Operational Guidelines for the Control of Visual Loss from Diabetic Retinopathy in India

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Hyderabad, Telangana 500033
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Foreword

In India diabetes mellitus is fast gaining the status of an epidemic, with 62 million people diagnosed with the disease and this number is likely to go up to 79.4 million by 2030 as per WHO reports.

Diabetic Retinopathy (DR) is one of the complications of diabetes mellitus (incidence ranging from 6-30%),and is a leading cause of visual impairment and avoidable blindness. The manifestations of DR may vary from mild background retinopathy to severe sight threatening proliferative retinopathy/macular edema. The early stages of DR, which are symptomless, are treatable, if detected and managed in time. The sad fact is that by the time the diabetic patient reaches the ophthalmologist, DR is already in an advanced stage, and the visual prognosis is bleak. This is due to lack of awareness and sensitisation not only among patients but also among medical professionals and the treating physicians/endocrinologists.

These operational guidelines for management of Diabetic Retinopathy have thus come at a very opportune moment. They provide a broad framework for the policy makers and planners for integration between two National Health Programmes viz, the NPCDCS (National Programme for Cancer, Diabetes, Cardiac diseases and Stroke) and NPCBVI(National Programme for Control of Blindness & Visual Impairment) through opportunistic screening of diabetic patients attending NCD clinics which have been set up in all district and sub district Hospitals. The use of teleophthalmology as an important tool (to be used by specially trained PMOAs/ Nurses) at health & wellness centers for opportunistic screening of diabetics attending the NCD clinics and sending the doubtful images to the Ophthalmologists for confirmation of DR Grading has been well conceptualised. This would help in minimising the drop outs among diabetics and a better utilization of the already crunched manpower of ophthalmologists. The guidelines also illustrate the set of interventions required at various levels of health care that need to be taken for prevention, early detection and treatment of DR cases.

These guidelines will benefit the patients, medical experts and ophthalmologists and go a long way in reducing the burden of avoidable blindness due to DR in our Country.

I congratulate the PHFI and Queen Elizabeth Diamond Jubilee Trust for the sincere efforts and hard labour that they have put in for development these guidelines.

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6. Little Flower Eye Hospital, Angamaly, Kerala
7. L.V. Prasad Eye Institute, Bhubaneswar, Odisha
8. Mahatma Gandhi Institute of Medical Sciences, Sewagram, Maharashtra
9. Global Institute of Ophthalmology, Mount Abu, Rajasthan
10. Vivekananda Mission Ashram-Netra Niramay Niketan- West Medinipur- West Bengal

Executive summary

- Diabetes is increasing in India and now affects 65 million adults. This is likely to increase to over 130 million by 2045. Almost half of the people with diabetes are not aware that they have the disease.
- Diabetic retinopathy (DR) is an important cause of vision impairment and blindness due to diabetes. Vision threatening DR, a severe stage of DR and diabetic macular edema (DME), affects 5–7 per cent of people with diabetes, that is, between 3 and 4.5 million.
- An increasing number of adolescents and young adults are developing diabetes due to changing lifestyles. These individuals are particularly at risk of developing DR and DME. Pregnancy among women with pre-existing diabetes can lead to rapid progression of DR to the stage where their vision is threatened.
- The main risk factors for DR and DME are increased duration of disease, poor control of high blood glucose and hypertension. There is strong evidence that good control of hyperglycaemia and hypertension reduce the incidence of vision threatening DR.
- Health education and engagement of people with diabetes about DR is essential. Regular screening for signs of DR and DME is essential in effective management of the disease and in preventing blindness.
- Speedy response by health systems, in screening for diabetes and DR, and increased access to diagnosis and treatment will help reduce the incidence of DR
- Resources and services available through the National Programme for the Control of Diabetes, Cancer and Cardiovascular Diseases, and the National Programme for the Control of Blindness and Visual Impairment can be utilised along with support from non-governmental and private organisations to the control and manage DR.
- There are highly effective and cost-effective treatments for vision- threatening DR. Timely laser treatment and vitreous surgery prevents blindness in up to 98 per cent of cases.
- Effective treatments for DME like laser, intraocular steroids and Anti–Vascular Endothelial Growth Factor (AntiVEGF) agents are available, which can prevent further loss of vision and sometimes improve vision.
- All diabetics should attend DR screening. Systems to screen for DR and DME need to be integrated into clinics at all levels of service delivery.
- Non-mydriatic digital fundus photography is a proven method for DR screening. Any trained healthcare professional can use this method.
- Clear referral pathways to eye care centres with the expertise and facilities for diagnosis and treatment should be available for persons suspected to have DR if needed.
- Patients with diabetes attending eye care services should have a detailed eye examination, including dilated retinal examination to detect DR, and get treatment if required.
- Close collaboration is needed between physicians and eye care professionals, among different professional groups, national programmes, and among different levels of service delivery.
- All aspects of the health system, including governance, health management information systems need to respond to the increase in DR, and develop the capacities of the health workforce, technology and infrastructure and financing.

Abbreviations

ASHA	Accredited Social Health Activist
ANM	Auxiliary Nurse and Midwife
CVD	Cardiovascular Diseases
CHC	Community Health Centres
DR	Diabetic Retinopathy
HWC	Health and Wellness Centres
IPHS	Indian Public Health Standards
IEC	Information, Education and Communication
IGNOU	Indira Gandhi National Open University
MCTS	Mother and Child Tracking System
NHM	National Health Mission
NPCB&VI	National Programme for the Control of Blindness and Visual Impairment
NPCDCS	National Programme for the Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke
NRHM	National Rural Health Mission
NCD	Non-Communicable Diseases
NGO	Non-Governmental Organisations
NPR	Non-Proliferative Diabetic Retinopathy
OA	Ophthalmic Assistants
PMOA	Paramedical Ophthalmic Assistants
PwDM	Persons with Diabetes Mellitus
PDR	Proliferative Diabetic Retinopathy
SHS	State Health Societies
SHC	Sub Health Centres
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes Mellitus
VEGF	Vascular Endothelial Growth Factor
VI	Vision Impairment
VTDR	Vision Threatening Diabetic Retinopathy

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1. Magnitude of diabetes in India

1.1 What is diabetes?

Diabetes Mellitus is a chronic non-communicable health condition characterised by an increase in the level of blood glucose. Diabetes occurs when the body is unable to produce any or enough of a hormone called insulin, or because the body cannot use insulin effectively. Insulin is produced by the pancreas and helps transport glucose from the blood stream into cells where glucose is converted into energy. The lack of insulin or the inability of the body to use insulin results in high levels of glucose circulating in the blood—a condition called hyperglycaemia. Hyperglycaemia if untreated or managed affects many organs in the body and leads to complications like retinopathy, nephropathy, gangrene, poor healing of ulcers, cardio vascular complications and neuropathy.

1.2 How is diabetes diagnosed?

Diabetes is diagnosed based on fasting blood glucose levels of 126 mg/dL (7.0 mmol/L) or above, or HbA1C levels of 6.5 per cent or above, or a random blood glucose level of 200 mg/dL (11.1 mmol/L) or above (Table 1). People with undiagnosed diabetes often notice symptoms like excessive thirst, weight loss, frequent passage of urine, fatigue etc. Impaired glucose tolerance is a pre-diabetic state and may precede diabetes by many years. Here, blood glucose levels are in between the range of normal and diabetic levels. These individuals are at risk of developing diabetes later (Table 1).

The above World Health Organization criteria are used for the diagnosis of diabetes in the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke.[1] Community health workers at the Health and Wellness Centres will refer persons with blood glucose levels above normal to higher centres like Primary Health Centres/Community Health Centres for further diagnosis and management.[2]

Table 1. Criteria used for the diagnosis of diabetes under the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke

Diagnosis	Fasting blood glucose (mg/dl)	2-hour post prandial blood glucose (mg/dl)
Diabetes Mellitus	≥ 126	≥ 200
Impaired Glucose Tolerance	< 100	> 140 to < 200
Impaired Fasting Glucose	≥110 to < 126	-

1.3 Types of diabetes

1. Type 1 diabetes mellitus (T1DM) usually has an acute onset at an early age. The cause is not known but is likely to have an auto-immune basis. Type 1 accounts for approximately 10 per cent of all diabetes patients.

2 Type 2 diabetes (T2DM) is the commonest type (>90 per cent of all diabetes) and has a more gradual onset. Risk factors include obesity (defined by a body mass index of greater than 30), lack of physical activity, poor diet, stress, urbanisation and a genetic predisposition. The onset of this type of diabetes at a young age, known as youth-onset T2DM, is increasing.

3. Hyperglycaemia in pregnancy (previously called gestational diabetes) occurs when women without a history of diabetes develop high blood glucose in the later stages of pregnancy. This usually resolves after delivery. However, women known to have diabetes before pregnancy, or who meet standard diagnostic criteria for DM in the first trimester (who are considered to have pre-existing diabetes) need close observation throughout pregnancy.

4. Diabetes secondary to other conditions, such as chronic pancreatic disease, or secondary to medication such as steroids.

1.4 Risk factors for diabetes

The strongest risk factor for diabetes is excess body fat as a result of an unhealthy diet and inadequate exercise. Early undernutrition, smoking and genetic factors also increase the risk. The control of diabetes is beyond the scope of these guidelines.

1.5 Global magnitude and prevalence of diabetes

In 2017, the International Diabetes Federation estimated that there were 451 million people with diabetes (18-99 years) worldwide.[3] These figures were projected to increase to 693 million by 2045. It was estimated that half of all people with diabetes were undiagnosed. In addition, there were 374 million people with impaired glucose tolerance and 21.3 million children were born to mothers with hyperglycaemia during pregnancy. Over 1 million children and adolescents had T1DM. In 2017, approximately 5 million deaths were attributed to diabetes among those aged 20-99 years.

Three quarters of people with diabetes live in low and middle-income countries. The global health care expenditure on people with diabetes was estimated to be US $ 850 billion in 2017.

The global prevalence of diabetes has been increasing over the past few decades at a rate much higher than expected. The prevalence is increasing in most countries because of ageing and lifestyle changes, and interactions between these two factors.[4]

The global prevalence is higher in men (9 per cent) than in women (7.9 per cent). In 2016, diabetes was ranked the eighth highest in terms of years lived with disability,[5] and the years of life lost from diabetes increased by 31 per cent between 2006 and 2016[6] (ranked in the ninth place in lower middle-income countries). The prevalence of diabetes increases with age, affecting 13-20 per cent of those aged 50 years and above.[7]

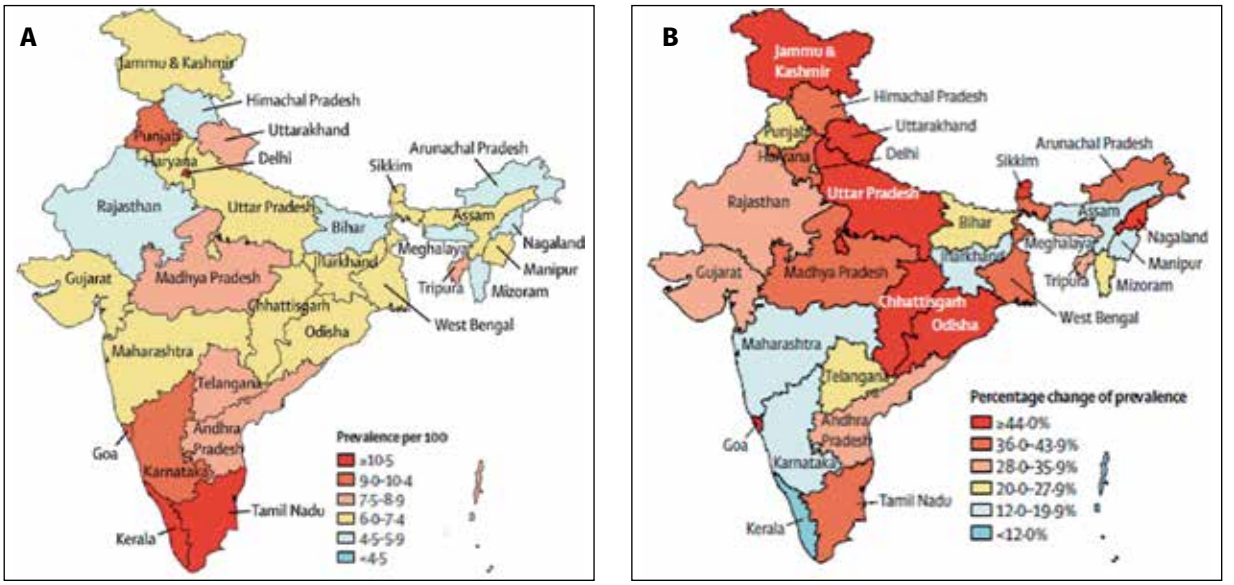
1.6 Diabetes in India

In 2016, there were an estimated 65 million persons with diabetes mellitus (PwDM) in India aged 20 years and older, which has increased by 2.5 million since 1990. In 2016, the prevalence was highest in Tamil Nadu, Kerala and Delhi, and lowest in Rajasthan, Bihar, Himachal Pradesh and North-Eastern States (Figure 1A). The prevalence has increased in all states except Kerala. The greatest increase was seen in states that are at a lower level of epidemiological transition (Figure 1B). The number of PwDM is projected to increase to 125 million by the year 2045. The overall age-standardised prevalence of DM is 7.9 per cent [95 per cent confidence interval (CI) 7.1-8.6 per cent].[8]

The "Indian phenotype", which comprises several factors, increases the susceptibility of Indians to diabetes.[9]

As in many other countries, the majority of PwDM in India have T2DM. In 2017, it was estimated that there were 128,500 young PwDM (< 20 years of age) [T1DM].[7]

The ICMR INDIAB survey of adults aged 20 years and above in 15 States in four zones, and in rural and urban areas, showed that the overall prevalence of diabetes was 7.3 per cent [95 per cent confidence



Age standardised prevalence of diabetes in India in 2016, by State

Change in age standardised prevalence of diabetes in India (1990-2016), by State

Figure 1 (A) Age standardised prevalence of diabetes in India in 2016 among adults aged 20 years, by State (B) Change in age standardised prevalence of diabetes in India in between 1990 and 2016, by State.[10]

interval (CI) 7.0-7.4 per cent].[11] The prevalence of diabetes was higher than in earlier studies, with variation between states. The prevalence of self-reported diabetes was higher in urban compared to rural and semi-rural populations.

