

## PHOTOFUNDUS CHARACTERISTIC OF DIABETES MELITUS PATIENT IN PRIMARY AND SECONDARY HEALTH CARE CENTERS

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### ABSTRACT

**Introduction:** The prevalence of diabetes mellitus increases over time in line with the prevalence of diabetic retinopathy is also expected to increase. It is not possible to determine which diabetic patients will have retinopathy, so therefore screening is needed. This study aims to have a better understanding in managing DM patients in the future, especially in cases of diabetic retinopathy in primary, secondary & community health care centers.

**Methods:** A descriptive analytical study. Data collected cross sectional study based of characteristic and portable photo fundus from DM patients while doing social service at a health service center.

**Results:** Portable photo fundus in this study, screening 138 DM patients, with majority of subjects is in the range 44-64 year age group (68.1%). There was the same number of patient between gender or type. History of DM in the family (63.0%) with a duration of DM  $\leq$  5 years (56.5%), mostly the quality of photo fundus that can be assessed (97.1%), patients who needed further treatment were referred to the ophthalmologist 59 cases (42.8%).

**Conclusion:** People who live far from cities and have limited access to health facilities can be reached using this portable photo fundus, so that blindness in peripheral areas will be more easily detected and this can be used as a screening modality and blindness due to diabetic retinopathy can be prevented.

**Keywords:** Screening, diabetic retinopathy, community ophthalmology, portable fundus photography

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## INTRODUCTION

Diabetes Melitus (DM) is a chronic metabolic disease that a major problem in the world. The incidence of diabetes mellitus throughout the world is increasing overtime, death and disability rates also in line. Diabetes melitus patients will have complication of macrovascular and microvascular damage. One of the most common microvascular complications that often occurs due to the long-term effects of DM is diabetic retinopathy. The prevalence of diabetic retinopathy throughout the world varies widely, estimation around 4.2 million adults and among them ranges from 10 - 61 % of patients will lose their vision due to diabetic retinopathy.<sup>1,2</sup>

The Global Burden of Disease Study in 2019 found that 5-10% of diabetic retinopathy accounts for all blindness in middle-income countries especially in adults aged 50 years and over.<sup>3</sup> Early detection and timely intervention are the keys to avoiding blindness due to diabetic retinopathy. Declaration of St. Vincent stated that all nations must make efforts to reduce DM-related complications, including blindness caused by diabetic retinopathy.<sup>17</sup> Systematic screening for diabetic retinopathy is still a challenge in many low-middle income countries due to limited resources.

Diabetic retinopathy screening, actually can be carried out in primary care health center, still community ophthalmology find it difficult to detect diabetic retinopathy cases, one of the main reasons is the lack of trained human resources and infrastructure, which will require cooperation from all parties, including patients, individual health care, community groups and all who are involved and work in controlling blindness caused by diabetic retinopathy must integrated to the screening protocols.<sup>4,14,15</sup>

This study aims to determine the characteristics of visual acuity, eye diseases, description of portable photo fundus of DM patients in primary and secondary health care centers, determine the percentage of referrals procedures and other eye diseases in DM patients to eye specialists at primary and secondary health care centers, determine is

there any correlation between the duration of DM and incidence of retinopathy, determine is there any correlation between the degree of retinopathy and visual acuity of DM patients in primary and secondary health care centers, so these data can be used for conducting further research and will provide better understanding in managing DM patients in the future, especially in cases of diabetic retinopathy in primary, secondary & community health care centers.

## METHODS

An observational analytic descriptive study was conducted in primary & secondary health care centers at 7 Regency/cities. Data collection was taken when doing social service within a period of 2 years from 2021 until 2022 by ophthalmology resident from Udayana University together with Indonesian Ophthalmologist Association Bali branch. This research has been declared ethically reviewed by the Research Ethics Committee - Faculty of Medicine Udayana University with the number 2318/UN14.2.2.VII.14/LT/2022, on August 24, 2022. An informed consent was obtained from each individual participant involved in the study. Inclusion criteria were all DM patients aged > 18 years who had been diagnosed with DM and had photo fundus taken, however DM patients who were not willing to participate in this study and also having an incomplete registration were excluded

from the study. Both eyes of a patient were included in the study. The data collection includes patient demographics (age and gender visual acuity, duration of DM, family history of DM, description of the photo fundus portable, eye diseases, percentage of referrals to eye specialists.

