Swedish National Diabetes Register

Annual Report 2012

Annual Report 2012: Results

Swedish National Diabetes Register (NDR) – Centre of Registers, Region Västra Götaland
www.ndr.nu

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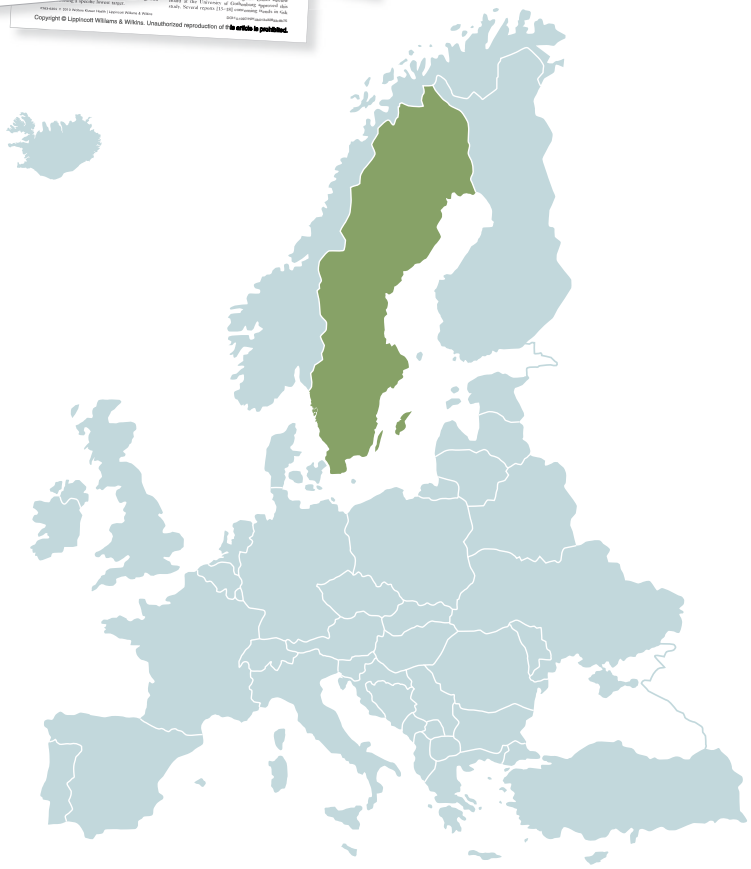


The Swedish National Diabetes Register (NDR) serves as a useful tool for providers of everyday care

Chronic diseases place a heavy burden not only on patients and their families, but on healthcare systems around the world. Such pressure on the infrastructure and organisation of the systems often leads to poor management of chronic conditions. The resulting complications reduce quality of life and dramatically increase healthcare costs. The personal and social repercussions are enormous. Diabetes management has a number of dimensions, each of which is multifaceted in itself. Thus, patients should receive advice from a wide range of skilled professionals who are working together. A diabetes centre is an important resource that permits a multidisciplinary team to communicate effectively while providing consistent, reliable counselling. In addition, an individual care plan should be set up on the basis of the patient's particular needs and circumstances.

A clinical, practice-based population register can be used to support structural care and identify patients who may not be complying with their medication regimen, exposing them to risk of inadequate diabetes control.

The NDR was launched in 1996 for the purpose of promoting evidence-based development of diabetes care by offering up-to-date information about changes in the treatment of glycaemia and other risk factors, as well as diabetic complications. Another aim is to support improvement in the quality of care provided by participating units at hospitals and primary care clinics. The overall objective is to reduce morbidity and mortality, as well as to maximise the cost-effectiveness of diabetes care. The NDR is maintained by the Swedish Society for Diabetology on behalf, and with the financial support, of the Swedish National Board of Health and Welfare and the Swedish Association of Local Authorities and Regions. The Swedish Diabetes Association, a patient advocacy group, actively uses the NDR as well.

The NDR has been online since April 2002 (www.ndr.nu), allowing individual clinics to quickly monitor their activities on a regular basis by virtue of immediate access to their own results, as well as national statistics for purposes of comparison.

The NDR, which has been an integral part of Swedish diabetes care for the past 17 years, has engaged the participation of both hospitals and primary care clinics. The register offers a unique opportunity to monitor the quality of care in terms of risk factors and the potential complications of diabetes, as well as the evolution of treatment methods. The results generated by the register have been presented at many international meetings and conferences. To our knowledge, the NDR is the largest diabetes register in the world.

Because the course of diabetes is complex and lifelong, both clinical practice and quality control of treatment measures must reflect systematic adherence to various guidelines. The NDR is an instrument to facilitate such monitoring and to disseminate findings in an accessible, transparent, comparable and timely manner. The register is both a repository of results and an educational tool for improving local quality assessment efforts. The register enables a focus on national quality indicators while following various process measures that are important at the local level. Diabetes care is largely self-managed these days. The NDR also promotes and facilitates the influence and participation of patients in their care and treatment. For example, patients can actively monitor data about their interactions with healthcare providers.

Improved diabetes care minimises risk factors and the incidence of complications. The result is less human suffering and greater social cost benefits. The findings of the proposed projects may prove highly useful during an implementation process that involves continuous monitoring of the performance of an individual diabetes care unit.

The NDR has established itself as a well-functioning tool to promote improvement efforts in the field of diabetes care. Documented evidence suggests that use of the register leads to better long-term outcomes. The critical factors for success are the emergence of healthcare systems in which measuring results is integral to the overall process, as well as training the entire team to participate in the improvement effort. Another factor that is crucial to the effectiveness of the project is the commitment of providers to measuring results, collecting data and discussing what they have learned.

The NDR is used extensively throughout the country. Opportunities abound for disseminating its information and findings, as well as measuring outcomes. NDR-IQ and other ongoing projects ensure the promulgation of new working methods, along with evidence-based approaches to ensuring progress and improvement.

Participating units and national coverage

Figure 1. Number of patients entered in NDR, 1996–2012

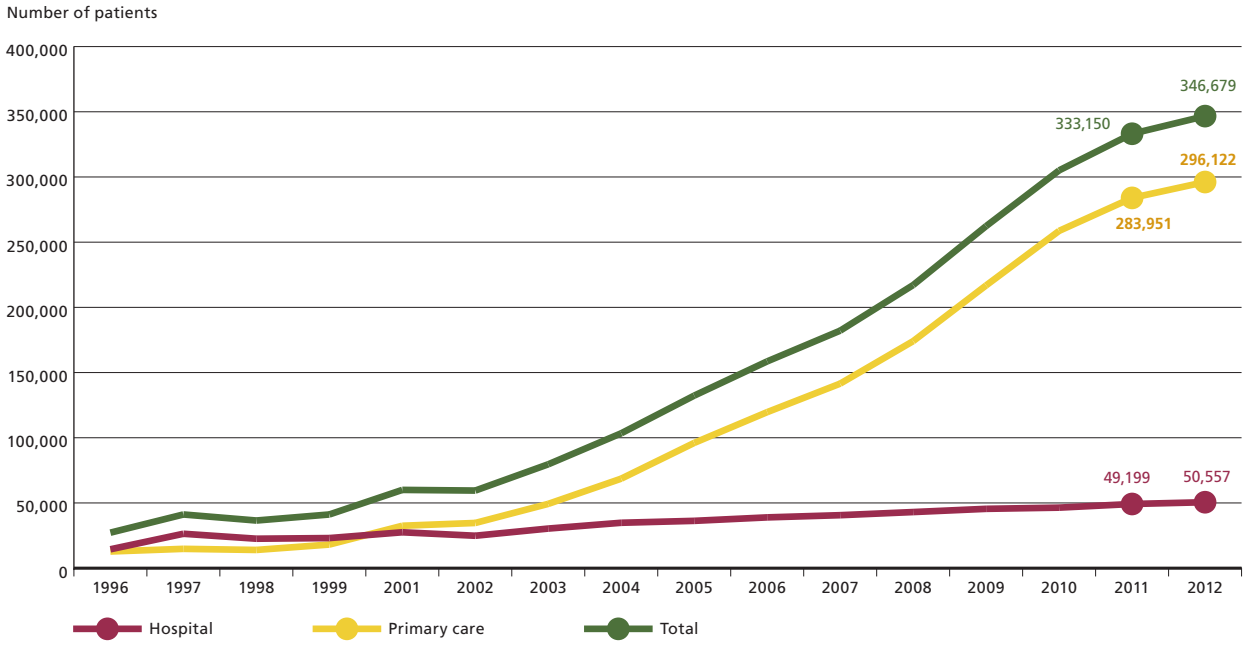
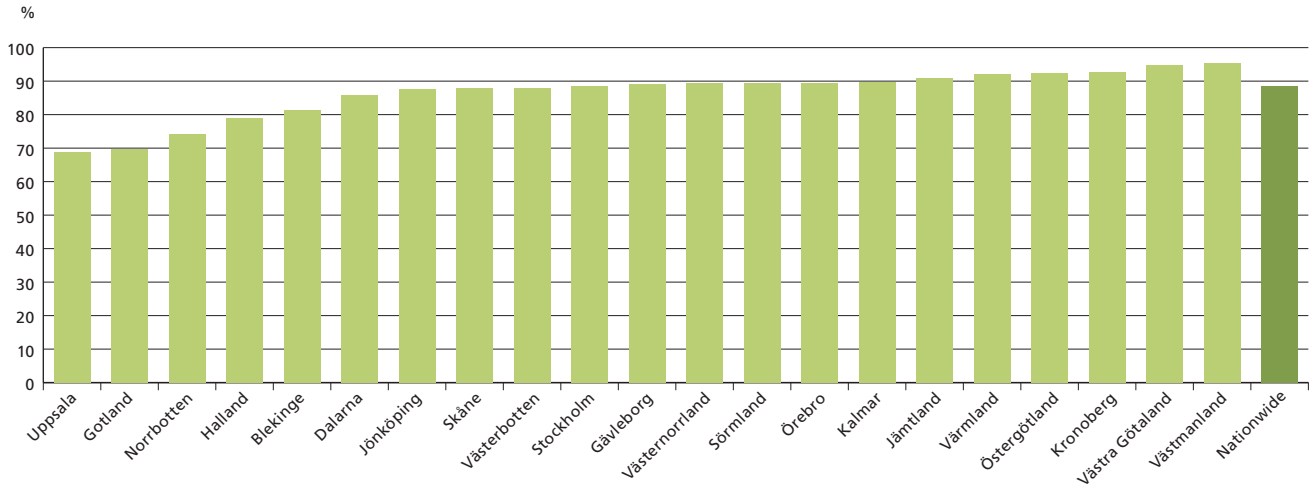


Figure 2. Comparison between the NDR and the Prescribed Drug Register. People age 50–80 entered in the Prescribed Drug Register on 1 January–31 December 2011 and in the NDR in 2010–2012. Matching based on unique Swedish personal identity numbers.



Results: 2008–2012

- Patients with type 1 diabetes at hospital
- Patients with type 2 diabetes at hospital
- All patients with diabetes in primary care

Table 1. Patients with type 1 diabetes at hospital: number, mean age, duration, men

	2008	2009	2010	2011	2012
Number	29,197	30,624	31,257	33,346	34,856
Mean age (SD)	45.9 (15.5)	46.0 (15.8)	45.9 (16)	45.7 (16.3)	45.8 (16.5)
Mean duration, years (SD)	23.0 (14.5)	23.0 (14.7)	23.1 (14.8)	23.2 (14.9)	23.3 (15.0)
Men (%)	16,235 (55.6)	17,040 (55.6)	17,422 (55.7)	18,788 (56.3)	19,549 (56.1)

Table 2. Patients with type 2 diabetes at hospital: number, mean age, duration, men

	2008	2009	2010	2011	2012
Number	12,336	12,737	12,136	12,010	10,889
Mean age (SD)	62.3 (12.6)	62.4 (12.6)	62.5 (12.6)	62.5 (12.7)	62.7 (12.6)
Mean duration, years (SD)	13.9 (9.6)	14.0 (9.7)	14.2 (9.7)	14.5 (9.8)	15.3 (9.9)
Men (%)	7,869 (63.8)	8,176 (64.2)	7,851 (64.7)	7,690 (64)	7,025 (64.5)

Table 3. Patients with diabetes in primary care: number, mean age, duration, men

	2008	2009	2010	2011	2012
Number	180,992	219,459	259,484	279,956	285,329
Mean age (SD)	67.8 (11.8)	67.8 (11.9)	67.9 (12.1)	68.0 (12.0)	68.2 (12.0)
Mean duration, years (SD)	8.6 (7.8)	8.7 (7.8)	8.8 (7.9)	8.9 (8.0)	9.2 (8.0)
Men (%)	99,852 (55.2)	121,568 (55.4)	143,909 (55.5)	156,266 (55.8)	160,389 (56.2)

