these conditions might not independently drive quality-of-life changes within this cohort. Multiple regression analysis highlighted that only age had a significant effect on quality of life ( $p = 0.025$ ), with older patients reporting slightly higher quality-of-life scores. This model, however, accounted for only 1.9% of the variance in quality of life, underscoring the need for further exploration of other contributing factors. Ordinal logistic regression revealed no significant predictors of confidence in managing conditions, suggesting that unexamined psychosocial or clinical factors may influence patients' self-assessment of disease management capabilities. These findings underscore the multifaceted epidemiological burden of managing comorbid hypertension, diabetes, and CAD, emphasizing the need for integrative public health strategies that address both medical and quality-of-life impacts to enhance patient outcomes in CAD populations.

**Keywords:** Epidemiology of Coronary Artery Disease; Hypertension and Diabetes Impact; Quality of Life in CAD Patients; Disease Management Confidence; Chronic Disease Comorbidity

### 1. Introduction

Coronary artery disease (CAD) remains a leading cause of morbidity and mortality worldwide, with a growing prevalence driven by chronic conditions such as hypertension and diabetes. As risk factors, hypertension and diabetes are particularly impactful in CAD epidemiology due to their role in accelerating atherosclerosis, endothelial dysfunction, and plaque formation. Studies have shown that the presence of these comorbidities not only increases the likelihood of CAD development but also exacerbates the disease course, leading to more severe outcomes and heightened healthcare burdens (Kannel & McGee, 2012).

The rise in CAD cases in regions like Jodhpur, India, reflects broader global trends, where hypertension and diabetes are increasingly prevalent, particularly in urban areas experiencing rapid lifestyle shifts. In India, the age-standardized prevalence of CAD is among the highest globally, with studies indicating that over 75% of CAD patients have coexisting hypertension, diabetes, or both (Goyal et al., 2019). The intersection of these comorbidities intensifies disease progression and complicates management, underscoring the need for an epidemiological focus on CAD's primary contributors. Understanding the influence of hypertension and diabetes on CAD not only provides insights into disease mechanisms but also informs public health strategies aimed at mitigating risks and improving patient outcomes.

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While significant literature has explored CAD's clinical progression, there is limited evidence on how the duration and severity of hypertension and diabetes impact CAD's epidemiological characteristics, particularly in underrepresented populations. This study addresses this gap by examining the relationships between hypertension, diabetes, and CAD in a sample of CAD patients from Jodhpur. Specifically, we assess the impact of these comorbidities on quality of life, treatment satisfaction, and confidence in disease management. By analyzing these factors, the study aims to contribute valuable data to inform targeted interventions, optimize disease management, and ultimately improve life expectancy and quality of life for CAD patients affected by hypertension and diabetes.

### *Objectives of the Study*

- To assess the quality of life and functional limitations experienced by patients with both hypertension and diabetes who have CAD, focusing on self-reported physical, emotional, and social well-being.
- To evaluate patient-reported symptoms and the frequency of lifestyle modifications among individuals with CAD, hypertension, and diabetes, identifying common challenges and barriers to effective disease management.
- To determine the impact of hypertension and diabetes on daily activities and overall health satisfaction in CAD patients, with a specific focus on patient perceptions of their health and treatment effectiveness.

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## **2. Methodology**

### **2.1. Study Design and Sample**

This cross-sectional study examines the impact of hypertension and diabetes on the epidemiology of coronary artery disease (CAD) in a population sample from Jodhpur, India. Data were collected from 391 CAD patients diagnosed with comorbid hypertension and/or diabetes, selected from healthcare facilities in the region. Participants were included if they had confirmed diagnoses of CAD, hypertension, and/or diabetes and were over 18 years old. Informed consent was obtained from all participants, ensuring ethical compliance.