All collected data were analyzed using univariate and bivariate analysis methods and entered with Statistical Package for the Social Science (SPSS) version 26. Visual acuity was categorized into 4 category using International classification of disease 2018 including : Mild or no visual impairment (VA equal to or better than 6/18), moderate visual impairment (VA between less than 6/18 equal to or better than 6/60), Severe visual impairment (VA between less than 6/60 equal to or better than 3/60), Blindness (VA less than 3/60 or equal to 1/60).

All patients with DM which is examined with optomed handheld fundus camera. The quality of photo fundus was categorized as can or cannot be determined based on whether the posterior pole of retina, disk and macula can be assessed or not. Diabetic retinopathy was categorized using Early Treatment Diabetic Retinopathy Study (ETDRS) Classification including : no retinopathy (no retinal lesions), Nonproliferative Diabetic Retinopathy (NPDR), Mild NPDR (A few microaneurysms, retinal hemorrhages & hard exudates), Moderate NPDR (Retinal hemorrhages about 20 per quadrant, in 1-3 quadrant with cotton wool spots); Severe NPDR (fulfilling one rule of the 4-2-1; Severe hemorrhages in 4 quadrants, Venous beading in 2 or more quadrants, Moderate IRMA in 1 or more quadrants), Proliferative Diabetic Retinopathy (PDR) Neovascularization at the disk (NVD) and elsewhere (NVE), Any NVD with vitreous hemorrhage. As the study endpoints were not intended to test a specific hypothesis but were rather descriptive in nature, formal calculations of power and sample size were not carried out.

## RESULTS

A total of 138 patients were included in the study, consisting of 69 (50%) males and females, with the majority age was within 44-64 years old (68.1%), family history of DM 87 (63.0%) was greater than those without a history 51 (37%). The duration of suffering from DM  $\leq$  5 years 78 (56.5%) was found to be more common than  $>$  5 years 60 (43.5%). The visual acuity in most eyes had mild or no visual impairment 81 (58.7%), least had severe visual impairment 7 (5.1%), and the rest had moderate visual impairment 26 (18.8%) follow with blindness 24 (17.4%).

All DM patients served at primary and secondary health care centers had photo fundus quality that could be assessed 134 (97.1%) only 4 (2.9%) could not be assessed due to lens opacification and uncooperativeness during the examination.

**Table 1.** Subject Characteristics of DM patients in primary and secondary health care centers

| Characteristics                | Total (N = 138) | Percentage (%) |
|--------------------------------|-----------------|----------------|
| <b>Aged</b>                    |                 |                |
| 25-44 yo                       | 3               | 2.2            |
| 44-64 yo                       | 94              | 68.1           |
| $\geq$ 65 yo                   | 41              | 29.7           |
| <b>Gender</b>                  |                 |                |
| Male                           | 69              | 50.0           |
| Female                         | 69              | 50.0           |
| <b>Family history of DM</b>    |                 |                |
| No                             | 87              | 63.0           |
| Yes                            | 51              | 37.0           |
| <b>Duration of DM</b>          |                 |                |
| $\leq$ 5 years                 | 78              | 56.5           |
| $>$ 5 years                    | 60              | 43.5           |
| <b>Visual Acuity both eyes</b> |                 |                |
| Mild or no visual impairment   | 81              | 58.7           |
| moderate visual impairment     | 26              | 18.8           |
| Severe visual impairment       | 7               | 5.1            |
| Blindness                      | 24              | 17.4           |

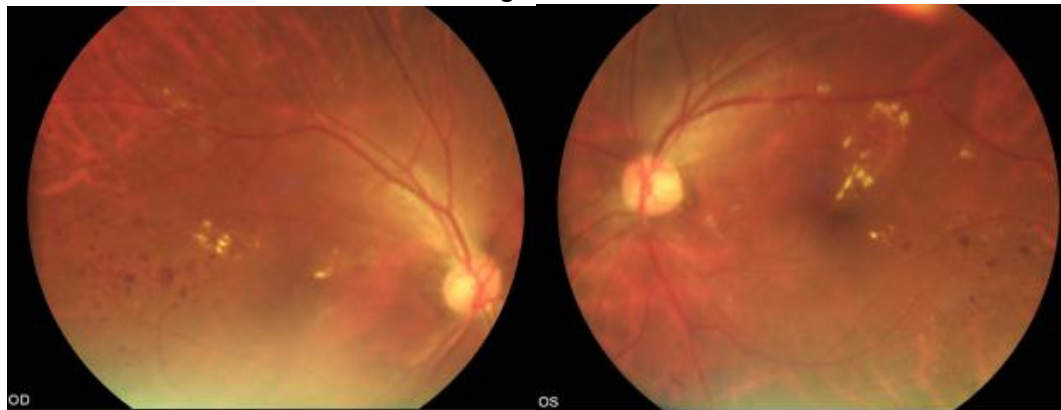
The results of portable photo fundus of both eyes showed no diabetic retinopathy 87 (63%), mild NPDR 32 (23.2%), moderate NPDR 7 (5.1%), PDR 11 (8%) and severe NPDR 1 (0.7%) as show in Figure 1-5.