Figure 3. Histogram by age. Patients with type 1 diabetes at hospital, 2012

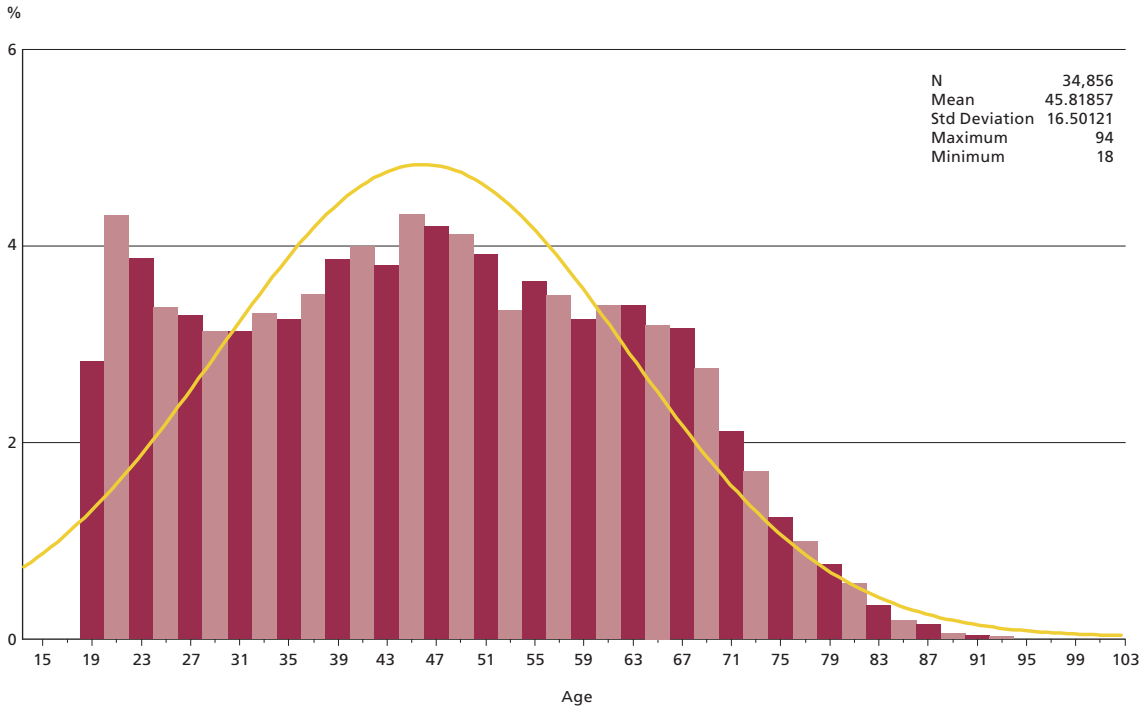


Figure 4. Histogram by age. Patients with type 2 diabetes at hospital, 2012

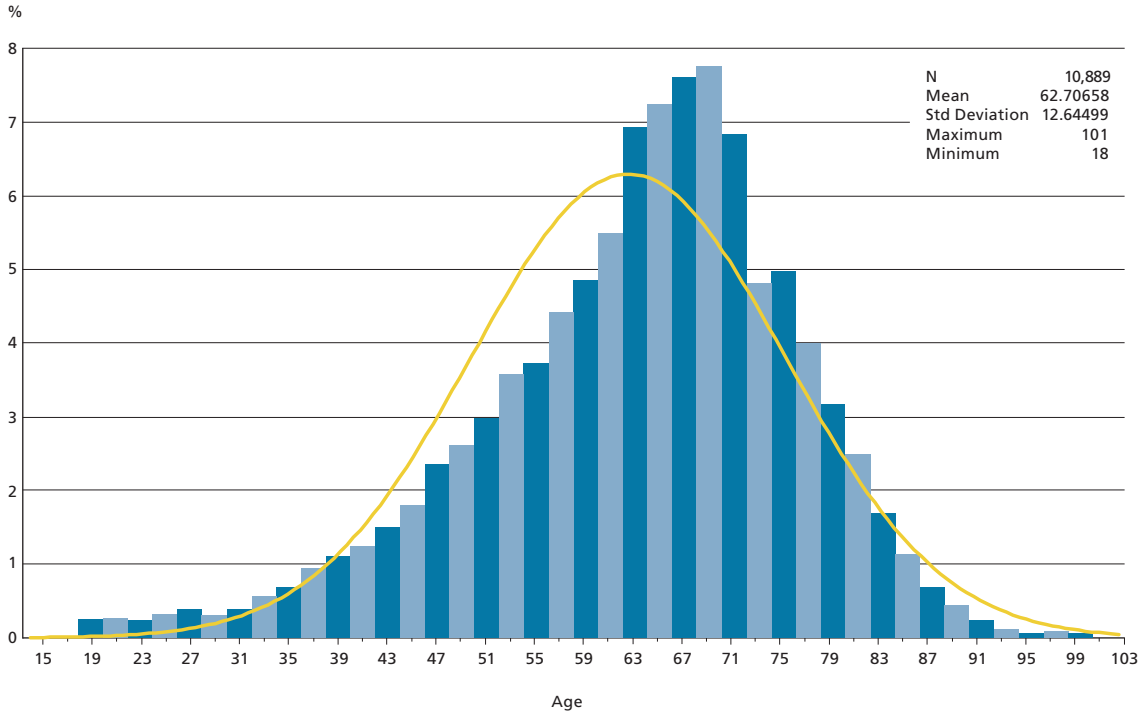
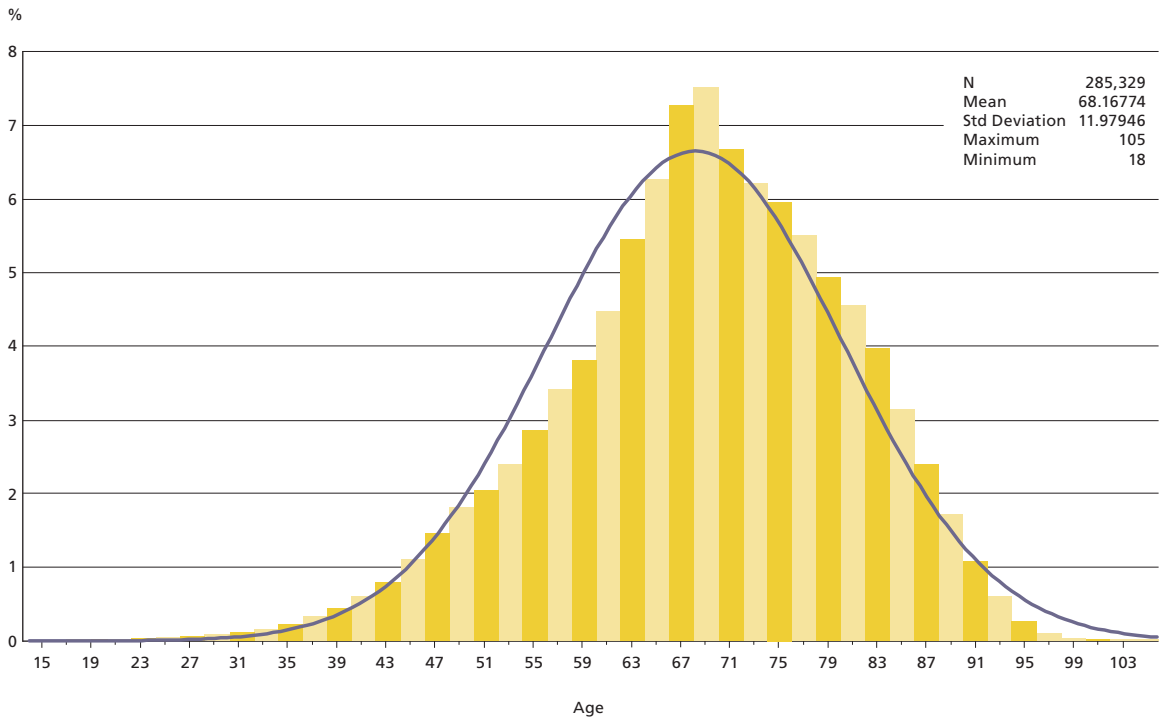


Figure 5. Histogram by age. Patients with diabetes in primary care, 2012



Lifestyle factors

Figure 6. Mean BMI:
Women at hospital and in primary care

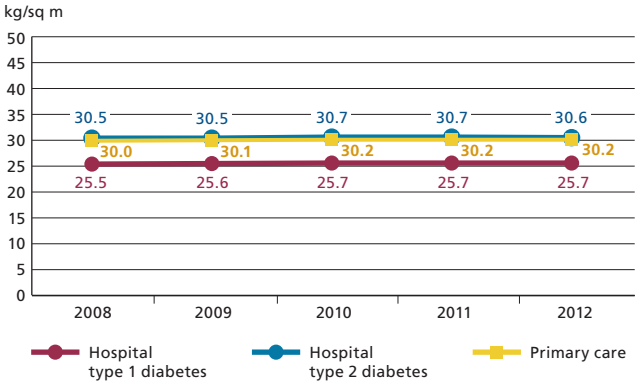


Figure 7. Mean BMI:
Men at hospital and in primary care

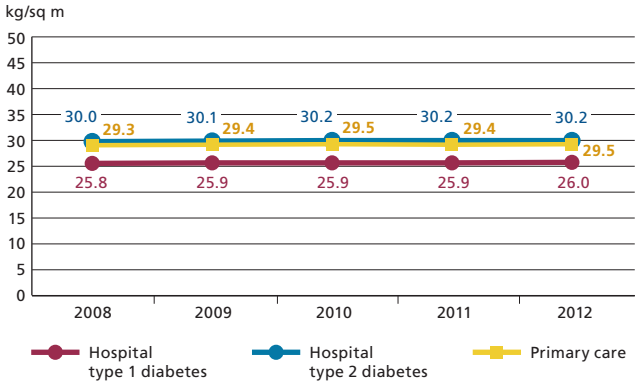


Figure 8. BMI < 25 kg/sq m:
Women at hospital and in primary care

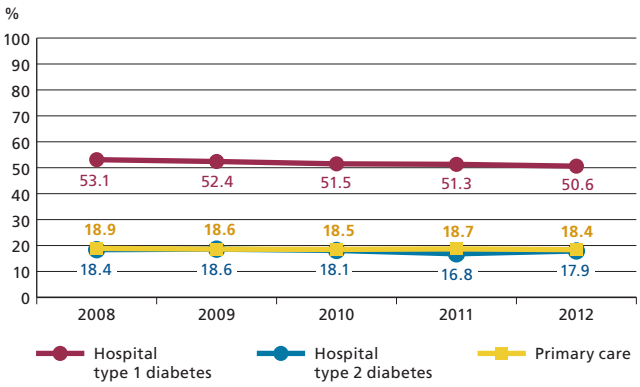


Figure 9. BMI < 25 kg/sq m:
Men at hospital and in primary care

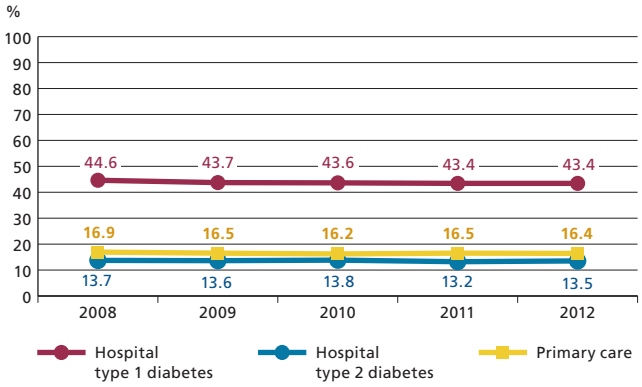


Figure 10. BMI by intervals:
Diabetes patients at hospital and in primary care

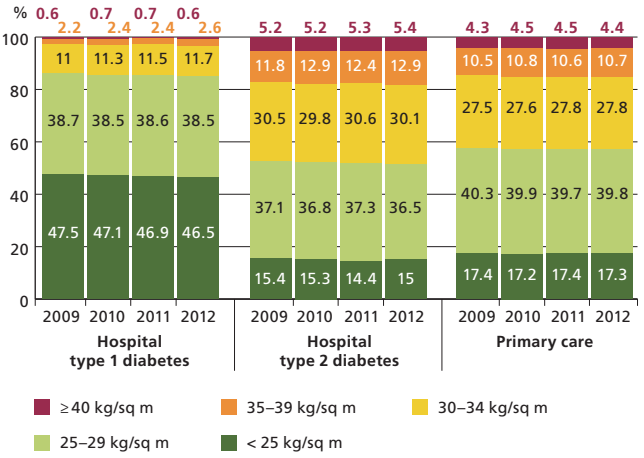


Figure 11. Mean waist circumference:
Women at hospital and in primary care

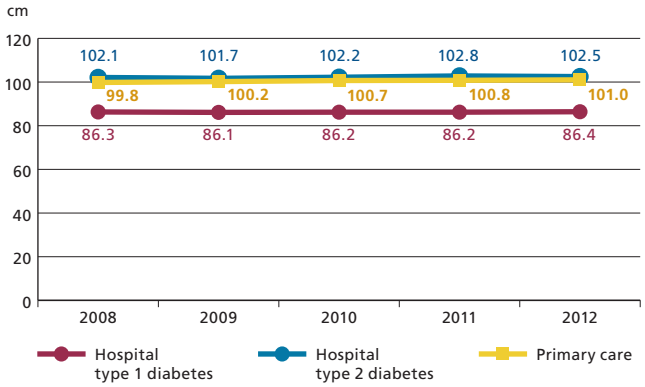


Figure 12. Mean waist circumference: Men at hospital and in primary care

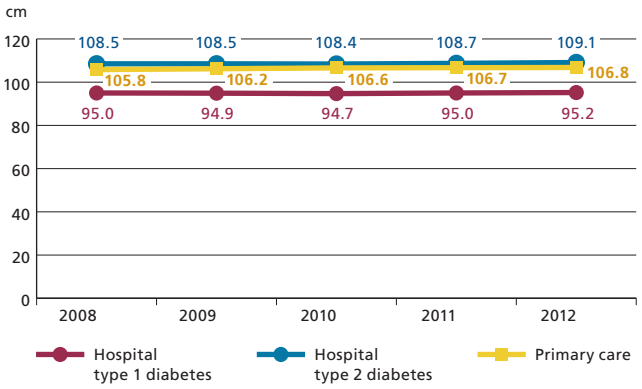


Figure 15. Type 1 diabetes patients at hospital who smoke

Figure 13. Physical leisure activities: Patients at hospital and in primary care

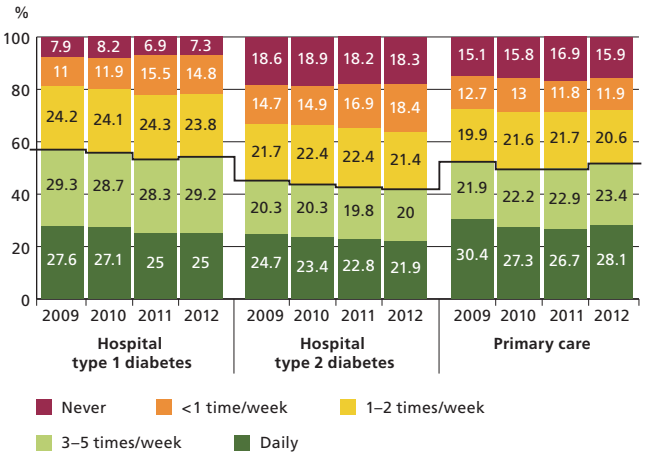


Figure 14. Women and men in primary care < age 60 and ≥ age 60 who smoke

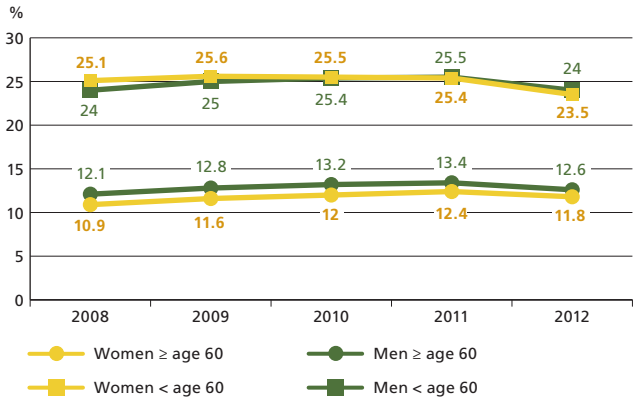
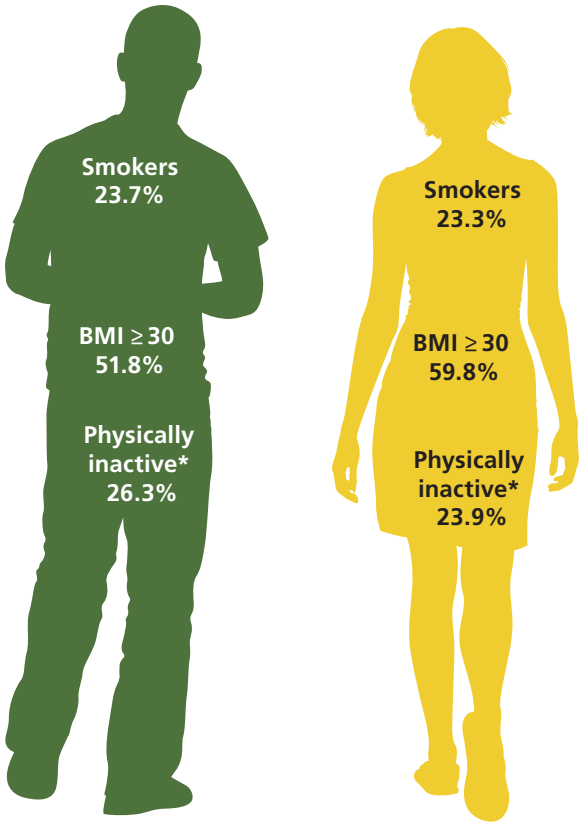


Figure 16. Smokers, BMI ≥ 30 kg/sq m and physically inactive patients age 30–60 in primary care 2012



Men: 42,298

Women: 27,165

* Physical leisure activity ≤ 1 time/week

HbA1c

Table 4. Hba1c intervals. All patients with type 1 diabetes and all patients with type 2 diabetes, 2012

HbA1c intervals (mmol/mol)						
	≤ 42	43–51	52–61	62–72	≥ 73	All
Type 1 diabetes						
Number (%)	1,480 (3.4)	5,488 (12.6)	12,213 (28.1)	12,896 (29.7)	11,316 (26.1)	43,393 (100)
Type 2 diabetes						
Number (%)	39,020 (14.2)	95,323 (34.7)	74,797 (27.3)	36,621 (13.4)	28,550 (10.4)	274,311 (100)

Figure 17. Mean for HbA1c (mmol/mol)

