

TYPE 2 DIABETES MELLITUS

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Definition

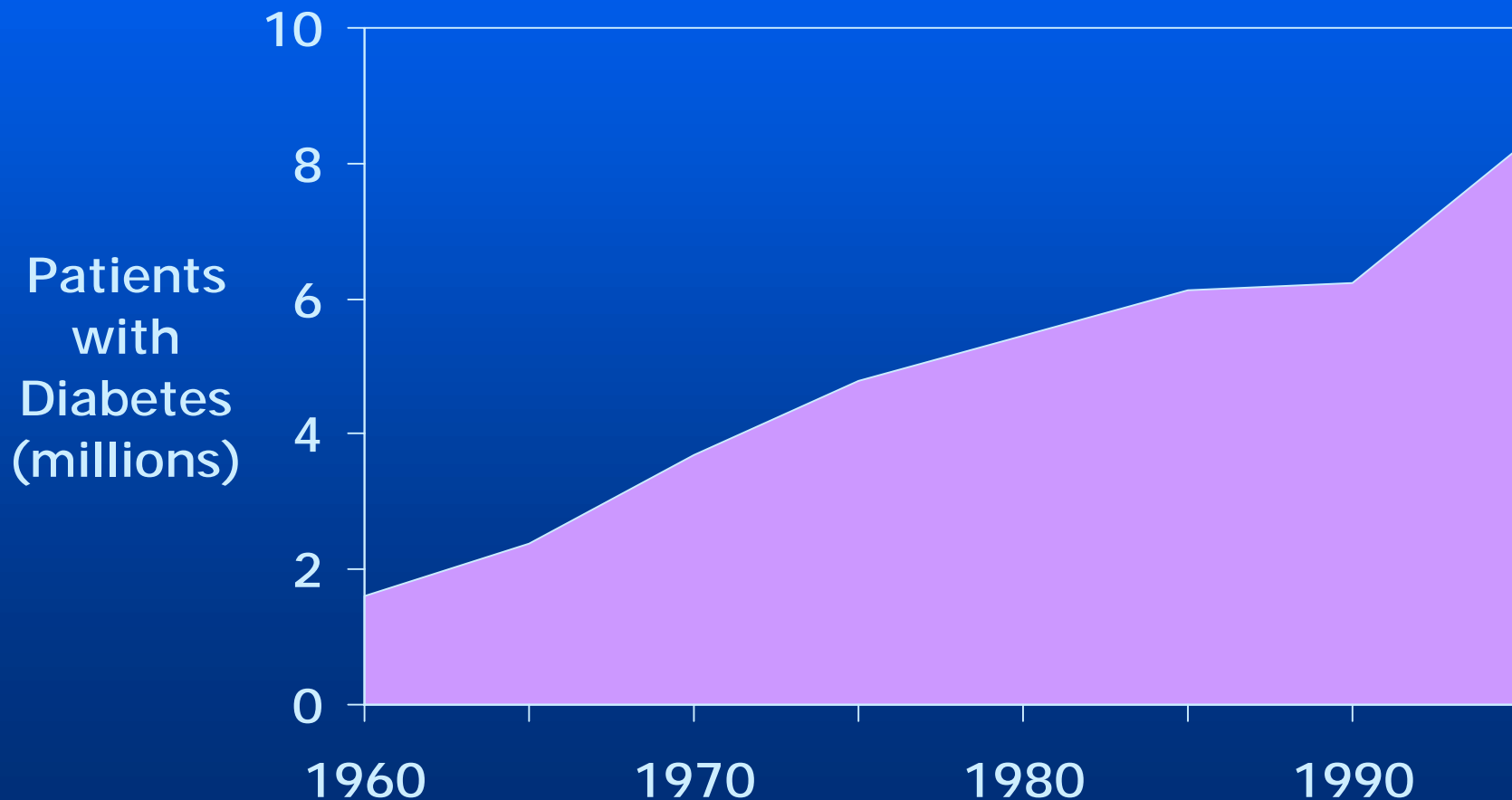
Diabetes mellitus: A chronic disorder characterized by a deficiency of insulin secretion and/or insulin effect, which causes hyperglycemia, disturbances of carbohydrate, fat and protein metabolism, and a constellation of chronic complications .

