

Country report Denmark – June 2016



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Health care | Risk factors | Prevention methods | Prevention activities | Organisation of cardiac rehabilitation | Future

Acknowledgement

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I. Structure of Health care in Denmark

Structure

People living in Denmark have access to healthcare services under a taxpayer-funded system. The central government outlines health policies and goals for the public health care system and provides treatment guidelines. Denmark's five counties govern and administer the health care system and are responsible for somatic and psychiatric treatment. The municipalities provide services such as rehabilitation, home care and general health-promoting information.

In 2012, Denmark had 3.6 practicing physicians per 1000 inhabitants, which is the same number as the European average. The number of practicing nurses per 1000 inhabitants was 16.3, way above the European average of 9.8 (1). In 2014, Denmark counted 72 cardiologists per million inhabitants. In 2010, approximately 60 % of all physicians had a licensed specialty degree. Hospitals employed 1.2 specialists per 1000 inhabitants. There were 0.7 specialists working in general practice and 0.2 practicing specialists per 1000 inhabitants. Sixty three percent of all physicians were employed in hospitals, while 20 % were general practitioners. Six percent were practicing specialists (2).

Finances

In 2011, Danish costs for health and medical care, expressed as percentage of gross domestic product (GDP) and excluding costs for Long-Term Nursing Care, were approximately equal to the median costs in Europe (3).

The Danish healthcare system is tax financed and doctor's appointments and care in hospital are at no individual charge for patients, and there is equal access to health-care independent of socioeconomic status or participation in the labor market. Costs for physiotherapy are partly covered after referral from a physician. The counties reimburse part of the patient expenses for prescribed medication at pharmacies, when yearly costs exceed 925 DKK (124 Euro). Patients who cannot afford the remaining medication costs can apply for economic help from the municipalities, if treatment is considered necessary. Patients with chronic diseases pay a maximum of 3.830 DKK (513 Euro) per year for medication specifically eligible for subsidy (4).

Approximately half of Denmark's inhabitants have additional private health care coverage, which partly covers expenses of e.g. examinations, treatment and rehabilitation in private hospitals and private practice (5). Private hospitals also receive patients referred by the public hospitals, but they treat only a small fraction of the Danish patients and generally do not treat patients with acute cardiology problems.

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II. Risk factor statistics

In 2013, Denmark counted 5.6 million inhabitants and the life expectancy at birth was 78 and 82 years for males and females respectively. (1) From 2006 to 2012 cardiovascular mortality has been declining and is no longer the primary cause of death, now overtaken by cancer. (2) Furthermore, since 1995 age-standardized cardiovascular mortality have been reduced by almost 60 percent and appears to continue dropping and is now as low as 127 per 100,000 inhabitants. (2) The decline in cardiovascular mortality since 1980 is among the largest in Europe. (3) Nevertheless, in 2012, ischemic heart disease was the leading cause of death, followed by lung cancer. (1) In the same year, more than 452,000 Danish individuals were living with a cardiovascular disease, corresponding to a 14 percent increase since 2006. (4) In the same period, the number of inhabitants older than 65 years of age has increased from approximately 710,000 to 870,000. (5) An aging population and a decreasing cardiovascular mortality could explain the increasing number of individuals living with cardiovascular disease in Denmark. The great decline in cardiovascular mortality is partly explained by primary prevention and by a decreasing prevalence of cardiovascular risk factors such as smoking. (6) The other parts of the explanation are a higher availability of revascularization and improvements in pharmaceutical treatment after ischaemic heart disease (IHD). (7) Moreover, decreasing cardiovascular mortality may be associated with the improvement in survival after out-of-hospital cardiac arrest. In Denmark, 30-day survival after out-of-hospital cardiac arrest has improved from 3.5 to 10.8% in the period between 2001 and 2011 and this improvement has been associated with an increase in bystander cardiopulmonary resuscitation. (8)

Figures 1-3 show temporal trends of cardiovascular disease (figure 1), ischemic heart disease (figure 2) and stroke (figure 3) associated mortality, expressed as age-standardized rates per 100,000 and as total number of deaths (trend lines). Figures 4-7 show age-standardized rates per 100,000 of prevalence and incidence for ischemic heart disease (figure 4), stroke (figure 5), atrial fibrillation (figure 6) and heart failure (figure 7).

Despite declining mortality, for cardiovascular disease, ischemic heart disease and stroke, the prevalence of ischemic heart disease and stroke has been stable throughout the period, while incidence shows a decreasing trend. The explanation could be that people are living longer with cardiovascular disease in Denmark. The same trend is observed for heart failure. Atrial fibrillation has increased in prevalence during the period but also increased slightly in incidence. Thus, atrial fibrillation appears to distinguish itself from the other cardiovascular diseases by not demonstrating declining incidence.

Figure 8 shows IHD prevalence for individuals between 35 and 79 years of age, expressed as age-standardized rates per 100,000 and grouped by educational level. As seen in other populations there is a tendency of much higher prevalence of IHD in individuals with a low educational level compared with higher educational levels.

Temporal trends in the number of coronary angiography and revascularization procedures are shown in figure 9. There is a trend for an increasing number of coronary angiographies while the number of percutaneous coronary interventions (PCI) is stable and the number of coronary artery bypass surgeries (CABG) is declining.

Temporal trends in cardiovascular-related medication are shown in figure 10. There is a trend of increasing consumption of all medication groups with the exception of antiarrhythmic medication. However, the consumption is measured based on the Danish registry of medicinal product statistics, containing information on all prescriptions on an individual level, dispensed in pharmacies since 1995. More specifically the registry contains information of drug type according to the International Anatomical Therapeutic Chemical (ATC) classification system but does not contain information on the indication of a given treatment. E.g., we know that the blood pressure-lowering related medication group represents many different treatment indications and is not only related to blood pressure-lowering therapy, which means this medication group is very heterogeneous. On the other hand, cholesterol-lowering therapy represents a much more homogeneous group.

All presented statistics are based on information from:

- 1) The National Causes of Deaths Register, all deaths in Denmark are registered and causes are assigned by ICD-10 codes.
- 2) The Danish National Patient Register, which holds information about all dates of admissions from Danish hospitals and diagnoses.
- 3) The Danish Register of Medicinal Product Statistics. (9)

Source: All figures have been drawn based on data extracted from the Danish Heart Foundation. HjerteTal.dk [Internet]. 2015 [cited 2016 Feb 14] (4) (Danish only).

Figure 1: Temporal trends in cardiovascular mortality. Age-standardized rates per 100,000 and total number of deaths.

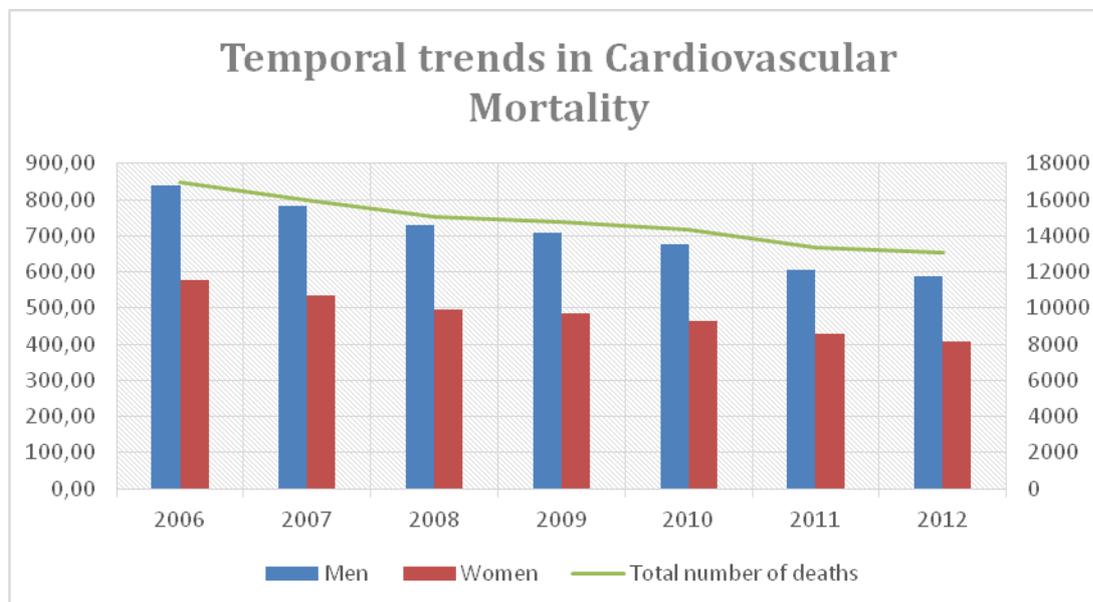


Figure 2: Temporal trends in ischemic heart disease mortality. Age-standardized rates per 100,000 and total number of deaths.