### **2.2. Data Collection**

Data were gathered using structured questionnaires and patient records. The questionnaire included sections on demographic information, duration of hypertension, diabetes, and CAD, as well as patient-reported outcomes such as quality of life, functional limitations, treatment satisfaction, and confidence in managing their health conditions. The survey design was developed to capture self-reported physical, emotional, and social well-being in alignment with the study objectives.

### **2.3. Variables**

#### *2.3.1. Independent Variables*

- Hypertension Duration: Coded on a scale from 1 to 4 (Less than 1 year, 1-3 years, 4-6 years, More than 6 years).
- Diabetes Duration: Coded similarly from 1 to 4, based on the number of years since diagnosis.
- CAD Duration: Coded on the same scale as the other conditions.
- Age: Recorded in age categories (Under 30, 30-40, 41-50, 51-60, Over 60).
- Gender: Coded as Male, Female, and Other.

#### *2.3.2. Dependent Variables*

- Quality of Life: Assessed on a 5-point scale (Excellent to Very Poor).
- Satisfaction with Treatment: Measured on a 5-point scale from Very Satisfied to Very Dissatisfied.
- Confidence in Managing Health: Measured using an ordinal scale from Very Confident to Not Confident at All.

### **2.4. Statistical Analysis**

- Descriptive Statistics: Frequency and percentage distributions were used to describe demographic variables, duration of conditions, and patient-reported outcomes.
- Correlation Analysis: Spearman correlation was used to assess the relationships between the duration of hypertension, diabetes, CAD, and quality of life, as well as satisfaction with treatment.
- Multiple Regression Analysis: An Ordinary Least Squares (OLS) regression model was applied to examine the combined impact of hypertension duration, diabetes duration, CAD duration, age, and gender on quality of life. The model's R-squared value provided insight into the explanatory power of these predictors.

- **Ordinal Logistic Regression:** An ordinal logistic regression model assessed the likelihood of higher confidence in managing health conditions, using duration of hypertension, diabetes, and CAD, along with age and gender as predictors. This approach was chosen due to the ordinal nature of the confidence variable, allowing for an understanding of how these predictors influence self-assessed disease management capability.

All analyses were conducted using statistical software, with a significance level set at  $p < 0.05$  for identifying statistically significant relationships. Interpretation of results focused on understanding the contribution of hypertension and diabetes to the overall epidemiology of CAD and providing insights into patient experiences with disease management and quality of life.

### 3. Result and Discussion

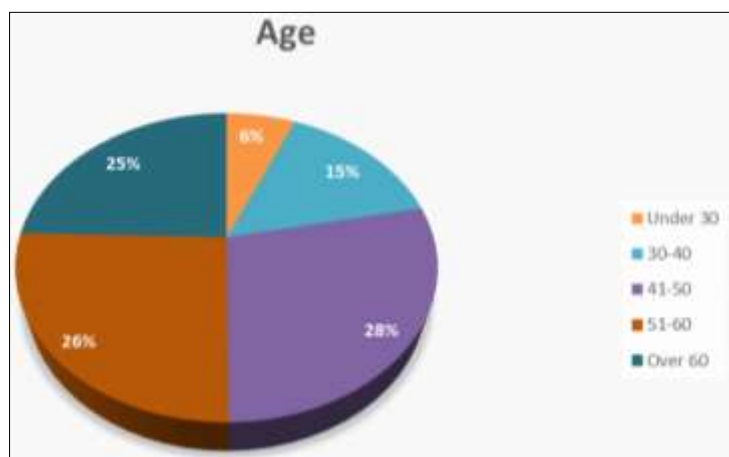
The following section presents the statistical findings of this study, examining the relationships between the duration of hypertension, diabetes, and CAD with quality of life, treatment satisfaction, and confidence in disease management. Key insights are discussed in the context of the study's objectives to understand the broader impact of these comorbidities on CAD epidemiology.