A recent study[12] in India estimated that 136,000 deaths (2.1 per cent of all deaths) were attributable to renal failure in 2015, and that the proportion has increased from 2.1 per cent in 2000-03 to 2.9 per cent by 2010-13. Diabetes was the strongest predictor. Individuals born in the 1970s had a higher risk than those born in the 1950s, suggesting that diabetes is becoming an increasingly important cause of premature mortality in India.

2. Diabetic retinopathy – An overview

2.1 What is diabetic retinopathy?

Diabetic retinopathy is a common microvascular complication of the eye that develops in PwDM. It affects patients of both Type 1 and Type 2 diabetes. In DR, the tiny blood vessels called capillaries supplying blood to the retina are affected and cause vision disturbances/blindness. Diabetic retinopathy is the leading cause of visual impairment (VI) and avoidable blindness among adults of working age group worldwide.[13]

2.2 Global magnitude of diabetic retinopathy

In 2010, 0.8 million adults were blind from DR (2.6 per cent of all blindness) and 3.7 million had VI (1.9 per cent). Blindness increased by 27 per cent and VI by 64 per cent between 1990 and 2010.[14] The magnitude is lower in East and South-East Asia and Oceania, which have younger populations than North America, West Europe and Australasia, which have ageing populations.

When it comes to Asia, in 2010, almost 300,000 people were blind from DR and close to 1.5 million were moderate or severely visually impaired in the South Asian region, which includes India.[14] The numbers are likely to increase given the increasing incidence and magnitude of diabetes and maturing of the "diabetes epidemic", as years lived with the disease is an important risk factor for DR.

In a meta-analysis[15] that used data from 35 high-quality surveys, which had grading of digital retinal images, the age-standardised prevalence of DR of any severity was 35 per cent; 7 per cent had proliferative DR (PDR), 6.8 per cent had macular edema (DME) and 10 per cent had vision threatening DR (VTDR) i.e., PDR and/or DME. South Asian populations had lower rates of DR: any retinopathy 19 per cent, proliferative retinopathy 1.3 per cent, macular edema 4.9 per cent and VTDR 5 per cent. Diabetic macular edema (DME) is a much more common cause of VI than PDR and causes loss of central vision. Visual loss from PDR can be more severe and can lead to no perception of light in both eyes.

2.3 Magnitude of diabetic retinopathy in India

Several studies[16] have been undertaken in different states in India, across different age groups and in urban and rural locations. The proportion of those with any DR ranged from 9.6 per cent in rural Central India[17] to 26.2 per cent in Kerala[18] whereas VTDR ranged from 0 per cent in Central India[17] to 13.5 per cent in Mumbai slums.[19] Although not reported in all studies, DME ranged from 2.1 per cent to 7.7 per cent.[18, 20] The variability maybe because some studies included only known diabetics while others included newly diagnosed diabetics (detected during the survey) as well. Some studies were conducted more than 15 years ago when the prevalence of DM was lower. Some were not adequately designed to draw valid statistical conclusions.

In the DR programme supported by the Queen Elizabeth Diamond Jubilee Trust (UK)[21] in India (2014-2019), 62,000 PwDM were screened for DR in 60 non-communicable diseases (NCD) clinics in 10 states between

Table 2. Estimated number of persons with diabetes and diabetic retinopathy in India

Coverage	Number with diabetes	Any Diabetic Retinopathy (%)		Vision Threatening Diabetic Retinopathy	
		%	N	%	N
National	65 million*	15-20%	9.8 - 13.0 million	5-7%	3.3 - 4.6 million**
In a district of 1 million, 56% ≥20 years	44,800*	15-20%	6700 - 8960	5-7%	2,240 - 3,136**

*Need to be screened/examined, but only approximately 50% are diagnosed; ** Need treatment

2015 and 2019. In this programme, 3,880 (6.34 per cent) PwDM underwent treatment for VTDR. This is similar to the 5 per cent reported in the meta-analysis of 35 studies globally.

Assuming 15-20 per cent of PwDM have any DR, and 5–7 per cent VTDR, 3.25-4.55 million people are at risk of visual loss, or have already lost vision from DR in India. This translates to 2,240 - 3,136 people aged 20 years and above in a district of 1 million. (Table 2). The four states with the highest estimates are West Bengal, Maharashtra, Tamil Nadu and Uttar Pradesh as they account for 40 per cent of the number of PwDM. Figure 2 shows the estimated number of persons with VTDR in different states in India based on diabetes prevalence.

The natural history of DR is that it progresses from mild ("background") retinopathy, characterised by a few microaneurysms and haemorrhage, to the more severe, vision threatening stages over time. An understanding of the natural history is important as it influences the timing of the first examination, and the frequency of subsequent examinations.

Diabetic retinopathy can develop more rapidly in youth-onset T2DM and during pregnancy.

A recent study conducted over four years in an urban population in Chennai, India estimated the age-standardised incidence of VTDR (from no DR or any DR) to be 5 per cent over a four year period.[22] These findings suggest that in India DR can progress more rapidly than in high-income settings and may be related to poor control of diabetes and/or lack of access to appropriate health care.

The risk of DR and consequently VI/blindness will increase proportionally with the increase in the incidence of diabetes in the coming years. Although the entire country is facing the diabetes epidemic, some states have a higher prevalence of the disease than the others.

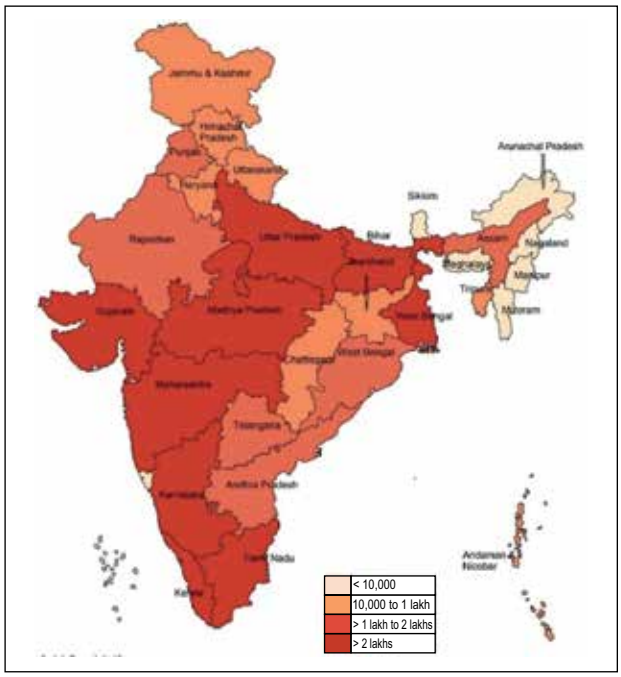


Figure 2. Estimated number of persons with Vision Threatening Diabetic Retinopathy in India

Assumption: Seven per cent of persons with diabetes have Vision Threatening Diabetic Retinopathy. Prevalence of diabetes used for VTDR is based on Global Burden of Disease (India)

2.4 How does diabetes cause retinopathy?

The retina is composed of layers of cells lining the back of the eye (Figure 3). The retina absorbs light and converts it into electric signals that are transmitted to the brain. In the brain the nerve impulses are interpreted as the images that we see.

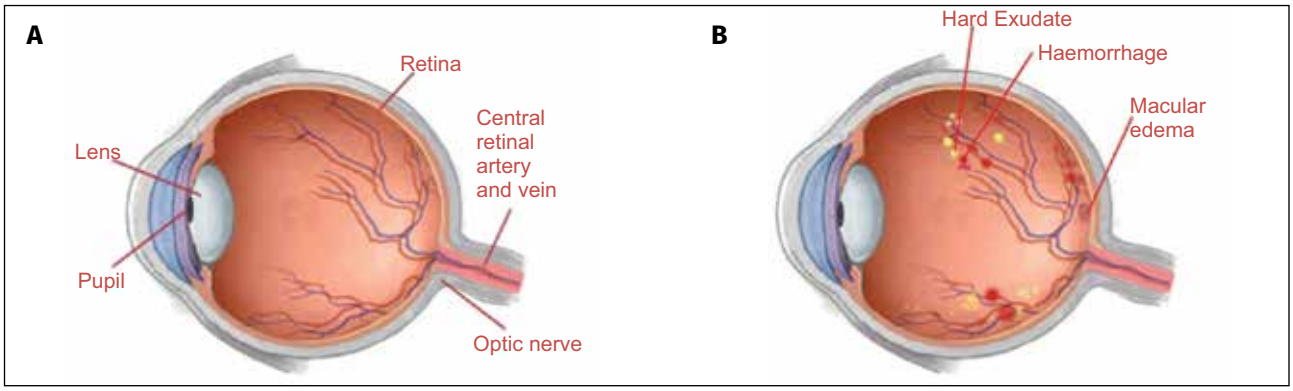


Figure 3. Anatomy of the normal eye (A) and changes in the retina due to diabetic retinopathy.

Panel B shows the several changes that can occur in the retina of the eye due to diabetic retinopathy.

The exact process by which diabetes affects the retina is complex and not completely understood. High blood glucose (hyperglycaemia) is thought to cause damage to cells in and around the small blood vessels that supply blood to the retina. Over time, the damaged blood vessels become weakened and they can leak or become blocked. Diabetic retinopathy is a progressive disease. In the absence of any intervention, the blood vessels undergo continuous change that damages the retina and eventually leads to loss of vision. Everyone with diabetes will develop DR to some degree if they live long enough.

Diabetic retinopathy is a complication of diabetes that also increases the risk of other eye conditions such as cataract (clouding of the lens of the eye), glaucoma (damage to the optic nerve of the eye) while also resulting in an increased risk of infection of the external eye. The term used to indicate the spectrum of eye conditions in diabetes is "diabetic eye disease".

2.5 Types of diabetic retinopathy

Diabetic retinopathy is categorised broadly as: non-proliferative and proliferative retinopathy, and diabetic macular edema (DME).

2.5.1 Non-proliferative diabetic retinopathy

Non-proliferative diabetic retinopathy (NPDR) is an early stage of DR. In this stage, hyperglycaemia causes damage to the retinal capillary walls (tiny blood vessels). This may cause tiny outpouchings of the retinal wall (microanaeurysms) which may rupture and cause bleeding (haemorrhage) or might leak fluid into the retina. The resolution of the fluid leaves behind sediments (lipid byproducts) called hard exudates on the retina.

Within NPDR, there are different stages of progression. Correct identification of the stages of progression is important to assess the risk of vision loss and to plan appropriate management.

2.5.2 Proliferative diabetic retinopathy

Proliferative diabetic retinopathy (PDR) is a serious stage of DR as it can lead to blindness. This stage is characterised by the formation of new blood vessels (neo-vascularisation) in response to the poor blood supply to the retina due to capillary closure. Vascular endothelial growth factor (VEGF), essential for certain normal physiological processes, has been linked with neo-vascularisation in DR. The new blood vessels formed are fragile, leaky and often take an abnormal course, growing up from the retina into the vitreous. If left untreated, the proliferative phase can lead to irreversible loss of vision.

2.5.3 Diabetic macular edema

The macula is the central part of retina. It is the most sensitive part of the retina responsible for detailed central vision and colour vision. In DME, fluid from the retinal capillaries leaks into the macula, causing it to swell (edema). The vision may be normal in the early stages, or it may blur or become distorted. Side vision (peripheral vision) is not affected. DME is a more common cause for loss of vision in PwDM than PDR.

2.6 What happens if diabetic retinopathy is not treated?

In the natural course of the disease, DR progresses through different stages with about seven to 10 per cent of people developing VTDR, which comprises proliferative DR and DME. In PDR the blood vessels

can become severely affected but may not cause any symptoms. The affected person is not aware that anything is wrong inside their eyes.

If not treated in time, PDR can lead to blindness from vitreous haemorrhage, retinal detachment and neo-vascular glaucoma. These stages are called advanced DR.

2.7 What are the different stages of advanced diabetic retinopathy?

2.7.1 Vitreous haemorrhage

The abnormal blood vessels in proliferative DR are fragile and can bleed. The blood spreads into the vitreous, a gel that fills the inside of the back of the eye, leading to sudden loss of vision. Surgery is needed to remove the hemorrhage if it does not clear on its own.

2.7.2 Retinal detachment

In PDR, the abnormal blood vessels can also lead to formation of scar tissue, which can pull on the retina causing it to detach. Retinal detachment causes sudden loss of vision. Complex surgery is required for retinal detachment, but the visual results are often poor.

2.7.3 Neo-vascular glaucoma

Neo-vascular glaucoma is a form of secondary glaucoma. In response to poor retinal blood flow in DR, abnormal blood vessels sometimes grow over structures at the front of the eye, leading to a blockage in the outflow of fluid from the eye. This leads to a build-up of pressure inside the eye (glaucoma). This form of glaucoma can be difficult to treat.

2.8 Who is at risk of diabetic retinopathy?

Although everyone with diabetes is at risk of developing DR and DME, there are some factors that expose a person to greater risk than others. There are several modifiable risk factors (Table 3) that give a good window of opportunity for interventions to slow the progression of DR. Factors such as long duration of diabetes, male sex, developing T1DM in the post puberty period, pregnancy in women with diabetes, and genetic predisposition are unmodifiable risk factors for DR.

2.9 How can diabetic retinopathy be prevented?

Diabetic retinopathy cannot be entirely prevented, but certain measures can slow the progression of the disease from advancing to VTDR. The preventive measures are described in Section 4.

2.10 What are the symptoms of diabetic retinopathy?

Diabetic retinopathy usually does not cause any symptoms until the advanced stages.

Symptoms of advanced DR are:

- Sudden vision loss (vitreous hemorrhage, retinal detachment)
- Floaters (shapes floating in the field of vision)
- Marked loss of vision with pain (glaucoma)

These symptoms are not specific to DR and can occur in other conditions as well. However, if they are experienced by PwDM, immediate medical attention is required.

As the advanced stages of PDR often cause permanent loss of vision, it is very important that PDR is detected early and treated.

The symptoms of DME are gradual loss of central vision which means that people cannot see details clearly, leading to difficulty with reading or recognising faces, for example.

Table 3. Modifiable risk factors of diabetic retinopathy

Modifiable risk factors	Action needed
High blood glucose	Good control blood glucose
High blood pressure	Good control of blood pressure
High blood lipids	Good control of blood lipids
Cataract surgery with poor glucose control	Good control of blood glucose before surgery

2.11 How are diabetic retinopathy and diabetic macular edema treated?

Effective management of diabetes and associated risk factors is the cornerstone of treatment and control of DR (of all stages) and DME.

