



TRUST RE

PERSPECTIVES



DIABETES

A LIFE UNDERWRITER'S PERSPECTIVE

LIFE & HEALTH REINSURANCE DEPARTMENT, NOVEMBER 2017

REINSURER OF CHOICE

INTRODUCTION

Diabetes is a prolonged elevation of glucose concentration in the blood (Hyperglycemia) evidenced by the Glycated Hemoglobin test (Hb1Ac) which indicates the average level of blood sugar over the past 2 to 3 months.

Glucose is an essential element for the human body and gives our muscles, blood cells and brain the energy they need. It is obtained by the transformation of the glucides contained in our foods during the digestion process.

The pancreas produces 2 hormones:

- Insulin

A hypoglycemic hormone – which regulates the level of glucose in the blood and is the key that allows glucose to enter the cells;

- Glucagon

A hyperglycemic hormone – which occurs when the body lacks sugar.

When the pancreas stops producing any or enough insulin, or if the insulin is not efficient enough, the concentration of glucose in the blood increases.

DIABETES

As indicated in the graph below, in a healthy body, the glucose is carried by the blood to the cells where the insulin is playing its regulation role. Part of the glucose is absorbed by the cells and the glucose remaining in the blood stays within a range of less than 1.26 g / l 2 fasting blood sugar, or greater than 2 g / l (11 mmol / l) at any time of day.

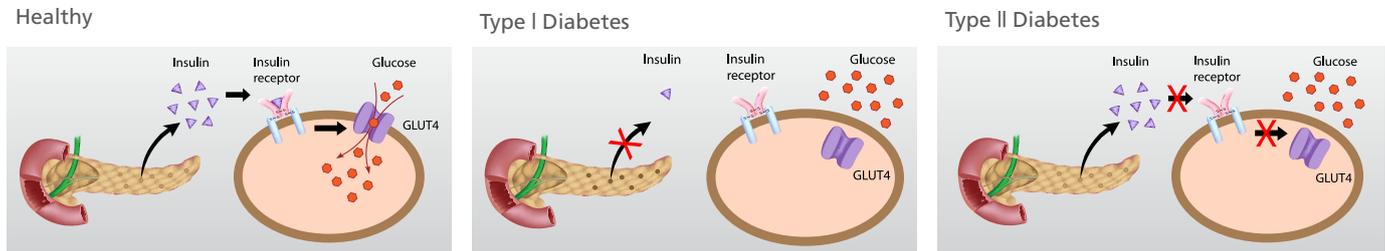


Fig.1

However, when this process is not working, hyperglycemia is the result.

TYPE OF DIABETES

There are several kinds of diabetes.

1. Diabetes Type 1, previously called insulin dependent Diabetes:

This kind of diabetes appears when the pancreas stops producing, or does not produce enough insulin due to the destruction of the cells producing insulin.

This type of diabetes usually occurs at younger ages in childhood or during the teenage years. Episodes of hypoglycemia and/or a significant loss of weight despite a good appetite are indicators of the disease. There are other, more discrete, symptoms such as frequent and abundant urination, abnormal thirst and intense general fatigue.

2. Diabetes Type 2, previously called non-insulin dependent Diabetes:

Type 2 diabetes is a disorder of glucose metabolism. It is the most frequent form of diabetes (90 to 95% of cases). Unlike Type 1 diabetes, it does not result from an insulin deficiency, but a resistance of the cells to insulin. In other words, insulin continues to be secreted by the beta cells of the pancreas, but it is no longer able to play its role in

regulating blood glucose (i.e. ensuring the passage of sugar from blood to cells).

3. Gestational diabetes:

Gestational diabetes usually onsets around the 24th week of the pregnancy. A diagnosis of gestational diabetes does not mean that the woman had or will have diabetes. In 90% of cases, it resolves after delivery. However, untreated or poorly controlled gestational diabetes, can hurt the baby and there is a higher probability of developing Type 2 Diabetes in future years.

DIABETES PREVALENCE

In the USA, according to the Center for Disease Control and prevention (CDC), around 21 million inhabitants are diagnosed with Diabetes. That is to say 6.6% of the total population. The number of persons suffering from diabetes has increased 4-fold over the period 1980 - 2012.

