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

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List of papers

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


**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CVD</td>
<td>Cardiovascular Disease</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>CV</td>
<td>Coefficient of Variation</td>
</tr>
<tr>
<td>HDL</td>
<td>High Density Lipoprotein</td>
</tr>
<tr>
<td>HbA₁c</td>
<td>Glycated Haemoglobin A₁c</td>
</tr>
<tr>
<td>HR</td>
<td>Hazard Ratio</td>
</tr>
<tr>
<td>LDL</td>
<td>Low Density Lipoprotein</td>
</tr>
<tr>
<td>LTPA</td>
<td>Leisure-Time Physical Activity</td>
</tr>
<tr>
<td>PH</td>
<td>Proportional Hazard</td>
</tr>
<tr>
<td>RR</td>
<td>Relative Risk</td>
</tr>
<tr>
<td>ROC</td>
<td>Receiver Operating Characteristics</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>TC</td>
<td>Total Cholesterol</td>
</tr>
<tr>
<td>VIF</td>
<td>Variation Inflation Factor</td>
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<td>WHO</td>
<td>World Health Organization</td>
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</table>
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
decreases 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 ≥ 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 an integral part of lifestyle 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 a 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 promotes an interest in own health and acquisition of knowledge that strongly influence people’s ability to reduce risk by successfully adopting a healthier lifestyle.

Dietary pattern

An important lifestyle 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 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 vegetable 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 plays 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 have 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 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

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

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 or www.tromsoundersokelsen.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 kg/m².

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 ≥140 mmHg or diastolic blood pressure ≥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: Boergering 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\textsubscript{1c}) in EDTA whole blood was based on an immunoturbidometric assay (UNIMATES, F. Hoffmann-La Roche AG: Basel, Switzerland). The CV for HbA\textsubscript{1c} was less than 5%.

\textit{Registration of exposure variables}

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

\textit{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.

\textit{Paper II:}

In paper II the focus was on change in BMI, lipids, blood pressure, smoking and glucose control (HbA\textsubscript{1c}). 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\textsubscript{1c} < 7.5%, blood pressure\textless{}=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(≤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 ATPIII) (121), in which the metabolic syndrome is present when three or more of the following criteria are fulfilled.

1. Hypertension; blood pressure ≥130/85 mmHg and/or antihypertensive medication.
2. Hypertriglyceridemia; fasting serum triglycerides > 1.70 mmol/L.
3. Low HDL cholesterol, < 1.03 mmol/L (men), <1.29 mmol/L (women).
4. Central obesity; waist circumference > 102 cm (men), >88 cm (women).
5. Fasting plasma glucose ≥ 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/m² for men and >27.0 kg/m² 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 HbA1c > 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 ≥ 11.1 mmol/l, fasting glucose > 7.0 mmol/l, 2 hour glucose load ≥ 11.1 mmol/l or HbA1c ≥ 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 31st, 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\textsuperscript{st} 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 kg/m² 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 ≥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 cofounding. 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).
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 like 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 BMI≤25 kg/m² conveyed the same risk as BMI >25 kg/m² and a negative family history of diabetes. The risk increased with increasing triglyceride levels and positive family history and increased BMI >25 kg/m². 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 subgroups 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$_1c$. 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


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
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

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.

Date for filling in this form: 

HOME

<table>
<thead>
<tr>
<th>Who do you live with?</th>
<th>Yes</th>
<th>No</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spouse/partner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other persons over 18 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persons under 18 years</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| How many of the children go to kindergarten? | 43 |

<table>
<thead>
<tr>
<th>What type of home do you live in?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Villa/ detached house</td>
</tr>
<tr>
<td>Farm</td>
</tr>
<tr>
<td>Flat /apartment</td>
</tr>
<tr>
<td>Terraced /semi-detached house</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How big is your home?</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approximately what year was your home built?</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Has your home been insulated after 1970?</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you live on the bottom floor/cell cellar level?</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If &quot;YES&quot;, is the floor laid on concrete?</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What is the main source of heat in your home?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric heating</td>
</tr>
<tr>
<td>Wood-burning stove</td>
</tr>
<tr>
<td>Central heating system using:</td>
</tr>
<tr>
<td>Paraffin</td>
</tr>
<tr>
<td>Electricity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you have fitted carpets in the living room?</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is there a cat in your home?</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is there a dog in your home?</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
</tr>
</tbody>
</table>

