



Editor's choice  
Scan to access more  
free content

## EXTENDED REPORT

# Results from systematic screening for cardiovascular risk in outpatients with rheumatoid arthritis in accordance with the EULAR recommendations

Jette Primdahl,<sup>1</sup> Joan Clausen,<sup>2</sup> Kim Hørslev-Petersen<sup>3</sup>

**Handling editor** Tore K Kvien

<sup>1</sup>Institute for Regional Health Research, University of Southern Denmark, Hospital of Southern Jutland, Aabenraa and King Christian X's Hospital for Rheumatic Diseases, Graasten, Denmark

<sup>2</sup>Outpatient Department, King Christian X's Hospital for Rheumatic Diseases, Graasten, Denmark

<sup>3</sup>Institute for Regional Health Research, University of Southern Denmark and King Christian X's Hospital for Rheumatic Diseases, Graasten, Denmark

## Correspondence to

Jette Primdahl, King Christian X's Gighospital, Toldbodgade 3, Graasten 6300, Denmark; jprimdahl@gigtforeningen.dk

Received 26 March 2013

Revised 24 May 2013

Accepted 26 June 2013

Published Online First

12 July 2013

## ABSTRACT

**Aim** To investigate risk factors for the development of cardiovascular disease (CVD) and estimate the risk of cardiovascular death in rheumatoid arthritis (RA) patients in accordance with EULAR recommendations.

**Materials and methods** Outpatients with RA ≤85 years of age from a Danish hospital were invited to participate. Patients' risk of cardiovascular death was calculated according to the SCORE system, based on total cholesterol/high-density lipoprotein (HDL) ratio, smoking habits, blood pressure, age and gender. The SCORE was adjusted based on disease duration, IgM-RF/anti-CCP positivity and the presence of extra-articular manifestations. Factors such as history of CVD, hypertension or diabetes mellitus (DM), fasting glucose, exercise habits, body mass index (BMI) and waist circumference were explored.

**Results** 836 patients participated; 71.5% women; mean (SD) age 64.3 years (12.0); 152 (19.1%) were already diagnosed with CVD and 74 (9.0%) with DM. Among the 644 patients without CVD or DM, 158 (24.5%) were smokers, 229 (35.8%) had a systolic blood pressure ≥140, 397 (65.6%) total cholesterol ≥5.0 mM/L, 326 (55.4%) low-density lipoprotein cholesterol ≥3.0 mM/L, 18 (4.0%) women and 19 (12.1%) men had a HDL-cholesterol level below 1.2/1.0 mM/L. BMI was >25 in 409 (63.8%). Waist circumference was above 80/94 cm in 297 (63.3%) of female and 111 (63.8%) of male patients, respectively, and 418 (64.9%) exercised ≤5 times a week. Among patients without DM, 14.3% had a fasting glucose ≥6.0 mmol/L. The SCORE was ≥5 in 122 (20.2%). They were referred to follow-up by their GP and community advice services.

**Conclusions** Systematic screening revealed several risk factors that needed medical follow-up or support to initiate lifestyle changes.

## INTRODUCTION

It is well documented that people with rheumatoid arthritis (RA) have excess mortality compared to the general population, partly due to an increased risk of cardiovascular events and cardiovascular death.<sup>1–3</sup> Although people with RA have an increased number of the traditional risk factors for the development of cardiovascular disease (CVD), this does not seem to explain all excess mortality in RA compared to the general population.<sup>4</sup> It seems likely that the inflammatory process and disease severity also increases the risk of CVD.<sup>4–8</sup> The excess risk posed by having RA may be compared to the risk from having diabetes

mellitus (DM) type II,<sup>9–11</sup> and is influenced by other disease-related factors and the pharmacological treatment, that is, with glucocorticoids, non-steroidal anti-inflammatory drugs, methotrexate, leflunomide and cyclosporine.<sup>12–13</sup> Male gender is associated with a greater risk of CVD.<sup>14</sup>

Longer disease duration, whether the patient is IgM-rheumatoid factor (RF) positive and/or anti-cyclic citrullinated peptide (anti-CCP) positive and the presence of certain extra-articular manifestations seem to be linked with the increased CVD risk due to RA.<sup>1–15–16</sup> In 2010, 10 European League Against Rheumatism (EULAR) recommendations for cardiovascular risk management were published.<sup>1</sup> Cardiovascular risk assessment in all patients with RA was recommended. Any identified risks should be managed according to local guidelines, and the patient's risk should be scored according to the SCORE system.<sup>17</sup> The risk SCORE should be adapted by a multiplication factor of 1.5 if the patient met two of the following three criteria: disease duration of more than 10 years, RF and/or anti-CCP positivity and the presence of certain extra-articular manifestations<sup>18</sup> (pericarditis, pleuritis, Felty's syndrome, polyneuropathy, mononeuritis, scleritis, episcleritis, glomerulonephritis, severe skin vasculitis or vasculitis in other organs). Adequate control of disease activity is also necessary to lower the CVD risk.<sup>1</sup>

To date, only one study has been identified that reported results from the implementation of the EULAR recommendations for cardiovascular risk management in patients with RA.<sup>19</sup> This Spanish study reported risk scores for 200 patients, but included patients with known CVD and DM, even though the SCORE system is not recommended in these patients. Furthermore, the study included rheumatic nodules in the risk assessment, whereas, in the EULAR recommendations, rheumatic nodules are not on the list of extra-articular manifestations that affect the modified SCORE.<sup>1–18</sup> There is a need for a larger study to assess the impact of risk factors for CVD when implementing the EULAR recommendations.