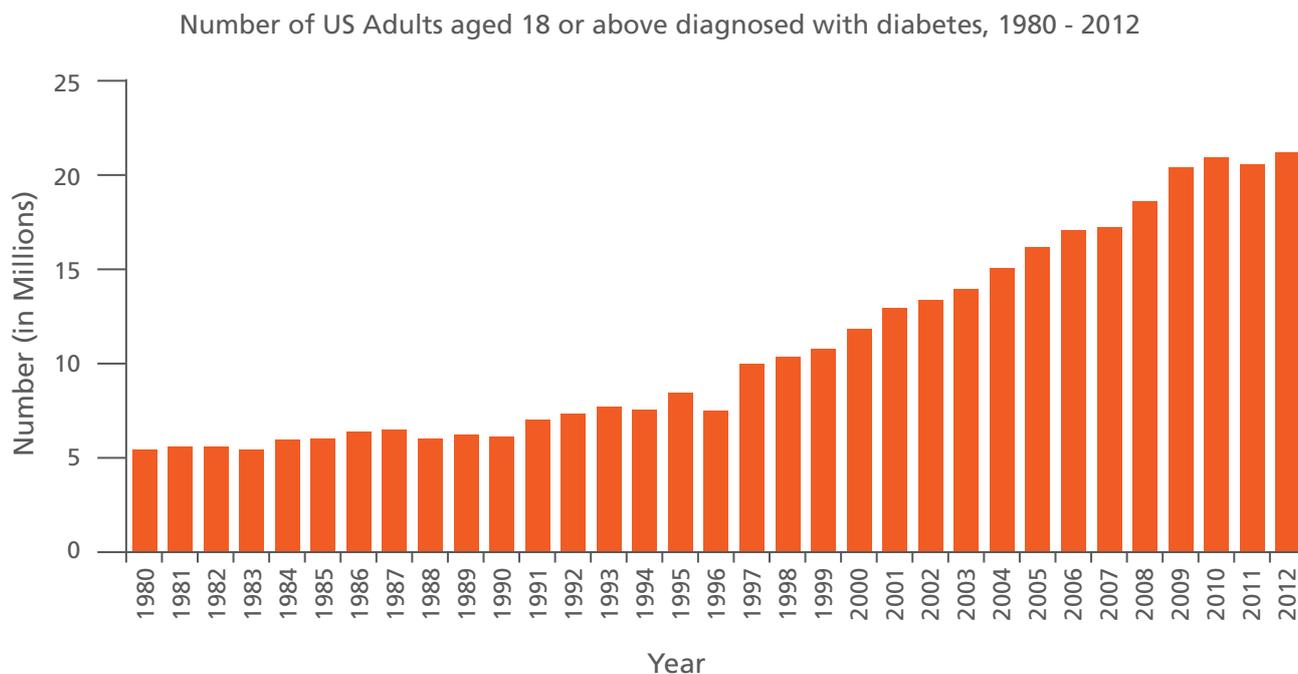


Fig.2

In the UK, the number of adults diagnosed with diabetes in 2015 was 3.45 million. That is to say 6.9% of the adult population.

In 2000, India topped the world with the highest number of people with diabetes mellitus (31.7 million). It is predicted that by 2030, diabetes mellitus may afflict up to 79.4 million individuals in that country. Preliminary results from a large community study conducted by the Indian Council of Medical Research (ICMR) between 2008 and 2010, revealed that the weighted prevalence of diabetes (for both known and newly diagnosed) in the Indian states of Tamil Nadu was 10.4%, Jharkhand, 5.3%, Chandigarh, 13.6% and Maharashtra, 8.4% with significant variation between rural and urban populations.

In China, a national survey conducted in 2009 estimated the age standardized prevalence of diabetes to be 9.7%. Based on 2010 data, Xu and al. estimated the overall prevalence of diabetes in the Chinese adult population to be 11.6% with a slight difference between males (12.1%) and females (11%). This study also highlighted that for newly detected diabetes the prevalence was 8.1% (8.5% for males and 7.7% for females). Moreover, prevalence increased with age, from 4.5% in age band 18-29 to 23.5% for 70 and above.

Furthermore, the increase of prevalence of diabetes was associated with economic development, as well as with overweight subjects.

DIABETES AND MORTALITY/MORBIDITY

Evaluating death due to diabetes is a real challenge for statisticians due to the lack of a standardized method for death certificate coding. Diabetes can be the immediate cause of death, for example, by causing cardiovascular disease but will remain unlisted on the death certificate since it is not the immediate cause of the terminal event.

Conversely, the presence of diabetes in the deceased body does not necessarily mean that diabetes contributed to mortality as it could be the case for trauma or another condition(s) that does not have a higher likelihood of occurring more frequently in a person with diabetes.

Moreover, diabetes is often associated with obesity, dyslipidemia, hypertension or even

smoking and the recording of all causes of death is affected by subjective judgement of physicians and different coding. Several studies highlighted that the burden of diabetes on mortality and survival was underestimated. Accordingly, estimating the burden of diabetes on mortality/morbidity can only be done by studying the individual cause of claim for estimating the excess of mortality due to diabetes, compared to non-diabetes cases.

By studying a cohort of diabetic patients using the National Health Insurance (NHI) in Taiwan during the years 1995-1998, Tseng CH estimated the excess of mortality in diabetic patients relative to the general population (fig.3).

Excess of Mortality for diabetic patients in Taiwan 1995 - 1998

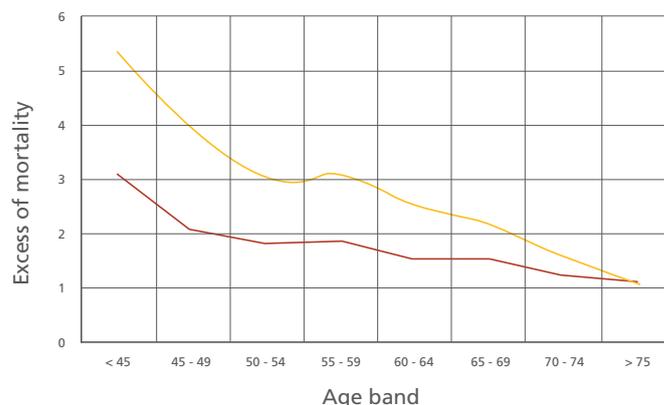


Fig.3

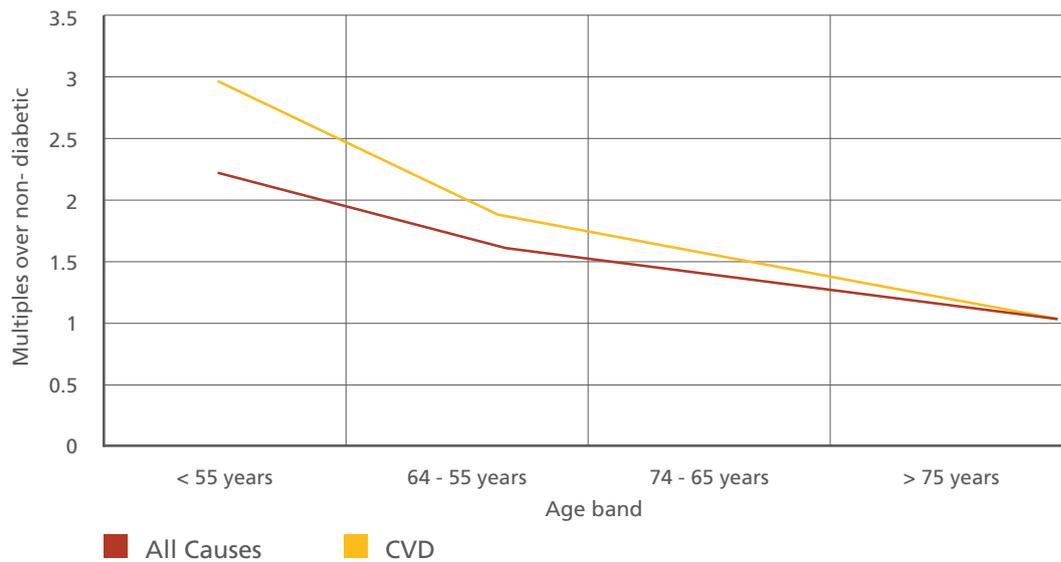
This study has evidenced a decreasing pattern of diabetes as a risk factor for mortality according to age. In other words, being diagnosed diabetic at a younger age increases the risk of mortality while diabetes diagnosed in older age does not represent a major risk factor for death.

