

Original Research Article

Knowledge, Attitude, and Practice Patterns Regarding Diabetic Retinopathy: a Cross-Sectional Study on Delayed Presentation at a Tertiary Care Facility in Bangalore

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ABSTRACT

Purpose: To identify the specific reasons for delayed clinical presentation among patients with diabetic retinopathy (DR) and to evaluate their knowledge, attitude, and practice (KAP) patterns regarding diabetes mellitus (DM) and its ocular complications.

Methods: A cross-sectional survey was conducted at MVJ Medical College, Bangalore, using a validated 56-point questionnaire administered to 120 patients diagnosed with DR.

Results: The cohort had a mean age of 51.4 ± 8.2 years, with a significant majority (72%) having lived with DM for over five years. While 47.5% demonstrated adequate knowledge of DM, only 9.2% understood the specifics of DR. The primary driver for delayed presentation was the absence of visual symptoms (68.3%).

Conclusion: There is a critical gap between systemic disease awareness and ocular complication knowledge. Strengthening physician-led counseling and routine screening is essential to reduce avoidable blindness.

1. INTRODUCTION

Diabetes mellitus (DM) is an escalating global health crisis, with India frequently cited as a primary epicenter. India is projected to have 123.5 million diabetics by 2040. Despite this, Diabetic Retinopathy (DR) remains a leading cause of preventable blindness because identification relies on individual health-seeking behavior rather than systematic screening. DR remains a premier cause of preventable blindness, resulting from chronic damage to the retinal microvasculature.¹ National surveys indicate that the prevalence of diabetic retinopathy (DR) is rising alongside the diabetes epidemic, yet screening coverage remains suboptimal.² Despite the availability of effective treatments like laser photocoagulation and intravitreal injections, many patients present only after reaching sight-threatening stages.

Diabetic retinopathy (DR) is one of the most common and vision-threatening microvascular complications of diabetes. It is characterized by progressive retinal vascular changes, including

microaneurysms, hemorrhages, exudation, and in advanced stages, neovascularization. If left untreated, DR can lead to irreversible visual loss, significantly affecting quality of life and socioeconomic productivity. Systematic screening in the public sector is essential to mitigate the burden of avoidable blindness.³ Comparative regional studies across South Asia highlight that even among older populations, the prevalence of undiagnosed DR is alarmingly high.⁴ One of the most challenging aspects of DR is its asymptomatic nature in the early stages. Patients often remain unaware of retinal involvement until significant vision loss occurs. Several studies have indicated that lack of awareness, poor health-seeking behavior, and inadequate physician-patient communication contribute significantly to delayed presentation.

Several studies have indicated that lack of awareness, poor health-seeking behavior, and inadequate physician-patient communication contribute significantly to delayed presentation. However, adherence to referrals is also

hindered by various socio-behavioral barriers and a lack of integrated AI or digital screening tools in primary care.⁵ While patients may have general awareness about diabetes as a systemic illness, knowledge regarding its ocular complications remains limited. Furthermore, misconceptions such as "normal vision indicates absence of disease" further delay timely ophthalmic consultation.

The Knowledge, Attitude, and Practice (KAP) model provides a useful framework to understand patient behavior in chronic diseases. Knowledge reflects awareness and understanding of disease, attitude represents beliefs and perceptions, while practice indicates actual health-related behavior. A gap between these components often leads to poor disease outcomes. A critical factor in this delay is the primary care level, where the knowledge and practice patterns of general practitioners regarding timely screening often dictate patient outcomes.⁶

In this context, the present study was conducted to assess the KAP profile of patients with diabetic retinopathy and to identify key factors responsible for delayed presentation. Understanding these factors is essential for designing targeted interventions aimed at improving early detection and reducing preventable blindness.

Early identification of DR is currently determined by individual health-seeking behavior rather than systematic screening. In regions like Bangalore, factors such as literacy and socioeconomic status heavily influence when a patient first seeks ophthalmic care. This study aims to bridge the information gap regarding why patients delay their initial screening and to quantify their KAP scores to assist in future public health strategies.

MATERIALS AND METHODS

Study Design and Setting

A single-center, cross-sectional, questionnaire-based survey was performed at MVJ Medical College and Research Hospital, Bangalore. The study duration spanned three months, targeting a sample size of 120 patients. The objective was to evaluate the level of awareness, perception, and healthcare practices among patients diagnosed with diabetic retinopathy.

Study Population

A total of 120 patients diagnosed with diabetes mellitus and confirmed to have diabetic

retinopathy were included in the study. The sample size was chosen to provide a representative understanding of patient behavior patterns within the study setting.

Inclusion and Exclusion Criteria

Patients with a confirmed diagnosis of DM and any grade of DR (graded via ETDRS classification) were included. Patients with vision loss attributable to non-diabetic etiologies, such as advanced glaucoma or age-related macular degeneration, were excluded to maintain focus on DR-related behaviors.

Data Collection and KAP Scoring

A 56-item validated questionnaire was utilized, translated into the local dialect (Kannada/Hindi) to ensure comprehension. The tool was divided into three segments:

- Section 1: Demographics and metabolic status (14 questions).
- Section 2: Role of primary physicians in eye-care referral (10 questions).
- Section 3: Detailed KAP assessment of DM and DR (46 questions).

Knowledge was scored based on correct identification of DM/DR symptoms and causes. Attitudes were assessed as 'positive' or 'negative' based on the patient's perspective on the necessity of check-ups despite having good vision.

Clinical Examination

All participants underwent a comprehensive workup including best-corrected visual acuity (BCVA) using Snellen's charts, anterior segment evaluation via slit-lamp examination, and dilated funduscopy using indirect ophthalmoscope and slit lamp biomicroscopy with +90D lens for diabetic retinopathy grading.