There are several treatment options available for DR and DME. The ophthalmologist may decide on one or a combination, based on the severity of DR, the possible complications of the treatment, the presence of other eye conditions etc.

Treatment options for DR and DME are:

- Injections into the vitreous (AntiVEGF agents or steroids)
- Laser photocoagulation
- Vitrectomy

(See Section 6 for more details)

2.12 Why is screening important for diabetic retinopathy?

Clinical trials show that early identification and treatment of DR reduces the risk of vision loss by over 90 per cent,[23,24] however several factors delay the identification of DR at an early stage.

Some of the inhibiting factors are:

- About half the people with diabetes are not aware that they have the condition.
- If aware of diabetes, they are unaware of complications of diabetes, including DR.
- Many lack awareness that a regular examination of the retina is needed to identify DR at early stages so that it can be treated to prevent loss of vision.
- Patients with DR do not experience any symptoms until advanced stages of the disease and therefore fail to access timely care.
- Opportunities to access services for the management of DR are limited.

Systematic screening methods have been shown to be very effective in the early detection of DR[25,26], thus providing opportunities for timely management. A DR screening programme should address all the challenges discussed above.

3. Integrated diabetic retinopathy screening and management programme

3.1 What is a DR screening and management programme? How will it be delivered?

The aim of the programme in India for DR screening and management is to reduce blindness and VI due to DR. The intention of this programme is that the prevention, detection and management of DR should become an integral component of public health services. Although currently there is no national programme for DR screening and treatment, existing national policies provide opportunities to integrate DR services into them. A pilot programme in 10 districts across 10 states in India has demonstrated the benefit of a targeted DR screening and management programme.[27]

3.2 How can the DR screening and management programme be integrated with existing health services?

The Government of India's programme for the control of non-communicable diseases —National Programme for the Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS) and National Programme for Control of Blindness and Visual Impairment (NPCB&VI)— offer scope to expand services for DR screening and management. Apart from this, there are several initiatives by non-governmental organisations (NGOs), local and international, and private hospitals that are addressing DR. The existing resources and processes in these programmes and the services offered for DR by NGOs and private providers can also be leveraged for the DR programme.

3.2.1 National Health Mission and the National Programme for Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke

The Government of India launched a flagship programme in 2005, the National Rural Health Mission (NRHM)[28], which was subsequently enlarged in scope to cover urban areas and transformed into the National Health Mission (NHM) in 2013.[29] The objective was to revamp existing mechanisms of health care service delivery. NRHM provided the platform to integrate the Family Welfare and the National Disease Control Programmes under one umbrella for optimisation of resources, such as human resources, augmenting community-based services by introducing the ASHA (Accredited Social Health Activist) at village level, and upgrading public health infrastructure through Indian Public Health Standards (IPHS).

The NPCDCS was launched in 2010 with the objective to prevent and control common non-communicable diseases (NCDs) through behaviour and lifestyle changes, and to provide early diagnosis and management of common NCDs.[2] Diabetes is an important component of the NPCDCS programme.

The activities of the NPCDCS programme are incorporated at all levels of the health system: states, districts, community health centres (CHCs), primary health centres (PHCs) and health and wellness centres (HWCs)/ sub health centres (SHCs). Monitoring at all levels is through NCD cells established for the purpose. The framework of the Indian health system and services available under NPCDCS are outlined in Figure 4.

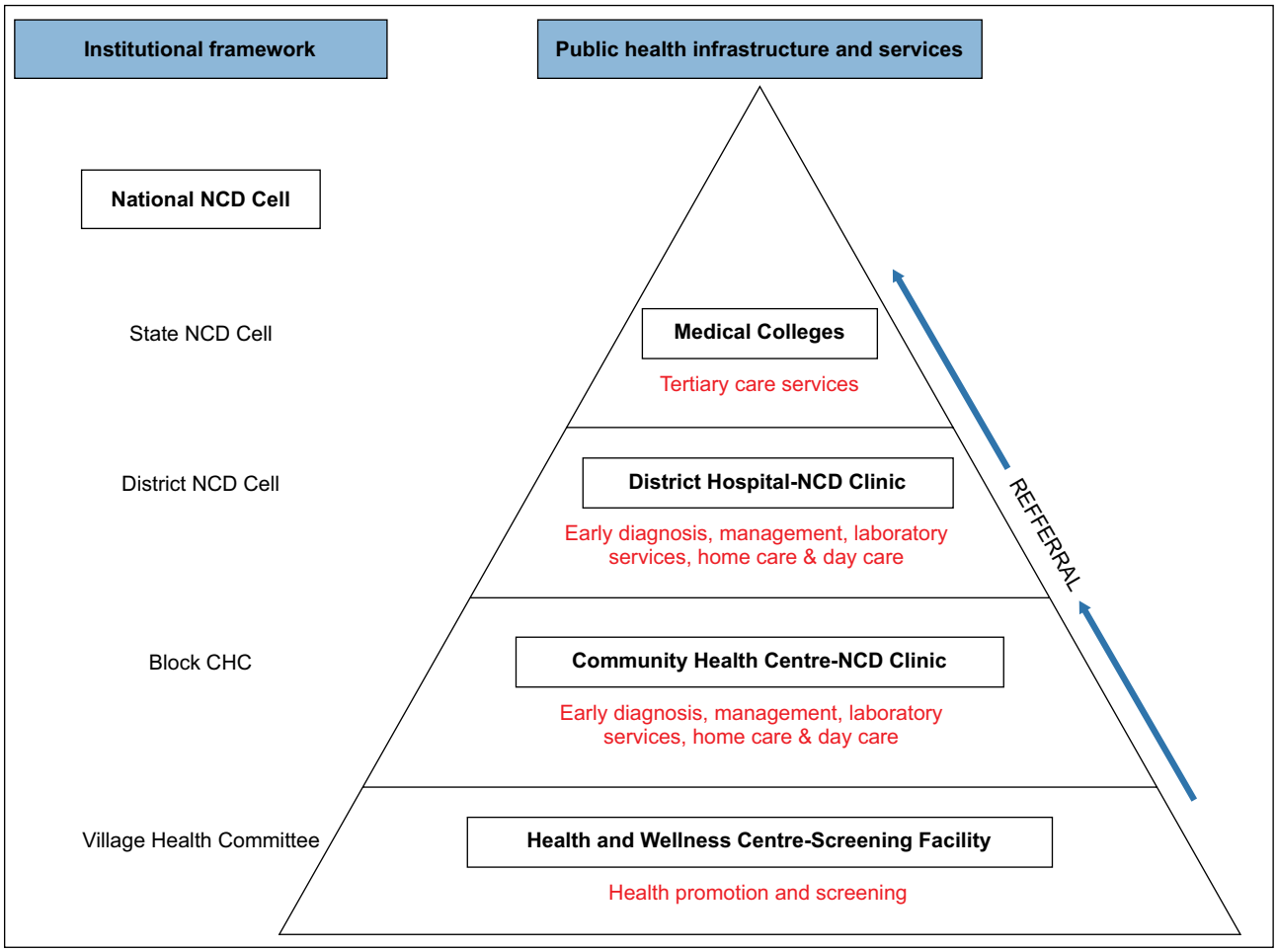


Figure 4: The framework of the Indian health system and services available under NPCDCS

The NPCDCS aims to integrate NCD interventions within the NHM framework to optimise resources for sustainability. The NCD cells proposed at various levels of the health system were to ensure implementation and supervision of programme activities related to health promotion, early diagnosis, treatment and referral. The programme also attempts to create a wider knowledge base in the community for effective prevention, detection, referrals and treatment.

Objectives of NPCDCS:

- Health promotion through behaviour change along with involvement of the community, civil society, community-based organisations, media etc.
- Opportunistic screening at all levels in the health care delivery system for early detection of diabetes, hypertension and common cancers. Outreach camps are also envisaged as part of this initiative
- Prevent and control chronic non-communicable diseases (NCDs), especially cancer, diabetes, cardiovascular diseases (CVDs) and stroke
- Build capacity at various levels of health care for prevention, diagnosis and treatment, information, education and communication (IEC), operational research and rehabilitation
- Provide support to the diagnosis and cost-effective treatment at primary, secondary and tertiary levels of health care
- Support the development of a database of NCDs through a surveillance system and to monitor NCD mortality and risk factors.

Strategies of the NPCDCS programme

The key objective of the NPCDCS is to ensure that NCD related health services are incorporated into Universal Health Coverage plans.

The strategies are:

- Opportunistic screening of persons aged 30 years at the point of primary contact with the health system: village/community, SHCs, PHCs, CHCs, district hospital or tertiary care hospital

- Opportunistic screening is undertaken for diabetes using random blood sugar to identify individuals who are at high risk of developing diabetes and cardiovascular diseases (CVD), warranting further investigation/management
- Establishment of NCD clinics in CHCs and District Hospitals for comprehensive examination of persons referred by health personnel at the periphery to identify and manage treatable stages of diseases. This also includes diabetes with screening, diagnosis and management (including diet counselling and lifestyle management) and home-based care as the key functions. The coverage of NCD clinics is proposed across India.

In the first year of inception, the strategies were proposed to be implemented in 20,000 sub-centres and 700 CHCs in 100 districts across 21 States during 2010-2012. As of June 2017, the NPCDCS covered 435 districts and 2143 CHCs. As part of opportunistic screening in 2016-2017, 22.4 million people were screened for diabetes at designated NCD clinics at district and CHCs. Among them 2.2 million (9.7 per cent) were found to have diabetes. Additionally, population-based screening using frontline health and community workers has been undertaken in 100 districts and 25 cities in India over the 2017-2018 period.[30]

For comprehensive management of lifestyle related disorders, a pilot project on integration of AYUSH with NPCDCS has been initiated in six districts in India.[31] A package of services has been proposed at different levels of health care in the country (Table 4).

Table 4. Package of services proposed at different levels of healthcare in the country

Health Facility	Package of services
Health & wellness centre (sub health centres)	• Health promotion for behaviour change and counselling • Opportunistic screening of diabetes and hypertension • Awareness generation of early warning signals of common cancers • Referral of suspected cases to CHC/ nearest health facility
Primary health centre	• Health promotion for behaviour change and counselling • Opportunistic screening of diabetes and hypertension • Clinical diagnosis and treatment of common CVDs • Identification of early warning signals of common cancers • Referral of suspected cases to nearest CHC
Community health centre/ first referral unit	• Prevention and health promotion including counselling • Early diagnosis through clinical and laboratory investigations • Management of common CVDs, diabetes and stroke cases • Lab investigations and diagnostics: blood sugar, total cholesterol, lipid profile, blood urea, x-ray, ECG, ultrasonography • Opportunistic screening of common cancers (oral, breast and cervix) • Referral of complicated cases to district hospital/higher health care facility
District hospital	• Diagnosis and management of cases of CVDs, diabetes, stroke and cancer (outpatient, inpatient and intensive care) including emergency services particularly for myocardial infarction & stroke. • Lab investigations and diagnostics • Referral of complicated cases to higher health care facility • Health promotion for behaviour change and counselling • Opportunistic screening of NCDs including common cancers. • Rehabilitation and physiotherapy services
Medical college	• Mentoring of district hospitals • Early diagnosis and management of cancer, diabetes, CVDs and other associated illnesses • Training of health personnel • Operational research

Table 5. Staffing pattern proposed for the different levels of the health system under the NPCDCS programme

Human Resource	Sub-centre/ Health & Wellness Centre	NCD Clinic / CHC	NCD Clinic / District Hospital
Medical officer	-	1	1
NCD nurse	-	2	2
Physiotherapist	-	-	1
Counsellor/ care coordinator	-	1	3
Lab technician	-	1	2
Data entry operator/ assistant	-	1	1
ANM/ male health worker	2	-	-

An indicative list of essential drugs for diabetes, CVD and stroke has been formulated. For diabetes this includes insulin (injectables), Metformin and Glimepiride tablets. A patient referral card has been developed. Standard formats have been devised for the sub-centre/HWCs, CHC at district and state levels (Annexures 4 - 11).

The staffing pattern proposed under the NPCDCS at different levels of the health system is shown in Table 5.

3.2.2 The 'Ayushman Bharat' initiative

Under the 'Ayushman Bharat' initiative, in order to expand access to comprehensive primary health care (CPHC), SHCs and PHCs are being strengthened as well as HWCs. The HWCs are to provide promotive, preventive, curative and rehabilitative care for an expanded range of services encompassing reproductive and child health services, communicable diseases, non-communicable diseases, palliative care and elderly care, oral health, ENT care, and basic emergency care. The services in HWCs will be provided through a mid-level health care provider (MLHP)/community health officer (CHO) placed at a HWC-SHC and medical officer at PHC (rural/ urban). The MLHP/CHO will undergo a certificate course in community health through the Indira Gandhi National Open University (IGNOU) or a public university. As of February 2019, 8030 health & wellness centres were functional across the country.

To leverage mobile technology, an application called mDiabetes[32] has been launched to generate awareness, to promote adherence to treatment and to inculcate healthy habits among the population with special focus on target groups.

3.2.3 National Programme for Control of Blindness and Visual Impairment

The National Programme for Control of Blindness and Visual Impairment (NPCB&VI) was launched in 1976 as a 100 per cent centrally sponsored scheme with the goal of reducing the prevalence of blindness to 0.3 per cent by 2020.[33] India was the first country in the world to have a national level public-funded programme for blindness control. Initially the programme had a specific disease focus on cataract but now the programme provides comprehensive eye care services and funds the management of other diseases causing blindness, including DR.

The objectives of NPCB&VI are to:

- Reduce the backlog of blindness
- Develop comprehensive eye care facilities in every district
- Develop human resources for providing eye care services
- Improve quality of service delivery to the affected population
- Secure participation of voluntary organisations/private practitioners in eye care
- Enhance community awareness on eye care
- Ensure human resources and eye care facilities.

Under NPCB&VI, trained ophthalmologists are posted at district and some sub-district hospitals and ophthalmic assistants/ ophthalmic officers (OA/OO) at upgraded PHC/ CHC (one OA/OO per 100,000 population) and district hospitals. In addition to the existing vision centres/ PHCs, the government proposed to add 1,500 new such facilities over the period 2017-2020. The NPCB&VI provides for appointment of contractual staff including ophthalmologists and OAs wherever

regular staff are not available. The duty charter of OA/OO under NPCB&VI includes detection of DR.

