

Development and evaluation of the gender-specific CONSTANCES job exposure matrix for physical risk factors in France¹

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1. Supplementary material
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Appendix 1: JEM performance measures at different cut-offs to create group exposures (asymptomatic cohort)

Male cohort – cut-off 50%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.23	18.18	98.31	0.58	3.39	10.30
Standing	0.65	78.43	86.27	0.82	45.25	48.71
Repetition	0.21	16.21	98.30	0.57	3.15	9.99
Change tasks	0.25	90.16	31.51	0.61	84.10	72.06
Rest eyes	0.34	93.07	36.28	0.65	86.44	77.43
Kneel or squat	0.39	35.84	96.21	0.66	8.28	14.00
Bend trunk	0.37	38.92	93.67	0.66	11.57	16.08
Drive machinery	0.26	15.99	99.85	0.58	0.93	4.94
Drive car or truck	0.40	32.92	97.99	0.65	7.14	16.59
Handle objects 1-4 kg	0.30	24.77	97.78	0.61	4.68	10.92
Handle objects >4 kg	0.11	6.74	99.56	0.53	0.84	6.37
Carry loads <10 kg	0.01	0.31	99.97	0.50	0.04	4.58
Carry loads 10-25 kg	0.01	0.57	99.97	0.50	0.04	2.43
Carry loads >25 kg	0.50	0.50	100.00	x	0.01	1.41
Use vibrating tools	0.61	42.92	97.93	0.70	6.53	10.91
Use computer screen	0.60	91.52	69.17	0.80	77.14	76.30
Use keyboard or scanner	0.13	85.24	74.01	0.80	59.26	56.16
Bend neck	0.27	9.55	98.73	0.54	2.40	13.66
Arms above shoulder	0.00	21.16	98.43	0.60	3.08	7.72
Reach behind	0.11	0.20	100.00	0.50	0.01	3.40
Arms abducted	0.20	8.00	99.17	0.54	1.53	9.67
Bend elbow	0.45	15.00	98.57	0.57	2.90	10.86
Rotate forearm	0.23	37.65	98.48	0.68	4.37	7.87
Bend wrist	0.45	17.16	98.55	0.58	3.09	10.48
Press base of hand	0.08	38.68	97.57	0.68	6.63	11.59
Finger pinch	0.42	4.48	99.82	0.52	0.36	4.26
Work outdoors	0.23	34.73	97.95	0.66	6.88	14.77

Male cohort – cut-off 40%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.34	34.72	95.28	0.65	7.81	10.30
Standing	0.64	86.18	77.81	0.82	53.36	48.71
Repetition	0.25	21.91	97.07	0.59	4.82	9.99
Change tasks	0.10	98.39	8.91	0.54	96.35	72.06
Rest eyes	0.21	97.68	17.91	0.58	94.16	77.43
Kneel or squat	0.42	49.53	91.98	0.71	13.83	14.00
Bend trunk	0.41	55.54	88.48	0.72	18.60	16.08
Drive machinery	0.41	34.36	98.77	0.67	2.86	4.94
Drive car or truck	0.45	44.29	95.05	0.70	11.47	16.59
Handle objects 1-4 kg	0.37	35.07	96.12	0.66	7.28	10.92
Handle objects >4 kg	0.30	26.63	97.79	0.62	3.76	6.37
Carry loads <10 kg	0.13	8.70	99.44	0.54	0.94	4.58
Carry loads 10-25 kg	0.11	6.88	99.73	0.53	0.44	2.43
Carry loads >25 kg	0.01	0.74	99.98	0.50	0.03	1.41
Use vibrating tools	0.53	50.17	96.98	0.74	8.16	10.91
Use computer screen	0.57	95.48	55.97	0.76	83.29	76.30
Use keyboard or scanner	0.58	88.31	68.54	0.78	63.38	56.16
Bend neck	0.16	12.90	97.90	0.55	3.58	13.66
Arms above shoulder	0.34	30.93	97.22	0.64	4.96	7.72
Reach behind	0.05	3.26	99.78	0.52	0.32	3.40
Arms abducted	0.26	23.92	96.61	0.60	5.38	9.67
Bend elbow	0.33	33.99	95.01	0.65	8.14	10.86
Rotate forearm	0.49	46.68	97.43	0.72	6.04	7.87
Bend wrist	0.33	30.47	96.43	0.63	6.39	10.48
Press base of hand	0.49	49.93	95.46	0.73	9.80	11.59
Finger pinch	0.09	5.46	99.77	0.53	0.45	4.26
Work outdoors	0.45	41.00	96.72	0.69	8.85	14.77