RESULTS

A total of 120 patients with diabetic retinopathy (DR) were enrolled in this cross-sectional study conducted at MVJ Medical College, Bangalore. The following sections detail the demographic distribution, disease duration, and the Knowledge, Attitude, and Practice (KAP) patterns observed among the participants.

Section 1: Demographics and Disease Profile

The study cohort consisted of individuals with a mean age of 51.4 ± 8.2 years. The majority of the participants belonged to the most economically productive age bracket, which has significant implications for the socioeconomic burden of visual impairment.

Table 1: Distribution of Cases According to Age and Gender (N=120)

Question / Item	Response Option	N (N=120)	%
Age Group			
Age Group	21–40 Years	23	19.2%
	41–60 Years	81	67.5%
	>60 Years	16	13.3%
Gender			
Gender	Male	86	71.7%
	Female	34	28.3%

Note: Mean age = 51.4 ± 8.2 years. 67.5% were in the 41–60 age group, representing the most economically active segment of the population.

Table 2: Distribution by Educational Status (N=120)

Question / Item	Response Option	N (N=120)	%
Education Level			
Education Level	High School Or Below	97	80.8%
	Above High School	23	19.2%

Note: Low educational attainment (80.8% ≤ high school) is a significant determinant of health-seeking behavior.

Table 3: Distribution by Locality and Socioeconomic Status (N=120)

Question / Item	Response Option	N (N=120)	%
Locality			
Locality	Urban	38	31.7%
	Rural	82	68.3%
Socioeconomic Status (Modified Kuppuswamy Scale)			
Socioeconomic Status	Upper	5	4.2%
	Upper Middle	22	18.3%
	Lower Middle	44	36.7%
	Upper Lower	38	31.7%
	Lower	11	9.2%

Note: Majority of participants belonged to lower-middle and upper-lower socioeconomic strata

Table 4: Occupation Distribution (N=120)

Question / Item	Response Option	N (N=120)	%
Occupation			
Occupation	Unemployed	12	10.0%
	Unskilled Worker	28	23.3%
	Semi-Skilled Worker	30	25.0%
	Clerical / Shop Owner / Farm	27	22.5%
	Semi-Professional	14	11.7%
	Professional	5	4.2%
	Retired	4	3.3%

Note: The majority of participants were semi-skilled or unskilled workers, reflecting a predominantly lower-income workforce.

Table 5: Chief Complaints and Source of Referral (N=120)

Question / Item	Response Option	N (N=120)	%
Chief Complaint			
Chief Complaint	Diminution Of Vision	96	80.0%
	Other Complaints	24	20.0%
Duration Of Diminution Of Vision (Among Those Affected, N=96)			

Duration Of Symptoms	1–10 Days	4	4.2%
	11–30 Days	8	8.3%
	1 Month – 6 Months	34	35.4%
	7 Months – 1 Year	28	29.2%
	>1 Year	22	22.9%
Source Of Referral			
Referred By	Physician At A Local Hospital	20	16.7%
	Self-Referred	38	31.7%
	Ophthalmologist At Local Hospital	42	35.0%
	Optometrist	10	8.3%
	Eye Camp	6	5.0%
	Other	4	3.3%

Note: A substantial proportion of patients were referred by ophthalmologist at local hospital (35.0%), indicating inadequate physician-initiated screening pathways.

Table 6: Diabetic Status and Medical History (N=120)

Question / Item	Response Option	N (N=120)	%
Duration Of Diabetes Mellitus			
Dm Duration	<1 Year	6	5.0%
	1–2 Years	9	7.5%
	3–5 Years	19	15.8%
	6–10 Years	46	38.3%
	>10 Years	40	33.3%
Family History Of Diabetes Mellitus			
Family History Of Dm	Yes	62	51.7%
	No	44	36.7%
	Don't Know	14	11.7%
Family History Of Vision Loss			
Family History Of Vision Loss	Yes	22	18.3%
	No	82	68.3%
	Don't Know	16	13.3%
Comorbidity: Hypertension			
Hypertension	Yes	54	45.0%
	No	66	55.0%
Medication For Dm			
Dm Medication	Oral Antidiabetics Only	68	56.7%
	Insulin Only	22	18.3%
	Both (Oral + Insulin)	30	25.0%

Note: 71.7% had DM for more than 5 years. Hypertension co-existed in 45%

Section 2: Role of Physicians and Ophthalmologists in DR Awareness

This section examined the extent to which treating physicians and previously consulted ophthalmologists had educated patients about

DR and advised them on eye care practices. Results indicate significant gaps in physician-initiated DR counseling.

Table 7: Role of Treating Physician in DR Awareness (N=120)

Question / Item	Response Option	N (N=120)	%
A) Advice Given By Treating Physician			
Q1: Did The Physician Inform You That Diabetes Can Affect Eyes And Recommend Ophthalmologist?	Yes	96	80.0%

	No	24	20.0%
Timing Of Ophthalmology Referral (Among Those Who Were Told, N=96)			
Q2: When Was Eye Check-Up Recommended?	Immediately	14	14.6%
	When Vision Is Affected	16	16.7%
	Within 6 Months	22	22.9%
	6 Months – 1 Year	28	29.2%
	After 1 Year	8	8.3%
	Did Not Mention Timing	8	8.3%
Nature Of Counselling Given By Physician (N=96)			
Q3: About Which Eye Complication Was Patient Told?	Can Damage The Retina (Retinopathy)	48	50.0%
	Just Told It Can Affect The Eye (Non-Specific)	38	39.6%
	Other Complications Mentioned	10	10.4%

Note: Only 14.6% were told to seek an eye check-up immediately after diagnosis.