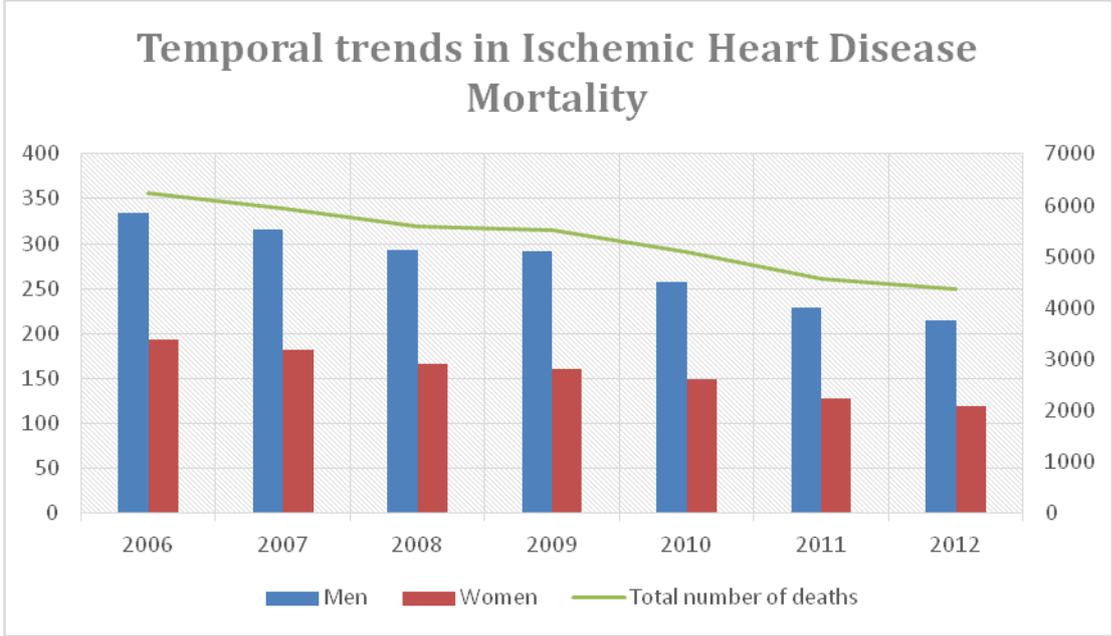


Figure 3: Temporal trends in stroke mortality. Age-standardized rates per 100,000 and total number of deaths.

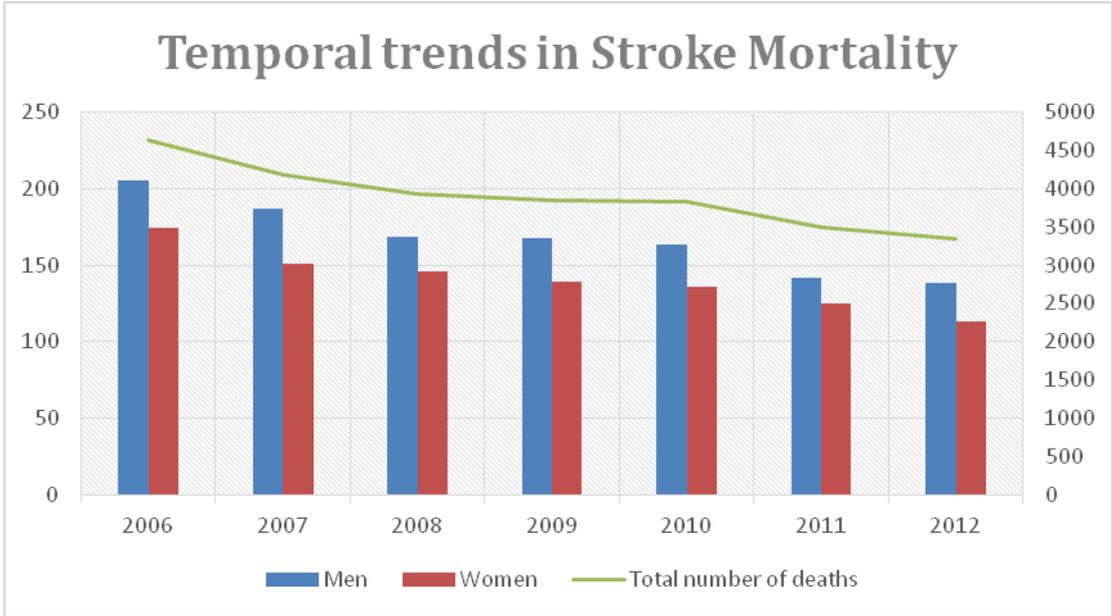


Figure 4: Prevalence and incidence of ischemic heart disease. Age-standardized rates per 100,000.

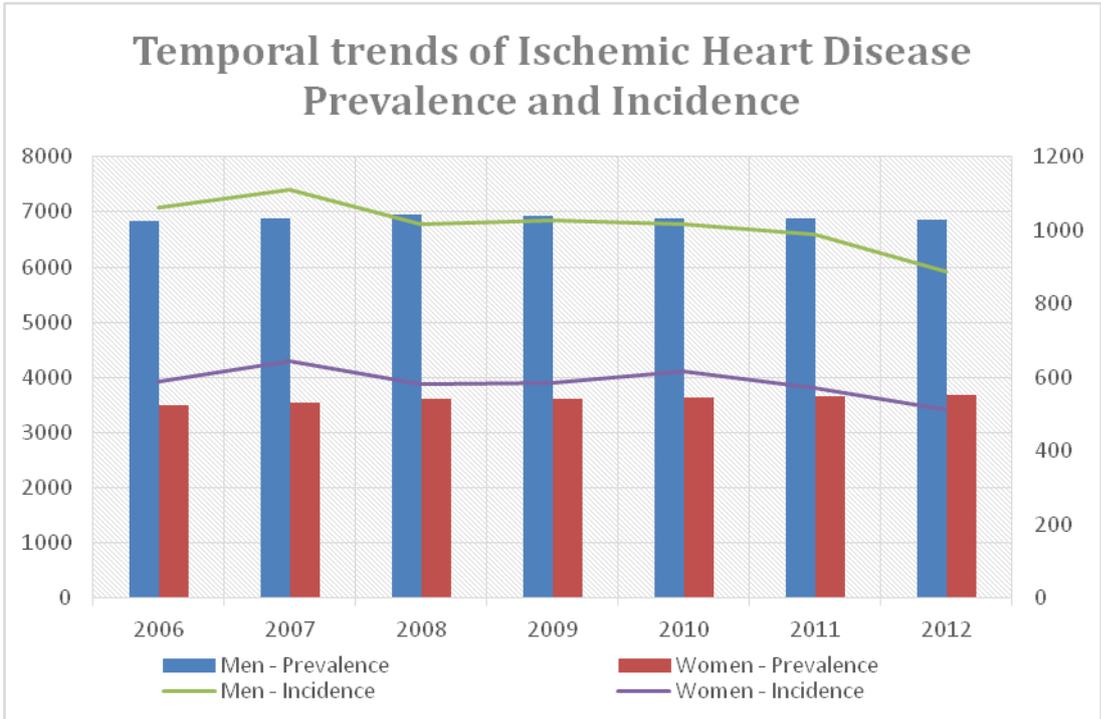


Figure 5: Prevalence and incidence of stroke. Age-standardized rates per 100,000.