Diagnostic Criteria

	Fasting Glucose	Random	OGTT (2 hr)
Normal	<110 mg/dl (5.5 mM)		<140 mg/dl (7.7 mM)
IFG/IGT	111-125 mg/dl		140-200 mg/dl
Diabetes	≥126 mg/dl (7.0 mM)	>200 mg/dl (11.1 mM)	>200 mg/dl (11.1 mM)

*Confirmation on a second day by any of the above methods

Prevalence of Diagnosed Diabetes Mellitus



Features of Type 1 Diabetes

- 80% occur before age 20
- May occur at any age
- Insulin deficient
 - autoimmune pathogenesis, HLA linked
 - less commonly non-immune mediated
- Ketosis prone
- Normal insulin sensitivity

Features of Type 2 Diabetes

- Most common after age 40
- Abdominal obesity present in 90%
- Insulin resistance/hyperinsulinemia
- Ketosis resistance
- Hypertension common
- High VLDL, low HDL cholesterol
- Accelerated atherosclerosis
- High in risk in many ethnic groups

Risk Factors for Type 2 Diabetes

- Age > 40
- Family history of diabetes
- Ethnicity
- Obesity; abdominal fat distribution
- GDM, or infant > 9 lbs
- Hypertension, hyperlipidemia
- Previous Impaired Glucose Tolerance