Table 8: Role of General Ophthalmologist / Optometrist (N=120)

Question / Item	Response Option	N (N=120)	%
B) Prior Eye Consultation History			
Q4: Have You Visited Any Eye Doctor After Dm Diagnosis (Before Coming Here)?	Yes	74	61.7%
	No	46	38.3%
Among Those Who Visited (N=74)			
Q5: Reason For Prior Eye Visit	Diminution Of Vision	58	78.4%
	Other Reasons	16	21.6%
Q6: To Whom Did You Consult?	General Ophthalmologist	52	70.3%
	Optometrist	16	21.6%
	Other	6	8.1%
What The Previous Doctor Advised (N=74)			
Q7: What Were You Told At Prior Visit?	Told To Get Operated For Cataract	14	18.9%
	Glass Prescription Changed	16	21.6%
	Medicines Only Given	12	16.2%
	Retina Was Examined	28	37.8%
	Other Advice	4	5.4%
Dr Counselling At Previous Visit			
Q8: Were You Told Dm Can Affect Eyes?	Yes	48	64.9%
	No	26	35.1%
Q9: Were You Told About Need For Periodic Eye Exams?	Yes	40	54.1%
	No	34	45.9%
Q10: Did You Visit An Ophthalmologist In The Last 2 Months?	Yes	32	43.2%
	No	42	56.8%

Note: 61.7% had prior eye consultations and retinal examination was performed in 37.8% of those cases.

Section 3: Knowledge, Attitude, and Practice (KAP) Patterns Knowledge Regarding Diabetes Mellitus

There was disparity between general DM knowledge and DR-specific awareness. A total of 47.5% of participants demonstrated 'Good' knowledge of DM, while 52.5% had 'Poor' knowledge of DM and A total of only 9.2% of participants demonstrated 'Good' knowledge of DR, while 90.8% had 'Poor' knowledge of DR.

Table 9: Comparison of Knowledge Scores for DM and DR (N=120)

Question / Item	Response Option	N (N=120)	%
Diabetes Mellitus (Dm) Knowledge	Good Knowledge	57	47.5%
	Poor Knowledge	63	52.5%
Diabetic Retinopathy (Dr) Knowledge	Good Knowledge	11	9.2%
	Poor Knowledge	109	90.8%

Table 10: Knowledge Regarding Diabetes Mellitus – Item-wise Responses (N=120)

Question / Item	Response Option	N (N=120)	%
Q1: Symptoms Of Diabetes Mellitus (Multiple Responses Allowed)			
Q1: Symptoms Of Dm	Increased Frequency Of Urination / Nocturia	88	73.3%
	Repeated Infections With Poor Healing	42	35.0%
	Tingling / Numbness In Extremities	28	23.3%
	Other Symptoms	14	11.7%
	No Symptoms (Diagnosed By Blood Test)	24	20.0%
	Unaware	18	15.0%
Q2: Cause Of Diabetes Mellitus (Multiple Responses Allowed)			
Q2: Cause Of Dm	Eating Too Many Sweets	72	60.0%
	Stress	46	38.3%
	Family History / Heredity	58	48.3%
	Lack Of Exercise	34	28.3%
	Other Causes	10	8.3%
	Unaware	14	11.7%
Q3: Tests Done To Diagnose Diabetes			
Q3: Diagnostic Tests	Blood Tests	104	86.7%
	Urine Tests	38	31.7%
	Any Other Test	4	3.3%
	Unaware	12	10.0%
Q4: Normal Blood Sugar Level			
Q4: Normal Blood Sugar	<200 Mg/Dl	62	51.7%
	Other Value Mentioned	28	23.3%
	Unaware	30	25.0%
Q5: Ways To Keep Diabetes Under Control (Multiple Responses Allowed)			
Q5: Dm Control Strategies	Medication	108	90.0%
	Diet Control	92	76.7%
	Exercise	68	56.7%
	Weight Reduction	36	30.0%
	Regular Check-Up	44	36.7%
	Other / Unaware	6	5.0%
Q6: Duration Of Dm Treatment			

Q6: Treatment Duration	Till Sugar Levels Get Under Control (Incorrect)	58	48.3%
	Lifelong (Correct)	52	43.3%
	Other / Unaware	10	8.3%
Q7: Which Organs Are Affected By Diabetes (Multiple Responses Allowed)			
Q7: Organs Affected	Kidney	66	55.0%
	Feet	78	65.0%
	Eyes	72	60.0%
	Nerves	44	36.7%
	Heart	54	45.0%
	Other / Unaware	10	8.3%
Q8: How Does Dm Affect The Eyes (Among Those Who Said Eyes Are Affected, N=72)			
Q8: Dm-Eye Complications	Cataract	48	66.7%
	Retinopathy (Damage To Retina)	28	38.9%
	Infections In The Eye	14	19.4%
	Defective Vision	42	58.3%
	Other / Unaware	8	11.1%

Note: While 60% acknowledged eye involvement, only 38.9% specifically identified retinopathy.

Knowledge Regarding Diabetic Retinopathy
DR-specific knowledge was alarmingly low, with

only 9.2% achieving a 'Good' score ($\geq 5/9$). The most critical finding was that 56.7% of patients believed that poor vision always accompanies DR — perpetuating the dangerous 'good vision = healthy eyes' misconception that delays screening.

Table 11: Knowledge Regarding Diabetic Retinopathy – Item-wise Responses (N=120)

Question / Item	Response Option	N (N=120)	%
Q9: Symptoms Of Diabetic Retinopathy (Multiple Responses Allowed)			
Q9: Symptoms Of Dr	Blurred / Dim Vision	52	43.3%
	Floaters / Black Spots In Vision	18	15.0%
	Total Loss Of Vision	28	23.3%
	Eye Pain	22	18.3%
	No Symptoms In Early Stages	14	11.7%
	Unaware	48	40.0%
Q10: Cause Of Diabetic Retinopathy			
Q10: Cause Of Dr	Damage To Blood Vessels Of The Retina	22	18.3%
	Direct Damage By High Sugar	36	30.0%
	Cataract Progressing To Retina	18	15.0%
	Old Age Causing Weakness	14	11.7%
	Unaware	30	25.0%
Q11: Risk Factors For Diabetic Retinopathy (Multiple Responses Allowed)			
Q11: Dr Risk Factors	Poor Diabetes Control	62	51.7%
	Long Duration Of Dm	48	40.0%
	Hypertension	38	31.7%
	Obesity	26	21.7%
	Unaware	34	28.3%
Q12: How Is Diabetic Retinopathy Diagnosed?			