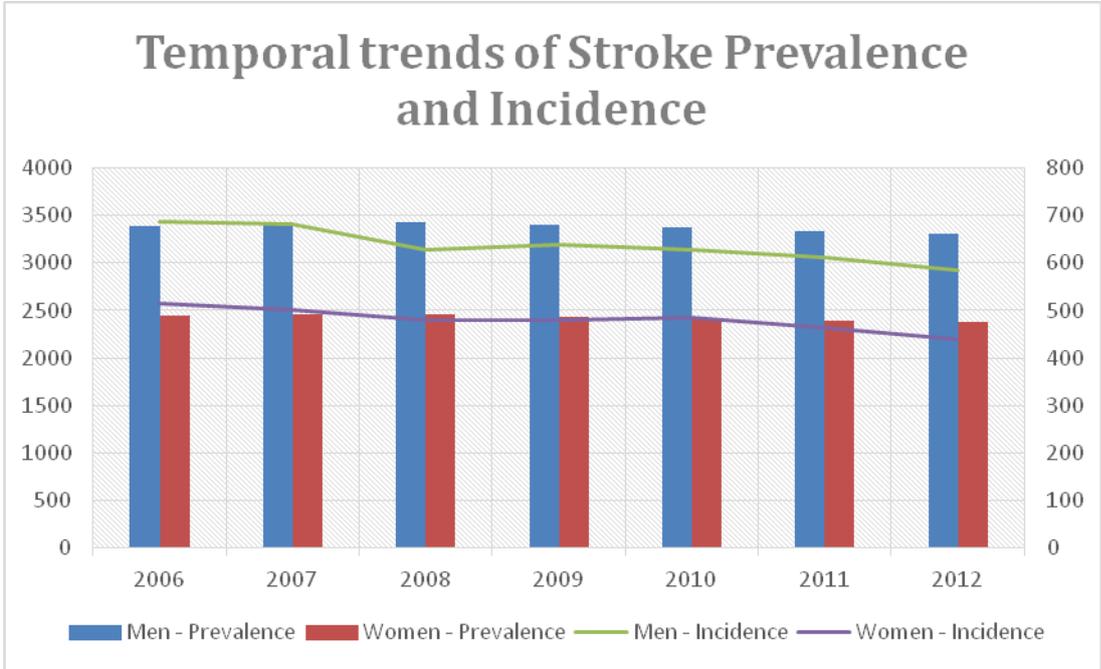


Figure 6: Prevalence and incidence of atrial fibrillation. Age-standardized rates per 100,000.

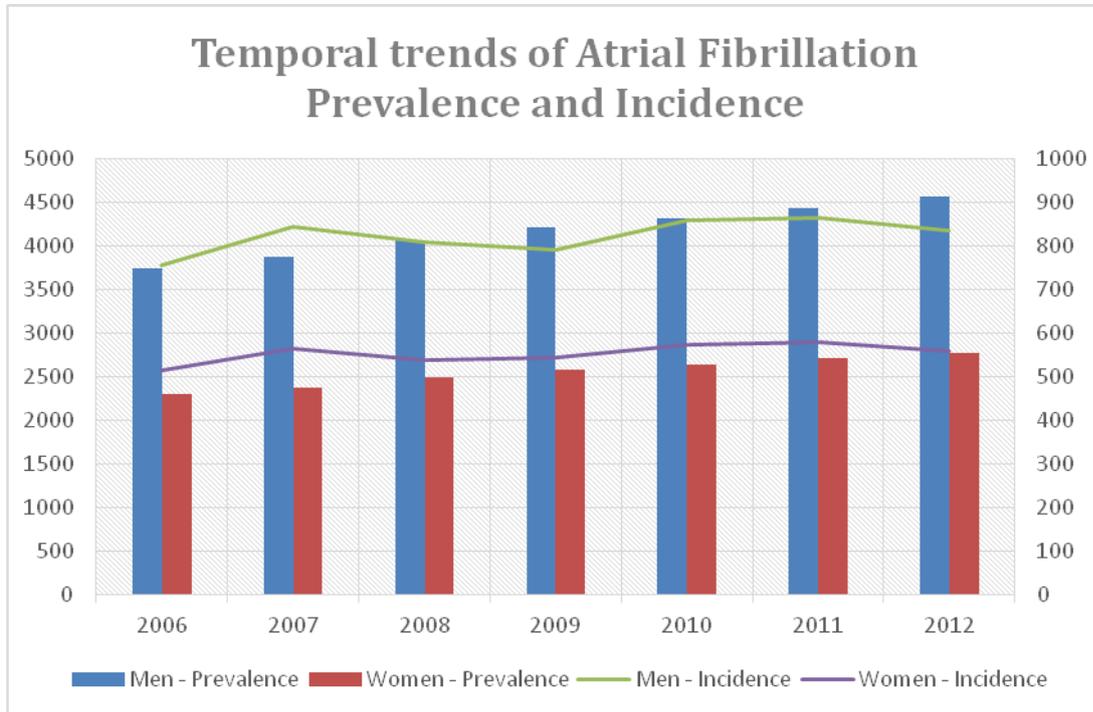


Figure 7: Prevalence and incidence of heart failure. Age-standardized rates per 100,000.

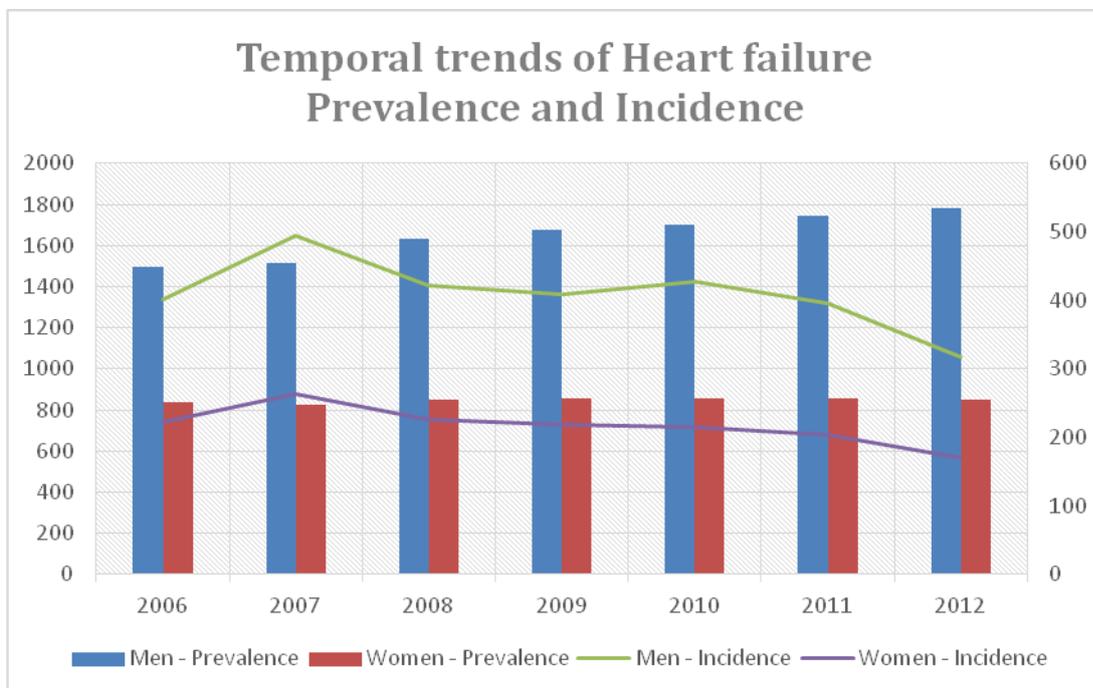


Figure 8: Educational level for individuals of 35-79 years of age and the prevalence of ischemic heart disease. Age-standardized rates per 100,000.