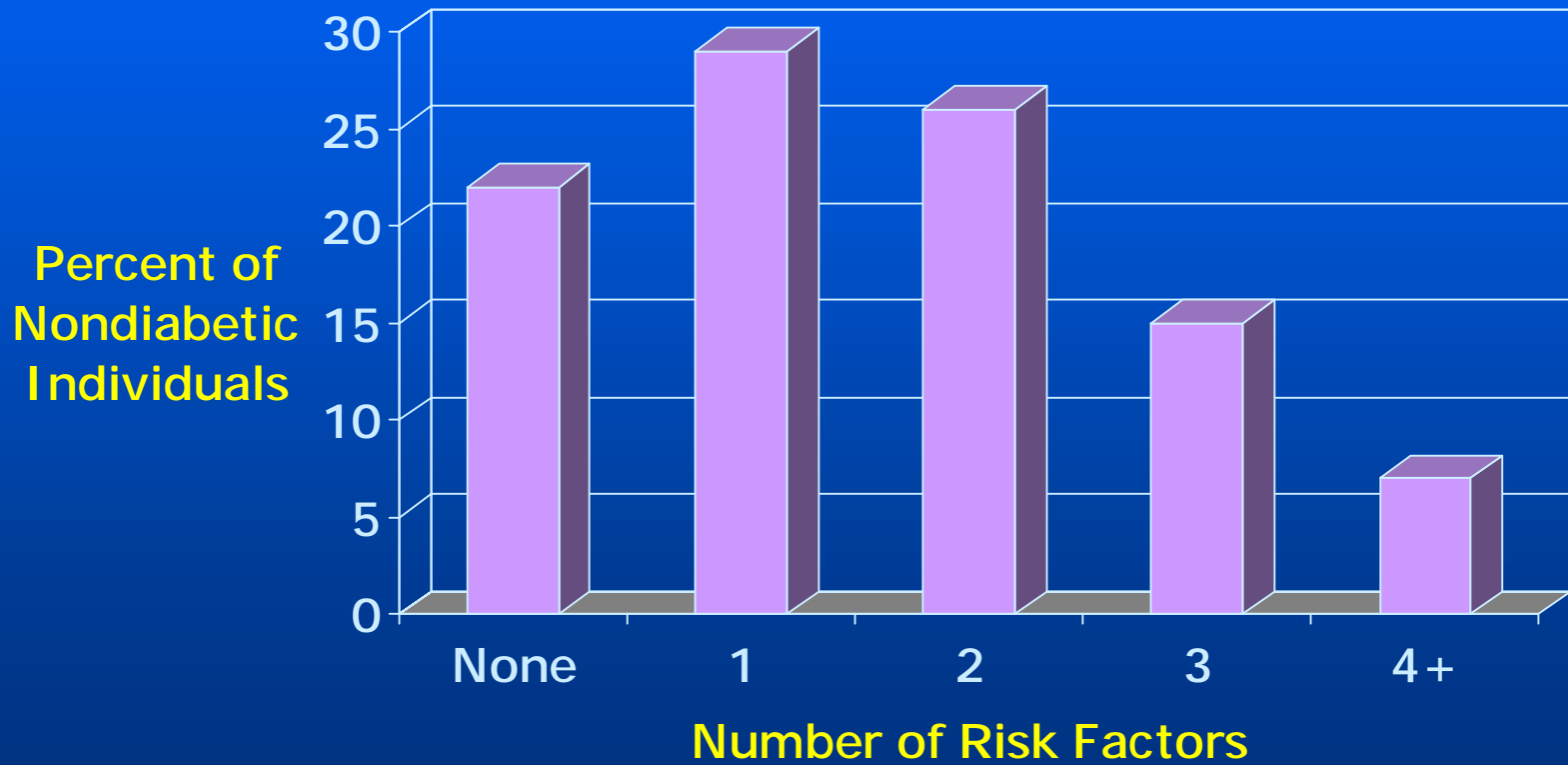
BODY MASS INDEX

HEIGHT	WEIGHT																														
	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250
5'0"	20	21	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
5'1"	19	20	21	22	23	24	25	26	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	43	44	45	46	47
5'2"	18	19	20	21	22	23	24	25	26	27	27	28	29	30	31	32	33	34	35	36	37	37	38	39	40	41	42	43	44	45	46
5'3"	18	19	19	20	21	22	23	24	25	26	27	27	28	29	30	31	32	33	34	35	35	36	37	38	39	40	41	42	43	43	44
5'4"	17	18	19	20	21	21	22	23	24	25	26	27	27	28	29	30	31	32	33	33	34	35	36	37	38	39	39	40	41	42	43
5'5"	17	17	18	19	20	21	22	22	23	24	25	26	27	27	28	29	30	31	32	32	33	34	35	36	37	37	38	39	40	41	42
5'6"	16	17	18	19	19	20	21	22	23	23	24	25	26	27	27	28	29	30	31	31	32	33	34	35	36	36	37	38	39	40	40
5'7"	16	16	17	18	19	20	20	21	22	23	23	24	25	26	27	27	28	29	30	31	31	32	33	34	34	35	36	37	38	38	39
5'8"	15	16	17	17	18	19	20	21	21	22	23	24	24	25	26	27	27	28	29	30	30	31	32	33	33	34	35	36	36	37	38
5'9"	15	16	16	17	18	18	19	20	21	21	22	23	24	24	25	26	27	27	28	29	30	30	31	32	32	33	34	35	35	36	37
5'10"	14	15	16	17	17	18	19	19	20	21	22	22	23	24	24	25	26	27	27	28	29	29	30	31	32	32	33	34	34	35	36
5'11"	14	15	15	16	17	17	18	19	20	20	21	22	22	23	24	24	25	26	26	27	28	29	29	30	31	31	32	33	33	34	35
6'0"	14	14	15	16	16	17	18	18	19	20	20	21	22	23	23	24	24	25	26	26	27	28	29	29	30	31	31	32	33	34	34
6'1"	13	14	15	15	16	16	17	18	18	19	20	20	21	22	22	23	24	24	25	26	26	27	28	28	29	30	30	31	32	32	33
6'2"	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	22	23	24	24	25	26	26	27	28	28	29	30	30	31	31	32
6'3"	12	13	14	14	15	16	16	17	17	18	19	19	20	21	21	22	22	23	24	24	25	26	26	27	27	28	29	29	30	31	31
6'4"	12	13	13	14	15	15	16	16	17	18	18	19	19	20	21	21	22	23	23	24	24	25	26	26	27	27	28	29	29	30	30