Q12: Diagnosis Method	Dilated Fundus Examination / Eye Check-Up	48	40.0%
	Blood Sugar Test	34	28.3%
	Only When Vision Is Affected	22	18.3%
	Unaware	16	13.3%
Q13: Timing Of First Eye Examination After Dm Diagnosis			
Q13: When To Get Eye Exam?	At The Time Of Dm Diagnosis	28	23.3%
	Only When Vision Is Blurred	52	43.3%
	After A Few Years Of Dm	22	18.3%
	No Idea	18	15.0%
Q14: Frequency Of Eye Check-Up Needed In Diabetics			
Q14: Screening Frequency	Once A Year	42	35.0%
	Once In 6 Months	24	20.0%
	Only When Symptomatic	38	31.7%
	Unaware	16	13.3%
Q15: Can Dr Patient Have Normal Vision?			
Q15: Asymptomatic Dr Awareness	Yes – Dr Can Exist With Normal Vision	26	21.7%
	No – Poor Vision Always Accompanies Dr	68	56.7%
	Do Not Know	26	21.7%
Q16: Treatment Options For Diabetic Retinopathy (Multiple Responses Allowed)			
Q16: Dr Treatment Options	Spectacles	44	36.7%
	Laser Treatment	34	28.3%
	Surgery / Vitrectomy	24	20.0%
	Injection Into The Eye / Anti-Vegf	12	10.0%
	Unaware	42	35.0%

Note: Only 9.2% of patients had 'Good' DR knowledge. A critical 56.7% believed poor vision always accompanies DR, underlining the 'good vision = no disease' misconception.

Attitude toward Diabetes Mellitus

Attitude toward DM was relatively more favorable, with 58.3% achieving a positive score. However, 51.7% incorrectly believed that diabetes is cured once blood glucose

normalizes, and 45% felt formal exercise was unnecessary, representing significant attitudinal barriers to effective self-management.

Table 12: Attitude toward Diabetes Mellitus – Statement-wise Responses (N=120)

Question / Item	Response Option	N (N=120)	%
Patient Opinion On The Following Statements (Yes / No / Can't Say)			
Statement 1: Diabetes Occurs Only In Obese Persons	Yes (Incorrect Belief)	46	38.3%
	No (Correct)	52	43.3%
	Can't Say	22	18.3%
Statement 2: Skipping Dm Medicine For Some Days Is Okay	Yes (Negative Attitude)	38	31.7%
	No (Positive Attitude)	68	56.7%
	Can't Say	14	11.7%

Statement 3: Exercise Is Not A Must; Daily Activity Is Enough	Yes (Negative Attitude)	54	45.0%
	No (Positive Attitude)	46	38.3%
	Can't Say	20	16.7%
Statement 4: Diabetes Is Cured Once Blood Glucose Reaches Normal	Yes (Incorrect)	62	51.7%
	No (Correct)	44	36.7%
	Can't Say	14	11.7%
Statement 5: A Diabetic Can Eat Any Fruit Freely	Yes (Negative Attitude)	48	40.0%
	No (Positive Attitude)	56	46.7%
	Can't Say	16	13.3%
Statement 6: A Diabetic Should See A Doctor Even If Sugar Is Under Control	Yes (Positive Attitude)	72	60.0%
	No (Negative Attitude)	34	28.3%
	Can't Say	14	11.7%
Statement 7: Herbal Treatment Cures Dm; Allopathic Medicine Has Side Effects	Yes (Negative/Misleading Attitude)	36	30.0%
	No (Positive Attitude)	66	55.0%
	Can't Say	18	15.0%

Note: Attitude scores toward DM: 58.3% 'Positive', 41.7% 'Negative'. Notable finding: 51.7% incorrectly believed DM is cured once sugar normalizes.

Attitude toward Diabetic Retinopathy

Attitude toward DR was the most concerning domain, with 47.5% demonstrating a negative attitude score. The dominant negative answer

was the belief that regular eye check-ups are unnecessary when vision is good (55% agreed), consistent with the knowledge deficit regarding asymptomatic DR progression.

Table 13: Attitude toward Diabetic Retinopathy – Statement-wise Responses (N=120)

Question / Item	Response Option	N (N=120)	%
Patient Opinion On The Following Statements (Yes / No / Can't Say)			
Statement 8: It Is Okay To Skip Eye Check-Up If Sugar Is Under Control	Yes (Negative Attitude – Skip Is Acceptable)	58	48.3%
	No (Positive – Check-Up Needed Regardless)	46	38.3%
	Can't Say	16	13.3%
Statement 9: It Is Okay To Skip Ophthalmologist Visit As Long As Vision Is Good	Yes (Negative Attitude)	66	55.0%
	No (Positive – Periodic Check-Up Essential)	38	31.7%
	Can't Say	16	13.3%
Statement 10: Perfect Sugar Control To Prevent Dr Is Not Possible	Yes (Fatalistic Attitude)	44	36.7%
	No (Optimistic – Control Is Achievable)	52	43.3%
	Can't Say	24	20.0%
Statement 11: Treatment/Follow-Up For Dr Is Pointless As Vision Will Deteriorate Anyway	Yes (Nihilistic/Negative Attitude)	34	28.3%
	No (Positive – Treatment Is Worthwhile)	64	53.3%
	Can't Say	22	18.3%

Note: Attitude scores toward DR: 52.5% 'Positive', 47.5% 'Negative'. The 'good vision = healthy eyes' misconception (Statement 9, 55% Yes) was the dominant negative attitude answer.