By studying and following up a cohort of diabetic patients registered in the Swedish National Diabetes Register, Tancredi, Rosengren and al. evidenced an excess of mortality among persons with Type 2 diabetes. Over the period of observation, they noted that patients with diabetes are higher risks for death by all causes in

general, and Cardiovascular in particular, than the general population. In this study it was also observed that the excess of mortality decreased according to age.

Several studies show that the major causes of death for diabetic patients are related to cardiovascular and renal complications. The following graph shows the impact of diabetes on mortality "All causes" and for Cardiovascular diseases (CVD) per age band. For people below age 55, suffering from diabetes increases the risk of death from all causes by 2.2 times, while it increases the risk of CVD by 3 times.

Diabetes as a major risk factor for death



Source: N Engl J Med. 2015 Oct 29;373(18):1720-32. doi: 10.1056/NEJMoa1504347.

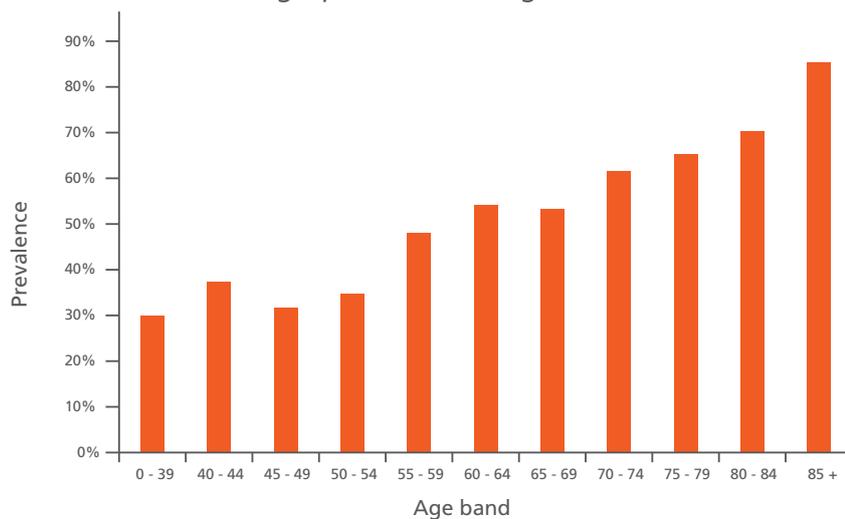
Fig.4

Impact of diabetes on disability

The prevalence of disabilities in those with diabetes increased with age, from 30.1% of people aged 0–39 to 85.1% in people aged 85 and over as shown in the following graph. After adjusting for differences in the age structure, males with diabetes were

twice as likely to have a disability as males without diabetes. Meanwhile for females with diabetes, the presence of disability was 2.5 times more likely than in females without diabetes.

Prevalence of impairment, limitation and restriction in daily living amongst persons suffering from diabetes



Source: Australian Institute of Health and Welfare, 2013

Fig.5

Overall, with age and gender combined, people with diabetes are 3 times as likely to have a disability as those without diabetes. Main restrictions include performing physical

activities or physical work and chronic or recurrent pain causing restriction in acts of daily living.

DIAGNOSIS OF DIABETES

There are several tests used for evaluating the level of sugar in the blood. Each test has its own meaning and limitation.

Fasting Blood Glucose (FBG)

The measure of blood glucose after not having eaten for a minimum of 8 hours. It is often the first test done to check for pre-diabetes and diabetes. This test can give an indication but cannot be a reliable test for insurance underwriting purposes.

Random Blood Glucose (RBG)

A blood sugar test taken from a non-fasting subject. This test, also called capillary blood glucose (CBG), assumes a recent meal has been eaten and therefore has higher reference values than the fasting blood glucose test.

Post Prandial Blood Glucose (PPBG)

Is a blood glucose test that determines the amount of glucose in the blood after a meal.

Oral Glucose Tolerance Test (OGTT)

A venous sample of a patient fasting from 10 pm on the previous night is taken. The patient is administered 75 g of Glucose and a further venous sample is taken after 2 hours. The result of the test reveals the impact of glucose administration on the blood glucose level and ingestion of glucose by the body cells.

Intermediate Stage

Impaired Glucose tolerance and impaired fasting glucose form an intermediate stage

in the natural history of diabetes mellitus. These glucose levels are above the normal level but below the level that is indicative for diabetes. Patients at Intermediate stage have a significant risk of developing diabetes and require a further check after a deferred period (2 or 3 months) and/or an additional rating.

HbA1c

The practical difficulty with regard to the above-mentioned test has made insurers rely on HbA1c, which as test criteria is more reliable and easy to obtain from a blood sample. Glucose reacts with various proteins in the blood, including hemoglobin, and the glycated products can be measured to provide an index of overall blood sugar levels during the life of the red blood cell. The test reveals the attachment of blood glucose to Hemoglobin (the protein that carries oxygen). Given that the average life cycle of red blood cells is 3 months, the test result represents more reliable blood glucose levels and avoids the variation owing either to a recent meal or fasting before the test. Further, in diabetics, glycation probably occurs throughout the life span of the red cell, although in non-diabetics it increases progressively with maturity of the red cell. In practice therefore, HbA1c will give a guide as to the overall blood sugar level in the previous 6-12 weeks and is thus the best single measurement available for assessment of blood sugar control.

