



Letter to the editor

## Impact of depression on incident stroke: A meta-analysis

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Depression is a clinical syndrome characterized by the key features sadness, reduced interest and pleasure, and additional psychological and vegetative symptoms [1]. Depression affects more than 121 million people worldwide [2], the average prevalence of depression estimated at 13.5% at ages  $\geq 55$  years and higher in women than in men [3], this creates a major burden on public health. In recent decades, overwhelming evidence indicates that depression was associated with well-known risk-factors for cardiovascular disease (CVD) such as hypertension [4], obesity [5], diabetes [6]. Meanwhile, two meta-analyses also showed a significant association between depression and stroke [7,8]. But, the data from studies included by previous meta-analyses were limited to May 2011. To our knowledge, many more prospective studies were published from then on [9–17], which allow more detailed analysis of the association between depression and risk of stroke. To obtain a more comprehensive estimate of the putative influence of the depression on stroke, we conducted a meta-analysis of prospective cohort studies to examine the depression in relation to the risk of stroke according to total and subtypes of stroke.

This meta-analysis was performed and reported according to the standard criteria of the Meta-analyses of Observational Studies in Epidemiology (MOOSE) conference statement [18]. A systematic search of published articles (through 15 June 2014) was performed by using electronic databases including PubMed, Embase and the Cochrane library databases. The following key words were used in our search strategies:

“depression,” “depressive symptoms,” “depressive disorder,” “depressive disorder, major,” and “stroke,” “cerebrovascular disease,” “cerebrovascular disorders,” “cerebral infarct,” “ischemic stroke,” “intracranial hemorrhage,” “intracranial artery disease,” “cardiovascular disease,” “myocardial ischemia,” “myocardial infarct,” “ischemic heart disease,” “coronary heart disease,” “angina,” and “longitudinal studies,” “cohort studies,” “prospective studies,” “follow-up studies.” We restricted the search to human studies. There were no language restrictions. Studies were considered eligible if they fulfilled all of the following criteria: (1) the study of adult patients had a community-based or population-based, prospective cohort design; (2) the exposure subject was a patient with depression or depression symptoms; (3) the outcome of interest was stroke, including all types of strokes (total, fatal, nonfatal, ischemic, and hemorrhagic); (4) the reported quantitative estimates of the

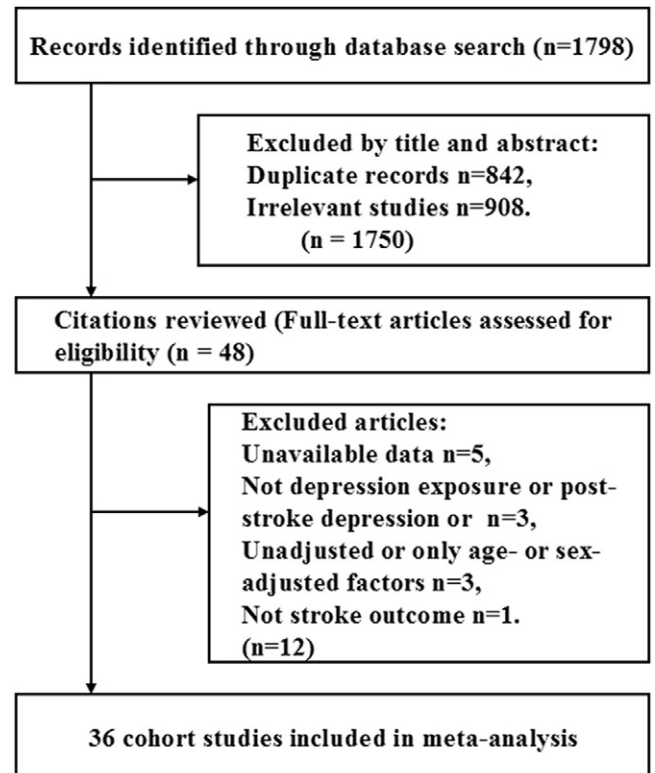


Fig. 1. Flowchart of study selection.

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**Table 1-A**  
Characteristics of studies included in the meta-analysis.