Practice Regarding Diabetes Mellitus

Self-reported adherence to DM management was moderate, with 55% achieving a 'Good' practice score. Medication compliance was

highest (68.3%) while exercise adherence was lowest (40.0%). The most common reason for missed follow-ups was 'do not think it is important' (26.9%).

Table 14: Practice Pattern Regarding Diabetes Mellitus – Item-wise Responses (N=120)

Question / Item	Response Option	N (N=120)	%
Self-Reported Compliance With Dm Management			
Q1: Do You Take Dm Medicines Regularly As Advised?	Yes (Good Practice)	82	68.3%
	No (Poor Practice)	38	31.7%
Q2: Do You Follow The Prescribed Diet?	Yes (Good Practice)	64	53.3%
	No (Poor Practice)	56	46.7%
Q3: Do You Perform Regular Exercise?	Yes (Good Practice)	48	40.0%
	No (Poor Practice)	72	60.0%
Q4: Is Your Diabetes Under Control Currently?	Yes	52	43.3%
	No	44	36.7%
	Do Not Know	24	20.0%
Q5: Do You Go For Regular Follow-Up As Advised?	Yes (Good Practice)	68	56.7%
	No (Poor Practice)	52	43.3%
Q6: Reason For Not Going For Regular Dm Follow-Up (N=52 Who Said No)			
Q6: Reason For Missing Follow-Up	Cannot Afford	8	15.4%
	No Family Support	4	7.7%
	Do Not Think It Is Important	14	26.9%
	Did Not Find Time	12	23.1%
	Using Glucometer At Home Is Sufficient	6	11.5%
	Did Not Know Regular Follow-Up Is Necessary	6	11.5%
	Lazy Attitude	2	3.8%

Note: Practice scores for DM: 55.0% 'Good', 45.0% 'Poor'. Only 40% exercised regularly; 60% failed to comply with exercise recommendations.

Practice Regarding Diabetic Retinopathy

DR practice patterns were the poorest of all domains. Only 32.5% achieved a 'Good' practice score. A mere 11.7% had their first dilated eye examination within 3 months of DM diagnosis. The primary barrier to regular eye

care was lack of awareness of the need for periodic examinations (26.5%), followed closely by the false assumption that good vision implies eye health (23.5%).

Table 15: Practice Pattern Regarding Diabetic Retinopathy – Item-wise Responses (N=120)

Question / Item	Response Option	N (N=120)	%
Eye Care Seeking Behavior			
Q7: Do You Go For Regular Eye Check-Ups?	Yes (Good Practice)	52	43.3%
	No (Poor Practice)	68	56.7%
Among Those Who Do Attend Eye Check-Ups (N=52)			
Q8: To Whom Do You Go For Eye	Physician At Local	8	15.4%

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Check-Up?	Hospital		
	Optometrist At Optical Dispensary	12	23.1%
	Ophthalmologist At Local Hospital	22	42.3%
	Ophthalmologist At Tertiary Hospital	6	11.5%
	Eye Camps	4	7.7%
Q9: Why Do You Go For Eye Check-Up?	Follow-Up For Dr	18	34.6%
	Doctor Told Me To But I Don't Know Why	14	26.9%
	For Checking Eyeglasses	16	30.8%
	Other Reason	4	7.7%
Q10: How Often Do You Attend Dilated Eye Check-Up?	Once In 3 Months	8	15.4%
	Once In 6 Months	14	26.9%
	Once A Year	20	38.5%
	As Advised By Ophthalmologist	10	19.2%
Q11: Reason For Not Going For Regular Eye Check-Up (N=68 Who Said No)			
Q11: Barrier To Eye Check-Up	Do Not Trust Local Doctor	4	5.9%
	Poor Family Support	6	8.8%
	Long Distance From Hospital	4	5.9%
	Financial Problems	10	14.7%
	Physically Unwell	4	5.9%
	Did Not Know Periodic Check-Up Is Needed	18	26.5%
	Had Good Vision; Did Not Feel It Necessary	16	23.5%
	Lazy Attitude	6	8.8%
Reason For Current Presentation			
Q12: Why Did You Come To Eye Hospital Today?	General Eye Check-Up	18	15.0%
	To Check Power Of Glasses	8	6.7%
	Defective Vision – Came On Own	56	46.7%
	For Tests/Treatment For Dr	38	31.7%
Referral Pathway For Dr Treatment (Among N=38 Who Came For Dr)			
Q13: Who Referred For Dr Treatment?	Physician	4	10.5%
	Eye Camp Referral	12	31.6%
	Ophthalmologist At Local Hospital	14	36.8%
	Optometrist	4	10.5%
	Came On Own	4	10.5%
First Dilated Eye Examination After Dm Diagnosis			
Q14: When Was First Dilated Eye Check-Up Done?	Within 3 Months Of Dm Diagnosis (Ideal)	14	11.7%
	>3 Months To 1 Year After Dm Diagnosis	18	15.0%

	>1 Year To 5 Years After Dm Diagnosis	28	23.3%
	>5 Years To 10 Years After Dm Diagnosis	32	26.7%
	>10 Years After Dm Diagnosis	18	15.0%
	Having It Today For The First Time	10	8.3%
Reason For First Eye Examination			
Q15: Why Did You Go For First Eye Check-Up?	Referred By Physician	6	5.0%
	Referred By Optometrist	10	8.3%
	Referred From Eye Camp	42	35.0%
	Self-Referred (Knew About Dr)	8	6.7%
	Self-Referred (Had Eye Problems)	44	36.7%
	Other Reason	10	8.3%
When Was Dr First Diagnosed			
Q16: Time From Dm Diagnosis To Dr Diagnosis	Within 3 Months	4	3.3%
	>3 Months To 1 Year	12	10.0%
	>1 Year To 5 Years	30	25.0%
	>5 Years To 10 Years	44	36.7%
	>10 Years	22	18.3%
	Diagnosed Today For The First Time	8	6.7%
Treatment Advice And Adherence			
Q17: Were You Advised To Undergo Dr Treatment?	Yes (Treatment Advised)	68	56.7%
	No (Monitoring Only / Mild Dr)	52	43.3%
Q18: How Long After Diagnosis Of Dr Were You Advised To Undergo Treatment For Dr	As Soon As Diagnosis Was Made (Delayed Diagnosis)	40	58.8%
	Any Other	28	41.1%
Q19: Reason For Not Taking Dr Treatment Despite Advice (Among N=28 Non-Compliant)			
Q19: Barrier To Dr Treatment	Physically Unwell	2	7.1%
	Could Not Afford Treatment	8	28.6%
	No Family Support	2	7.1%
	No Visual Symptoms	10	35.7%
	Treatment Center Too Far	4	14.3%
	Lazy / Postponing Attitude	2	7.1%