The below chart gives the indication of the limit within the normal range, impaired range and for the pathological range.

TEST	Normal	Impaired	Pathology
Hemoglobin (HbA1c)	below 5.7%	5.7 to 6.4%	6.5% or more
Fasting blood glucose	less than 6.0 mmol/L	6.1 to 7.0 mmol/L	7.0 mmol/L or more
Random Plasma glucose			11.1 mmol/L or more
Oral glucose Tolerance	Less than 7.8 mmol/L	7.8 to 11.1 mmol/L	11.1 mmol/L or more

* Slight difference for levels below 10 mmol/L – up to 15% lower in capillary (blood finger prick) than in venous samples.

* Conversion factor : 1 mmol/L = 18 mg/dl Mmol/L = millimole per liter. Mg/dl = milligram/ deciliter

Diabetes Treatment

Once diagnosed with diabetes, a patient will have to go through a change of lifestyle (diet) and take medication for his/her whole life.

Appropriate Diet

- Carbohydrates in the form of starch which is slowly digested.
- Restriction of simple carbohydrates like Glucose & Sucrose which are rapidly absorbed.
- Reduction in fat to avoid the tendency of high lipid level in diabetics.

The diet should be made as varied and interesting as possible to ensure compliance.

Obese patients need to be told about the necessity of weight loss and advised the advantage of reducing the severity of the disease with better control.

Medication

In addition to maintaining a healthy weight, many Type 2 diabetes subjects require medication.

- Metformin – medicine of choice - improves insulin resistance.
- Thiazolidinediones – similar effect as metformin - used less owing to adverse cardiovascular effect.
- Sulfonylureas such as Glibenclamide & Gliclazide improves insulin secretions.
- Nateglinide and Rapaglinide – given immediately before a meal to reduce rise in blood glucose.
- Drug Acrobase – slows down absorption of carbohydrate from the gut.

Regime chosen for a patient is dependent on a multitude of factors and is always discussed in detail with the patient for understanding and cooperation.

At a certain stage, medication may not be working any more for maintaining the level of sugar in the blood within a normal range.

In such a case, insulin treatment may be recommended by the attending physician.

- Insulin

All those with Type 1 and some with Type 2 require treatment with subcutaneous injection as well as a balanced diet. Insulin cannot be given by mouth as it is destroyed in the gut before being absorbed. The majority have a subcutaneous injection, most people learn to use a pen injection system, which is very simple, disposable and pocket-sized. The dosage is generally twice a day, mostly a standard mixture of long and short acting insulin or a regime injected separately given a few minutes before the meal to exert its effect as the meal is absorbed.

Insulin preparations that can be inhaled or sprayed up the nose are available, they are absorbed through the mucous membrane to the blood stream. It is important to match the dose of insulin with the diet of the individual or else the blood glucose will rise too high or sink too low. The whole process requires getting the patient used to the regime with patience and perseverance from all sides.

Diabetic Complications

People with diabetes are at a higher risk of developing a number of disabling (morbidity) and Life threatening (mortality) health problems than people without diabetes. As time elapses, diabetes causes many complications which may broadly be classified as:

1. Complications that can occur at any time in a diabetic's life and may or may not be associated with the treatment of the condition involved.
 - Diabetic Ketoacidosis
 - Hyperosmolar Coma
 - Hypoglycemia
2. Complications as a result of diabetes

having been present for a considerable time.

- Eye disease – Retinopathy & Cataract
- Kidney disease – Diabetic Nephropathy
- Heart disease – Angina, Myocardial infarction, Stroke, Peripheral artery disease & Congestive Heart failure
- Disease made worse by Hypertension, Smoking, raised lipid levels
- Nerves disease – (Diabetic neuropathy) – Peripheral neuropathy, Diabetic neuropathy, Autonomic neuropathy

Diabetic Keto-acidosis

Usually happens when a patient with Type 1 diabetes has not started insulin treatment or is receiving too little insulin, and develops infectious diseases such as Pneumonia or a Urinary Tract Infection. In a normal patient during infection, the body will automatically increase insulin secretion to cope with increased metabolic requirements. In a normal patient during infection, the body will automatically increase insulin secretion to cope with increased metabolic requirements, whereas in a diabetic there is relative deficiency. Diabetic patients taking a fixed amount of insulin daily are advised to increase insulin during illness.

Insulin is required for glucose to enter the cells. In case of deficiency, cells look forward to alternate sources of energy, mainly in the form of fats and protein (muscle wasting). Increase in fat breakdown is imperfect and leads to production of ketone bodies such as Acetone and Acetoacetic acid. As a result of acidosis, the body attempts to compensate by breathing more deeply than normal. Acidosis is clinically observed with the presence of ketone in the urine and the breath smelling of acetone. The patient becomes dehydrated and ill, and if untreated, will lapse into coma and death. Treatment of the condition needs to be prompt with extra insulin, usually given in a drip with simultaneous administration of fluids and electrolytes. The patient must be monitored carefully and a search has to be made of underlying illnesses that may have precipitated the problem.

Hyperosmolar Coma

An acute condition where the blood sugar gradually rises to a very high level (70 mmol/L

or higher) when diabetes is undertreated or stopped. The patient suffers severe dehydration, becomes weak and lapses into a drowsy state or unconsciousness. Treatment is rehydration and careful use of small quantities of insulin until recovery. After such an episode, the diabetic regime and the degree of supervision of the patient have to be carefully reviewed.

Hypoglycemia

A fall in the blood glucose to a subnormal level owing to an inappropriately large insulin dose, not eating properly after normal insulin administration and occasional alcohol consumption where blood sugar falls abnormally. The exact level of blood glucose developing-hypoglycemia is variable and depends on the individual and the absolute level of blood glucose and the length of time it was low. A diabetic patient is at risk when the level falls below 3.4 mmol/L and symptoms start showing at levels below 1.7 mmol/L. The patients may feel hot and sweaty, become confused or behave oddly. Left untreated, the patient may become unconscious because of an epileptic fit, and not recover; or if they do, they could be left with irreversible brain damage, i.e. neuroglycopenia due to glucose starvation of brain cells.