## OBJECTIVE

The objective was to investigate the spread of traditional risk factors for the development of CVD and the risk SCORE for cardiovascular death when implementing the EULAR recommendations for cardiovascular risk management in a Danish hospital population of outpatients with RA.



► <http://dx.doi.org/10.1136/annrheumdis-2013-203688>

► <http://dx.doi.org/10.1136/annrheumdis-2013-203911>

**To cite:** Primdahl J, Clausen J, Hørslev-Petersen K. *Ann Rheum Dis* 2013;**72**:1771–1776.

## METHODS

## Implementation of the EULAR recommendations

A multidisciplinary group was established at King Christian X's Hospital for Rheumatic Diseases in Graasten, Denmark, to implement the EULAR recommendations<sup>1</sup> for RA outpatients at the hospital. The group defined the aim, the content and planned the delivery of the screening consultations. A set of detailed clinical guidelines was developed based on the EULAR recommendations and national guidelines.<sup>1 20–22</sup> Screening consultations were to be delivered as 30-min nursing consultations in addition to the patient's normal follow-up visits. The nurses were offered 4 h of training covering CVD and risk management, diet and CVD and opportunities in secondary care for lifestyle change support.

## Participants

All outpatients with RA 85 years of age or less connected to King Christian X's Hospital for Rheumatic Diseases in Graasten, Denmark, were invited by a standard letter to a screening consultation.

## Study design

Before the screening consultation, the patients had their fasting glucose, triglycerides, total cholesterol, high density lipoprotein (HDL) cholesterol and low density lipoprotein (LDL) cholesterol levels checked.

The patient's habits regarding smoking (smoker/non-smoker), exercise (less than five times a week/five times a week or more), alcohol (below or above the national recommendations of a maximum seven units per week for women and 14 for men) were explored. The patient's height (cm) and weight (kg) were measured with the patient in light clothes and without shoes, and the patient's body mass index (BMI) was calculated as weight (kg) by squared height (m<sup>2</sup>). Waist circumference (cm) was measured 2 cm above the patients' umbilicus (midway between the lower rib margin and the iliac crest).<sup>14</sup> Blood pressure was measured while the patient was sitting in a chair and after at least 5 min rest.<sup>22</sup> If the patient's blood pressure exceeded 5 mm Hg above the nationally recommended limits, a total of four measures (two on each arm) were performed and the mean of the last two measures was used.<sup>22</sup> Each patient's risk SCORE was calculated based on age, gender, smoking habits, systolic blood pressure and total cholesterol/HDL ratio.<sup>17</sup> Denmark was considered to be a high-risk area for CVD in Europe when implementing the screening consultations. In accordance with the EULAR recommendations and national guidelines for the management of RA,<sup>1 23</sup> the risk SCORE was multiplied by 1.5 if the patient fulfilled the above-mentioned criteria. To determine whether the patient had any of the specific extra-articular manifestations, the patient was asked whether a rheumatologist at any time had said that the patient had arthritis apart from in the joints, such as in the eyes, nerves, the vascular system or in other organs. The findings from the screening were discussed with the patient and advice and training in relation to identified risks were offered. Patients were referred to follow-up by the general practitioner (GP) in cases in which the modified risk SCORE was 5% or greater. Patients with blood pressure above the recommended level, total cholesterol above 8 mmol/L or fasting glucose of 6 mmol/L or greater were also referred to their GP. Patients were informed about opportunities to receive additional lifestyle change support in community health centres. Written pamphlets concerning smoking cessation, low-lipid diet and RA were offered.

The patient was offered a page with the actual risk SCORE written on the SCORE chart and the other results from the screening to take home. The findings from the consultations were documented in a Danish rheumatological quality database, the DANBIO registry, and in the patient's journal. Following the consultation, a copy of the note in the journal was sent electronically to the patient's GP. Patients with known DM or CVD or a risk SCORE of 5% or greater will be invited for a follow-up screening visit in 1 year, if they are interested; patients without known DM or CVD and a SCORE of less than 5% will be invited for a new screening consultation in 2 years. Patients over the age of 80 years will only be invited again if they express a wish for a new screening consultation.

## Statistical analysis

STATA V10.1 was used to perform descriptive statistical analyses. Results are reported with mean and SD or median and IQR depending on the distribution of the data. Percentages are calculated based on the number of observations available for each variable.

## RESULTS

From September 2011 to November 2012, 836 patients accepted and completed a screening consultation (74.3% of the hospital RA population); 598 (71.5%) were women. Reasons to decline were due to severe disability or co-morbidities, or that it was difficult for them to attend due to transportation or work-related issues. Some patients felt that their GP already took care of the content in the screening consultation or that they did not want to discuss lifestyle issues. Approximately 10% of the patients declined to participate, but the exact number was not recorded.

