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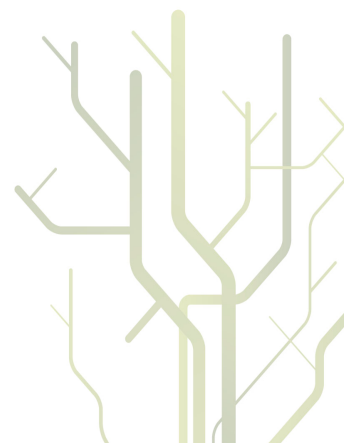
**FACULTY OF HEALTH SCIENCES  
DEPARTMENT OF COMMUNITY MEDICINE**

**INCIDENCE AND RISK FACTORS FOR TYPE 2 DIABETES  
IN A GENERAL POPULATION. The Tromsø Study.**



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## Contents

|   |    |
|---|----|
| Acknowledgements .....  | 3  |
| List of papers .....  | 5  |
| Abbreviations .....   | 6  |
| Introduction .....  | 7  |
| <i>Background</i> .....   | 7  |
| <i>Epidemiology of type 2 diabetes</i> .....                      | 8  |
| <i>Aetiology of type 2 diabetes</i> .....                         | 8  |
| <i>Risk factors for type 2 diabetes</i> .....                     | 9  |
| <i>BMI</i> .....  | 9  |
| <i>Lipids</i> .....   | 10 |
| <i>Hypertension</i> .....   | 10 |
| <i>Smoking</i> .....  | 11 |
| <i>Physical inactivity</i> .....                                  | 12 |
| <i>Low education</i> .....  | 13 |
| <i>Dietary pattern</i> .....                                      | 13 |
| <i>Genetics</i> .....   | 14 |
| <i>Risk scores for type 2 diabetes</i> .....                      | 15 |
| Aims of the thesis .....  | 17 |
| Material and methods .....  | 18 |
| <i>Study design</i> .....   | 18 |
| <i>Study population</i> .....                                     | 18 |
| <i>Data from questionnaire and examinations</i> .....             | 19 |
| <i>Registration of exposure variables</i> .....                   | 21 |
| <i>Follow up and case identification of type 2 diabetes</i> ..... | 23 |
| <i>Statistical analysis</i> .....                                 | 23 |
| Main results .....  | 25 |
| General discussion .....  | 27 |
| <i>Methodological considerations</i> .....                        | 27 |
| Validity .....  | 27 |
| <i>Random error</i> .....   | 27 |
| Systematic errors (bias and confounding) .....                    | 28 |
| <i>Selection bias</i> .....                                       | 28 |
| <i>Information bias</i> .....                                     | 29 |
| <i>Confounding and interaction</i> .....                          | 30 |
| External validity .....   | 31 |
| Implications for public health practice .....                     | 32 |
| Conclusions .....   | 33 |
| Further research .....  | 33 |
| Erratum .....   | 35 |
| References .....  | 36 |
| Papers I-III  |    |
| Appendix A-D  |    |

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## List of papers

This thesis based on the following papers, referred to in the text with their Roman numerals;

- I. Josepha Joseph, Johan Svartberg, Inger Njølstad, Henrik Schirmer. Incidence of and risk factors for type 2 diabetes in a general population. The Tromsø Study. *Scand J of Public Health*, 2010;38 (7):768-775.
- II. Josepha Joseph, Johan Svartberg, Inger Njølstad, Henrik Schirmer. Change in cardiovascular risk factors in relation to diabetes status. The Tromsø Study. Manuscript (Submitted).
- III. Josepha Joseph, Johan Svartberg, Inger Njølstad, Henrik Schirmer. Risk factors of type 2 diabetes in groups stratified according to Metabolic Syndrome. A 10-year follow-up of The Tromsø Study. *European J Epidemiology* 2010 Dec 28<sup>th</sup> online.

## Abbreviations

|                   |                                      |
|-------------------|--------------------------------------|
| BMI               | Body Mass Index                      |
| CVD               | Cardiovascular Disease               |
| CI                | Confidence Interval                  |
| CV                | Coefficient of Variation             |
| HDL               | High Density Lipoprotein             |
| HbA <sub>1c</sub> | Glycated Haemoglobin A <sub>1c</sub> |
| HR                | Hazard Ratio                         |
| LDL               | Low Density Lipoprotein              |
| LTPA              | Leisure-Time Physical Activity       |
| PH                | Proportional Hazard                  |
| RR                | Relative Risk                        |
| ROC               | Receiver Operating Characteristics   |
| SD                | Standard Deviation                   |
| TC                | Total Cholesterol                    |
| VIF               | Variation Inflation Factor           |
| WHO               | World Health Organization            |

## **Introduction**

### ***Background***

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces (1). There are mainly two types of diabetes; Type 1 diabetes is immune-mediated and requires daily administration of insulin. The other common type is type 2 diabetes and characterized by insulin resistance or relative insulin deficiency (1,2). Type 2 diabetes is the most common form and comprises of 90% of people with diabetes around the world (1). The prevalence of type 2 diabetes rates continue to increase with increasing number of patients at risk of serious diabetes-related complications. Having type 2 diabetes increase the risk of a myocardial infarction two times and the risk of suffering a stroke two to four times. It is also a leading cause of blindness, limb amputation and kidney failure (1,3-5). Although trials of secondary prevention after myocardial infarction show as good or better short term effect of interventions in patients with diabetes as in patients without, patients with diabetes have not had a similar reduction in longer-term case fatality rates of cardiovascular disease (CVD) (6). Population based studies of CVD risk factor trends among subjects with and without diabetes show differing trend in disfavour of those with diabetes (7). Studies of adherence to guidelines for CVD prevention targets in patients with diabetes in general practice have shown that only 13% reach all the targets (8). Previous studies have found appropriate lifestyle intervention and/or drug treatment are effective in delaying or preventing both diabetes and its complications (9-12). Accordingly, simple, sensitive and acceptable tools for identification of subjects at risk are warranted.

### ***Epidemiology of type 2 diabetes***

The world prevalence of diabetes in 2010 among adults aged 20-79 years is estimated to 6.4%, affecting 285 millions adults (13). Between 2010 and 2030, there is an expected 70% increase in numbers of adults with diabetes in developing countries and a 20% increase in developed countries (13). Each year more than 231,000 people in the United states and more than 3,96 million people worldwide die from diabetes and its complications (2). This number is expected to increase by more than 50 percent over next decade (1). Estimated global healthcare expenditures to treat and prevent diabetes and its complications is at least 376 billion US Dollar (USD) in 2010. By 2030, this number is projected to exceed some 490 billion USD (14). These costs are mainly due to treatment of concomitant CVD (15). It has been shown in several studies that a clustering of features, such as high plasma glucose, obesity, dyslipidemia (high triglyceride and total cholesterol levels low high density lipoprotein (HDL) cholesterol levels and hypertension, referred to as insulin resistance or the metabolic syndrome, is a marker of increased risk for the development of type 2 diabetes as well as for CVD (16,17). Environmental and lifestyle factors are the main causes of the dramatic increase in type 2 diabetes prevalence (18-20). Genetic factors probably identify those most vulnerable to these changes. Further more, studies have shown certain ethnic groups to be more susceptible to developing diabetes than others (21,22).

### ***Aetiology of type 2 diabetes***

Type 2 diabetes results from an imbalance between insulin sensitivity and insulin secretion. Both longitudinal and cross-sectional studies have demonstrated that the earliest detectable abnormality in type 2 diabetes is an impairment of the body's ability to respond to insulin. Impaired insulin action is observed in several tissues e.g., skeletal muscle, adipose tissue and the liver. It leads to increased insulin secretion from the pancreas to overcome impaired insulin action. Compensatory hyperinsulinemia maintains glucose level within normal



range, but in individual at high risk of developing diabetes, beta cells function eventually declines and leads to the development of impaired glucose tolerance and eventually overt diabetes mellitus (23-25).

### ***Risk factors for type 2 diabetes***

Many studies have elaborated the associations between several risk factors and the risk of type 2 diabetes. Body mass index (BMI), lipids, hypertension, smoking, physical inactivity, low education, dietary patterns, family history, and recently also specific genes are the most frequently documented risk factors for type 2 diabetes (26-32).

### ***BMI***

Many longitudinal studies have reported that increased BMI is a strong risk factor for type 2 diabetes (27,33-36). A strong positive association between obesity and type 2 diabetes is found both in men (33,36-38), and women (27,33,36,39). Obesity is associated with increased risk of developing insulin resistance and type 2 diabetes. In obese individuals adipose tissue releases increased amounts of non-esterified fatty acids, glycerol, hormones, pro-inflammatory cytokines and other factors involved in the development of insulin resistance. When insulin resistance is accompanied by dysfunction of the beta cells, the following fall in insulin secretion results in failure to control blood glucose level leading to type 2 diabetes. Many genes interact with the environment leading to obesity and in some also to diabetes. Many genes have been shown to be involved in determining the whole range of BMI in a population, with each gene only explaining a few hundred grams difference in body weight (40). Genes responsible for obesity and insulin resistance interact with environmental factors such as increased fat/ calorie intake and decreased physical activity resulting in the development of obesity and insulin resistance followed ultimately by the development of type 2 diabetes (41,42).

## ***Lipids***

Unfavourable blood lipids has been reported as a risk factor for type 2 diabetes by several prospective studies (27,28,33,35,36,43). An inverse relationship between HDL cholesterol and risk of type 2 diabetes have been documented in several of these (27,28,35,43). Some prospective studies found low HDL cholesterol to be a stronger risk factor for type 2 diabetes in women only (35,44). Only one previous study measuring non-fasting triglycerides found an independent risk of type 2 diabetes connected to elevated triglyceride levels (36). High plasma triglycerides and low plasma HDL cholesterol levels are both seen in the insulin resistance syndrome, which is a prediabetic state (16,17), suggesting that non-fasting triglycerides and HDL cholesterol levels reflect the degree of insulin resistance. The mechanisms suggested are increased circulating levels of free fatty acids due to increased insulin levels and increased chylomicron-assembly and secretion in the gut, the latter process being a result of localized insulin resistance in the intestine. Cross sectional studies have shown that high BMI is associated with a higher level of total cholesterol and unfavourable lipids pattern, with low concentrations of HDL cholesterol and high triglycerides concentrations (45-47). Longitudinal studies have shown BMI change over time to be positively associated with changes in total cholesterol, triglycerides, and low density lipoprotein (LDL) cholesterol and negatively associated with HDL cholesterol change (48,49). Apart from triglycerides, all these lipids have been shown to convey diabetes risk independently of BMI, but how they interact have been little studied.

## ***Hypertension***

Previous prospective and case control studies have shown that hypertension progression is an independent predictor of type 2 diabetes (34,50-52). Several possible factors are likely causes of the association between type 2 diabetes and hypertension. Endothelial dysfunction could be one of the common pathophysiological pathways explaining the strong association

between blood pressure and incident type 2 diabetes. Studies have shown that markers of endothelial dysfunction are associated with new-onset of diabetes (53,54), and endothelial dysfunction is closely related to blood pressure and hypertension (55). Markers of inflammation such as C-reactive protein have been consistently related to incident of type 2 diabetes (56), and to increasing blood pressure levels (57), suggesting that inflammation might be another explanatory factor for the association between blood pressure, the metabolic syndrome, and incident type 2 diabetes (58). Finally, insulin resistance could be another potential link between blood pressure levels and the incidence of type 2 diabetes (59). In addition evidence from cross sectional and cohort studies suggests a strong relation between blood pressure and BMI and risk of type 2 diabetes (46-48,60). Although studies show that blood pressure increases with increasing BMI, the risk of type 2 diabetes associated with hypertension is independent of BMI and BMI change. A causal relationship between hypertension and type 2 diabetes is further strengthened by a recent randomized clinical trial study showing a 14% reduction of risk of diabetes in subjects with glucose intolerance by allocation to 5 year treatment with valsartan, an angiotensin II blocker with antihypertensive properties (61).

### ***Smoking***

Several prospective studies reported that current smoking is a risk factor for developing type 2 diabetes (19,62-65). Recently, a meta- analysis including 25 prospective studies showed that current smoking was associated with a 44% increased risk of diabetes (66). The association between smoking and type 2 diabetes was stronger for heavy smokers  $\geq 20$  cigarettes/day compared with light smokers or former smokers (66-68). In addition some studies found an increased risk of type 2 diabetes the first 2-3 years after smoking cessation (62,63), with a risk in the ARIC study equalling the

smokers first after 12 years (63). Smoking leads to insulin resistance and inadequate compensatory insulin secretion response (69-71). This could be due to a direct effect of nicotinic or other components of cigarette smoke on beta cells of the pancreas as suggested by the association of cigarette smoking with chronic pancreatitis and pancreatic cancer (72). Also, some studies suggest that heavy smokers with evidence of increased systemic inflammation who gain substantial in weight after quitting, are at high risk of developing type 2 diabetes (63,73). However over longer follow up, smoking cessation is associated with a reduction in risk of developing type 2 diabetes (74).

### ***Physical inactivity***

Longitudinal studies have found physical inactivity to be a strong risk factor for type 2 diabetes (36,75-78). Prolonged television watching as a surrogate marker of sedentary lifestyle, was reported to be positively associated with diabetes risk in both men and women (79-81). Moderate and vigorous physical activity was associated with a lower risk of type 2 diabetes (37,75,82). Evidence from clinical trials which included physical activity as a integral part of life style interventions suggested that onset of type 2 diabetes can be prevented or delayed as a result of successful lifestyle interventions that included physical activity as a part of this interventions (9-11,83). Physical activity plays an important role in delaying or prevention of development of type 2 diabetes in those at risk both directly by improving insulin sensitivity and reducing insulin resistance, and indirectly by beneficial changes in body mass and body composition (84-86).

### ***Low education***

Previous prospective studies have examined the association between educational attainment and the incidence of diabetes and found that low education is significant predictor of type 2 diabetes (26,87,88). In a cross sectional study of National Population Health Survey found that people with less than high school diploma were almost twice as likely to report having diabetes as those with a bachelor degree or more (89) . Another cross sectional study from the National Health Interview Survey found that women with low education had a higher prevalence of diabetes than the better educated. Furthermore, the association varied by race / ethnicity and gender, with Whites, Hispanics and women exhibiting a stronger association between education and diabetes than blacks and men (90). A recent cross sectional study found that type 2 diabetes risk was higher in the least educated who were obese and inactive compared to the more educated (91). These studies suggest that educational attainment promote an interest in own health and acquisition of knowledge that strongly influence people's ability to reduce risk by successfully adopting a healthier life style.

### ***Dietary pattern***

An important life style factor associated with the development of type 2 diabetes is dietary habits. Positive association have been reported between the risk of type 2 diabetes and different patterns of food intake (92-95). Higher dietary glycemic index has been consistently associated with elevated risk of type 2 diabetes in prospective cohort studies (95,96). The relative risk (RR) for type 2 diabetes highest to the lowest glycemic index was; for quintiles 1–5, respectively: 1, 1.15, 1.07, 1.27, and 1.59 (*P* for trend 0.001), whereas cereal fiber intake was associated with a decreased risk for quintiles 1–5, respectively: 1, 0.85, 0.87, 0.82, and 0.64 (*P* for trend 0.004), (95).

A prospective study found that regular consumption of white rice is associated with an increased risk of type 2 diabetes whereas replacement of white rice by brown rice or other whole grains was associated with a lower risk (93). A review which included 19 studies, "On diet and risk of type 2 diabetes: the role of fat and carbohydrate" concluded that a higher intake of polyunsaturated fat and long-chain n.3 fatty acid is beneficial, whereas a higher intake of saturated fat and trans fat adversely affects glucose metabolism and insulin resistance (97). Another prospective study found higher consumption of butter, potatoes and whole milk to be associated with increased risk of type 2 diabetes. Higher consumption of fruits and vegetables was associated with reduced risk of type 2 diabetes (98). The possible mechanisms suggested are that insoluble fibre intake was consistently associated with improved insulin sensitivity and decreases risk of type 2 diabetes (99,100). Furthermore large observational studies have suggested an association between low vitamin D status or low vitamin D intake and increased incidence of type 2 diabetes (101,102). The suggested mechanisms are that vitamin D deficiency may contribute to beta cell dysfunction, insulin resistance and inflammation that may result in type 2 diabetes. The effect of dietary habits has in all these studies been shown to be independent of BMI change.