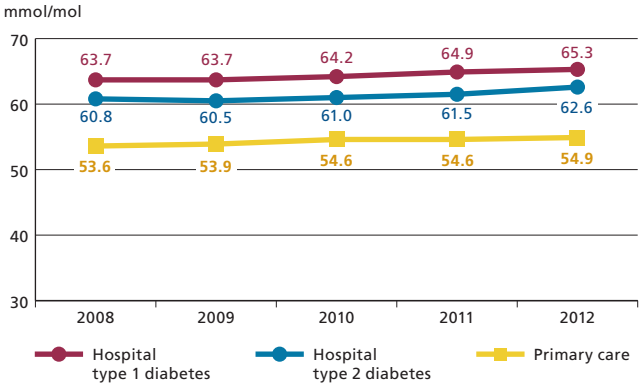


Figure 18. Mean for HbA1c (mmol/mol). Women

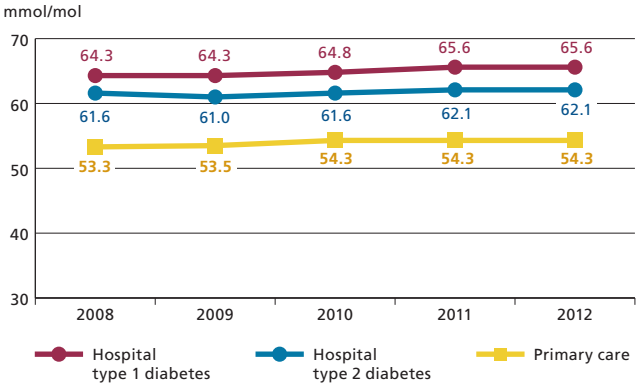


Figure 19. Mean for HbA1c (mmol/mol). Men

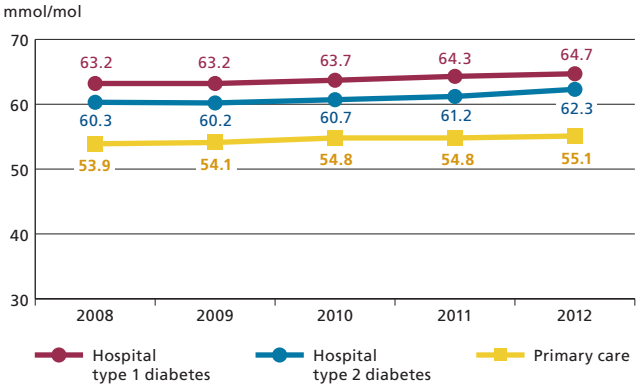


Figure 20. Mean for HbA1c (mmol/mol) among patients < age 70 and diabetes duration ≤ 3 years

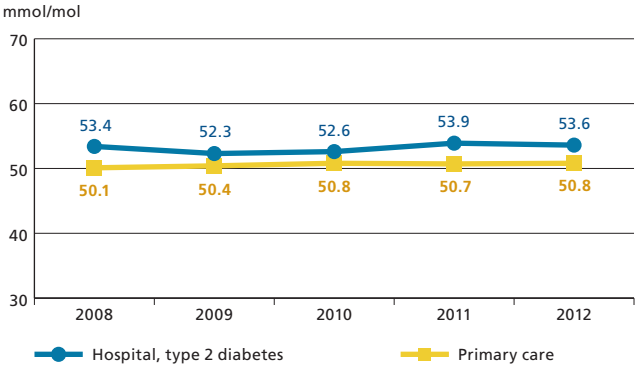


Figure 21. HbA1c < 52 (mmol/mol). Patients at hospital and in primary care

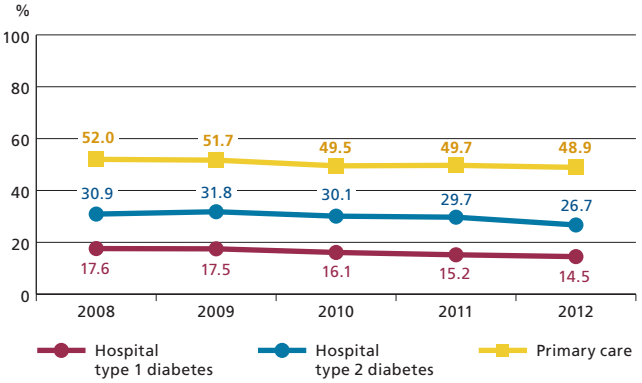


Figure 22. HbA1c > 73 (mmol/mol). Patients at hospital and in primary care

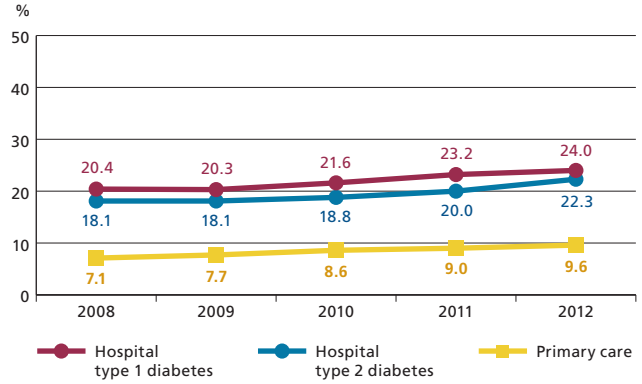


Figure 23. HbA1c < 52 (mmol/mol) in various types of hypoglycaemia treatment. Type 2 diabetes at hospital

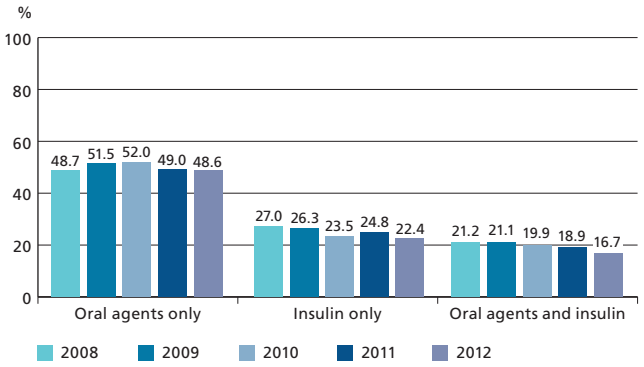


Figure 24. HbA1c < 52 (mmol/mol) in various types of hypoglycaemia treatment. Primary care

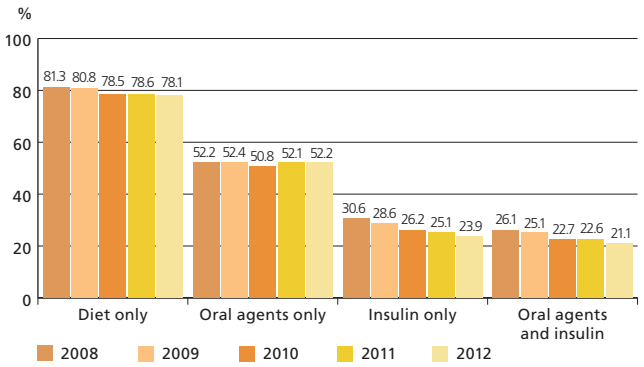


Figure 25. HbA1c < 52 (mmol/mol) among patients who had one HbA1c level in 2008–2012

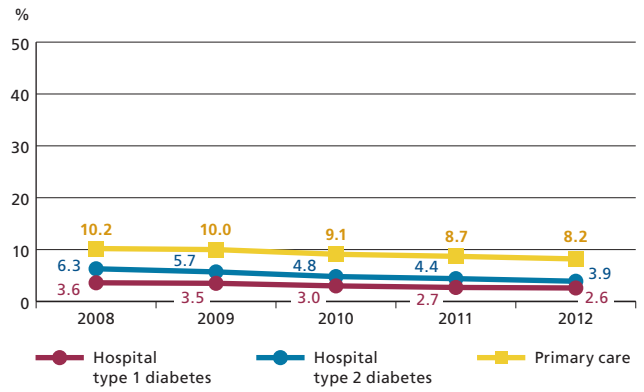


Figure 26. HbA1c < 52 (mmmol/mol) among patients < age 70 and diabetes duration ≤ 3 years

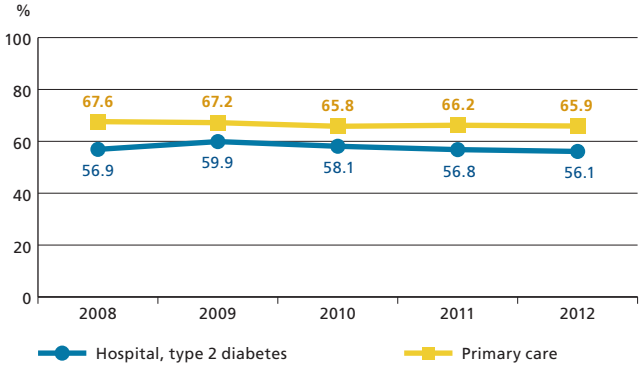
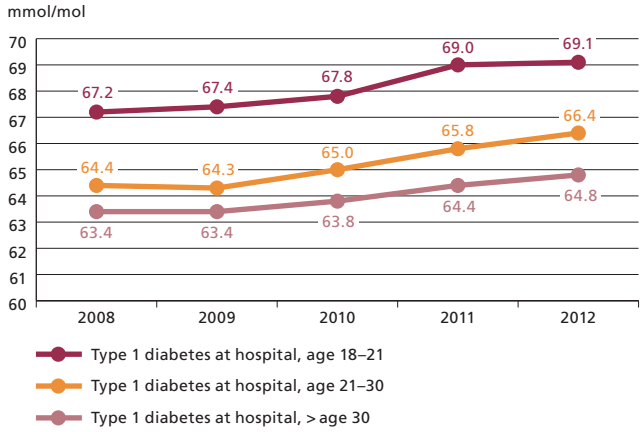


Figure 27. Mean for HbA1c (mmol/mol) among patients in various age groups with type 1 diabetes at hospital



Tables 5a–c. HbA1c > 73 mmol/mol

Table 5a. Patients with HbA1c > 73 (mmol/mol). Type 1 diabetes at hospital

	2008	2009	2010	2011	2012
Number	5,835	6,088	6,587	7,586	8,211
Mean age (SD)	43.8 (15.2)	44.2 (15.5)	44.0 (15.9)	43.6 (16.1)	43.9 (16.5)
Number (BMI)	5,314	5,526	6,043	6,796	7,395
Mean BMI, kg/sq m (SD)	26.2 (4.6)	26.2 (4.7)	26.2 (4.7)	26.2 (4.7)	26.3 (4.7)
Number (HbA1c)	5,835	6,088	6,587	7,586	8,211
Mean HbA1c, mmol/mol (SD)	84.0 (10.9)	83.6 (10.3)	83.5 (10.1)	83.8 (10.0)	84.1 (10.5)
Number (systolic blood pressure mm Hg) (SD)	5,635	5,814	6,318	7,220	7,793
Mean systolic blood pressure	128.0 (15.8)	127.6 (15.9)	127.1 (15.7)	126.7 (15.3)	126.6 (15.4)
Number (LDL)	4,532	4,712	5,071	5,849	6,411
Mean LDL, mmol/l (SD)	2.7 (0.8)	2.8 (0.9)	2.8 (0.9)	2.7 (0.9)	2.7 (0.9)
Number of smokers (%)	1,031 (18.9)	1,066 (19.1)	1,193 (19.5)	1,336 (19.3)	1,456 (19.0)
Number of physically inactive patients (%)	1,160 (27.8)	1,250 (27.0)	1,535 (29.3)	1,899 (30.4)	2,063 (30.0)

Table 5b. Patients with HbA1c > 73 (mmol/mol). Type 2 diabetes at hospital

	2008	2009	2010	2011	2012
Number	2,183	2,248	2,193	2,343	2,380
Mean age (SD)	59.6 (12.4)	59.4 (12.6)	60.2 (12.6)	60.2 (12.8)	60.8 (12.5)
Number (BMI)	1,957	2,001	1,978	2,075	2,127
Mean BMI, kg/sq m (SD)	31.7 (5.8)	31.9 (5.9)	31.7 (6.0)	31.5 (5.8)	31.5 (5.7)
Number (HbA1c)	2,183	2,248	2,193	2,343	2,380
Mean HbA1c, mmol/mol (SD)	86.2 (12.0)	85.8 (11.5)	85.5 (11.0)	86.2 (11.6)	86.0 (11.4)
Number (systolic blood pressure mm Hg) (SD)	2,082	2,120	2,086	2,192	2,273
Mean systolic blood pressure	135.9 (17.1)	135.1 (17.6)	134.1 (16.6)	133.7 (16.6)	133.7 (17.1)
Number (LDL)	1,696	1,714	1,698	1,780	1,873
Mean LDL, mmol/l (SD)	2.5 (0.9)	2.5 (0.9)	2.5 (1.0)	2.5 (1.0)	2.4 (1.0)
Number of smokers (%)	304 (15.0)	333 (16.3)	312 (15.7)	342 (16.5)	354 (16.2)
Number of physically inactive patients (%)	676 (41.5)	763 (43.9)	783 (45.4)	838 (44.2)	923 (46.6)

Table 5c. Patients with HbA1c > 73 (mmol/mol). Primary care

	2008	2009	2010	2011	2012
Number	12,355	16,065	21,141	23,954	26,259
Mean age (SD)	64.1 (12.8)	64.3 (13.1)	64.8 (13.4)	65.0 (13.3)	65.5 (13.3)
Number (BMI)	10,531	13,393	17,557	20,619	22,861
Mean BMI, kg/sq m (SD)	31.1 (5.9)	31.2 (5.9)	31.2 (6.0)	31.1 (5.9)	31.1 (5.8)
Number (HbA1c)	12,355	16,065	21,141	23,954	26,259
Mean HbA1c, mmol/mol (SD)	85.1 (11.8)	85.3 (11.6)	85.6 (11.8)	85.9 (11.7)	86.0 (11.9)
Number (systolic blood pressure mm Hg) (SD)	11,561	14,927	19,589	22,228	24,535
Mean systolic blood pressure	138.4 (17.8)	137.5 (17.6)	137.1 (17.5)	136.6 (17.2)	136.1 (16.9)
Number (LDL)	7,414	9,638	13,192	15,630	17,002
Mean LDL, mmol/l (SD)	2.8 (1.0)	2.8 (1.0)	2.8 (1.0)	2.8 (1.0)	2.7 (1.0)
Number of smokers (%)	1,959 (19.3)	2,573 (20.2)	3,320 (19.6)	3,895 (20.2)	3,771 (18.5)
Number of physically inactive patients (%)	3,188 (38.2)	4,573 (41.4)	5,946 (41.8)	6,855 (41.3)	7,334 (40.7)

Figure 28a. Histogram for HbA1c (mmol/mol). All patients with type 1 diabetes, 2012

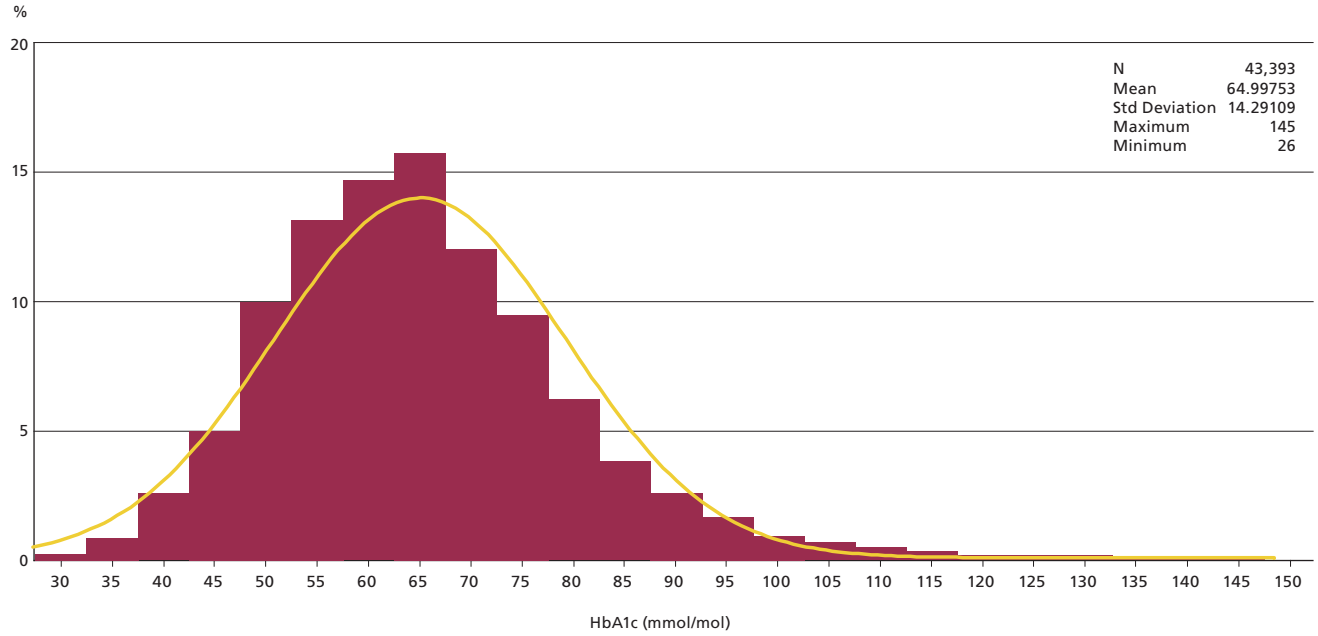


Figure 28b. Histogram for HbA1c (mmol/mol). All patients with type 1 diabetes, 2011

