



Comprehensive Diabetes Testing

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Comprehensive diabetes testing, from central lab to point of care

Diabetes testing

There are many tools in the arsenal of diabetes-related diagnostic tests. Insulin, C-peptide, urinary albumin, serum fructosamine, and glycosylated hemoglobin determinations can provide valuable information. These assays can be used to aid in the differentiation of type 1 from type 2 diabetes, to diagnose and monitor the diabetic's glycemic control, and follow the progression of the disease.⁸

A costly and deadly disease

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels. According to the International Federation of Diabetes, an estimated 463 million adults were living with diabetes globally in 2019, and 10% of the global population is expected to have the disease by 2030.¹ The longer a person lives with untreated diabetes, the worse his or her outcome will likely be. In 2019, IDF estimates that total diabetes-related health expenditure will reach USD 760 billion.

Diabetes testing is performed for various reasons on many different types of patients

- **Newly diagnosed diabetics**
To help determine if they have type 1 or type 2 diabetes when the clinical indications are inconclusive.⁸
- **Type 2 diabetics**
To monitor and adjust therapies.⁸
- **All diabetics**
To test for diabetic nephropathy by measuring their urinary albumin-to-creatinine ratio.⁸
- **Postmenopausal women**
Studies indicate that this group may have an increased risk for cardiac mortality if they have an elevated urinary albumin to creatinine ratio.²
- **Women diagnosed with polycystic ovary syndrome (PCOS)**
This syndrome affects about 6% of all women, with 50% having insulin resistance. Early diagnosis of PCOS is important, as it has been linked to an increased risk for developing several medical risks, including insulin resistance and type 2 diabetes.³
- **Gestational diabetes**
Gestational diabetes (GDM) is a form of diabetes consisting of high blood glucose levels during pregnancy. It develops in 1 in 25 pregnancies worldwide and is associated with complications to both mother and baby. GDM usually disappears after pregnancy, but women with GDM and their children are at an increased risk of developing type 2 diabetes later in life. Approximately half of women with a history of GDM go on to develop type 2 diabetes within 5–10 years after delivery.⁴

Choose Siemens Healthineers for your diabetes testing

Choice of fully automated systems you can trust:

- Chemistry
- Immunoassay
- Integrated
- Point of care

Diabetes testing: Glucose is only the beginning!

Test*	Clinical Utility ⁶
Albumin:creatinine ratio	Diagnose and monitor early kidney disease.
C-peptide	Distinguish between type 1 and type 2 diabetes, or between factitious insulin levels and insulinoma.
Creatinine	Assess kidney function in the diagnosis and treatment of certain renal diseases, in monitoring renal dialysis, and as a basis for the estimated glomerular filtration rate and presence of proteinuria.
Cystatin C	Recognized as a sensitive marker in the early detection of kidney disease and, when combined with the creatinine value, may improve the estimated glomerular filtration rate.
Fructosamine	Monitor average glucose levels over a period of 2–3 weeks. It is primarily ordered when a diabetic treatment plan is being started or adjusted in order to monitor the effect of the change in diet, exercise, or medication.
Glucose	Detect both hyperglycemia and hypoglycemia to help diagnose diabetes and monitor glucose levels in diabetics
HbA1c	Monitor the overall glycemic control of diabetics over a long-term period of up to 3 months to help minimize the complications caused by chronically elevated glucose levels.
Insulin	Detect islet cell tumor, insulin resistance in diabetics and women with PCOS, and type 1 or type 2 diabetes.
Urinary albumin	Aids in the diagnosis of diabetic nephropathy with its associated increased risk of cardiac mortality, end-stage renal disease, and proliferative retinopathy.

*Not all assays are available on all systems; availability is subject to local regulatory requirements.

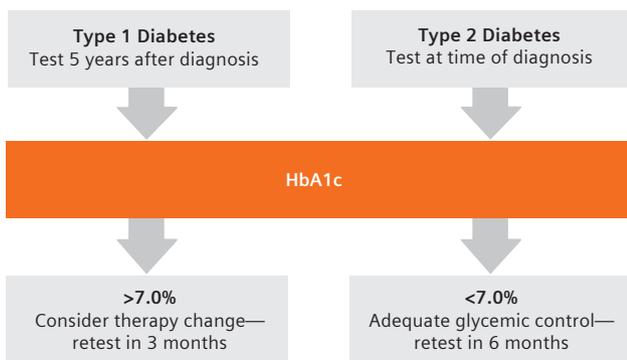
HbA1c: a simple test to help control diabetes

