

A screening tool for the risk of disability retirement due to musculoskeletal disorders ¹

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1 *Supplementary tables and figures*

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Results

Models adjusted for age, sex and education

Age, sex and education independently predicted disability retirement due to MSDs. Disability was more common in women, older workers, and among less educated people. After adjustment for age, sex and education, a new disability pension award due to MSDs was more common when the following risk factors were present: sedentary lifestyle, obesity, low self-rated health, moderate or poor self-rated physical work ability, moderate or poor self-rated mental work ability, diabetes, depression, burnout, physician-diagnosed chronic back disorder, physician-diagnosed chronic neck disorder, physician-diagnosed chronic shoulder disorder, upper extremity tendinopathy, sciatica, self-reported arthritis, physician-diagnosed arthritis, an operation for a spinal disorder, carpal tunnel release, shoulder pain limiting daily activities, neck pain limiting daily activities, back pain limiting daily activities, multisite pain in the past 7 days, multisite pain in the past 30 days, a fracture, high total cholesterol, high level of total cholesterol to HDL ratio, high level of non-HDL cholesterol, high triglycerides, high C-reactive protein, heavy physical work, work demanding long lasting standing or walking, work demanding kneeling or squatting, work demanding standing or leaning forward without support, work with a vibrating tool, manual handling of loads, repetitive movements of the hands or wrists, using keyboard, work demanding high handgrip forces, work demanding the hands above the shoulder girdle, and high job demands.

The following factors were not related to subsequent disability retirement due to MSDs: marital status, commuting to work, number of weekly hours of strenuous leisure time physical activity, frequency of leisure time activity, smoking, anxiety, psychosis, substance use, alcohol problems, LDL cholesterol, HDL cholesterol, work requiring sitting, work requiring driving a car, tractor or other work machines, shift work, satisfaction with the current job, social support at work, job control, bullying, work atmosphere, and threats of becoming unemployed or being laid off.

Table S1. Background characteristics of the development population, survey weighted mean (SD) or proportion.

Characteristic	Mean (SD)	%
Age	44.2 (8.2)	
30–40		36
41–50		37
51–60		27
Women		49
Years of education	12.7 (3.6)	
<i>Lifestyle factors</i>		
Body mass index	26.4 (4.5)	
Waist circumference (cm)	91.2 (13)	
Obesity (BMI ≥ 30 kg/M ²)		19
Sedentary lifestyle		16
Smoking		
Former		19
Occasional		7
Current		26
<i>Self-reported conditions</i>		
Rheumatoid arthritis		1
Knee osteoarthritis		4
Hip osteoarthritis		1
Hand osteoarthritis		4
Diabetes		3
Multisite musculoskeletal pain in the past 30 days		66
Multisite musculoskeletal pain in the past 7 days		15
Musculoskeletal pain limiting daily activities in the past 5 years		36
Surgery for a spinal disorder or carpal tunnel syndrome		3
<i>Physician-diagnosed conditions</i>		
Chronic neck disorder		4
Chronic shoulder disorder		4
Chronic rotator cuff tendinitis		2
Chronic back disorder		8
Possible or probable sciatica		5
Rheumatoid arthritis		1
Knee osteoarthritis		2
Hip osteoarthritis		1
<i>Occupational factors</i>		
Heavy work		29
Handling loads heavier than 20 kg		17
Using a vibrating tool		7
Moderate or poor current physical work ability		16

Table S2: Sensitivity, specificity and the positive and negative predictive values for the risk predictive tool for sex-specific cut-off of top 25% of index (score ≥ 3 for men and >3 for women) in the development sample

Summary estimate	All	Men	Women
Sensitivity			
%	71.6	70.5	72.2
95% CI	64.3-78.1	57.4-81.5	63.0-80.1
Specificity			
%	77.1	74.8	79.2
95% CI	75.6-78.4	72.7-76.9	77.2-81.0
Positive predictive value			
%	13.6	9.1	18.2
95% CI	11.4-15.9	6.6-12.0	14.8-22.1
Negative predictive value			
%	98.2	98.6	97.8
95% CI	97.6-98.6	97.8-99.2	96.9-98.5

Table S3: Sensitivity, specificity and the positive and negative predictive values for the risk predictive tool for age-specific cut-off of top 40% and top 20% of index in the development sample