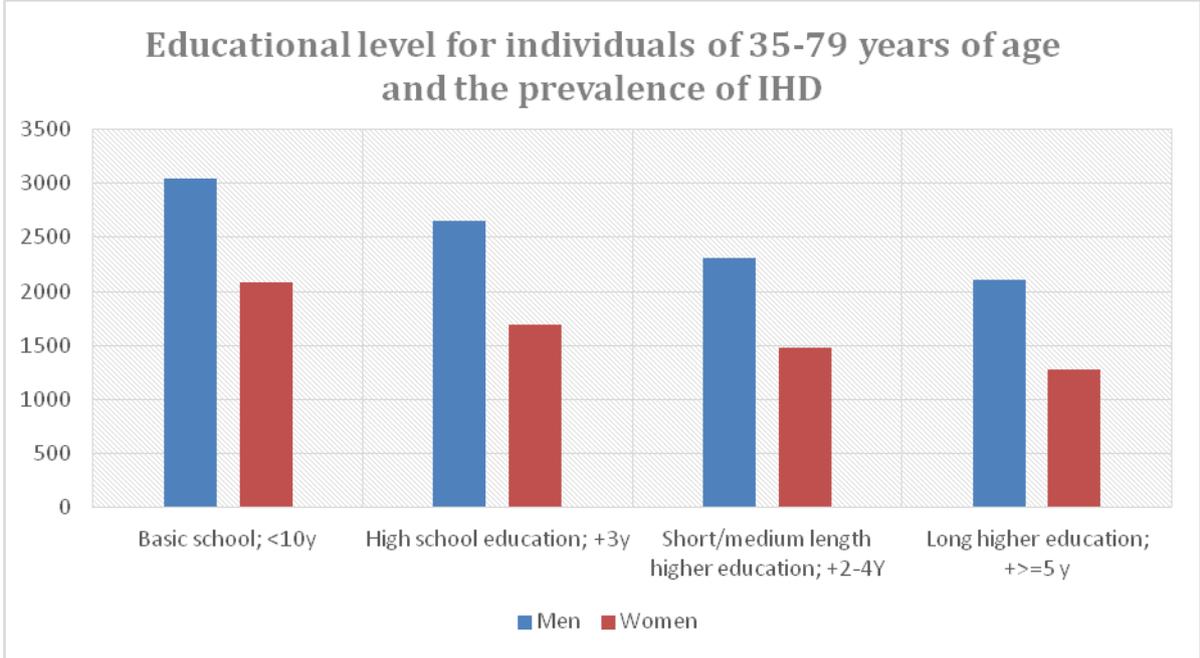


Figure 9: Temporal trends of the number of coronary angiography and revascularization procedures.

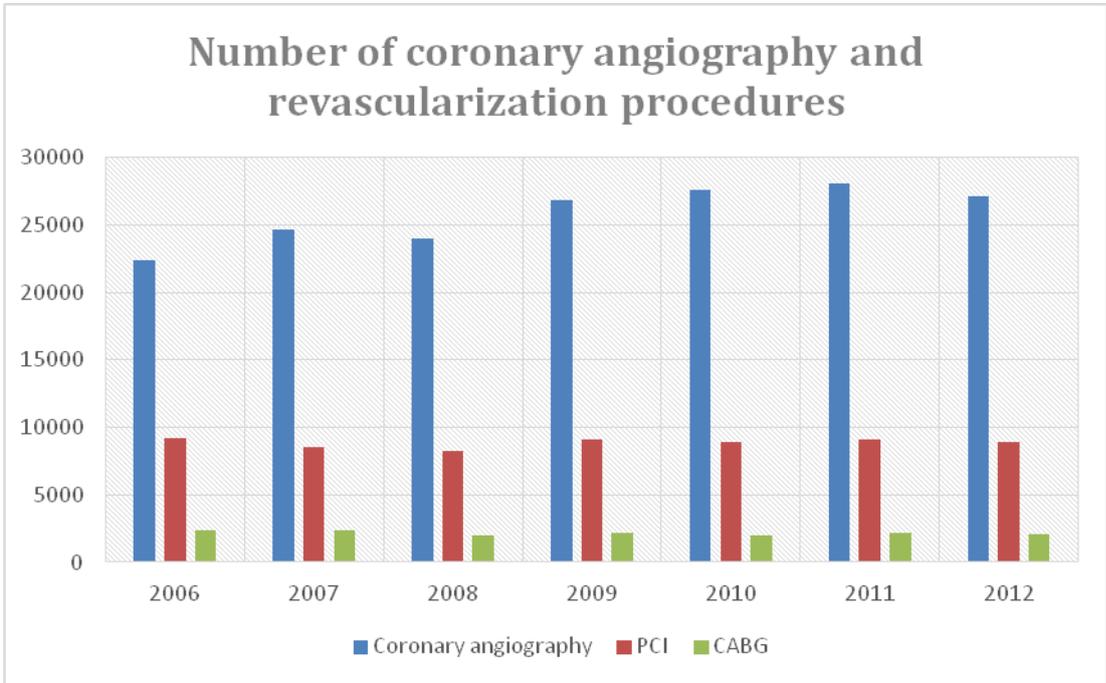
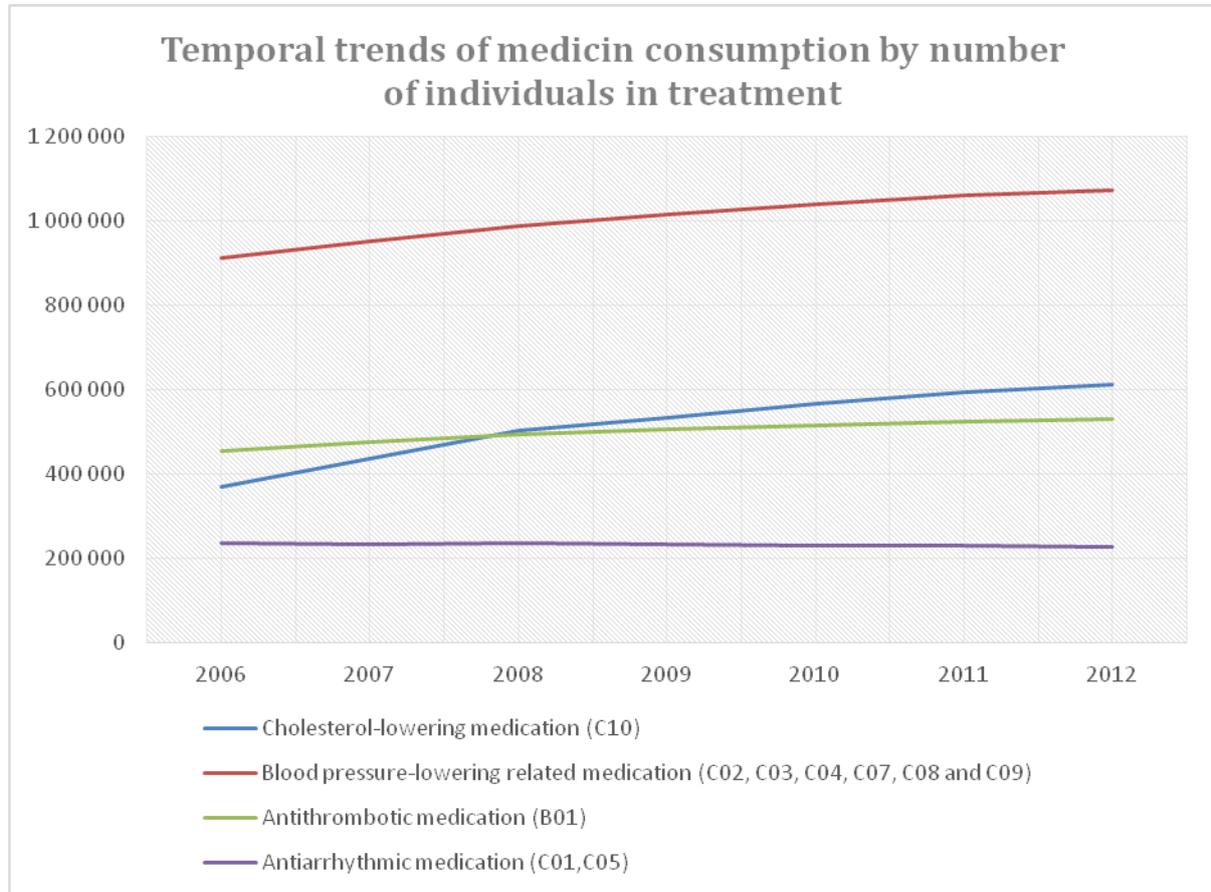