Male cohort – cut-off 30%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.38	55.13	89.94	0.73	14.70	10.30
Standing	0.61	89.42	72.32	0.81	57.76	48.71
Repetition	0.29	38.85	91.93	0.65	11.15	9.99
Change tasks	0.04	99.73	3.03	0.51	98.96	72.06
Rest eyes	0.18	98.54	14.07	0.56	95.70	77.43
Kneel or squat	0.43	71.02	84.00	0.78	23.70	14.00
Bend trunk	0.42	68.99	83.16	0.76	25.22	16.08

Drive machinery	0.43	38.27	98.35	0.68	3.46	4.94
Drive car or truck	0.48	58.31	90.52	0.74	17.58	16.59
Handle objects 1-4 kg	0.41	54.19	91.23	0.73	13.73	10.92
Handle objects >4 kg	0.34	36.88	96.22	0.67	5.89	6.37
Carry loads <10 kg	0.25	21.36	98.34	0.60	2.56	4.58
Carry loads 10-25 kg	0.16	10.74	99.54	0.55	0.71	2.43
Carry loads >25 kg	0.02	0.99	99.97	0.50	0.05	1.41
Use vibrating tools	0.54	58.38	95.31	0.77	10.55	10.91
Use computer screen	0.52	97.01	47.02	0.72	86.58	76.30
Use keyboard or scanner	0.48	94.92	50.64	0.73	74.94	56.16
Bend neck	0.18	25.53	91.15	0.58	11.13	13.66
Arms above shoulder	0.35	37.43	95.78	0.67	6.78	7.72
Reach behind	0.08	4.89	99.67	0.52	0.49	3.40
Arms abducted	0.32	42.18	92.21	0.67	11.12	9.67
Bend elbow	0.36	52.48	89.58	0.71	14.99	10.86
Rotate forearm	0.51	59.67	95.23	0.77	9.09	7.87
Bend wrist	0.36	45.78	92.18	0.69	11.80	10.48
Press base of hand	0.49	54.98	94.19	0.75	11.51	11.59
Finger pinch	0.14	9.93	99.29	0.55	1.10	4.26
Work outdoors	0.50	57.29	92.48	0.75	14.87	14.77

Male cohort – cut-off 20%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.36	72.44	82.71	0.78	22.97	10.30
Standing	0.56	92.05	64.75	0.78	62.92	48.71
Repetition	0.27	54.39	84.44	0.69	19.44	9.99
Change tasks	0.03	99.83	2.41	0.51	99.20	72.06
Rest eyes	0.05	99.91	3.24	0.52	99.20	77.43
Kneel or squat	0.40	80.06	78.92	0.79	29.34	14.00
Bend trunk	0.39	76.25	77.74	0.77	30.94	16.08
Drive machinery	0.42	51.12	96.21	0.74	6.12	4.94
Drive car or truck	0.47	68.06	86.08	0.77	22.90	16.59
Handle objects 1-4 kg	0.38	73.03	83.31	0.78	22.84	10.92
Handle objects >4 kg	0.33	65.64	88.40	0.77	15.04	0.37
Carry loads <10 kg	0.30	43.71	94.52	0.69	7.23	4.58
Carry loads 10-25 kg	0.27	36.39	97.14	0.67	3.68	2.43
Carry loads >25 kg	0.23	25.25	98.83	0.62	1.51	1.41
Use vibrating tools	0.51	71.40	90.56	0.81	16.19	10.91
Use computer screen	0.41	98.55	34.15	0.66	90.80	76.30
Use keyboard or scanner	0.42	96.63	43.28	0.70	79.13	56.16
Bend neck	0.13	53.90	67.63	0.61	35.31	13.66
Arms above shoulder	0.31	66.47	84.79	0.76	19.17	7.72

Reach behind	0.17	15.17	98.56	0.57	1.90	3.40
Arms abducted	0.33	65.28	83.98	0.75	20.78	9.67
Bend elbow	0.34	66.68	83.04	0.75	22.37	10.86
Rotate forearm	0.49	66.84	92.97	0.80	11.74	7.87
Bend wrist	0.34	61.25	85.47	0.73	19.42	10.48
Press base of hand	0.48	64.58	90.92	0.78	15.51	11.59
Finger pinch	0.18	18.00	97.67	0.58	3.00	4.26
Work outdoors	0.48	68.89	87.37	0.78	20.94	14.77