Vision centres have also been set up by the NGO sector, catering to a population of 30,000 each and a trained vision technician manages these centres.

Training

The NPCB&VI provides training in the form of retina fellowships to ophthalmologists and provides for equipment, such as lasers, at medical colleges and regional institutes of ophthalmology. Training fellowships of three month duration are supported for medical retina and laser techniques as well as for vitreoretinal surgery. The skills emphasised in the fellowship include the use of indirect ophthalmoscope, fluorescein angiography, use of +78D and +90 D lenses for examination in addition to conducting PRP laser delivery for 20 cases, under the supervision of a trained ophthalmologist. NPCB&VI has accredited a list of training institutions for imparting this training.

Reimbursement

NPCB&VI also supports a scheme of reimbursement of costs for vitreoretinal surgery and laser treatment undertaken in the private/NGO sector. NPCB&VI provides a grant-in-aid for NGOs for management of DR: Rs 2,000 is given for treatment/ management of DR and Rs 10,000 is provided for vitreoretinal surgery.

Outreach services

Development of multipurpose district ophthalmic units (DOUs) is one of the new initiatives of NPCB&VI introduced during the 12th Five Year Plan (2012-2017).

The objectives of the scheme are:

- To operationalise multipurpose district mobile ophthalmic units in district hospitals for improved access to eye care services
- To further expand eye-care coverage
- To make eye care services available in remote and underprivileged areas of the country.

The activities under the scheme include diagnosis of DR among others such as:

- Screening of eyes
- School eye screening
- Transporting patients from screening centers to the nearest district hospital/ referral centre for further management
- On the spot refraction and provision of glasses
- Diagnosis of glaucoma
- Display of information, education and communication (IEC) messages on its outer panels.

To carry out the activities, fully equipped mobile vans with trained paramedical ophthalmic assistants/ ophthalmic officers (PMOAs/OOs) are being provided in a phased manner to cover all districts with special preference to hilly/remote areas. During the 12th Five Year Plan, it was planned that 4000 multipurpose district mobile ophthalmic units in district hospitals would be introduced in a phased manner.

An estimated annual service load for DR control and management for the government health facilities is shown in Table 6.

Table 6. Estimated annual service load for government healthcare facilities for systematic screening of diabetes/diabetic retinopathy, diagnosis and management

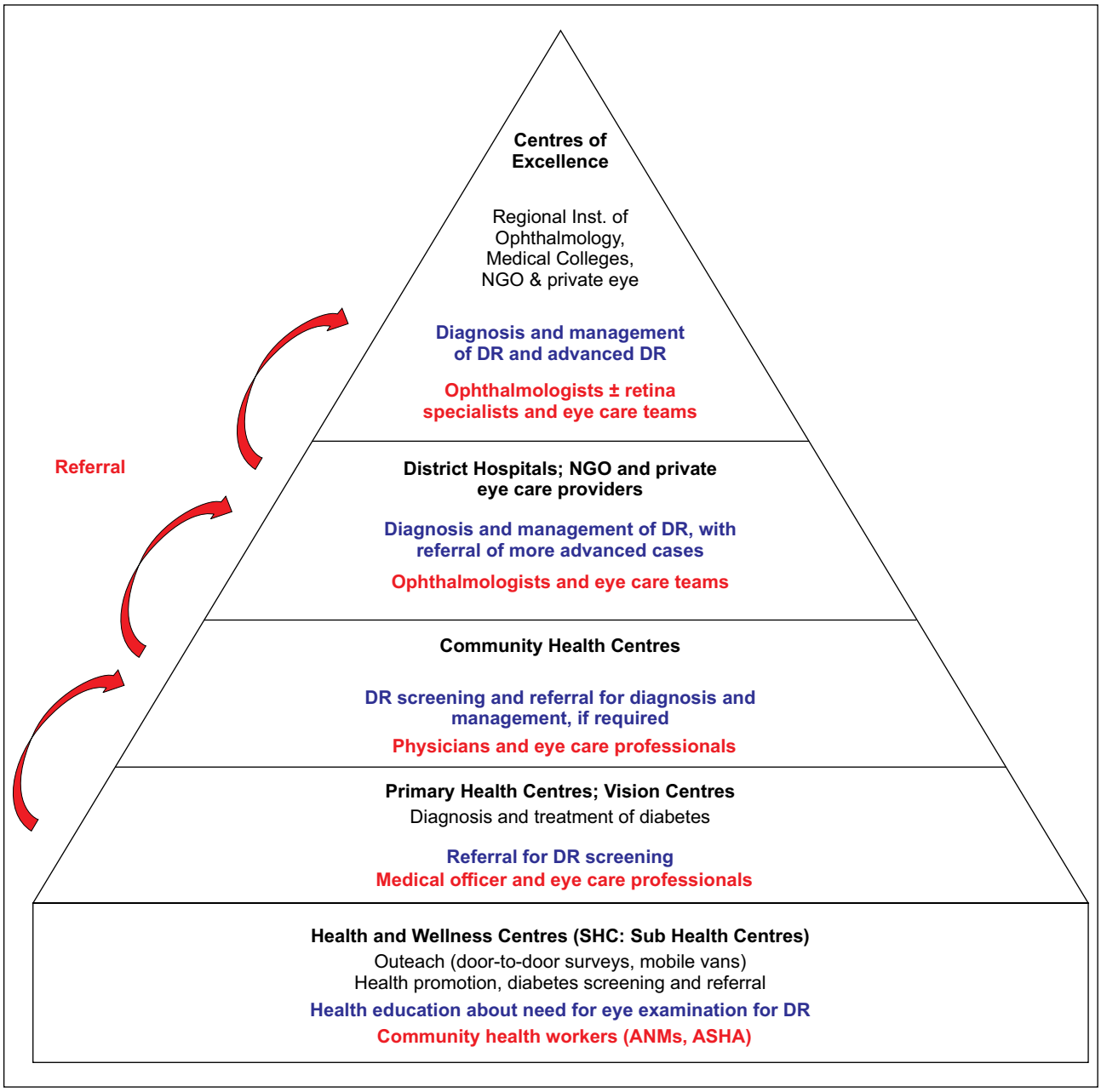
Level of healthcare facility	Population covered	At risk of DM (≥30 years)	People with diabetes	PwDM with DR	PwDM with VTDR
		45%[34]	8%[11]	25%	7%
Health and wellness centres/ sub-health centre	5,000	2,250	180	45	3
Primary health centre	30,000	13,500	1,080	270	19
Community health centre	1,20,000	54,000	4320	1080	76
District health centre (hospital)	10,00,000	4,50,000	36,000	9,000	630
Action needed		Screening for diabetes	Screening for DR	Screen failure: refer for diagnosis	Treatment and follow up

The key tasks for the different healthcare professionals in control and management of DR is given in Annexure 1 and the list of basic equipment and drugs available in the public health systems for the purposes in Annexure 2.

3.2.4 Primary eye care services

With the global initiative of VISION 2020: The Right to Sight – India, the government of India established primary eye care services in fixed PHCs in rural areas. These primary eye care services (also known as vision centres) are managed by trained "ophthalmic officers/ PMOAs and are provided with necessary infrastructure. The non-governmental tertiary care institutions have also established their own vision centres and are actively providing primary eye care services.[35] Some of them provide DR screening services and employ telemedicine. For good universal health coverage, it was estimated that a minimum of 26,400 vision centers; 2,640 secondary centers; 264 tertiary centers and 27 centers of advanced tertiary care are needed for the population of India.[36] To operate these, an estimated 98, 244 allied health personnel and 6,832 practicing ophthalmologists

Figure 5. Existing infrastructure and human resources available for diabetic and vision care services under the public health system



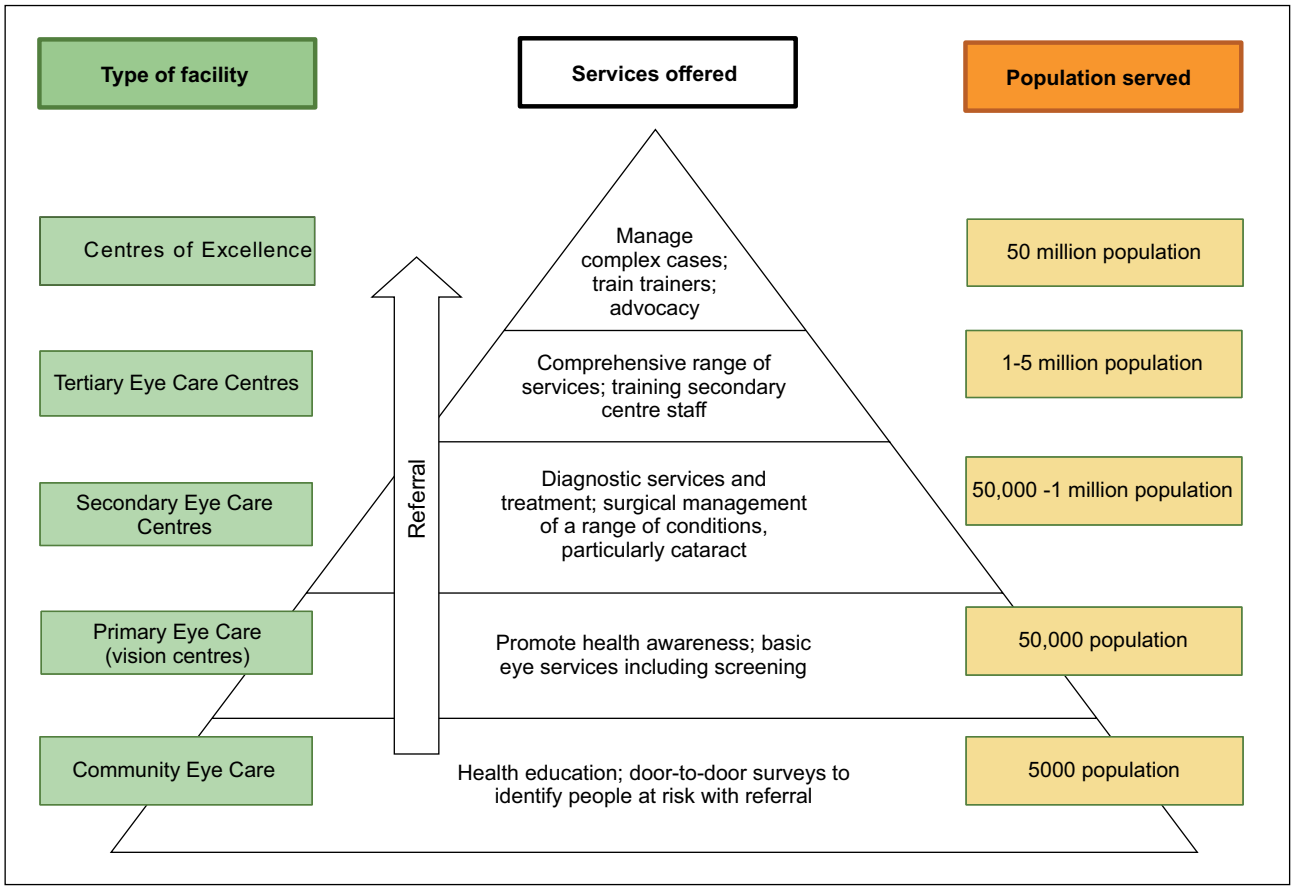


Figure 6: The Government of India proposed model for eye care services

are required. The existing infrastructure and human resources available for diabetes and eye care services is shown in Figure 5.

The Government of India proposed a model for eye care service delivery under the Vision 2020 initiative. The model initially developed by LV Prasad Eye Institute is a bottom-up approach of referral for eye care services and underpins the importance of vision centers/ primary health centres in the success of any eye care service delivery model (Figure 6) with required equipment and infrastructure (Annexure 2).

Primary health care should be supported by community-based care provided by accredited social health activists (ASHA) and the female health workers/ANMS at the SHCs. In addition to their work in detecting people with diabetes, they can play an important role in motivating all registered/ known people with diabetes to take part in regular screening for complications and co-morbidities (Table 7).

3.3 Support from community-based personnel

Suggested roles and responsibilities of different commuity-based personnel are listed in Table 7.

3.4 How will the objective of the diabetic retinopathy programme be achieved?

Several strategies have to be adopted to achieve the objective of an integrated DR programme. The strategies to achieve the objective of the DR programme through the Theory of Change are outlined in Figure 7.

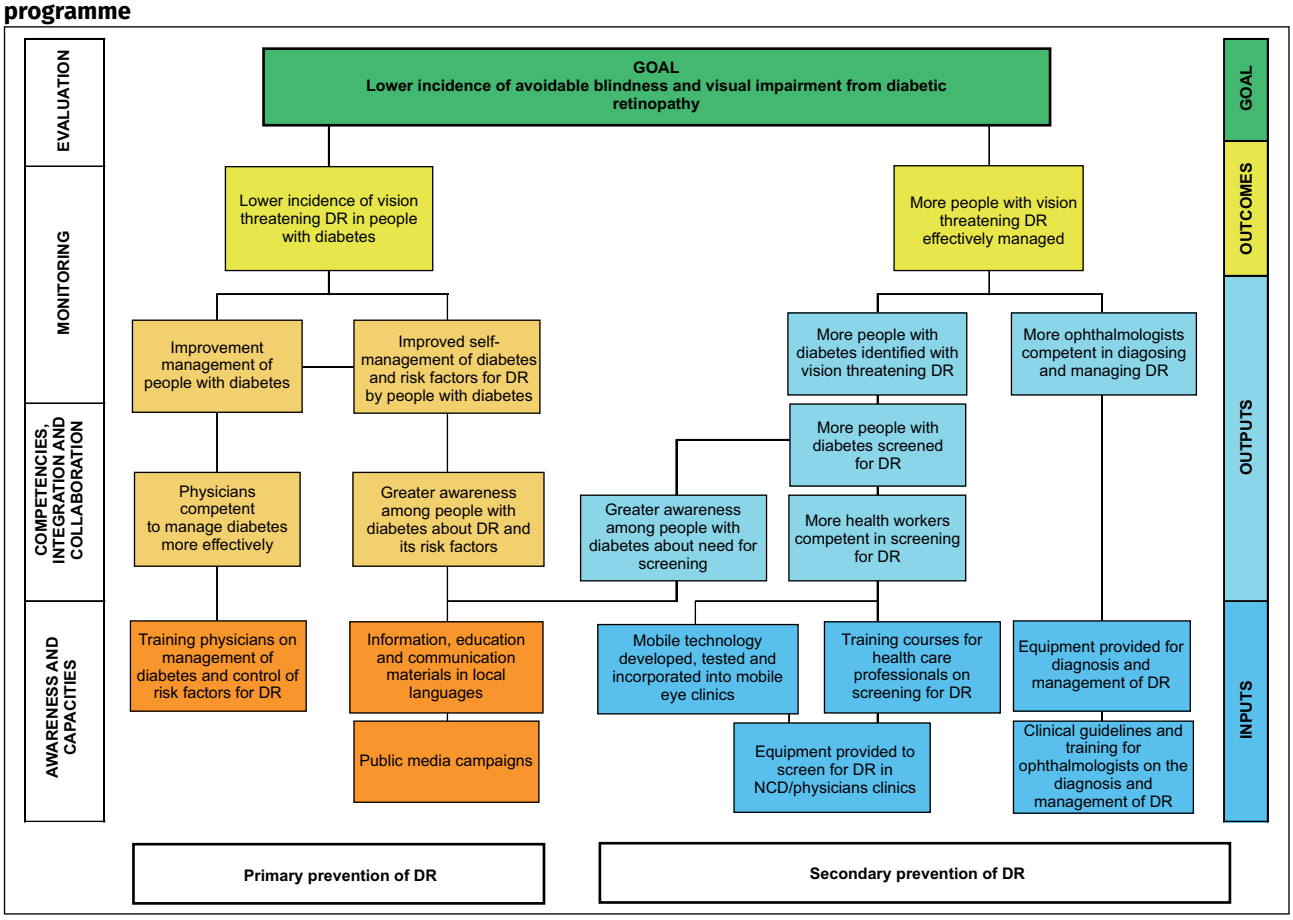
Theories of Change define and describe all the interconnected elements needed to bring about the long-term goal of a programme using a causal pathway. The long-term goal is defined first, and working back from this, inputs and interventions, activities and processes are described in a logical manner.