Patients' disease activity measured by the disease activity score in 28 joints (DAS28)–C reactive protein (CRP) score<sup>24</sup> and physical disability measured by the health assessment questionnaire (HAQ)<sup>25</sup> were not recorded in the screening consultations; however, we drew data from an outpatient visit if it was performed within 2 months before or after the screening consultation in order to characterise the population. For some of the patients the most recent follow-up fell outside the 2-month range. DAS28–CRP was thus available in only 526 patients and the HAQ in 626 patients. The demographic and disease-related data relating to the screened population are set out in table 1.

Among the screened patients, 349 (42.0%) were already diagnosed with hypertension, 152 (19.1%) with ischaemic CVD and 74 (9.0%) with DM.

The spread of the traditional risk factors for ischaemic CVD is reported in table 2 for all 836 patients.

Out of the 748 patients without previously diagnosed DM, 95 (14.3%) had an impaired fasting glucose ( $\geq 6.0$  mmol/L), which means that DM cannot be excluded. A fasting glucose of 7.0 or greater indicates that the patient probably has undiagnosed DM. A total of 15 patients (2.0%) had a fasting glucose of 7.0 or greater.

Out of the 836 screened patients, 644 patients (77%) were not previously diagnosed with DM or CVD. The number of patients exceeding the recommended levels for each risk factor is shown in table 3.

Thirty-four patients reported that they had both CVD and DM. The recommended level for LDL cholesterol is 1.8 mmol/L or less for this group<sup>14</sup> and 25 (73.5%) of these patients did not meet that recommendation. Among the 349 patients with known hypertension who already received antihypertensive

**Table 1** Demographic and disease characteristics of the included population

		n=
Female gender		598 (71.5%)
Age, years (mean±SD)	64.3 (12.0)	836
Disease duration	9(5–17)	814
Positive anti-CCP	580 (90.5%)	641
Positive RF	690 (87.2%)	791
CRP (0–10)	3 (1–7)	538
DAS28–CRP (0–10)	2.4 (1.8–3.2)	526
Low (DAS28–CRP <2.6)	298 (56.7%)	
Moderate (2.6 ≤ DAS28–CRP ≤ 3.2)	108 (20.5%)	
High (DAS28–CRP >3.2)	120 (22.8%)	
HAQ	0.5 (0.125–1.0)	626
Being treated with prednisolone (0/1)	75 (9.0%)	836
Being treated with DMARD (0/1)	660 (78.9%)	836
Being treated with anti-TNF (0/1)	168 (20.1%)	836
Known hypertension (0/1)	349 (42.0%)	831
Known ischaemic CVD (0/1)	152 (19.1%)	794
Men	53 (24%)	221
Women	99 (17.3%)	573
Known DM (0/1)	74 (9.0%)	822
Alcohol above limits (n)	50 (6.4%)	787
Women >7 units per week	19 (3.4%)	560
Men >14 units per week	31 (13.7%)	227

Anti-CCP, anti-cyclic citrullinated peptide; anti-TNF, anti-tumour necrosis factor; Being treated with DMARD, could be one or more disease-modifying antirheumatic drug; CRP, C-reactive protein; CVD, cardiovascular disease; DAS28–CRP, disease activity score in 28 joints, CRP and patient global assessment score; DM, diabetes mellitus, percentages are calculated based on number of observations for each variable; HAQ, health assessment questionnaire; (n=), number and percentage of the population; mean (SD), SD or median (IQR), IQR, as appropriate; RF, rheumatoid factor.

medication, only 189 (54.2%) had a systolic blood pressure below 140 mm Hg.

The SCORE system is not recommended for patients with known CVD and/or DM as the SCORE chart will underestimate

**Table 2** The spread of cardiovascular risk factors for all the patients with number and percentage of the patients with observations or median and IQR range

Variable	All patients	N
Current smokers (0/1) (n)	192 (23.0%)	836
SBP (mm Hg)	135 (123–144)	830
DBP (mm Hg)	83 (76–90)	829
Total cholesterol (mM/L)	5.2 (4.6–5.9)	794
LDL-cholesterol (mM/L)	3.0 (2.4–3.7)	771
HDL-cholesterol (mM/L)		
Women	1.8 (1.5–2.1)	573
Men	1.5 (1.2–1.7)	221
Triglycerides (mM/L)	1.04 (0.78–1.39)	791
Fasting glucose (mM/L)	5.4 (5–5.7)	729
BMI (kg/m <sup>2</sup> )	26.5 (23.5–30.3)	833
Waist circumference (cm)		835
Women	85 (78–96)	597
Men	99 (92–106)	238
Exercise <5 times a week (n)	552 (66.0%)	836

BMI, body mass index calculated as weight (kg)/squared height (m<sup>2</sup>); DBP, diastolic blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoprotein; mM/L, milli Mol per litre; SBP, systolic blood pressure.

their risk.<sup>17</sup> Due to a lack of blood test results in some of the 644 patients without known DM and CVD, we only managed to obtain a risk SCORE on 605 patients. In 170 (28.1%) of these patients the multiplication factor 1.5 was applied.