Summary estimate	Top 40%		Top 20%		
	Aged 41-50 (score ≥ 3)	Aged 51-60 (score ≥ 4)	Aged 30-40 (score >1)	Aged 41-50 (score >3)*	Aged 51-60 (score >4)
Sensitivity					
%	81.1	74.4	50.0	44.6	59.3
95% CI	70.3-89.3	63.9-83.2	24.7-75.3	33.0-56.6	48.2-69.8
Specificity					
%	63.9	67.4	79.7	89.7	85.7
95% CI	61.2-66.5	64.2-70.6	77.4-81.8	87.9-91.3	83.2-87.9
Positive predictive value					
%	11.5	18.5	2.8	20.0	29.1
95% CI	8.9-14.5	14.5-23.0	1.2-5.5	14.2-26.9	22.5-36.5
Negative predictive value					
%	98.3	96.4	99.3	96.6	95.5
95% CI	97.2-99.1	94.6-97.7	98.6-99.7	95.4-97.5	93.8-96.8

* The top 12% of the index

Table S4: Hazard ratios (HR) and discriminatory ability of the predictors in the Finnish Helsinki Health Study

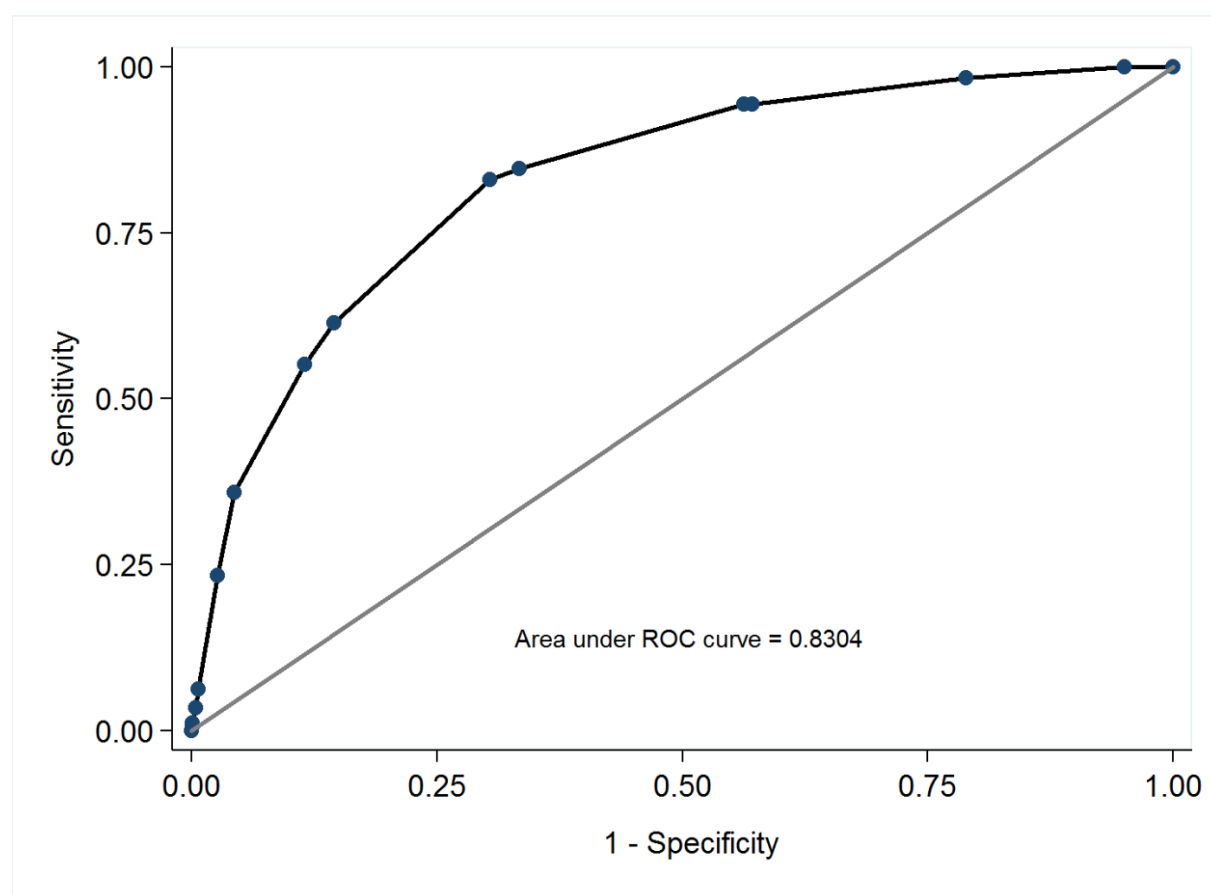
Predictor	N	Disability retirement (%)	HR	95% CI	Gönen and Heller's K concordance coefficient
Age					
40	1304	0.8	1		
45	1402	1.6	1.83	0.86-3.86	
50	1396	6.9	7.28	3.78-14.02	
55	1638	6.4	9.91	5.10-19.26	
60	784	4.9	33.66	15.86-71.45	
Sex					
Men	1403	2.7	1		
Women	5121	4.6	1.28	0.90-1.82	
Education					
Low or medium	4741	5.4	1		
University/college degree	1783	0.7	0.17	0.10-0.29	0.809
Current musculoskeletal pain limiting daily activities					
No	3831	1.6	1		
Yes	2560	7.8	3.22	2.35-4.41	
Current multisite pain					
No	5472	3.1	1		
Yes	934	10.3	1.32	1.00-1.74	
Rheumatoid arthritis or osteoarthritis					
No	5593	2.7	1		
Yes	931	13.2	3.05	2.36-3.95	