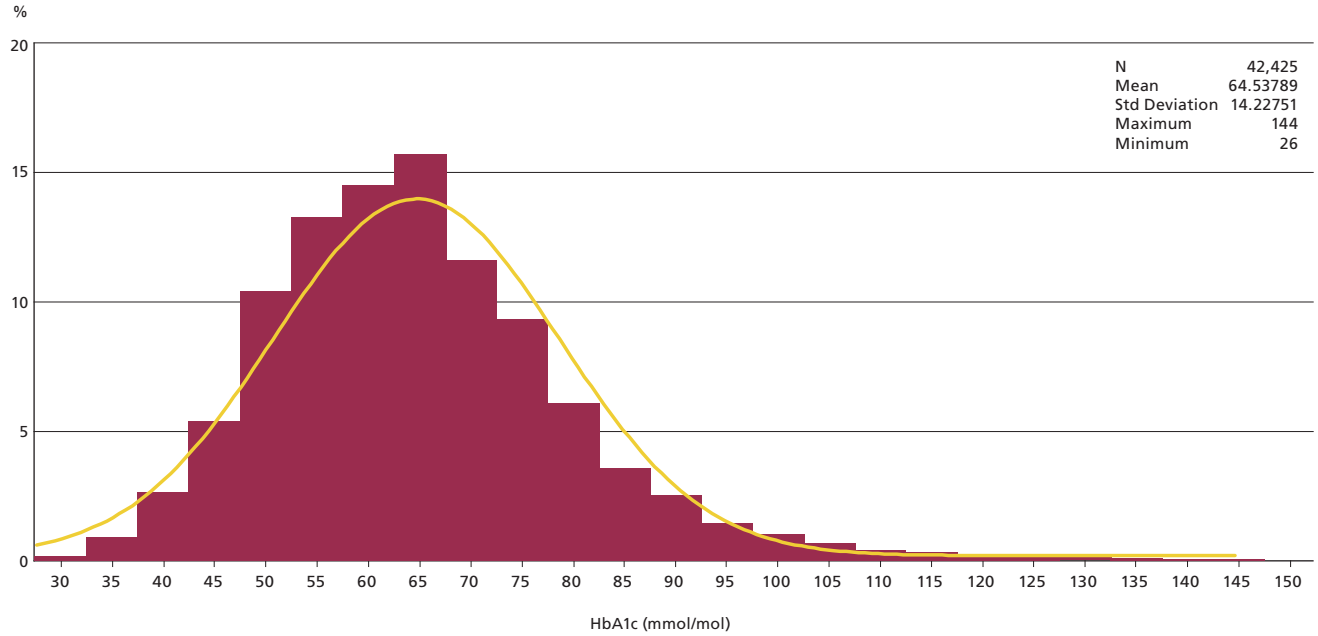


Figure 29a. Histogram for HbA1c (mmol/mol). All patients with type 2 diabetes, 2012

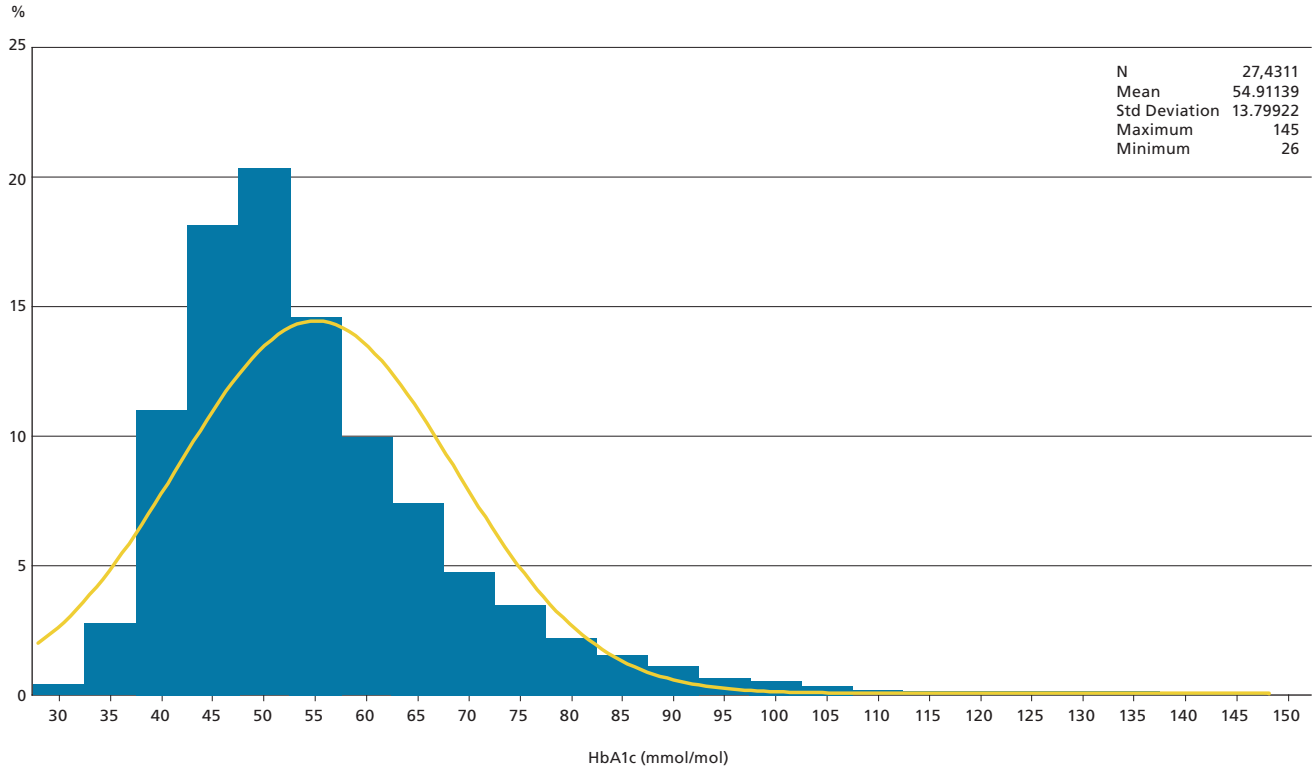
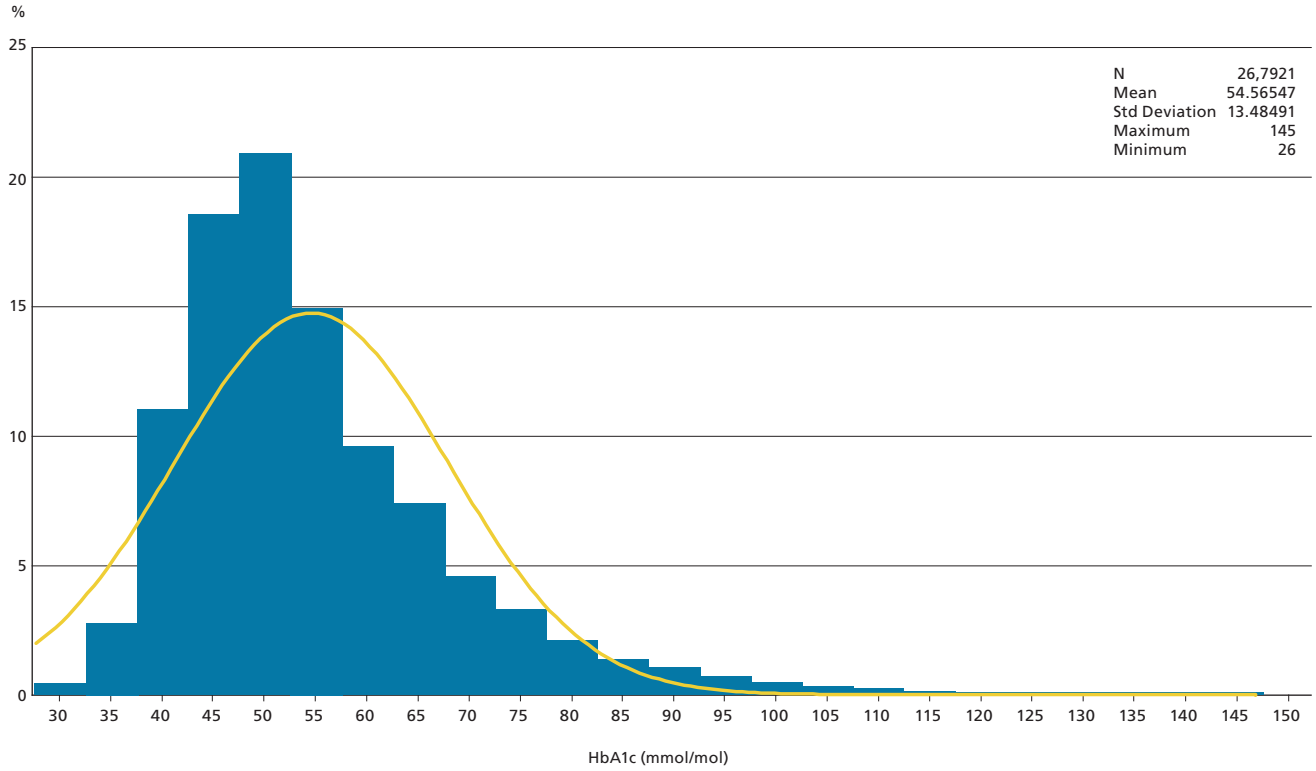


Figure 29b. Histogram for HbA1c (mmol/mol). All patients with type 2 diabetes, 2011



Diabetes treatment

Figure 30. Hypoglycaemia treatment among patients with type 2 diabetes at hospital

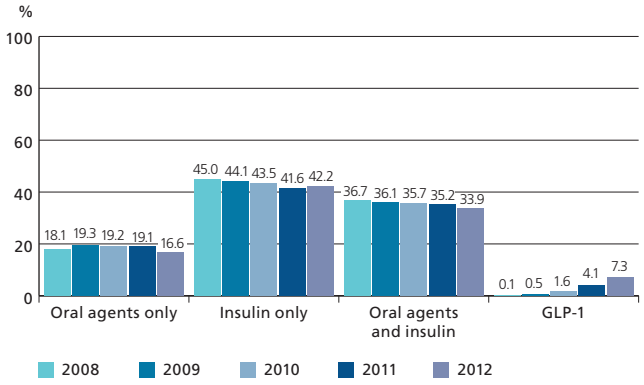


Figure 31. Various types of hypoglycaemia treatment. Primary care

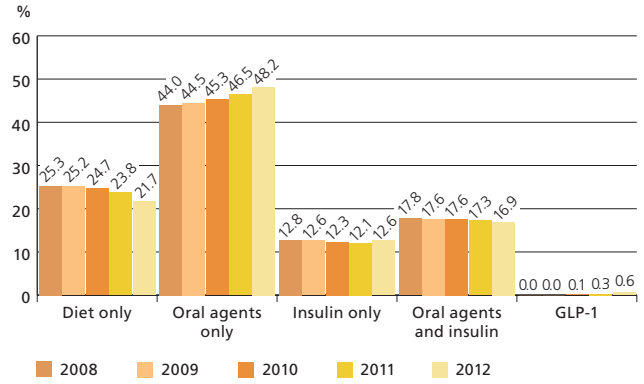


Figure 32. Hypoglycaemia treatment among patients < age 70 and diabetes duration ≤ 3 years. Primary care

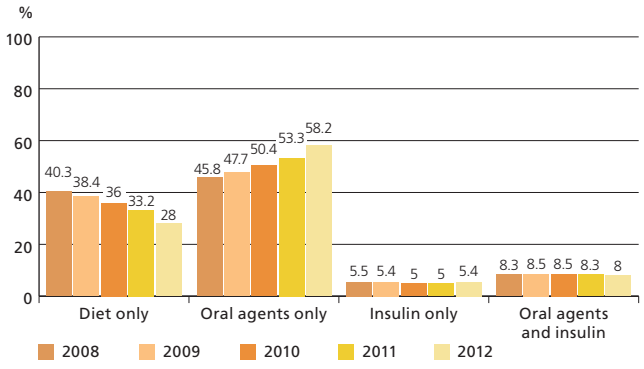


Figure 33. Various types of hypoglycaemia treatment by intervals of diabetes duration. Primary care, 2012

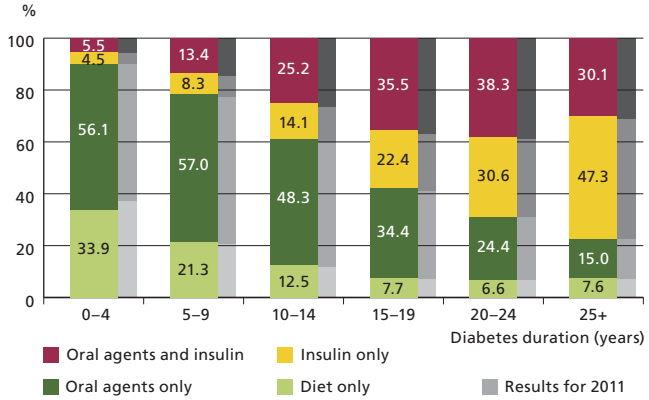


Figure 34. Hypoglycaemia treatment among patients with HbA1c >73 (mmol/mol). Type 2 diabetes at hospital

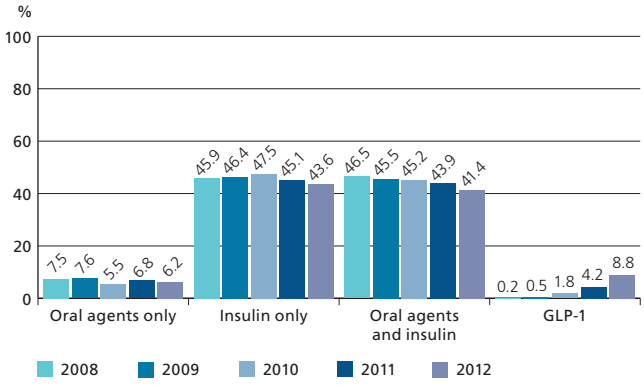


Figure 35. Hypoglycaemia treatment among patients with HbA1c >73 (mmol/mol). Primary care

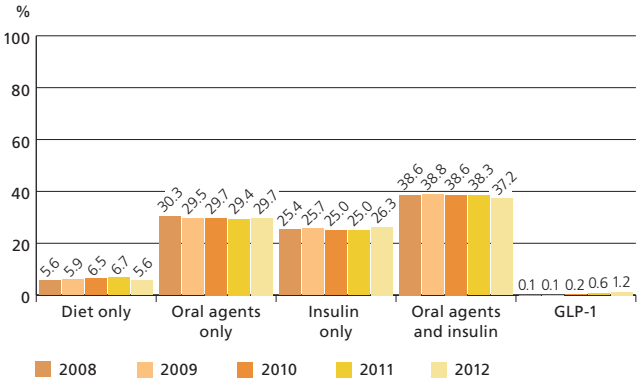
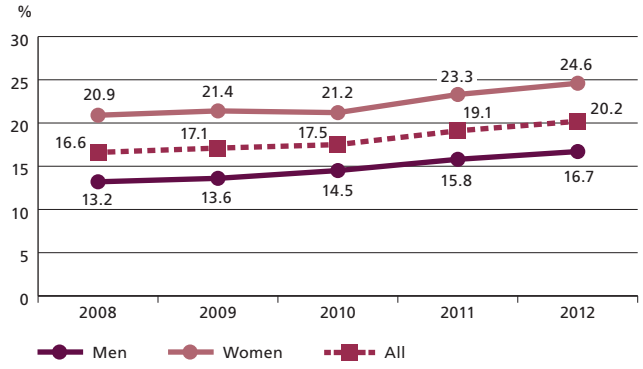


