

Original article

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Long working hours and use of psychotropic medicine: a follow-up study with register linkage ¹

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Power calculations

We wanted to know what the statistical power to detect an effect of long working hours was in the individual prospective tests that appeared in the research papers that were read and evaluated in the course of the present project.

The effect sizes of interest were firstly a risk ratio of 1.2, which is classified as a weak association according to Monson's guide to strength of association [Monson, 1990], and secondly a risk ratio of 1.5, which is classified as a moderate association.

In line with Pejtersen et al., (2015), we considered an 80% power to be acceptable and a 95% power to be desirable.

For each of the concerned studies, we used the following procedure to estimate the statistical powers to detect a risk ratio of 1.2 and 1.5, respectively.

The confidence interval of a published risk ratio was used to estimate the standard error (Stderr) of its logarithm by means of the equation

$$Stderr = \frac{\log(UpperCL) - \log(LowerCL)}{2\Phi^{-1}(1-\alpha)} \quad (1)$$

where UpperCL is the upper confidence limit and LowerCL is the lower confidence limit of a 100(1-2 α)% confidence interval.

The power to detect a risk ratio of x as a function of Stderr and α was thereafter approximated by the equation

$$Power = \Phi\left(\frac{\log(x)}{Stderr} - \Phi^{-1}(1-\alpha)\right) \quad (2)$$

where Φ is the standard normal distribution function.

The equations are based on the central limit theorem and Gauss' propagation of error formulas. The derivation of the power formula is given by Bickel and Doksum (1977).

The results of the power calculations are given in table A1. A graphic presentation is given in figure A1.

References

Bickel PJ, Doksum KA (1977) Mathematical statistics: basic ideas and selected topics. Prentice Hall, Englewood Cliffs.

Monson RR. Occupational Epidemiology. 2nd ed. Boca Raton, FL: CRC Press; 1990.

Pejtersen JH, Burr H, Hannerz H, Fishta A, Hurwitz Eller N. Update on work-related psychosocial factors and the development of ischemic heart disease: a systematic review.

Cardiol Rev. 2015 Mar-Apr;23(2):94-8.

Table A1: Calculated statistical powers to detect a risk ratio (RR) of 1.2 and 1.5 respectively, for each of the reviewed studies.

	Study population	Sex^a	Exposure categories	Outcome	Type of follow-up data^b	Risk ratio (RR)	95% CI	Power to detect a RR of 1.2	Power to detect a RR of 1.5
Bildt et al., 2002	General population, Sweden	W	Do you work overtime? Often vs. other responses	Sub-clinical depression	Q	1.1	0.5-2.7	0.06	0.15
	General population, Sweden	M	Do you work overtime? Often vs. other responses	Sub-clinical depression	Q	0.6	0.3-1.4	0.07	0.18

	General population, Sweden	W	Do you work overtime? Often vs. other responses	Reduced psychological well-being	Q	1.3	0.8-2.1	0.11	0.38
	General population, Sweden	M	Do you work overtime? Often vs. other responses	Reduced psychological well-being	Q	1.1	0.6-2.1	0.08	0.24
	General population, Sweden	W	Do you work overtime? Often vs. other responses	High alcohol consumption	Q	1.9	0.9-4.0	0.07	0.19
	General population, Sweden	M	Do you work overtime?	High alcohol consumption	Q	0.5	0.2-1.4	0.06	0.13

			Often vs. other responses						
d'Errico et al., 2011	Union workers, Italy	B	Overtime <=4 h/w vs. no overtime	Antidepressant drug prescription	R	1.71	0.97- 3.01	0.09	0.29
	Union workers, Italy	B	Overtime >4 h/w vs. no overtime	Antidepressant drug prescription	R	1.00	0.63- 1.60	0.12	0.40
Laksonen et al., 2012	Employees of the City of Helsinki, Finland	W	>40 h/w vs <=40 h/w	Psychotropic drug prescription	R	0.96	0.77- 1.18	0.39	0.96
	Employees of the City of Helsinki, Finland	M	>40 h/w vs <=40 h/w	Psychotropic drug prescription	R	1.25	0.88- 1.78	0.17	0.62