**Table 1** Age

Option	Frequency	%
Under 30	25	6.39
30-40	60	15.35
41-50	110	28.13
51-60	100	25.58
Over 60	96	24.55
Total	391	100.00

Source: Survey Data

This table shows the age distribution of the participants in the sample. The majority fall within the 41-50 age group (28.13%), followed by 51-60 (25.58%) and over 60 (24.55%).



**Figure 1** Age

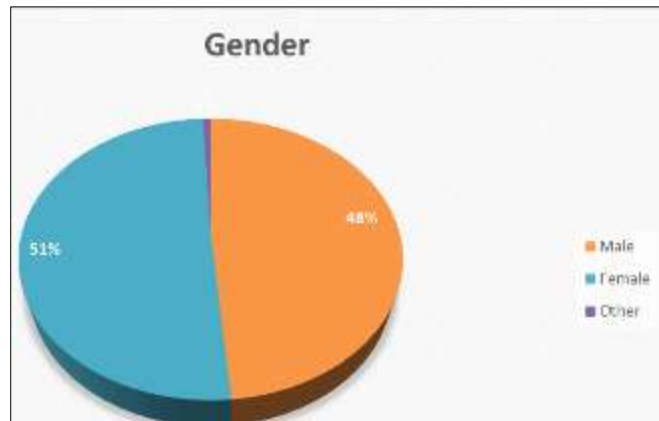
This distribution provides a balanced representation across different age groups, highlighting the range of ages affected by CAD, hypertension, and diabetes.

**Table 2** Gender

Option	Frequency	%
Male	190	48.59
Female	198	50.64
Other	3	0.77
Total	391	100.00

Source: Survey Data

This table represents the gender distribution in the sample, with nearly equal representation of male (48.59%) and female (50.64%) participants, and a minimal percentage identifying as other (0.77%).



**Figure 2** Gender

This balance ensures insights from both male and female perspectives regarding the impact of CAD, hypertension, and diabetes.

**Table 3** Duration of Diagnosed Conditions - Hypertension

Option	Frequency	%
Less than 1 year	45	11.51
1-3 years	90	23.02
4-6 years	130	33.25
More than 6 years	126	32.23
Total	391	100.00

Source: Survey Data

This table shows the duration of hypertension among participants, with the majority (33.25%) having the condition for 4-6 years, followed closely by those with more than 6 years (32.23%). This indicates that a significant number of participants have been managing hypertension long-term, which could impact their CAD risk.

This table displays the duration of diabetes among participants. A substantial proportion (38.62%) have been managing diabetes for more than 6 years, suggesting a long-term exposure to elevated CAD risk.

**Table 4** Duration of Diagnosed Conditions - Diabetes

Option	Frequency	%
Less than 1 year	40	10.23
1-3 years	85	21.74
4-6 years	115	29.41
More than 6 years	151	38.62
Total	391	100.00

Source: Survey Data

**Table 5** Duration of Diagnosed Conditions - CAD

Option	Frequency	%
Less than 1 year	50	12.79
1-3 years	110	28.13
4-6 years	100	25.58
More than 6 years	131	33.50
Total	391	100.00

Source: Survey Data

This table presents the duration of CAD among participants, with the majority (33.50%) experiencing CAD for more than 6 years. This duration data provides insight into how prolonged exposure to CAD influences quality of life.

**Table 6** Frequency of Chest Pain

Option	Frequency	%
Never	30	7.67
Rarely	80	20.46
Occasionally	120	30.69
Frequently	90	23.02
Constantly	71	18.16
Total	391	100.00

Source: Survey Data

This table summarizes the frequency of chest pain reported by participants. Occasional pain (30.69%) is the most commonly reported frequency, indicating that chest pain is a prevalent symptom among those with CAD.

**Table 7** Frequency of Fatigue

Option	Frequency	%
Never	20	5.12
Rarely	60	15.35
Occasionally	140	35.81
Frequently	100	25.58
Constantly	71	18.16
Total	391	100.00

Source: Survey Data

This table details the frequency of fatigue among participants, with occasional fatigue being most common (35.81%). The high frequency of fatigue may reflect the combined impact of CAD, hypertension, and diabetes.