Measurements of hemoglobin A1c (HbA1c) are effective in diagnosis and monitoring long-term glucose control in individuals with diabetes. Studies have shown that improving HbA1c control can greatly reduce the risk of complications from diabetes, including:

- Kidney disease
- Eye damage
- Heart disease
- Amputations

HbA1c measures blood glucose control in type 1 and type 2 diabetics. For every 1% reduction in results of HbA1c blood tests, the risk of developing eye, kidney, and nerve disease is reduced by 40%, while the risk of heart attack is reduced by 14%.⁷

The American Diabetes Association (ADA) recommends that anyone with diabetes have their HbA1c levels tested at least once every 6 months, and every 3 months if HbA1c level is not meeting treatment goals.



Charts adapted from American Diabetes Association recommendations.

Glucose

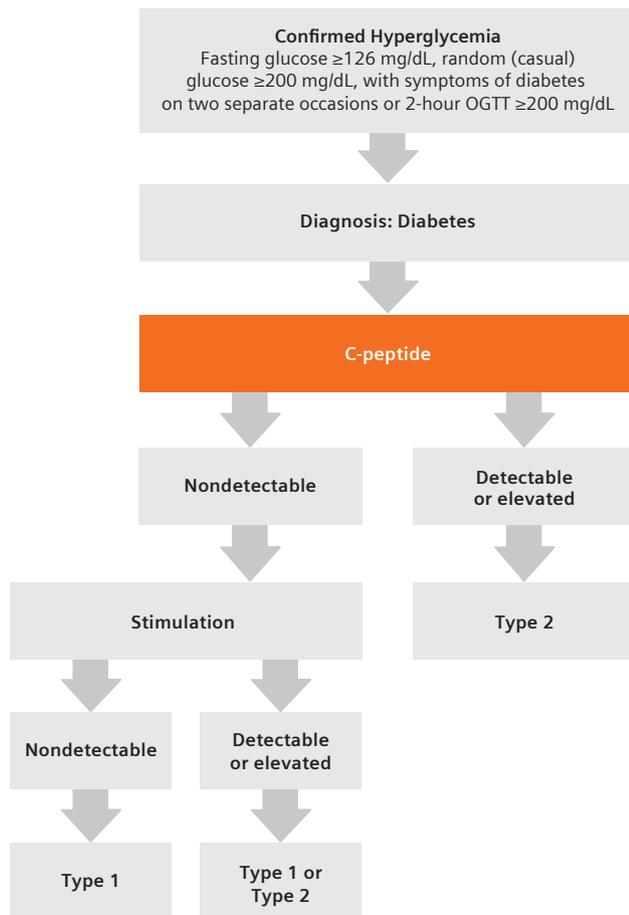
Glucose measurements are used in the diagnosis and treatment of disorders of carbohydrate metabolism such as diabetes, hypoglycemia, and insulinoma.² Diabetes is a common disease that begins with few symptoms, and therefore glucose testing is often used to screen healthy, asymptomatic individuals for impaired fasting glucose and diabetes. Testing is especially important for people at high risk of developing diabetes, such as those with a family history of diabetes, those who are overweight, and those who are older than 45 years old.⁵ Glucose testing (glucose tolerance test) is also commonly used to diagnose diabetes that occurs during pregnancy (gestational diabetes).

A glucose test may also be ordered to help diagnose diabetes when someone has symptoms of hyperglycemia (high blood sugar) or hypoglycemia (low blood sugar). Occasionally, a blood glucose level may be ordered along with C-peptide to evaluate insulin production.⁶

C-Peptide: a specific determinant for appropriate therapy

The measurement of C-peptide levels can be a useful aid in the diagnosis and treatment of abnormal insulin secretions. C-peptide levels measured in response to intravenous glucagon can provide useful information when attempting to differentiate between type 1 and type 2 diabetes in difficult cases.

Measurement of C-peptide is valuable in the investigation of possible factitious hypoglycemia attributable to surreptitious insulin administration.⁹