Ribet et al., 1999	General population, France	B	Work week often > 48 hours. Yes, now vs no, never	Sleep disorders	Q	0.9	0.8-1.1	0.61	1.00
Shields, 1999	General population, Canada	W	>= 41 h/w vs 35-40 h/w	Major depressive episodes	Q	2.2	1.1-4.4	0.07	0.21
	General population, Canada	M	>= 41 h/w vs 35-40 h/w	Major depressive episodes	Q	0.6	0.3-1.3	0.07	0.19
Suwazano et al., 2003	Workers in a telecommunication enterprise, Japan	W	8-12 h/d vs <= 8 h/d	Mental symptoms (General fatigue, sleeping problems,	Q	1.10	0.95- 1.27	0.69	1.00

Tarumi et al., 2003	White collar workers in a Japanese company	B	45-49 h/w vs <45 h/w	Medical insurance claim for mental disorder (F00-F99)	R	1.32	0.44-3.93	0.05	0.11
	White collar workers in a Japanese company	B	>=50 h/w vs <45 h/w	Medical insurance claim for mental disorder (F00-F99)	R	1.36	0.46-4.06	0.05	0.11
Varma et al., 2012	Medical doctors, Denmark	B	41-44 h/w vs 37-40 h/w	Anti depressive drug prescription	R	0.95	0.50-1.77	0.08	0.24
	Medical doctors, Denmark	B	45-49 h/w vs 37-40 h/w	Anti depressive drug prescription	R	0.88	0.43-1.78	0.07	0.20
	Medical doctors, Denmark	B	50-54 h/w vs 37-40 h/w	Anti depressive drug prescription	R	0.83	0.32-2.14	0.06	0.13

	Medical doctors, Denmark	B	55-59 h/w vs 37-40 h/w	Anti depressive drug prescription	R	0.67	0.15- 2.94	0.04	0.08
	Medical doctors, Denmark	B	>=60 h/w vs 37-40 h/w	Anti depressive drug prescription	R	0.48	0.06- 3.68	0.04	0.06
Virtanen et al., 2009	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Short sleep	Q	1.98	1.05- 3.76	0.08	0.24
	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Difficulty in falling asleep	Q	3.68	1.58- 8.58	0.06	0.15
	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Frequent waking during night	Q	0.86	0.50- 1.46	0.10	0.32
	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Early waking	Q	1.58	0.91- 2.73	0.10	0.30
	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Waking without feeling refreshed	Q	1.98	1.04- 3.77	0.08	0.23
	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Short sleep	Q	1.09	0.76- 1.57	0.16	0.59

	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Difficulty in falling asleep	Q	1.58	0.88- 2.82	0.09	0.28
	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Frequent waking during night	Q	0.94	0.69- 1.27	0.22	0.74
	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Early waking	Q	1.04	0.73- 1.46	0.18	0.63
	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Waking without feeling refreshed	Q	1.14	0.76- 1.72	0.14	0.49
Virtanen et al., 2011	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Depressive symptoms	Q	1.66	1.06- 2.61	0.12	0.42
	Civil servants, UK	B	>55 h/w vs. 35-40 h/w	Anxiety symptoms	Q	1.74	1.15- 2.61	0.14	0.49
	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Depressive symptoms	Q	1.02	0.78- 1.34	0.26	0.84
	Civil servants, UK	B	41-55 h/w vs. 35-40 h/w	Anxiety symptoms	Q	1.02	0.79- 1.32	0.29	0.87

Virtanen et al., 2012	Civil servants, UK	B	9 h/d vs 7-8 h/d	Major depressive episodes	Q	0.66	0.29-1.48	0.06	0.16
	Civil servants, UK	B	10 h/d vs 7-8 h/d	Major depressive episodes	Q	1.27	0.59-2.72	0.07	0.18
	Civil servants, UK	B	11-12 h/d vs 7-8 h/d	Major depressive episodes	Q	2.52	1.12-5.65	0.06	0.16
Present publication	General population, Denmark	B	41 - 48 h/w vs 32-40 h/w	Psychotropic drug prescription	R	1.04	0.94-1.15	0.94	1.00
	General population, Denmark	B	>48 h/w vs 32-40 h/w	Psychotropic drug prescription	R	1.15	1.02-1.30	0.84	1.00