Figure 10: Temporal trends of pharmaceutical consumption by number of individuals in treatment



Risk factors

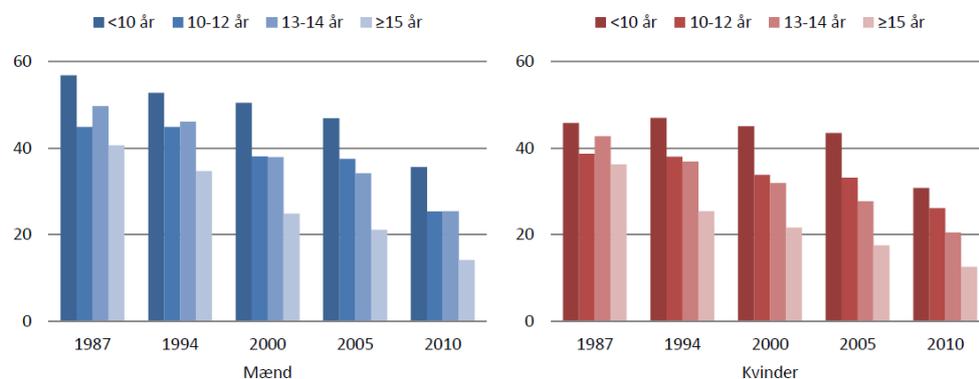
There has been a beneficial development in the prevalence of most, but not all, cardiovascular disease (CVD) risk factors in Denmark the last 30 to 40 years. Ongoing studies show that this overall decrease in risk factors may have greatly contributed to the dramatic fall in coronary heart disease (CHD) deaths in Denmark these last decades. Part of this trend may be explained by health promoting legislation, as Denmark was the first country in the world to ban the use of trans-fatty acids in the food industry (2003) and later also followed other European countries to promote a smoking ban in public areas (2007).

Although the trend has been positive for all socioeconomic classes there clearly are differences giving the most educated men and women a more beneficial development compared to the least educated.

Smoking

The proportion of smokers in Denmark has declined during the last decades (9). In 1987 half of the males and 42% of the females > 25 years old were smokers whereas the numbers were halved in 2010. The biggest declines in both absolute and relative numbers have been seen in the group of most educated men (40.6% to 14.1%) and

women (36.2% to 12.5%) whereas the declines, especially in relative terms, among the least educated were much smaller (from 56.8% to 35.6% in men and from 45.8% to 30.8% in women). Thus the social gradient has grown in this period.



Sundheds- og sygelighedsundersøgelserne 1987-2010

Source: Copy from SuSy project, Koch *et al.*, National Institute of Public Health, University of Southern Denmark.

The most recent survey indicates that there may be stagnation in this decline during the last few years (10).

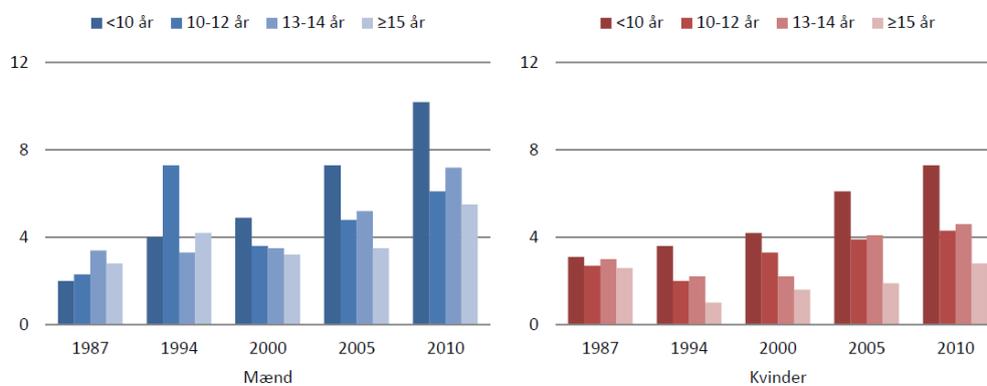
Hypertension

Data from the Copenhagen City Heart Study estimates that 1.1 MIO Danes have blood pressure ≥ 140 mmHg or that 1 of 5 Danes have high blood pressure. From 1976 to 2001 the untreated age-adjusted population blood pressure (BP) decreased 2.2 mmHg in women and 3.2 mmHg in men. Age and BMI were significant determinant factors in the decreasing population blood pressure. The blood pressure decrease was most marked in the younger generations. A social gradient was observed: women with high household income had lower BP than women with low household income. Among men there was no social gradient.

The proportion of treated individuals increased during the 25 years and in 2001 19.4% of women and 16.4 % of men were treated with antihypertensive medicine. In the treated part of the population mean BP decreased by nine mmHg indicating an improvement in treatment. It may also reflect the availability of guidelines and medicine, physicians' attitude towards hypertension treatment, systematic control, patient awareness and patient compliance. In 2001 the mean treated blood pressure was 148.7 mmHg. There were no gender differences but the older part of the treated population was not treated as aggressively as the younger individuals in the population. Individuals with ischemic heart disease were treated better than individuals with stroke or individuals with neither of the two diseases. Only 26% of treated hypertensives had BP below 140 mmHg. In reports from other epidemiological surveys the number of treated hypertensives with BP below target goal was higher.

Diabetes

Like in most other westernized countries the prevalence of diabetes mellitus (DM) in Denmark is increasing, mostly in men. In 2012 320,000 were registered with a diagnosis of diabetes and this is a doubling during the last 10 years. According to the International Diabetes Federation it is, however, estimated, that approximately another 40% have not been diagnosed so the real number may be over 500,000 (The Danish National Diabetes Register). Also in diabetes there is a negative social gradient that in relative numbers has grown the last 30 years (9). Thus, the prevalence of DM increased from 2.8% to 5.5% among the most educated men and from 2.0 to 10.2 among the least educated in the period from 1987 to 2010. In the same period the prevalence in women rose from 2.6% to 2.8% and from 3.1% to 7.3% among the most vs. least educated women, respectively.



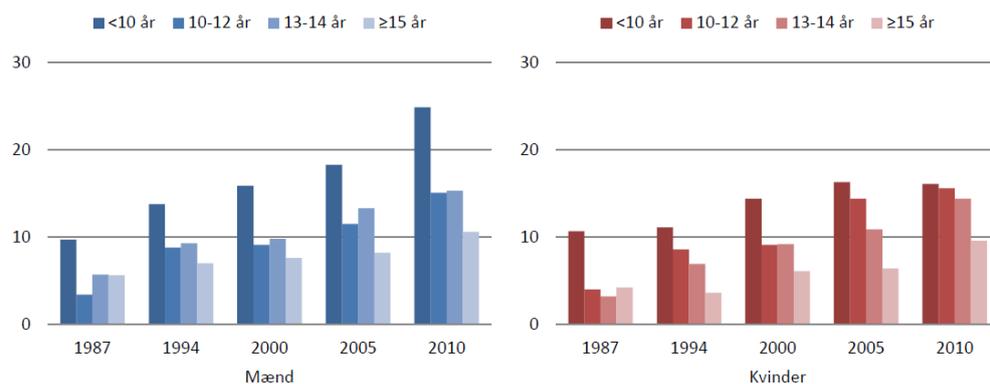
Sundheds- og sygelighedsundersøgelserne 1987-2010

Source: Copy from SuSy project, Koch *et al.*, National Institute of Public Health, University of Southern Denmark.

Physical inactivity and obesity

In national surveys (Sundhedsprofilen) from 2010 and 2013 it was found that approximately 15% of both men and women had a physical inactive sedentary lifestyle, but there were, however, substantial differences between the least educated (30%) and the highest educated (10%). Previous studies indicate that there is a trend towards a more physical active lifestyle during the last 20 years (MONICA III, Health 2006 and Copenhagen City Heart Studies).

Results from repeated surveys from 1987 to 2010 demonstrate that the prevalence of obesity ($BMI > 30 \text{ kg/m}^2$) has doubled from 7% to 13-25% (9). Also here there were great differences according to educational levels with an increase among the least educated men from 9.7% to 24.9% compared to 5.6% to 10.6 among the most educated, respectively. In women the difference was from 10.7% to 16.1% with the lowest education and from 4.2% to 9.6% in those with the highest education.