Charts adapted from American Diabetes Association recommendations

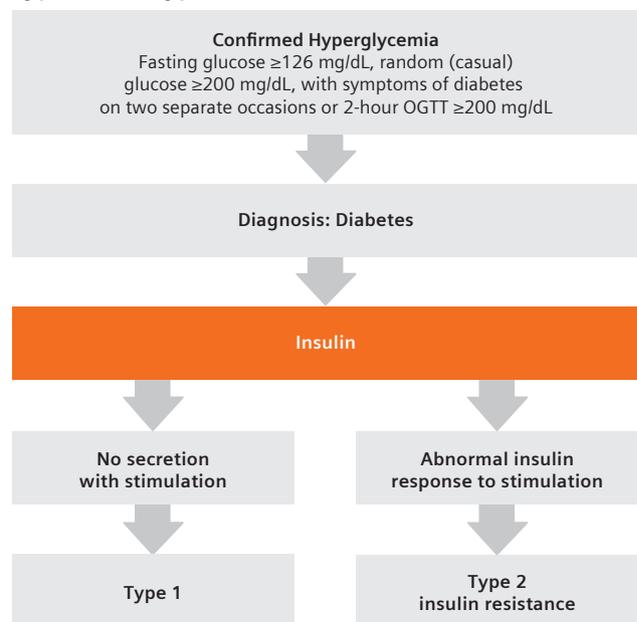
Insulin: an important tool for distinguishing type 1 from type 2 diabetes and insulinoma from factitious hypoglycemia

Measurement of insulin levels can be used to aid in the selection of the most appropriate antihyperglycemic agent in patients with type 2 diabetes. It is believed that the lower the pretreatment insulin concentration, the more appropriate insulin might be as the drug of choice to initiate treatment.¹⁰

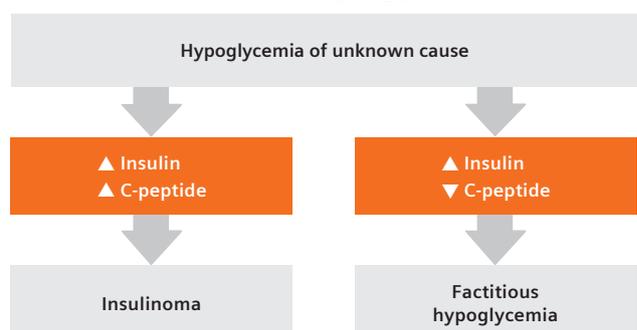
Fasting insulin-to-glucose levels may be valuable in the assessment of insulin resistance in diabetics as well as in women with polycystic ovary syndrome (PCOS).

Insulin measurements are also used to establish the pathogenesis of fasting hypoglycemia. The diagnosis of an islet cell tumor, for instance, is based on the persistence of inappropriately increased plasma insulin levels in the presence of low glucose levels.

Type 1 from type 2 diabetes



Insulinoma from factitious hypoglycemia



Charts adapted from American Diabetes Association recommendations.

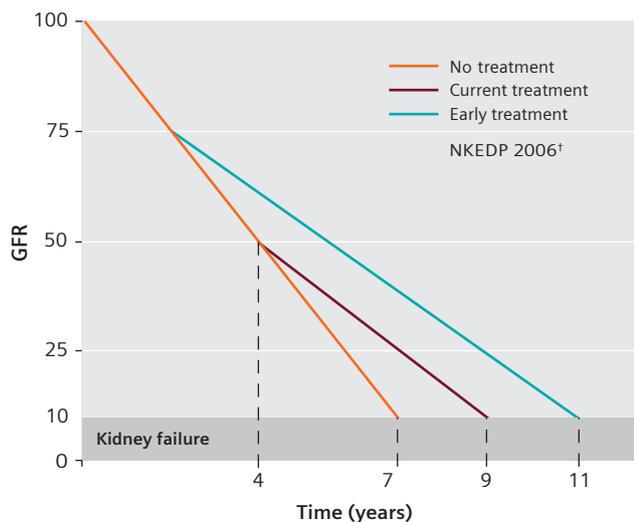
Cystatin C: sensitivity and specificity when assessing renal function

There are an estimated 463 million diabetics worldwide,¹ with diabetes being the most common cause of kidney failure. Cystatin C is used in the diagnosis and treatment of renal dysfunction as an alternative to creatinine and creatinine clearance tests.

Studies demonstrate that serial measurements of serum cystatin C provide an accurate estimation of trends in kidney function in patients with diabetes and normal or elevated glomerular filtration rate (GFR).² Patients who may benefit most from GFR assessment using cystatin C include those at high risk for chronic kidney disease where monitoring is required, including diabetics. Earlier detection can lead to better clinical outcomes.

Stage	Description	GFR Range	N Latex Cystatin C (mg/L)
1	Normal or increased GFR	≥90	≤0.8
2	Mildly decreased GFR	60–89	0.86–1.25
3	Moderately decreased GFR	30–59	1.26–2.34
4	Severely decreased GFR	15–29	2.35–4.16
5	Kidney failure	<15	>4.16

Cystatin C has been shown to detect renal dysfunction as early as stage 2.