A Theory of Change can be modified in the light of preliminary studies or changing priorities in order to identify what needs to be monitored or assessed in terms of inputs, outputs, outcomes and impact. In addition, states would have their own strategies for eye care under the NCD and blindness prevention programme. These strategies would need to be expanded according to the needs of each state.

Table 7. Roles and responsibilities of different community-based personnel

Roles & responsibilities	ASHA	ANM / Female HW
Increasing awareness	• Educate people about diabetes and its complications during house-to-house visits • Counsell people about diabetes and the need for DR screening to reduce the risk of development and progression of disease	• Pre-conceptional counselling on DR for women with diabetes • Counsell women with hyperglycaemia of pregnancy, to reduce the risk of diabetes
Support for DR screening	• Explain the procedure of DR screening • Motivate people with diabetes to get screened annually • Mobilise people with diabetes to visit DR screening centres	• Explain the procedure of DR screening to women • Motivate women with diabetes to get screened annually • Mobilise women with diabetes to visit DR screening centres
Support for referral	• Motivate identified DR cases to get treatment and explain the risks of not being treated	• Motivate women who were identified with DR to get treatment and explain the risks of not being treated
Follow up of non-compliant people with diabetes	• Identify, track missing cases and motivate them to get treatment	• Identify, track missing cases and motivate them to get treatment
Follow up	• Follow-up of treated cases	• Follow-up of treated cases

Figure 7. Theory of change: different strategies to adopt to achieve the objective of the diabetic retinopathy programme



DR: Diabetic Retinopathy; VTDR: Vision Threatening Diabetic Retinopathy

4. Prevention of diabetic retinopathy and diabetic macular edema

4.1 How can vision-threatening diabetic retinopathy be controlled?

The prevention of VTDR and its complications can be attempted at several levels (Table 8). The cornerstone of any preventive measure is to empower the public/patients by enhancing their knowledge of the disease, its consequences and actions required to prevent the disease.

4.2 Goals at different prevention levels

- **Primordial prevention**: prevention of risk factors for diabetes
- **Primary prevention**: identify persons with diabetes and treat risk factors for DR
- **Secondary prevention**: screen and effectively treat all patients with vision threatening DR before the onset of visual loss
- **Tertiary prevention**: treat VTDR as this can prevent visual loss, or improve vision (DME); vision rehabilitation

Table 8. Levels of prevention and services to prevent/control diabetic retinopathy

Levels of prevention	Healthcare person who implements the strategy
1. Primordial prevention	
Education about diabetes and its complications, and the benefits of a healthy lifestyle	Community health workers
Mobilise people at risk for diabetes to attend diabetes screening camps	ASHAs
2. Primary prevention	
Screen for diabetes and confirm the diagnosis	ANMs
Good control of blood glucose, and hypertension and dyslipidemia, if present	Physicians at all levels
Promote lifestyle changes to improve control of the above	Physicians, counsellors, peer support groups
3. Secondary prevention	
Referral for retinal screening / retinal examination by an ophthalmologist	NCD staff and physicians at all levels
Integrated visual acuity measurement and retinal screening for DR in vision centres/NCD clinics in CHCs and district hospitals; in physicians and endocrinologists clinics using non-mydriatic digital fundus camera	Screening can be undertaken by the following, if competent after training: ophthalmic officers/ assistants or equivalent, NCD nurses, other healthcare professionals

Levels of prevention	Healthcare person who implements the strategy
Grading images, with referral of those with signs of mild or more severe DR, or who fail screening for other reasons (e.g., poor image quality; reduced visual acuity). Annual screening for those with no or minimal DR	Ophthalmologists/diabetic eye screeners trained in image grading
Manage vision threatening DR, with regular follow up	Trained ophthalmologists
4. Tertiary prevention	
Treat DME associated with loss of vision	Trained ophthalmologists
Manage advanced DR, if indicated, at the discretion of the ophthalmologist	Retina specialists in centres of excellence
Rehabilitation for those with irreversible loss of vision	Rehabilitation workers

5. Screening for diabetic retinopathy

5.1 Components of an effective DR screening programme

An effective DR screening programme should involve all the following components:

- All eligible people should be identified and screened in a timely manner i.e., those known to have diabetes
- The screening test used is validated and has high levels of sensitivity and specificity
- Those who are screened should receive their results (whether DR is present or not present) in a timely manner
- While communicating screening results, sufficient information should be provided to those screened for a proper understanding of their condition
- Facilities are in place for confirmatory diagnosis and management
- Robust systems are in place for tracking and monitoring.

Activities that can be undertaken at different levels of the health system are illustrated in Table 9.

5.2 Who needs to be screened for diabetic retinopathy?

All persons diagnosed with diabetes should be screened for DR.

Table 9. Activities for diabetes and diabetic retinopathy screening across all centres

Activities	PHC/CHC/ HWCs	Diabetes centres/ clinics (NCD clinics)	Vision centre	Secondary centre	Tertiary centre
Diabetes screening					
History	+	+	+	+	+
Blood test	+	+	+	+	+
DR screening					
Visual acuity measurement	+	+	+	+	+
Dilated eye examination: direct ophthalmoscopy or slit lamp biomicroscopy			+	+	+
Fundus photography	+/-	+	+/-	+	+
Distribution of IEC material	+	+	+	+	+
Counselling & referral to secondary/tertiary eye care centres	+	+	+	+	+

Table 10. Timing and frequency of screening for diabetic retinopathy of different groups of persons with diabetes

Type of diabetes	Screening initiation and frequency of screening
Type I with an early onset	• At 10 years of age • If no DR detected: screen again in one year
Type 1 with an onset after puberty	• Detailed eye examination at diagnosis • If no DR detected, start screening 5 years after diagnosis • Annual screening if no DR is detected • Refer to an ophthalmologist if there are any signs of DR or DME
Type 2 and youth-onset diabetes	• As soon as possible after the diagnosis of diabetes • If no or mild DR is detected: screen again in one year
Pregnancy in known diabetics	• Dilated retinal examination by an ophthalmologist before conception or at the first antenatal visit • Then every three to six months during pregnancy with the frequency determined by the findings. • If DR is detected during pregnancy, examinations should continue for 12 months after delivery
Gestational diabetes	• No DR screening required during pregnancy • If diabetes is detected after pregnancy, annual screening is required

5.3 When to screen for diabetic retinopathy?

Given the limited data on the incidence and progression of DR in India, the following recommendations have been drawn from guidelines of other countries, most of which are for high-income countries, from ICMR (2018), ninth International Council of Ophthalmology (2017),[37] VISION 2020 India (2015)[38] and a review of guidelines in Asia.[39]

Table 10 gives recommendations for the initial and follow-up screening for DR in India. The timing of follow-up screenings depend on the findings at screening. When there are no abnormal findings, screening should be undertaken again in one year. If any abnormalities detected, the ophthalmologist will decide on the frequency of follow-up examination. The follow-up screening recommendations given here are therefore suggestive.

5.4 What tests are done in diabetic retinopathy screening?

The principal purpose of screening for DR is to detect retinopathy that warrants a more detailed examination by an ophthalmologist followed by treatment, if required. During screening, other eye conditions associated with diabetes, such as cataract and retinal vein occlusions, maybe detected. Such individuals should also be referred to an ophthalmologist.

The minimum components of a screening evaluation should include the following:

- Medical history
- Measurement of visual acuity in each eye
- Evaluation of the retina

In the medical history, the following essential information must be collected:

- Duration of diabetes
- Past glycemic control (HbA1c)
- Medications, especially for diabetes
- Presence of the following: obesity, renal disease, other systemic conditions
- Hypertension, serum lipid levels, pregnancy
- Ocular history

5.5 How is visual acuity measured?

Visual acuity measurement is very important in PwDM and should be done during each visit to diabetes and eye care facilities.

Anyone with reduced vision in one or both eyes (vision of less than 6/12) should be referred, even if no DR is detected on screening. This is because they may have DME, which cannot always be detected during screening.

Visual acuity measurement assesses how well a person can see. Vision can be measured for viewing distant and near objects. Visual acuity for distance must be measured using standard charts, at the correct test distance (usually six meters), with the chart at the eye level of the person being tested. For non-literate populations, an E-Chart is used where the direction of the limbs of the E are indicated by the person being tested. Distance vision should be assessed with the person wearing their spectacles if they normally use them for distance viewing.

Visual acuity is recorded using numbers, such as 6/6, or 6/24. The first (top) number is the test distance (usually 6 for 6 meters). The second (below) number is the distance (in metres) at which a person with normal vision would be able see a letter of that size. 6/6 is normal vision, and a vision of 6/6 to 6/12 is classified as "near normal". A visual acuity of less than 6/12 is defined as visual impairment.

5.6 How is retinal evaluation done?

A range of different techniques can be used to evaluate the retina for DR, but not all are suitable for screening: possible methods include indirect ophthalmoscopy through a dilated pupil, direct ophthalmoscopy through a dilated pupil, non-mydriatic fundus (retina) photography (static or hand-held) using cameras specifically designed to be used through an undilated pupil, and mydriatic fundus photography (static or hand-held) which need a dilated pupil. Some of these techniques, such as indirect ophthalmoscopy require considerable expertise. Mobile phone applications are currently being tested and hold promise but should not yet be used as they have not been fully validated.

5.7 What is fundus photography?

The fundus camera is a complex optical system used for imaging the retina. In simple terms, it can be described as a specialised low power microscope with a camera attached. These cameras provide high quality images of the retina and the optic nerve. The images are used to diagnose and treat retinal conditions. As the images can be stored, it serves as a visual record allowing the ophthalmologist to track whether there have been any changes in the patient's retina over time.

5.8 Why is fundus photography a recommended method for screening in DR?

- Fundus photography can be performed quickly using a digital fundus camera
- The stored images are a visual record, allowing change over time to be determined
- It is user-friendly
- It has high sensitivity and specificity
- It is acceptable to PwDM
- Any healthcare professional (ophthalmic officers/assistants, nurses) can be trained to take high quality images
- Grading images can be done easily to decide on referral to ophthalmologists
- Images allow a system for quality control of grading, unlike clinical examination.

Non-mydriatic (without pupil dilatation) photography of the retina is recommended for DR screening, since the cameras are less expensive, and have continued to improve in terms of the quality of images, and software for storage. Cameras with a stand are preferred, rather than hand-held devices, as they are more stable, and it is easier to obtain gradable images.

Pupil dilatation may be required if good images cannot be obtained when the pupils are small or there are early or advanced cataracts. In countries like India, it is for these reasons that poor images can occur in up to 30 per cent of those screened. Pupil dilation, which requires the presence of a medically qualified professional, increases the proportion of people with gradable images.

5.9 Who can perform screening for diabetic retinopathy?

Any healthcare professional suitably trained can screen for DR: ophthalmic officers/ assistants/ optometrists, NCD nurses, physicians and trained technicians. All those involved in the screening for DR (diabetic eye screeners) need to undergo appropriate training in the use of non-mydriatic digital fundus camera and storage and grading of images with documentation of the findings.

Table 11. Different levels of health system where diabetic retinopathy screening can be done

Primary care services	Services for PwDM	Imaging	Pupil dilation	Grading images
In NCD clinics without eye care services (e.g., in PHCs)	Yes	Yes	No[a]	Remote
In NCD clinics with refraction / primary eye care but no medical officer	Yes	Yes	No[a]	Imager/remote
In NCD clinics with refraction / primary eye care with a medical officer	Yes	Yes	Yes[b]	Imager/remote
Secondary / tertiary services				
In NCD / physicians' clinics	Yes	Yes	Yes[b]	Imager/remote
In eye departments / hospitals	No	Yes	Yes[c]	Ophthalmologist

a. A medically qualified person needs to be present to sanction pupil dilation

b. If needed, to obtain a good image of the retina

c. Pupils should be dilated routinely in eye departments/hospitals

5.10 Where can diabetic retinopathy screening be done?

Screening for DR can be done at all levels in the health system - wherever PwDM access healthcare services (Table 11), whether in the public, NGO or private sector.

- At PHCs where vision centres are functional
- At NCD clinics in CHCs and district hospitals
- In medical colleges and other tertiary level services
- Screening should also take place in all eye care centres, eye departments and specialist hospitals when people with diabetes attend, regardless of the problem they present with. This is known as opportunistic screening.

It is essential that an imaging system like a fundus camera is available and the 'photographer' should have been trained in taking and storing images. If the image is taken by a technician, for example, and image grading is done remotely by an ophthalmologist, adequate internet bandwidth must be available to transmit the images. Where remote grading is done, the report should be communicated to the PwDM in the same sitting, if possible. If this is not possible, it should be available when the patient visits the NCD clinic next time, or the PwDM can be contacted by mobile phone.