WORK

<table>
<thead>
<tr>
<th>If you have paid or unpaid work, which statement describes your work best?</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am mainly seated while working</td>
</tr>
<tr>
<td>(e.g., at a desk/assembly work)</td>
</tr>
<tr>
<td>My work requires a lot of walking</td>
</tr>
<tr>
<td>(e.g., shop assistant, light industrial work, teaching)</td>
</tr>
<tr>
<td>My work entails a lot of walking and lifting</td>
</tr>
<tr>
<td>(e.g., postman/woman, nurse, building work)</td>
</tr>
<tr>
<td>I do heavy physical work</td>
</tr>
<tr>
<td>(e.g., forestry, heavy agricultural/construction work)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you have any influence on how your work is organised?</th>
</tr>
</thead>
<tbody>
<tr>
<td>No, not at all</td>
</tr>
<tr>
<td>To a small extent</td>
</tr>
<tr>
<td>Yes, to a large extent</td>
</tr>
<tr>
<td>Yes, I decide myself</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Are you on call; do you work shifts or nights?</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you do any of the following jobs (full- or part-time)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
</tr>
<tr>
<td>Farmer</td>
</tr>
<tr>
<td>Fisherman</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tick one box only for each item.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
</tr>
<tr>
<td>Farmer</td>
</tr>
<tr>
<td>Fisherman</td>
</tr>
</tbody>
</table>
### Your Own Illnesses

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

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

<table>
<thead>
<tr>
<th>Illness</th>
<th>Yes</th>
<th>No</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip fracture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrist/forearm fracture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whiplash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Injury</strong> requiring hospital admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric ulcer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duodenal ulcer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric/duodenal ulcer surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throat/neck surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Have you ever had, or do you still have: **Tick box one only for each item.**

<table>
<thead>
<tr>
<th>Illness</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epilepsy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migraine</td>
<td></td>
<td></td>
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<tr>
<td>Chronic bronchitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psoriasis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoporosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibromyalgia/fibrositis/chronic pain syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological problems...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver disease</td>
<td></td>
<td></td>
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<tr>
<td>Kidney disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appendectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergy and hypersensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atopic eczema (e.g., childhood eczema)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand eczema</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay fever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food allergy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other hypersensitivity (not allergy)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Times</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Have you had any of these in the last two weeks? **times**

<table>
<thead>
<tr>
<th>Times</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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.**

<table>
<thead>
<tr>
<th>Illness</th>
<th>Mother</th>
<th>Father</th>
<th>Brother</th>
<th>Sister</th>
<th>Child</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke or brain haemorrhage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction before age 60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric/duodenal ulcer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoporosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- age when they got diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Symptoms

Do you cough approximately every day of the year? **Yes** **No**

If “Yes”: **Is your cough productive?**

Have you had this kind of cough for as long as 3 months in each of the last two years? **Yes** **No**

Have you had periods of wheezing in your chest? **Yes** **No**

If “Yes”, has this occurred: **Tick one box only for each item.**

<table>
<thead>
<tr>
<th>Periods</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>At night</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In connection with respiratory infections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In connection with physical exertion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In connection with very cold weather</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Have you noticed sudden changes in your pulse or heart rhythm in the last year? **Yes** **No**

How often do you suffer from sleeplessness? **Yes** **No**

- Never, or just a few times a year **Yes** **No**
- 1-2 times a month **Yes** **No**
- Approximately once a week **Yes** **No**
- More than once a week **Yes** **No**

If you suffer from periods of sleeplessness, what times of the year does it affect you most? **Yes** **No**

- No particular time of year **Yes** **No**
- Especially during the dark winter months **Yes** **No**
- Especially during the midnight sun period **Yes** **No**
- Especially in spring and autumn **Yes** **No**

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

How often do you suffer from headaches? **Yes** **No**

- Seldom/never **Yes** **No**
- Once a month or more **Yes** **No**
- Once a week or more **Yes** **No**
- Every day **Yes** **No**

Does the thought of getting a serious illness ever worry you? **Yes** **No**

- Not at all **Yes** **No**
- Only a little **Yes** **No**
- Some **Yes** **No**
- Very much **Yes** **No**