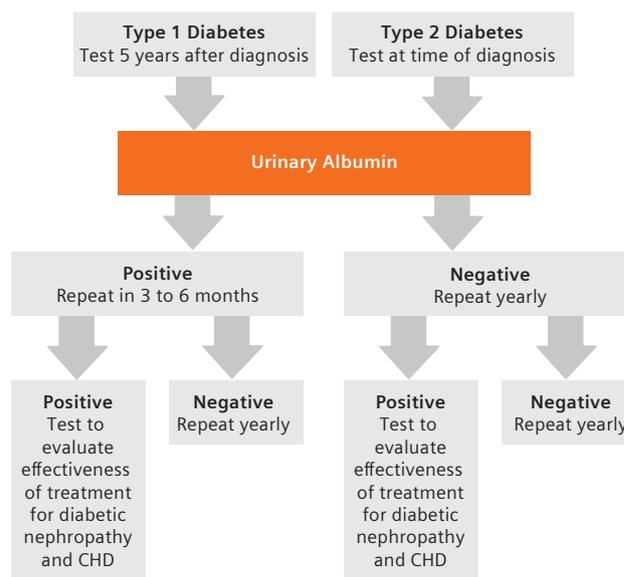
†NKDEP: Chronic Kidney Disease in the United States. www.nkdep.nih.gov (2006).

Urinary albumin: a sensitive marker for diabetic nephropathy

Determination of low levels of urinary albumin (microalbumin) is a valuable tool in the diagnosis of diabetic nephropathy. Early detection of microalbuminuria in diabetics is critical because immediate intervention can slow the progression of disease. The International Diabetes Federation and American Diabetes Association recommend that annual urinary albumin testing of patients without clinical proteinuria should begin in pubertal or postpubertal individuals 5 years after diagnosis of type 1 diabetes and at the time of diagnosis of type 2 diabetes.

Elevated levels of albumin in urine can also provide an early warning sign for physicians that the kidneys are not functioning properly. In patients with diabetes, the presence of very small, or micro levels of albumin in urine are clinically significant and may indicate early signs of kidney disease. These micro levels of albumin in urine, when in the 30 to 300 mg range in 24 hours, are referred to as microalbuminuria.

An additional tool for more accurate assessment of microalbuminuria is the use of microalbumin-to-creatinine ratio tests (A:C). The American Diabetes Association recommends A:C ratio testing for nephropathy as the preferred method over albumin alone to reduce the risk of false-negative and false-positive results that may be due to varying urine concentration.¹



Siemens Healthineers provides a full complement of diabetes testing systems and assays



Atellica CH System



Atellica IM System



ADVIA Centaur XPT System



ADVIA Chemistry XPT System



Dimension EXL System



Dimension Vista System



IMMULITE System



BN ProSpec System

Whether it's routine testing for glucose, HbA1c, and urinary albumin, or esoteric tests for insulin and C-peptide, Siemens Healthineers menu makes it easy for you to provide your ordering physicians a full complement of tests.

	Atellica® Solution								
	ADVIA Centaur® Systems	ADVIA® Chemistry Systems	Atellica® CH 930 Analyzer	Atellica® IM 1300/1600 Analyzer	BN ProSpec® Systems	Dimension® EXL™ Systems	Dimension Vista® Systems	DCA Vantage® Analyzer	IMMULTE® Systems
C-Peptide	•			•					•
Creatinine [‡]		•	•			•	•	•	
Cystatin C		•	•		•		•		
Fructosamine		•	•						
Glucose		•	•			•	•		
HbA1c		•	•			•	•	•	
Insulin	•			•					•
Urinary Albumin		•	•		•	•	•	•	•

Assay availability varies by country and is subject to local regulatory requirements.
[‡]Urine only.



Point-of-care Testing Options

Drive diabetes-patient compliance using the DCA Vantage Analyzer with clinically proven HbA1c,³ albumin and creatinine tests, and albumin-to-creatinine (A:C) ratio results. Simple enough to use in your office or clinic, and yet powerful enough to deliver lab-quality performance at the point of care.

For additional information, visit siemens-healthineers.com/diabetes.

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Product availability may vary from country to country and is subject to varying regulatory requirements. Please contact your local representative for availability.

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Siemens Healthineers Headquarters

Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen, Germany
Phone: +49 9131 84-0
siemens-healthineers.com

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Siemens Healthcare Diagnostics Inc.
Laboratory Diagnostics
511 Benedict Avenue
Tarrytown, NY 10591-5005
USA
Phone: +1 914-631-8000