In eye departments and hospitals, high-risk checklists, such as the one developed by Mohan's Diabetes Specialties Centre[40] (Annexure 3), can be a useful for patients aged 30 years and above, so that early detection of retinal changes can be facilitated even among those who were not previously diagnosed as having diabetes.

5.11 Grading retinal images

The person grading the images needs to take a management decision for each person screened at each screening session for which there are three options:

1. Enough DR is present to warrant referral to an ophthalmologist (or)
2. No DR, or only mild DR is present: further screening is recommended, usually in a year
3. If the image is of poor quality and cannot be graded, the person should be referred to an ophthalmologist.

Another reason for referral is reduced visual acuity, even in the absence of any detectable DR.

It is not necessary for the grader to make a detailed analysis on the extent of DR, as described in the International Classification of DR[41] for example. Referral decisions can be taken based on the presence or absence of some of the key retinal findings in DR (Table 12).

5.12 What other criteria are needed for referral?

In addition to the referral criteria based on whether DR and/or DME are detected, the visual acuity and presence of other retinal pathology also need to be considered (Figure 8)

Table 12: Grading of diabetic retinopathy and diabetic macular edema from digital fundus photography (non-mydriatic), and decisions for referral

Condition	Findings observable on dilated retinal examination (from the International classification of DR)	Referral decision at screening
Diabetic retinopathy		
No apparent DR	No abnormalities seen	Screen again in 12 months
Mild non-proliferative DR	Microanaeurysms only	Screen again in 12 months
Moderate non-proliferative DR	More than just micro aneurysms, but less than severe non-proliferative DR	Screen again in 6-12 months or refer to ophthalmologist
Severe non-proliferative DR	Any of the following:	Refer to ophthalmologist, to be seen within 2-3 months
	Intra-retinal haemorrhage (≥20 in each quadrant);	
	Definite venous beading (in two quadrants);	
	Intra-retinal microvascular abnormalities (in one quadrant)	
	No signs of proliferative retinopathy	
Proliferative DR	Severe non-proliferative DR and one or more of the following:	Urgent referral to ophthalmologist, to be seen as soon as possible
	Neovascularisation	
	Vitreous or pre-retinal haemorrhage	
Image not gradable		Refer to ophthalmologist
Diabetic macular edema		
No apparent DME	No retinal thickening or hard exudates in posterior pole	Screen again in 12 months
DME that <u>does not</u> involve the centre of the macula	Retinal thickening or hard exudates in the posterior pole but not involving the centre of the macula	Refer to ophthalmologist, to be seen within 2-3 months
DME that <u>does</u> involve the centre of the macula	Retinal thickening or hard exudates involving the centre of the macula	Urgent referral to ophthalmologist, to be seen as soon as possible

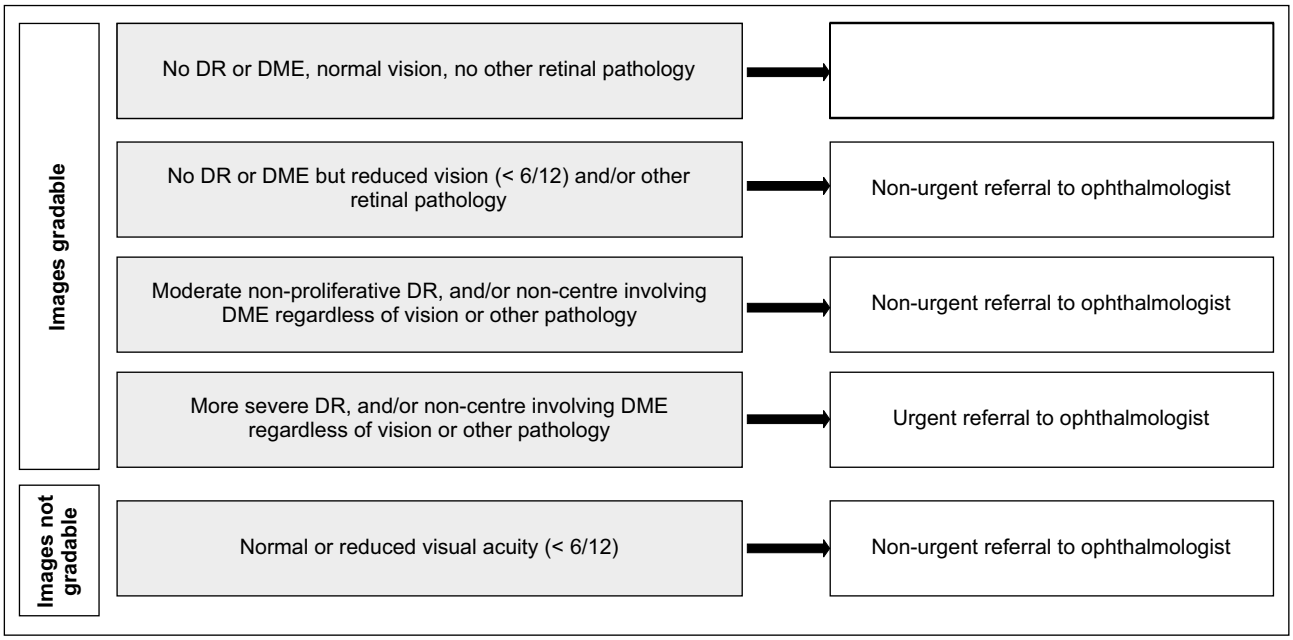


Figure 8. Decision tree for referral at DR screening

6. Assessment and management of diabetic retinopathy and diabetic macular edema

6.1 Management of patients referred to an ophthalmologist

The ophthalmologist will take a medical history, including the degree of control of diabetes, and the duration and type of diabetes. A detailed ophthalmic examination is required to confirm the presence and severity of DR and DME, which requires additional investigations (Table 13). Once the diagnosis has been confirmed, decisions can be made about optimal management for the patient.

Table 13. List of ophthalmic investigations for the assessment of diabetic retinopathy and diabetic macular edema, which guide decision about treatment

Ophthalmic investigation	Purpose
Slit lamp microscopy[a]	To give a magnified, binocular view of the retina. This is particularly useful to see if DME is present, and to look very carefully for signs of proliferative retinopathy i.e. new vessels on the optic disc or elsewhere in the retina
Dilated fundus photography with a larger number of images[a]	To provide more detailed images of the retina and to document the signs
Optical coherence tomography(OCT)[a]	To investigate the detailed anatomy of the macula, to assess the presence, location, type and severity of DME. OCT findings are important in decision making in the management of DME
Fluorescein angiography[b]	To see if there are new vessels which were not visible on clinical examination, and to see if visual loss is due to occlusion of capillaries at the macula. The latter cannot be treated and may be made worse by some forms of treatment.
B-scan ultrasonography[b]	Useful when the retina cannot be seen e.g., if there is vitreous hemorrhage or a dense cataract. Useful for planning surgery for retinal detachment and to remove vitreous hemorrhage.

a. Minimal essential equipment to diagnose diabetic retinopathy and macular edema

b. Required for the management of advanced diabetic retinopathy

6.2 How is vision threatening diabetic retinopathy and macular edema managed?

Ensuring optimal control of both blood glucose and other risk factors leading to DR is very important. Most patients with DME and DR will already be on medication to control blood glucose levels, but it may be necessary to refer some to a physician who will then assess whether additional medication is required, and to control other risk factors such as hypertension. If the patient was not known to be a diabetic before the DR or DME was detected, they must be referred to a physician. Even otherwise, the treating physician

Table 14. Treatment options for diabetic retinopathy and macular edema, mode of delivery, complications and initial follow-up

Type of DR	Treatment	Delivery	Possible complications	Frequency of initial follow up
Proliferative DR; severe pre-proliferative DR	Extensive laser treatment of the peripheral retina	Can be completed in two sessions per eye	Loss of peripheral field of vision; can cause DME	Every few months after treatment
	AntiVEGF agents	Monthly injections for at least a year	Infection inside the eye	Every month for 12 months, less often thereafter
Diabetic macular edema	Laser treatment of the macula Laser prevents further loss of vision	Usually done in one session per eye	Patchy loss of central vision	Every few months after treatment
	Anti-VEGF agents can improve vision	As above	As above	As above
	Steroids can improve vision	Injected into the eye or around the eye	Cataracts and raised intraocular pressure	Follow-up as required. Can be repeated
	Vitrectomy	Complex surgery; only for some types of DME	Cataract; retinal detachment	Follow-up as required

should be kept in the loop about the findings of the examination as the management of diabetes and control of the risk factors for DR needs the input of physicians.

Several factors influence the choice of treatment for a patient. The severity of DR/DME, and whether they are both present, are important factors. Other factors that need to be considered are whether the patient is likely to return regularly for follow-up, as some interventions need to be repeated frequently for up to a year, whereas laser treatment is almost "one-off". The treatment is usually decided on a case-by-case basis, after discussion with the patient.

Counselling patients before treatment is critical to ensure patients understand what the treatment entails, the possible complications, the need for close follow-up after treatment, and the need for a very long follow-up of patients treated for DR and DME. Information, education and communication (IEC) materials that are in simple language, preferably in the local vernacular need to be provided. The treatment options are summarised in Table 14.

7. Monitoring and programme management

Successful management of the DR screening and management programme would largely depend on the level of synergy between the NPCDCS and the NPCB&VI programmes. Activities such as systematic identification of people with diabetes and initiation of appropriate management of diabetes are included in the NPCDCS programme, with details provided in the guidelines. The NPCB&VI programme deals with the eye care component. It is important to construct a seamless flow of activities between the two programmes to achieve successful early screening and management of DR in the country. Close collaboration between physicians and ophthalmologists is also critical for the optimum management of patients.

7.1 Tracking persons with diabetes

Tracking PwDM needing retinal examination is an essential component for success of a DR screening and management programme. Tracking helps identify if the the PwDM referred have access to the screening and treatment services. Tracking should be bi-directional: forward tracking of PwDM requiring screening for diabetes/DR, with backward feedback to those screened/managed for DR. Backward tracking is necessary to check compliance with medical advice, such as keeping follow-up schedules, taking medications, etc. Community-based workers are best suited for tracking, provided appropriate support systems are available. The Mother and Child Tracking System (MCTS) of the Government of India's Reproductive and Child Health (RCH) Programme is a good example of a support system for tracking individuals and service delivery.

The MCTS is an innovative, centralised information technology-based web application established to improve the delivery of RCH care services through name-based tracking. It was developed to facilitate and monitor service delivery as well as to establish a two-way communication between service providers and those accessing the RCH programme. The MCTS generates work plans for the ANM s and sends regular alerts to the service providers. It also provides an opportunity to monitor delivery of services for health managers and helps in evidence-based planning and continuous assessment of service delivery to pregnant women and children. A similar template can be used for a DR programme.

7.1.1 Tracking DR

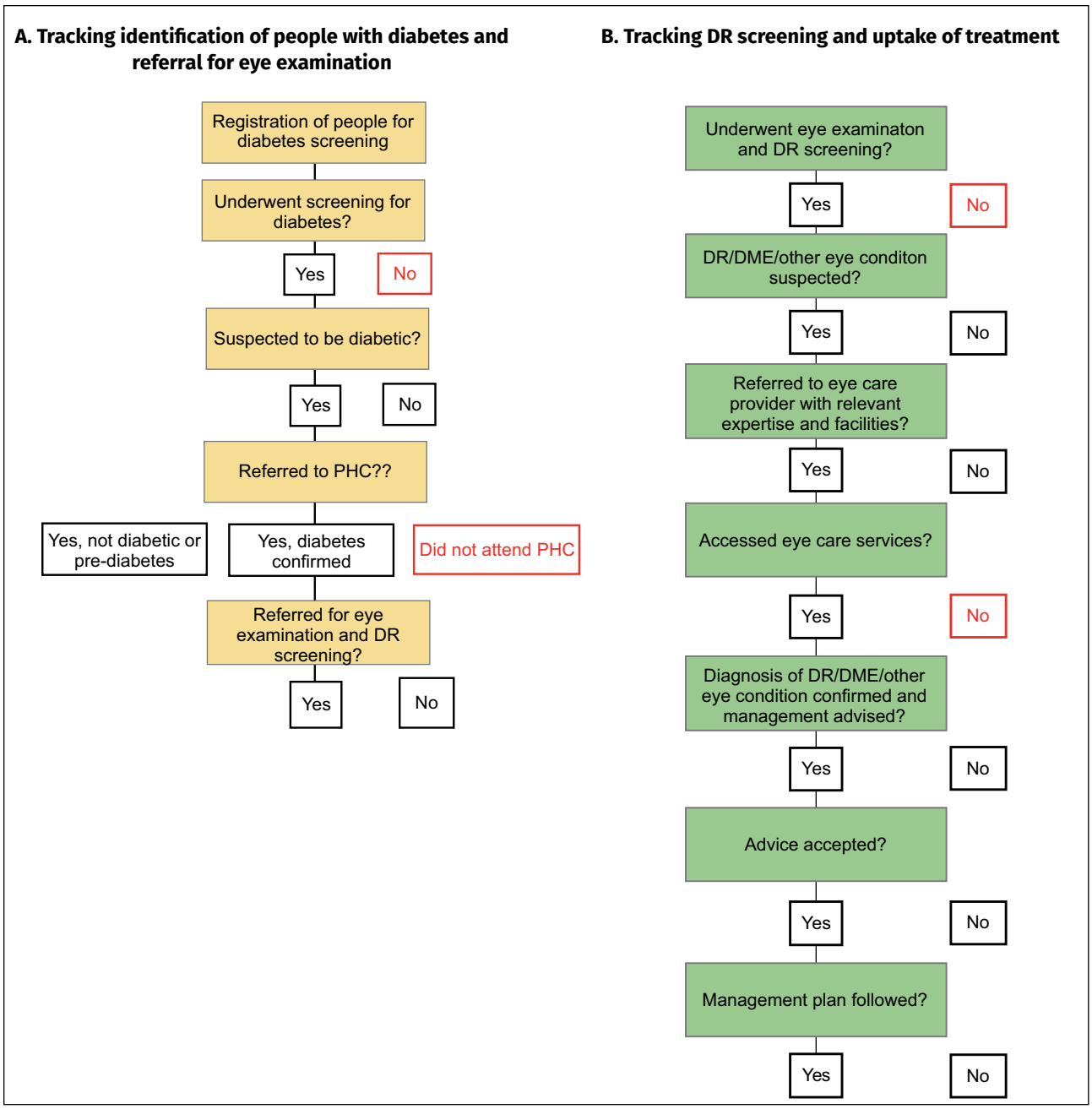
The development and use of the health management information system (HMIS) for NPCDCS and NPCB&VI is work in progress at different levels in the various states. The data generated are mainly used for monitoring, evaluation and programme management. The data inputs are provided by data entry operators stationed in PHCs/CHCs.