First author, publication (yr)	Country/population	No. of participants	Age rang or mean (yr)	Follow-Up Duration (yr)	Depression assessment	Stroke ascertainment	No. of stroke cases	Pre-stroke excluded	Study quality
Seifert et al. (2012) [9]	Germany/European	3852 (M and W)	55–64	6.13	GDS	ICD and hospital records	156	No	5
Majed et al. (2012) [10]	France, Ireland/European	9601 (M)	48–64	10	CES-D	Hospital or general practitioner records	136	Yes	7
Li et al. (2012) [11]	China/Asian	5015 (M and W)	41	9	ICD-9	ICD-9	156	Yes	6
Rahman et al. (2013) [12]	Sweden/European	36,654 (M and W)	63	3.86	ICD-7,8,9,10	ICD and surgical codes	833	No	5
Jackson and Mishra (2013) [13]	Australia/European	10,547 (W)	47–52	12	CES-D	Self-report, ICD-10, and death certificates	177	Yes	7
Kohler et al. (2013) [14]	Germany/European	2854 (M and W)	≥75	6	GDS	Self-report	856	Yes	6
Teng et al. (2013) [15]	China/Asian	2416 (M and W)	≥65	8	CES-D	Self-report, register records, and death certificates	NA	No	5
Pequignot et al. (2013) [16]	France/European	7308 (M and W)	69–77	5.3	CES-D	Hospital records and death certificates	141	Yes	7
Yan et al. (2013) [17]	United States	4619 (M and W)	≥65	11.5	CES-D	Self-report and medical records	652	Yes	5
Vogt et al. (1994) [21]	United States	2573 (M and W)	≥18	15	DI	Death index and vital records	NA	Yes	5
Everson et al. (1998) [22]	United States	6676 (M and W)	43.4	29	HPLDS	Death certificates	169	Yes	8
Simons et al. (1998) [23]	Australia/European	2805 (M and W)	≥60	8.2	CES-D	Hospital and death records	306	No	6
Whooley and Browner (1998) [24]	United States	7518 (W)	≥67	6	GDS	Hospital records and death certificates	94	No	7
Jonas and Mussolino (2000) [25]	United States	6095 (M and W)	25–74	16	GWB-D	Hospital records and death certificates	483	Yes	7
Larson et al. (2001) [26]	United States	1703 (M and W)	≥18	13	DIS	Self-reports and death certificates	95	Yes	6
Ohira et al. (2001) [27]	Japan/Asian	879 (M and W)	40–78	10.3	SDS	Death certificate, medical records, and clinical diagnosis	69	Yes	8
Ostir et al. (2001) [28]	United States	2478 (M and W)	≥65	6	CES-D	Physician diagnosis and death certificates	340	Yes	6
May et al. (2002) [29]	United Kingdom/European	2124 (M)	45–59	14	GHQ	Medical records	130	Yes	7
Yasuda et al. (2002) [30]	Japan/Asian	817 (M and W)	≥65	7.5	GHQ	Death certificates	20	No	7
Wassertheil-Smoller et al. (2004) [31]	United States	93,676 (W)	50–79	4.1	CES-D	Self-report and medical records	751	No	5
Gump et al. (2005) [32]	United States	11,216 (M)	35–57	18.4	CES-D	Death certificates	167	Yes	7
Avendano et al. (2006) [33]	United States	2812 (M and W)	≥65	12	CES-D	Self-report and medical records	270	Yes	7
Stumer et al. (2006) [34]	Germany/European	5114 (M and W)	40–65	8.5	SPQ	Medical records and death certificates	62	Yes	8
Kamphuis et al. (2006) [35]	Finland, Italy, Netherlands/European	799 (M)	70–90	10	SDS	Death certificates	66	Yes	6
Arbelaez et al. (2007) [36]	United States	5525 (M and W)	≥65	11	CES-D	Medical records and death certificates	607	Yes	7
Salaycik et al. (2007) [37]	United States	4120 (M and W)	29–100	8	CES-D	Physician diagnosis	228	Yes	6
Bos et al. (2008) [38]	Netherlands/European	4424 (M and W)	≥61	5.8	CES-D	Self-reports, physician diagnosis, and medical records	291	Yes	6
Lee et al. (2008) [39]	China/Asian	4962 (M and W)	18–44	5	ICD-9	Medical records	98	Yes	7
Liebetrau et al. (2008) [40]	Sweden/European	401 (M and W)	85	3	DSMMD-III	Self-report, medical records, and death certificates	56	Yes	5
Surtees et al. (2008) [41]	United Kingdom/European	20,627 (M and W)	41–80	8.5	HLEQ-DSM-IV	Physician diagnosis, medical records, and death certificates	595	Yes	7
Whooley et al. (2008) [42]	United States	1017 (M and W)	67	4.8	PHQ	Self-report and medical records	47	No	6
Wouts et al. (2008) [43]	Netherlands/European	2965 (M and W)	≥55	7.7	CES-D	Self-report and medical records	176	Yes	7
Glymour et al. (2010) [44]	United States	19,087 (M and W)	≥50	8.1	CES-D	Self- or proxy-reports	1864	Yes	8
Nabi et al. (2010) [45]	Finland/European	23,282 (M and W)	20–54	7	BDI	Register or mortality records	129	Yes	8
Peters et al. (2010) [46]	International	2656 (M and W)	≥80	2.1	GDS	Self-report and medical records	97	No	6
Pan et al. (2011) [47]	United States	80,574 (W)	54–79	6	MHI-5	Self-report, medical records, and death certificates	1033	Yes	8

Abbreviations: BDI: Beck Depression Inventory; CES-D: Center for Epidemiologic Studies Depression Scale; DIS: diagnostic interview schedule; DSMMD: Diagnostic and Statistical Manual of Mental Disorders; GDS: Geriatric Depression Scale; GHQ: General Health Questionnaire; GWB-D: General Well-Being Schedule-Depressed Mood Scale; HLEQ: Health and Life Experiences Questionnaire; HPLDS: Human Population Laboratory Depression Scale; LMHI: Langner Mental Health Index; MDD: major depressive disorder; MHI-5: five-item Mental Health Index; SDS: Zung's Self-Rating Depression Scale; DI: depression index; SPQ: standardized personality questionnaires; ICD: international classification of diseases; M: men; W: women; NA: not applicable.

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