Figure 36. Insulin pump among patients with type 1 diabetes at hospital



Blood pressure

Table 6. Systolic blood pressure intervals.
All patients with type 1 diabetes and all patients with type 2 diabetes, 2012

Intervals of systolic blood pressure (mm Hg)						
	< 110	110–119	120–129	130–139	≥ 140	All
Type 1 diabetes						
Number (%)	3,038 (7.2)	6,984 (16.5)	12,855 (30.3)	9,800 (23.1)	9,765 (23.0)	42,442 (100)
Type 2 diabetes						
Number (%)	6,822 (2.5)	20,586 (7.7)	58,799 (21.9)	74,287 (27.7)	108,151 (40.3)	268,645 (100)

Figure 37. Mean blood pressure (mm Hg).
Patients at hospital and in primary care

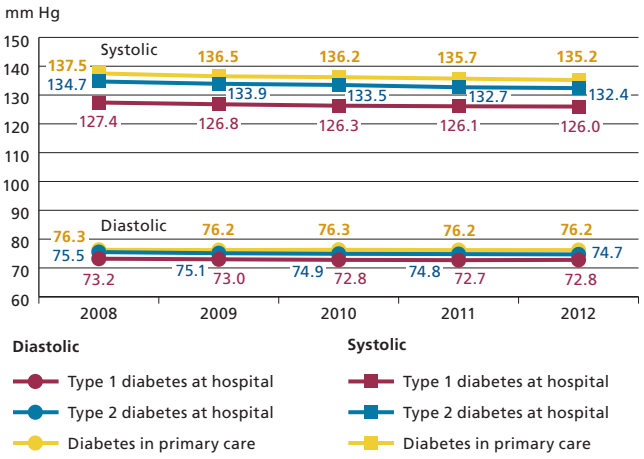


Figure 38. Systolic blood pressure in various intervals.
All patients with type 2 diabetes

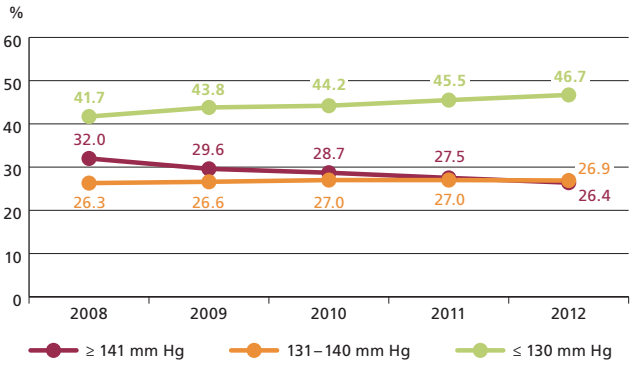


Figure 39. Blood pressure ≤ 130/80 mm Hg.
All patients at hospital and in primary care

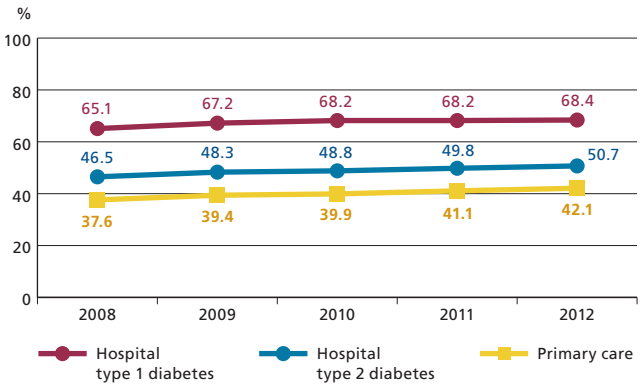


Figure 40. Blood pressure < 130/80 mm Hg.
All patients at hospital and in primary care

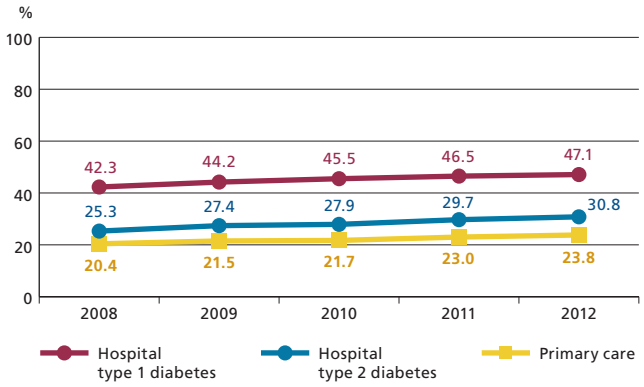


Figure 41. Blood pressure ≤ 140/80 mm Hg.
All patients at hospital and in primary care

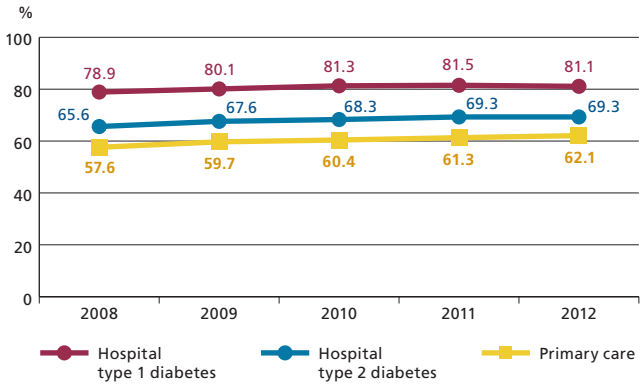


Figure 42. Antihypertensive drugs for patients
at hospital and in primary care

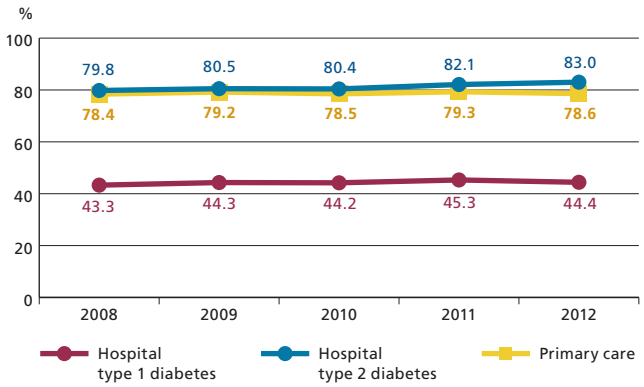


Figure 43. Blood pressure ≤ 130/80 mm Hg among patients treated with antihypertensive drugs at hospital and in primary care

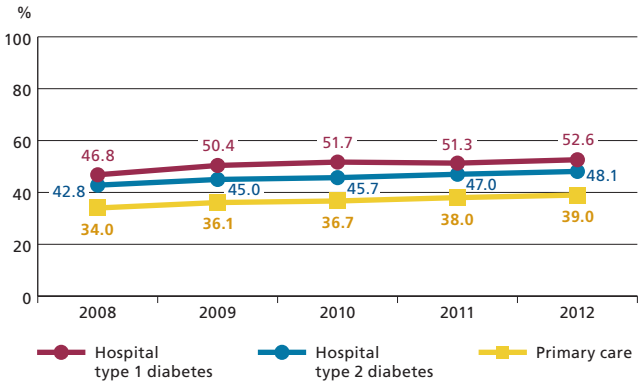


Figure 44. Blood pressure < 130/80 mm Hg among patients treated with antihypertensive drugs at hospital and in primary care

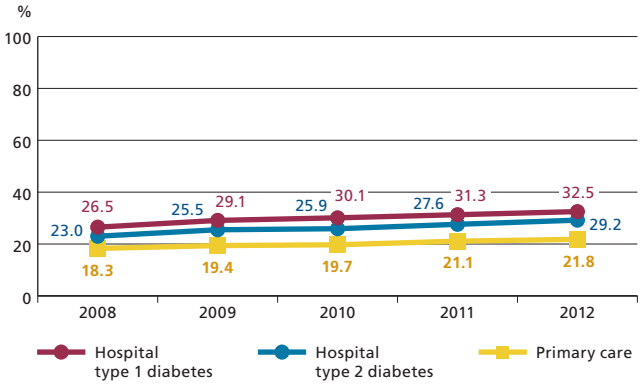


Figure 45. Blood pressure < 140/80 mm Hg. All patients at hospital and in primary care

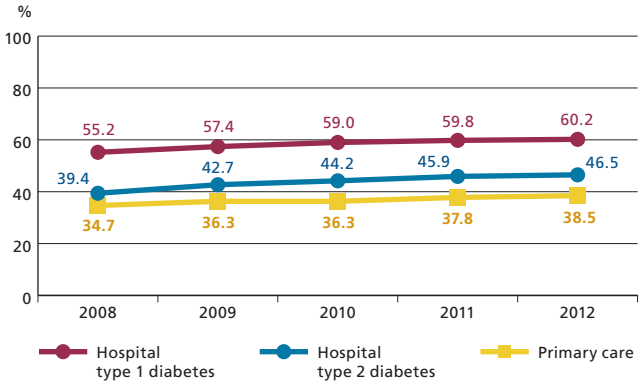


Figure 46. Blood pressure ≤ 140/80 mm Hg among patients treated with antihypertensive drugs at hospital and in primary care

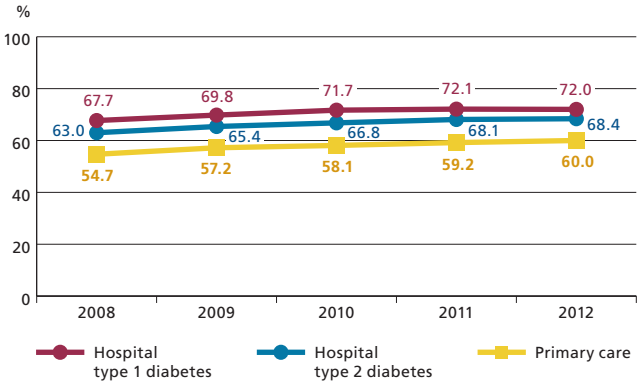


Figure 47. Blood pressure < 140/80 mm Hg among patients treated with antihypertensive drugs at hospital and in primary care

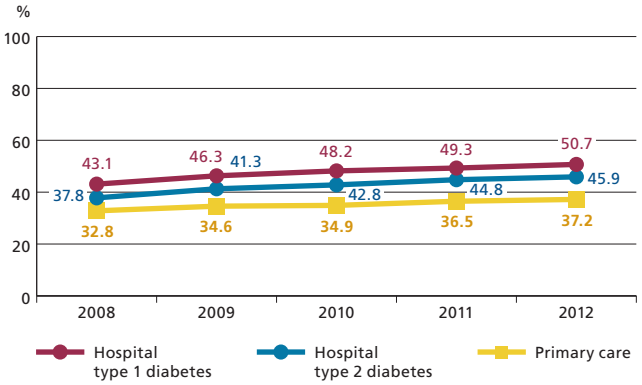


Figure 48. Histogram for systolic blood pressure (mm Hg). All patients with type 1 diabetes, 2012

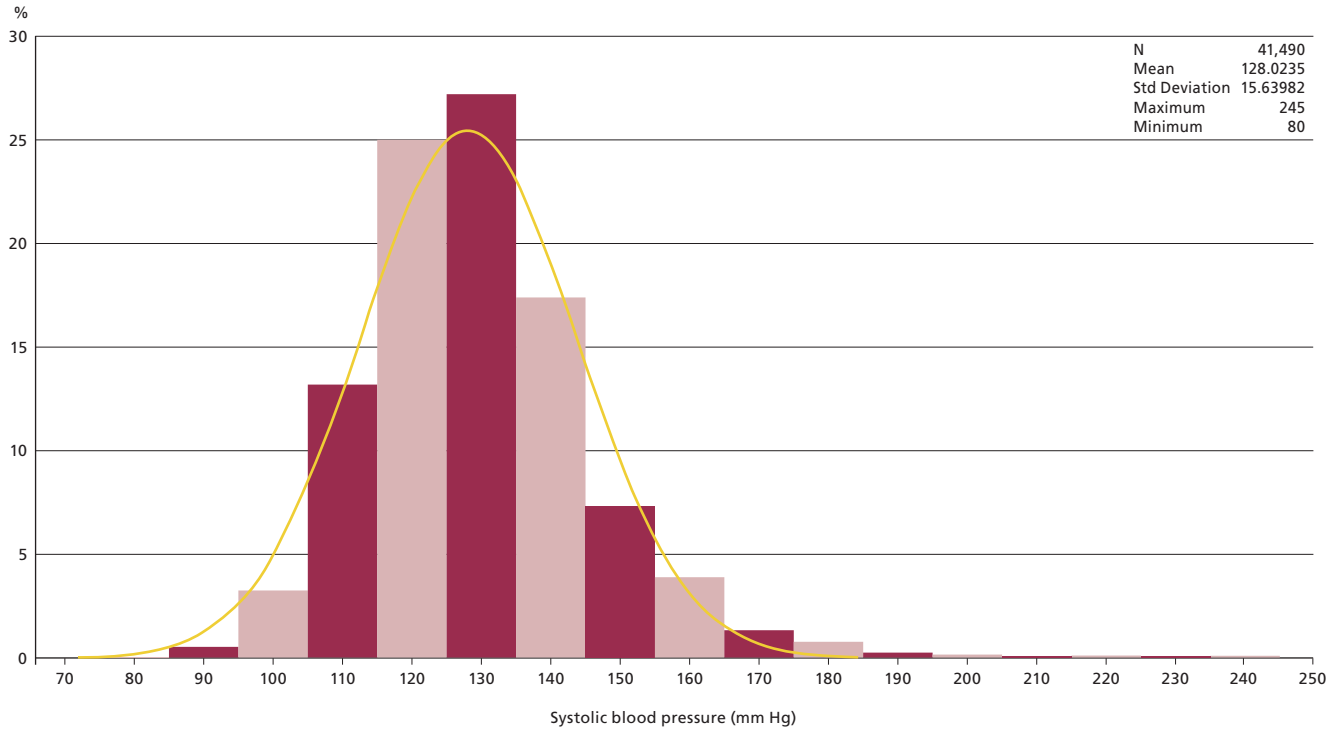
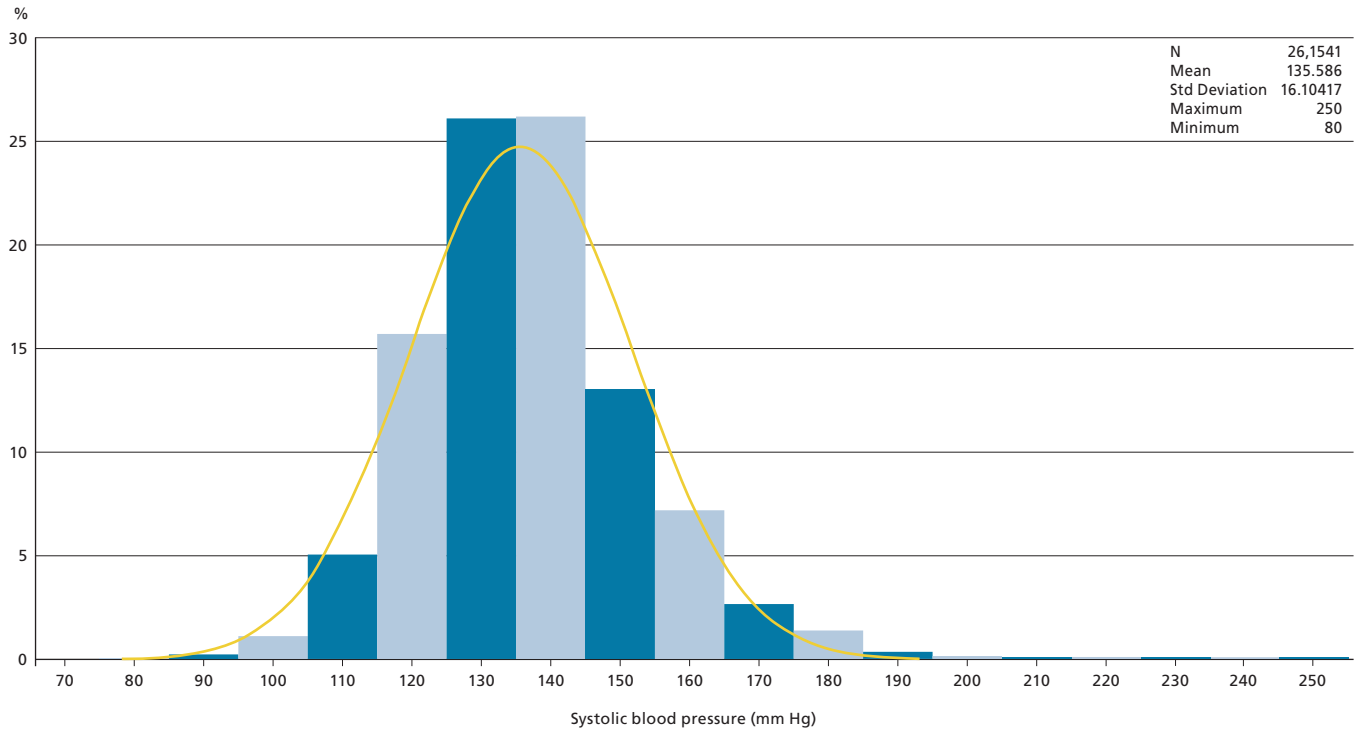