^aW=women, M=men and B= both

^bQ= questionnaire data, R = register data

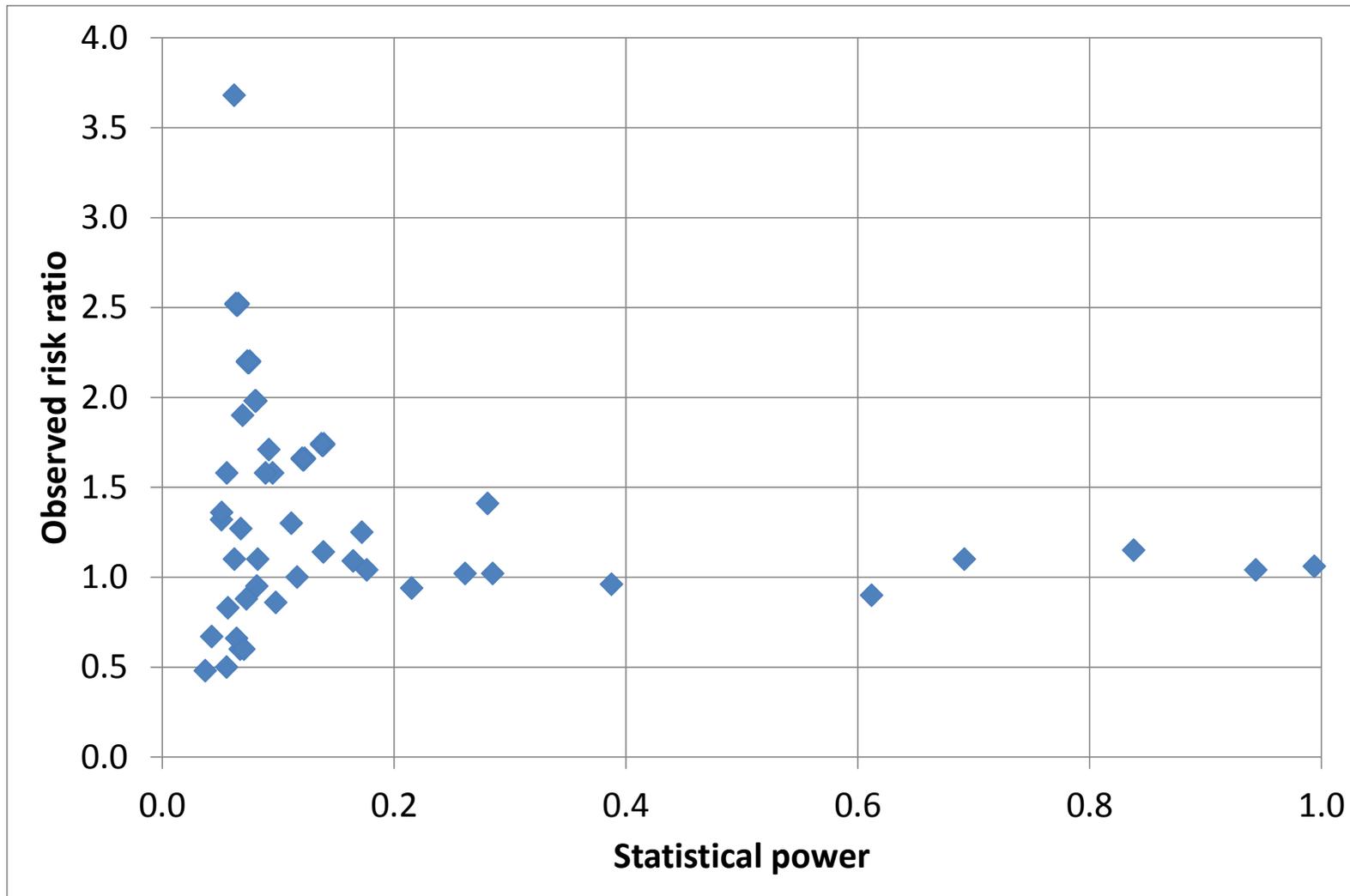


Figure A1. Observed risk ratio for each of the studies mentioned in table A1.