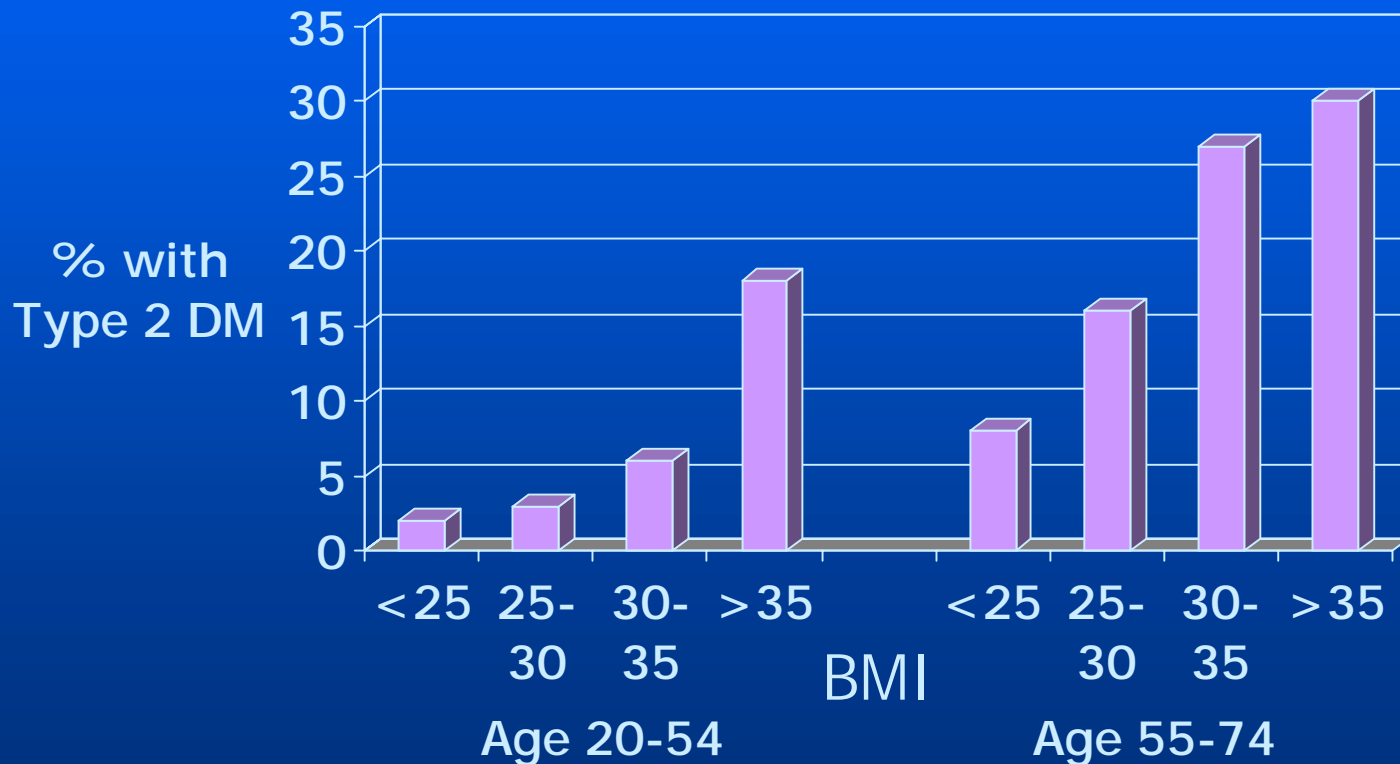
Risk Factors for Type 2 Diabetes

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Risk Factors for Type 2 Diabetes



Prevalence of Type 2 DM by Body Mass Index



Complications of Diabetes

Magnitude of the Problem

- Diabetic retinopathy: most common cause of blindness before age 65
- Nephropathy: most common cause of ESRD
- Neuropathy: most common cause of non-traumatic amputations
- 2-3 fold increase in cardiovascular disease