Figure 49. Histogram for systolic blood pressure (mm Hg). All patients with type 2 diabetes, 2012



Lipid lowering drug therapy

Figure 50. LDL cholesterol < 2.5 mmol/l. Patients at hospital and in primary care

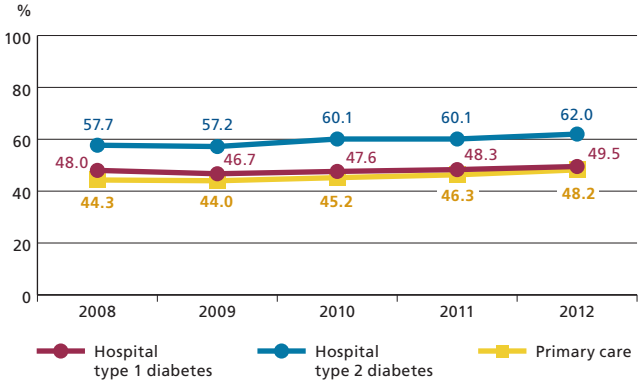


Figure 51. LDL < 2.5 mmol/l among patients treated with lipid lowering drugs at hospital and in primary care

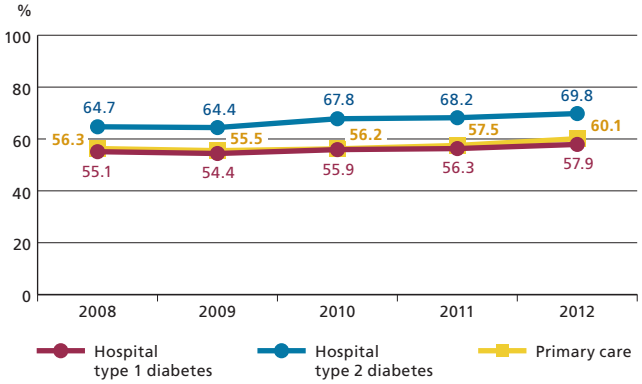


Figure 52. Lipid lowering drugs among patients at hospital and in primary care

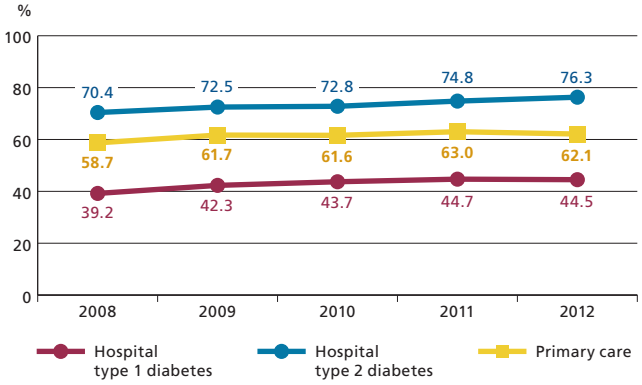


Figure 53. Total cholesterol < 4.5 mmol/l among patients at hospital and in primary care

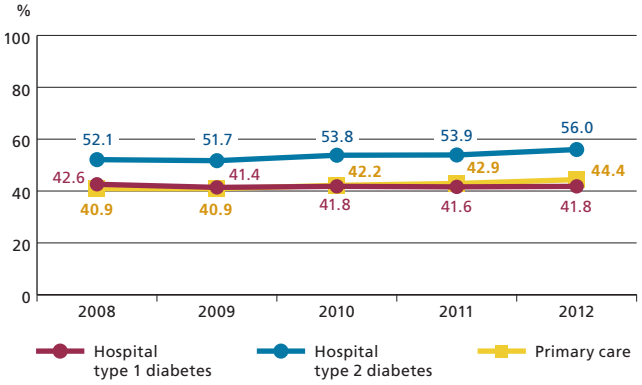


Figure 54. Total cholesterol < 4.5 mmol/l among patients treated with lipid lowering drugs at hospital and in primary care

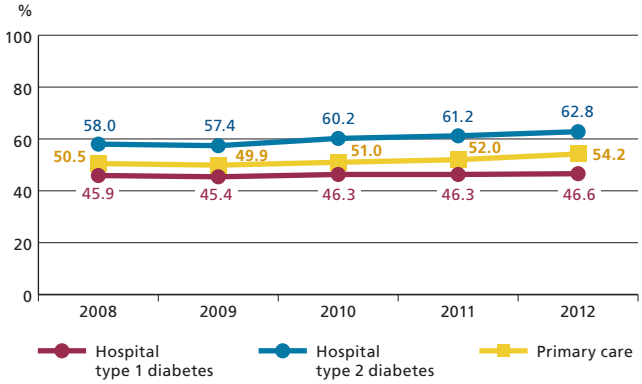


Figure 55. Triglycerides < 1.7 mmol/l among patients at hospital and in primary care

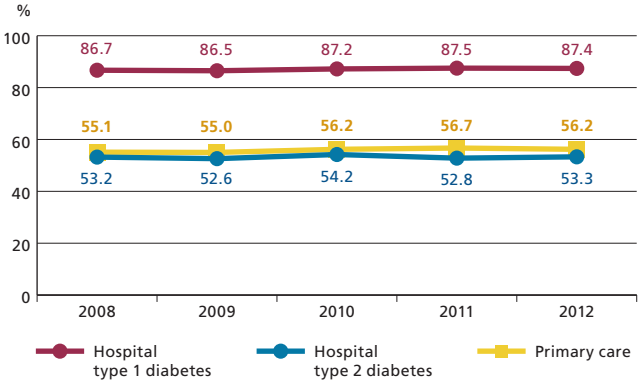


Figure 56. Triglycerides < 1.7 mmol/l among patients treated with lipid lowering drugs at hospital and in primary care

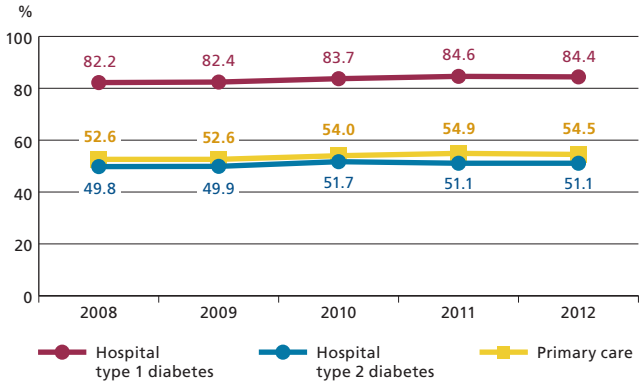


Figure 57. HDL cholesterol > 1.0 mmol/l for men and > 1.3 mmol/l for women at hospital and in primary care

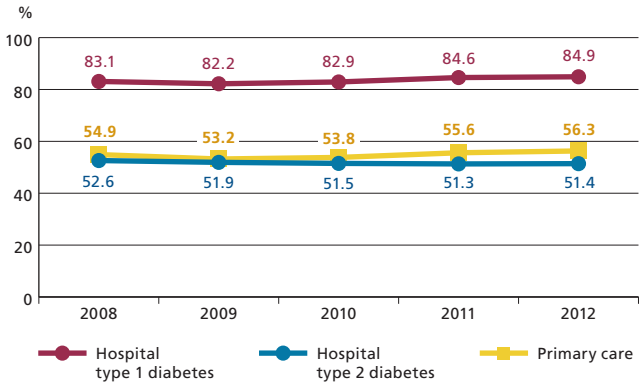
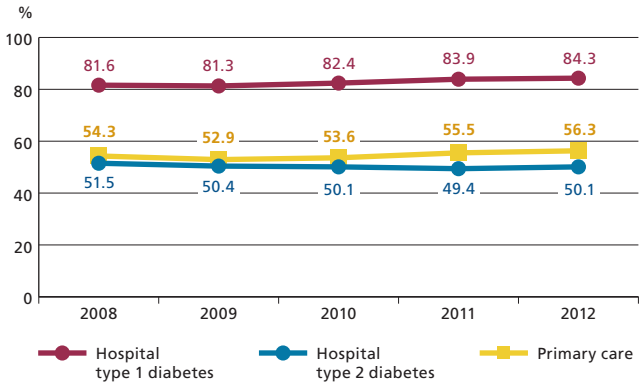


Figure 58. HDL cholesterol > 1.0 mmol/l for men and > 1.3 mmol/l for women treated with lipid lowering drugs at hospital and in primary care



Diabetic nephropathy

Figure 59. Microalbuminuria (urine albumin excretion 20–200 microgram/min) among patients with diabetes duration ≤ 4 years at hospital and in primary care

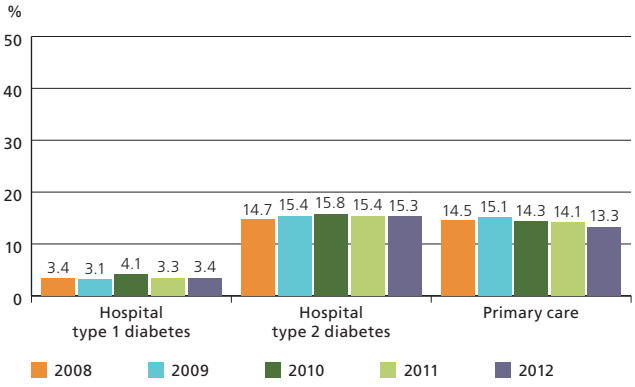


Figure 60. Macroalbuminuria (urine albumin excretion > 200 micrograms/min) among patients with diabetes duration ≤ 4 years at hospital and in primary care

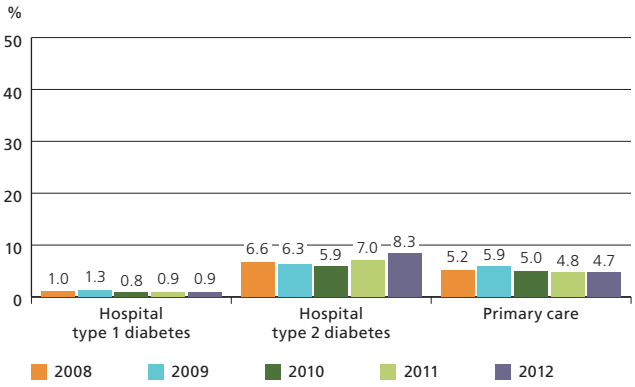
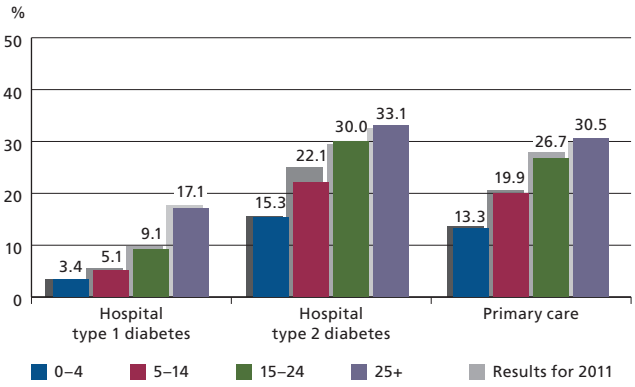


Figure 61. Microalbuminuria (urine albumin excretion 20–200 microgram/min) by diabetes duration among patients at hospital and in primary care, 2012



Treatment with ASA

Figure 62. Macroalbuminuria (urine albumin excretion > 200 microgram/min) by diabetes duration among patients at hospital and in primary care, 2012

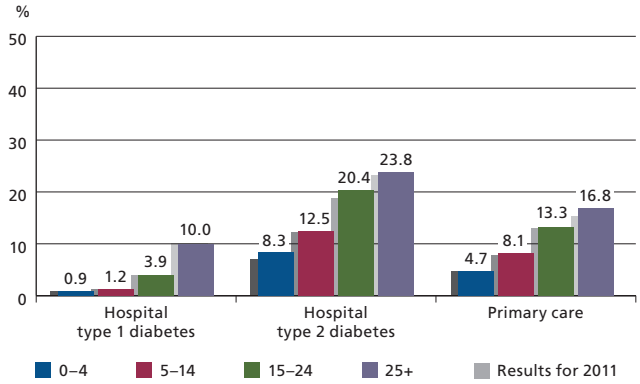


Figure 63. Acetylsalisylic acid for all type 1 diabetes patients at hospital and for type 2 patients with coronary heart disease at hospital

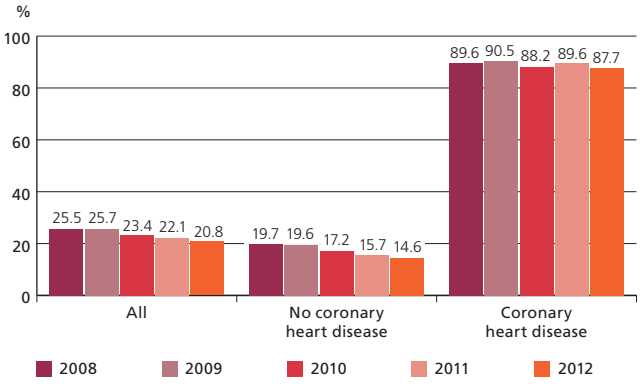


Figure 64. Acetylsalisylic acid for all type 2 diabetes patients at hospital and for type 2 diabetes patients with coronary heart disease at hospital