### ***Genetics***

Several studies have found that genetic components play an important role in pathogenesis of type 2 diabetes (18,103-105). Several prospective studies and cross-sectional studies have reported that positive family history among first-degree relatives confers an increased risk of type 2 diabetes and the risk is greater when both parents are affected (103,104,106,107). A study on twins has demonstrated that concordance estimate for type 2 diabetes is high in monozygotic compared to dizygotic and the rate increases with duration of follow-up (108). Also, diabetes prevalence varies substantially among different ethnic groups (18), and this observation of substantial variation of disease prevalence across ethnic groups that share a

similar environment, supports the idea that genetic factors contribute to disease predisposition (109). Data from multiple laboratories support that genetic factors predispose to development of type 2 diabetes by reducing insulin sensitivity and insulin secretion which deteriorate in parallel in most human type 2 diabetes cases (109-111). Recent studies have identified variants in 11 genes (TCF7L2, PPARG, FTO, KCNJ11, NOTCH2, WFS1, CDKAL1, IGF2BP2, SLC30A8, JAZF1, and HHEX) to be significantly associated with the risk of type 2 diabetes independently of other clinical risk factors and variants in 8 of these genes were associated with impaired beta-cell function (32). Among these genes expressed in pancreatic cells and involved in impairment of insulin secretion, the transcription factors 7-like 2 (TCF7L2), is the locus with the highest risk of type 2 diabetes (HR 1.5) (32,112-114). This corresponds to an attributable risk of 25%, due to an average single allele frequency 18-30% in Northern Europeans (112). Still the value of genetic information decreased by duration of follow up and eventually only increases the receiver operating characteristics (ROC) achieved by clinical risk factors from 0.74 to 0.75 ( $p < 0.0001$ ), (32). So far genetic information is of interest for research purposes only.

### ***Risk scores for type 2 diabetes***

A simple, sensitive and acceptable screening tool is vital in early identification and intervention of type 2 diabetes. Because fasting blood glucose tests are invasive, time consuming, and requires fasting status and/or glucose ingestion, several attempts have been made to assess the diabetes risk according to diabetes risk factors such as age, obesity, blood lipids, blood pressure, smoking, physical inactivity, diet, family history of diabetes, history of intermediate hyperglycaemia, and gestational diabetes, etc. A review of tools for predicting risk of type 2 diabetes in daily practice concluded that the Finnish Diabetes Risk Score (FINDRISC) was the most useful as it had the highest ROC area (ROC 87%) when validated in other populations and was independent of blood sampling or other invasive

tests (115). A recent study on early detection of type 2 diabetes mellitus in Chinese and Indian adult populations found age, obesity and family history of diabetes to be moderately discriminative for early detection of diabetes with only an ROC of 62% in men and 64% in women (116,117), clearly showing the need for screening tools incorporating more risk factors.



## **Aims of the thesis**

The main aim of this thesis was to explore different risk factors for type 2 diabetes in the population of Tromsø, with the main focus being:

- To determine the incidence of type 2 diabetes in a Norwegian population.
- To determine gender specific impact of lipids on the risk of type 2 diabetes independent of BMI.
- To investigate the changes in cardiovascular risk factors in relation to of type 2 diabetes status over time from 1994 to 2008 and to what degree targets in prevention guidelines were reached.
- To evaluate whether diabetes risk in subjects with low metabolic score were more likely to be detected by other risk factors than the metabolic factors BMI, lipids and hypertension.

## **Material and methods**

### ***Study design***

This is a large population-based observational study. Due to the prospective design of this study, the risk factors included were measured and classified before the occurrence of diabetes.

### ***Study population***

The population-survey in Tromsø has comprised the cohorts presented in table 1. The target cohort of the present thesis comprises the 27158 persons who attended the fourth survey in 1994/95. At that time all residents of the Tromsø municipality born 1969 or earlier were invited to the phase 1 of the fourth survey. Among 37559 persons invited, 2139 persons died or moved before their scheduled phase 1 examination. The eligible population was therefore 35420 persons, and 73% of those invited attended the phase I examination of the survey and answered the relevant questionnaires. This is the population studied in paper I and paper III. A subgroup of 6820 from phase 1 attended a second examination (phase 2) a few weeks after the main Tromsø IV survey and this gave additional baseline information on waist circumference in paper III. In 2001/02, 10353 were invited to the Tromsø V survey. A total of 8130 subjects attended the survey. Of these, 7191 were followed from the 1994 survey. This enabled us to evaluate the change in risk factors from 1994 to 2001 in paper III. In 2007/2008, 19762 subjects were invited to the Tromsø VI survey and a total of 12984 attended. Among these, 10327 had also attended the 1994 survey. These subjects were the basis for analysis of change in cardiovascular risk factors in relation to diabetes status from 1994 to 2008 in paper II.

**Table 1: The Tromsø Study 1974-2008**

| Study year | Study's name      | Number of participants | Age group | Attendance rates |
|------------|-------------------|------------------------|-----------|------------------|
| 1974       | <u>Tromsø I</u>   | 6595 men               | 20-49     | 74%              |
| 1979-80    | <u>Tromsø II</u>  | 16621 men and women    | 20-54     | 78%              |
| 1986-87    | <u>Tromsø III</u> | 21826 men and women    | 12-67     | 76%              |
| 1994-95    | <u>Tromsø IV</u>  | 27158 men and women    | 25-97     | 73%              |
| 2001-02    | <u>Tromsø V</u>   | 8130 men and women     | 30-89     | 79%              |
| 2007-8     | <u>Tromsø VI</u>  | 12984 men and women    | 30-87     | 66%              |

A total of 40,051 different people have participated in at least one of the studies, while 15,157 have participated on three or more occasions ( [www.tromsostudy.com](http://www.tromsostudy.com) or [www.tromsundersokelsen.no](http://www.tromsundersokelsen.no)).

### ***Data from questionnaire and examinations***

Questionnaires printed on the reverse side of letters of invitation were distributed to the eligible population in each Tromsø survey (Appendix A-D). In the fourth survey (1994/1995) two sets of questionnaires were handed out; the second one with different versions for those above and below 70 years of age (appendix A-C). The first one was printed on the reverse side of a letter of invitation, while the second one was handed out at the health examination to be returned by mail.

The first questionnaire was checked for inconsistency by a trained nurse at the health examination, and it included questions on disease and symptoms, habits with respect to leisure-time physical activity (LTPA), diet, smoking, coffee consumption and work related issues. The second questionnaire included questions on health condition, earlier disease, disease in the family, use of medication and health service, marital status, education level and more thorough questions on diet and LTPA. The second questionnaire differed for

those younger or older than 70 years with more focus on activity of daily living and cognitive function in the elderly (appendix B-C).

Physical inactivity was defined as less than 3 hours per week of light activity in leisure time without sweating or dyspnoea. Moderate LTPA was defined as 3 hours or more of light activity or 1-2 hours of hard LTPA per week which caused sweating or dyspnoea. Hard LTPA was defined as a hard activity with sweating or becoming out of breath for 3 hours or more per week.

Educational level was defined as having completed 1: primary and secondary-school, 2: high school or vocational school 1-4 years, 3: university less than 4 years and 4: 4 years or more.

Family history of diabetes was reported as first degree family members, i.e. parents or siblings, with a history of diabetes.

Smoking status was ascertained as current, previous or never smoker.

Height and weight was measured at screening with light clothing without shoes, BMI was computed as  $\text{kg/m}^2$ .

Blood pressure was recorded in the sitting position after two minutes' rest by the use of an automatic blood pressure measurement device (Dinamap Vital Signs Monitor, Waukesha, US). Three recordings were taken at 2-minute intervals, and the mean of the two last readings were used in the analysis. The participants were considered to have hypertension if he or she had systolic blood pressure  $\geq 140$  mmHg or diastolic blood pressure  $\geq 90$  mmHg or reported being on antihypertensive medication.

Non-fasting blood samples were collected from an antecubital vein, serum prepared by centrifugation after one hour respite at room temperature, and analyzed at the Department of Clinical Chemistry, University Hospital of North Norway. Serum total cholesterol and triglycerides were analyzed by enzymatic colorimetric methods and commercially available

kits (CHOD-PAP for cholesterol and GPO-PAP for triglycerides: Boeringer Mannheim). Serum HDL-cholesterol was measured after precipitation of lower-density lipoproteins with heparin and manganese chloride. The coefficients of variation (CV) for total cholesterol 1.1%, triglycerides 2.6% and for HDL cholesterol 4.4% respectively. Determination of glycated haemoglobin (HbA<sub>1c</sub>) in EDTA whole blood was based on an immunoturbidometric assay (UNIMATES, F. Hoffmann-La Roche AG: Basel, Switzerland). The CV for HbA<sub>1c</sub> was less than 5%.

### ***Registration of exposure variables***

Data from questionnaires and examinations used to define exposure variables in each paper depending on the main aim of the corresponding analysis.

#### ***Paper I:***

Using information collected from questionnaires and examinations, the risk factors included in this paper were age, BMI, diastolic and systolic blood pressure, total cholesterol, serum triglycerides, HDL cholesterol, treatment for hypertension, smoking habits, leisure-time physical activity, educational level and family history of diabetes.

#### ***Paper II:***

In paper II the focus was on change in BMI, lipids, blood pressure, smoking and glucose control (HbA<sub>1c</sub>). LDL cholesterol (LDL-C) was calculated by means of the Friedewald formula if the triglyceride concentration was <4.5 mmol/l (118). 138 cases were found to have triglycerides >4.5 mmol/l and were excluded from LDL-C calculation. For estimation of adherence to current guidelines the national guidelines from 1995 and 2000 (same cut off values) were used with HbA<sub>1c</sub> < 7.5%, blood pressure ≤140/85mmHg, total cholesterol/HDL cholesterol (TC/HDL-C) ratio <4 TC < 6.5 mmol/l (119). To estimate the challenge facing clinicians today, the guidelines from the American diabetes association was used with blood

pressure <130/80 mmHg, LDL-C <2.5 mmol/l and HbA1c <7% (120), deviating only from national guidelines with regards to blood pressure( $\leq$ 135/80 mmHg).

### ***Paper III***

In paper III the metabolic syndrome was defined according to a modified version of the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) (121), in which the metabolic syndrome is present when three or more of the following criteria are fulfilled.

1. Hypertension; blood pressure  $\geq$ 130/85mmHg and /or antihypertensive medication.
2. Hypertriglyceridemia; fasting serum triglycerides > 1.70 mmol/L.
3. Low HDL cholesterol, < 1.03mmol/L (men), <1.29 mmol/L (women).
4. Central obesity; waist circumference > 102 cm (men), >88 cm (women).
5. Fasting plasma glucose  $\geq$  6.1 mmol/L.

Because waist circumference measurements were available only for a subset of participants, BMI was used instead of waist circumferences as suggested as a possible alternative in other studies (122,123). In this analysis, the cut - off values for BMI were calculated as the mean BMI values in men and women with waist circumference of 102 and 88 cm, respectively. Accordingly, BMI >28.3 kg/m<sup>2</sup> for men and >27.0 kg/m<sup>2</sup> for women were used. The last criterion of fasting plasma glucose was not available and was not included in the analysis.

The other risk factors included in this paper were age, total cholesterol, family history of type 2 diabetes, smoking, physical inactivity and educational level.

A subgroup of 6820 who met for a second visit a few weeks after the main survey, gave additional baseline information on waist circumference. In 2001, 7191 of the original cohort of the 1994/95 survey participated in the fifth Tromsø survey. This enabled us to evaluate the change in risk factors from 1994 to 2001.

### ***Follow up and case identification of type 2 diabetes***

Possible cases of diabetes mellitus were identified through self-reported diabetes in questionnaires or  $Hb_{A1c} > 6.5\%$  in the health surveys 1994/95 or 2001 and 2008, and through linkage of the Tromsø Study participant list to diabetes related discharge diagnoses in the digital patient records at the only local hospital (ICD- 9 codes 250, 357.2, 362.0, 583.8, 648.0, 648.8, 790.2, ICD-10 codes E10 -E14, O24 and R73). Some cases of hospital confirmed diabetes, but with no diabetes-related discharge diagnosis, were detected through our adjudication process for cardiovascular diseases. We validated all possible cases of diabetes by checking their medical records. Cases were classified as having no diabetes, type 1 or type 2 diabetes, based on glucose measurements if they had non fasting glucose  $\geq 11.1$  mmol/l, fasting glucose  $> 7.0$  mmol/l, 2 hour glucose load  $\geq 11.1$  mmol/l or  $Hb_{A1c} \geq 7.0\%$  in the hospital laboratory database or recorded use of insulin or oral anti-diabetic drugs (124). C-peptide measurement was the common method at the hospital during the follow-up period to differentiate between type 1 diabetes and type 2 diabetes, while glutamic acid decarboxylase antibody (anti-GAD) measurements were performed in a minority of cases. Follow up ended December 31<sup>st</sup>, 2005. In paper II the cases were followed from the screening in 1994 to the screening in 2008 to estimate the change in risk factor levels.

### ***Statistical analysis***

To determine the risk of type 2 diabetes for different risk factors, Hazard ratios (HR) were calculated using Cox' proportional hazard (PH) model in the SPSS software (version 17.0, SPSS Inc., Chicago, IL, USA). The Cox model is a robust model that gives good estimate of regression coefficients, hazard ratios and adjusted survival curves which closely approximate the results for the correct parametric model (125). In paper I & III, for each participant, person-years of follow-up were accrued from the date of enrolment through the

date a type 2 diabetes-events was diagnosed, the date the participant died or officially moved from the municipality of Tromsø, or through the end of the study period, December 31<sup>st</sup> 2005. Total length of follow up was 258571 person-years of follow-up. The proportional hazard model assumes a constant hazard ratio over time, or equivalently, a hazard for one individual that is proportional to the hazard for any other individual, where the proportionality constant is independent of time. Satisfaction of PH assumption was assessed for type 2 diabetes risk predictors using the graphical approach. Log-log survival curves of independent variables above mentioned were parallel and this indicates that the PH assumption is satisfied. All proportional hazard models were adjusted for possible confounders which might be associated with both exposure and effect variables. Point estimates for HR are presented for 1 standard deviation (SD) change for continuous variables. The Variation Inflation Factor (VIF) showed low multicollinearity (<4 for all independent variables) (126). Interaction terms of all possible combination of two or more causes that might modify one another were introduced in the models to determine the necessity for interaction terms in final models. Data are presented stratified by sex. Confidence interval 95% (CI 95%) was estimated and the significance level was chosen at  $p < 0.05$ . In paper I, Incidence rates were calculated by dividing the number of incident cases by person years in each age group. Age specific incidence was calculated by direct standardization with the use of World Health Organization (WHO) European Standard Population (127). In all three papers, base line differences in means between groups were tested using by age-adjusted general linear models. Differences in proportions were tested with logistic regression adjusted for age. In paper II, changes were calculated as difference between examinations in 2007-2008 and 1994-1995 and differences in change between groups tested with general linear model or logistic regression where appropriate.



## **Main results**

### ***Paper I: Incidence of and risk factors of type 2 diabetes in a general population***

The study is based on 12431 men and 13737 women aged 25 to 98 years, attending the Tromsø Study in 1994, followed through 2005, and who did not have diabetes when entering the study. A total of 522 validated incident type 2 diabetes cases were registered, during a median follow-up 10.8 years, 308 among men and 214 among women. The age standardized incidence rate was higher in men than in women, 2.6 (95%CI 2.32-2.90) and 1.6 (95%CI 1.40-1.83) per 1000 person years, respectively. In multivariate survival analysis, age, BMI, triglycerides, HDL cholesterol, hypertension, family history of diabetes, low education and smoking were independent predictors of type 2 diabetes in both genders  $p < 0.05$ . Total cholesterol and lack of leisure-time physical activity were independent predictors in men only. We found an interaction between HDL cholesterol and triglyceride levels, ( $p < 0.001$ ), and between triglyceride levels and a positive family history of diabetes ( $p = 0.04$ ). These interactions were independent of BMI. A positive family history combined with triglycerides in the highest tertile and BMI  $> 25 \text{ kg/m}^2$  conveyed a 10 year risk of type 2 diabetes of 10% (95%CI 8-12%) vs 0.2% (95%CI 0.08-0.31%) for the lowest risk group.

### ***Paper II: Change in cardiovascular risk factors in relation to diabetes status.***

The study is based on 10327 subjects who attended the Tromsø Study in 1994 and were screened again in 2007/2008. There were 49 prevalent cases, and 392 incident cases of type 2 diabetes were diagnosed between 1994 and 2008. Incident and prevalent cases of type 2 diabetes significantly decreased in HDL-C and increased in triglycerides, BMI, and anti-hypertensive treatment during 14 years of follow-up. Incident and prevalent cases of type 2 diabetes had decreasing levels of HDL-C total TC, blood pressure and increasing levels of triglycerides, BMI, and anti- hypertensive treatment. Despite decreasing blood pressure, more than 73% of the treated cases had blood pressure above 135/80 at end of follow up.