Microvascular Complications

■ Diabetic retinopathy

- background retinopathy
- macular edema
- proliferative retinopathy

■ Diabetic nephropathy

■ Diabetic neuropathy

- distal symmetrical polyneuropathy
- mononeuropathy (peripheral, cranial nerves)
- autonomic neuropathy

Macrovascular Complications

Complications

- Coronary Heart Disease
- Cerebrovascular Disease
- Peripheral Vascular Disease

Risk Factors

- Dyslipidemia
- Hypertension
- Smoking
- Family history
- Hyperglycemia

Prevention of Diabetic Complications

- Weight reduction
- Exercise
- Control glycemia
- Improve lipid profile
- Smoking cessation
- Treat Hypertension
- Daily salicylate therapy

Rationale for Nutrition Therapy in Type 2 DM

- Obesity and/or central fat distribution contribute to insulin resistance
- Carbohydrate intake is a major influence on blood glucose level, and must be balanced with drug effects
- Hyperlipidemia often present
- Blood glucose and lipid levels influence risk of complications

Nutrition Therapy of Diabetes

SUMMARY:

- Nutrition therapy is essential component
- Consistent timing of meals and consistent carbohydrate intake are most important
- Meal plans must be highly individualized to suit the patient's preferences for schedule and contents, and to achieve blood glucose control
- Referral to RD and multiple visits are almost always needed

Energy Metabolism During Exercise

- Glucose uptake increases up to 20-fold
- Glucose the preferred initial energy source for exercise (first 90-180 min)
- Fatty acids become more important with prolonged exercise
- Exercise accompanied by decreased insulin, increased glucagon secretion

Benefits of Exercise in Normal Subjects

- Reduces risk of developing Type 2 diabetes
 - 500 kcal/wk = 6% risk reduction
 - vigorous weekly exercise = 33% risk reduction
 - exercise program in subjects with IGT reduced risk by 63% over 5 years

Acute Effects and Benefits of Exercise

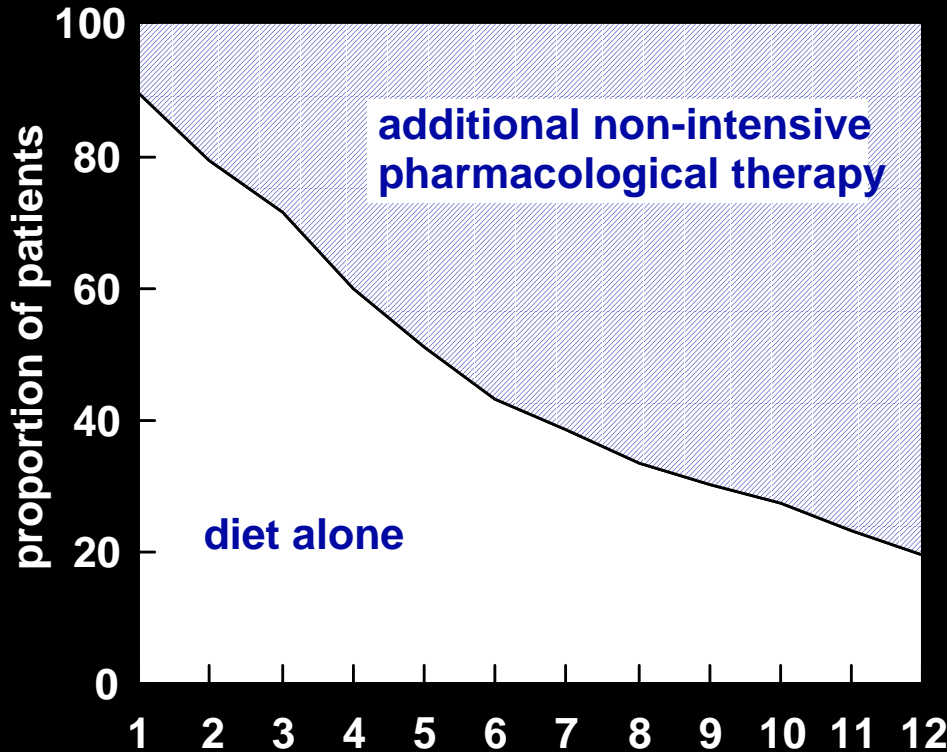
- In patients with diabetes, exercise lowers glucose because insulin does not decrease.
- Increases insulin sensitivity.
- Increases glucose storage as glycogen.
- Improved insulin sensitivity: apparent quickly, but fades within 2-3 days after exercise.