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

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of times</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a general practitioner (GP)/Emergency GP</td>
<td></td>
</tr>
<tr>
<td>Psychologist or psychiatrist</td>
<td></td>
</tr>
<tr>
<td>Other medical specialist (not at a hospital)</td>
<td></td>
</tr>
<tr>
<td>Hospital out-patient clinic</td>
<td></td>
</tr>
<tr>
<td>Hospital admission</td>
<td></td>
</tr>
<tr>
<td>Medical officer at work</td>
<td></td>
</tr>
<tr>
<td>Physiotherapist</td>
<td></td>
</tr>
<tr>
<td>Chiropractor</td>
<td></td>
</tr>
<tr>
<td>Acupuncturist</td>
<td></td>
</tr>
<tr>
<td>Dentist</td>
<td></td>
</tr>
<tr>
<td>Alternative medical practitioner (homeopath, foot zone therapist, etc.)</td>
<td></td>
</tr>
<tr>
<td>Healer, faith healer, clairvoyant</td>
<td></td>
</tr>
</tbody>
</table>

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

---

**Number of times the past year**

---

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of times</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a general practitioner (GP)/Emergency GP</td>
<td></td>
</tr>
<tr>
<td>Psychologist or psychiatrist</td>
<td></td>
</tr>
<tr>
<td>Other medical specialist (not at a hospital)</td>
<td></td>
</tr>
<tr>
<td>Hospital out-patient clinic</td>
<td></td>
</tr>
<tr>
<td>Hospital admission</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Chiropractor</td>
<td></td>
</tr>
<tr>
<td>Acupuncturist</td>
<td></td>
</tr>
<tr>
<td>Dentist</td>
<td></td>
</tr>
<tr>
<td>Alternative medical practitioner (homeopath, foot zone therapist, etc.)</td>
<td></td>
</tr>
<tr>
<td>Healer, faith healer, clairvoyant</td>
<td></td>
</tr>
</tbody>
</table>
### 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

<table>
<thead>
<tr>
<th>Medication</th>
<th>Yes</th>
<th>No</th>
<th>Mths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painkillers</td>
<td></td>
<td></td>
<td>215</td>
</tr>
<tr>
<td>Sleeping pills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquilizers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antidepressants</td>
<td></td>
<td></td>
<td>231</td>
</tr>
<tr>
<td>Allergy drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Dietary supplements

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Yes</th>
<th>No</th>
<th>Mths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron tablets</td>
<td></td>
<td></td>
<td>237</td>
</tr>
<tr>
<td>Calcium tablets or bonemeal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D supplement</td>
<td></td>
<td></td>
<td>242</td>
</tr>
<tr>
<td>Other vitamin supplements</td>
<td></td>
<td></td>
<td>247</td>
</tr>
<tr>
<td>Cod liver oil or fish oil capsules</td>
<td></td>
<td></td>
<td>248</td>
</tr>
</tbody>
</table>

Have you in the last 14 days used the following medicines or dietary supplements? **Tick one box only for each item.**

#### Medicines

<table>
<thead>
<tr>
<th>Medication</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painkillers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antipyretic drugs (to reduce fever)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migraine drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eczema cream/ointment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart medicine (not blood pressure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lipid lowering drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeping pills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquilizers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antidepressants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other drugs for nervous conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antacids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric ulcer drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes tablets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroxin tablets (for metabolic disorder)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cortisone tablets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other medicine(s)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Dietary supplements

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron tablets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium tablets or bonemeal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D supplement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vitamin supplements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cod liver oil or fish oil capsules</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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?