Sundheds- og sygelighedsundersøgelserne 1987-2010

Source: Copy from SuSy project, Koch *et al.*, National Institute of Public Health, University of Southern Denmark.

Diet

A report based on telephone interview and food frequency questionnaires compared consumption in Denmark 2004 to results from 1995, 1998 and 2001.

The results showed that from 1995 to 2004 substantial changes in food consumption occurred. There has been a significant increase in fruit and salad/shredded vegetables, and a decrease in bread, potatoes, vegetables, milk and meat as a main meal. The use of low fat milk (0.5% fat) has increased and a larger part of the population does not use any fat spread on bread. During the last three years, 2001-2004, the consumption of fruit and vegetables has hardly changed, while potatoes, bread and milk have continued to decrease (reductions of 5-10%). For meat as a main meal the trend has changed, from a steady downward trend in 1995-2001 to an increase (from an average 4.7 times/week in 2001 to 5.0 in 2004). "Mini-milk" (0.5% fat), which was introduced on the Danish market in 2000/2001, is now used by twice as many as in the 2001-survey (27% in 2004, 11% in 2001). Half of those, who do drink milk, now use either mini-milk or skimmed milk (0.1% fat). Almost half of the women (46%) and one third of the men (36%) do not use any fat spread on rye bread. That is twice as many as in 1995, but there has been no further increase in this proportion since 2001.

http://sundhedsstyrelsen.dk/publ/mer/2005/Befolkningens_foedevareforbrug2004_udg2_005.pdf (Danish only)

Hypercholesterolemia

The level of total cholesterol in the Danish population fell from 6.07 to 5.12 mmol/L based on population studies from 1991 and 2006/7 and also the prevalence of persons with hypercholesterolemia fell (MONICA III and Health 2006). There were no significant differences between socioeconomic groups. Some of these differences can be explained by statin treatment as the intake of statins has increased in the same period but it is estimated that the major cause may be change in health behavior. Here, the above mentioned ban of use of trans-fatty acids in the food industry may have contributed to this development.

A recent statement of statin use in Denmark shows that more than 600,000 persons are treated with statins, of these nearly 300,000 as secondary prophylaxis. Most of the persons in primary prophylaxis have other risk factors as DM or hypertension (Danish Health Authority).

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III. Main actors and Prevention methods

The **central government** legislates through the Danish Health Act and through laws such as the Act on Smoking and the Food Act. Besides law enforcement, the Danish government recently started to grant financial support to disease prevention projects through a bottom-up principle.

The **Danish Health Authority** advises the central government on health, disease and treatment and supervises the health care system.

The Danish **counties** govern and administer the health care system and are responsible for somatic and psychiatric treatment. They provide health plans, run public hospitals and organise home practice, including within specialised treatment. There are five counties in Denmark and each county prioritises independently and decides on service levels, within the boundaries of the Danish Health Act. <http://www.regioner.dk/> (Danish only)

The Danish **municipalities** are responsible for disease prevention and for providing a framework for a healthy lifestyle. In 2012, the Danish Health Authority issued recommendations for disease prevention in 11 different focus areas, with the aim to prioritise and develop the quality of prevention initiatives in the different municipalities. Amongst the main topics are alcohol use, physical activity, food and meals, mental health, overweight, drug use and smoking. There are 98 municipalities in Denmark and each municipality decides which areas to prioritise, how to implement the recommendations and the degree of service level, as long as the Danish Health Act is respected. The Centre for Prevention in Practice, under Local Government Denmark, the interest group and member authority of Danish municipalities, supports the municipalities in assuring knowledge-based and good quality prevention work. <http://www.kl.dk>

The **Committee for Heart Diseases** follows the development in the area of heart diseases, evaluates the need for new initiatives and advises the Danish Health Authority. <http://sundhedsstyrelsen.dk>

The **Danish National Institute of Public Health** aims to improve public health concerns through research, knowledge and education. The institute assists public authorities with research-based counseling within the field of public health. <http://www.si-folkesundhed.dk>

The Danish Society of Cardiology aims to improve theoretical knowledge and advancement of medical practice within cardiovascular disease. The society gathers its members through scientific meetings and organises trainings within the field of cardiology. In addition, the society advises health authorities on cardiology training. The organisation publishes national practice guidelines within cardiology, based on endorsement of the practice guidelines published by the [European Society of Cardiology](#). <http://www.cardio.dk/>

The Danish Heart Foundation is a non-governmental organisation that aims to improve health through research, prevention and patient support within cardiovascular disease. The Danish Heart Foundation is the largest single financial supporter of

cardiovascular research in Denmark with an annual donation of 25-50 million DKK to research. <https://www.hjerteforeningen.dk/>

There exists a range of **partnerships** in specific areas of disease prevention, between partners such as public institutions, interest groups, patient organisations, municipalities and industrial companies. Denmark currently has partnerships on e.g. reducing salt-intake, increasing whole grain-intake (<http://www.fuldkorn.dk>), diminishing psychological stress and increasing the use of the bike in everyday life (<http://www.tacyklen.dk>) (*Danish only*).

The caregivers in cardiovascular prevention are general practitioners and personnel in hospitals, in municipal rehabilitation and health centers and in home care. Children regularly receive health checks by health visitors. Patients can consult specialists only by referral from a general practitioner.

IV. Main Prevention activities

Several public health strategies and partnerships are involved in the effort to decrease and prevent the burden of cardiovascular disease in Denmark. In some cases, these initiatives are collaborations between public and private enterprises.

In 2012 the Danish Health Authority released 11 focus areas (“prevention packages”) which are recommendations in specific areas to be implemented across the 98 municipalities across Denmark for use in public schools, day care institutions, nursing homes, and other public areas (www.interventionsforskning.dk). These focus areas include recommendations for nutrition, physical activity, hygiene, sun protection, indoor climate, sexual health, mental health, tobacco, alcohol, obesity and use of drugs.

General guidelines also include requirements for basic knowledge and competencies in these areas for care providers, teachers, and other professionals working within the municipal sector (school, culture, health care, care giving etc.).

For cardiovascular disease prevention focus areas include:

Physical Activity: the current guidelines for primary prevention recommend 60 minutes of moderate to high intensity physical activity per day in age group 5-17 years and 30 minutes for adults. Guidelines include recommendations for implementation in the municipal sector ranging school as well as in day care facilities and nursing homes. An estimated 45% of the municipalities currently fulfill the goals for implementation, which is an improvement from 2013 where only 26% of the municipal sector had implemented these recommendations.

Tobacco: The area with the highest focus is tobacco prevention which includes, for instance, a total ban on smoking in public buildings, places of work, public transport, restaurants etc, smoking cessation courses, special courses for the young or pregnant etc. Minimum age for buying tobacco products is currently 18 years (since 2008). In addition, advertisements for tobacco products have been prohibited since 2001. An estimated 46% of the recommendations have been implemented in the public sector. Over the last 5 years two national campaigns (“Every cigarette harms”, 2011 and “Get help stop smoking”, 2015/2016) against smoking have aimed at increasing the number of smokers who quit tobacco, limit the number of young people who start smoking and reduce the numbers of ex-smokers who relapse.

As part of implementing the EU Directive 2014/40/EU on Tobacco Products, Denmark has recently adopted a law on the use of electronic cigarettes. The law imposes stricter safety requirements for the products and prohibits the sale to children under 18, but does not prohibit the use of e-cigarettes, neither with nor without nicotine.

Alcohol: The recommendations for alcohol include a maximum weekly consumption of 7 units for women and 14 units for men. The public sector supports the private sector in developing and implementing strategies for alcohol use, and is involved in health campaigns for the young, population groups at risk, and in cases of chronic alcohol addiction. An estimated 34% of the municipalities’ goals in the alcohol initiatives have been implemented in 2015.

Obesity: The recommendations pay special attention to prevent obesity in the young and adolescent. This is implemented by, for instance, introducing healthy meals and physical activity from early age, and throughout the educational system and daycare facilities. Also, health care providers counsel parents in nutrition and healthy lifestyle. An estimated 28% of the counties live up to the recommendations.