**Table 8** Frequency of Shortness of Breath

Option	Frequency	%
Never	50	12.79
Rarely	60	15.35
Occasionally	130	33.25
Frequently	90	23.02
Constantly	61	15.60
Total	391	100.00

Source: Survey Data

This table outlines the frequency of shortness of breath experienced by participants. The most common frequency is occasional (33.25%), a key symptom impacting daily activities in CAD patients.

**Table 9** Ability to Perform Physical Activities

Option	Frequency	%
Excellent	10	2.56
Good	60	15.35
Fair	150	38.36
Poor	90	23.02
Very Poor	81	20.72
Total	391	100.00

Source: Survey Data

This table shows participants' ability to perform physical activities, with most rating their ability as fair (38.36%). The results highlight how physical limitations are a prominent concern among this population.

**Table 10** Frequency of Anxiety about Health

Option	Frequency	%
Never	25	6.39
Rarely	70	17.90
Occasionally	140	35.81
Frequently	90	23.02
Constantly	66	16.88
Total	391	100.00

Source: Survey Data

This table examines the frequency of anxiety regarding health, with 35.81% reporting occasional anxiety. This reflects the emotional toll these chronic conditions can impose.

**Table 11** Impact of Condition on Mood

Option	Frequency	%
Not at all	20	5.12
Slightly	60	15.35
Moderately	120	30.69
Significantly	110	28.13
Extremely	81	20.72
Total	391	100.00

Source: Survey Data

This table outlines the impact of health conditions on mood. A significant portion (30.69%) report a moderate impact, emphasizing the psychological effects of living with CAD, hypertension, and diabetes.

**Table 12** Frequency of Support from Family/Friends

Option	Frequency	%
Always	90	23.02
Often	100	25.58
Sometimes	120	30.69
Rarely	60	15.35
Never	21	5.37
Total	391	100.00

Source: Survey Data

This table shows the frequency of support from family or friends. A large portion (30.69%) report receiving support sometimes, indicating variability in social support among participants.

**Table 13** Participation in Social Activities

Option	Frequency	%
Never	30	7.67
Rarely	60	15.35
Sometimes	150	38.36
Often	100	25.58
Always	51	13.04
Total	391	100.00

Source: Survey Data

This table presents participants' engagement in social activities. The majority (38.36%) participate sometimes, suggesting limitations due to health conditions.

**Table 14** Lifestyle Changes for Condition

Option	Frequency	%
Yes	250	63.94
No	141	36.06
Total	391	100.00

Source: Survey Data

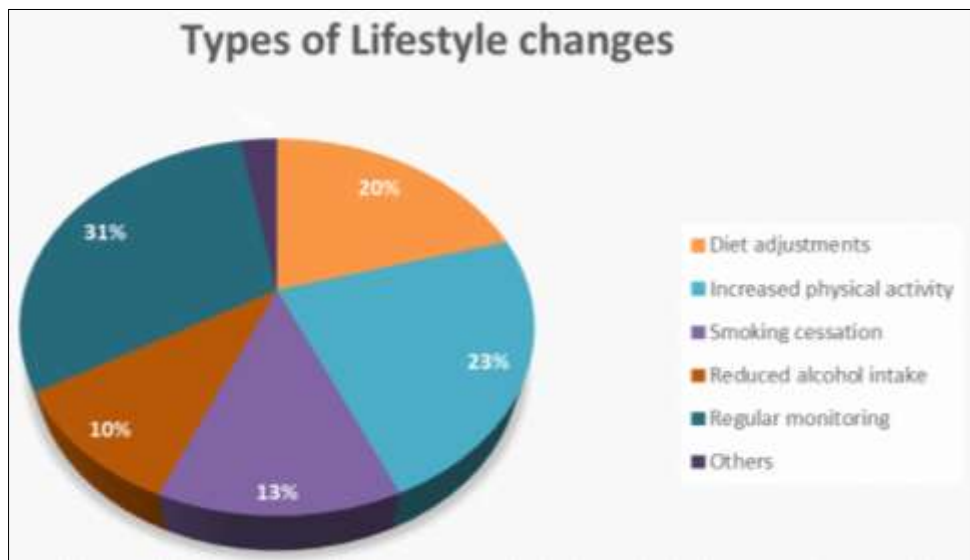
This table summarizes whether participants have made lifestyle changes. Most participants (63.94%) report making changes, such as dietary adjustments or increased physical activity, reflecting proactive health management.