Table S5: An average 11-year predicted risk (%) by the level of the prediction risk score in the development and validation populations

Prediction index	Development population		Validation population	
	Predicted	Observed	Predicted	Observed
≤ 0	0.29	0.40	0.40	0.17
1.0	0.96	0.91	1.09	1.17
1.5-2.0	2.46	2.00	2.25	2.06
2.5-3.0	5.79	5.84	4.06	4.65
3.5-4.0	10.28	11.22	8.39	10.84
4.5-5.0	17.71	29.21	14.41	14.54
≥ 5.5	39.37	31.43	24.38	25.20

Table S6: Screening checklist and suggested points for risk factor profiles

Risk profile	Men	Women
Age		
30-40	0	0
41-45	1	1
46-50	1	2
51-55	2	2.5
56-60	2	3
A college or university education	-1	-1
Multisite musculoskeletal pain in the past month	1	1
Musculoskeletal pain limiting daily activities in the past month	1	1
Rheumatoid arthritis or hip/knee osteoarthritis	1	1
Surgery for a spinal disorder or carpal tunnel syndrome	1	1

**Figure S1:** Area under the receiver operating curve (ROC) for the continuous prediction index (score -1 to 7) in the development population

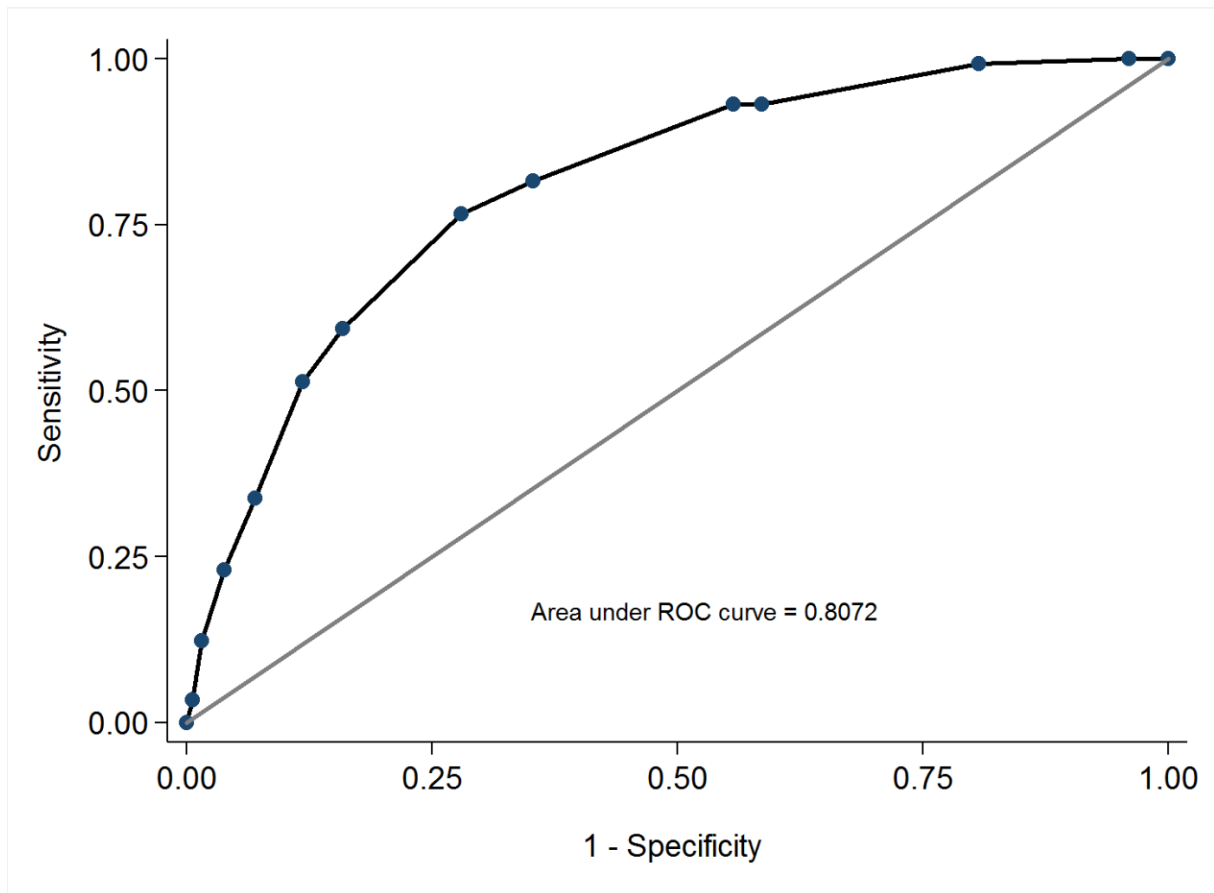


Figure S2: Area under the receiver operating curve (ROC) for the continuous prediction index (score -1 to 6) in the validation population