Similarly, less than 35% of incident cases using statins had LDL-C below the recommended threshold value of 2.5 mmol/l. Despite greater relative reduction in cardiovascular risk factors among people with type 2 diabetes compared to those without, treatment targets were met in less than 50% of subjects with type 2 diabetes. Fourteen percent reached the combined targets for glucose, blood pressure and LDL- C control.

***Paper III: Risk factors for type 2 diabetes in groups stratified according to criteria of metabolic syndrome.***

The study is based on 1298 men and 13695 women, attending the Tromsø Study in 1994, followed through 2005, and who did not have diabetes when entering the study. A total of 492 validated incident type 2 diabetes cases were registered. For those fulfilling  $\geq 3$  metabolic score criteria, increasing age, BMI, triglycerides, hypertension and a family history of diabetes were independent predictors. Of these risk factors age, BMI, hypertension and triglycerides predicted type 2 diabetes more strongly in subjects with low metabolic score. The risk associated with a positive family history was unaffected by metabolic score. In the low risk group with low metabolic score, smoking, low education and in men also inactivity, significantly improved prediction. Adding these non metabolic risk factors increased correct classification significantly (ROC area increased from 77.2% to 87.1%,  $p < 0.0001$ ). In this study one half of the incident cases of type 2 diabetes were missed by using high metabolic score for risk prediction.

## **General discussion**

### ***Methodological considerations***

#### **Validity**

The aim of an epidemiological study is to be both valid and reliable and to avoid random and systematic error. The validity has two different aspects. A measurement is valid if it measures what it is suppose to measure. This validity can be divided into an internal and an external validity. Internal validity is the degree to which the results of a study are correct for the sample of people being studied. External validity refers to whether the results from the study can be applied to other populations who were not actually studied (128). In epidemiological research, two broad types of errors afflict studies; systematic errors and random errors. Systematic error can also be termed as bias and confounding. Different type of bias can distort the estimation of an epidemiologic measure of interest and retract both the internal and external validity. Random error can affect the reliability of the measurement and precision of estimate (129).

#### ***Random error***

Random error is the chance of non-reproducibility of a study finding. It can result in weakening of a true association or inability of finding an association between exposure and effect variables. Precision (lack of random error) can be improved by increasing the size of the study and efficiency of the study by modifying its design (129). The large size of this study reduces sampling error and therefore increases precision. Moreover, the study efficiency is improved with the proper allocation of subjects into study groups using all the available information of the data.

Random error was addressed by statistical inference. Estimation of the associated relative risk and its confidence interval were calculated. Hypotheses were tested at the 0.05 alpha

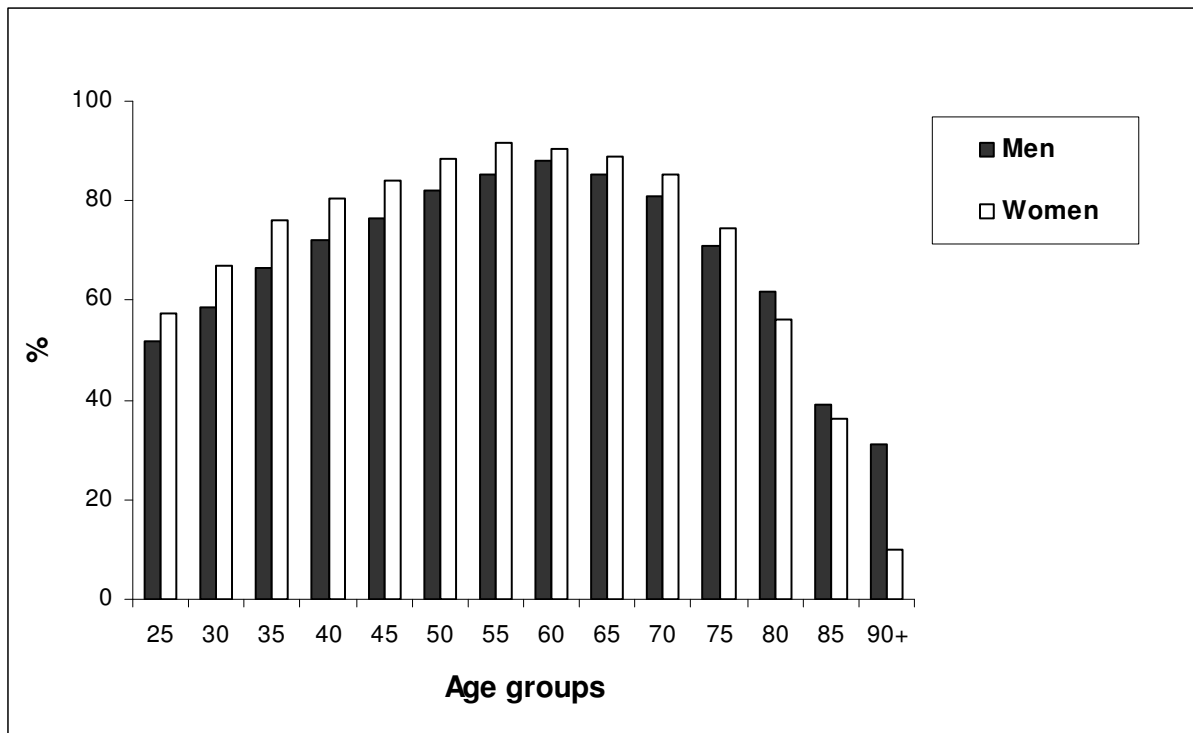
level with 95% confidence intervals. The null hypothesis was rejected if the chance of a random finding was less than 5% ( $p$  value  $< 0.05$ ). Otherwise the null hypothesis was retained and the analysis reported as non-significant. By applying this significance level on the tests, Type I errors, which represent the possibility of rejecting null hypothesis that are true, are avoided. Although the avoidance of Type I error increase the likelihood of Type II error, which represent the possibility of not rejecting a null hypothesis when it is false, the large study size and a long follow-up time in this study minimize the chance of Type II error.

### **Systematic errors (bias and confounding)**

#### ***Selection bias***

Selection bias occurs in the procedures used to select individuals to be studied (130;131). This type of bias occurs if there are systematic differences in the exposure status and disease status between those who participated and those who do not participate in the study. The potential for selection bias is limited with 73% of the eligible population included in this study. Apart from age (born 1969 or earlier), there were no defined criteria for those invited to the fourth survey. Figure 1 show the percentages of attendance by age groups among men and women respectively. The lowest attendance rate were among those less than 40 years and those older than 75 years, with attendance rates of 67% and 71% among men and 76% and 74% among women. We have no possibility to explore differences between responders and non responders. Previous findings from the Tromsø study showed agreeable result between individuals who returned and did not return second questionnaire (132).

**Figure 1: Percentage of attendance by age groups among men and women**



### ***Information bias***

Information bias can occur whenever there exist errors or misclassifications in the measurement of subjects, but the consequences of the errors are different, depending on whether the distribution of errors for one variable depends on the actual value of other variables (129). Misclassification of discrete variables can be of two types: Differential misclassifications are errors that depend on the values of other variables; i.e. systematic errors, and non-differential misclassifications are errors that do not depend on other variables; i.e. random errors. Variables used in paper I - paper III as categorical variables smoking, hypertensive treatment, lipids treatment, physical inactivity, family history of diabetes and education level could lead to a recall bias since they were only self-reported. But as this information is obtained prior to development of disease recall bias is minimized. As these categorical variables all are subject to change over time this is most likely to introduce a random error weakening the associations found. We have no indication of

serious errors of the other cardiovascular risk factors that are used in all three papers such as blood pressure, serum lipids and BMI. Serum lipids were measured in a non-fasting state. The value of triglycerides may depend on the time since last meal (133). However when we adjusted for time since last meal in the multivariable analysis it had no effect on the estimates of interest.

### ***Confounding and interaction***

A definition of confounding is confusion, or mixing of effects which implies that the effect of an exposure variable mixed together with effect of other variables leads to a bias (130). Confounding exists if meaningfully different interpretations of the relationship of interest result when an extraneous variable or a covariate is ignored or included in the data analysis. With a large number of independent risk factors for type 2 diabetes risk, it is certain that some of these risk factors will have some degree of associations. The association between the exposure and effect variables might be distorted by an extraneous factor(s) which is/are associated with the effect (diabetes risk) in both exposed and unexposed groups leading to mixing of effects or confounding. There are ways of avoiding or adjusting for confounding. In our analysis we stratified on possible confounders such as age and sex or we included all possible confounding variables as covariates and adjusted in the linear or multivariate models. Separate from confounding, some extraneous factors can also have a modification on the effect of an exposure. This effect modification or interaction; difference in effect of one factor according to the level of another factor, can have direct biological and public health relevance. Therefore interaction terms (exposure variable multiplied by possible effect modifier) were introduced to the models to assess any significant differences between models with and without the interaction term. In paper I we found significant independent interactions between HDL cholesterol and triglycerides,  $p < 0.001$  and between family history of diabetes and triglycerides ( $p = 0.04$ ). The increased risk conveyed by decreasing

HDL cholesterol increased by increasing triglyceride levels and more so at high BMI levels. This interaction was most prominent in women. We did not find any interaction between BMI and dyslipidemia in any form, but in men we found an interaction between family history and increased BMI ( $p < 0.0001$ ). Of the interactions with family history of diabetes, the interaction with triglyceride levels was most prominent. A positive family history in those with  $\text{BMI} \leq 25 \text{ kg/m}^2$  conveyed the same risk as  $\text{BMI} > 25 \text{ kg/m}^2$  and a negative family history of diabetes. The risk increased with increasing triglyceride levels and positive family history and increased BMI  $> 25 \text{ kg/m}^2$ . The absolute risk of type 2 diabetes over 10 years increased from 0.1% (95% CI 0.04–0.3) to 10.1% (95% CI 7.4–13.7) in women and from 0.3% (95% CI 0.1–0.7) to 10.3% (95% CI 7.8–12.5) in men, respectively.

### **External validity**

The external validity of the study refers to the generalization of the internally valid results for the source populations to other populations. The population in this study is representative of the Norwegian and Scandinavian population, as it is largely a middle-class Caucasian population. To assess the statement of more universal association we have to gather information from different populations. In the Tromsø Study we assessed associations between cardiovascular risk factors and type 2 diabetes. Other studies and other study population have addressed these associations, may be not in the same sub groups and with the same range of risk factors as the present results. It is important to compare result between different populations. Association between risk factors may vary due to differences in dietary habits, ethnic differences and genetic variation or other characteristics. Although the participation in the Tromsø Study is not statistically representatives for the population of Norway, we believe that the inferences drawn from study could be generalized to the Norwegian population. In Tromsø the incidence of cardiovascular disease, education, and lifestyles is in accordance with data from other parts

of Norway (134). A relative high proportion of population in the municipality of Tromsø comprises a homogeneous set of individuals, although a few of the inhabitants are of Sami or Finnish origin, 3 and 7% respectively (as reported in Tromsø III).

### **Implications for public health practice**

This study is one of few studies which included several risk factors such as family history of type 2 diabetes, lipids and blood pressure as well as life style risk factors. As shown in paper I and paper III, high BMI is an important risk factor for type 2 diabetes. Public health approaches such as promoting healthier eating practice and active lifestyle to stop increase or even reduce BMI would successfully prevent type 2 diabetes. This could be implemented by health education through media as well as in clinical and primary care settings. In the latter prevention could be targeted to those at highest risk by screening of family history, smoking and physical activity habits in addition to simple measurements of blood pressure and non-fasting triglycerides. Helping patients with smoking cessation and prevention or treatment of hypertension also will prevent the more prevalent lung and cardiovascular diseases.

In paper II risk factor levels are shown to be high in subjects with type 2 diabetes despite the favourable changes in blood pressure and total cholesterol over time. Consequently a substantial number of patients do not reach treatment targets. Clinicians need to adhere more strictly to treatment guidelines. As weight loss and physical activity affects both lipids, blood pressure and glucose control non-pharmacological treatment could increase fulfilment of treatment targets.

In paper III the use of fixed criteria of metabolic syndrome to target subjects at risk of developing missed 50% of the cases indicating a need for a wider approach to diabetes prevention. Incorporating low education, smoking and a family history of type 2 diabetes, improved risk classification significantly to levels matching FINDRISC.



## **Conclusions**

- A total of 522 validated incident type 2 diabetes cases were registered, during a median follow-up 10.8 years, 308 among men and 214 among women. The age standardized incidence rate was higher in men than in women, 2.6 (95%CI 2.32-2.90) and 1.6 (95%CI 1.40-1.83) per 1000 person years, respectively.
- Age, BMI, triglycerides, HDL cholesterol, hypertension, family history of diabetes, low education and smoking were independent predictors of type 2 diabetes in both genders and in addition also total cholesterol and lack of physical activity in men.
- Unfavourable levels of HDL cholesterol and in triglycerides, BMI, and hypertension were seen in diabetes cases during 14 years of follow-up. Despite a reduction in both blood pressure and total cholesterol among people with diabetes, treatment targets were met in less than 50% of subjects. This might explain why coronary disease patients with type 2 diabetes have a worse long term prognosis than patients without type 2 diabetes.
- In early detection of type 2 diabetes, the use of metabolic syndrome criteria miss more than 50% of cases. Therefore screening tools acknowledging a wider range of risk factors need to be adopted in early detection of diabetes. We suggest in addition to BMI, physical inactivity and age to incorporate smoking and non-fasting triglycerides (as an early marker of insulin resistance) in these risk scores.

## **Further research**

1. Further research should focus on primary prevention by health education in primary and secondary care settings on life style factors such as food intake, smoking, physical activity, reducing obesity and early detection of lipids, blood pressure as well as early screening of those who have family history of diabetes and test the effect of different educational programme in prevention of diabetes.

2. Risk scores including non-fasting triglycerides should be tested against the FINDRISC in a new dataset to answer whether the inclusion of lipids improves case detection. Cut off values for low risk, need for prevention and possible undiagnosed diabetes should be established by evaluating the risk score against oral glucose testing and HbA<sub>1c</sub>. The first two cut off values i.e. low risk and need for prevention, need to be established in a prospective follow up study. The latter; cut off for undiagnosed diabetes, is best established in a cross sectional study.
3. More follow up studies should be done to assess the benefits of different treatment modalities on control of hyperglycaemia as well as on other cardiovascular risk factors such as blood pressure and lipids in diabetes patients to prevent further CVD and other complications. Especially the focus should be on assessing the effect of non-pharmacological interventions based on healthy lifestyle such as increased physical activity, smoking cessation, weight loss and a healthy dietary pattern.
4. More studies are needed in understanding of how genetic variation contributes to disease within populations. This will require a simultaneous acquisition of detailed genetic and environmental (life-style) data from very large population cohorts. So far large endeavours like the DECODE study (135), have increased our understanding of the mechanisms behind development of type 2 diabetes, but clinically useful information is still lacking.

## **Erratum**

Paper I

The  $p$  values were mistyped in abstract and main text

The corrected version as follows:

### ***Abstract***

In multivariate survival analysis, age, body mass index (BMI), triglycerides, high-density lipoprotein (HDL) cholesterol, hypertension, family history of diabetes, low education and smoking were independent predictors of T2DM in both genders ( $p<0.05$ ). Total cholesterol and lack of leisure-time physical activity were independent predictors in men only. We found an interaction between HDL cholesterol and triglyceride levels ( $p<0.001$ ) and between triglyceride levels and a positive family history of diabetes ( $p=0.04$ ).

### ***Result***

We did not find any interaction between BMI and dyslipidemia in any form, but in men we found an interaction between family history and increased BMI ( $p<0.0001$ ). Of the interactions with family history of diabetes, the interaction with triglyceride levels was most prominent.

### ***Discussion***

For men, a positive family history interaction with BMI caused elevated risk for elevated BMI also at low triglyceride levels ( $p<0.0001$ ).