<table>
<thead>
<tr>
<th>Fat</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard margarine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft margarine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butter/margarine blend</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oils</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Bread Type</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>White bread</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light textured brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinary brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coarse brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisp bread</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.**

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full cream milk (fresh or soured)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(glasses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-skimmed milk (low-fat)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(fresh or soured) (glasses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skimmed milk (fresh or soured) (glasses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tea (cups)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange juice (glasses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slices of bread in total (incl. crisp-bread)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slices of bread with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e.g., mackerel in tomato sauce)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- lean meat (e.g., ham)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- fat meat (e.g., salami)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- cheese (e.g. Gouda/ Norvegia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- brown cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- smoked cod caviare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- jam and other sweet spreads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How many **times per week** do you normally eat the following foodstuffs? **Tick a box for all foodstuffs listed.**

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Never</th>
<th>Less than 1</th>
<th>2-3</th>
<th>4-5</th>
<th>More than 6</th>
<th>approximately everyday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoghurt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiled or fried egg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast cereal/oat meal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For dinner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- sausage/meatloaf/meatballs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- fish (e.g., salmon/redfish)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- lean fish (e.g., cod)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- fishballs/fishpudding/fishcakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayonnaise, remoulade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cauliflower/cabbage/broccoli</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apples/pears</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oranges, mandarins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweetened soft drinks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar-free (“Light”) soft drinks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waffles, cakes, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**ALCOHOL**

How often do you usually drink beer? [ ] [ ] [ ]
- Never, or just a few times a year
- 1-2 times a month
- Approximately once a week
- 2-3 times a week
- Approximately every day

1-2 times a month
- Approximately once a week
- 2-3 times a week
- 3 or more times a week

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

**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 [ ]

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 [ ]

**PREGNANCY**

How many children have you given birth to? 349 children

Are you pregnant now? Yes [ ] No [ ] Don't know [ ]

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

If "Yes", during which pregnancy?

High blood pressure First [ ] Later [ ]
Proteinuria First [ ] Later [ ]

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

<table>
<thead>
<tr>
<th>Child</th>
<th>Year of birth:</th>
<th>Number of months breastfed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>348</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>356</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>364</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**URINARY INCONTINENCE**

How often do you suffer from urinary incontinence?
- Never: 325
- Not more than once a month: 326
- Two or more times a month: 327
- Once a week or more: 328

Your comments:

**CONTRACEPTION AND OESTROGEN**

Do you, or have you ever, used:
- Contraceptive pills (incl. minipill): 372
- A hormonal intrauterine device: [ ]
- Oestrogen (tablets or patches): 374
- Oestrogen (cream or suppositories): 376

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

If you use, or have ever used, contraceptive pills:
- Age when you began taking the pill: 396 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? 396 years

Thank you for helping us! Remember to post the form today!
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. 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
National Health University of Tromsø
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.

Day Month Year

Date for filling in this form: 18

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
- Farm ..................................................42
- 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? 4

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

(e.g., desk/assembly work)

- My work required a lot of walking ................5

(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
- Good ................................................62
- Difficult ..........................................63
- Very difficult ...................................64

CHILDHOOD/YOUTH

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

..........................................................34-38

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

How old were your parents when they died?

- Mother .............................................30 Year
- Father ..............................................32 Year
**HEALTH AND ILLNESS**

Has your state of health changed in the last year?
- Yes, it has deteriorated
- No, unchanged
- Yes, it has improved

How do you feel your health is now compared to others of your age?
- Much worse
- A little worse
- About the same
- A little better
- Much better

Have you ever had:
- Hip fracture
- Wrist/forearm fracture
- Whiplash
- Injury requiring hospital admission
- Gastric ulcer
- Duodenal ulcer
- Gastric/duodenal ulcer surgery
- Throat/neck surgery

Have you ever had, or do you still have:
- Cancer
- Epilepsy
- Migraine
- Parkinsons disease
- Chronic bronchitis
- Psoriasis
- Osteoporosis
- Fibromyalgia/fibrositis/chronic pain syndrome
- Psychological problems for which you have sought help
- Thyroid disease
- Liver disease
- Recurrent urinary Incontinence
- Glaucma
- Cataract
- Arthrosis (osteoarthritis)
- Rheumatoid arthritis
- Kidney stones
- Appendectomy
- Allergy and hypersensitivity
  - Atopic eczema (e.g., childhood eczema)
  - Hand eczema
  - Hay fever
  - Food allergy
  - Other hypersensitivity (not allergy)

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

Have you had any of these in the last two weeks?

**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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mother</th>
<th>Father</th>
<th>Brother</th>
<th>Sister</th>
<th>Child</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke or brain haemorrhage</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Myocardial Infarction before age 60</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Cancer</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Hypertension</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Asthma</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Arthrosis (osteoarthritis)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Psychological problems</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Dementia</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

**SYMPTOMS**

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

If "Yes":
- Is your cough productive?
- Have you had this kind of cough for as long as 3 months in each of the last two years?
- Have you had periods of wheezing in your chest?
- If "Yes", has this occurred:
  - At night
  - 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?
- Yes
- No

Have you lost weight in the last year?
- Yes
- No

How many kilograms?