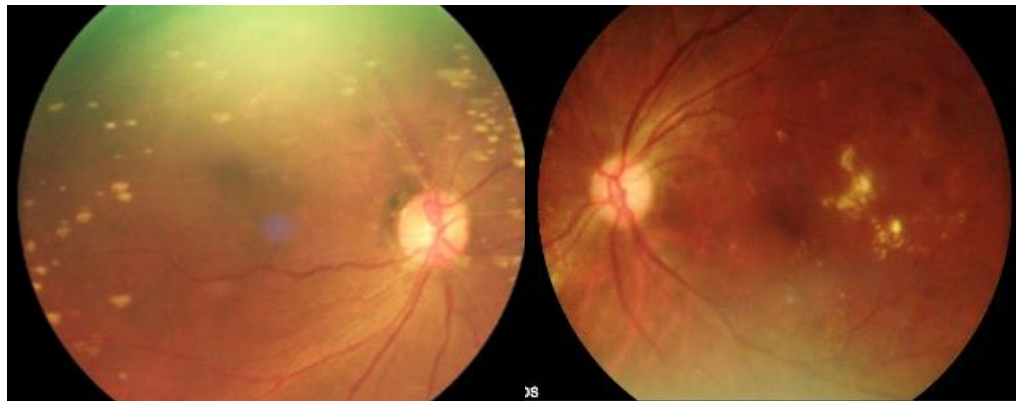
**Figure 1.** No diabetic retinopathy



**Figure 2.** Mild NPDR



**Figure 3.** Moderate NPDR



**Figure 4.** Severe NPDR

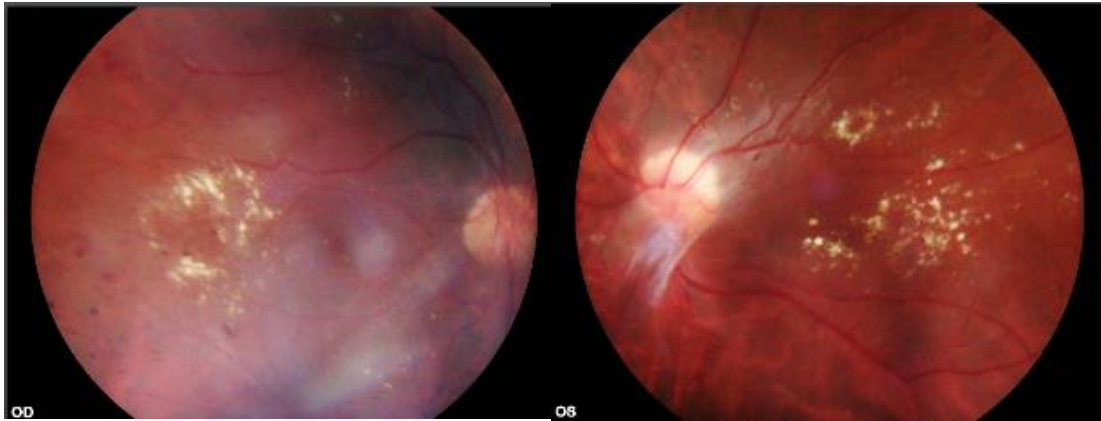


Figure 5. PDR

The quality of the photo fundus is considered can be determined as the disk and macula can be assessed or not, as shown in Figure 6 and 7. The results of eye examination of both eyes, apart from diabetic retinopathy, showed that 87 (63%) had no other eye disease and 51 (37%) had other eye disease such as Pterygium, Cataract, Glaucoma, Macular scar, Geography atrophy, Retinitis pigmentosa, Vitreous Opacity, Optic disc swelling, Papil atrophy, while fundus photographs are shown in Figure 8-13.