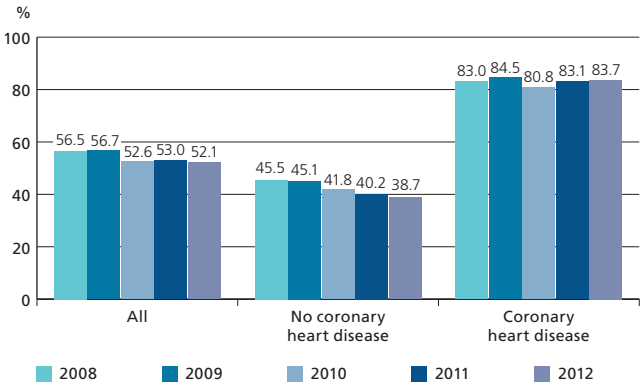
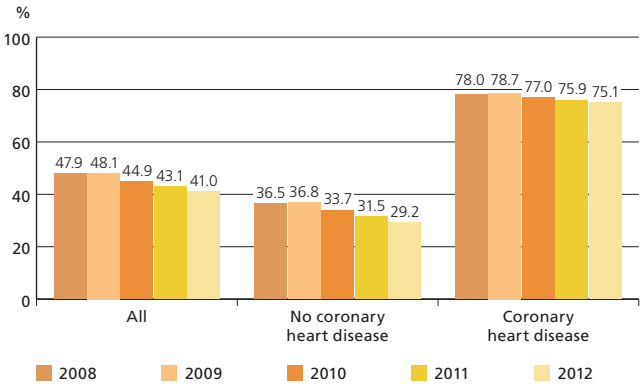
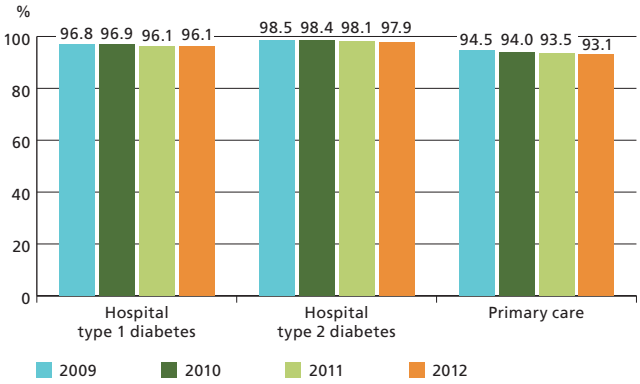


Figure 65. Acetylsalisylic acid for all patients and for patients with coronary heart disease in primay care

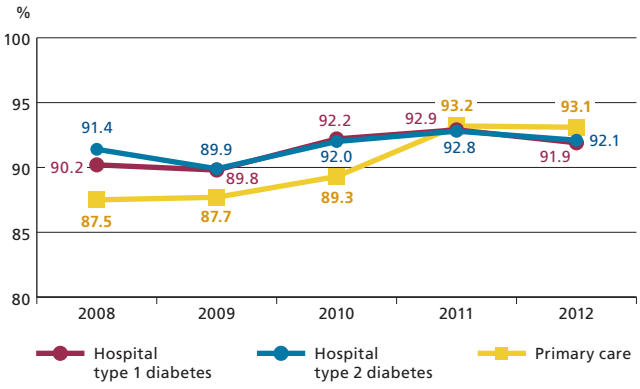


Monitoring of eye and foot status

Figure 66. Monitoring of eye status during the last 2 years among patients with type 1 diabetes at hospital and the last 3 years among patients with type 2 diabetes at hospital and in primary care



Figur 67. Monitoring of foot status during the last year at hospital and in primary care



Examples from the county council

County views

Each county has a table, along with a "Target" snapshot of its results (mean and percentage) compared with the nationwide mean. The Target shows the county's participation rate at 12 o'clock (based on an assumption of 4% diabetes occurrence), followed clockwise by the results for patients with type 2 diabetes at hospital, patients with type 1 diabetes at hospital and patients in primary care. The Target is not a comprehensive measure of the quality of diabetes care in the county, but rather an incentive for analysis, learning and improvement.

We recommend that you compare each Target with the one from the year before.

The three shades indicate:

- The county's results are poorer than the nationwide mean by a statistically significant margin.
- The county's results are on a par with the nationwide mean.
- The county's results are better than the nationwide mean by a statistically significant margin.

Västra Götaland

	Hospital, type 1 diabetes		Hospital, type 2 diabetes		Primary care	
Indications	**Nationwide**	**County council**	**Nationwide**	**County council**	**Nationwide**	**County council**
Mean value						
HbA1c, mmol/mol	65.3	64.0	62.6	61.6	54.9	53.7
Systolic blood pressure, mm Hg	126.0	124.5	132.4	130.9	135.2	134.1
LDL-cholesterol, mmol/l	2.6	2.5	2.4	2.4	2.7	2.6
Proportion (%)						
Non-smokers	87.9	89.4	87.3	85.9	85.3	84.5
Non-development of albuminuria	94.4	93.9	83.6	78.7	91.8	91.9
Monitoring of eye status*	96.1	97.1	97.9	98.3	93.1	96.0
Monitoring of foot status**	91.9	89.0	92.1	90.1	93.1	96.8

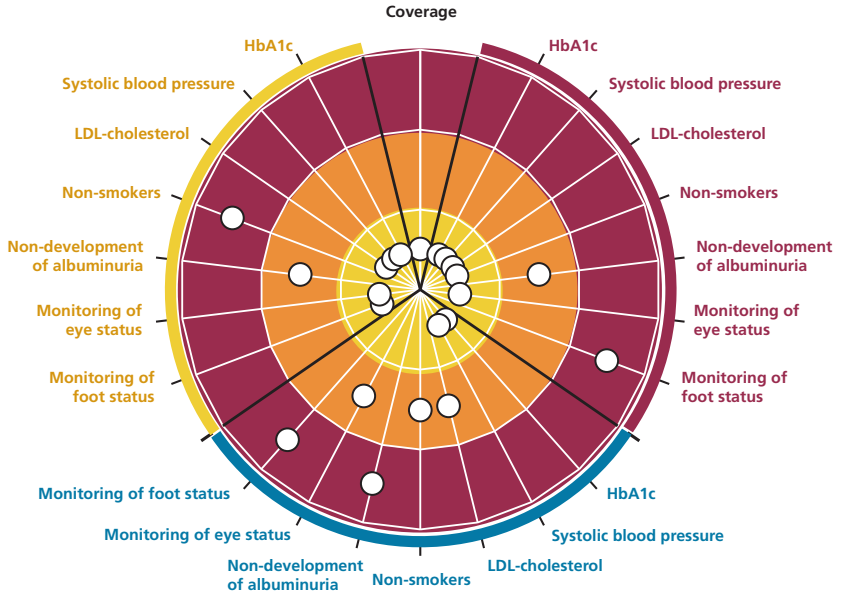
* the last 2 years among patients with type 1 diabetes at hospital, as well as the last 3 years among patients with type 2 diabetes at hospital and primary care
** last year

Västra Götaland

Hospital, type 1 diabetes
N = 6,435
Mean age = 45.5
Mean duration = 22.7
Men = 56.6%

Hospital, type 2 diabetes
N = 2,337
Mean age = 63.7
Mean duration = 15.4
Men = 67.6%

Primary care
N = 56,640
Mean age = 68.5
Mean duration = 9.0
Men = 55.9%



Example from hospital

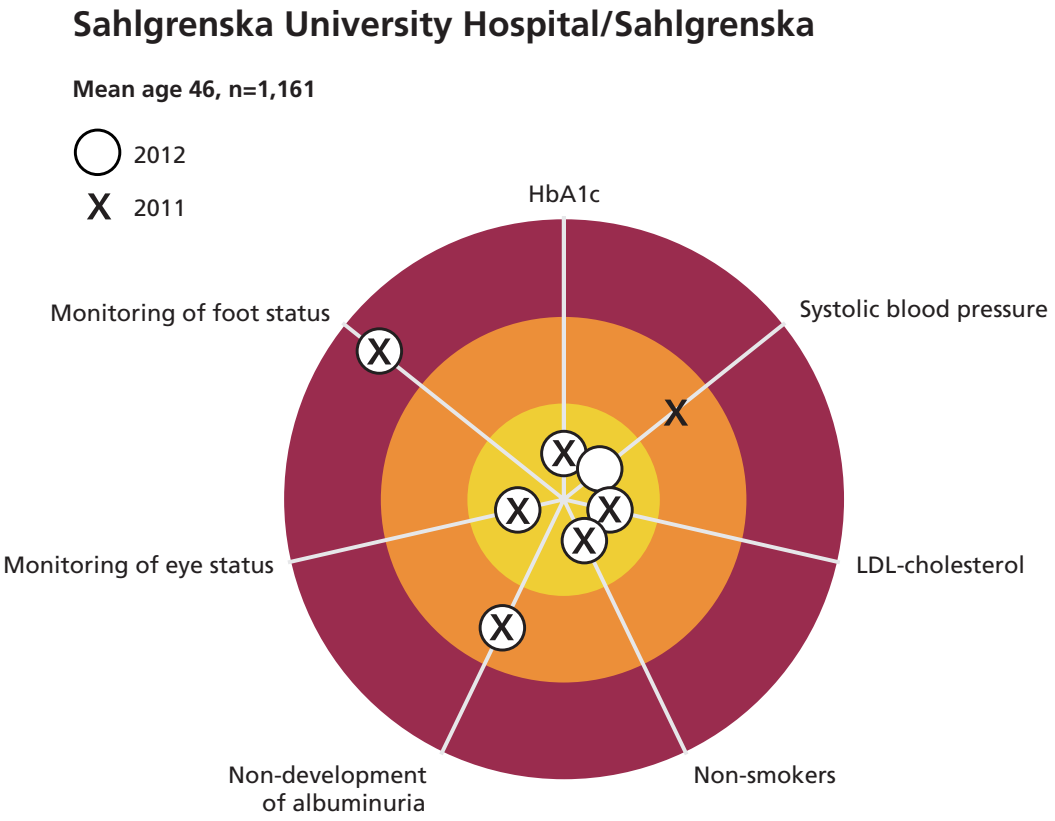
Hospital views

Each hospital has a table, along with a "Target" snapshot of its results (mean and percentage) compared with the nationwide mean. The Target shows patients with type 1 diabetes at hospital.

The Target is not a comprehensive measure of the quality of diabetes care at the hospital, but rather an incentive for analysis, learning and improvement.

The three shades indicate:

- The hospital's results are poorer than the nationwide mean by a statistically significant margin.
- The hospital's results are on a par with the nationwide mean.
- The hospital's results are better than the nationwide mean by a statistically significant margin.



Publications

1. Nilsson PM, Gudbjornsdottir S, Eliasson B, Cederholm J. Hypertension in diabetes: trends in clinical control in repeated large-scale national surveys from Sweden. J Hum Hypertens 2003;17:37-44.

2. Gudbjornsdottir S, Cederholm J, Nilsson PM, Eliasson B. The National Diabetes Register in Sweden: An implementation of the St. Vincent Declaration for Quality Improvement in Diabetes Care. Diabetes Care 2003;26:1270-6.

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11. P.J. Kelly 1, P.M. Clarke 2, A.J. Hayes 1, U-G. Gerdtham 345 , J. Cederholm 6, P. Nilsson 7, B . Eliasson 8, S. Gudbjornsdottir Predicting the mortality of people with type 2 diabetes mellitus following major complications: a study using Swedish National Diabetes Register data.Diabetic Medicine 2013, aceppterad

12. B Zethelius, S Gudbjörnsdottir, B Eliasson, K Eeg-Olofsson, J Cederholm , on behalf of the NDR. Level of physical activity associated with risk of cardiovascular diseases and mortality in patients with type 2 diabetes. Report from the Swedish National Diabetes Register (NDR) Accepterad för publ 2013 I European Journal of Preventive Cardiology

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14. Hanberger L, Ludvigsson J, Nordfeldt S: Use of a web 2.0 portal to improve education and communication in young diabetes patients with families – a case study. J Med Internet Res. 2013 Aug 23;15(8):e175

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Summary of publications

Type 1 diabetes

Glycemic Control and Cardiovascular Disease in 7,454 patients with type 1 diabetes. An observational study from the Swedish National Diabetes Register (NDR).

Eeg-Olofsson K, Cederholm J, Nilsson P, Zethelius B, Svensson, A-M, Guðbjörnsdóttir S, Eliasson B.
Diabetes Care 2010;33:1640-1666.

- Progressively increasing risks of CHD and CVD with higher HbA1c
- Risk increase of 34% for CHD and 32% for CVD per 1% unit increase in HbA1c
- No sign of J-shaped risk curve across HbA1c 5–11% in all patients, or in those with shorter or longer diabetes duration
- A group with baseline HbA1c mean 7.2% had 42% lower risk of CHD and 37% lower risk of CVD, compared to a group with baseline HbA1c mean 9.0%, when followed for 5 years
- Results in this large observational study are in accordance with the observational DCCT/EDIC study

A new model for 5-year risk of cardiovascular disease in type 1 diabetes, from the Swedish National Diabetes Register (NDR).

Cederholm J, Eeg-Olofsson K, Eliasson B, Zethelius B, Gudbjörnsdottir S.
Diabetic Medicine 2011;28:1213-1220
Presented at: http://www.ndr.nu/risk/

- A risk model for 5-year risk of CVD has been validated in Swedish patients with type 2 diabetes, with 8 clinical predictors: HbA1c, systolic BP, smoking, total- / HDL-cholesterol, macroalbuminuria, history of CVD, onset age and duration of diabetes

Glycaemic control and incidence of heart failure in 20,985 patients with type 1 diabetes: an observational study.

Lind M, Bounias I, Olsson M, Gudbjörnsdottir S, Svensson AM, Rosengren A.
Lancet. 2011 378:140-6

- Patients with age >18 years and no previous heart failure, followed from 1998 to 2009, showed considerably higher incidence of heart failure per 100,000 person-years with HbA1c(DCCT) >10.5% (5.2 per 1000 person-years) compared to HbA1c <6.5% (1.4 per 1,000 person-years).
- HR for heart failure was 4.0 with HbA1c >10.5% compared to <6.5%, adjusted for clinical characteristics and risk factors.
- The positive association between HbA(1c) and risk of heart failure in fairly young patients with type 1 diabetes indicates a potential for prevention of heart failure with improved glycaemic control.

Type 2 diabetes

New aspects of HbA1c as a risk factor for cardiovascular diseases in type 2 diabetes: an observational study from the Swedish National Diabetes Register (NDR).

Eeg-Olofsson K, Cederholm J, Nilsson PM, Zethelius B, Svensson AM, Gudbjörnsdóttir S,Eliasson B.
Journal of Internal Medicine; 2010;268:471-82

- The risks of all outcomes (CHD, stroke, CVD and total mortality) increased progressively with higher baseline or updated mean HbA1c during 6 years of follow-up, confirmed by significant HR for HbA1c and the outcomes.
- There was no sign of a J-shaped risk curve at the lowest HbA1c values down to 5%.
- This concerned all patients, and also those with longer diabetes duration (>7 years, mean 15 years), and those with a history of CVD.
- A patient group with baseline HbA1c mean 6.5% had a relative risk reduction of 20% for fatal/nonfatal CHD, 16% for fatal/nonfatal CVD, and no risk increase for fatal CVD or total mortality, compared to a patient group with baseline HbA1c mean 7.5% (1% difference in HbA1c)
- This large observational study concerned patients treated at hospitals and primary care nationwide, representing what actually took place in clinical practice.

The relationship between glycaemic control and heart failure in 83,021 patients with type 2 diabetes.

Lind M, Olsson M, Rosengren A, Svensson AM, Bounias I, Gudbjörnsdottir S.
Diabetologia. 2012 55:2946-53

- Impaired glycaemic control of HbA1c(DCCT) > 7% was associated with an increased risk of hospitalisation for heart failure in patiets followed for 7 years.
- HR for risk of heart failure was 1.12 (1.10–1.14) per each %-unit increase in HbA1c.

Systolic blood pressure and risk of cardiovascular diseases in type 2 diabetes: An observational study from the Swedish National Diabetes Register (NDR).

Cederholm J, Gudbjörnsdóttir S, Eliasson B, Zethelius B, Eeg-Olofsson K, Nilsson PM.
Journal of Hypertension 2010;28:2026-2035.

Different methods to present the effect of blood pressure on cardiovascular diseases by Cox regression.

Cederholm J, Zethelius B, Eliasson B, Gudbjörnsdottir S, Nilsson PM.
Journal of Hypertension 2012;30:235-237

Blood pressure and risk of cardiovascular diseases in type 2 diabetes: further findings from the Swedish National Diabetes Register (NDR-BP II).

Cederholm J, Gudbjörnsdottir S, Eliasson B, Zethelius B, Eeg-Olofsson K, Nilsson PM; NDR.
Journal of Hypertension 2012 30:2020-30.