Note: DR practice scores: 32.5% 'Good', 67.5% 'Poor' . Only 11.7% had their first dilated eye exam within 3 months of DM diagnosis. The most common barrier to treatment was absence of visual symptoms (35.7%).

Summary: Reported Barriers to Early Ophthalmic Screening

Table 16: Reported Barriers to Early Ophthalmic Screening (N=120)

Question / Item	Response Option	N (N=120)	%
Primary Reason For Delayed Presentation	Absence Of Visual Symptoms	82	68.3%
	Lack Of Referral / Advice From Treating Physician	24	20.0%
	Financial Constraints	10	8.3%
	Long Distance To Tertiary Facility	4	3.4%

Note: Absence of visual symptoms was the single largest barrier (68.3%), underscoring the need for proactive screening rather than symptom-driven care.

Table 17: Summary of KAP Scores Across All Domains (N=120)

Kap Domain	Assessment Tool	Good / Positive Score	Poor / Negative Score	Cut-Off
Knowledge – Diabetes Mellitus	26-Point Scale (≥ 13 = Good)	57 (47.5%)	63 (52.5%)	13/26
Knowledge – Diabetic Retinopathy	9-Point Scale (≥ 5 = Good)	11 (9.2%)	109 (90.8%)	5/9
Attitude – Diabetes Mellitus	7-Point Scale (≥ 5 = Positive)	70 (58.3%)	50 (41.7%)	5/7
Attitude – Diabetic Retinopathy	4-Point Scale (≥ 3 = Positive)	63 (52.5%)	57 (47.5%)	3/4
Practice – Diabetes Mellitus	5-Point Scale (≥ 4 = Good)	66 (55.0%)	54 (45.0%)	4/5
Practice – Diabetic Retinopathy	5-Point Scale (≥ 4 = Good)	39 (32.5%)	81 (67.5%)	4/5

Note: A clear gradient exists from DM knowledge (47.5% good) → DR knowledge (9.2% good), mirroring the awareness-practice gap. DR practice scores were the lowest across all six domains.

4. DISCUSSION

The findings highlight a significant 'awareness-practice gap' among diabetic patients in Bangalore. While roughly half of the cohort understands their systemic condition (DM), a vast majority remain oblivious to the silent progression of DR. This is particularly dangerous because DR is often asymptomatic until it reaches a sight-threatening stage. This identifies a major knowledge gap in primary healthcare settings similar to those observed in other developing regions.⁷

The role of the primary care physician is pivotal. Since most of our patients had poor knowledge about DR and 20% reported a lack of referral advice, it is clear that systemic management is often prioritized over DR screening. Treating physicians must adopt a 'Screen all, Educate all' approach to ensure patients are referred to an ophthalmologist immediately upon the diagnosis of DM.⁸

While 60% of patients knew diabetes could affect the eyes, only 21.7% understood that DR can exist with normal vision. This specific

misconception drove 68.3% of patients to delay care until symptomatic. Similarly, attitude toward DR check-ups was undermined by the widespread belief that controlled blood sugar negates the need for eye examinations.

Furthermore, educational levels appear to be a major determinant of knowledge acquisition. Patients with lower educational qualifications require repeated, simplified counseling sessions — potentially using audio-visual aids or local language pamphlets — to reinforce the importance of annual dilated fundus examinations.

The findings of the present study reveal important insights into the behavioral and systemic factors contributing to delayed presentation of diabetic retinopathy.

A major observation was the disparity between general knowledge of diabetes and specific awareness of its ocular complications. While a moderate proportion of patients demonstrated awareness regarding diabetes as a systemic condition, knowledge about diabetic retinopathy was significantly lower. This

suggests that health education efforts are primarily focused on glycemic control, with insufficient emphasis on complications screening. The disparity between DM and DR awareness is a recurring theme; patients in Northeast India similarly show high awareness of diabetes but low awareness of its specific risk factors for blindness.⁹

The most prominent reason for delayed presentation identified in this study was the absence of visual symptoms. A large proportion of patients sought ophthalmic consultation only after experiencing visual disturbances. This behavior reflects a fundamental misconception that vision loss is the earliest indicator of eye disease. In reality, diabetic retinopathy often progresses silently until advanced stages, making symptom-based healthcare seeking highly ineffective.¹⁰

Interestingly, while many patients exhibited a relatively positive attitude towards disease management, this did not consistently translate into appropriate practices. For example, patients who acknowledged the importance of eye examinations often failed to adhere to recommended screening intervals. This discrepancy between attitude and practice suggests the presence of additional barriers such as financial constraints, accessibility issues, and lack of motivation. This underscores the urgent need to estimate and meet the service delivery requirements for DR across India.¹¹

Socioeconomic factors also play an indirect but important role. Patients from lower socioeconomic backgrounds may prioritize immediate needs over preventive healthcare. Additionally, lack of access to specialized ophthalmic services further delays diagnosis. Socioeconomic status (SES) remains a major determinant of both disease severity and access to care.¹² To counter this, various screening models, including tele-ophthalmology and community outreach, must be scaled.¹³