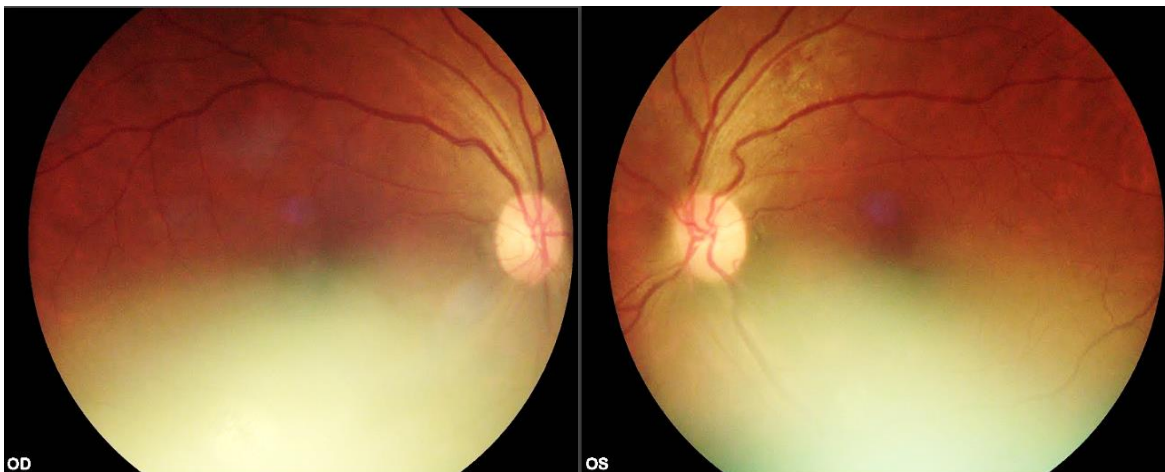


Figure 6. Photo fundus Quality can be Determine

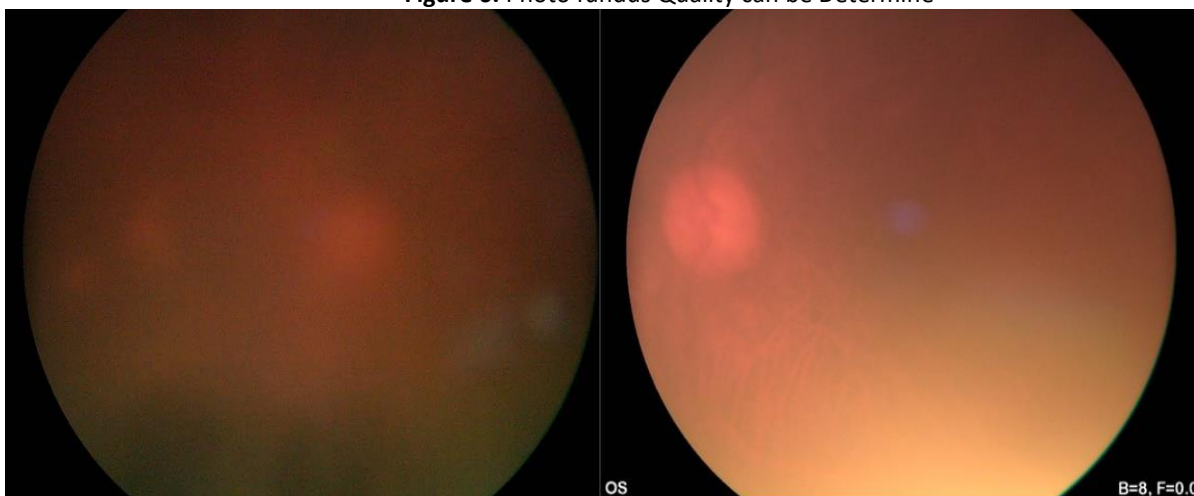


Figure 7. Photo fundus Quality cannot be Determine



**Figure 8.** Clinically Significant Macular Edema



**Figure 9.** Suspect Epiretinal Membrane



**Figure 10.** Optic Disc Swelling

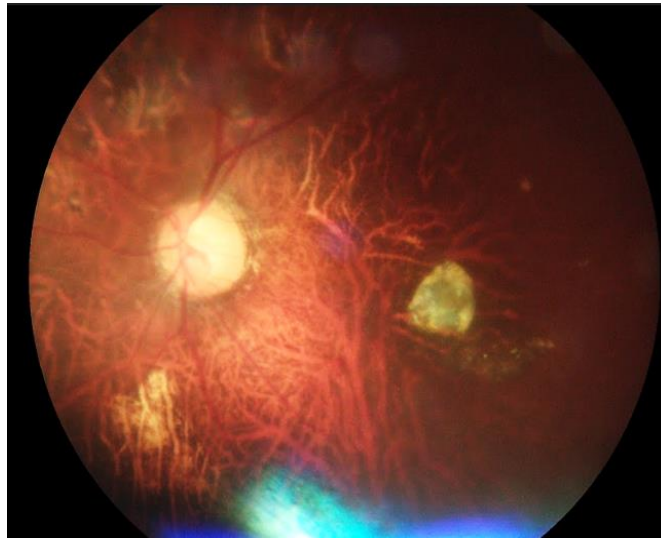


Figure 11. Macula Scar

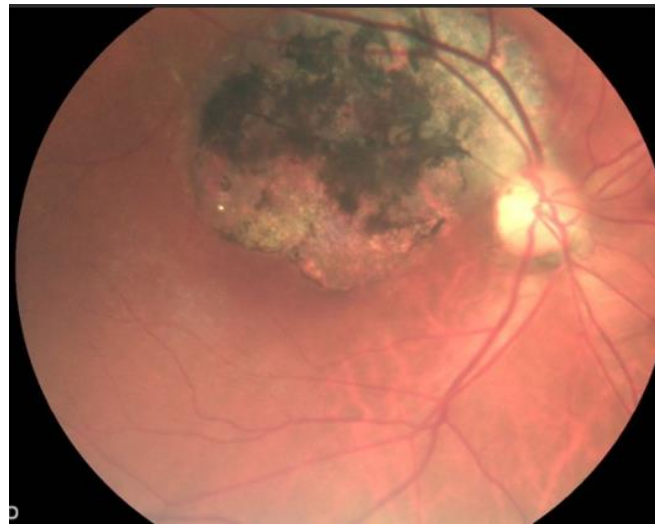


Figure 12. Geographic Atrophy

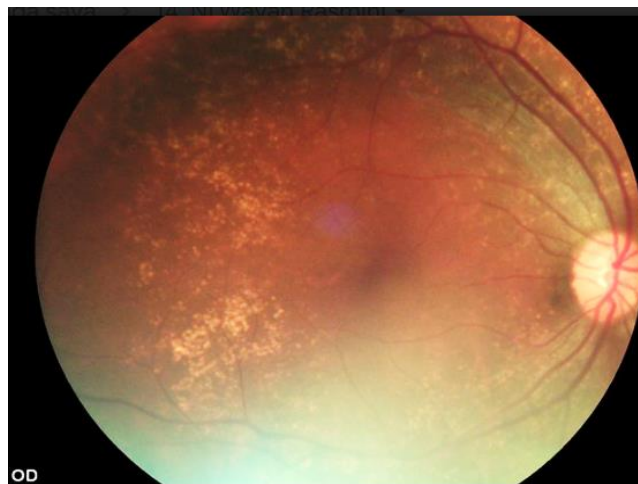


Figure 13. Retinitis Pigmentosa

**Table 2.** Percentage of referrals to eye specialists

| Eye Examination              | Total (N = 138) | Percentage (%) |
|------------------------------|-----------------|----------------|
| Referrals to eye specialists | 59              | 42.8           |
| Not referred                 | 79              | 57.2           |

The percentage of referrals to eye specialists was 59 (42.8%) and not referred was 79 (57.2%). In the group who had a duration of DM equal to and below 5 years and had retinopathy was 27 (34.6%) while in another group who had a duration of DM

**Table 3.** The relationship between duration of DM and incidence of retinopathy

| Duration of DM | Retinopathy | Percentage (%) | No Retinopathy | Percentage (%) |
|----------------|-------------|----------------|----------------|----------------|
| ≤ 5 years      | 27          | 34.6           | 51             | 65,4           |
| > 5 years      | 24          | 40             | 36             | 60             |
| Total          | 51          | 37             | 87             | 63             |

p = 0,516

**Table 4.** Relationship between degree of retinopathy & visual acuity after controlling confounding variables

| Variable             | Coefficient Estimation | p     | CI 95%        |
|----------------------|------------------------|-------|---------------|
| Pterygium            | 0,681                  | 0,093 | -0,11 – 1,47  |
| Cataract             | 3,581                  | 0,000 | 2,59 – 4,57   |
| Glaucoma             | -1,994                 | 0,114 | -4,46 – 0,47  |
| Macular scar         | 1,589                  | 0,233 | -1,02 – 4,20  |
| Geography atrophy    | 2,270                  | 0,039 | 0,11 – 4,42   |
| Retinitis pigmentosa | 0,642                  | 0,202 | -2,11 – 3,39  |
| Vitreous Opacity     | 18,953                 | 0,648 | 18,95 – 18,95 |
| Optic disc swelling  | 22,534                 | -     | -116 – 170    |