How often do you suffer from sleeplessness?
- Never, or just a few times a year
- 1-2 times a month
- Approximately once a week
- More than once a week

If you suffer from periods of sleeplessness, what times of the year does it affect you most?
- No particular time of year
- Especially during the ‘polar nights’
- Especially during the midnight sun period
- Especially in spring and autumn

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

Do you feel that you usually get enough sleep?
- Yes
- No

Do you suffer from:
- Dizziness
- Poor memory
- Lack of energy
- Constipation
### BODILY FUNCTIONS

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>With some help</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking indoors on one level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking up/down stairs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking outdoors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking approx. 500 metres</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Going to the toilet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing yourself</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking a bath/shower</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressing and undressing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting in and out of bed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating meals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doing light housework (e.g., washing)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doing heavier housework (e.g., cleaning floor)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Going shopping</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>With difficulty</th>
<th>No</th>
</tr>
</thead>
</table>

Can you read (if necessary with glasses)?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Are you dependent on any of the following aids?

<table>
<thead>
<tr>
<th>Aids</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking stick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crutches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking frame/Zimmer frame</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheelchair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing aid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety alarm device</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### USE OF HEALTH SERVICES

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

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of times the past year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put 0 if you have not had such contact</td>
<td></td>
</tr>
<tr>
<td>To a general practitioner (GP)/emergency GP</td>
<td></td>
</tr>
<tr>
<td>Psychologist or psychiatrist</td>
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</tr>
<tr>
<td>Other medical specialist (not at a hospital)</td>
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<td>Hospital out-patient clinic</td>
<td></td>
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<tr>
<td>Hospital admission</td>
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<td></td>
</tr>
<tr>
<td>Chiropractor</td>
<td></td>
</tr>
<tr>
<td>Acupuncturist</td>
<td></td>
</tr>
<tr>
<td>Dentist</td>
<td></td>
</tr>
<tr>
<td>Chiroprodist</td>
<td></td>
</tr>
<tr>
<td>Alternative medical practitioner (homeopath, foot zone therapist, etc.)</td>
<td></td>
</tr>
<tr>
<td>Healer, Faith healer, clairvoyant</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If "Yes", who can give you help?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>With some help</th>
<th>No</th>
</tr>
</thead>
</table>

Do you have domestic help?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Do you receive services from the district nurse?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### 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:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Number of months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painkillers</td>
<td></td>
</tr>
<tr>
<td>Sleeping pills</td>
<td></td>
</tr>
<tr>
<td>Tranquillizers</td>
<td></td>
</tr>
<tr>
<td>Antidepressants</td>
<td></td>
</tr>
<tr>
<td>Allergy drugs</td>
<td></td>
</tr>
<tr>
<td>Asthma drugs</td>
<td></td>
</tr>
<tr>
<td>Heart medicine (not blood pressure)</td>
<td></td>
</tr>
<tr>
<td>Insulin</td>
<td></td>
</tr>
<tr>
<td>Diabetes tablets</td>
<td></td>
</tr>
<tr>
<td>Thyroxin tablets (for metabolic disorder)</td>
<td></td>
</tr>
<tr>
<td>Cortisone tablets</td>
<td></td>
</tr>
<tr>
<td>Remedies for constipation</td>
<td></td>
</tr>
</tbody>
</table>

Dietary supplements:

<table>
<thead>
<tr>
<th>Dietary supplements</th>
<th>Number of months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron tablets</td>
<td></td>
</tr>
<tr>
<td>Vitamin D supplement</td>
<td></td>
</tr>
<tr>
<td>Other vitamin supplements</td>
<td></td>
</tr>
<tr>
<td>Calcium tablets or bonemeal</td>
<td></td>
</tr>
<tr>
<td>Cod liver oil or fish oil capsules</td>
<td></td>
</tr>
</tbody>
</table>

### FAMILY AND FRIENDS

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)?