- Systolic BP < 140/80 mmHg strongly reduced risk of CVD, pointing to a general treatment target for SBP 130–135/75 mmHg, also in patients with a history of CVD

- The CVD risk was slightly increased with lowest BP < 115 mmHg, with a J-shaped curve for systolic BP but not for diastolic BP

Trends in blood pressure control in patients with type 2 diabetes: data from the Swedish National Diabetes Register (NDR).

Nilsson PM, Cederholm J, Zethelius BR, Eliasson B, Eeg-Olofsson K, Gudbjörnsdottir S.
Blood Pressure 2011;20:348-354

- BP control improved from 2005 to 2009, in cross-sectional surveys 2005–2009 (n=180,000).
- BP control also improved in patients followed individually from 2005 to 2009 (n=79,000), with antihypertensive treratment increasing from 73% to 82% and uncontrolled BP > 140/90 mmHg decreased significantly from 58% to 47%.
- This improvement was related to decrease in BMI, and to increase in use of antihypertensive drug.
- However, still about half of the patients had BP >140/90 mmHg.

Pulse pressure strongly predicts cardiovascular disease risk in patients with type 2 diabetes from the Swedish National Diabetes Register (NDR).

Nilsson PM, Cederholm J, Eeg-Olofsson K, Eliasson B, Zethelius B, Guðbjörnsdóttir S.
Diabetes & Metabolism 2009;35:439–446

- Normal pulse pressure mean 60 mmHg (= mean BP 140/80) showed decreased risks of CHD and CVD by 24% and 22% compared to high PP >75 mmHg (= mean BP 160/80)

Clinical usefulness of different lipid measures for prediction of coronary heart disease in type 2 diabetes: a report from the Swedish National Diabetes Register.

Eliasson B, Cederholm J, Eeg-Olofsson K, Svensson AM, Zethelius B, Gudbjörnsdottir S.
Diabetes Care 2011;34:2095-2100

- LDL cholesterol was not the best predictor of CHD risk among blood lipids in type 2 diabetes.
- Ratio non-HDL- / HDL-cholesterol had a stronger effect on CHD risk than LDL cholesterol, and low TG:HDL values were more often seen within the lowest non-HDL:HDL tertile than within the lowest LDL cholesterol tertile.
- The CHD rate decreased with lower LDL-cholesterol until around 3.0 mmol/l, but not with even lower LDL. In contrast, the CHD rate decreased continuously with lower ratio non-HDL- / HDL-cholesterol or lower ratio total-/HDL-cholesterol.

Additive effects of glycaemia and dyslipidaemia on risk of cardiovascular diseases in type 2 diabetes: an observational study from the Swedish National Diabetes Register.

Gudbjörnsdottir S, Eliasson B, Eeg-Olofsson K, Zethelius B, Cederholm J.
Diabetologia 2011;54:2544-2551

- Hyperglycaemia and hyperlipidaemia combined showed the lowest risk at lowest combination levels of both, and a considerable increase **in CHD / CVD risk at high combination levels.**
- The effect of the lipid ratio total- / HDL-cholesterol was somewhat higher, but the effect of HbA1c was also obvious and even more so when blood lipids also were higher.

Risk of cardiovascular disease and mortality in overweight and obese patients with type 2 diabetes: an observational study in 13,087 patients.

Eeg-Olofsson K, Cederholm J, Nilsson PM, Zethelius B, Nunez L, Guðbjörnsdóttir S, Eliasson B.
Diabetologia 2009;52:65-73.

- Patients with normal weight (BMI 18–24.9 kg/m^2) showed decreased risks of CHD and CVD by 15% and 22% compared to overweight (BMI 25–29.9 kg/m^2) or obesity (BMI >30 kg/m^2), independently of clinical characteristics and smoking.

Obesity and cardiovascular risk factors in type 2 diabetes: Results from a national diabetes register.

Ridderstråle M, Guðbjörnsdóttir S, Eliasson B, Nilsson PM, Cederholm J.
Journal of Internal Medicine 2006;259:314-22.

- Obesity was a strong predictor for development of hypertension, hyperlipidemia and microalbuminuria during 6 years of follow-up, implying that obesity treatment is of value to achieve a reduction of these important cardiovascular risk factors.

Smoking as an independent risk factor for myocardial infarction or stroke in type 2 diabetes: a report from the Swedish National Diabetes Register.

Nilsson PM, Cederholm J, Eeg-Olofsson K, Eliasson B, Zethelius B, Fagard R, Guðbjörnsdóttir S.
European Journal of Cardiovascular Prevention and *Rehabilitation 2009;16:506-512.*

- Non-smokers in middle-ages showed decreased risks of CHD and CVD by 57% and 38% compared to smokers.

Leisure time physical activity associate with risk of cardiovascular diseases in patients with type 2 diabetes: Report from the Swedish National Diabetes Register (NDR)

Zethelius B, Gudbjörnsdottir S, Eliasson B, Eeg-Olofsson K, Cederholm J.

Abstract European Association for the Study of Diabetes (EASD), October 2, 2012, Berlin

- Comparing 8,500 patients with higher baseline LTPA (regular 3 times/week or more) and 7,000 with low baseline LTPA (never or 1–2 times/week), HR for fatal/nonfatal CHD, fatal/nonfatal CVD, fatal CVD and total mortality were 0.80 (0.67–0.95; p=0.01), 0.79 (0.69–0.92; p=0.002), 0.59 (0.42–0.85; p=0.004), 0.68 (0.55–0.82; p<0.001), adjusting for age, sex, diabetes duration, type of treatment and smoking.
- Including also conventional cardiovascular risk factors as covariates and adjusting with a propensity score, HR were 0.84 (0.71–1.00), 0.86 (0.74–0.99; p=0.04), 0.66 (0.46–0.95; p=0.02) and 0.71 (0.58–0.87; p<0.001), respectively.
- Comparing those 11,000 patients with baseline low and final higher and baseline higher LTPAcombined with those 4,000 patients who had low baseline and low final LTPA, HR for fatal/nonfatal CHD, fatal/nonfatal CVD, fatal CVD and total mortality were 0.58 (0.49–0.70), 0.58 (0.50–0.67), 0.43 (0.30–0.62), 0.47 (0.39–0.58), all p<0.001, when adjusting with a propensity score including all clinical characteristics and cardiovascular risk factors

Effect of tight control of HbA1c and blood pressure on cardiovascular diseases in type 2 diabetes: An observational study from the Swedish National Diabetes Register (NDR).

Cederholm J, Zethelius B, Nilsson PM, Eeg-Olofsson K, Eliasson B, Guðbjörnsdóttir S.
Diabetes Research and Clinical Practice 2009;86:74-81.

Samband mellan riskfaktorer och komplikationer vid diabetes. Rapport efter 13 år med Nationella diabetes-registret (NDR).

Cederholm J, Nilsson PM, Eliasson B, Eeg-Olofsson K, Zethelius B, Guðbjörnsdóttir S.
Läkartidningen 2009;42:2684-2689.

- A multifactorial approach improves risk factor control and decreases risk of CVD
- Long-term tight control of HbA1c was related to low BMI, weight reduction and non-smoking
- Long-term tight control of BP was related to low BMI and absence of albuminuria
- A combined long-term tight control of HbA1c <7,5% (median 6.5%) and BP <140/90 (median 130/80) reduced risks of CHD and CVD by 31% and 33%.
- The effects of HbA1c and BP on outcomes risk were additive.
- Almost half (40–43%) of all cases of CHD and CVD may be prevented, if at the same time both HbA1c >7.5%, BP >140/90 mmHg, obesity and smoking were eliminated.

Microalbuminuria and risk factors in type 1 and type 2 diabetic patients.

Cederholm J, Eliasson B, Nilsson PM, Weiss L, Guðbjörnsdóttir S.
Diabetes Research and Clinical Practice 2005;67:258-66.

Risk factors for the development of albuminuria and renal impairment in type 2 diabetes – the Swedish National Diabetes Register (NDR).

Afghahi H, Cederholm J, Eliasson B, Zethelius B, Gudbjörnsdottir S, Hadimeri H, Svensson MK.
Nephrology Dialysis Transplantation 2011;26:1236-1243.

- Development of albuminuria or renal impairment during 5 years were determined by high BMI and triglycerides and low HDL as new predictors, except for high HbA1c and blood pressure.
- Obesity and prominent obesity (>35 kg/m^2) had strong impact on the risk for development of albuminuria or renal impairment.

Risk prediction of cardiovascular disease in type 2 diabetes: a risk equation from the Swedish National Diabetes Register.

Cederholm J, Eeg-Olofsson K, Eliasson B, Zethelius B, Nilsson PM, Guðbjörnsdóttir S.
Diabetes Care 2008;31:2038-43.

- A simplified risk model for estimation of the 5-year risk of CVD has been published, using one blood sample for measurement of HbA1c and 8 clinical predictors: systolic BP, smoking, BMI, use of BP and lipid-lowering drugs, sex, onset age and duration of diabetes.

A new model for 5-year risk of cardiovascular disease in type 2 diabetes, from the Swedish National Diabetes Register (NDR).

Zethelius B, Eliasson B, Eeg-Olofsson K, Svensson AM, Gudbjörnsdottir S, Cederholm J.
Diabetes Research and Clinical Practice 2011;93:276-284
Presented at: http://www.ndr.nu/risk/

- A more elaborated risk model for 5-year risk of CVD has been validated in Swedish patients with type 2 diabetes, with 12 clinical predictors: HbA1c, duration of diabetes, systolic BP, BMI, smoking, total- / HDL-cholesterol, micro- and macroalbuminuria, atrial fibrillation, history of CVD, sex and onset age

Time trends in absolute and modifiable coronary heart disease risk in patients with Type 2 diabetes in the Swedish National Diabetes Register (NDR) 2003–2008.

Fhärm E, Cederholm J, Eliasson B, Gudbjörnsdottir S, Rolandsson O.
Diabetic Medicine 2012 Feb;29(2):198-206

- A high achievement of treatment goals and a low mean modifiable 10-year CHD risk (UKPDS risk model) was found at the 3-year follow-up of patients with newly developed type 2 diabetes, both in a cross-sectional survey in 2008 and in patients individually followed since 2003.
- Mean modifiable 10-year risk (part of total absolute risk due to modifyable cardiovascular risk factors) decreased from 38% to 19% from 2003 to 2008, implying decrease in future incidence of myocardial infarction (CHD).
- This indicates the feasibility and significance of early multifactorial risk factor treatment.

The gap between guidelines and reality: Type 2 diabetes in a national diabetes register 1996–2003.

Eliasson B, Cederholm J, Nilsson P, Guðbjörnsdóttir S.
Diabetic Medicine 2005;22:1420-6.

Antihyperglycaemic treatment of type 2 diabetes: Results from a national diabetes register.

Eliasson B, Eeg-Olofsson K, Cederholm J, Nilsson PM, Guðbjörnsdóttir S.
Diabetes & Metabolism 2007;33:269-76.

- HbA1c (DCCT) levels for addition of insulin to oral agents in clinical practice decreased from 7.5–7.8% in 1996–97 to around 6.5% in 2002–03.
- Use of insulin increased from 15% with diabetes duration 1–5 years, to 56% with duration 11–15 years, and to 71% with duration 16–20 years.

Obesity and cardiovascular risk factors in type 2 diabetes: Results from a national diabetes register.

Ridderstråle M, Guðbjörnsdóttir S, Eliasson B, Nilsson PM, Cederholm J.
Journal of Internal Medicine 2006;259:314-22.

- Glucose-lowering therapy that caused weight increase was related to increase in HbA1c with oral agents, and to increase in blood pressure with oral agents or insulin.

Risk factor control in patients with Type 2 diabetes and coronary heart disease: findings from the Swedish National Diabetes Register (NDR).

Guðbjörnsdóttir S, Eeg-Olofsson K, Cederholm J, Zethelius B, Eliasson B, Nilsson PM.
Diabetic Medicine 2009;26:53-60.

- Patients with a history of myocardial infarction (CHD) 1–2 years before follow-up in 2005 showed a high use of lipid-lowering drugs (86%), corresponding to 65% achieving target LDL <2.5 mmol/l. A discrepancy existed between the prevalent use of antihypertensive drugs (94%) and the low proportion of only 40% reaching blood pressure target <130/80 mHg. Regretfully, a high prevalence of adverse lifestyle characteristics prevailed: 42% had obesity, 68% had waist 102 (men)/88 (women) cm, and almost 20% smokers with age < 65 years.

Long-term mortality in patients with type 2 diabetes undergoing coronary angiography: the impact of glucose-lowering treatment.

Saleh N, Petursson P, Lagerqvist B, Skúladóttir H, Svensson A, Eliasson B, Gudbjörnsdottir S, Eeg-Olofsson K, Norhammar A.
Diabetologia. 2012 55:2109-2117.

- 12,000 patients who had performed coronary angiography 2001–2009 had a significantly 20% higher long-term mortality risk during follow-up when treated with insulin, compared to those treated with oral agents, after adjustment for measured confounders.

Glucose-lowering treatment and clinical results in 163,121 patients with type 2 diabetes: An observational study from the Swedish national diabetes register.

Ekström N, Miftaraj M, Svensson AM, Andersson Sundell K, Cederholm J, Zethelius B, Gudbjörnsdottir S, Eliasson B.
Diabetes Obesity Metabolism 2012; 14:717-7126.

- 163,000 patients with type 2 diabetes in 2009 showed insufficiently reached treatment goal HbA1c (DCCT) <7% in all treatment groups, varying from 70% with metformin to 25% with insulin + sulphonylurea.
- Patients on insulin-based treatment regimens had the longest duration of diabetes, more cardiovascular risk factors and the highest proportions of patients not reaching HbA1c target.

Effectiveness and safety of metformin in 51,675 patients with type 2 diabetes and different levels of renal function: a cohort study from the Swedish National Diabetes Register.

Ekström N, Schiöler L, Svensson AM, Eeg-Olofsson K, Miao Jonasson J, Zethelius B, Cederholm J, Eliasson B, Gudbjörnsdottir S.
BMJ Open 2012; 2(4).

- Among 51,000 patients with type 2 diabetes followed for 4 years, metformin showed lower risk than insulin for CVD and all-cause mortality and slightly lower risk for all-cause mortality compared with other sulphonylurea.
- Patients with renal impairment showed no increased risk of CVD, all-cause mortality or acidosis/serious infection. In clinical practice, the benefits of metformin use clearly outbalance the risk of severe side effects.

HbA1C and cancer risk in patients with type 2 diabetes – a nationwide population-based prospective cohort study in Sweden.

Miao Jonasson J, Cederholm J, Eliasson B, Zethelius B, Eeg-Olofsson K, Gudbjörnsdottir S.
PLoS One. 2012;7:e38784

- A cohort study on 25,000 patients with type 2 diabetes registered 1997–1999 and followed until 2009 was used to follow-up for cancer through register linkage. We calculated incidences of and hazard ratios (HR) for cancer in groups categorized by HbA1c <58 mmol/mol (DCCT 7.5%) versus >58 mmol/mol, by quartiles of HbA1c, and by HbA1c continuously at Cox regression, with covariance adjustment for age, sex, diabetes duration, smoking and insulin treatment, or adjusting with a propensity score.
- There were no associations between HbA1c and risks for all cancers or specific types of cancer in patients with type 2 diabetes.

Estimating the cost of diabetes mellitus related events from inpatient admissions in Sweden using administrative hospitalization data.

Gerdtham UG, Clarke P, Hayes A, Guðbjörnsdóttir S.
Pharmacoeconomics 2009;27:81-90.

- Costs (in Euro) of hospital care of diabetic patients with diabetes who suffered complications when followed for 6 years have been estimated, both when a complication occurred and in the following years, concerning: heart failure, myocardial infaction, stroke, renal failure and amputation.

SVENSK FÖRENING FÖR DIABETOLOGI
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The Centre of Registers Region Västra Götaland is a repository of information for registers of healthcare quality. The Swedish Association of Local Authorities and Regions has charged the Centre with supporting the development, operation and use of national quality registers, as well as taking advantage of the registers to promote research and quality improvements.

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