## References

- (1) World Health Organization. Fact Sheet No.312: What is Diabetes? Available at: [Http:// www.who.iny/mediacentre/factsheets/fs312/en/](Http://www.who.iny/mediacentre/factsheets/fs312/en/) Accessed on: September 5, 2009.
- (2) International Diabetes Federation. Diabetes Atlas. 4th edn. Brusesls: International Diabetes Federation, 2009.
- (3) International Diabetes Federation. Diabetes Atlas. 3rd edn. Brusesls: International Diabetes Federation, 2006.
- (4) Centers for Disease Control. National Diabetes Fact Sheet-2007. Available at: <http://www.cdc.gov/diabetes/pubs/pdf/ndfs-2007.pdf>. Accessed on: February 18, 2009.
- (5) Agency for healthcare research and øuality. Screening for type 2 diabetes mellitus in adults. Available at:<http://www.ahrq.gov/clinic/uspstf08/type2/type2rs.htm>. Accessed on: February 19, 2009.
- (6) Cubbon RM, Wheatcroft SB, Grant PJ, Gale CP, Barth JH, Sapsford RJ, et al. Temporal trends in mortality of patients with diabetes mellitus suffering acute myocardial infarction: a comparison of over 3000 patients between 1995 and 2003. *Eur Heart J* 2007 ;28(5):540-5.
- (7) Preis SR, Pencina MJ, Hwang SJ, D'Agostino RB, Sr., Savage PJ, Levy D, et al. Trends in cardiovascular disease risk factors in individuals with and without diabetes mellitus in the Framingham Heart Study. *Circulation* 2009;120(3):212-20.
- (8) Jenssen TG, Tonstad S, Claudi T, Midthjell K, Cooper J. The gap between guidelines and practice in the treatment of type 2 diabetes A nationwide survey in Norway. *Diabetes Res Clin Pract* 2008;80 (2):314-20.
- (9) Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;344(18):1343-50.
- (10) Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346(6):393-403.
- (11) Ramachandran A, Snehalatha C, Mary S, Mukesh B, Bhaskar AD, Vijay V, et al. "The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1)." *Diabetologia* 2006;49(2):289-97.
- (12) Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). *Lancet*1998; 352 :854-65.
- (13) Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract* 2010; 87(1):4-14.

- (14) International Diabetes Federation. Diabetes Atlas. 4th edn. The economic- impact of diabetes.<http://www.diabetesatlas.org/content/economic-impactofdiabetes>. Accessed on: February 4, 2010.
- (15) Gilmer TP, O'Connor PJ, Rush WA, Crain AL, Whitebird RR, Hanson AM, et al. Predictors of health care costs in adults with diabetes. *Diabetes Care* 2005 ;28(1):59-64.
- (16) Taskinen MR. Diabetic dyslipidaemia: from basic research to clinical practice. *Diabetologia* 2003 ; 46(6):733-49.
- (17) Reaven GM. Banting lecture 1988. Role of insulin resistance in human disease. *Diabetes* 1988;37(12):1595-607.
- (18) Diamond J. The double puzzle of diabetes. *Nature* 2003; 423(6940):599-602.
- (19) Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, et al. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *N Engl J Med* 2001; 345(11):790-7.
- (20) Zimmet P, Alberti KGMM, Shaw J. Global and societal implications of the diabetes epidemic. *Nature* 2001;414(6865):782-7.
- (21) Shai I, Jiang R, Manson JE, Stampfer MJ, Willett WC, Colditz GA, et al. Ethnicity, obesity, and risk of type 2 diabetes in women. *Diabetes Care* 2006; 29(7):1585-90.
- (22) McBean AM, Li S, Gilbertson DT, Collins AJ. Differences in diabetes prevalence, incidence, and mortality among the elderly of four racial/ethnic groups: Whites, Blacks, Hispanics, and Asians. *Diabetes Care* 2004; 27(10):2317-24.
- (23) Bloomgarden ZT. Insulin resistance: current concepts. *Clin Ther* 1998; 20(2):216-31.
- (24) Stumvoll M, Goldstein BJ, van Haeften TW. Type 2 diabetes: principles of pathogenesis and therapy. *Lancet* 2005 ;365(9467):1333-46.
- (25) DeFronzo RA, Bonadonna RC, Ferrannini E. Pathogenesis of NIDDM. A balanced overview. *Diabetes Care* 1992; 15(3):318-68.
- (26) Valdes S, Botas P, Delgado E, Alvarez F, Cadorniga FD. Population-based incidence of type 2 diabetes in northern Spain: the Asturias Study. *Diabetes Care* 2007; 30(9):2258-63.
- (27) Meisinger C, Thorand B, Schneider A, Stieber J, Doring A, Lowel H. Sex differences in risk factors for incident type 2 diabetes mellitus: the MONICA Augsburg cohort study. *Arch Intern Med* 2002;162(1):82-9.
- (28) Haffner SM, Miettinen H, Stern MP. Relatively more atherogenic coronary heart disease risk factors in prediabetic women than in prediabetic men. *Diabetologia* 1997; 40(6):711-7.

- (29) Bassuk SS, Manson JE. Lifestyle and risk of cardiovascular disease and type 2 diabetes in women: A review of the epidemiologic evidence. *Am J Lifestyle Med* 2008 ;2(3):191-213.
- (30) Gadsby R. Epidemiology of diabetes *Adv Drug Deliv Rev* 2002; 54(9):1165-72.
- (31) Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, Yoon KH, et al. Diabetes in Asia: epidemiology, risk factors, and pathophysiology. *JAMA* 2009; 301:2129-40.
- (32) Lyssenko V, Jonsson A, Almgren P, Pulizzi N, Isomaa B, Tuomi T, et al. Clinical risk factors, DNA variants, and the development of type 2 diabetes. *N Engl J Med* 2008; 359(21):2220-32.
- (33) Knowler WC, Pettitt DJ, Saad MF, Charles MA, Nelson RG, Howard BV, et al. Obesity in the Pima Indians: its magnitude and relationship with diabetes. *A J Clin Nutr* 1991;53 : S1543-S51.
- (34) Kumari M, Head J, Marmot M. Prospective study of social and other risk factors for incidence of type 2 diabetes in the Whitehall II study. *Arch Intern Med* 2004;64 (17): 873-80.
- (35) Njolstad I, Arnesen E, Lund-Larsen PG. Sex differences in risk factors for clinical diabetes mellitus in a general population: a 12-year follow-up of the Finnmark Study. *Am J Epidemiol* 1998; 147(1):49-58.
- (36) Almdal T, Scharling H, Jensen JS, Vestergaard H. Higher prevalence of risk factors for type 2 diabetes mellitus and subsequent higher incidence in men. *Eur J Intern Med* 2008 ;19(1):40-5.
- (37) Manson JE, Nathan DM, Krolewski AS, Stampfer MJ, Willett WC, Hennekens CH. A Prospective Study of Exercise and Incidence of Diabetes Among US Male Physicians. *JAMA* 1992 ;268(1):63-7.
- (38) Skarfors ET, Selinus KI, Lithell HO. Risk factors for developing non-insulin dependent diabetes: a 10 year follow up of men in Uppsala. *BMJ* 1991;303(6805):755-60.
- (39) Colditz GA, Willett WC, Stampfer MJ, Manson JE, Hennekens CH, Arky RA, et al. Weight as a risk factor for clinical diabetes in women. *Am J Epidemiol* 1990;132(3): 501-13.
- (40) Hebebrand J, Hinney A. Environmental and Genetic Risk Factors in Obesity. *Child and Adolesc Psychiatric Clin N Am* 2009 ;18(1):83-94.
- (41) Kahn SE, Hull RL, Utzschneider KM. Mechanisms linking obesity to insulin resistance and type 2 diabetes. *Nature* 2006; 444(7121):840-6.
- (42) O'Rahilly S, Farooqi IS. Genetics of obesity. *Philos Trans R Soc Lond B Biol Sci* 2006; 361(1471):1095-105.

- (43) Jacobsen BK, Bonna KH, Njolstad I. Cardiovascular risk factors, change in risk factors over 7 years, and the risk of clinical diabetes mellitus type 2. The Tromsø study. *J Clin Epidemiol* 2002; 55(7):647-53.
- (44) Fagot-Campagna A, Narayan KM, Hanson RL, Imperatore G, Howard BV, Nelson RG, et al. Plasma lipoproteins and incidence of non-insulin-dependent diabetes mellitus in Pima Indians: protective effect of HDL cholesterol in women. *Atherosclerosis* 1997;128(1):113-9.
- (45) Tsai WL, Yang CY, Lin SF, Fang FM. Impact of obesity on medical problems and quality of life in Taiwan. *Am J Epidemiol* 2004 15;160(6):557-65.
- (46) Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. *JAMA* 1999;282(16):1523-9.
- (47) Wild SH, Byrne CD. ABC of obesity. Risk factors for diabetes and coronary heart disease. *BMJ* 2006;333(7576):1009-11.
- (48) Czernichow S, Mennen L, Bertrais S, Preziosi P, Hercberg S, Oppert JM. Relationships between changes in weight and changes in cardiovascular risk factors in middle-aged French subjects: effect of dieting. *Int J Obes Relat Metab Disord* 2002; 26(8):1138-43.
- (49) Rainwater DL, Mitchell BD, Comuzzie AG, VandeBerg JL, Stern MP, MacCluer JW. Association among 5-year changes in weight, physical activity, and cardiovascular disease risk factors in Mexican Americans. *Am J Epidemiol* 2000;152(10):974-82.
- (50) Conen D, Ridker PM, Mora S, Buring JE, Glynn RJ. Blood pressure and risk of developing type 2 diabetes mellitus: the Women's Health Study. *Eur Heart J* 2007;28(23):2937-43.
- (51) Gress TW, Nieto FJ, Shahar E, Wofford MR, Brancati FL. Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus. *N Engl J Med* 2000;342(13):905-12.
- (52) Movahed MR, Sattur S, Hashemzadeh M. Independent association between type 2 diabetes mellitus and hypertension over a period of 10 years in a large inpatient population. *Clin Exp Hypertens* 2010;32 (3):198-201.
- (53) Meigs JB, Hu FB, Rifai N, Manson JE. Biomarkers of endothelial dysfunction and risk of type 2 diabetes mellitus. *JAMA* 2004;291(16):1978-86.
- (54) Meigs JB, O'Donnell CJ, Tofler GH, Benjamin EJ, Fox CS, Lipinska I, et al. Hemostatic markers of endothelial dysfunction and risk of incident type 2 diabetes: The Framingham Offspring Study. *Diabetes* 2006;55(2):530-7.
- (55) Gokce N, Holbrook M, Duffy SJ, Demissie S, Cupples LA, Biegelsen E, et al. Effects of race and hypertension on flow-mediated and nitroglycerin-mediated dilation of the brachial artery. *Hypertension* 2001;38(6):1349-54.

- (56) Hu FB, Meigs JB, Li TY, Rifai N, Manson JE. Inflammatory markers and risk of developing type 2 diabetes in women. *Diabetes* 2004;53(3):693-700.
- (57) Blake GJ, Rifai N, Buring JE, Ridker PM. Blood pressure, C-reactive protein, and risk of future cardiovascular events. *Circulation* 2003;108(24):2993-9.
- (58) Ridker PM, Buring JE, Cook NR, Rifai N. C-reactive protein, the metabolic syndrome, and risk of incident cardiovascular events: an 8-year follow-up of 14 719 initially healthy American women. *Circulation* 2003;107(3):391-7.
- (59) Ferrannini E, Buzzigoli G, Bonadonna R, Giorico MA, Oleggini M, Graziadei L, et al. Insulin resistance in essential hypertension. *N Engl J Med* 1987;317(6):350-7.
- (60) Wilsgaard T, Schirmer H, Arnesen E. Impact of body weight on blood pressure with a focus on sex differences: the Tromso Study, 1986-1995. *Arch Intern Med* 2000;160(18):2847-53.
- (61) McMurray JJ, Holman RR, Haffner SM, Bethel MA, Holzhauer B, et al. Effect of valsartan on the incidence of diabetes and cardiovascular events. *N Engl J Med* 2010; 362(16):1477-90.
- (62) Hur NW, Kim HC, Nam CM, Jee SH, Lee HC, Suh I. Smoking cessation and risk of type 2 diabetes mellitus: Korea medical insurance corporation study. *Eur J Cardiovasc Prev Rehabil* 2007;14(2):244-9.
- (63) Yeh HC, Duncan BB, Schmidt MIs, Wang NY, Brancati FL. Smoking, smoking cessation, and risk for type 2 diabetes mellitus. *Ann Intern Med* 2010 ;152(1):10-7.
- (64) Manson JE, Ajani UA, Liu S, Nathan DM, Hennekens CH. A prospective study of cigarette smoking and the incidence of diabetes mellitus among us male physicians. *Am J Med* 2000 ;109(7):538-42.
- (65) Sairenchi T, Iso H, Nishimura A, Hosoda T, Irie F, Saito Y, et al. Cigarette smoking and risk of type 2 diabetes mellitus among middle-aged and elderly Japanese men and women. *Am J Epidemiol* 2004;160(2):158-62.
- (66) Willi C, Bodenmann P, Ghali WA, Faris PD, Cornuz J. Active smoking and the risk of type 2 diabetes: a systematic review and met-analysis. *JAMA* 2007; 298(22):2654-64.
- (67) Nagaya T, Yoshida H, Takahashi H, Kawai M. Heavy smoking raises risk for type 2 diabetes mellitus in obese men; but, light smoking reduces the risk in lean men: a follow-up study in Japan. *Ann Epidemiol* 2008;18(2):113-8.
- (68) Patja K, Jousilahti P, Hu G, Valle T, Qiao Q, Tuomilehto J. Effects of smoking, obesity and physical activity on the risk of type 2 diabetes in middle-aged Finnish men and women. *J Intern Med* 2005; 258(4):356-62.
- (69) Attvall S, Fowelin J, Lager I, Von SH, Smith U. Smoking induces insulin resistance--a potential link with the insulin resistance syndrome. *J Intern Med* 1993; 233(4):327-32.



- (70) Facchini FS, Hollenbeck CB, Jeppesen J, Chen YD, Reaven GM. Insulin resistance and cigarette smoking. *Lancet* 1992;339(8802):1128-30.
- (71) Janzon L, Berntorp K, Hanson M, Lindell SE, Trell E. Glucose tolerance and smoking: a population study of oral and intravenous glucose tolerance tests in middle-aged men. *Diabetologia* 1983;25(2):86-8.
- (72) Talamini G, Bassi C, Falconi M, Sartori N, Salvia R, Rigo L, et al. Alcohol and smoking as risk factors in chronic pancreatitis and pancreatic cancer. *Dig Dis Sci* 1999;44(7):1303-11.
- (73) Duncan BB, Schmidt MI, Chambless LE, Folsom AR, Heiss G, Inflammation markers predict increased weight gain in smoking quitters. *Obes Res* 2003;11(11):1339-44.
- (74) Wannamethee SG, Shaper AG, Perry IJ. Smoking as a modifiable risk factor for type 2 diabetes in middle-aged men. *Diabetes Care* 2001;24(9):1590-5.
- (75) Fretts AM, Howard BV, Kriska AM, Smith NL, Lumley T, Lee ET, et al. Physical activity and incident diabetes in American Indians: the Strong Heart Study. *A J Epidemiol* 2009;170(5):632-9.
- (76) Gimeno D, Elovainio M, Jokela M, De VR, Marmot MG, Kivimaki M. Association between passive jobs and low levels of leisure-time physical activity: the Whitehall II cohort study. *Occup Environ Med* 2009;66(11):772-6.
- (77) Villegas R, Shu XO, Li H, Yang G, Matthews CE, Leitzmann M, et al. Physical activity and the incidence of type 2 diabetes in the Shanghai women's health study. *Int J Epidemiol* 2006;35(6):1553-62.
- (78) Jeon CY, Lokken RP, Hu FB, van Dam RM. Physical activity of moderate intensity and risk of type 2 diabetes: a systematic review. *Diabetes Care* 2007;30(3):744-52.
- (79) Hu FB, Li TY, Colditz GA, Willett WC, Manson JE. Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. *JAMA* 2003;289(14):1785-91.
- (80) Hu FB, Leitzmann MF, Stampfer MJ, Colditz GA, Willett WC, Rimm EB. Physical activity and television watching in relation to risk for type 2 diabetes mellitus in men. *Arch Intern Med* 2001;161(12):1542-8.
- (81) Krishnan S, Rosenberg L, Palmer JR. Physical activity and television watching in relation to risk of type 2 diabetes: the Black Women's Health Study. *Am J Epidemiol* 2009;169(4):428-34.
- (82) Weinstein AR, Sesso HD, Lee IM, Cook NR, Manson JE, Buring JE, et al. Relationship of Physical Activity vs Body Mass Index With Type 2 Diabetes in Women. *JAMA* 2004 Sep 8;292(10):1188-94.
- (83) Pan XR, Li GW, Hu YH, Wang JX, Yang WY, An ZX, et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. *Diabetes Care* 1997; 20 (4):537-44.