Chronic Effects and Benefits of Exercise in Diabetes

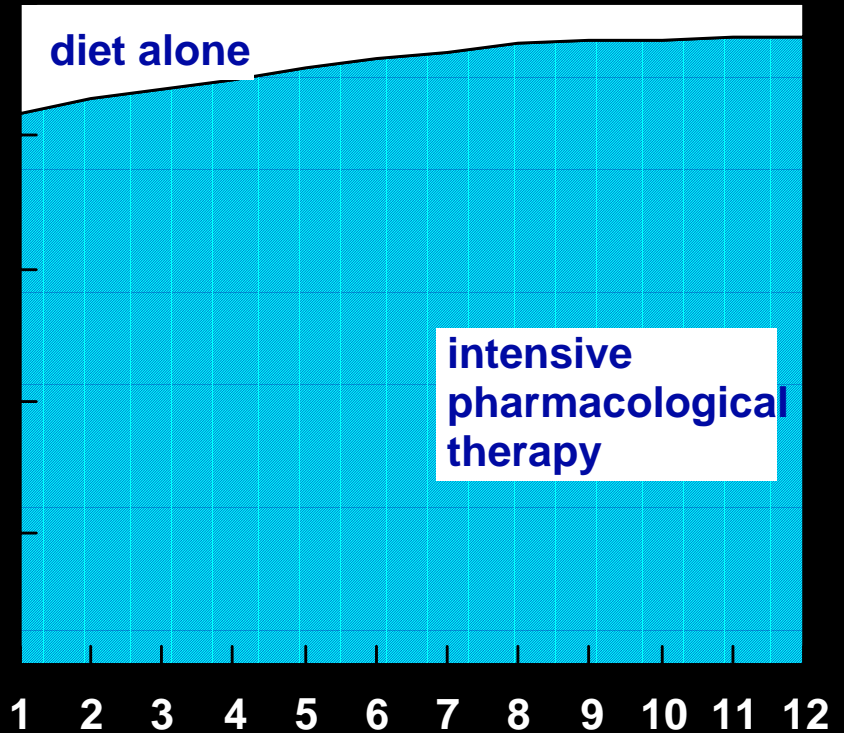
- Improves glucose control (HbA1c drops 15%)
- Improves lipids (TG and HDL-C)
- Improves fitness
- Facilitates weight control by increasing energy expenditure and lean body mass
- Lowers blood pressure