Nutrition is a focus area where successful partnerships between the private and public sector have been established. The Official Dietary Guidelines were renewed in 2013 and consists of 10 advices on healthy living with the message of

- 1) *eat a varied diet, not too much and live an active life;*
- 2) *eat fruit and vegetables;*
- 3) *eat more fish;*
- 4) *choose whole grain;*
- 5) *choose lean meat and cold cuts;*
- 6) *eat less saturated fat;*
- 7) *choose low fat dairy products*
- 8) *drink water;*
- 9) *eat less sugar;*
- 10) *eat less salt.*

The Danish Veterinary and Food Administration has launched the website www.altomkost.dk (all about nutrition) to promote official guidelines and information on nutrition and physical activity. The goals are supported by initiatives concerning e.g. labelling of foods.

The Danish Wholegrain Partnership

The Danish Wholegrain Partnership is a collaboration between the Danish Veterinary and Food Administration, The Danish Cancer Society, The Danish Heart Foundation, The Danish Diabetes Association and a range of food businesses, that work together to motivate the population to eat more whole grain. The Danish Veterinary and Food Administration recommend at least 75 grams of whole grain per day. Before the Danish Wholegrain Partnership was established in 2008, the population only consumed 36 grams of whole grain per day and 6% of the Danish population consumed the recommended daily amount. In 2014 the corresponding number had increased to 63 grams and 30% consumed the recommended daily amount.

Legislation on Trans-fatty acids

Denmark was the first country in the EU to introduce national rules for industrially produced trans-fat content. Since 2004, oils and fat products, including those in pre-processed food, can maximum contain 2% (g/g) industrially produced trans-fat. The Danish law has resulted in a large reduction of trans-fat content in pre-processed food. In 2003 26% of food products contained too much trans-fat, which fell to 6% of food products in 2014. The content of trans-fat in food products in Denmark is now so low that it is considered of no risk for health.

In a recent report, the EU-commission, recommends common regulation of trans-fatty acids in food products. The report concludes that high intake of trans-fatty acids

significantly increases the risk of cardiovascular disease and that trans-fat does so more than any other nutrient per calorie. Denmark has, together with a handful of other EU-countries, invited the EU-commission to regulate on a European level.

Another EU report documents that taxes on 'unhealthy' food, such as for example food with high content of sugar, fat or salt, reduces intake of such products. In 2011 Denmark introduced tax on food with saturated fat. The law resulted in a reduced intake of butter, margarine and oil in the Danish population. The law was, however abolished in 2012 together with an admonition of the Danish existing sugar-tax.

V. Organisation of cardiac rehabilitation in Denmark

In Denmark, cardiac rehabilitation (CR) is recommended as integrated care with individually planned and coherent rehabilitation across sectors from hospital to municipal. Cardiac rehabilitation in Denmark is divided into three phases. Phase I takes place during hospitalisation. Phase II refers to the initial 8-12 weeks outpatient CR, and includes the period from hospital discharge until an acceptable level of daily functioning is achieved. Phase III includes follow-up and maintenance in the primary sector.

Denmark is divided into 5 administrative counties; within these, in total 34 hospitals offer CR. Each county contains a number of municipalities. In 2007, a Danish structural reform committed the municipalities to become the principal responsible for rehabilitation, including services for cardiac patients, in close cooperation with the treating hospital. Regarding patients with ischemic heart disease, referral to CR is considered established systematically at 97% of the hospitals. Accordingly, 94% of the hospitals provide an individually tailored CR programme.

Additionally, CR is indicated for a number of patients based on other cardiac diseases, such as heart failure (estimated 3,600 individuals with treatment in progress in 2014) and heart valve disease. Patients with other heart diseases are not systematically referred to CR programmes but initiatives are being taken to build up systems for patients with atrial fibrillation with focus on education.

In 2013, it was estimated that >13,000 (13,204) patients were potentially eligible for CR due to ischemic heart disease. Participation rates for CR for these patients were overall 73.5%. The percentage of patients participating in physical activity was 52.8%, in psycho-education 63.6%, in dietary advice 20.2% and 26.1% were examined by a physician. Previous Danish studies have shown that patients with lower socioeconomic status attended to a lesser degree in CR. In a recent study (unpublished data from Graversen *et al.*) these results are confirmed but it is possible that this trend is explained by differences in comorbidity. There were no gender differences in neither information about or participation rate in CR.

Participation rates for patients with heart failure were the following in 2013-2014; 34% participated in physical activity, 88% received psycho-education, 95% had an echocardiography performed, and 93% had NYHA classification.

Coverage of CR programmes for patients after heart valve surgery in 2014 was high (73%), with national programme variation. The overall uptake rate was 52%.

The content of CR programmes

In 2013, a National Clinical Guideline was published in Denmark by the Danish Health Authority supported by the Danish Society of Cardiology. According to the national clinical guidelines, CR independently of delivery by hospital or municipality comprises a comprehensive programme including:

- Individual needs assessment and referral to cardiac rehabilitation
- Assessment of physical functioning (e.g., cardiopulmonary exercise testing, symptom limited test on bicycle ergometer or treadmill, 6 minute walking test)
- Physical exercise (including aerobic exercise, interval training and strength exercises)
- Psycho-education: information and education for patients and relatives regarding the disease, medication etc.
- Dietary screening and intervention where indicated (e.g., weight loss)
- Smoking cessation
- Risk factor screening and management (dyslipidemia, hypertension, diabetes)
- Assessment of psychosocial conditions including screening for clinically relevant anxiety and depression, and other social conditions with possible influence on treatment and compliance (e.g., drug or alcohol abuse and psychiatric problems)
- Screening for return to work and occupational rehabilitation

Phase II CR at the Danish hospitals fulfill the recommended elements such as systematic referral (97%), individually tailored programme (94%), physical exercise (100%), smoking cessation (94%), psychosocial support (94%), psychoeducation and patient education (94%), dietary advice and treatment by dietitian (97%), and risk-factor control and modulation (92%).

97% of the hospitals provide disease specific education for patients with ischemic heart disease. In approximately 50% of the hospitals, physical exercise is provided partially or fully by the municipality, However; only 53% offer physical exercise programs 12 weeks twice weekly as recommended in the national guidelines.

Initiation of CR

Depending on the cardiac condition, physical exercise and needs assessment, CR is typically initiated 4-12 weeks after discharge. Before planning an individually tailored physical exercise programme the national guideline recommend that the physical capacity should be assessed, such as a symptom limited treadmill test, performed by specially trained personnel (physiotherapist, nurse, lab technician) supervised by a physician.

Indications for CR and populations

The national guidelines recommend that patients with ischemic heart disease (myocardial infarction, angina pectoris, after CABG and PCI), heart failure, and those after heart valve surgery are systematically referred to CR. A rehabilitation plan is regulatory, and performed at hospital discharge.

Ischemic heart disease

Patients with acute coronary syndrome can commence physical exercise one week after revascularization with PCI. Assessment of patients without full revascularization by a cardiologist before initiation of a physical exercise programme is mandatory. After CABG, physical exercise can be initiated after 4-6 weeks, due to the sternotomy.

Heart failure

Patients with heart failure should commence CR within 12 weeks after hospitalisation or treatment in the outpatient clinic. It is recommended that patients with left ventricular ejection fraction (LVEF) $\leq 40\%$ initiate individualised supervised physical exercise at latest 12 weeks after hospitalisation, and receive an individualised education programme including information about diet, physical exercise, symptoms, medication, disease awareness and risk factors within 12 weeks after first outpatient visit or hospitalisation. However, physical exercise should only be initiated in clinically stable patients in NYHA (New York Heart Association Functional Classification) class II-III, with optimal medical treatment during at least 3 weeks no symptoms. In general, physical exercise is not encouraged in patients with heart failure in NYHA class IV.

Patients after heart valve surgery

It is recommended that patients after valve surgery initiate physical exercise 4-6 weeks after the procedure, in order to ensure optimal recovery of the sternotomy. Generally, it is considered good clinical practice that patients after valve surgery receive psychoeducation, dietary intervention, smoking cessation information, despite lack of evidence on the effect of CR for this patient group. The national guideline invites specific research within the field of CR following heart valve surgery.