- (84) Hamman RF, Wing RR, Edelstein SL, Lachin JM, Bray GA, Delahanty L, et al. Effect of weight loss with lifestyle intervention on risk of diabetes. *Diabetes Care* 2006; 29(9):2102-7.
- (85) Boule NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. *JAMA* 2001; 286(10):1218-27.
- (86) Kay SJ, Fiatarone Singh MA. The influence of physical activity on abdominal fat: a systematic review of the literature. *Obes Rev* 2006;7(2):183-200.
- (87) Maty SC, Everson-Rose SA, Haan MN, Raghunathan TE, Kaplan GA. Education, income, occupation, and the 34-year incidence (1965-99) of Type 2 diabetes in the Alameda County Study. *Int J Epidemiol* 2005;34(6):1274-81.
- (88) Leonetti DL, Tsunehara CH, Wahl PW, Fujimoto WY. Educational attainment and the risk of non-insulin-dependent diabetes or coronary heart disease in Japanese-American men. *Ethn Dis* 1992; 2(4):326-36.
- (89) Tang M, Chen Y, Krewski D. Gender-related differences in the association between socioeconomic status and self-reported diabetes. *Int J Epidemiol* 2003 ;32(3):381-5.
- (90) Borrell LN, Dallo FJ, White K. Education and diabetes in a racially and ethnically diverse population. *Am J Public Health* 2006;96(9):1637-42.
- (91) Dasgupta K, Khan S, Ross NA. Type 2 diabetes in Canada: concentration of risk among most disadvantaged men but inverse social gradient across groups in women. *Diabetic Medicine* 2010;27(5):522-31.
- (92) Liese AD, Weis KE, Schulz M, Toozee JA. Food intake patterns associated with incident type 2 diabetes: the Insulin Resistance Atherosclerosis Study. *Diabetes Care* 2009; 32(2):263-8.
- (93) Sun Q, Spiegelman D, van Dam RM, Holmes MD, Malik VS, Willett WC, et al, White rice, , brown rice, and risk of type 2 diabetes in US men and women. *Arch Intern Med* 2010;170(11):961-9.
- (94) van Dam RM, Rimm EB, Willett WC, Stampfer MJ, Hu FB. Dietary patterns and risk for type 2 diabetes mellitus in U.S. men. *Ann Intern Med* 2002; 136(3):201-9.
- (95) Schulze MB, Liu S, Rimm EB, Manson JE, Willett WC, Hu FB. Glycemic index, glycemic load, and dietary fiber intake and incidence of type 2 diabetes in younger and middle-aged women. *Am J Clin Nutr* 2004;80(2):348-56.
- (96) Villegas R, Liu S, Gao YT, Yang G, Li H, Zheng W, et al. Prospective study of dietary carbohydrates, glycemic index, glycemic load, and incidence of type 2 diabetes mellitus in middle-aged Chinese women. *Arch Intern Med* 2007;167(21) :2310-6.
- (97) Hu FB, van Dam RM, Liu S. Diet and risk of Type II diabetes: the role of types of fat and carbohydrate. *Diabetologia* 2001;44(7):805-17.

- (98) Montonen J, Knekt P, Harkanen T, Jarvinen R, Heliovaara M, Aromaa A, et al. Dietary patterns and the incidence of type 2 diabetes. *AmJ Epidemiol* 2005;161(3):219-27.
- (99) Salmeron J, Ascherio A, Rimm EB, Colditz GA, Spiegelman D, Jenkins DJ, et al. Dietary fiber, glycemic load, and risk of NIDDM in men. *Diabetes Care* 1997;20 (4):545-50.
- (100) Meyer KA, Kushi LH, Jacobs DR, Jr., Slavin J, Sellers TA, Folsom AR. Carbohydrates, dietary fiber, and incident type 2 diabetes in older women. *Am J Clin Nutr* 2000;71(4):921-30.
- (101) Knekt P, Laaksonen M, Mattila C, Harkanen T, Marniemi J, Heliovaara M, et al. Serum vitamin D and subsequent occurrence of type 2 diabetes. *Epidemiology* 2008;(5):666-71.
- (102) Pittas AG, Wason-Hughes B, Li T, van Dam RM, Willett WC, Manson JE, et al. Vitamin D and calcium intake in relation to type 2 diabetes in women. *Diabetes Care* 2006; 29(3):650-6.
- (103) Amini M and Janghorban M Diabetes and impaired glucose regulation in first-degree relatives of patients with type 2 diabetes in Isfahan, Iran: Prevalence and risk factors. *Rev Diabet Stud* 2007; 4:169-176.
- (104) Meigs JB, Cupples LA, Wilson PW. Parental transmission of type 2 diabetes: the Framingham Offspring Study. *Diabetes* 2000; 49(12):2201-7.
- (105) Harrison TA, Hindorff LA, Kim H, Wines RC, Bowen DJ, McGrath BB, et al. Family history of diabetes as a potential public health tool. *Am J Prev Med* 2003; 24(2):152-9.
- (106) Ma XJ, Jia WP, Hu C, Zhou J, Lu HJ, Zhang R, et al. Genetic characteristics of familial type 2 diabetes pedigrees: a preliminary analysis of 4468 persons from 715 pedigrees. *CMJ* 2008; 88(36):2541-3.
- (107) Bjornholt JV, Erikssen G, Liestol K, Jervell J, Thaulow E, Erikssen J. Type 2 diabetes and maternal family history: an impact beyond slow glucose removal rate and fasting hyperglycemia in low-risk individuals? Results from 22.5 years of follow-up of healthy nondiabetic men. *Diabetes Care* 2000;23(9):1255-9.
- (108) Medici F, Hawa M, Ianari A, Pyke DA, Leslie RD. Concordance rate for type II diabetes mellitus in monozygotic twins: actuarial analysis. *Diabetologia* 1999; 42(2):146-50.
- (109) Swapan Kumar Das and Steven C Elbein. The genetic basis of type 2 diabetes. *Cellscience* 2006 ;2:100-31.
- (110) Elbein SC, Wegner K, Kahn SE. Reduced beta-cell compensation to the insulin resistance associated with obesity in members of caucasian familial type 2 diabetic kindreds. *Diabetes Care* 2000;23(2):221-7.

- (111) Gerich JE. The genetic basis of type 2 diabetes mellitus: impaired insulin secretion versus impaired insulin sensitivity. *Endocr Rev* 1998;19(4):491-503.
- (112) Cauchi S, Froguel P. TCF7L2 genetic defect and type 2 diabetes. *Curr Diab Rep* 2008; 8(2):149-55.
- (113) Lyssenko V. The transcription factor 7-like 2 gene and increased risk of type 2 diabetes: an update. *Curr Opin Clin Nutr Metab Care* 2008; 11(4):385-92.
- (114) Prokopenko I, McCarthy MI, Lindgren CM. Type 2 diabetes: new genes, new understanding. *Trends Genet* 2008; 24(12):613-21.
- (115) Schwarz PE, Li J, Lindstrom J, Tuomilehto J. Tools for predicting the risk of type 2 diabetes in daily practice. *Horm Metab Res* 2009;41(2):86-97.
- (116) Gao WG, Qiao Q, Pitkaniemi J, Wild S, Magliano D, Shaw J, et al. Risk prediction models for the development of diabetes in Mauritian Indians. *Diabet Med* 2009; 26(10):996-1002.
- (117) Gao WG, Dong YH, Pang ZC; Nan HR, Wang SJ, Ren J, Zhang L, Tuomilehto J, Qiao Q. A simple Chinese risk score for undiagnosed diabetes. *Diabet Med* 2010; 27:274-82.
- (118) Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem* 1972 ;18:499-502.
- (119) Claudi T, Midthjell K, Furuseth K, Hanssen KF, Hestvold P-I, Øgar P. NSAM's guidelines for treatment of diabetes in general practice. Oslo: Norwegian college of general practitioners, Norwegian institute of public health, Norwegian medical association, Norwegian Diabetes Assoc (2000) (in Norwegian).
- (120) Standards of medical care in diabetes-2009. *Diabetes Care* 2009;32:S6-12.
- (121) Expert Panel on Detection Evaluation and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA* 2001;285:2486-97.
- (122) Sattar N, Gaw A, Scherbakova O, Ford I, O'Reilly DS, Haffner SM, et al. Metabolic syndrome with and without C-reactive protein as a predictor of coronary heart disease and diabetes in the West of Scotland Coronary Prevention Study. *Circulation* 2003; 108(4):414-9.
- (123) Wannamethee SG, Shaper AG, Lennon L, Morris RW. Metabolic syndrome vs Framingham Risk Score for prediction of coronary heart disease, stroke, and type 2 diabetes mellitus. *Arch Intern Med* 2005; 165: 2644-50.
- (124) Saudek CD, Herman WH, Sacks DB, Bergenstal RM, Edelman D, Davidson MB. A new look at screening and diagnosing diabetes mellitus. *J Clin Endocrinol Metab* 2008;93 (7):2447-53.

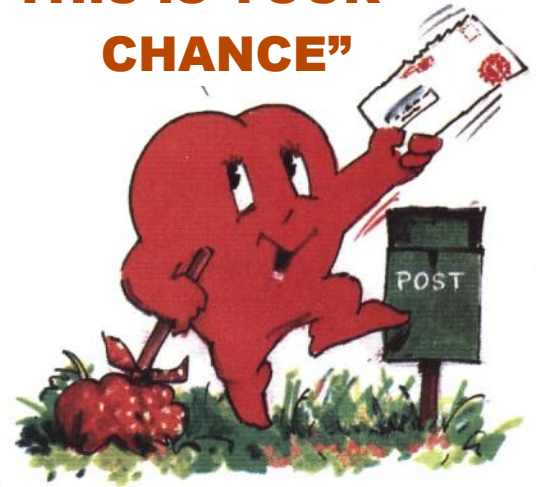
- (125) Kelson DG. Survival analysis. A self learning text, New York, Berlin, Heidelberg; Springer-Verlag:1996.
- (126) Hair JF, Black WC, Babin BJ, Anderson RE ,Tatham RL. Multivariate data analysis. 6<sup>th</sup> ed. Upper Saddle River NJ; Prentice Hall: 2006.
- (127) Ahamad OB, Boschi-Pinto C, Lopez AD, Murray CJL, Lozano R, Inoue M. Age standardization of rates: a new WHO standard. Geneva: EIP/GPE/EBD, World Health Organization, [www.who.int/healthinfo/paper31](http://www.who.int/healthinfo/paper31) pdf (2001)Accessed on: May 26, 2009.
- (128) Young TK. Population Health, Concept and Methods. 2<sup>nd</sup> ed. Toronto; Oxford. University Press, inc:2005.
- (129) Rothman K J, Modern epidemiology, 2<sup>nd</sup> ed, Philadelphia; Lipincott-Raven:1998.
- (130) Rothman K. Epidemiology. An introduction, First ed. New York: Oxford University press, Inc; 2002.
- (131) Gerstman BB. Epidemiology kept simple. 2<sup>nd</sup> ed. New Jersey; Wiley-Liss, Inc., Hoboken: 2003.
- (132) Jacobsen BK, Thelle DS. The Tromso Heart Study: responders and non-responders to a health questionnaire, do they differ? Scand J Soc Med 1988;16(2):101-4.
- (133) Cooper GR, Myers GL, Smith SJ, Schlant RC. Blood lipid measurements: Variations and practical utility. JAMA 1992 ;267(12):1652-60.
- (134) Statistics Norway. Statistical Yearbook 2009.Oslo, Norway: Statistics Norway, 2009.
- (135) Helgason A, Palsson S, Thorleifsson G, Grant SF, Emilsson V, Gunnarsdottir S, et al. Refining the impact of TCF7L2 gene variants on type 2 diabetes and adaptive evolution. Nat Genet 2007;39(2):218-25.



# HEALTH SURVEY

Invitation

**“THIS IS YOUR  
CHANCE”**



Date of birth

Social security No.

Municipality

Electoral ward No.

## Welcome to the Tromsø Health Survey!

The Health Survey is coming to Tromsø. This leaflet will tell you when and where. You will also find information about the survey in the enclosed brochure.

*We would like you to fill in the form overleaf and take it with you to the examination.*

The more people take part in the survey, the more valuable its results will be. We hope, therefore, that

you will be able to come. Attend even if you feel healthy, if you are currently receiving medical treatment, or if you have had your cholesterol and blood pressure levels taken recently.

Yours sincerely,  
**Municipal Health Authorities  
Faculty of Medicine - University of Tromsø  
National Health Screening Service**

*“THIS IS A REAL  
OPPORTUNITY- TAKE IT!”*



## YOUR OWN HEALTH

What is your current state of health? *Tick one box only.*

- Poor ..... 12  1  
 Not so good .....  2  
 Good .....  3  
 Very good .....  4

Do you have, or have you ever had:

|                                   | Yes | No | Age first time |
|-----------------------------------|-----|----|----------------|
| Myocardial infarction..... 13     |     |    | years          |
| Angina pectoris..... 16           |     |    | years          |
| Stroke/ brain haemorrhage..... 19 |     |    | years          |
| Asthma ..... 22                   |     |    | years          |
| Diabetes ..... 25                 |     |    | years          |

Do you take medicine for high blood pressure?

- Currently ..... 28  1  
 Before, but not now .....  2  
 Never used .....  3

Have you during the last year suffered from pains and/or stiffness in muscles and joints that have lasted continuously for at least 3 months? 29

| Yes                      | No                       |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |

Have you in the last two weeks felt:

|                          | No                       | A little                 | A lot                    | Very much                |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Nervous or worried? 30   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Anxious?..... 31         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Secure and calm?..... 32 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Irritable? ..... 33      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Happy and optimistic? 34 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Down/depressed? .... 35  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lonely? ..... 36         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                          | 1                        | 2                        | 3                        | 4                        |

## SMOKING

Did any of the adults at home smoke while you were growing up? ..... 37

| Yes                      | No                       |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |

Do you now, or have you previously, lived with daily smokers after your 20<sup>th</sup> birthday? 38

| Yes                      | No                       |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |

If "YES", for how many years in all? ..... 39

| Years                |
|----------------------|
| <input type="text"/> |

How many hours a day do you normally spend in smoke-filled rooms? ..... 41

| Hours                |
|----------------------|
| <input type="text"/> |

*Put 0 if you do not spend time in smoke-filled rooms.*

Do you yourself smoke:

- Cigarettes daily? ..... 43  Yes  No  
 Cigars/ cigarillos daily? ..... 44  Yes  No  
 Pipe daily? ..... 45  Yes  No

If you previously smoked daily, how long is it since you stopped?..... 46

| Years                |
|----------------------|
| <input type="text"/> |

If you smoke daily at the moment, or have smoked before?

How many cigarettes do you smoke/ did you smoke per day? ..... 48

| cigarettes           |
|----------------------|
| <input type="text"/> |

How old were you when you began smoking daily?..... 52

| Age                        |
|----------------------------|
| <input type="text"/> years |

How many years in all have you smoked daily? ..... 54

| Years                |
|----------------------|
| <input type="text"/> |

## EXERCISE

How has your physical activity in leisure time been during this last year? *Think of your weekly average for the year.*

*Time spent going to work counts as leisure time.*

|   | None                     | Less than 1              | 1-2                      | 3 or more                |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| Light activity ( <i>not sweating/out of breath</i> ) ..... 56 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Hard activity ( <i>sweating/out of breath</i> ) ..... 57      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1                        | 2                        | 3                        | 4                        |

## COFFEE

How many cups of coffee do you drink daily?

*Put 0 if you do not drink coffee daily.*

|                       |                           |
|-----------------------|---------------------------|
| Boiled coffee..... 58 | <input type="text"/> Cups |
| Other coffee ..... 60 | <input type="text"/> Cups |

## ALCOHOL

Are you a teetotaler? ..... 62

| Yes                      | No                       |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |

How many times a month do you normally drink alcohol? *Do not count low-alcohol beer.*

*Put 0 if less than once a month. .... 63*

| Times                |
|----------------------|
| <input type="text"/> |

How many glasses of beer, wine or spirits do you normally drink in a fortnight? 65

|   | Beer                         | Wine                         | Spirits                      |
|---|------------------------------|------------------------------|------------------------------|
| <i>Do not count low-alcohol beer.</i>   | <input type="text"/> Glasses | <input type="text"/> Glasses | <input type="text"/> Glasses |
| <i>Put 0 if less than once a month.</i> |                              |                              |                              |

## FAT

What kind of margarine or butter do you normally use on Bread? *Tick one box only.*

- Don't use butter/margarine ..... 71  1  
 Butter .....  2  
 Hard margarine .....  3  
 Soft margarine .....  4  
 Butter/margarine blend ...  5  
 Light margarine .....  6

## EDUCATION/WORK

What is the highest level of education you have completed?