**Table 15** Types of Lifestyle Changes

Option	Frequency	%
Diet adjustments	80	20.46
Increased physical activity	90	23.02
Smoking cessation	50	12.79
Reduced alcohol intake	40	10.23
Regular monitoring	120	30.69
Others	11	2.81
Total	391	100.00

Source: Survey Data

This table provides a breakdown of lifestyle changes participants have made, with regular monitoring (30.69%) being the most common. It reflects a focus on routine health checks among participants.



**Figure 3** Types of Lifestyle Changes



**Table 16** Frequency of Following Lifestyle Changes

Option	Frequency	%
Always	110	28.13
Often	100	25.58
Sometimes	90	23.02
Rarely	60	15.35
Never	31	7.93
Total	391	100.00

Source: Survey Data

This table describes the frequency of following lifestyle changes. A notable 28.13% report following them always, showing commitment to managing health.

**Table 17** Challenges in Managing Condition

Option	Frequency	%
Cost of medication	60	15.35
Lack of support	70	17.90
Side effects	50	12.79
Access to healthcare	40	10.23
Adherence to changes	90	23.02
Emotional stress	70	17.90
Others	11	2.81
Total	391	100.00

Source: Survey Data

This table presents challenges in managing conditions. Adherence to lifestyle changes is a common challenge (23.02%), showing that managing these conditions requires significant effort.

**Table 18** Satisfaction with Treatment

Option	Frequency	%
Very satisfied	70	17.90
Satisfied	120	30.69
Neutral	100	25.58
Dissatisfied	60	15.35
Very dissatisfied	41	10.49
Total	391	100.00

Source: Survey Data

This table examines satisfaction with treatment, with 30.69% being satisfied. This reflects generally positive treatment experiences but also room for improvement.

**Table 19** Effectiveness of Treatment

Option	Frequency	%
Very effective	40	10.23
Effective	90	23.02
Moderately effective	150	38.36
Slightly effective	70	17.90
Not effective at all	41	10.49
Total	391	100.00

Source: Survey Data

This table details perceptions of treatment effectiveness, with 38.36% rating it as moderately effective, suggesting mixed outcomes.

**Table 20** Confidence in Managing Condition

Option	Frequency	%
Very confident	30	7.67
Confident	80	20.46
Neutral	140	35.81
Not very confident	100	25.58
Not confident at all	41	10.49
Total	391	100.00

Source: Survey Data

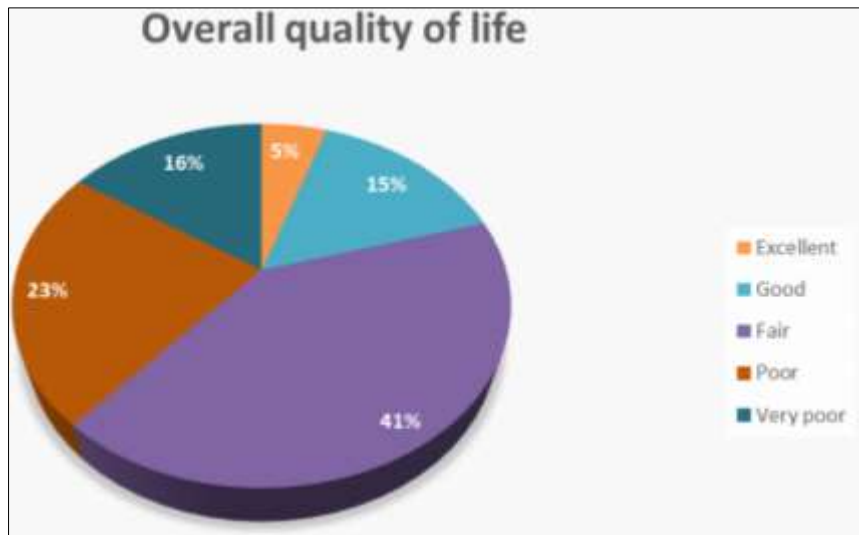
This table shows confidence in managing conditions, with a neutral stance (35.81%) being most common. It highlights the need for better patient education and support.