Treatment is to give rapidly absorbable sugar, preferably glucose either by mouth or intravenously. The hormone glucagon is given intramuscularly which converts glycogen in the liver to glucose and raises blood glucose. This leads to initial recovery and thereafter glucose is administered by mouth.

Diabetic patients are advised to carry glucose and take it at the first warning sign. Some have little or no warning and become unconscious very rapidly. Occasionally, there can be an attack even if extreme care is taken.

A diabetic patient on insulin, particularly those who pursue tasks such as driving or working with heights, is considered high risk from an insurance perspective. The history of hypoglycemia is thus an important factor in assessing Mortality and Morbidity risk.

Eye related diseases

- Cataract

In diabetes, a cataract occurs early in the course of disease or is present at the time of diagnosis. The condition (which normally affects elderly people) can occur earlier in middle age for those with diabetes.

- Retinopathy

The condition affects the small blood vessels of the retina. In its early stages, this can produce hemorrhages and micro aneurysms, which are usually asymptomatic. Subsequently there are exudates and when these appear in or near the macula, there will be impairment of vision. The retinal ischemia can stimulate the growth of abnormal new blood vessels (neo-vascularization). These can result in pre-retinal or vitreous hemorrhage, again threatening vision in the affected eye.

Retinopathy may be proliferative or non-proliferative. There is a substantial risk that the non-proliferative condition may progress, especially if the intra retina hemorrhages are widespread and if there are cotton wool spots. The risk of progression to proliferative retinopathy in such cases after 1 year is 32% and after 5 years is 68%.

Proliferative retinopathy implies the growth of new vessels, which can bleed or produce fibrosis, traction and retinal detachment. There is a sub group termed high-risk proliferative retinopathy in which there are extensive new vessels close to the optic nerve and associated with pre retinal or vitreous hemorrhage. In such cases, the one-year incidence of severe loss of vision is 10% and the 5 year incidence is 50%.

Treatment is by improving diabetic control, treating hypertension if present and cauterizing the abnormalities by means of very fine laser beams.

Kidney disease – Diabetic Neuropathy

Diabetic Kidney disease is the commonest cause of end stage renal disease accounting for 40% of new cases and can occur as:

- Microalbuminuria

The earliest manifestation of diabetic kidney disease is microalbuminuria, the appearance in the urine of small but abnormal quantities of albumin. The normal urinary albumin is 20 mg/l (2 mg/dl) and a constitution of 20-300 mg/l (2-30 mg/dl) constitutes microalbuminuria.

The prevalence of microalbuminuria in Type 1 diabetes is related to the duration of diabetes and reaches about 50% in 30 years. It is more likely in subjects with poor blood sugar control and high blood pressure. In Type 2 diabetes, hypertension will often precede microalbuminuria.

Treatment is with either a beta-blocker or an angiotensin – converting enzyme inhibitor (ACE1) to reduce the risk of developing microalbuminuria.

- Clinical nephropathy

Microalbuminuria increases by around 15% a year and when it exceeds 300 mg/l, this becomes clinical nephropathy, known as Glomerulopathy. Blood pressure level needs to be maintained at a target less than 130/80 to prevent further deterioration. It is now a standard practice for all diabetics with microalbuminuria or clinical nephropathy to receive an ACE1 or Angiotensin Receptor Blocker (ARB) irrespective of blood pressure. There is an increased risk of cardiovascular disease and sudden death in those with diabetic nephropathy. Aggressive management of all modifiable risk factors by intensive treatment of hyperglycemia, dyslipidemia and hypertension is beneficial in reducing cardiovascular events and the progression of renal disease.

- End stage renal disease

The management is similar whether diabetes is the underlying cause or not. Dialysis is often started earlier in those with diabetes because of the likelihood of coronary disease, and is often in the form of continuous ambulatory peritoneal diabetes. Reliable vascular access restricts the use of hemodialysis; good blood pressure and blood sugar control can be difficult. Prognosis is poor using either

method: a quarter of patients using dialysis die within 1 year and three quarters die within 5 years. Transplantation may offer a better route for survival, especially if a combined renal-pancreatic transplant is undertaken. There is an 80% survival rate at 5 years, which is similar to those with a non-diabetic kidney disease.

Cardiovascular Diseases

- Coronary disease

The nature of coronary disease in diabetics is similar to non-diabetic subjects but it tends to be more extensive and progresses more rapidly. Survival rates are lower once the diagnosis is angiographically confirmed, being 70% after 5 years in diabetics and 45% in non-diabetics.

A Finnish study showed that diabetics without known cardiovascular disease were at similar risk of cardiac events and death as those without diabetes who have had a previous myocardial infarction. As a rule, diabetics have a lifespan around ten years shorter than that of a non-diabetic, and the major cause of this premature mortality is macro vascular disease. The hazards are confined not only to those with proven diabetes but also to those with impaired glucose tolerance with increased risk of atheromatous disease.

The presence of microalbuminuria in those with diabetes will double the risk of coronary disease, an important point to be remembered when underwriting such a case. In addition to the underlying atheromatous disease there are coagulation abnormalities that may promote thrombosis, such as increased platelet aggregation and decreased fibrinolysis. The prevalence of silent ischemia is increased five-fold in those with diabetes but the mechanism is unclear.

- Myocardial Infarction

Mortality from myocardial infarction is about twice as common in those with diabetes than in non-diabetics, largely due to an increase in heart failure. It is probable that myocardial

infarction has been under diagnosed in those with diabetes, as the presentation may be subtle. But with the advent of Troponin measurement as a diagnostic test, more cases may be detected which will have implications for critical illness cover. The management of coronary disease is broadly similar, whether or not a subject has diabetes, but there is both an early and a late increase in mortality following coronary surgery or angioplasty in those with diabetes.