- 7-10 years primary, folk high school ..... 72  1  
 Technical school, vocational school, 1-2 years high secondary school .....  2  
 A-levels/High secondary school (3-4 years).....  3  
 College/university, less than 4 years ...  4  
 College/university, 4 or more years .....  5

What is your current work situation?

- Paid work ..... 73   
 Full-time housework ..... 74   
 Education, military service.. ..... 75   
 Unemployed, on leave ..... 76

How many hours of paid work do you have per week? ..... 77

| No. of hours         |
|----------------------|
| <input type="text"/> |

Do you receive any of the following benefits?

- Sickness benefit (sick leave) ..... 79   
 Rehabilitation benefit ..... 80   
 Disability pension ..... 81   
 Old-age pension ..... 82   
 Social welfare benefit ..... 83   
 Unemployment benefit ..... 84

## ILLNESS IN THE FAMILY

Have one or more of your parents or siblings had a heart attack or had angina (heart cramp)? ..... 85

| Yes                      | No                       | Don't know               |
|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



# Tromsø Health Survey

The main aim of the Tromsø Study is to improve our knowledge about cardiovascular diseases in order to aid prevention. The survey is also intended to improve our knowledge of cancer and other general conditions, such as allergies, muscle pains and mental conditions. We would therefore like you to answer some questions about factors that may be relevant for your risk of getting these and other illnesses.

This form is part of the Health Survey, which has been approved by the Norwegian Data Inspectorate and the Regional Board of Research Ethics. The answers will only be used for research purposes and will be treated in strict confidence. The information you give us may later be stored along with information from other public health registers in accordance with the rules laid down by the Data Inspectorate and the Regional Board of Research Ethics.

If you are in doubt about what to answer, tick the box that you feel fits best.

The completed form should be sent to us in the enclosed pre-paid envelope.

Thank you in advance for helping us.

Yours sincerely,

Faculty of Medicine  
University of Tromsø

National Health  
Screening Service

If you do not wish to answer the questionnaire, tick the box below and return the form. Then you will not receive reminders.

I do not wish to answer the questionnaire. ....17

Date Month Year

Date for filling in this form: .....18 ...../...../.....

## CHILDHOOD/YOUTH

What Norwegian municipality did you live in at the age of 1 year?

.....24-28

If you did not live in Norway, give country of residence instead of municipality.

How was your family's economic situation while you were growing up?

- Very good .....29   
 Good .....   
 Difficult .....   
 Very difficult .....

For how much of the first three years of your life

- did you live in a town/city? .....30 \_\_\_\_ Years  
 - did your family have a cat or dog in the home? .....31 \_\_\_\_ Years

For how much of the first 15 years of your life

- did you live in a town/city? .....32 \_\_\_\_ Years  
 - did your family have a cat or dog in the home? .....34 \_\_\_\_ Years

## HOME

Who do you live with?

Tick once for each item and give the number of persons. Yes No Number

Spouse/partner .....36   \_\_\_\_\_

Other persons over 18 years .....37   \_\_\_\_\_

Persons under 18 years .....40   \_\_\_\_\_

How many of the children go to kindergarten? .....43 \_\_\_\_\_

What type of home do you live in?

Villa/ detached house .....45  1

Farm .....  2

Flat / apartment .....  3

Terraced /semi-detached house .....  4

Other .....  5

How big is your home? .....46 \_\_\_\_\_ m<sup>2</sup>

Approximately what year was your home built? .....49 \_\_\_\_\_

Has your home been insulated after 1970? .....53  Yes  No

Do you live on the bottom floor/cellar level? .....54

If "YES", is the floor laid on concrete? .....55

What is the main source of heat in your home?

Electric heating .....56

Wood-burning stove .....

Central heating system using:

Paraffin .....

Electricity .....

Do you have fitted carpets in the living room? .....60  Yes  No

Is there a cat in your home? .....61

Is there a dog in your home? .....62

## WORK

If you have paid or unpaid work, which statement describes your work best?

I am mainly seated while working .....63  1  
 (e.g., at a desk/assembly work)

My work requires a lot of walking .....  2  
 (e.g., shop assistant, light industrial work, teaching)

My work entails a lot of walking and lifting .....  3  
 (e.g., postman/woman, nurse, building work)

I do heavy physical work .....  4  
 (e.g., forestry, heavy agricultural/construction work)

Do you have any influence on how your work is organised?

No, not at all .....64  1

To a small extent .....  2

Yes, to a large extent .....  3

Yes, I decide myself .....  4

Are you on call; do you work shifts or nights? .....65  Yes  No

Do you do any of the following jobs (full- or part-time)?

Tick one box only for each item. Yes No

Driver .....66

Farmer .....

Fisherman .....

## YOUR OWN ILLNESSES

Have you ever had:

Tick one box only for each item. Give your age at the time.

If you have had the condition several times, how old were you **last time**?

|  | Yes                      | No                       | Age     |
|--|--------------------------|--------------------------|---------|
| Hip fracture .....                               | <input type="checkbox"/> | <input type="checkbox"/> | .....69 |
| Wrist/forearm fracture .....                     | <input type="checkbox"/> | <input type="checkbox"/> | .....72 |
| Whiplash .....                                   | <input type="checkbox"/> | <input type="checkbox"/> | .....75 |
| <b>Injury</b> requiring hospital admission ..... | <input type="checkbox"/> | <input type="checkbox"/> | .....78 |
| Gastric ulcer .....                              | <input type="checkbox"/> | <input type="checkbox"/> | .....81 |
| Duodenal ulcer .....                             | <input type="checkbox"/> | <input type="checkbox"/> | .....84 |
| Gastric/duodenal ulcer surgery .....             | <input type="checkbox"/> | <input type="checkbox"/> | .....87 |
| Throat/ neck surgery .....                       | <input type="checkbox"/> | <input type="checkbox"/> | .....90 |

Have you ever had, or do you still have:

Tick one box only for each item.

|   | Yes                      | No                       |
|---|--------------------------|--------------------------|
| Cancer .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Epilepsy .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Migraine .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Chronic bronchitis .....                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Psoriasis .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| Osteoporosis .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Fibromyalgia/fibrositis/chronic pain syndrome .....         | <input type="checkbox"/> | <input type="checkbox"/> |
| Psychological problems for which you have sought help ..... | <input type="checkbox"/> | <input type="checkbox"/> |
| Thyroid disease .....                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Liver disease .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| Kidney disease .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Appendectomy .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>Allergy and hypersensitivity:</b>                        |                          |                          |
| Atopic eczema (e.g., childhood eczema) .....                | <input type="checkbox"/> | <input type="checkbox"/> |
| Hand eczema .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| Hay fever .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| Food allergy .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Other hypersensitivity (not allergy) .....                  | <input type="checkbox"/> | <input type="checkbox"/> |

How many times have you had a cold, influenza (flue), vomiting/diarrhoea, or similar in the last six months? \_\_\_\_\_times

Have you had any of these in the last two weeks? .....112  Yes  No

## ILLNESS IN THE FAMILY

Tick the appropriate box for relatives that have, or have ever had the following illnesses:

Tick "None" if none of your relatives have had the condition.

|   | Mother                   | Father                   | Brother                  | Sister                   | Child                    | None                     |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Stroke or brain haemorrhage .....         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Myocardial infarction before age 60 ..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cancer .....                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Asthma .....                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Gastric/ duodenal ulcer .....             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Osteoporosis .....                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Psychological problems .....              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Allergy .....                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Diabetes .....                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - age when they got diabetes .....        | .....167                 | .....                    | .....                    | .....                    | .....                    | .....                    |

## SYMPTOMS

Do you cough approximately every day of the year? .....177  Yes  No  
If "Yes":

Is your cough productive? .....178

Have you had this kind of cough for as long as 3 months in each of the last two years? .....179

Have you had periods of wheezing in your chest? .....180

If "Yes", has this occurred:

Tick one box only for each item.

At night .....181

In connection with respiratory infections .....

In connection with physical exertion .....

In connection with very cold weather .....

Have you noticed sudden changes in your pulse or heart rhythm in the last year? .....185

How often do you suffer from sleeplessness?

Never, or just a few times a year .....186  1

1-2 times a month .....  2

Approximately once a week .....  3

More than once a week .....  4

If you suffer from periods of sleeplessness, what times of the year does it affect you most?

No particular time of year .....187  1

Especially during the dark winter months .....  2

Especially during the midnight sun period .....  3

Especially in spring and autumn .....  4

Have you in the last year suffered from sleeplessness to the extent that it has affected your ability to work? .....188  Yes  No

How often do you suffer from headaches?

Seldom/never .....189  1

Once a month or more .....  2

Once a week or more .....  3

Every day .....  4

Does the thought of getting a serious illness ever worry you?

Not at all .....190  1

Only a little .....  2

Some .....  3

Very much .....  4

## USE OF HEALTH SERVICES

How many visits have you made during the past year due to your own health or illness?

Tick 0 if you have **not** had such contact

Number of times the past year

To a general practitioner (GP)/ Emergency GP .....191 \_\_\_\_\_

Psychologist or psychiatrist ..... \_\_\_\_\_

Other medical specialist (not at a hospital) ..... \_\_\_\_\_

Hospital out-patient clinic .....197 \_\_\_\_\_

Hospital admission ..... \_\_\_\_\_

Medical officer at work ..... \_\_\_\_\_

Physiotherapist .....203 \_\_\_\_\_

Chiropractor ..... \_\_\_\_\_

Acupuncturist ..... \_\_\_\_\_

Dentist .....209 \_\_\_\_\_

Alternative medical practitioner (homoeopath, foot zone therapist, etc.) \_\_\_\_\_

Healer, faith healer, clairvoyant ..... \_\_\_\_\_

## MEDICATION AND DIETARY SUPPLEMENTS

Have you during the past year used any of the following medicines every day or almost daily? Indicate how many months you used them.

Put **0** for items you have **not** used.

### Medications

Painkillers .....215 \_\_\_\_\_ mths  
 Sleeping pills ..... \_\_\_\_\_ mths  
 Tranquilizers ..... \_\_\_\_\_ mths  
 Antidepressants .....221 \_\_\_\_\_ mths  
 Allergy drugs ..... \_\_\_\_\_ mths  
 Asthma drugs ..... \_\_\_\_\_ mths

### Dietary supplements

Iron tablets .....227 \_\_\_\_\_ mths  
 Calcium tablets or bonemeal ..... \_\_\_\_\_ mths  
 Vitamin D supplement ..... \_\_\_\_\_ mths  
 Other vitamin supplements .....233 \_\_\_\_\_ mths  
 Cod liver oil or fish oil capsules ..... \_\_\_\_\_ mths

Have you in the last 14 days used the following medicines or dietary supplements?

Tick **one** box only for **each** item.

### Medicines

Yes No

Painkillers .....237    
 Antipyretic drugs (to reduce fever)    
 Migraine drugs    
 Eczema cream/ointment    
 Heart medicine (not blood pressure)    
 Lipid lowering drugs .....242    
 Sleeping pills    
 Tranquilizers    
 Antidepressants    
 Other drugs for nervous conditions    
 Antacids .....247    
 Gastric ulcer drugs    
 Insulin    
 Diabetes tablets    
 Thyroxin tablets (for metabolic disorder)    
 Cortisone tablets .....252    
 Other medicine(s)

### Dietary supplements

Iron tablets    
 Calcium tablets or bonemeal    
 Vitamin D supplement    
 Other vitamin supplements .....257    
 Cod liver oil or fish oil capsules

## FRIENDS

How many good friends do you have whom you can talk confidentially with and who give you help when you need it? *Do not count people you live with, but do include other relatives!* .....259 \_\_\_\_\_ good friends

How many of these good friends do you have contact with at least once a month? .....261 \_\_\_\_\_

Yes No

Do you feel you have enough good friends? .....263

How often do you normally take part in organised gatherings, e.g., sewing circles, sports clubs, political meetings, religious or other associations?

Never, or just a few times a year .....264  1  
 1-2 times a month  2  
 Approximately once a week  3  
 More than once a week  4

## DIET

If you use butter or margarine on your bread, how many slices does a small catering portion normally cover? By this, we mean the portion packs served on planes, in cafés, etc. (i.e., 10-12g)

A catering portion is enough for about .....265 \_\_\_\_\_ slices

What kind of fat is normally used in **cooking** (not on the bread) in your home?

Butter .....266   
 Hard margarine .....   
 Soft margarine .....   
 Butter/margarine blend .....   
 Oils .....270

What kind of bread (bought or home-made) do you usually eat? Tick **one or two** boxes!

The bread I eat is most similar to  White bread .....271  Light textured brown  Ordinary brown  Coarse brown  Crisp bread .....275

How much (in **number** of glasses, cups, potatoes or slices) do you usually eat or drink **daily** of the following foodstuffs?

Tick **one** box for **each** foodstuff.

|   | 0                        | Less than 1              | 1-2                      | 3-4                      | 5-6                      | More than 6              |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Full cream milk (fresh or soured) (glasses)             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Semi-skimmed milk (low-fat) (fresh or soured) (glasses) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Skimmed milk (fresh or soured) (glasses)                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Tea (cups)  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Orange juice (glasses)                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Potatoes .....281                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Slices of bread in total (incl. crisp-bread)            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Slices of bread with                                    |                          |                          |                          |                          |                          |                          |
| - fish  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (e.g., mackerel in tomato sauce)                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - lean meat (e.g., ham)                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - fat meat (e.g., salami)                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - cheese (e.g. Gouda/ Norvegia) .....286                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - brown cheese  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - smoked cod caviare                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - jam and other sweet spreads                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1                        | 2                        | 3                        | 4                        | 5                        | 6                        |

How many **times per week** do you normally eat the following foodstuffs?

Tick a box for **all** foodstuffs listed.

|   | Never                    | Less than 1              | 1                        | 2-3                      | 4-5                      | approximately everyday   |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Yoghurt .....290  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Boiled or fried egg <input type="checkbox"/>                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Breakfast cereal/ oat meal, etc. .... <input type="checkbox"/>      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| For dinner  |                          |                          |                          |                          |                          |                          |
| - meat <input type="checkbox"/>                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - sausage/ meatloaf/ meatballs <input type="checkbox"/>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - fat fish (e.g., salmon/redfish) .....295 <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - lean fish (e.g., cod) <input type="checkbox"/>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - fishballs/fishpudding/fishcakes <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - vegetables <input type="checkbox"/>                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Mayonnaise, remoulade <input type="checkbox"/>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Carrots .....300 <input type="checkbox"/>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cauliflower/cabbage/ broccoli <input type="checkbox"/>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Apples/pears <input type="checkbox"/>                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Oranges, mandarins <input type="checkbox"/>                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sweetened soft drinks <input type="checkbox"/>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sugar-free ("Light") soft drinks <input type="checkbox"/>           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Chocolate <input type="checkbox"/>                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Waffles, cakes, etc. ....307 <input type="checkbox"/>               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1                        | 2                        | 3                        | 4                        | 5                        | 6                        |

## ALCOHOL

How often do you usually drink

|                                   |                                |                                |                                     |
|-----------------------------------|--------------------------------|--------------------------------|-------------------------------------|
| Never, or just a few times a year | beer? <input type="checkbox"/> | wine? <input type="checkbox"/> | Spirits? <input type="checkbox"/> 1 |
| 1-2 times a month                 | <input type="checkbox"/>       | <input type="checkbox"/>       | <input type="checkbox"/> 2          |
| Approximately once a week         | <input type="checkbox"/>       | <input type="checkbox"/>       | <input type="checkbox"/> 3          |
| 2-3 times a week                  | <input type="checkbox"/>       | <input type="checkbox"/>       | <input type="checkbox"/> 4          |
| Approximately every day           | <input type="checkbox"/>       | <input type="checkbox"/>       | <input type="checkbox"/> 5          |

308 310

Approximately how often in the last year have you drunk alcohol that equals at least 5 small bottles of beer, a bottle of wine, or 1/4 bottle of spirits?

|                        |          |                            |
|------------------------|----------|----------------------------|
| Not in the last year   | .....311 | <input type="checkbox"/> 1 |
| Just a few times       | .....    | <input type="checkbox"/> 2 |
| 1-2 times a month      | .....    | <input type="checkbox"/> 3 |
| 1-2 times a week       | .....    | <input type="checkbox"/> 4 |
| 3 or more times a week | .....    | <input type="checkbox"/> 5 |