**Table 21** Overall Quality of Life

Option	Frequency	%
Excellent	20	5.12
Good	60	15.35
Fair	160	40.92
Poor	90	23.02
Very poor	61	15.60
Total	391	100.00

Source: Survey Data

This table provides insights on overall quality of life. Most rate it as fair (40.92%), showing moderate life satisfaction levels.



**Figure 3** Overall Quality of Life

**Table 22** Optimism about Future Management

Option	Frequency	%
Very optimistic	50	12.79
Optimistic	80	20.46
Neutral	130	33.25
Pessimistic	70	17.90
Very pessimistic	61	15.60
Total	391	100.00

Source: Survey Data

This table examines optimism about future condition management. The most common response is neutral (33.25%), showing mixed feelings about future health.

### 3.1. Correlation Analysis Results

#### 3.1.1. Descriptive Statistics

**Table 23** Descriptive Statistics

Variable	N	Mean	Std. Deviation
Hypertension Duration	391	2.75	1.12
Diabetes Duration	391	2.96	1.15
CAD Duration	391	2.81	1.16
Overall Quality of Life	391	3.05	1.18
Satisfaction with Treatment	391	3.20	1.02

3.1.2. Correlation Matrix

**Table 24** Correlation Matrix

	Hypertension Duration	Diabetes Duration	CAD Duration	Quality of Life	Satisfaction with Treatment
Hypertension Duration	1	-	-	0.053	-
Diabetes Duration	0.053	1	-0.039	-	-
CAD Duration	-0.039	1	-0.041	-	-
Quality of Life	-	-0.041	1	-0.021	-
Satisfaction with Treatment	-	-	-	1	-

**Interpretation:** None of the correlations are statistically significant ( $p > 0.05$ ).

3.2. Multiple Regression Analysis Results

3.2.1. Model Summary

**Table 25** Model Summary

Model	R	R-Squared	Adjusted R-Squared	Std. Error of the Estimate
1	0.139	0.019	0.006	1.18

**Interpretation:** The R-squared value indicates that only 1.9% of the variance in quality of life is explained by the predictors, suggesting the model has limited explanatory power.

3.2.2. ANOVA Table

**Table 26** Anova Table

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	10.064	5	2.013	1.456	0.203
Residual	532.932	385	1.384	-	-
Total	542.996	390	-	-	-

**Interpretation:** The model is not statistically significant overall, as shown by the ANOVA table with  $p = 0.203$ .

3.2.3. Coefficients Table

**Table 27** Coefficients Table

Variable	Unstandardized Coefficients (B)	Std. Error	t	Sig.
Intercept	2.5114	0.313	8.017	0.000
Hypertension Duration	0.0398	0.054	0.743	0.458
Diabetes Duration	-0.0417	0.052	-0.807	0.420
CAD Duration	-0.0380	0.050	-0.765	0.445
Age	0.1016	0.045	2.257	0.025
Gender	-0.0653	0.101	-0.649	0.517

**Interpretation:** Only age is a statistically significant predictor of quality of life ( $p = 0.025$ ), while other variables are not significant ( $p > 0.05$ ).