- Cerebrovascular disease

Cerebral infarction but not cerebral haemorrhage is more common in both Type 1 and Type 2 diabetes than it is in the general population and the risk extends to those with impaired glucose tolerance. About 40% of cerebral infarcts are due to local thrombosis, 25% due to embolism from heart and 20% due to lacunar strokes related to small vessel disease. For conventional term assurance or income protection policies which terminate at age 65, the risk of stroke in diabetics is not an important consideration. However, it will be a major factor in considering long-term care products. Diabetes increases the risk of death from a stroke. The incidence of high dependency and hyperglycemia following a stroke also increases the risk of death from said stroke.

- Peripheral vascular disease

This generally affects the lower limbs and is an indicator of generalized atheromatous disease although this may not be clinically evident in other territories. It occurs three times as often in diabetics than in the general population and is a strong predictor of mortality. The implication of peripheral vascular disease in diabetics depends on co-existing factors such as neuropathy. Diabetic foot ulcers are commonly due to these combinations, the neuropathy producing impairment of sensation and thus a loss of awareness of minor injuries. Infection may or may not supervene and the poor blood flow will prevent normal healing mechanisms. When such ulcers are infected, the prognosis for the limb is poor and 76% of such cases result in amputation.

The classical symptom of peripheral vascular disease is intermittent claudication, that is, calf pain due to relative ischemia that occurs consistently with exercise and is relieved promptly by rest. It is often not reported by those with diabetes, possibly because of concomitant neuropathy or because the disease is characteristically more distal than in non-diabetics. In conclusion, the presence of peripheral arterial disease indicates macrovascular disease elsewhere and this will affect underwriting decisions. Because those with ulcers, critical ischemia and amputation frequently require long periods in hospital, the cost is extremely high. This has major implications for the provision of long-term care.

Implications of lifestyle risk factor

- Smoking

Both men and women have an increased risk of developing diabetes and as a group have less diabetic control than non-smokers as shown by HbA1c level. The risk is eliminated 5 years after stopping smoking in women and after 10 years in men.

Smoking is an independent risk factor and speeds progression of microalbuminuria to frank proteinuria in addition to the increased cardiovascular risk associated with nephropathy. There is a strong correlation between cigarette smoking and coronary heart disease in both diabetic and non-diabetics but the combination of diabetes and smoking doubles the risk from that of a non-smoker.

- Diabetic dyslipidemia

Dyslipidemia of diabetes are part of the metabolic syndrome that is a major contributory cause of Type 2 diabetes, the maintaining of poor control and the development of complications. The hallmark of metabolic syndrome is insulin resistance, and this can be improved principally by weight loss and lifestyle modifications. Drugs such as metformin and thiazolidinedione

(Pioglitazone and Rosiglitazone) are used as adjuncts.

In Type 1 diabetes, there is often no lipid abnormality on presentation. If subsequent control is poor, and especially if associated with microalbuminuria and nephropathy, then total cholesterol and low-density lipoprotein cholesterol (LDL-C) are elevated, as are triglycerides.

Good glycemic control will normalize these abnormalities.

In Type 2 diabetes, in addition to the abnormalities mentioned above, there is a low concentration of high density lipoprotein cholesterol (HDL-C), which is regarded as particularly atherogenic, along with small dense LDL and remnant particles. These last two are not measurable as yet in clinical practice, but a high triglyceride level is generally regarded as a marker of their presence.

The management of diabetic dyslipidemia begins with lifestyle changes. Weight loss will reduce triglycerides and elevate HDL-C levels whether achieved by diet and exercise, pharmacotherapy or bariatric surgery. An increase in physical exercise can reduce cardiovascular risk and mortality in diabetes and will reduce insulin resistance. Even moderate exercise will reduce LDL-C and elevate HDL-C independently of other factors. A high triglyceride level may be associated with excessive alcohol intake but a modest amount will elevate HDL-C by around 10%. They are regarded as beneficial in cardiovascular terms.

The second line of treatment is improvement in glycemic control. Better control can certainly reduce triglyceride levels, and the glitazones in particular may improve lipid abnormalities by better blood sugar control. With the increasing experience of the benefits and safety of the available drugs, they are being used more and more, and targets for treatment are being intensified.

Increasingly in diabetic dyslipidemia, a combination of different classes of lipid-

lowering drugs are used in an attempt to reach target levels.

- Hypertension

Hypertension is twice as common in those with diabetes compared to those without diabetes. It is particularly prevalent in Type 2 diabetes. In the WHO multinational study of Vascular disease, 41.9% of those with Type 1 diabetes had hypertension compared with 46.8% of those with Type 2 diabetes. Much of this prevalence in Type 2 diabetes is related to obesity; weight loss is therapeutic for both. There is a link with albumin excretion, in that those in whom this is normal have a low prevalence of hypertension, whereas those with macro albuminuria have a high prevalence. The latter are also at high risk of progressive renal disease and coronary events.

Increasingly systolic blood pressure raised cardiovascular mortality throughout the population, but in diabetics the risk is doubled. There is good evidence that lowering blood pressure reduces mortality.

The target blood pressure for those with diabetes remains controversial. From the underwriting point of view, the applicant with diabetes who is on a number of different drugs may be a better risk than those on minimal treatment. It is the level of blood pressure achieved that matters.

Diabetic Neuropathy

- Peripheral Neuropathy

The prevalence of peripheral nephropathy in diabetics is hard to assess, as symptoms do not correlate well with signs or with demonstrable nerve conduction abnormalities. Neuropathy cannot be measured in the same way that one can measure retinopathy by grading the photographic abnormalities or nephropathy by measuring albumin excretion.

The neuropathic foot can lead to tissue damage because of undetected injury, and if there is an impairment of blood flow as well,

there is a high risk of ulceration which may become infected. This is a common prelude to amputation. Frequent self-examination and regular podiatry assessment are essential to avoid this.

A particular form of neuro-arthropathy was described by Charcot in 1868. It is characterized by progressive joint destruction, which can result in fracture and dislocations. Diabetic amyotrophy is a multifocal neuropathy occurring usually in middle-aged or elderly diabetics. It affects principally the anterior thigh muscles, which are often painful and weak and knee jerks are depressed or absent. There may be muscle wasting.