Female cohort – cut-off 50%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.20	14.55	98.77	0.57	2.40	8.72
Standing	0.74	88.50	85.16	0.87	51.13	49.27
Repetition	0.17	12.76	98.76	0.56	2.65	12.25
Change tasks	0.20	86.25	32.10	0.59	80.02	66.08
Rest eyes	0.35	89.25	42.91	0.66	78.96	68.00
Kneel or squat	0.40	36.93	95.97	0.66	10.08	18.39
Bend trunk	0.44	51.86	89.83	0.71	19.68	22.81
Drive machinery	0.04	1.87	99.99	0.51	0.03	0.76
Drive car or truck	0.41	29.67	99.45	0.65	2.24	5.81
Handle objects 1-4 kg	0.08	5.15	99.64	0.52	0.69	6.85
Handle objects >4 kg	0.00	0.14	99.98	0.50	0.03	4.02
Carry loads <10 kg	x	x	99.99	x	0.01	2.90
Carry loads 10-25 kg	x	x	99.99	x	0.01	1.34
Carry loads >25 kg	x	x	100.00	x	0.00	1.02
Use vibrating tools	0.18	11.08	99.78	0.55	0.53	2.81
Use computer screen	0.62	90.47	71.79	0.81	75.29	75.61
Use keyboard or scanner	0.68	84.01	83.99	0.84	54.44	56.51
Bend neck	0.05	4.04	99.34	0.52	1.40	21.87
Arms above shoulder	0.08	4.68	99.75	0.52	0.61	8.10
Reach behind		x	100.00		0.00	3.67
Arms abducted	0.05	2.74	99.86	0.51	0.36	8.24
Bend elbow	0.07	4.59	99.70	0.52	0.70	9.30
Rotate forearm	0.03	1.85	99.94	0.51	0.11	2.31
Bend wrist	0.09	5.16	99.79	0.52	0.59	7.59
Press base of hand	0.05	3.19	99.83	0.52	0.27	3.13
Finger pinch	0.05	3.14	99.88	0.52	0.27	5.00
Work outdoors	0.25	16.26	99.71	0.58	0.90	3.82

Female cohort – cut-off 40%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.29	25.55	97.27	0.61	4.72	8.72
Standing	0.73	91.32	81.59	0.86	54.34	49.27
Repetition	0.23	18.90	97.67	0.58	4.36	12.25
Change tasks	0.04	99.21	4.24	0.52	98.04	66.08
Rest eyes	0.25	95.01	25.52	0.60	88.44	68.00
Kneel or squat	0.48	62.46	88.00	0.75	21.28	18.39
Bend trunk	0.49	70.58	82.99	0.77	29.23	22.81
Drive machinery	0.21	16.04	99.72	0.58	0.40	0.76
Drive car or truck	0.43	37.40	98.33	0.68	3.75	5.81
Handle objects 1-4 kg	0.16	11.55	98.83	0.55	1.88	6.85
Handle objects >4 kg	0.06	3.43	99.76	0.52	0.37	4.02
Carry loads <10 kg	0.00	0.10	99.99	0.50	0.01	2.90
Carry loads 10-25 kg	x	x	99.99	x	0.01	1.34
Carry loads >25 kg	x	x	99.99	x	0.01	1.02
Use vibrating tools	0.20	99.59	99.59	0.57	0.78	2.81
Use computer screen	0.49	96.43	45.57	0.71	86.19	75.61
Use keyboard or scanner	0.67	86.53	80.38	0.83	57.43	56.51
Bend neck	0.08	7.01	98.32	0.53	2.85	21.87
Arms above shoulder	0.12	7.57	99.47	0.54	1.10	8.10
Reach behind	0.04	2.48	99.85	0.51	0.23	3.67
Arms abducted	0.17	13.03	98.69	0.56	2.27	8.24
Bend elbow	0.21	16.33	98.24	0.57	3.12	9.30
Rotate forearm	0.12	7.05	99.78	0.53	0.38	2.31
Bend wrist	0.18	12.88	98.88	0.56	2.01	7.59
Press base of hand	0.08	5.38	99.66	0.53	0.50	3.13
Finger pinch	0.08	4.97	99.74	0.52	0.49	5.00
Work outdoors	0.27	18.32	99.53	0.59	1.15	3.82