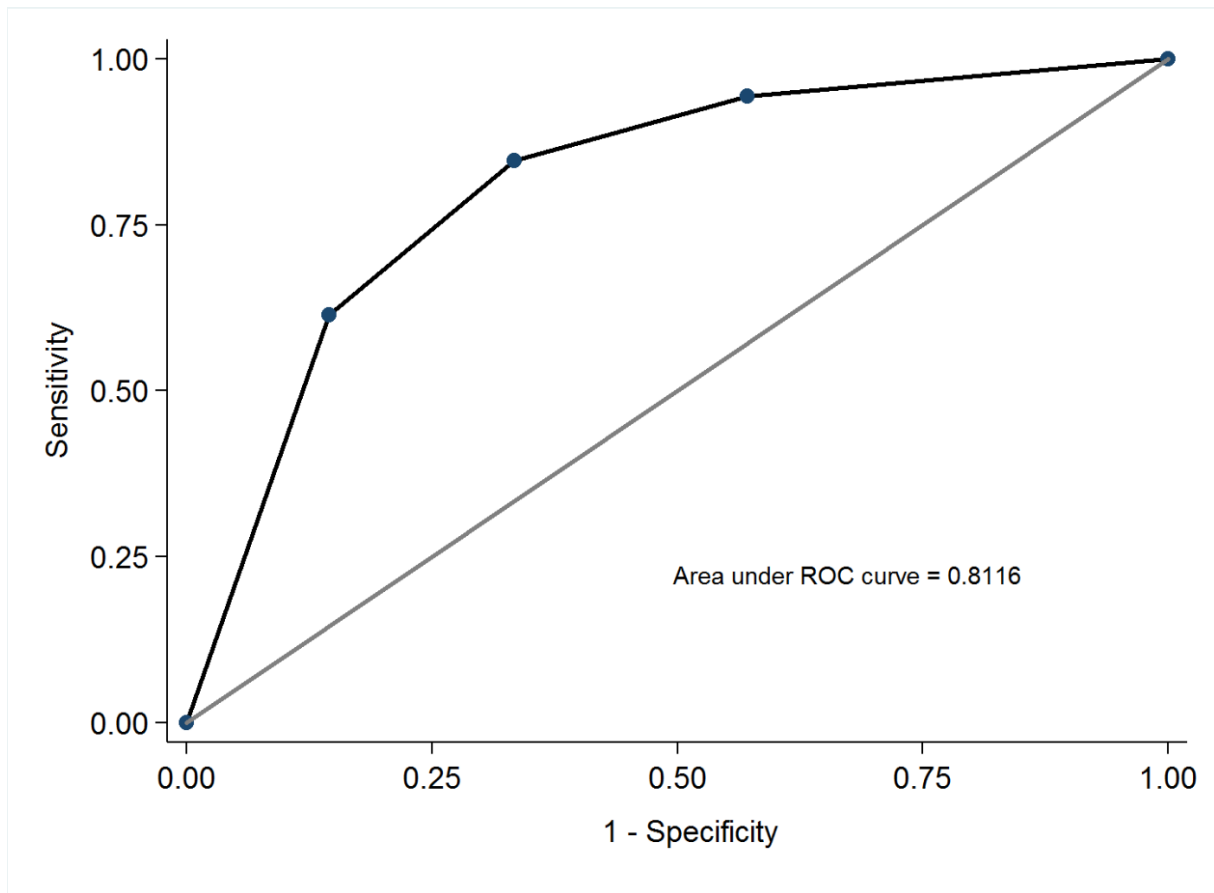


Figure S3: Area under the receiver operating curve (ROC) for the prediction index classified into four groups (1-40%, 41-60%, 60-80%, and 81-100%) in the development population