Atrial Fibrillation

Systematic referral to cardiac rehabilitation for patients with atrial fibrillation or after radiofrequency ablation is not implemented. However, in the event of psychological problems, and loss of functioning, CR should be considered. Currently, establishment of atrial fibrillation clinics is under process (see below) and research in exercise training aimed at atrial fibrillation patients is conducted in some centers in Denmark.

Organisation in clinics

Phase II rehabilitation

Phase II CR at hospitals is organised as an intersectional programme with a multidisciplinary approach including a physician, nurse, physiotherapist, dietitian, and smoke-cessation instructor. The hospital based programme is supervised by a cardiologist. Full information on organization of phase II rehabilitation at municipality level in Denmark is not yet available.

Heart failure clinics

The establishment of heart failure clinics managing congestive heart failure are established throughout Denmark, and appear efficient in terms of therapy optimisation and decline in heart-failure related readmissions. Heart failure clinics offer an integrated approach with education, control of fluid retention, and titration of medication.

It is recommended that an echocardiography is performed at least 6 months before and at latest 7 days after hospitalisation/initiation of an out-patient course. NYHA classification should be conducted within 12 weeks of the treatment period, and relevant heart failure medication for patients with systolic heart failure (LVEF \leq 40%) with ACE-inhibitor/AT2-receptor-antagonist should be prescribed at latest 8 weeks after the first out-patient visit. If LVEF \leq 35 % beta-blocker should be offered at latest 12 weeks after hospitalization/first outpatient visit if tolerated

Atrial fibrillation clinics

Inspired from other European countries, since 2011 the number of atrial fibrillation clinics are increasing in Denmark. The purpose of these new clinics is to ensure a better and more optimal treatment for the more than 100,000 Danes suffering from atrial fibrillation, through examination, guidance and education. Nurse-led atrial fibrillation clinics have shown to reduce the number of readmissions and the risk of stroke and death from cardiovascular disease.

Registration, databases and quality assurance

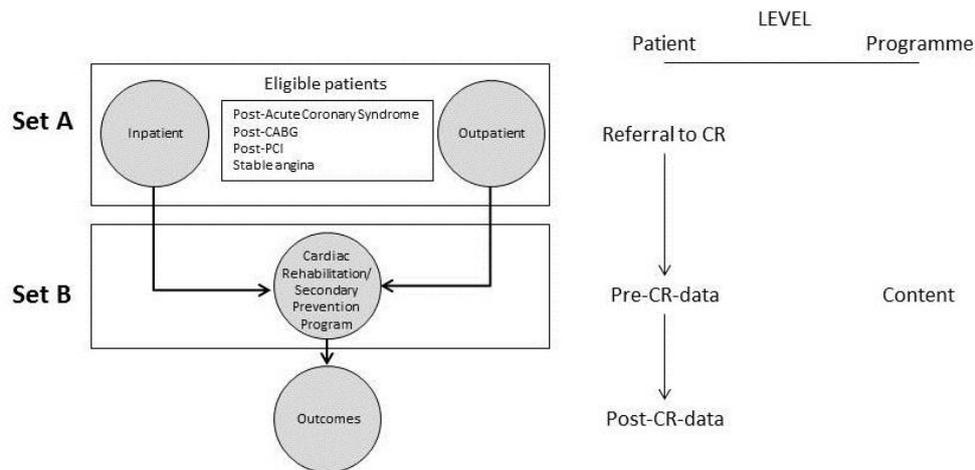
Denmark has 2 databases specifically on cardiac rehabilitation services: The Danish Cardiac Rehabilitation Database (DHRD) and The Danish Heart Failure Database (DHFD).

The Danish Cardiac Rehabilitation Database

DHRD is a web-based clinical quality database aiming towards higher quality in CR for patients with coronary heart disease in Denmark (<http://www.kcks-vest.dk/kliniske-kvalitetsdatabaser/hjerterehabilitering/>). Registration of data into the DHRD began in August 2015. The DHRD was initiated by the national working group on preventive cardiology and rehabilitation under the Danish Society of Cardiology and was approved as a national clinical quality registry on CR by the Danish Health and Medicines Authority in 2011. The DHRD is supported by the cross-disciplinary professional associations: the Danish Society of Cardiology, the Danish Nurses' Organization, the Association of Danish Physiotherapists and the Danish Association of Clinical Dietitians.

DHRD systematically monitors quality of CR provision across programs and over time. Data can be assessed as part of research related to outcome and organisation of CR. It is regulatory for all hospitals offering CR to report data to the database. Data are collected every third year using electronic questionnaire for the personnel responsible for conducting CR (physicians, nurses, physiotherapists, dietitians), and only includes rehabilitation activities at hospital delivering phase II CR. The database collects and monitors the offered CR programmes in order to the national clinical recommendations

for CR from The Danish National Board of Health. National audits compare quality of CR over time and between hospitals to stimulate quality improvement.



Abbreviations: CR, cardiac rehabilitation; CABG, coronary artery bypass grafting; PCI, percutaneous coronary intervention.

Source: AD Zwisler *et al.* The Danish Cardiac Rehabilitation Database. Submitted.

The Danish Heart Failure Database

The database collects data regarding 7 indicators for patients diagnosed with heart failure for the first time. The data improves and monitors quality in the treatment and care of all patients in Denmark with heart failure. The database is nationwide and has been active since 2003.

The Danish Atrial fibrillation Database

A new database concerning the treatment of atrial fibrillation is being prepared and is expected to be finally established and implemented by the end of 2016. As for the other two quality databases mentioned above this is a nationwide database with the purpose to monitor and improve the treatment and follow-up for patients with atrial fibrillation. The database will include data from all patients with atrial fibrillation with contact to a hospital (department or outdoor clinic) or a general practitioner. Data will be collected through administrative registers and is planned to include 11 indicators with information of examinations, pharmacological treatment and education.

Network activities, research and translation into clinical practice

A working group on Preventive Cardiology and Rehabilitation is established under the Danish Society of Cardiology, and several networks within cardiac rehabilitation for multidisciplinary teams are being established, such as regional networks for nurses and regional networks for physiotherapists within CR. Over the past decade several professorships in prevention, rehabilitation and cardiac rehabilitation have been created at the Danish universities (Copenhagen University, University of Southern Denmark, University of Aarhus and University of Aalborg), and cardiac rehabilitation is increasingly being focus of research as well as educational pre- and post-graduate activities. Recently, a national knowledge center for rehabilitation and palliation has been

established to ensure translation of evidence into clinical practice to the benefit of patients and society.

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VI. The Future

Needs

Primary preventive measures and policy making aimed at decreasing the burden of cardiovascular disease in Denmark have been successful. There has been a decrease in the incidence of cardiovascular disease, which is, although still highly prevalent, no longer the leading cause of death in Denmark. There are, however, still areas that need particular attention. The Danish Society of Cardiology and The Danish Heart Foundation propose three targets for prevention:

- 1) tobacco smoking, with particular focus on young individuals
- 2) social inequality in health
- 3) obesity and diabetes

Possibilities

Regulations on tobacco consumption have so far been effective and there has been a change in public opinion; but there is still a great potential for further reduction. We propose further structural initiatives to limit access to tobacco including increase in retail price, generic packaging of tobacco products, further restrictions on public smoking and higher legal age of purchasing tobacco. We specifically aim to reduce tobacco consumption by 25% in 2025.

Strategies to address socioeconomic disparities in health are needed and should be implemented early. Public awareness on healthy lifestyle should be raised through promotion of daily physical activity and facilitation of healthy nutritional choices for everyone. This should be implemented by focused efforts throughout the educational system and structural interventions.

Obstacles

Although risk modification through policy making has proven successful, further changes require support by political decision makers and the public opinion. The social gradient and stagnation in health outcomes in the lower socioeconomic strata pose a particular challenge.

Plans

The Danish Society of Cardiology and The Danish Heart Foundation will continue to work together to prevent the development of cardiovascular disease in Denmark through public information, research, development of national guidelines, and by influencing policy makers. We have identified three areas which require increased focus in the coming years in order to continue the progress in preventing cardiovascular disease in Denmark and in future generations.