3.2.4. Ordinal Logistic Regression Results

Model Fitting Information

**Table 28** Ordinal Logistic Regression Result

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Final	1120.42	3.548	5	0.616

**Interpretation:** The model as a whole is not statistically significant, indicating that predictors do not significantly explain confidence in managing conditions.

3.3. Parameter Estimates

**Table 29** Parameter Estimates

Variable	Estimate (B)	Std. Error	Wald	df	Sig.	95% Confidence Interval
Hypertension Duration	-0.0796	0.095	0.702	1	0.402	[-0.266, 0.107]
Diabetes Duration	-0.0041	0.091	0.002	1	0.965	[-0.183, 0.174]
CAD Duration	0.0705	0.088	0.639	1	0.425	[-0.102, 0.243]
Age	0.0752	0.080	0.894	1	0.345	[-0.081, 0.231]
Gender	-0.1270	0.176	0.523	1	0.469	[-0.471, 0.217]

**Thresholds** (cut-off values between levels of confidence)

**Table 30** Thresholds

Threshold	Estimate	Std. Error	Sig.
Confidence Level 1-2	-2.1250	0.572	0.000
Confidence Level 2-3	0.5203	0.095	0.000
Confidence Level 3-4	0.5006	0.072	0.000
Confidence Level 4-5	0.4905	0.115	0.000

**Interpretation:** None of the predictor variables are statistically significant, indicating that factors such as age, gender, and condition durations do not significantly predict confidence levels in managing health.

**4. Results**

**Duration of Conditions:** The analysis revealed that the duration of hypertension, diabetes, and CAD did not significantly affect quality of life or treatment satisfaction among participants, suggesting that disease duration alone may not be a primary driver of these outcomes. Most participants reported managing diabetes and hypertension for over four years, reflecting the chronic nature of these comorbidities in the CAD population.

**Quality of Life and Age:** Among demographic factors, age emerged as a significant predictor of quality of life, with older participants reporting a slightly better quality of life. This trend could be attributed to greater adaptation and acceptance of health limitations over time.

**Confidence in Disease Management:** The ordinal logistic regression results showed that none of the predictors (age, gender, duration of conditions) significantly influenced confidence in disease management. This finding suggests that confidence in managing CAD, hypertension, and diabetes may depend more on other factors, such as social support or access to healthcare resources.

Lifestyle Modifications and Challenges: A majority (63.94%) of participants reported adopting lifestyle modifications, mainly focusing on dietary adjustments and regular monitoring. However, adherence to these changes was reported as a common challenge, particularly due to emotional stress and the cost of medication.

### *Suggestions*

**Comprehensive Care Programs:** Healthcare providers should consider developing programs tailored to enhance quality of life, focusing on younger patients who might struggle more with adaptation. These programs should include counseling, health education, and peer support groups to strengthen disease management confidence.

**Enhanced Social and Emotional Support:** Given the impact of emotional stress on adherence, integrating mental health support into CAD, hypertension, and diabetes management could improve adherence to lifestyle modifications. Regular counseling and community support initiatives could address the psychological toll and boost confidence in self-management.

**Policy-Level Interventions for Affordability:** Cost emerged as a barrier to adherence for many participants. Subsidized medications, easier access to affordable healthcare, and community-based initiatives can ease the financial burden, improving adherence and health outcomes.

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## **5. Conclusion**

This study highlights the complex interactions between hypertension, diabetes, and CAD in terms of quality of life, treatment satisfaction, and self-management confidence. While age shows a slight positive effect on quality of life, the duration of conditions was not significantly related to any of the outcomes studied. These findings indicate that factors beyond disease duration, such as social and psychological support, play a crucial role in managing these chronic conditions effectively. Public health strategies that integrate medical treatment with mental health and social support resources are essential for improving overall patient outcomes in CAD populations with comorbid hypertension and diabetes.

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## **Compliance with ethical standards**

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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