of more than 5 years and had retinopathy was 24 (40%) this difference was not significant p = 0,516. Relationship between degree of retinopathy & visual acuity after controlling confounding variables. Cataracts were identified as the effect causes for visual impairment with an estimated coefficient of 3.581 and it is statistically significant.

## DISCUSSION

The study we carried out by taking several samples that represent the population in the area from various places in Bali. The study in Indonesia carried out by Sasongko, et al in Yogyakarta, have a similar to our study, the subjects median age is 58.4 years, and the gender was not much different between male 40.3 and female 44.<sup>5</sup>

Mas Putrawati et al., study found that 66 % of the samples had history of DM. It has already known well that patients with DM family history will have a risk to gain DR.

Duration of diabetes had a strong association with the incidence of diabetic retinopathy, within 6-10 years (OR 1.24, P= <0.001). Moreover, Sasongko, et al have reported that was no significant difference in patients who had a family history of DM (OR 1.16, P=0.21).<sup>6</sup> Based on the visual acuity examination were mostly dominated by moderate visual impairment 46.5%, this is slightly different in our study that showed most people had mild or no visual impairment in 58.7%.<sup>5</sup>

Guideline for diabetic retinopathy screening examinations from American Diabetes Association in people with type 1 diabetes must be carried out for the first time the patient had been diagnosed and 5 years after the onset of the disease, while in people with type 2 diabetes they must undergo a screening examination



immediately upon diagnosis, and follow-up is according to each patient's condition.<sup>7,18</sup> The percentage of referrals to ophthalmologists in this study was also quite high at 42.8% of the total DM patients who underwent screening. This aligned with Sasongko et al research results which found that almost 95% of the study population had never had an eye examination before and had never been screened for diabetic retinopathy.<sup>5,8,9</sup>

According to Gonzales et al, a quality photo fundus image affects several elements such as brightness, contrast, color, object clarity and texture which influence the degree of gray.<sup>10,11</sup> Ideally Posterior eye examination requires experts who are trained as medical students, eye specialists and also skilled at using these tools such as 60,78, 90D lenses along with a slitlamp, but it is difficult to carry out, and portable fundus photography is an ideal option. Portable photo fundus examination also makes the patient comfortable not glare and blurry when compared to the ideal posterior examination using an additional lens and slit lamp, the patient must be given a mydriatic test (a drug used to dilate the pupil) and will be examined with a certain light intensity. However, the disadvantages using portable fundus photography for example in patients who have cataracts there will be artifacts in the retinal images so that they are less than optimal, and also images the retina is less detailed. Other case, if the patient has difficulty opening his eyes, or often blinks, then he has to repeated the procedure, those will take some time, and also the retinal area covered by portable fundus photography ranges from 40-50 degrees and it does not include the peripheral part of the retina.<sup>12-16</sup>

Impacts that can affect a person if they suffer from diabetic retinopathy, is not only blindness, but it will be affected globally, for example, someone who has just experienced vision problems when they come to an eye doctor for treatment, found that the person is in the stage of blindness, which

is permanent and cannot be cured, then the person loses his job even though the patient is still in the productive age category, cannot earn money and becomes a burden on the family, affecting the quality of life and if the family depends on the person experiencing this disability, then one family will become a burden on society. The socioeconomic burden will increase due to diabetic retinopathy blindness and this has a very global impact and can be avoided, and most of all countries around the world will have government program to prevent blindness.

## CONCLUSION

Diabetic retinopathy screening in primary medical care clinics must be integrated and facilitated a referral to other physicians or eye doctor for control of the risk factors and other associated complications of diabetes. Ideally screening DR, need availability of skilled human resources and efficient technology and also should be cost-effective and valid. One of the revolutions in retinal examination programs is portable photo fundus, especially in cases of screening for DR. This tool is very useful because it is efficient, requires a short time to operate, small in size, can be carried practically anywhere, easy to operate by anyone who has been trained, and this tool is considered cost effective, and not only DR can be detected but other retinopathy and maculopathy conditions can also be diagnosed.

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