- Autonomic neuropathy

Autonomic neuropathy is an important complication, as it affects the heart, the bowel and the genitourinary system. A simplified classification of autonomic neuropathy is as follows:

- Cardiovascular

The heart is richly supplied with autonomic nerves relating to both sympathetic and parasympathetic systems. They affect particularly the heart rate and also the coronary resistance vessels. An early sign of cardiac autonomic neuropathy is resting tachycardia.

A variation of less than 10 beats / minute suggests autonomic neuropathy. Left ventricular diastolic dysfunction is a feature of autonomic neuropathy and there is an increase in the risk of painless myocardial ischemia and silent myocardial infarction. The combination of autonomic neuropathy and silent myocardial ischemia carries a poor prognosis. Postural hypotension is a common manifestation of autonomic neuropathy but is not always symptomatic. The diagnosis is made if there is a fall in systolic pressure of over 30 mm Hg on standing. There has been interest in the association between a prolonged QT interval (on the ECG), autonomic neuropathy and sudden death. An increase in QT dispersion (difference between the longest and the shortest QT

interval on the ECG) can predict mortality in Type 2 diabetes.

- Gastrointestinal

This can probably affect any part of the bowel, although in practice the two clinical manifestations are gastroparesis and diabetic diarrhea. Although gastric emptying is commonly delayed in diabetes, the main symptoms of gastroparesis is rare. Other causes of obstruction must clearly be excluded. Diabetic diarrhea is a little more common and is probably caused by a combination of factors. Certainly gut denervation is one, but there may well be bacterial overgrowth, bile salt malabsorption and a shortened transit time. It is usually associated with other disorders of autonomic function. It is important to exclude celiac disease, which has an increased incidence in Type 1 diabetes.

- Bladder disorders

The neuropathy may cause the sensation of a full bladder to be impaired, subsequently resulting in reduced bladder emptying. Peak urine flow is reduced and the duration of the flow increased. Eventually urinary retention may occur with or without overflow. Incontinence, the neurogenic bladder. Self-catheterization is the treatment of choice, but there is a major risk of urinary infection. Long term recurrent urinary tract infection can cause renal disease and eventually renal failure.

- Sweating abnormalities

This condition is not of great concern in insurance medicine but it is mentioned for the sake of completion. Sweating abnormalities are a form of autonomic neuropathy. There is usually increased sweating in the upper body but a reduction in the feet. This can produce dryness and a risk of cracked feet, which may result in infection in the foot, which is already compromised in other ways. Gustatory sweating occurs shortly after eating but is confined to the upper body. It is a feature of diabetic autonomic neuropathy, which runs

a variable course. It is not especially common but can be socially embarrassing.

- Abnormal response to hypoglycemia

When blood sugar falls there is automatic stimulation resulting in tachycardia and palpitation, sweating and tremor. These symptoms alert the diabetic to an impending hypo and the urgent need for sugar in some form. The autonomic neuropathy might blunt this response sufficiently to produce hypoglycemic unawareness that are hypos which patients cannot manage themselves. In clinical practice it is usually possible to regain awareness of hypoglycemia by adjusting the diet and medication. In most cases, this means reducing insulin doses and allowing a few months of modest hypoglycemia.

Supervision of Diabetic Patients

Once diagnosed, the patient will have diabetes throughout his life. All Diabetic patients should undergo checks regularly, at least once per year, if the problem persists. The purpose of the review is to check and to advise on diabetic control, to monitor therapy and to look for evidence of diabetic complications. Examination is carried out by the patient's General Practitioner for straightforward cases and in a designated diabetic clinic, run by a diabetologist, for complex problems.

As a measure of overall control, a measurement of HbA1c will provide insights on diabetic control. While a rating above 8.5% indicates poor control, the aim should be to reduce to a level below 7%; levels below 6% are normal indicators.

The below regular checks help monitor diabetes.

- Eye examination by Retinal Photography at least once a year.
- Examination of the feet – looking for poor circulation & neuropathy – conjunction of which puts the feet at high risk of damage with consequent disability.
- Blood pressure to be checked and treated
- Serum Lipids to be measured and treated

Underwriting Diabetes

Given that the overall mortality in diabetes is higher than 100% with slightly more prevalence in females, in those who are overweight and certain other groups, the underwriter is faced with many problems. Discussion of the case with the Chief Medical Officer (CMO) may be desirable.

Requirement(s):

- General Physician's Report (GPR) accompanied by a Diabetic questionnaire – if possible a Specialist's report.
- Generally, Medical Examiner's Report (MER) is not required unless a particular feature of the case demands it.

Basis for Rating:

- Rating depends on current age and the length of time the disease has been present.

- Age at onset of diabetes is important as relative mortality is expressed as a percentage which decreases as age rises.
- Though the risk for both older and younger subjects is similar, it is riskier for younger people with diabetes.
- Recent onset of the disease and cases discovered at routine insurance medical examination should be postponed for 6 months, to allow investigation and establishment of a treatment origin (although there can be exceptions).
- A small rating applied to Impaired Glucose Tolerance or Impaired Fasting Glucose.
- Critical Illness: Usual for diabetic risk to be declined for critical illness cover.

Risk chart for age/duration

The below table serves as a broad reference range for ascertaining the risk factor according to the age and duration of the Diabetes (Slight: 25 to 50%; Moderate 75 to 100%; High over 150%).