Based on the European recommendations, a SCORE less than 5% is considered to be low to moderate risk, 5–10% is high risk and 10% or greater is very high risk for cardiovascular death within 10 years.<sup>14</sup> The risk SCORE are reported in table 4. When Denmark was considered to be a high-risk country, 20.2% of the patients without previously diagnosed CVD or DM had a high or very high risk (≥5%) for cardiovascular death within 10 years. Due to a reduced number of cardiovascular deaths, Denmark is now considered to be a low-risk area according to new recommendations from the European and Danish Societies of Cardiology.<sup>14 26</sup> The number of patients with a SCORE of 5% or greater thus decreases to 16.2%. The corresponding number for female patients is 11.4%, decreasing to 6.9% and for male patients 45.3%, decreasing to 42.6% when using the low-risk score charts.<sup>14</sup>

## DISCUSSION

By implementing systematic screening for cardiovascular risk factors in nursing consultations, the patient, the outpatient department and the patient's GP attained an overview of the patient's individual risk profile. This arrangement also allowed us to explore the patient's motivation for lifestyle changes and offer relevant health promotional training relating to the patient's everyday life, and offer written information (brochures) and support to initiate desired lifestyle changes in primary care.

Initiation or adjustment of lipid-lowering or anti-hypertensive medication or follow-up on lifestyle issues in general would require extra follow-up visits, and we considered that the work involved would lie outside the rheumatologists' core competences. We therefore chose to refer these patients to their GPs. The screened patients seem representative of the more than 16 000 Danish RA patients registered in the DANBIO registry (73% women and 73% RF positive).<sup>27</sup> The patients seen at King Christian X's Hospital for Rheumatic Disease represent more than 90% of known patients with RA in the uptake area for the hospital.<sup>28</sup>

We found that 14.3% of the patients without known DM had an impaired fasting glucose (≥6.0 mmol/L), meaning that DM cannot be excluded.<sup>29</sup> Two per cent had a fasting glucose of 7 mmol/L or greater, which is considered in Denmark to be the threshold for diagnosing DM.<sup>29</sup> The percentages with elevated fasting glucose above 6 and 7 mM/L were even higher in the subgroup with known CVD (27.2% and 10.3%, respectively). In a Danish study from 2003, the prevalence of impaired fasting glucose varied between 4.7% and 17.8%, depending on age and gender.<sup>30</sup> The prevalence of DM is increasing and increases with increasing age, BMI, lack of physical activity and male gender.<sup>30</sup>

CVD was already known in 19.1% of the patients and 42% were diagnosed with hypertension, compared to 9.3% with CVD and 32% with hypertension in a European sample.<sup>31</sup> Although 42% of our sample was already treated with anti-hypertensive drugs, only 54.2% of these patients had a systolic blood pressure below 140 mm Hg at the time of the consultation. The prevalence of a well-treated systolic blood pressure is a little higher in the Danish general population (63.1%).<sup>32</sup> Unfortunately, 63.8% in the group who were already known to have CVD had elevated high blood pressure and, among

**Table 3** The number of patients exceeding the recommended levels reported for patients with no known DM or CVD and for the subgroups of patients with known CVD or DM displayed separately

Variable	No DM or CVD		Known CVD n=152	Known DM n=74
Women	448 (69.6%)	644		
Current smokers (0/1)	158 (24.5%)	644	26 (17.1%)	11 (14.9%)
Normal BP (SBP <140)	411 (64.2%)	640	97 (63.8%)	
Diabetes patients (SBP <130)			19 (26.4%)	
Light HT (SBP 140–159)	168 (26.3%)	644	38 (25.0%)	
Diabetes patients (SBP 130–159)				44 (61.1%)
Moderate HT (SBP 160–179)	48 (7.5%)	644	12 (7.9%)	6 (8.3%)
Severe HT (SBP ≥180)	13 (2.0%)	644	5 (3.3%)	3 (4.2%)
Total cholesterol ≥5.0 mmol/L	397 (65.6%)	605		
Diabetes or CVD (≥4.5 mmol/L)			98 (64.5%)	41 (57.7%)
LDL-cholesterol ≥3.0 mmol/L	326 (55.4%)	588		
Diabetes or CVD ≥1.8 mmol/L			128 (84.2%)	55 (80.9%)
HDL-cholesterol		605		
Women (≤1.2 mmol/L)	18 (4.0%)	448		
Men (≤1.0 mmol/L)	19 (12.1%)	157		
Diabetes patients (≤1.0 mmol/L)			4 (2.6%)	2 (2.8%)
Triglycerides >1.7 mmol/L	70 (11.6%)	602		
Diabetes or CVD >2.0 mmol/L			17 (11.2%)	10 (14.1%)
F-glucose ≥6.0 mmol/L	71 (12.7%)	559	37 (27.2%)	
F-glucose ≥7.0 mmol/L	10 (1.8%)	559	14 (10.3%)	23 (36.5%)
Overweight (BMI >25)	409 (63.8%)	641	96 (63.2%)	55 (74.3%)
Obese (BMI >30)	163 (25.4%)	641	42 (27.6%)	29 (39.2%)
High waist circumference		643		
Women (>80 cm)	297 (63.3%)	469	66 (66.7%)	42 (79.2%)
Men (>94 cm)	111 (63.8%)	174	36 (67.9%)	16 (76.2%)
Exercise <5 times a week	418 (64.9%)	644	48 (31.6%)	54 (73.0%)

Percentages are calculated based on the number of observations for each variable in each subgroup.