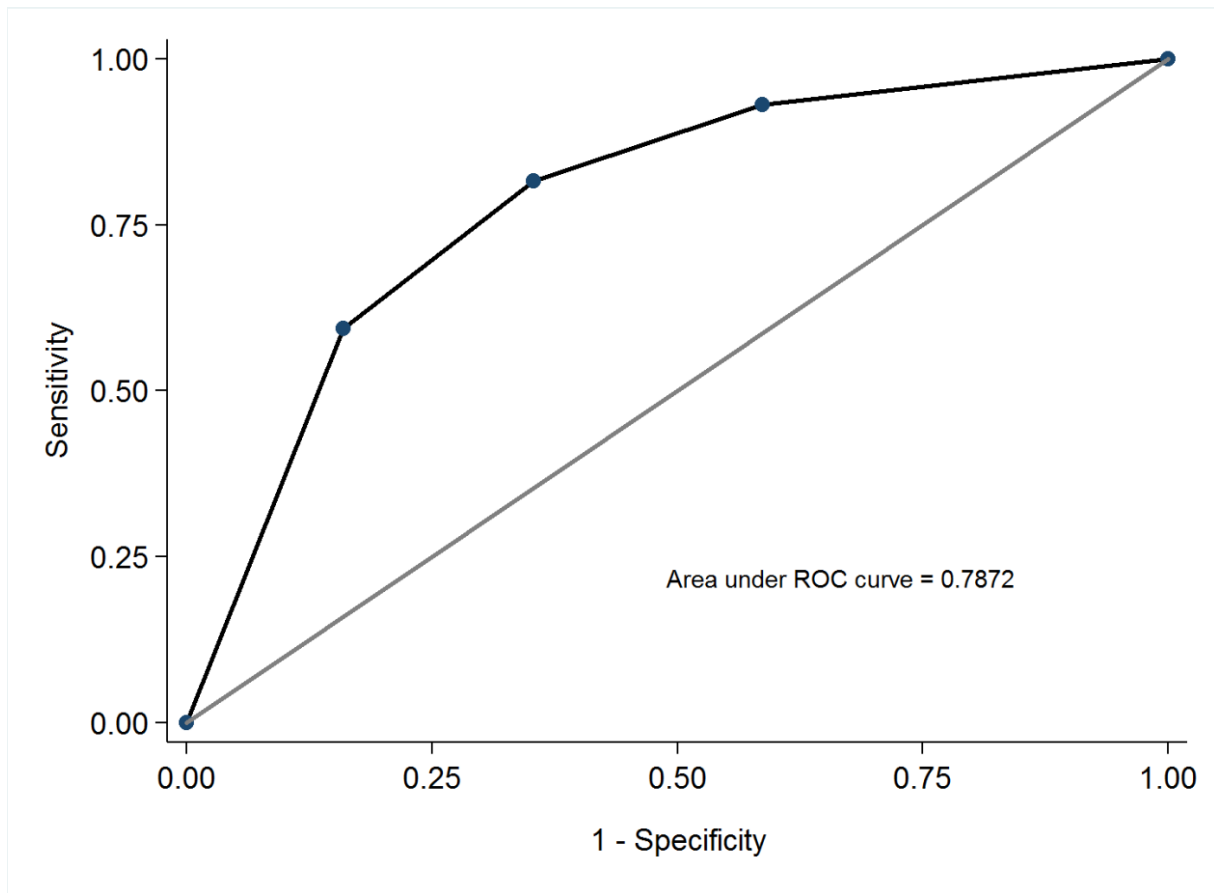


Figure S4: Area under the receiver operating curve (ROC) for the prediction index classified into four groups (1-40%, 41-60%, 60-80%, and 81-100%) in the validation population