Actual Therapy

Conventional Policy
accept < 15 mmol/L



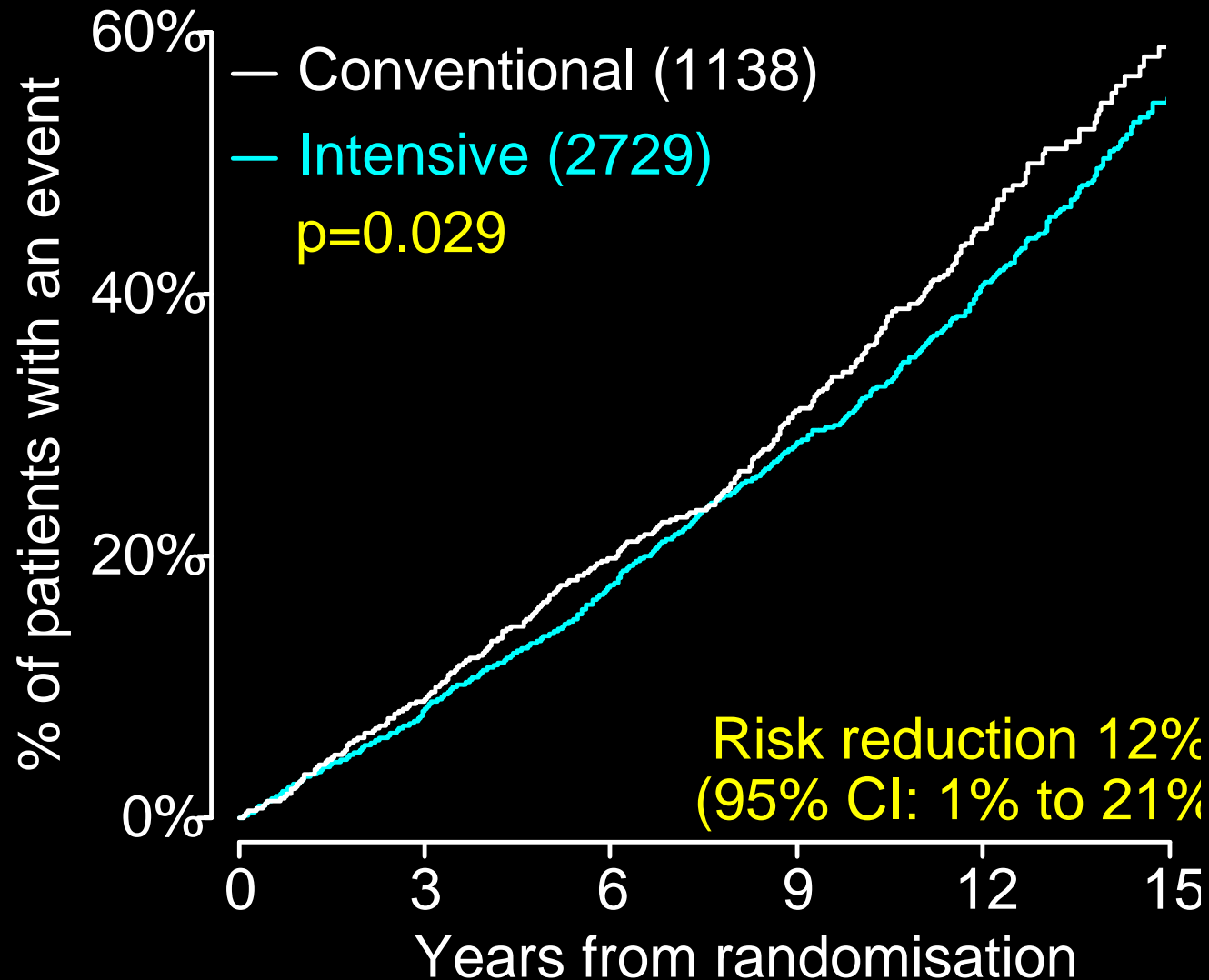
Intensive Policy
aim for < 6 mmol/L



Years from randomisation

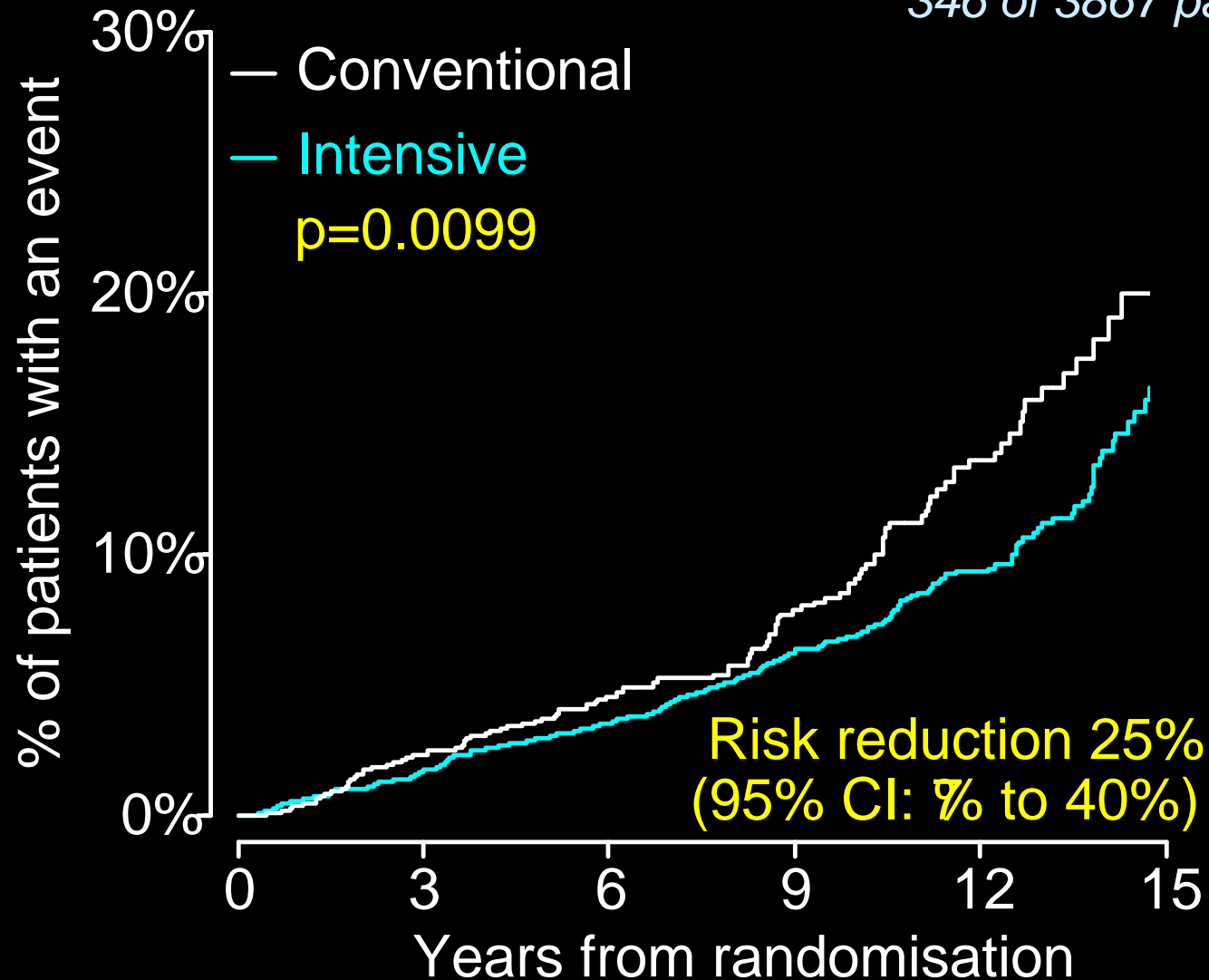
Any Diabetes Related Endpoint (cumulative)

1401 of 3867 patients (36%)



Microvascular Endpoints (cumulative)

renal failure or death, vitreous haemorrhage or photocoagulation
346 of 3867 patients (9%)



Pathophysiology-based Therapy for Type 2 Diabetes

■ Defect in insulin sensitivity

- exercise
- weight reduction
- thiazolidinediones
- metformin

■ Defect in insulin secretion

- sulfonylureas (mild defect)
- insulin (severe defect)

Pathophysiology-based Therapy for Type 2 Diabetes

- Increased hepatic glucose output
 - metformin > thiazolidinediones
 - insulin (sulfonylurea)
- Carbohydrate absorption (post-prandial hyperglycemia)
 - acarbose

Prevention of Diabetic Complications

- Optimize glycemic control
- Control hypertension < 135/85 mm Hg
- Screen at diagnosis, then annually for microalbuminuria
- Use angiotensin converting-enzyme inhibitor when microalbuminuria is reproducible

Prevention of Diabetic Complications

- Ophthalmoscopic exam of the eye every 3-6 months with a formal exam annually
- Determine the fasting lipid profile each year and treat to LDL <100
- Prescribe 325 mg aspirin to be taken daily