BMI, body mass index calculated as weight (kg)/squared height (m<sup>2</sup>); CVD, cardiovascular disease; F, fasting; HDL, high-density lipoprotein; HT, hypertension; LDL, low-density lipoprotein, SBP, systolic blood pressure in mm Hg.

**Table 4** High-risk modified SCORE based on Denmark considered being a high-risk area and the extra RA risk for the 644 patients without DM and CVD, the European low risk area SCORE reports the risk SCORE in the period since Denmark has been considered to be a low-risk area (since May 2012)

	All n=605	Women n=448	Men n=157
European high-risk area RA modified SCORE			
Risk SCORE	2 (1, 4)	2 (1, 3)	4 (3, 7)
Low/moderate risk	483 (79.8%)	397 (88.6%)	86 (54.8%)
High risk	101 (16.7%)	48 (10.7%)	53 (33.8%)
Very high risk	21 (3.5%)	3 (0.7%)	18 (11.5%)
European low-risk area SCORE			
Low/moderate risk	529 (87.4%)	426 (95.1%)	103 (65.6%)
High risk	67 (11.1%)	21 (4.7%)	46 (29.3%)
Very high risk	9 (1.5%)	1 (0.2%)	8 (5.1%)
European low-risk area RA modified SCORE			
Risk SCORE	2 (1, 4)	1.5 (1, 3)	4 (2, 6)
Low/moderate risk	507 (83.8%)	417 (93.1%)	90 (57.3%)
High risk	77 (12.7%)	30 (6.7%)	47 (29.9%)
Very high risk	21 (3.5%)	1 (0.2%)	20 (12.7%)

Median and (IQR). The number of patients without known DM and CVD are reported for low/moderate risk (<5%), high risk (5 ≤ high risk <10%) and very high risk (≥10%) and the percentages of the population without DM and CVD that we obtained a risk score for and stratified by gender. For gender-specific numbers, the percentages are calculated as the share of the female or male population with no known DM and CVD when we have obtained a risk score.

CVD, cardiovascular disease; DM, diabetes mellitus; RA, rheumatoid arthritis.



patients with DM, 73.6% had blood pressure above the recommended level of 130 mm Hg.

Inflammation seems to affect the cholesterol level in a paradoxical way, such as a decline in LDL-cholesterol when the patient's CRP level is increased.<sup>33</sup> The median value and IQR for the CRP and DAS28–CRP (table 1) are within the normal range and thus the lipid paradox may not be applicable for our population. Although quite a few were probably already on lipid-lowering treatment, 55.4% of the patients without known DM or CVD still had a LDL-cholesterol above 5.0 mmol/L. The situation was even more exacerbated in the group of patients with known CVD (84.2%) or DM (80.9%). There seems to be a large gender difference in the percentages with low HDL-cholesterol levels (ratio 3:1 for men/women), whereas this does not seem to be the case in the share with high waist circumference; this concurs with the results from a US study.<sup>34</sup>

In 2010, 20.9% of the general Danish population were smokers and the proportion was 22.2% for residents in the region of southern Denmark.<sup>35</sup> Among the screened patients, the number was 23%, decreasing to 17.1% if the patient had known CVD and 14.9% in patients with DM, indicating that smoking habits had changed in some patients after diagnosis. In the general population in Denmark 46.7% are overweight (BMI >25) and 13% are obese (BMI >30), and in the region of southern Denmark the numbers are 49.3% and 14%.<sup>35</sup> The share of overweight is about one third higher (63.8%) in the screened patients and the number of obese is doubled in persons with RA with or without CVD (27.6/25.4%) compared to the general population. For people with diabetes, the problem is even greater (74.3% overweight and 39.2% obese), reflecting the cause for the increasing number of DM type II patients currently.<sup>14</sup> Unfortunately, there is a positive linear association of BMI and all-cause mortality.<sup>14 36</sup> The visceral adipose tissue in abdominal fat promotes intracellular inflammatory pathophysiological processes.<sup>36</sup> Furthermore, the risk of hypertension is up to five times higher in obese individuals than in those with normal weight, and the risk of dyslipidaemia develops progressively with increasing BMI.<sup>36</sup>

A low alcohol intake may have a preventive effect on the development of CVD, whereas heavy drinking seems to increase the risk of CVD.<sup>37 38</sup> Only 3.4% of the female and 13.7% of the male patients reported alcohol intake above the nationally recommended limits of 7/14 units per week, compared to 24.3% in the Danish general population above the age of 15 years and 20.8% in the region of southern Denmark.<sup>35</sup> The main reason for this difference is probably due to the high percentage of patients treated with disease-modifying antirheumatic drugs, in which the number one choice is methotrexate, which requires a need for alcohol restriction.<sup>23</sup>

When the high-risk country charts and RA-modified risk were used, a fifth (20.2%) of the patients had an elevated risk of cardiovascular death. Using the SCORE charts for low-risk countries, this number is reduced to 16.2%. The SCORE may underestimate the absolute risk of cardiovascular death in 10 years, because increased disease activity, genetic dispositions to CVD, obesity and lack of exercise will further affect the patient's risk. The risk of cardiovascular events is probably increased even before diagnosis.<sup>39 40</sup> It is very important that the patient's disease activity is treated to target at the same time as we are trying to reduce the patient's risk through the impact from the other risk factors.<sup>41</sup> In our population, there were still 22.8% of patients with a DAS28–CRP above 3.2, indicating room for improvement.