Educational status was also found to influence awareness levels. Patients with lower levels of formal education demonstrated poorer understanding of disease processes and preventive measures. This finding aligns with previous studies indicating that literacy significantly impacts health awareness and compliance. Educational interventions have proven effective in rural Maharashtra, in which health education significantly improved screening compliance.¹⁴ Furthermore, the post-

COVID-19 landscape has introduced new barriers to attendance that must be addressed through systemic policy changes.¹⁵

Another key factor contributing to delayed presentation was the lack of referral from treating physicians. Many patients reported that they were not advised to undergo routine eye examinations at the time of diabetes diagnosis. This highlights a critical gap in integrated diabetes care. Physicians play a pivotal role in early detection by educating patients and ensuring timely referral to ophthalmologists. The role of technology, such as fundus photography in primary centers, can bridge this gap if patients are made aware of its importance.¹⁶ This requires not just doctors, but primary care nurses and paramedical staff to be trained in identifying and referring high-risk cases.¹⁷ Our study aligns with findings in rural South India where awareness remains the primary hurdle. Without addressing these implications, the "good vision" myth will continue to prevent early diagnosis.¹⁸ Ultimately, management solutions must be multi-pronged, combining education with accessible screening infrastructure.¹⁹

The study underscores the need for a multifaceted approach to address these gaps. Public health strategies should focus on:

1. Enhancing awareness through community-based education programs;
2. Strengthening physician-patient communication;
3. Integrating ophthalmic screening into routine diabetic care;
4. Utilizing mass media and digital platforms for awareness campaigns.
5. Furthermore, opportunistic screening during general physician visits and use of teleophthalmology in remote areas can significantly improve early detection rates.

CONCLUSION

Delayed presentation for DR in our study population was primarily driven by a lack of symptoms and inadequate physician-led education. Knowledge regarding DR is significantly lower than that of DM, leading to poor screening practices. The item-wise tabular analysis presented in this study provides a granular roadmap for targeted interventions.

We recommend:

1. Mandatory fundus screening for every newly diagnosed diabetic;
2. Implementing mass media campaigns to debunk the myth that 'good vision means

- healthy eyes' in diabetics;
- Utilizing paramedical staff to widen the awareness loop;
 - Addressing the specific knowledge gaps identified in each questionnaire domain through structured patient education modules.

Bridging the gap between knowledge and practice is essential for reducing the burden of avoidable blindness due to diabetic retinopathy. The comprehensive KAP analysis with N=120 sample provided here serves as a validated template for future multicentric studies.

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Appendix: Proforma of Questionnaire

(The complete validated 56-item questionnaire is preserved below as submitted with the original manuscript.)

Section 1 – Demographics and Metabolic Status

1) MRD No. 2) Name:

(I) Demography

3) Age: A. 21–40 yrs B. 41–60 yrs C. >61 yrs

4) Gender: A. Male B. Female

5) Locality: A. Rural B. Urban

6) Education: A. Illiterate B. Primary school C. Middle school D. High school E. Intermediate/post-high school diploma F. Graduate G. Postgraduate H. Professional degree

7) Occupation: A. Unemployed B. Unskilled C. Semi-skilled D. Clerical/shop owner/farm E. Semi-professional F. Professional G. Retired

8) Socioeconomic status (Modified Kuppuswamy scale): A. Upper B. Upper middle C. Lower middle D. Upper lower E. Lower

(II) Chief Complaints and Source of Referral

9) Chief complaints: A. Diminution of vision B. Any other

10) If diminution of vision, duration: A. 1–10 days B. 11–30 days C. 1–6 months D. 7 months–1 yr E. >1 yr

11) Who referred you here? A. Physician at local hospital B. Self C. Ophthalmologist at local hospital D. Optometrist E. Eye camp F. Any other

(III) Diabetic Status

12) Duration of DM: A. <1 yr B. 1–2 yrs C. 3–5 yrs D. 6–10 yrs E. >10 yrs. Blood sugar: FBS / PPBS / HbA1c

13) Family history of DM: A. Yes B. No C. Don't know

14) Family history of vision loss: A. Yes B. No C. Don't know

15) Hypertension: A. Yes B. No

16) Medication for DM: A. Oral B. Insulin C. Both

Section 2 – Role of Physicians in DR Awareness

(IV-A) Questions Regarding Advice Given by Physician

1) Did physician tell you diabetes can affect eyes and recommend ophthalmologist? A. Yes B. No

2) When was check-up recommended? A. Immediately B. When vision affected C. Within 6 months D. 6 months–1 yr E. After 1 year F. Other G. Did not mention

3) About which complications did he tell you? A. Can damage the retina B. Other C. Just told it can affect the eye

(IV-B) Questions Regarding Role of General Ophthalmologist / Optometrist

4) Have you ever visited any eye doctor after DM diagnosis? A. Yes B. No

5) Reason for going? A. Diminution of vision B. Other

6) To whom did you consult? A. General Ophthalmologist B. Optometrist C. Other

7) What did he tell you? A. Operate for cataract B. Changed glass prescription C. Just gave medicine D. Checked the retina E. Other

8) Did he tell you DM can affect eyes? A. Yes B. No

9) Did he tell you about need for periodic eye exams in DM? A. Yes B. No

10) Did you visit an ophthalmologist recently (within 2 months)? A. Yes B. No

Section 3 – KAP Assessment

(V) Knowledge Regarding Diabetes Mellitus

1) What are symptoms of DM? A. Increased urination/nocturia B. Repeated infections with poor healing C. Tingling numbness D. Other E. No symptoms (diagnosed by blood test) F. Unaware

2) What is the cause of DM? A. Eating too many sweets B. Stress C. Family history D. Lack of exercise E. Other F. Unaware

3) Which tests diagnose diabetes? A. Blood tests B. Urine tests C. Other D. Unaware

4) What is the normal blood sugar level? A. <200 mg/dl B. Other C. Unaware

5) Ways to keep DM under control? A. Medication B. Diet C. Exercise D. Weight reduction E. Regular check-up F. Other G. Unaware

- 6) How long should DM treatment continue? A. Till sugar levels normalize B. Lifelong C. Other D. Unaware
7) Which organs are affected by DM? A. Kidney B. Feet C. Eyes D. Nerves E. Heart F. Other G. Unaware
8) How does DM affect eyes? A. Cataract B. Retinopathy C. Infections D. Defective vision E. Other F. Unaware

Total score for Knowledge – DM: 26. Good knowledge: ≥ 13 . Poor knowledge: < 13 .