For the purposes of tracking, real-time data entry by the healthcare workers will be the ideal method as work plans and feedback can be provided in a timely manner to community-based health workers. On-the field, real-time data entry is achievable as there is provision for electronic tablets for community health workers under the NPCDCS and for OO/PMOAs and ophthalmologists under the NPCB&VI programme.

However, the availability of internet access and others issues need to be overcome.[42]Under the pilot project supported by the Queen Elizabeth Diamond Jubilee Trust, [21] a dedicated data entry and archival system has been developed and this software (Annexure 12) is beneficial since it includes DR and other eye details, unlike the NCD form or the forms used in NPCB&VI, which do not have any integrating components for diabetes and eye diseases. A recommended activity flow for tracking DR beneficiaries is shown in Figure 9.

Tracking is particularly important when images captured are accessed by remote graders, as the findings of the grading and the action required need to be communicated to those screened. Good systems need to be in place to ensure timely communication (Figure 10).

Figure 9. Recommended sequences for data flow in the process of tracking persons with diabetes



Red boxes indicate reminder messages to community members and people with diabetes, and alerts to community-based health workers and programme managers for action.

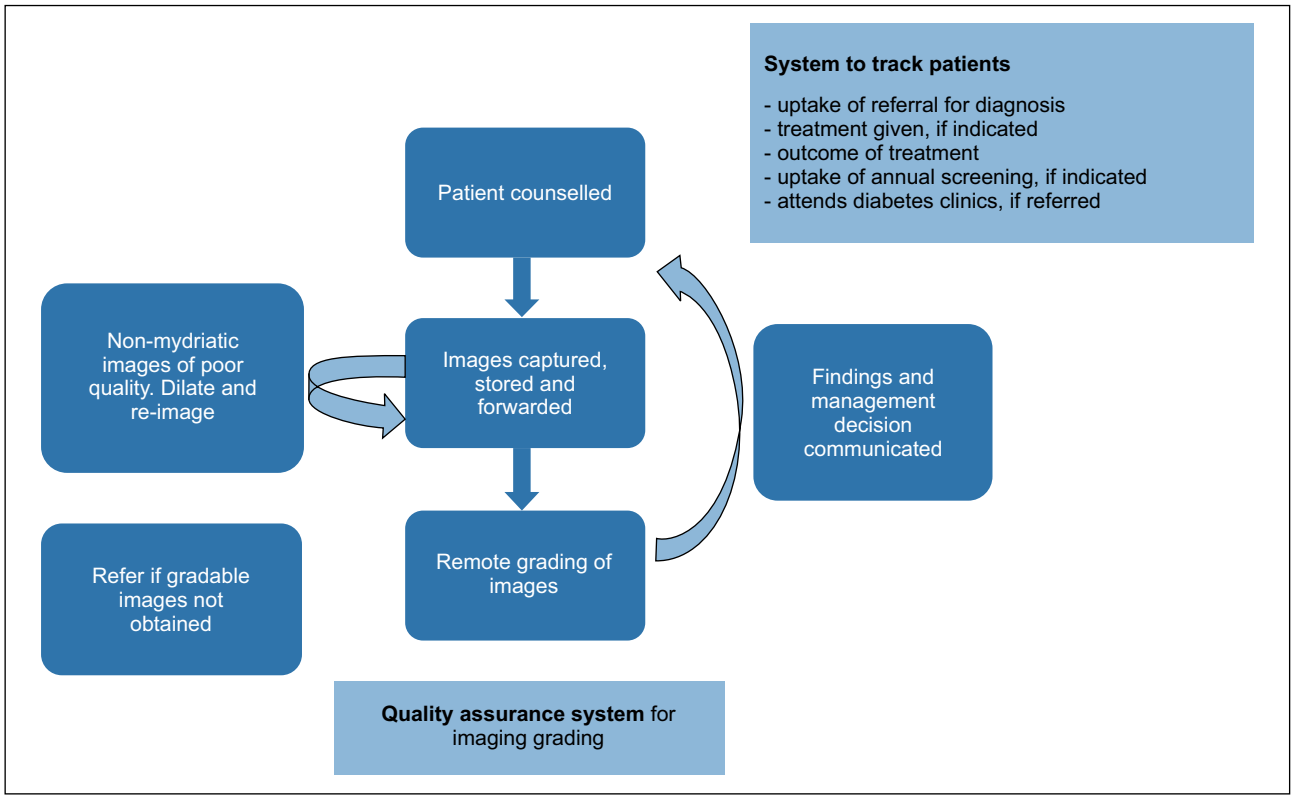


Figure 10. Systems needed in remote image interpretation for diabetic retinopathy screening

7.2 Programme monitoring

Monitoring in simple terms refers to the description, counting, and tracking of processes or events of a programme against what was originally planned. Monitoring aids in assessing if a programme is progressing on the intended path in a timely manner to achieve the set goals and objectives. Various indicators such as input, process, output, and outcome indicators are used to monitor the programme.

The success of the DR programme relies on the following components:

- Awareness generation among the lay audience about diabetes and its complications and the need for regular screening for DR and other eye diseases
- Capacity building by providing necessary human resources and equipment in the health facilities to carry out screening and management of VTDR and other eye diseases
- Periodic training of the healthcare staff on diabetes screening, DR screening and management for knowledge enhancement.

Important indicators to monitor the above components are given in Table 15. The list is not exclusive and additional indicators may be needed according to state specific plans and objectives.

The indicators listed in the table are specific for each health facility. They need to be compiled annually at district, state and country level.

Indicators from Nos. 1-10 in the table reflect the impact of the screening programme, especially awareness of PwDM on diabetes and eye complications enabling them to manage diabetes better and access eye care services.

7.3 Programme administration

The implementation and management of both NPCDCS and NPCB&VI are decentralised with major activities carried by the state and district health societies under the NHM. The central government provides directions and support to the programmes. The DR programme is planned to largely draw its resources and use the processes of NPCDCS and NPCB&VI.

The DR programme can be considered as consisting of two phases. Phase I involves identification of people at risk for diabetes, screening and management of diabetes. These activities are

Table 15. Suggested list of key monitoring indicators for the diabetic retinopathy programme

No	Indicators	Health facility	Reported by	Reporting frequency
Indicators related to identifying people with diabetes, treatment utilisation for diabetes and screening for DR				
1	Proportion of eligible persons screened for diabetes	HWC*	CHW	Monthly
2	No. of persons suspected to have diabetes	HWC	CHW	Monthly
3	No. of suspected persons diagnosed with diabetes	HWC/PHC and above	Physician	Monthly
4	Proportion of PwDM screened for DR	HWC/DH*	Eye care personnel	Monthly
5	No. of PwDM suspected with DR and/or other blinding eye diseases	Vision centre, CHC and above	Eye care personnel	Monthly
6	Proportion of suspected DR/other blinding eye conditions seen by an ophthalmologist	CHC and above	Ophthalmologist	Monthly
7	Proportion of suspected DR diagnosed with the condition	CHC and above	Ophthalmologist	Monthly
8	No. of persons diagnosed who underwent treatment for DR	Tertiary care centers**	Ophthalmologist	Monthly
9	Proportion of persons with good outcomes after treatment	Tertiary care centers**	Ophthalmologist	Monthly
10	No. of PwDM attending annual screening for DR	HWC	CHW	Annually
Indicators related to human resources				
11	How many community-based health workers are available for diabetes screening in each village?	HWC	District programme manager	Annually
12	Have the community-based health workers undergone training for DR screening programme?	HWC	District programme manager	Annually
13	Is a diabetic eye care personnel/NCD clinic nurse available in the facility?	Vision centers/CHC and above	District programme manager	biannually
14	No. of physicians available in each facility	PHC* and above	District programme manager	Annually
15	No. of physicians who underwent the DR training programme in each facility	PHC* and above	District programme manager	Annually
16	Is the diabetic eye care personnel/NCD clinic nurse trained in obtaining digital imaging and reporting?	Vision centers and CHCs	District programme manager	Annually
17	No. of ophthalmologists available in each facility	CHC and above	District programme manager	Annually
18	No. of ophthalmologists who underwent retina fellowships	DH and above	District programme manager	Annually
Indicators related to equipment and other resources for DR screening				
19	Is a digital fundus camera available and computer available in the facility?	Vision centers and CHCs	District programme manager	Annually
20	Is internet facility available in the facility?	Vision centers and CHCs	District programme manager	Annually
21	IEC material on diabetes and complications	HWC, PHC, vision centres, CHCs and above	District programme manager	Annually

*Includes urban equivalent facilities, **Medical Colleges and Regional Institutes of Ophthalmology. HWC: Health and Wellness Centre; CHW: Community Health Workers

important as early screening and good control of diabetes reduces the risk of VTDR. Phase I is essentially under NPCDCS. Phase II of the programme involves screening for DR, diagnosis and management of DR. Phase II activities are largely the activities of NPCB&VI. District programme managers of both NPCDCS and NPCB&VI should be able to access data related to diabetes and eye health. This will help in anticipating the service load in each facility and to plan effectively for the future. Sharing of information between the NPCDCS and NPCB&VI, especially through HMIS, would avoid duplication of administrative efforts in the DR programme.

7.3.1 Functions of the State Health Societies

The State Health Societies (SHS) manage the activities of the programme through the State NCD cell for NPCDCS and Blindness Division for the NPCB&VI programme. Their primary purpose is to plan, implement and monitor the NCD and blindness control activities in all the districts of the state as per the pattern of assistance approved by the Centre. The SHS is responsible for continuous flow of required funds to the districts for uninterrupted services. The SHS works for the achievement of the physical and financial targets planned under the programme in the state.

7.3.2 Functions of the District Health Societies

The primary functions of the District Health Societies (DHS) include planning, implementation and monitoring of activities at the district level.

Major activities include but not limited to the following:

- To assess the number of people with diabetes in the district
- To collect, maintain and report district level data to the SHS
- To organise DR screening camps
- To identify those needing care at higher level and provide logistic support
- To plan and organise training of community-based workers, healthcare workers and physicians involved in NCD and eye care services
- To procure drugs and consumables from SHS in the Government facilities
- To receive and monitor use of funds, equipment and materials from the government and other agencies/donors
- To involve voluntary and private hospitals providing free/subsidised eye care services in the district and identify NGO facilities that can be considered for non-recurring grants under the programme (NPCB&VI).

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9. Annexures

Annexure 1

Table 16. Key tasks of various healthcare professionals in the control and management of diabetic retinopathy

Tasks	ASHA	ANM / MPW	Diabetic eye screener	Physician/ diabetologist	Ophthalmologist /retina specialist
Health promotion	✓	✓	-	✓	-
Counselling on control of risk factors for diabetes	✓	✓	-	✓	-
Identifying population at risk for diabetes	✓	✓	-	✓	-
Mobilise community for diabetes screening	✓	✓	-	-	-
Identify suspected diabetes	✓	✓	-	✓	-
Referral to physician	✓	✓	-	-	-
Manage diabetes	-	-	-	✓	-
Counsel diabetics registered on the need for DR screening	✓	✓	✓	✓	✓
Refer to DR screening	-	-	-	✓	-
Screen for DR	-	-	✓	-	-
Refer suspected cases to ophthalmologist	-	-	✓	✓	-
Diagnose and manage DR	-	-	-	-	✓

ASHA: Accredited Social Health Activists; ANM: Auxiliary Nurse and Midwifery, MPW: Multi-Purpose Workers

Annexure 2

Table 17. Equipment and drugs available/required for the control of diabetic retinopathy screening and management at the different levels of health systems

Equipment/drug list	HWC/SHC	PHC	Vision centre; mobile ophthalmic vans	CHC	DH/ SDH	Tertiary care centres
Diabetes and risk factor screening						
Digital BP monitor/ sphygmomanometer	✓	✓	✓	✓	✓	✓
Measuring tape	✓	✓	✓	✓	✓	✓
Weighing machine	✓	✓	✓	✓	✓	✓
Glucometer with glucose strips	✓	✓		✓	✓	✓
HbA1C		✓		✓	✓	✓
Serum lipid profile		✓		✓	✓	✓
Diabetes, hypertension and lipid control						
T. Glibenclamide		✓		✓	✓	✓
T. Metformin		✓		✓	✓	✓
Insulin Injection (Soluble 40IU)		✓		✓	✓	✓
T. Amlodipine		✓		✓	✓	✓
T. Atenolol		✓		✓	✓	✓
T. Enalapril		✓		✓	✓	✓
T. Methyldopa		✓		✓	✓	✓
Lipid lowering agents		✓		✓	✓	✓
Screening, monitoring, treatment of diabetic retinopathy and other blinding diseases*						
Visual acuity charts: distance and near			✓	✓	✓	✓
Pin-hole occluder			✓	✓	✓	✓
Digital non-mydriatric fundus camera			✓	✓	✓	✓
Computer and software for fundus camera			✓	✓	✓	✓
Slit lamp biomicroscope and lenses for retina examination			✓	✓	✓	✓
Direct ophthalmoscope			✓	✓	✓	✓
Indirect ophthalmoscope with 20D/28D lens				✓	✓	✓
Fundus fluorescein angiography with retina camera						✓
Optical Coherence Tomography						✓
Inj. Tropicamide					✓	✓
Proparacaine 0.5% eye drops					✓	✓
Methylcellulose eye drops					✓	✓
T. Diamox 250mg						✓
Argon green laser						✓
Laser contact lenses						✓
Laser slit-lamp delivery system						✓
Steroid injection: Triamcinalone						✓
Anti-VEGF: Inj. Avastin 1.25mg						✓

*Essential list of International Agency for Preventable Blindness (https://iapb.standardlist.org/essential-lists/iapb-essential-list-diabetic-retinopathy/).