In young people the SCORE will be low, regardless of smoking habits, cholesterol and blood pressure levels and thus the chart may underestimate their risk.<sup>17</sup> In the new European guidelines for prevention of CVD,<sup>14</sup> it is recommended that young people with a low risk should be scored by a relative risk chart. Furthermore, the SCORE chart only includes age groups up to 65–70 years,<sup>17</sup> and thus will probably underestimate the risk for older patients.

One of the strengths of our study is the large number of patients and the systematic documentation in a national registry. Furthermore, most of the hospital population had been invited for a cardiovascular risk assessment during the first 15 months.

The study also had some limitations. Unfortunately, we are not able to report the exact number of patients who declined to participate and compare them to the group who participated to assess potential bias. We did not verify the patients' self-reported version of whether they had extra-articular manifestations of their RA and comorbidities in registry data or in the patients' clinical journals. This may have caused an underestimation of the modified risk scores. Also, we did not include information on whether patients had a family history of CVD, if patients were undergoing lipid-lowering treatment or whether they had severe kidney disease.

The results from this study can help other hospitals plan the resources needed for a systematic approach to screening. As we have reported the SCORE for both high and low-risk countries, other European countries can compare their risk SCORES to the ones reported in this study.

Our results indicate gender differences in lipid status and there are substantial gender differences in the distribution of the risk SCORE. The other risk factors should be further explored for age and gender differences. Future studies need to explore the patients' experiences of screening consultations and reasons to decline participation, and whether the SCORE system provides a realistic estimation of the patients' actual risk of cardiovascular death. This study provides a solid background for a prospective follow-up study to determine whether the patients actually visit their GP as recommended and whether changes in risk and development of CVD occur over time.

## CONCLUSIONS

Systematic screening revealed several risk factors that required medical follow-up or support to initiate lifestyle changes in order to reduce patients' risk of CVD and cardiovascular death. Cardiovascular risk management in patients with already known DM or CVD needs to be improved. When using the charts for high-risk countries, more than 20% of our patients have an increased risk of cardiovascular death in 10 years. When using the charts for low-risk countries, the number decreases to 16%.

**Acknowledgements** The authors would like to acknowledge the multidisciplinary group who implemented the systematic screening (senior consultants Lis Smedegaard Andersen and Johnny Raun, head of the secretariat Anette Christensen, head of the department of clinical chemistry Charlotte Drachmann and the outpatient nurses Pia Rhode Rasmussen and Kirsten Nørret Hansen). They would like to thank Niels Steen Krogh from Zitellab and the DANBIO registry for cooperation in development of the CVR theme as part of a yearly visit. They also wish to thank Lorna Campbell for assistance in language editing.

**Contributors** JP: Study design, data acquisition, data analysis, manuscript drafting. JC: Study design, data acquisition and critical comments to manuscript drafting. KHP: Study design and critical comments to manuscript drafting.

**Competing interests** None.

**Ethics approval** As this was an observational study in which screening consultations were implemented as an integral part of clinical practice at the hospital, ethical approval was not obtained and the patients were not asked for written consent to participate. The patients could decline to participate at any time

without influencing their follow-up at the hospital in general. We did not invite patients considered have dementia or those over 85 years of age, as we considered it unethical to discuss lifestyle with this group of patients.