For approximately how many years has your alcohol consumption been as you described above? .....312 \_\_\_ years

## WEIGHT REDUCTION

About how many times have you deliberately tried to lose weight? Write 0 if you never have.

|                 |          |           |
|-----------------|----------|-----------|
| - before age 20 | .....314 | ___ times |
| - after age 20  | .....316 | ___ times |

If you have lost weight, about how many kilos have you ever lost at the most?

|                 |          |        |
|-----------------|----------|--------|
| - before age 20 | .....318 | ___ kg |
| - after age 20  | .....320 | ___ kg |

What weight would you be satisfied with (your "comfort weight")? .....322 \_\_\_ kg

## URINARY INCONTINENCE

How often do you suffer from urinary incontinence?

|                            |          |                            |
|----------------------------|----------|----------------------------|
| Never                      | .....325 | <input type="checkbox"/> 1 |
| Not more than once a month | .....    | <input type="checkbox"/> 2 |
| Two or more times a month  | .....    | <input type="checkbox"/> 3 |
| Once a week or more        | .....    | <input type="checkbox"/> 4 |

Your comments:

## TO BE ANSWERED BY WOMEN ONLY

### MENSTRUATION

How old were you when you had your first menstruation? .....326 \_\_\_ years

If you no longer menstruate, how old were you when you stopped having menstruation? .....328 \_\_\_ years

Apart from pregnancy and after giving birth, have your menstruation ever stopped for 6 months or more? Yes No  
.....330

If "Yes", how many times? .....331 \_\_\_ times

If you still menstruate or are pregnant: \_\_\_\_\_ day/month/year

What date did your last menstruation begin? .....333 \_\_\_/\_\_\_/\_\_\_

Do you normally use painkillers to relieve period pains? Yes No  
339

### PREGNANCY

How many children have you given birth to? .....340 \_\_\_ children

Are you pregnant now? Yes No Don't know  
.....342

During pregnancy, have you had high blood pressure and/or proteinuria? Yes No  
.....343

If "Yes", during which pregnancy? Pregnancy First Later

|                     |          |                          |                          |
|---------------------|----------|--------------------------|--------------------------|
| High blood pressure | .....344 | <input type="checkbox"/> | <input type="checkbox"/> |
| Proteinuria         | .....346 | <input type="checkbox"/> | <input type="checkbox"/> |

If you have given birth, fill out for each child the year of birth and approximately how many months you breastfed the child.

| Child | Year of birth: | Number of months breastfed |
|-------|----------------|----------------------------|
| 1     | 348 _____      | _____                      |
| 2     | _____          | _____                      |
| 3     | 356 _____      | _____                      |
| 4     | _____          | _____                      |
| 5     | 364 _____      | _____                      |
| 6     | _____          | _____                      |

### CONTRACEPTION AND OESTROGEN

|                                      |          |                          |                          |
|--------------------------------------|----------|--------------------------|--------------------------|
| Do you, or have you ever, used:      | Now      | Used to                  | Never                    |
| Contraceptive pills (incl. minipill) | .....372 | <input type="checkbox"/> | <input type="checkbox"/> |
| A hormonal intrauterine device       | .....    | <input type="checkbox"/> | <input type="checkbox"/> |
| Oestrogen (tablets or patches)       | .....374 | <input type="checkbox"/> | <input type="checkbox"/> |
| Oestrogen (cream or suppositories)   | .....    | <input type="checkbox"/> | <input type="checkbox"/> |
|                                      | 1        | 2                        | 3                        |

If you use contraceptive pills, hormonal intrauterine device, or oestrogen, what brand do you currently use?

.....376 \_\_\_\_\_

If you use, or have ever used, contraceptive pills:

Age when you began taking the pill? .....380 \_\_\_ years

How many years in total have you taken the pill? .....382 \_\_\_ years

If you have given birth, how many years did you take the pill before your first child? .....384 \_\_\_ years

If you have stopped taking the pill: Age when you stopped? .....386 \_\_\_ years

# Tromsø Health Survey

## for the over 70s

The main aim of the Tromsø Study is to improve our knowledge about cardiovascular diseases in order to aid prevention. The survey is also intended to improve our knowledge of cancer and other general conditions, such as allergies, muscle pains and mental conditions. The ultimate aim is to gain an overview of the general health of the elderly population. We would therefore like you to answer the questions below.

This form is part of the Health Survey, which has been approved by the Norwegian Data Inspectorate and the Regional Board of Research Ethics. The answers will only be used for research purposes and will be treated in strict confidence. The information you give us may later be stored along with information from other public health registers in accordance with the rules laid down by the Data Inspectorate and the Regional Board of Research Ethics.

If you are in doubt about what to answer, tick the box that you feel fits best.

The completed form should be sent to us in the enclosed pre-paid envelope.

Thank you in advance for helping us.

Yours sincerely,

Faculty of Medicine  
University of Tromsø

National Health  
Screening Service

If you do not wish to answer the questionnaire, tick the box below and return the form. Then you will not receive reminders.

I do not wish to answer the questionnaire. ....17

Day Month Year

Date for filling in this form: .....18 ...../...../.....

### CHILDHOOD/YOUTH

What Norwegian municipality did you live in at the age of 1 year?

.....24-28

If you did not live in Norway, give country instead of municipality

How was your family's financial situation while you were growing up?

- Very good .....29  1  
 Good .....  2  
 Difficult .....  3  
 Very difficult .....  4

How old were your parents when they died?

Mother .....30 \_\_\_\_\_ Year  
 Father .....32 \_\_\_\_\_ Year

### HOME

Who do you live with?

Tick once for each item and give the number. Yes No Number

- Spouse/partner .....34    
 Other persons over 18 years .....35   \_\_\_\_\_  
 Persons under 18 years .....38   \_\_\_\_\_

What type of home do you live in?

- Villa/ detached house .....41  1  
 Farm .....  2  
 Flat/apartment .....  3  
 Terraced /semi-detached house .....  4  
 Other .....  5

How long have you lived in your present home? .....42 \_\_\_\_\_ Year

Is your home adapted to your needs? .....44  Yes  No

If "No", do you have problems with:

- Space .....45    
 Variable temperature/  
 too cold/too warm .....46    
 Stairs .....47    
 Toilet .....48    
 Bath/shower .....49    
 Maintenance .....50    
 Other (please specify) .....51

Would you like to move into a retirement home?

### PREVIOUS WORK AND FINANCIAL SITUATION

Which statement best describes the type of work you did for the last 5-10 years before you retired?

- I was mainly seated while working .....53  1  
 (e.g., desk/assembly work)  
 My work required a lot of walking .....  2  
 (e.g., shop assistant, housewife, teaching)  
 My work required a lot of walking and lifting ...  3  
 (e.g., postman, nurse, construction work)  
 I did heavy physical work .....  4  
 (e.g., forestry, heavy agricultural work,  
 heavy construction work)

Did you do any of the following jobs (full- or part-time)?

- Tick one box only for each item. Yes No  
 Driver .....54    
 Farmer .....55    
 Fisherman .....56

How old were you when you retired? .....57 \_\_\_\_\_ Year

What kind of pension do you have?

- Basic state pension .....59   
 Additional pensions .....60

How is your current financial situation?

- Very good .....61  1  
 Good .....  2  
 Difficult ...  3  
 Very difficult .....  4

## HEALTH AND ILLNESS

Has your state of health changed in the last year?

- Yes, it has deteriorated .....62  1  
 No, unchanged .....  2  
 Yes, it has improved .....  3

How do you feel your health is now compared to others of your age?

- Much worse .....63  1  
 A little worse .....  2  
 About the same .....  3  
 A little better .....  4  
 Much better .....  5

## YOUR OWN ILLNESSES

Have you ever had:

Tick one box only for each item. Give your age at the time. If you have had the condition several times, how old were you last time?

- |  | Yes                      | No                       | Age   |
|--|--------------------------|--------------------------|-------|
| Hip fracture .....64                       | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Wrist/forearm fracture .....67             | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Whiplash .....70                           | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Injury requiring hospital admission ....73 | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Gastric ulcer .....76                      | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Duodenal ulcer .....79                     | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Gastric/duodenal ulcer surgery .....82     | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Throat/neck surgery .....85                | <input type="checkbox"/> | <input type="checkbox"/> | _____ |

Have you ever had, or do you still have:

Tick one box only for each item.

- |   | Yes                      | No                       |
|---|--------------------------|--------------------------|
| Cancer .....88  | <input type="checkbox"/> | <input type="checkbox"/> |
| Epilepsy .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Migraine .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Parkinsons disease .....                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Chronic bronchitis .....                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Psoriasis .....93   | <input type="checkbox"/> | <input type="checkbox"/> |
| Osteoporosis .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Fibromyalgia/fibrositis/chronic pain syndrome .....         | <input type="checkbox"/> | <input type="checkbox"/> |
| Psychological problems for which you have sought help ..... | <input type="checkbox"/> | <input type="checkbox"/> |
| Thyroid disease .....                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Liver disease .....98                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Recurrent urinary incontinence .....                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Glaucoma .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Cataract .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Arthrosis (osteoarthritis) .....                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Rheumatoid arthritis .....103                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Kidney stones .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| Appendectomy .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Allergy and hypersensitivity                                |                          |                          |
| Atopic eczema (e.g., childhood eczema) .....                | <input type="checkbox"/> | <input type="checkbox"/> |
| Hand eczema .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| Hay fever .....108  | <input type="checkbox"/> | <input type="checkbox"/> |
| Food allergy .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| Other hypersensitivity (not allergy) .....                  | <input type="checkbox"/> | <input type="checkbox"/> |

How many times have you had a cold, influenza (flue), diarrhoea /vomiting, or similar in the last six months? 111 \_\_\_\_\_ Times

Have you had any of these in the last two weeks? .....113  Yes  No

## ILLNESS IN THE FAMILY

Put a mark for relatives who have, or have ever had, any of the following conditions:

Tick "None" for conditions which none of your relatives have had.

|   | Mother                   | Father                   | Brother                  | Sister                   | Child                    | None                     |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Stroke or brain haemorrhage .....114        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Myocardial infarction before age 60 .....20 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cancer .....126                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Hypertension .....132                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Asthma .....138                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Osteoporosis .....144                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Arthrosis (osteoarthritis) .....150         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Psychological problems .....156             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Dementia .....162                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Diabetes mellitus .....168                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - age when they got diabetes .....174       | _____                    | _____                    | _____                    | _____                    | _____                    | _____                    |

## SYMPTOMS

Do you cough daily for periods of the year? .....184  Yes  No

If "Yes":

Is your cough productive? .....185

Have you had this kind of cough for as long as 3 months in each of the last two years? 186

Have you had periods of wheezing in your chest? 187

If "Yes", has this occurred:

Tick one box only for each item.

At night .....188

In connection with respiratory infections .....

In connection with physical exertion .....

In connection with very cold weather .....191

Have you noticed sudden changes in your pulse or heart rhythm in the last year? .....192

Have you lost weight in the last year? .....193

If "Yes":

How many kilograms? .....194 \_\_\_\_\_ kg

How often do you suffer from sleeplessness?

Never, or just a few times a year .....196  1

1-2 times a month .....  2

Approximately once a week .....  3

More than once a week .....  4

If you suffer from periods of sleeplessness, what times of the year does it affect you most?

No particular time of year .....197  1

Especially during the 'polar nights' .....  2

Especially during the midnight sun period .....  3

Especially in spring and autumn .....  4

Do you usually take a nap during the day? 198  Yes  No

Do you feel that you usually get enough sleep?

Do you suffer from:

Dizziness .....200  No  A little  A lot

Poor memory .....

Lack of energy .....

Constipation .....203

Does the thought of getting a serious illness ever worry you?

- Not at all .....204
- Only a little .....
- Some .....
- Very much .....

### BODILY FUNCTIONS

Can you manage the following everyday activities on your own without help from others?

- |  | Yes                      | With some help           | No                       |
|--|--------------------------|--------------------------|--------------------------|
| Walking indoors on one level .....205          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Walking up/down stairs                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Walking outdoors                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Walking approx. 500 metres                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Going to the toilet                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Washing yourself .....210                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Taking a bath/shower                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Dressing and undressing                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Getting in and out of bed                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Eating meals                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cooking .....215                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Doing light housework (e.g., washing up)       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Doing heavier housework (e.g., cleaning floor) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Going shopping                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Taking the bus                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Can you hear normal speech (if necessary with a hearing aid)? .....220

Can you read (if necessary with glasses)? .....221

Are you dependent on any of the following aids?

- |                              | Yes                      | No                       |
|------------------------------|--------------------------|--------------------------|
| Walking stick .....222       | <input type="checkbox"/> | <input type="checkbox"/> |
| Crutches                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Walking frame/Zimmer frame   | <input type="checkbox"/> | <input type="checkbox"/> |
| Wheelchair                   | <input type="checkbox"/> | <input type="checkbox"/> |
| Hearing aid                  | <input type="checkbox"/> | <input type="checkbox"/> |
| Safety alarm device .....227 | <input type="checkbox"/> | <input type="checkbox"/> |

### USE OF HEALTH SERVICES

How many visits have you made during the past year due to your own health or illness:

Put 0 if you have not had such contact

To a general practitioner (GP)/emergency GP .....228

Psychologist or psychiatrist .....229

Other medical specialist (not at a hospital) .....230

Hospital out-patient clinic .....234

Hospital admission .....235

Physiotherapist .....236

Chiropractor .....240

Acupuncturist .....241

Dentist .....242

Chiropractist .....246

Alternative medical practitioner (homoeopath, foot zone therapist, etc.) .....247

Healer, Faith healer, clairvoyant .....248

Do you have domestic help?

- Private .....252
- Municipal .....

Do you receive services from the district nurse?

- 
- 

Are you pleased with the health care and home assistance services your municipality supplies?

- |                             | Yes                      | No                       | Don't know               |
|-----------------------------|--------------------------|--------------------------|--------------------------|
| Assigned family GP .....255 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| District nurse              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Home assistance             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Do you feel confident that you can receive the health care and home assistance you require if you need it?

- Confident .....258  1
- Not confident .....  2
- Very unsure .....  3
- Don't know .....  4

### MEDICATION AND DIETARY SUPPLEMENTS

Have you for any length of time in the past year used any of the following medicines every day or almost daily?

Indicate how many months you used them for.

Write 0 for items you have not used.

Medication:

- Painkillers .....259 \_\_\_\_\_ mths
- Sleeping pills ..... \_\_\_\_\_ mths
- Tranquillizers ..... \_\_\_\_\_ mths
- Antidepressants .....265 \_\_\_\_\_ mths
- Allergy drugs ..... \_\_\_\_\_ mths
- Asthma drugs ..... \_\_\_\_\_ mths
- Heart medicine (not blood pressure) .....271 \_\_\_\_\_ mths
- Insulin ..... \_\_\_\_\_ mths
- Diabetes tablets ..... \_\_\_\_\_ mths
- Thyroxin tablets (for metabolic disorder) .....277 \_\_\_\_\_ mths
- Cortisone tablets ..... \_\_\_\_\_ mths
- Remedies for constipation ..... \_\_\_\_\_ mths

Dietary supplements:

- Iron tablets .....283 \_\_\_\_\_ mths
- Vitamin D supplement ..... \_\_\_\_\_ mths
- Other vitamin supplements ..... \_\_\_\_\_ mths
- Calcium tablets or bonemeal .....289 \_\_\_\_\_ mths
- Cod liver oil or fish oil capsules ..... \_\_\_\_\_ mths

### FAMILY AND FRIENDS

Do you have close relatives who can give you help and support when you need it? .....293

If "Yes", who can give you help? <sup>†</sup>

- Spouse/partner .....294
- Children .....
- Others .....

How many good friends do you have whom you can talk confidentially with and who give you help when you need it? .....297

Do not count people you live with, but do include other relatives!

Do you feel you have enough good friends? <sup>9</sup>

Do you feel that you belong to a community or group of people who can depend on each other and who feel committed to each other (e.g., a political party, religious group, relatives, neighbours, work place, or organisation)?

- Strong sense of belonging .....300  1
- Some sense of belonging .....  2
- Not sure .....  3
- Little or no sense of belonging .....  4

How often do you normally take part in organised gatherings, e.g., sewing circles, sports clubs, political meetings, religious or other associations?

- Never, or just a few times a year .....301  1  
 1-2 times a month .....  2  
 Approximately once a week .....  3  
 More than once a week .....  4

## DIET

Number

How many meals a day do you normally eat (dinner and bread meals)? .....302 \_\_\_\_\_

How many times a week do you eat a hot dinner? .....304 \_\_\_\_\_

What kind of bread (bought or home-made) do you usually eat?