Female cohort – cut-off 30%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.33	40.03	93.67	0.67	9.27	8.72
Standing	0.71	92.46	78.24	0.85	56.59	49.27
Repetition	0.28	29.91	94.28	0.62	8.68	12.25
Change tasks	0.02	99.70	1.95	0.51	99.14	66.08
Rest eyes	0.22	95.91	22.32	0.59	90.08	68.00
Kneel or squat	0.48	81.90	79.72	0.81	31.61	18.39
Bend trunk	0.48	77.65	79.01	0.78	33.92	22.81
Drive machinery	0.22	17.91	99.66	0.59	0.47	0.76
Drive car or truck	0.42	40.90	97.54	0.69	4.69	5.81

Handle objects 1-4 kg	0.30	33.24	95.68	0.64	6.30	6.85
Handle objects >4 kg	0.28	27.61	97.69	0.63	3.33	4.02
Carry loads <10 kg	0.12	8.37	99.38	0.54	0.84	2.90
Carry loads 10-25 kg	0.00	0.22	99.99	0.50	0.02	1.34
Carry loads >25 kg	x	x	99.99	x	0.01	1.02
Use vibrating tools	0.25	21.95	98.69	0.60	1.89	2.81
Use computer screen	0.44	97.62	38.52	0.68	88.81	75.61
Use keyboard or scanner	0.56	95.03	59.06	0.77	71.51	56.51
Bend neck	0.16	30.49	84.44	0.57	18.83	21.87
Arms above shoulder	0.19	15.17	98.06	0.57	3.02	8.10
Reach behind	0.04	2.56	99.85	0.51	0.24	3.67
Arms abducted	0.29	31.30	95.45	0.63	6.75	8.24
Bend elbow	0.31	35.37	94.31	0.65	8.45	9.30
Rotate forearm	0.19	13.72	99.42	0.57	0.88	2.31
Bend wrist	0.24	21.54	97.27	0.59	4.16	7.59
Press base of hand	0.11	8.21	99.33	0.54	0.91	3.13
Finger pinch	0.12	8.12	99.46	0.54	0.92	5.00
Work outdoors	0.32	32.74	97.64	0.65	3.52	3.82

Female cohort – cut-off 20%

Physical exposure	K	Sensitivity (%)	Specificity (%)	AUC	Exposed groups (%)	Exposed individuals (%)
Physical intensity	0.33	64.37	85.93	0.75	18.46	8.72
Standing	0.67	93.82	73.60	0.84	59.62	49.27
Repetition	0.26	51.00	82.83	0.67	21.32	12.25
Change tasks	0.01	99.95	0.79	0.50	99.70	66.08
Rest eyes	0.01	99.97	0.61	0.50	99.79	68.00
Kneel or squat	0.47	85.55	77.22	0.81	34.32	18.39
Bend trunk	0.46	83.22	74.22	0.79	38.89	22.81
Drive machinery	0.20	19.03	99.52	0.59	0.62	0.76
Drive car or truck	0.37	49.90	94.49	0.72	8.09	5.81
Handle objects 1-4 kg	0.32	62.41	88.25	0.75	15.22	6.85
Handle objects >4 kg	0.31	49.71	94.14	0.72	7.62	4.02
Carry loads <10 kg	0.25	37.95	95.91	0.67	5.07	2.90
Carry loads 10-25 kg	0.19	28.02	97.98	0.63	2.37	1.34
Carry loads >25 kg	0.29	47.04	98.27	0.73	2.20	1.02
Use vibrating tools	0.27	32.52	97.47	0.65	3.37	2.81
Use computer screen	0.32	99.25	24.48	0.62	93.47	75.61
Use keyboard or scanner	0.50	97.03	50.57	0.74	76.33	56.51
Bend neck	0.13	68.19	51.90	0.60	52.50	21.87
Arms above shoulder	0.26	46.11	88.80	0.67	14.03	8.10
Reach behind	0.05	2.72	99.83	0.51	0.27	3.67
Arms abducted	0.31	53.59	88.48	0.71	14.99	8.24

Bend elbow	0.31	47.87	89.72	0.69	13.77	9.30
Rotate forearm	0.22	20.27	98.81	0.60	1.63	2.31
Bend wrist	0.28	41.54	91.88	0.67	10.66	7.59
Press base of hand	0.16	14.87	98.33	0.57	2.08	3.13
Finger pinch	0.15	11.89	98.70	0.55	1.83	5.00
Work outdoors	0.31	43.49	95.52	0.70	5.97	3.82