**Provenance and peer review** Not commissioned; externally peer reviewed.

## REFERENCES

- Peters MJ, Symmons DP, McCarey D, *et al.* EULAR evidence-based recommendations for cardiovascular risk management in patients with rheumatoid arthritis and other forms of inflammatory arthritis. *Ann Rheum Dis* 2010;69:325–31.
- Avina-Zubieta JA, Choi HK, Sadatsafavi M, *et al.* Risk of cardiovascular mortality in patients with rheumatoid arthritis: a meta-analysis of observational studies. *Arthritis Rheum* 2008;59:1690–7.
- Gullick NJ, Scott DL. Co-morbidities in established rheumatoid arthritis. *Best Pract Res Clin Rheumatol* 2011;25:469–83.
- del Rincon ID, Williams K, Stern MP, *et al.* High incidence of cardiovascular events in a rheumatoid arthritis cohort not explained by traditional cardiac risk factors. *Arthritis Rheum* 2001;44:2737–45.
- Evans MR, Escalante A, Battafarano DF, *et al.* Carotid atherosclerosis predicts incident acute coronary syndromes in rheumatoid arthritis. *Arthritis Rheum* 2011;63:1211–20.
- Innala L, Moller B, Ljung L, *et al.* Cardiovascular events in early RA are a result of inflammatory burden and traditional risk factors: a five year prospective study. *Arthritis Res Ther* 2011;13:R131.
- Gonzalez A, Maradit Kremers H, Crowson CS, *et al.* Do cardiovascular risk factors confer the same risk for cardiovascular outcomes in rheumatoid arthritis patients as in non-rheumatoid arthritis patients? *Ann Rheum Dis* 2008;67:64–9.
- Solomon DH, Kremer J, Curtis JR, *et al.* Explaining the cardiovascular risk associated with rheumatoid arthritis: traditional risk factors versus markers of rheumatoid arthritis severity. *Ann Rheum Dis* 2010;69:1920–5.
- Lindhardsen J, Ahlehoj O, Gislason GH, *et al.* The risk of myocardial infarction in rheumatoid arthritis and diabetes mellitus: a Danish nationwide cohort study. *Ann Rheum Dis* 2011;70:929–34.
- Peters MJ, van Halm VP, Voskuyl AE, *et al.* Does rheumatoid arthritis equal diabetes mellitus as an independent risk factor for cardiovascular disease? A prospective study. *Arthritis Rheum* 2009;61:1571–9.
- van Halm VP, Peters MJ, Voskuyl AE, *et al.* Rheumatoid arthritis versus diabetes as a risk factor for cardiovascular disease: a cross-sectional study, the CARRE Investigation. *Ann Rheum Dis* 2009;68:1395–400.
- Symmons DP, Gabriel SE. Epidemiology of CVD in rheumatic disease, with a focus on RA and SLE. *Nat Rev Rheumatol* 2011;7:399–408.
- Micha R, Imamura F, Wylers von Ballmoos M, *et al.* Systematic review and meta-analysis of methotrexate use and risk of cardiovascular disease. *Am J Cardiol* 2011;108:1362–70.
- Perk J, De Backer G, Gohlke H, *et al.* European Guidelines on cardiovascular disease prevention in clinical practice (version 2012): the Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts). *Atherosclerosis* 2012;223:1–68.
- Turesson C, McClelland RL, Christianson TJ, *et al.* Severe extra-articular disease manifestations are associated with an increased risk of first ever cardiovascular events in patients with rheumatoid arthritis. *Ann Rheum Dis* 2007;66:70–5.
- Turesson C, Jacobsson LT, Sturfelt G, *et al.* Rheumatoid factor and antibodies to cyclic citrullinated peptides are associated with severe extra-articular manifestations in rheumatoid arthritis. *Ann Rheum Dis* 2007;66:59–64.
- Conroy RM, Pyorala K, Fitzgerald AP, *et al.* Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. *Eur Heart J* 2003;24:987–1003.
- Turesson C, O'Fallon WM, Crowson CS, *et al.* Occurrence of extraarticular disease manifestations is associated with excess mortality in a community based cohort of patients with rheumatoid arthritis. *J Rheumatol* 2002;29:62–7.
- Gomez-Vaquero C, Robustillo M, Narvaez J, *et al.* Assessment of cardiovascular risk in rheumatoid arthritis: impact of the new EULAR recommendations on the score cardiovascular risk index. *Clin Rheumatol* 2012;31:35–9.
- Hildebrandt P, Larsen ML, Prescott E, *et al.* Forebyggelse af hjertesygdom (Prevention of heart disease) Dansk Cardiologisk Selskab (Danish Cardiological Association). 2010. <http://www.cardio.dk> (accessed 15 Aug 2012).
- Christensen B, Færgemann O, Heebøll-Nielsen, *et al.* Forebyggelse af iskæmisk hjerte-kar-sygdom i almen praksis (Prevention of ischemic cardiovascular disease in general practice). Dansk Selskab for Almen Medicin (DSAM) (Danish Association for General Practice) 3rd edn; 2007:52. [http://www.dsam.dk/files/9/iskaemisk\\_hjerte\\_kar\\_sygdom\\_2007.pdf](http://www.dsam.dk/files/9/iskaemisk_hjerte_kar_sygdom_2007.pdf) (accessed 20 Mar 2013).author initials
- Bang LE, Christensen KL, Hansen KW, *et al.* Diagnostisk blodtryksmåling—på døgnbasis, hjemme og i konsultationen. (Diagnostic measurement of blood pressure —at 24-hour basis, at home and in the consultation). Dansk Hypertensionsselskab (Danish Hypertension Association) 2006. [http://www.dahs.dk/fileadmin/BTmaaling\\_version-17.pdf](http://www.dahs.dk/fileadmin/BTmaaling_version-17.pdf) (accessed 20 Mar 2013).