Tick one or two boxes!  
 The bread I eat is most similar to

|                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| White bread              | Light textured brown     | Ordinary brown           | Coarse brown             | Crisp bread              |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 306                      |                          |                          |                          | 310                      |

What kind of fat is normally used in cooking (not on the bread) in your home?

- Butter .....311   
 Hard margarine .....   
 Soft margarine .....   
 Butter/margarine blend .....   
 Oils .....315

How much (in number of glasses, cups, potatoes or slices) do you usually eat or drink daily of the following foodstuffs?

Tick one box for each foodstuff.

|  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
|  | 0                        | Less than 1              | 1-2                      | 3 or more                |
| Milk of all types (glasses) .....316                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Orange juice (glasses) ..... <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Potatoes ..... <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Slices of bread in total (incl. crispbread)              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Slices of bread with                                     |                          |                          |                          |                          |
| - fish (e.g., mackerel in tomato sauce)                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - cheese (e.g., Norwegia) ..... <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - smoked cod caviar .....322                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|  | 1                        | 2                        | 3                        | 4                        |

How many times per week do you normally eat the following foodstuffs?

Tick a box for all foodstuffs listed.

|   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
|   | Never                    | Less than 1              | 1                        | 2 or more                |
| Yoghurt .....323  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Boiled or fried egg ..... <input type="checkbox"/>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Breakfast cereal/oat meal, etc. ... <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| For dinner  |                          |                          |                          |                          |
| - meat ..... <input type="checkbox"/>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - fat fish (e.g., salmon/red-fish) ... <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - lean fish (e.g., cod) .....328                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| - vegetables (raw or cooked)..... <input type="checkbox"/>      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Carrots (raw or cooked) ..... <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cauliflower/cabbage/broccoli ..... <input type="checkbox"/>     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Apples/pears ..... <input type="checkbox"/>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Oranges, mandarins, etc. ....333                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | 1                        | 2                        | 3                        | 4                        |

Your comments:

## WELL BEING

How content do you generally feel with growing old?

- Good .....334  1  
 Quite good .....  2  
 Up and down .....  3  
 Bad .....  4

What is your view of the future?

- Bright .....335  1  
 Not too bad .....  2  
 Quite worried .....  3  
 Dark .....  4

## TO BE ANSWERED BY WOMEN ONLY

### MENSTRUATION

How old were you when you had your first menstruation? .....336 \_\_\_\_\_ Years

How old were you when you stopped having menstruations? ....338 \_\_\_\_\_ Years

### PREGNANCY

How many children have you given birth to? .....340 \_\_\_\_\_ Children

If you have given birth, fill out for each child the year of birth and approximately how many months you breastfed the child. If you have given birth to more than 6 children, note their birth year and number of months you breastfed at the space provided below for comments.

| Child | Year of birth: | Number of months breastfed: |
|-------|----------------|-----------------------------|
| 1     | 342 _____      | _____                       |
| 2     | 346 _____      | _____                       |
| 3     | _____          | _____                       |
| 4     | _____          | _____                       |
| 5     | 358 _____      | _____                       |
| 6     | _____          | _____                       |

During pregnancy, have you had high blood pressure and/or proteinuria? .....366  Yes  No

If "Yes", during which pregnancy?

|                              |                          |                          |                          |
|------------------------------|--------------------------|--------------------------|--------------------------|
|                              |                          | First                    | Later                    |
| High blood pressure .....367 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Proteinuria .....369         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### OESTROGEN

Do you use, or have you ever used oestrogen:

|                                 |                          |                          |                          |                          |
|---------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                 |                          | Now                      | Used to                  | Never                    |
| Tablets or patches .....371     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cream or suppositories .....372 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

If you use oestrogen, what brand do you currently use?

.....373

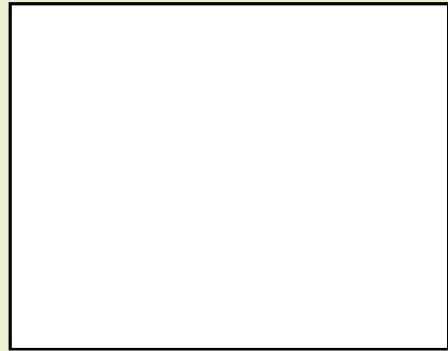




# Tromsø-undersøkelsen

The form will be read electronically. Please use a blue or black pen  
You can not use comas, use upper-case letters.

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## HEALTH AND DISEASES

1 How do you in general consider your own health to be?

- Very good
- Good
- Neither good nor bad
- Bad
- Very bad

2 How is your health compared to others in your age?

- Much better
- A little better
- About the same
- A little worse
- Much worse

3 Do you have, or have you had?

|   | Yes                      | No                       | Age first time       |
|---|--------------------------|--------------------------|----------------------|
| Heart attack .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Angina pectoris .....                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Stroke/brain hemorrhage.....                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Atrial fibrillation .....                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| High blood pressure .....                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Osteoporosis .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Asthma .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Chronic bronchitis/Emphysema/COPD....                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Diabetes mellitus .....                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Psychological problems (for which you have sought help)     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Low metabolism.....   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Kidney disease, not including urinary tract infection (UTI) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Migraine .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |

4 Do you have persistent or constantly recurring pain that has lasted for 3 months or more?

- Yes
- No

5 How often have you suffered from sleeplessness during the last 12 months?

- Never, or just a few times
- 1-3 times a month
- Approximately once a week
- More than once a week

6 Below you find a list of different situations. Have you experienced some of them in the last week (including today)? (Tick once for each complaint)

|   | No complaint             | Little complaint         | Pretty much              | Very much                |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| Sudden fear without reason                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| You felt afraid or worried .....                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Faintness or dizziness .....                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| You felt tense or upset .....                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Easily blamed yourself .....                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sleeping problems .....                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Depressed, sad .....                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| You felt useless, worthless .....                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Feeling that life is a struggle                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Feeling of hopelessness with regard to the future ..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## USE OF HEALTH SERVICES

7 Have you during the past year visited: If YES; how many times?

|  | Yes                      | No                       | No. of times         |
|--|--------------------------|--------------------------|----------------------|
| General practitioner (GP) .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Psychiatrist/psychologist .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Medical specialist outside hospital (other than general practitioner/psychiatrist)   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Physiotherapist .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Chiropractor .....   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Alternative medical practitioner (homeopath, acupuncturist, foot zone therapist, herbal medical practitioner, laying on hands practitioner, healer, clairvoyant, etc.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Dentist/dental service .....   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |

8 Have you during the last 12 months been to a hospital?

|   | Yes                      | No                       | No. of times         |
|---|--------------------------|--------------------------|----------------------|
| Admitted to a hospital .....                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Had consultation in a hospital without admission; |                          |                          |                      |
| At psychiatric out-patient clinic                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| At another out-patient clinic .....               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |

9 Have you undergone any surgery during the last 3 years?

- Yes
- No

## USE OF MEDICINE

10 Do you take, or have you taken some of the following medications? (Tick once for each line)

|                                    | Never used               | Now                      | Earlier                  | Age first time       |
|------------------------------------|--------------------------|--------------------------|--------------------------|----------------------|
| Drugs for high blood pressure      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Lipid lowering drugs .....         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Drugs for heart disease .....      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Diuretics .....                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Medications for osteoporosis ..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Insulin .....                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Tablets for diabetes .....         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Drugs for metabolism               |                          |                          |                          |                      |
| Thyroxine/levaxin .....            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |

11 How often have you during the last 4 weeks used the following medications?(Tick once for each line)

|                                    | Not used the last 4 weeks | Less than every week     | Every week, but not daily | Daily                    |
|------------------------------------|---------------------------|--------------------------|---------------------------|--------------------------|
| Painkillers on prescription .....  | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> |
| Painkillers non-prescription ..... | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> |
| Sleeping pills .....               | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> |
| Tranquillizers .....               | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> |
| Antidepressants .....              | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> |

12 State the names of all medications -both those on prescription and non-prescription drugs- you have used regularly during the last 4 weeks. Do not include vitamins, minerals, herbs, natural remedies, other nutritional supplements, etc.

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If the space is not enough for all medications, use an additional paper of your own.

When attending the survey centre you will be asked whether you have used antibiotics or painkillers the last 24 hours. If you have, you will be asked to provide the name of the drug, strength, dose and time of use.

## FAMILY AND FRIENDS

13 Who do you live with? (Tick for each question and give the number)

|                                     | Yes                      | No                       | Number               |
|-------------------------------------|--------------------------|--------------------------|----------------------|
| Spouse/cohabitant .....             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Other persons older than 18 years.. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |
| Persons younger than 18 years ..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> |

14 Tick for relatives who have or have had

|                                       | Parents                  | Children                 | Siblings                 |
|---------------------------------------|--------------------------|--------------------------|--------------------------|
| Myocardial infarction .....           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Myocardial infarction before 60 years | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Angina pectoris .....                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Stroke/brain haemorrhage .....        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Osteoporosis .....                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Stomach/duodenal ulcer .....          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Asthma .....                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Diabetes mellitus .....               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Dementia .....                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Psychological problems .....          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Drugs/substance abuse .....           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

15 Do you have enough friends who can give you help when you need it?

Yes  No

16 Do you have enough friends whom you can talk confidentially with?

Yes  No

17 How often do you normally take part in organised gatherings, e.g. sports clubs, political meetings, religious or other associations?

Never, or just a few times a year  
 1-2 times a month  
 Approximately once a week  
 More than once a week

## WORK, SOCIAL SECURITY AND INCOME

18 What is the highest level of education you have completed? (Tick one)

Primary, 1-2 years secondary school  
 Vocational school  
 High secondary school (A-level)  
 College/university less than 4 years  
 College/university 4 years or more

19 What is your main occupation/activity? (Tick one)

Full time work  Housekeeping  
 Part time work  Retired/benefit recipient  
 Unemployed  Student/military service

20 Do you receive any of the following benefits?

- Old-age, early retirement or survivor pension
- Sickness benefit (are in a sick leave)
- Rehabilitation benefit
- Full disability pension
- Partial disability pension
- Unemployment benefits
- Transition benefit for single parents
- Social welfare benefits

21 What was the households total taxable income last year? Include income from work, social benefits and similar

- Less than 125 000 NOK
- 125 000-200 000 NOK
- 201 000-300 000 NOK
- 301 000-400 000 NOK
- 401 000-550 000 NOK
- 551 000-700 000 NOK
- 701 000 -850 000 NOK
- More than 850 000 NOK

22 Do you work outdoors at least 25% of the time, or in cold buildings (e.g. storehouse/industry buildings)?

- Yes
- No

## PHYSICAL ACTIVITY

23 If you have paid or unpaid work, which statement describes your work best?

- Mostly sedentary work  
*(e.g. office work, mounting)*
- Work that requires a lot of walking  
*(e.g. shop assistant, light industrial work, teaching)*
- Work that requires a lot of walking and lifting  
*(e.g. postman, nursing, construction)*
- Heavy manual labour

24 Describe your exercise and physical exertion in leisure time. If you activity varies much, for example between summer and winter, then give an average. The question refers only to the last year. (Tick the one that fits best)

- Reading, watching TV, or other sedentary activity.
- Walking, cycling, or other forms of exercise at least 4 hours a week *(here including walking or cycling to place of work, Sunday-walking, etc.)*
- Participation in recreational sports, heavy gardening, etc. *(note: duration of activity at least 4 hours a week)*
- Participation in hard training or sports competitions, regularly several times a week.

25 How often do you exercise? (With exercise we mean for example walking, skiing, swimming or training/sports)

- Never
- Less than once a week
- Once a week
- 2-3 times a week
- Approximately every day

26 How hard do you exercise on average?

- Easy- do not become short-winded or sweaty
- You become short-winded and sweaty
- Hard- you become exhausted

27 For how long time do you exercise every time on average?

- Less than 15 minutes
- 15-29 minutes
- 30-60 minutes
- More than 1 hour

## ALCOHOL AND TOBACCO

28 How often do you drink alcohol?

- Never
- Monthly or more infrequently
- 2-4 times a month
- 2-3 times a week
- 4 or more times a week

29 How many units of alcohol (a beer, a glass of wine or a drink) do you usually drink when you drink alcohol?

- 1-2
- 3-4
- 5-6
- 7-9
- 10 or more

30 How often do you drink 6 units of alcohol or more in one occasion?

- Never
- Less frequently than monthly
- Monthly
- Weekly
- Daily or almost daily

31 Do you smoke sometimes, but not daily?

- Yes
- No

32 Do you/did you smoke daily?

- Yes, now
- Yes, previously
- Never

33 If you previously smoked daily, how long is it since you stopped?

Number of years

34 If you currently smoke, or have smoked before: How many cigarettes do you or did you usually smoke per day?

Number of cigarettes

35 How old were you when you began smoking daily?

Number of years

36 How many years in all have you smoked daily?

Number of years

37 Do you use or have you used snuff or chewing tobacco?

- No, never
- Yes, previously
- Yes, sometimes
- Yes, daily

## DIET

38 Do you usually eat breakfast every day?

Yes  No

39 How many units of fruits or vegetables do you eat on average per day? (units means for example a fruit, a cup of juice, potatoes, vegetables)

Number of units   +

40 How many times per week do you eat hot dinner?

Number

41 How often do you usually eat these products? (Tick once for each line)

|   | 0-1<br>times/<br>mth     | 2-3<br>times/<br>mth     | 1-3<br>times/<br>week    | 4-6<br>times/<br>week    | 1-2<br>times/<br>day     |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Potatoes .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Pasta/rice .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Meat (not processed) .....                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Processed meat<br>(sausages/meatloaf/meatballs) .....     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Fruits, vegetables, berries .....                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lean fish .....   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Fat fish .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (e.g. salmon, trout, mackerel, herring, halibut, redfish) |                          |                          |                          |                          |                          |

42 How much do you normally drink the following? (Tick once for each line)

|                                      | Rarely/<br>never         | 1-6<br>glasses<br>/week  | 1<br>glass<br>/day       | 2-3<br>glasses<br>/day   | 4 or more<br>glasses<br>/day |
|--------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|------------------------------|
| Milk, curdled milk,<br>yoghurt ..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>     |
| Juice .....                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>     |
| Soft drinks<br>with sugar .....      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>     |

43 How many cups of coffee and tea do you drink daily? (Put 0 for the types you do not drink daily)

|  | Number of cups                            |
|--|---|
| Filtered coffee .....                                    | <input type="text"/> <input type="text"/> |
| Boiled coffee (coarsely ground coffee for brewing) ..... | <input type="text"/> <input type="text"/> |
| Other types of coffee .....                              | <input type="text"/> <input type="text"/> |
| Tea .....  | <input type="text"/> <input type="text"/> |

44 How often do you usually eat cod liver and roe? (i.e. "mølje")

Rarely/never  1-3 times/year  4-6 times/year  
 7-12 times/year  More than 12 times/year

45 Do you use the following supplements?

|   | Daily                    | Sometimes                | No                       |
|---|--------------------------|--------------------------|--------------------------|
| + Cod liver oil or fish oil capsules .....  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Omega 3 capsules (fish oil, seal oil) ..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Vitamins and/or mineral supplements .....   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## QUESTIONS FOR WOMEN

46 Are you currently pregnant?

Yes  No  Uncertain

47 How many children have you given birth to?

Number   +

48 If you have given birth, fill in for each child: birth year, birth weight and months of breastfeeding (Fill in the best you can)

| Child | Birth year  | Birth weight in grams   | Months of breastfeeding                   |
|-------|---|---|---|
| 1     | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> |
| 2     | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> |
| 3     | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> |
| 4     | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> |
| 5     | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> |
| 6     | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | <input type="text"/> <input type="text"/> |

49 During pregnancy, have you had high blood pressure?

Yes  No

50 If yes, which pregnancy?

The first  Second or later

51 During pregnancy, have you had proteinuria?

Yes  No

52 If yes, which pregnancy?

The first  Second or later

53 Were any of your children delivered prematurely (a month or more before the due date) because of preeclampsia?

Yes  No

54 If yes, which child?

1st child 2nd child 3rd child 4th child 5th child 6th child

55 How old were you when you started menstruating?

Age   +

56 Do you currently use any prescribed drug influencing the menstruation?

Oral contraceptives, hormonal IUD or similar .....

Yes  No

Hormone treatment for

menopausal problems .....

Yes  No

When attending the survey centre you will get a questionnaire about menstruation and possible use of hormones. Write down on a paper the names of all the hormones you have used and bring the paper with you. You will also be asked whether your menstruation have ceased and possibly when and why.





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