<table>
<thead>
<tr>
<th></th>
<th>Strong sense of belonging</th>
<th>Some sense of belonging</th>
<th>Not sure</th>
<th>Little or no sense of belonging</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Do you feel you have enough good friends?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

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)?

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<tr>
<th></th>
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<th>Some sense of belonging</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Do you feel you have enough good friends?

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<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
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Do you have close relatives who can give you help and support when you need it?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If "Yes", who can give you help?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>With some help</th>
<th>No</th>
</tr>
</thead>
</table>

Do you have domestic help?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Do you receive services from the district nurse?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assigned family GP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District nurse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home assistance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Confident</th>
<th>Not confident</th>
<th>Very unsure</th>
<th>Don’t know</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>Put 0 if you have not had such contact</th>
<th>Number of times the past year</th>
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<tbody>
<tr>
<td>To a general practitioner (GP)/emergency GP</td>
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<tr>
<td>Psychologist or psychiatrist</td>
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<td>Other medical specialist (not at a hospital)</td>
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<td></td>
</tr>
<tr>
<td>Healer, Faith healer, clairvoyant</td>
<td></td>
</tr>
</tbody>
</table>
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
- 1-2 times a month ................................................................. 302
- Approximately once a week .................................................. 303
- More than once a week ......................................................... 304

**DIET**

How many meals a day do you normally eat (dinner and bread meals)? ........................................... 305

How many times a week do you eat a hot dinner? ................................................................. 306

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

- White bread .............................................................. 307
- Light textured brown ...................................................... 308
- Ordinary brown ............................................................ 309
- Coarse brown ............................................................... 310
- Crisp bread .................................................................. 311

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

- Butter ........................................................................ 312
- Hard margarine .............................................................. 313
- Soft margarine .............................................................. 314
- Butter/margarine blend .................................................... 315
- Oils ............................................................................. 316

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.**

- Milk of all types (glasses) .................................................. 317
- Orange juice (glasses) ....................................................... 318
- Potatoes ....................................................................... 319
- Slices of bread in total (incl. crispbread) ......................... 320
- Slices of bread with
  - fish (e.g., mackerel in tomato sauce) ......................... 321
  - cheese (e.g., Norwegian) ............................................. 322
  - smoked cod caviar ..................................................... 323

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

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

- Yoghurt ...................................................................... 324
- Boiled or fried egg ......................................................... 325
- Breakfast cereal/oat meal, etc. ....................................... 326
- For dinner
  - meat ........................................................................ 327
  - fat fish (e.g., salmon/red-fish) ..................................... 328
  - lean fish (e.g., cod) ..................................................... 329
  - vegetables (raw or cooked) ........................................ 330
  - carrots (raw or cooked) ............................................. 331
  - cauliflower/cabbage/broccoli .................................... 332
  - apples/pears ............................................................. 333
  - oranges, mandarins, etc. ......................................... 334

**WELL BEING**

How content do you generally feel with growing old?

- Good ....................................................................... 335
- Quite good ................................................................. 336
- Up and down .............................................................. 337
- Bad ........................................................................... 338

What is your view of the future?

- Bright ....................................................................... 339
- Not too bad .................................................................... 340
- Quite worried ............................................................ 341
- Dark ............................................................................ 342

**MENSTRUATION**

How old were you when you had your first menstruation? ......................................................... 343

How old were you when you stopped having menstruations? ................................................................. 344

**TO BE ANSWERED BY WOMEN ONLY**

**PREGNANCY**

How many children have you given birth to? ................................................................. 345

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.

<table>
<thead>
<tr>
<th>Child</th>
<th>Year of birth:</th>
<th>Number of months breastfed:</th>
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During pregnancy, have you had high blood pressure and/or proteinuria?

If "Yes", during which pregnancy?

- First ........................................................................ 346
- Later ......................................................................... 347

Yes No

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<th>Later</th>
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<td>Proteinuria ............................................................ 349</td>
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**OESTROGEN**

Do you use, or have you ever used oestrogen:

- Tablets or patches .......................................................... 350
- Cream or suppositories .................................................. 351

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

...352

Your comments:

Thank you for helping us! Remember to post the form today!