- Asmussen KH, Steengaard-Pedersen K, Hørslev-Petersen K, *et al.* Dansk Reumatologisk Selskabs Kliniske Retningslinje for Klassifikation, Diagnostik, Behandling og Monitorering af Reumatoid Arthritis (RA). (The Clinical Guideline from the Danish Rheumatological Association for Classification, Diagnose, Treatment and Monitoring of Rheumatoid Arthritis (RA). Dansk Reumatologisk Selskab (Danish Rheumatological Association); 2012. [http://www.danskreumatologisk-selskab.dk/fileadmin/DRS/kliniskeretningslinjer/Dansk\\_Reumatologisk\\_Selskabs\\_Kliniske\\_Retningslinje\\_for\\_Diagnostik\\_Klassifikation\\_Behandling\\_og\\_Monitorering\\_af\\_Reumatoid\\_Artrit\\_revideret\\_september\\_2012\\_PDF\\_kopi\\_.pdf](http://www.danskreumatologisk-selskab.dk/fileadmin/DRS/kliniskeretningslinjer/Dansk_Reumatologisk_Selskabs_Kliniske_Retningslinje_for_Diagnostik_Klassifikation_Behandling_og_Monitorering_af_Reumatoid_Artrit_revideret_september_2012_PDF_kopi_.pdf) (accessed 20 Mar 2013).
- Prevoo ML, van't Hof MA, Kuper HH, *et al.* Modified disease activity scores that include twenty- eight-joint counts. Development and validation in a prospective longitudinal study of patients with rheumatoid arthritis. *Arthritis Rheum* 1995;38:44–8.
- Thorsen H, Hansen TM, McKenna SP, *et al.* Adaptation into Danish of the Stanford Health Assessment Questionnaire (HAQ) and the Rheumatoid Arthritis Quality of Life Scale (RAQoL). *Scand J Rheumatol* 2001;30:103–9.
- Prescott ER, Rasmussen H, Gustafsson I. 34. Forebyggelse af hjertesygdom (Prevention of heartdisease). Dansk Cardiologisk Selskab (Danish Cardiological Association). 2012. <http://nbv.cardio.dk/forebyggelse> (accessed 20 Mar 2013).
- Jensen DV, Hetland M. Danbio, Dansk Reumatologisk Database, Årsrapport 2011. (Danbio, Danish Rheumatological Database, Yearly Report 2011). Danbio, 2012.
- Pedersen JK. Rheumatoid arthritis in the southern part of Denmark—studies of incidence, prevalence and joint damage related to symptom duration [PhD thesis]. University of Southern Denmark, 2007.
- Hildebrandt PM, Madsen MM, Egstrup K, *et al.* Diabetes og Hjertesygdom (Diabetes and heart disease) Dansk Cardiologisk Selskab (Danish Cardiological Association). 2008 <http://cardio.synkron.com/sw14033.asp> (accessed 20 Mar 2013).
- Glumer C, Jorgensen T, Borch-Johnsen K. Prevalences of diabetes and impaired glucose regulation in a Danish population: the Inter99 study. *Diabetes Care* 2003;26:2335–40.
- Naranjo A, Sokka T, Descalzo MA, *et al.* Cardiovascular disease in patients with rheumatoid arthritis: results from the QUEST-RA study. *Arthritis Res Ther* 2008;10:R30.
- Kronborg C, Hallas J, Jacobsen IA. Prævalens, behandling og kontrol af arteriel hypertension i Danmark—sekundærpublikation (Prevalence, treatment and control of arterial hypertension in Denmark—secondarypublication). *Ugeskrift for læger* 2009;171:3.
- Amezaga Urruela M, Suarez-Almazor ME. Lipid paradox in rheumatoid arthritis: changes with rheumatoid arthritis therapies. *Curr Rheumatol Rep* 2012;14:428–37.
- Katz PP, Yazdany J, Trupin L, *et al.* Sex differences in assessment of obesity in rheumatoid arthritis. *Arthritis Care Res (Hoboken)* 2013;65:62–70.
- Den nationale sundhedsprofil 2010—Hvordan har du det? (National health profile 2010—How are you?) 1st edn., Islands Brygge 67, 2300 København S: Sundhedsstyrelsen. 2011. <http://www.sundhedsprofil2010.dk/Pages/Home.aspx> (accessed 20 Mar 2013).
- Haslam DW, James WP. Obesity. *Lancet* 2005;366:1197–209.
- Carlsson AC, Wandell PE, Gigante B, *et al.* Seven modifiable lifestyle factors predict reduced risk for ischemic cardiovascular disease and all-cause mortality regardless of body mass index: a cohort study. *Int J Cardiol* Published Online First: 22 Nov 2012. pii: S0167-5273(12)01420-9. doi:10.1016/j.ijcard.2012.10.045
- Emberson JR, Shaper AG, Wannamethee SG, *et al.* Alcohol intake in middle age and risk of cardiovascular disease and mortality: accounting for intake variation over time. *Am J Epidemiol* 2005;161:856–63.
- Kremers HM, Crowson CS, Thorneau TM, *et al.* High ten-year risk of cardiovascular disease in newly diagnosed rheumatoid arthritis patients: a population-based cohort study. *Arthritis Rheum* 2008;58:2268–74.
- Maradit-Kremers H, Crowson CS, Nicola PJ, *et al.* Increased unrecognized coronary heart disease and sudden deaths in rheumatoid arthritis: a population-based cohort study. *Arthritis Rheum* 2005;52:402–11.
- Provan SA, Semb AG, Hisdal J, *et al.* Remission is the goal for cardiovascular risk management in patients with rheumatoid arthritis: a cross-sectional comparative study. *Ann Rheum Dis* 2011;70:812–17.