Age	Duration of Diabetes	
	Up to 10 years	11 to 25 years
20 - 39	Moderate / High	High
40 – 49	Moderate	Moderate / High
50 – 59	Slight / Moderate	Moderate
60 & above	Slight	Slight / Moderate

Diabetes that requires Declinature

- Coronary: with history of Myocardial infarction and established coronary artery disease.
- Cerebral: with history of stroke and established Peripheral vascular disease.
- End stage renal disease, Neuropathy and Advanced Retinopathy.
- Blood Glucose: FBS > 14 mmol/L and/or RBS > 16.6 mmol/L
- Urine: Glucose dip stick ++++ and/or Protein >290 mg/dl
- Blood Pressure: Systolic > 185 mmHg and/or Diastolic > 110 mm/Hg
- Lipid: Total cholesterol > 300 mg/dl (7.6 mmol/L) and/or Triglycerides > 275 mg/dl (3.03 mmol/L)
- Lifestyle: BMI > 40 and /or Smoking > 20 cigarettes per day.
- Proliferative Retinopathy and more than Moderate Non Proliferative

Diabetes Rating

Diabetes Rating shall depend on the following factors:

- HbA1c values
- Age at time of diagnosis: age shall be the age at diagnosis and not age at proposal
- Duration of the Policy: For a duration of more than 3 years, the Extra premium shall be calculated using the multiplication factor given

- Diabetic Complications: The sum of the Life ratings for diabetes and additional impairments should be increased as shown in the table.

- The overall sum of Ratings, if above +400 % and/or Risks with multiple complications or impairments, should be declined

Policy Duration less than 3 years (Basic rating)

HbA1c Values	Diagnosed Within the last 12 months*	Age at Time of Diagnosis of Diabetes (Years)				
		< 40	40 - 55	56 - 64	65 - 74	> = 75
< 6.9%	75%	75%	50%	50%	50%	25%
7.0% - 7.8%	125%	75%	50%	50%	50%	50%
7.9% - 8.7%	150%	125%	75%	50%	50%	50%
8.8% - 9.6%	250%	150%	100%	100%	75%	50%
9.6% - 11.9%	Decline	250%	225%	175%	175%	75%
> 12.0%	Decline	Decline	Decline	Decline	Decline	Decline

Adjustment factor of policy duration higher than 4 (multiply the above basic rating)

Policy Duration	Diagnosed Within the last 12 months*	Age at Time of Diagnosis of Diabetes (Years)				
		< 40	40 - 55	56 - 64	65 - 74	> = 75
4 to 6 years	x1.5	x1.25	x1.10	x1.0	x1.0	x1.0
7 to 10 years	x1.75	x1.50	x1.25	x1.15	x1.10	x1.0
11 to 15 years	Decline	x2.0	x1.75	x1.50	Decline	Decline
16 to 20 years	Decline	Decline	x2.0	x1.75	Decline	Decline
Over 20 years	Decline	Decline	Decline	Decline	Decline	Decline

Additional Rating for Diabetes with Complications (add the below value to the above Adjusted Basicrating)

Complication		Diagnosed Within the last 12 months*	Age at Time of Diagnosis of Diabetes (Years)				
			< 40	40 - 55	56 - 64	65 - 74	> = 75
Hypertension Rating	Up to +25	Nil	Nil	Nil	Nil	Nil	Nil
	+25 to 100	+100%	+75%	+50%	+25%	Nil	Nil
	Over +100%	Decline	Decline	Decline	Decline	Decline	Decline
Build Rating	0 to +50%	+50%	+50%	+25%	+25%	Nil	Nil
	+50 to +100%	+100%	+100%	+75%	+50%	+25%	Nil
	Over +100%	Decline	Decline	Decline	Decline	Decline	Decline
Hyperlipidemia	0 to +50%	+50%	+50%	+25%	+25%	Nil	Nil
	Over +50%	Decline	+100%	+75%	+50%	Nil	Nil
Urine Dip stick	++	Decline	Decline	+75%	+75%	+75%	+75%
	+++	Decline	Decline	Decline	+150%	+125%	+100%
Non Proliferative Retinopathy	Mild	Decline	Decline	+75%	+50%	+50%	+25%
	Moderate	Decline	Decline	+100%	+75%	+75%	+50%

* Diagnosed within last 6 months – Risk requires Postponement for 3 to 6 months until adequate control is established. Accept only better risk if the applicant's attitude and background (eg. Occupation / Lifestyle) indicate a firm expectation of early and continuing Medical Treatment - the Extra premium applies irrespective of Age

Rating for Disability & Accident Disability Benefit (ADB)

Total Diabetic Rating*	Disability	ADB
Up to 75	Standard Rate*2	Standard rate
100 to 150	Decline	Standard rate*2
Over 150	Decline	Decline

*Rating for Life cover including additional ratings for diabetic complications and additional impairments

Rating for Critical Illness

Favorable Risk Profile (Good Control, BP and Lipids Satisfactory, Non-Smoker, Normal Weight)

- +100% for Rating highlighted in orange

Less Favorable Risk Profile

- +100% and Exclude Coronary Artery disease, Cerebrovascular and Peripheral Vascular disease.
- If Retinopathy present – Exclude Loss of Vision

Rating for Income Protection

Duration from Diagnosis to age at end of policy term	Diet only	Oral drugs	Insulin
Under 10 years	0 to +50	+50	+50 to +100
10-25 years	+50 to +100	+50 to +150	+150 to +250
Above 26 years	Decline	Decline	Decline

Rating for presence of long term complications

- Vascular Disease

Patients with evidence of widespread vascular disease would attract a rating appropriate to the condition together with extra rating for coincidence of condition with diabetes. Diabetes with coronary artery disease in particular has a worse prognosis.

- Diabetic Retinopathy

Patients with all but very mild retinal changes should be rated severely or declined for morbidity benefits. Retinopathy in itself does not increase mortality, however, since it is often eventually associated with other diabetic complications, it should incur a moderate addition.

- Diabetic Nephropathy

- Patients who have persistent proteinuria from diabetic nephropathy are declined all insurance.

- Patients with micro proteinuria – considered for mortality risks – particularly for short term or if applicant is middle aged or older.
- Presence of hypertension in patients with renal disease is a particularly unfavorable feature.
- Any degree of renal failure will be declined.

- Diabetic Neuropathy

Autonomic neuropathy usually results in declination.

Symmetrical peripheral neuropathy, if mild, would not attract a special extra for life – although it is significant for Income Protection (IP).

A more advanced neuropathy would attract a moderate extra for life and a declination for IP.

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