Tromsø Health Survey
**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?
   - Heart attack
   - Angina pectoris
   - Stroke/brain hemorrhage
   - Atrial fibrillation
   - High blood pressure
   - Usteoporosis
   - Asthma
   - Chronic bronchitis/Emphyysma/COPD
   - Diabetes mellitus
   - Psychological problems (for which you have sought help)
   - Low metabolism
   - Kidney disease, not including urinary tract infection (UTI)
   - Migraine

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
   - You felt afraid or worried
   - Faintness or dizziness
   - You felt tense or upset
   - Easily blamed yourself
   - Sleeping problems
   - Depressed, sad
   - You felt useless, worthless
   - Feeling that life is a struggle
   - Feeling of hopelessness with regard to the future

**USE OF HEALTH SERVICES**

7. Have you during the past year visited:
   - Yes
   - No
   - No. of times
   - General practitioner (GP)
   - Psychiatrist/psychologist
   - Medical specialist outside hospital (other than general practitioner/psychiatrist)
   - Physiotherapist
   - Chiropractor
   - Alternative medical practitioner (homeopath, acupuncturist, foot zone therapist, herbal medical practitioner, laying on hands practitioner, healer, clairvoyant, etc.)
   - Dentist/dental service

8. Have you during the last 12 months been to a hospital?
   - Yes
   - No
   - No. of times
   - Admitted to a hospital
   - Had consultation in a hospital without admission:
     - At psychiatric out-patient clinic
     - At another out-patient clinic

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)

- Drugs for high blood pressure
- Lipid lowering drugs
- Drugs for heart disease
- Diuretics
- Medications for osteoporosis
- Insulin
- Tablets for diabetes
- Drugs for metabolism
- Thyroxine/levaxin

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

- Painkillers on prescription
- Painkillers non-prescription
- Sleeping pills
- Tranquillizers
- Antidepressants

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.

**FAMILY AND FRIENDS**

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

- Spouse/cohabitant
- Other persons older than 18 years.
- Persons younger than 18 years

14. Tick for relatives who have or have had

- Parents
- Children
- Siblings

- Myocardial infarction
- Myocardial infarction before 60 years
- Angina pectoris
- Stroke/brain haemorrhage
- Osteoporosis
- Stomach/duodenal ulcer
- Asthma
- Diabetes mellitus
- Dementia
- Psychological problems
- Drugs/substance abuse

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
- Part time work
- Retired/benefit recipient
- Unemployed
- Student/military service
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

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
- More than 400 000 NOK
- 401 000-550 000 NOK
- 551 000-700 000 NOK
- 701 000-850 000 NOK
- 851 000-1 000 000 NOK
- More than 1 000 000 NOK

Do you work outdoors at least 25% of the time, or in cold buildings (e.g. storehouse/industry buildings)?
- Yes
- No

### PHYSICAL ACTIVITY

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

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.

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

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

For how long time do you exercise every time on average?
- Less than 15 minutes
- 15-29 minutes
- More than 1 hour

### ALCOHOL AND TOBACCO

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

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

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

Do you smoke sometimes, but not daily?
- Yes
- No

Do you/did you smoke daily?
- Yes
- Yes, now
- Yes, previously
- Never

If you previously smoked daily, how long is it since you stopped?
- Number of years

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

How old were you when you began smoking daily?
- Number of years

How many years in all have you smoked daily?
- Number of years

Do you use or have you used snuff or chewing tobacco?
- No, never
- Yes, sometimes
- Yes, previously
- 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)
   - Potatoes ☐
   - Pasta/rice ☐
   - Meat (not processed) ☐
   - Processed meat (sausages/meatloaf/meatballs) ☐
   - Fruits, vegetables, berries ☐
   - Lean fish ☐
   - Fat fish (e.g. salmon, trout, mackerel, herring, halibut, redfish) ☐

42. How much do you normally drink the following? (Tick once for each line)
   - Milk, curdled milk, yoghurt ☐
   - Juice ☐
   - Soft drinks with sugar ☐

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 ☐

44. How often do you usually eat cod liver and roe? (i.e. “mule”)
   - 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 ☐
   - Omega 3 capsules (fish oil, seal oil) ☐
   - Vitamins and/or mineral supplements ☐

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**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)
<table>
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<tr>
<th>Child</th>
<th>Birth year</th>
<th>Birth weight in grams</th>
<th>Months of breastfeeding</th>
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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 ☐

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*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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