HWC: Health & Wellness Centre; SHC: Sub-health Centre; PHC: Primary Health Centre, CHC: Community Health Centre; DH: District Hospital; SDH: Sub-District Hospital

Annexure 3

Table 18. The Indian Diabetes Risk score – a screening tool for diagnosing unrecognised diabetes in the community

Variables	Score
Age (years)	
<35	0
35-49	20
>49	30
Abdominal obesity	
Waist: <80cms (female), 90cms (male)	0
Waist: 80-89cms (female), 90-99cms (male)	10
Waist: >90cms (female), >100cms (male)	20
Physical activity	
Exercise (regular) + strenuous work	0
Exercise (regular) or strenuous work	10
No exercise and sedentary work	20
Family history	
No family history	0
Either parents	20
Both parents	30
Minimum Score	0
Maximum Score	100

Reference: Madras Diabetic Research Foundation-Indian Diabetic Risk Score[40]

Risk for diabetes: High- score: ≥60, moderate- score: 30-59, Low: Score <30

Annexure 4

Table 19. Community Based Assessment Checklist (CBAC) Form for early detection of NCDs

General Information				
Name of ASHA	Village/ward			
Name of MPW/ANM	Sub centre (in case of rural areas)			
PHC/UPHC	Date			
Individual details				
Name	Any identifier (Aadhar Card, UID, Voter ID, other)			
Age	State Health Insurance Scheme:(Y/N) __			
Sex	Telephone no.			
Address				
Part A: Risk Assessment				
Question	Range		Circle Any	Write Score
1. What is your age? (in complete years)	30-39 years		0	
	40-49 years		1	
	≥ 50 years		2	
2. Do you smoke or consume smokeless products such as gutka or khaini?	Never		0	
	Used to consume in the past/ sometimes now		1	
	Daily		2	
3. Do you consume alcohol daily	No		0	
	Yes		1	
4. Measurement of waist (in cm)	Female	Male		
	80 cm or less	90 cm or less	0	
	81-90 cm	91-100 cm	1	
	More than 90 cm	More than 100 cm	2	
5. Do you undertake any physical activities for minimum of 150 minutes in a week?	At least 150 minutes in a week		0	
	Less than 150 minutes in a week		1	
6. Do you have a family history (any one of your parents or siblings) of high blood pressure, diabetes and heart disease?	No		0	
	Yes		2	
Total Score				

A score above four indicates that the person may be at risk for these NCDs and needs to be prioritised for attending the weekly NCD day. The form will be filled up by ASHA or any community health worker assigned for the purpose.

Extracted from: Module for multi-purpose workers on prevention, screening and control of common non-communicable diseases- http://nhsrcindia.org/ sites/default/ files/Multi-Purpose%20Workers%28MPW%29-on%20Prevention%2C%20 Screening%20%26%20 Control%20of%20NCDs-English.pdf)

Annexure 5

Table 20. NPCDCS reporting proforma for sub-centre

Form 1 - Part A															
National Programme on Prevention and Control of Cancer, Diabetes, CVDs & Stroke (NPCDCS)															
Reporting proforma for sub centre															
Name ofthe sub centre__PHC___Block/Mandal___District___ State__															
Month_Year___															
Part A															
Name of the village	**Total no. of NCD checkups done**			**No. of new persons suspected for DM and referred for confirmation**			**No. of new persons suspected for HTN and referred for confirmation**			**No. of known cases of DM on follow-up**			**No. of known cases of HTN on follow-up**		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Total															

Part A for form 1 reports the results of diabetes and hypertension screening.

Extracted from: Module for multipurpose workers on prevention, screening and control of common non-communicable diseases-http://nhsrcindia.org/sites/default/files/Multi-Purpose%20Workers%28MPW%29-on%20Prevention%2C%20Screening%20%26%20Control%20of %20NCDs-English.pdf.

The report should be filled by the ANM of the Sub Centre and sent to the Medical Officer In-charge on the last day of the same month of the screening.

Annexure 6

Table 21. NPCDCS reporting proforma for primary health centres

Form 2								
Name of the Block---------- District---------- State---------- Month---------- Year----------								
Number of sub centres in the block ------- Number of sub centres reported----------								
			During the month			**Cumulative since April during current year**		
			Male	**Female**	**Total**	**Male**	**Female**	**Total**
	No. of screening camps organised during the month							
	No. of people screened for	Blood sugar						
		Blood pressure						
	No. of people suspected with	Diabetes						
		Hypertension						
		Common cancers						
		Oral						
		Breast						
		Cervical						
	No. of persons referred to Community Health Centre							

Extracted from NPCDCS Operational guidelines.(https://www.karnataka.gov.in/hfw/nhm/Documents/NPCDCS%20Final%20Operational%20Guidelines.pdf)

The form should be filled by the Primary Health Centre medical officer in-charge and report to the District NCD cell on the 5th of every month

Annexure 7

Table 22. NPCDCS reporting format for NCD Cells at Community Health Centres

Form 3													
Indicator		**During the reporting month**						**Cumulative since April during current year**					
		Male		**Female**		**Total**		**Male**		**Female**		**Total**	
		New	**Old**	**New**	**old**	**New**	**Old**	**New**	**Old**	**New**	**Old**	**New**	**Old**
No. of persons attended NCD Clinic													
No. of persons referred from PHC/SC													
Total no. of attendees													
Patients diagnosed with/suspected cases of CVDs & cancer as confirmatory diagnosis may not be possible at CHC	Diabetes												
	Hypertension												
	Cardiovascular diseases*												
	Cancer-oral												
	Breast												
	Cervical												
No. of persons referred to district hospital													
No. of persons counselled for health promotion and prevention of NCDs													

Extracted from :NPCDCS Operational guidelines.(https://www.karnataka.gov.in/hfw/nhm/ Documents/NPCDCS%20Final%20Operational%20Guidelines.pdf).The form should be filled by Medical Officer in-charge of Community Health Centre and reported to the District NCD cell on the 5th of every month

Annexure 8

Table 23. NPCDCS Reporting format for district hospitals

Form 4													
Indicator		During the reporting month						Cumulative since April during current year					
		Male		Female		Total		Male		Female		Total	
		New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
No. of persons attended NCD Clinic													
No. of persons referred from CHC/PHC													
TOTAL													
New patients diagnosed	Diabetes												
	Hypertension												
	CVDs												
	Cancer-oral												
	Breast												
	Cervical												
No. of persons put on treatment (whatever is possible) including follow up	Diabetes												
	Hypertension												
	CVDs												
	Cancer-oral												
	Breast												
	Cervical												
No. of persons referred to tertiary care centres	Diabetes												
	Hypertension												
	CVDs												
	Cancer												
No. of Patients treated at CCU	CVDs												
	Stroke												
No. of Patients treated at CCU													
No. of persons counselled for health promotion & prevention of NCDs													
No. of patients attended for physiotherapy													

Extracted from: NPCDCS Operational guidelines.(https://www.karnataka.gov.in/hfw/ nhm/Documents/NPCDCS%20Final%20Operational%20Guidelines.pdf) The form will be filled by the medical officer in-charge of the District NCD Clinic and report to District NCD cell on the 5th of every month.

Annexure 9

Table 24. NPCDCS Reporting proforma for District NCD Cell

Form 5A														
Indicator		During the reporting month						Cumulative since April during current year						
		Male		Female		Total		Male		Female		Total		
		New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	
No. of persons attended NCD Clinics														
No. of persons reported in-referral														
TOTAL														
New patients diagnosed/ suspected with CVDs & stroke (as confirmatory diagnosis may not be possible), with follow up.	Diabetes													
	Hypertension													
	CVDs													
	Cancers-oral													
	Breast													
	Cervical													
No. of persons put on treatment (whatever is possible) including follow up	Diabetes													
	Hypertension													
	CVDs													
	Cancers-oral													
	Breast													
	Cervical													
No. of persons referred to tertiary hospitals	Diabetes													
	Hypertension													
	CVDs													
	Cancers-oral													
	Breast													
	Cervical													
No. of patients treated at CCU	CVDs													
	Stroke													
Patients attended day care facility for cancer care (number of chemotherapy sessions)														
No. of persons counselled for health promotion & prevention of NCDs														
No. of patients attended for physiotherapy														

NPCDCS Operational guidelines.(https://www.karnataka.gov.in/hfw/nhm/Documents/ NPCDCS%20Final%20Operational%20Guidelines.pdf).

To be filled in by district nodal officer monthly and reported to the State NCD Cell by the 10th of every monthExtracted from: NPCDCS Operational guidelines. (https://www. karnataka.gov. in/hfw/nhm/ Documents/NPCDCS%20Final%20Operational%20Guidelines.pdf).To be filled in by district nodal officer monthly and reported to the State NCD Cell by the 10th of every month

Annexure 10

Table 25. Reporting proforma for District NCD Cell

Form 5B						
Indicator	**During the month**			**Cumulative since April during current year**		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
No. of screening camps organised during the month						
No. of people screened for blood sugar & blood pressure						
No. of persons suspected with diabetes						
Hypertension						
Cancers						
Oral						
Breast						
Cervical						
No. of persons referred from sub centres to CHCs						

Extracted from: NPCDCS Operational Extracted guidelines. (https://www. karnataka.gov.in/hfw/nhm/Documents/NPCDCS%20Final%20Operational%20Guidelines.pdf).To be filled in by District nodal officer monthly and reported to State NCD Cell by the 10th of every month.

Annexure 11

Table 26. Reporting proforma for State NCD Cell (Form 6)

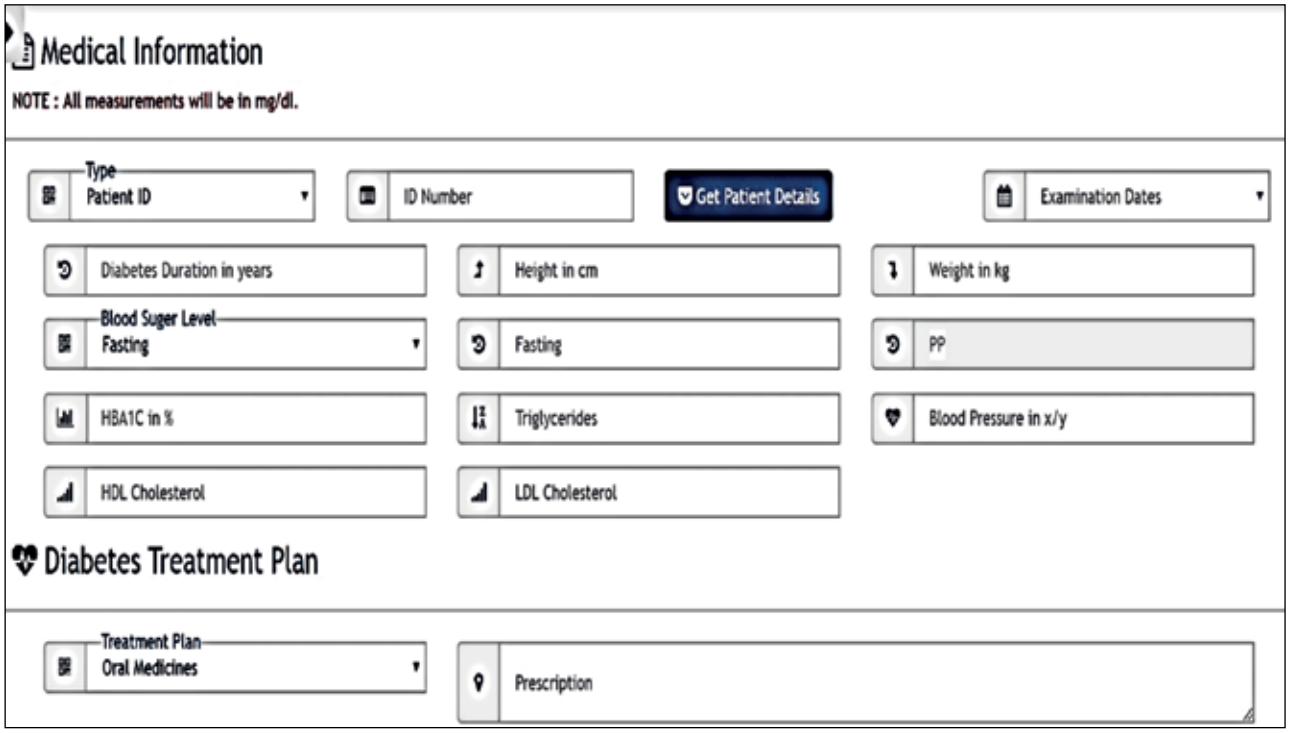
Indicator		As on 31st March (year) (cumulative since beginning) (A)	Annual target for the year (B)	Achievement during the reporting month (C)	Cumulative achievement since 1st Apr (Year) (D)	Cumulative achievement since beginning (E)=(A)+(D)	%
I. Facilities							
1	District NCD Cells						
2	District NCD Clinics						
3	District CCU facilities						
4	District day care Centres						
5	CHC NCD Clinics						
II Programme Data							
1	No. of patients attended NCD Clinics (In Lakh)						
2	No of In-referrals						
	Total						
4	Patients diagnosed with						
	Diabetes						
	Hypertension						
	CVDs*						
	Cancers						
	Oral						
	Breast						
	Cervical						
9	No of patients put on treatment						
	Diabetes						
	Hypertension						
	CVDs*						
	Cancers						
10	No of patients referred to tertiary care/TCCC						
	Diabetes						

Indicator		As on 31st March (year) (cumulative since beginning) (A)	Annual target for the year (B)	Achievement during the reporting month (C)	Cumulative achievement since 1st Apr (Year) (D)	Cumulative achievement since beginning (E)=(A)+(D)	%
	Hypertension						
	CVDs*						
	Cancers						
11	**No of patients treated at CCU**						
	CVDs						
	Stroke						
12	No. of chemotherapy sessions for cancer care						
13	No of persons counselled for health promotion and prevention of NCDs						
14	No. of patients who attended physiotherapy						
15	Utilisation of funds based onFMR reports (Rs. In Lakh)						
III. Other programme markers							
1	No. of outreach camps organised						
2	No of persons screened for blood sugar and blood pressure						
3	No of persons suspected with diabetes						
4	Hypertension						
5	Cancers						
	Oral						
	Breast						
	Cervical						
6	No. of persons referred to higher facilities						

Extracted from: NPCDCS Operational guidelines (https://www.karnataka.gov.in/ hfw/nhm/Documents/NPCDCS%20Final%20Operational%20Guidelines.pdf).To be filled by State Nodal officer and reported to the National NCD Cell by the 15th of every month

Annexure 12

Figure 11. Sample page (screen shot) of dedicated diabetic retinopathy software



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