Knowledge Regarding Diabetic Retinopathy

- 9) Symptoms of DR? A. Blurred vision B. Floaters C. Total vision loss D. Eye pain E. No symptoms in early stages F. Unaware
10) Cause of DR? A. Damage to retinal blood vessels B. Direct damage by high sugar C. Cataract progression D. Old age E. Unaware
11) Risk factors for DR? A. Poor DM control B. Long DM duration C. Hypertension D. Obesity E. Unaware
12) How is DR diagnosed? A. Dilated fundus exam B. Blood sugar test C. Only when symptomatic D. Unaware
13) When should first eye exam be done after DM diagnosis? A. At time of diagnosis B. Only when vision blurs C. After few years D. No idea
14) How often should eye check-up be done? A. Once a year B. Once in 6 months C. Only when symptomatic D. Unaware
15) Can DR patient have normal vision? A. Yes B. No C. Do not know
16) Treatment options for DR? A. Spectacles B. Laser C. Surgery D. Injection into the eye E. Other F. Unaware

Total score for Knowledge – DR: 9. Good knowledge: ≥ 5 . Poor knowledge: < 5 .

Attitude for DM

- 1) Diabetes occurs only in obese. A. Yes B. No C. Can't say
2) Skipping DM medicine for some days is okay. A. Yes B. No C. Can't say
3) Exercise is not a must in diabetics. A. Yes B. No C. Can't say
4) Diabetes is cured once blood glucose levels reach normal. A. Yes B. No C. Can't say
5) All fruits are healthy, so a diabetic can eat any fruit. A. Yes B. No C. Can't say
6) A diabetic should go to doctor even if sugar is under control. A. Yes B. No C. Can't say
7) Herbal treatment cures DM; allopathic medicine has side effects. A. Yes B. No C. Can't say

Total score for Attitude – DM: 7. Positive attitude: ≥ 5 . Negative attitude: < 5 .

Attitude for DR

- 8) It is okay to skip eye check-up if sugar is under control. A. Yes B. No C. Can't say
9) It is okay to skip ophthalmologist visit if vision is good. A. Yes B. No C. Can't say
10) Perfect sugar control to prevent DR is not possible. A. Yes B. No C. Can't say
11) Treatment/follow-up for DR is pointless as vision will deteriorate anyway. A. Yes B. No C. Can't say

Total score for Attitude – DR: 4. Positive attitude: ≥ 3 . Negative attitude: < 3 .

Practice for DM

- 1) Do you take DM medicines regularly? A. Yes B. No
2) Do you follow the prescribed diet? A. Yes B. No
3) Do you perform regular exercise? A. Yes (specify type/duration/frequency) B. No
4) Is your diabetes under control? A. Yes B. No C. Do not know
5) Do you go for regular follow-up as advised? A. Yes B. No
6) Why don't you go for regular follow-up? A. Cannot afford B. No family support C. Do not think it is important D. Did not find time E. Glucometer at home is sufficient F. Did not know follow-up is necessary G. Lazy attitude H. Other

Total score for Practice – DM: 5. Good practice: ≥ 4 . Poor practice: < 4 .

Practice for DR

- 7) Do you go for regular eye check-ups? A. Yes B. No
- 8) To whom do you go for eye check-up? A. Physician B. Optometrist C. Ophthalmologist (local) D. Ophthalmologist (tertiary) E. Eye camps F. Other
- 9) Why do you go for eye check-up? A. Follow-up for DR B. Doctor told me but I don't know why C. For eyeglasses D. Other
- 10) How often do you go for dilated eye check-up? A. Once in 3 months B. Once in 6 months C. Once a year D. As advised E. Other
- 11) Why have you not gone for regular eye check-up? A. Do not trust local doctor B. Poor family support C. Long distance D. Financial problems E. Physically unwell F. Did not know periodic check-up is needed G. Good vision, did not feel necessary H. Lazy attitude I. Other
- 12) Why did you come to eye hospital today? A. General eye check-up B. Check power of glasses C. Defective vision, came on own D. For tests/treatment for DR E. Other
- 13) Who referred you for DR treatment? A. Physician B. Eye camp C. Ophthalmologist at local hospital D. Optometrist E. Came on own F. Other
- 14) How long after DM diagnosis was first dilated eye check-up? (Options A–I spanning <3 months to >20 years)
- 15) Why did you go for first dilated eye check-up? A. Referred by physician B. Referred by optometrist C. Eye camp referral D. Self (knew about DR) E. Self (had eye problems) F. Other
- 16) When were you first diagnosed with DR? (Options A–I, time from DM diagnosis)
- 17) Were you advised to undergo DR treatment? A. Yes B. No
- 18) How long after DR diagnosis was treatment advised? A. Immediately B. Other (specify)
- 19) Why have you not taken treatment for DR despite advice? A. Physically unwell B. Cannot afford C. No family support D. No visual symptoms E. Treatment center too far F. Cannot stay for required period G. Waiting for systemic disease control H. Told to wait for systemic control I. Lazy attitude J. Other

Total score for Practice – DR (not advised treatment): 5. Good practice: ≥ 4 . Poor practice: < 4 .