·Review·

Dementia studies in Chinese populations

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Variations in the prevalence of dementia in different ethnic groups have been reported worldwide, and a number of reviews have provided a picture of epidemiological studies in dementia research. However, little is known about epidemiological studies in Chinese populations. In this review, we searched PubMed and the Web of Science for original research articles published in English up to July 2013 on the prevalence, incidence, risk factors, and prognosis of dementia in Chinese populations worldwide. Except for the prevalence, we included only population-based follow-up studies. We identified 25 studies in elderly Chinese residents in Mainland China, Hong Kong, Taiwan, and Singapore, and found a higher prevalence of dementia in Mainland China than in the other locations, which may be due to that the studies from Mainland China are more recent than those from other locations. A notable increase in incidence was observed when dementia cases were diagnosed using 10/66 diagnostic criteria compared to other criteria. Studies on risk factors for dementia were limited and mostly from Mainland China. Age, gender, education, smoking, and alcohol consumption were related to the risk of dementia in Chinese populations. Only two prognostic studies were identified, and age, gender, and residential area were related to the prognosis of dementia. In conclusion, the prevalence, incidence, and risk factors for dementia found in Chinese populations were comparable to other ethnic groups, but no conclusive results on prognosis were found. The differences in prevalence and incidence were influenced by the diagnostic criteria and the time of study. Longitudinal population-based studies on the incidence, risk factors, and prognosis of dementia in Chinese populations are required.

Keywords: dementia; epidemiology; risk factors; prognosis; prevalence; incidence

Introduction

The prevalence of dementia increases with age and is predicted to increase in developing countries. Alzheimer's Disease International projected that 115 million people will be suffering from Alzheimer's disease (AD)/dementia in 2050 and a markedly increasing proportion will come from less developed regions/countries like Latin America, Africa, India, China, south Asia and the western Pacific region[1-2]. Dementia is a devastating and costly disorder, and is the major cause of disability and mortality in the elderly[3]. It imposes a great burden on society and will place a great demand on the long-term care of the sufferer as well as on the family and health-care providers.

China has the largest population in the world and is facing population ageing. A recent meta-analysis that included 48 studies published in English between 1980 and 2010 in Mainland China, Hong Kong, and Taiwan, reported a pooled prevalence of 3.0% in people aged >60 years[4]. And the number of people with dementia is expected to

double every 20 years[5].

Although a number of reviews and meta-analyses have reported the prevalence and incidence of dementia in Mainland China, little is known about whether its prevalence, incidence, risk factors, and prognosis in Chinese residents in Mainland China differ from those in other places. In a most recent systematic review and meta-analysis, Wu and colleagues estimated the area prevalence of dementia in different regions and revealed a pattern of significantly decreasing prevalence from Mainland China, to Hong Kong, to Taiwan, suggesting that areas in Mainland China are facing the greatest dementia challenge[5].

This review aims to provide a comprehensive description of epidemiological studies published in English in Chinese populations worldwide, as well as to explore the possible differences among Mainland China and other locations.

Methods

We systematically searched PubMed and the Web of Science for literature on the prevalence, incidence, risk factors, and prognosis of dementia, using the keywords "prevalence" or "incidence" or "risk factors" or "prognosis", "dementia" or "Alzheimer's disease", and "Chinese". The search was limited to original research articles on humans, published in English up to July 2013. We also searched for relevant studies from reviews and research articles. We applied the following inclusion criteria:

(1) Studies in a population aged 60 years and above; if the study population age was <60, information was available to calculate the prevalence or incidence for those aged 60+.

(2) Studies that were population/community-based; cross-sectional studies for the prevalence of dementia, and follow-up studies for the incidence, risk factors, and prognosis of dementia.

(3) Diagnosis of dementia and types of dementia were based on internationally-recognized criteria.

(4) Studies that included any type of dementia, including AD and vascular dementia (VaD).

(5) Studies that included all degrees of severity of dementia.

(6) Studies on prognosis that included only populations consisting of dementia patients.

(7) Studies that provided information on the prevalence or incidence of dementia, either directly or with information available for calculation.

Results

We finally identified 719 studies that focused on Chinese populations. After reading the abstracts and applying the inclusion criteria, we identified 25 studies using populations drawn from Mainland China, Hong Kong, Taiwan, and Singapore to be included in this review.

Prevalence of Dementia in Chinese

A total of 19 studies on the prevalence of dementia among Chinese were identified (Table 1). Eight were from Mainland China, five from Taiwan, five from Singapore, and only one from Hong Kong. Nine of the studies were carried out before 2000 and they were mostly from Taiwan (n = 5); studies from the year 2000 and onwards were mostly from Mainland China (n = 7).

Various diagnostic criteria for dementia were used. Studies from Mainland China used different versions of the Diagnostic and Statistical Manual of Mental Disorders (DSM) and one used the Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS-AGECAT). Most studies from Taiwan used different versions of the DSM and one used the International Classification of Diseases, tenth revision: Neurological adaptation (ICD-10NA). Most of the studies from Singapore used GMS-AGECAT while one used DSM-IV.

For diagnosis of the different types of dementia, in two of the three studies[6-8] AD was diagnosed using the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA), and VaD used the National Institute of Neurological Disorders and Stroke-Association Internationale pour la Recherche et l'Enseignement en Neurosciences (NINDS-AIREN) while the other study used ICD-10 and the Hachinski Ischemic Score.

The prevalence of dementia ranged from 2.1% to 4.2% among people aged 60+ years[9-11] and 1.8% to 9.1% among people aged ≥65 years[6-8, 11-21]. A higher prevalence for Chinese aged ≥65 years was reported in studies from Mainland China (ranging from 3.2% to 9.9%) compared to Chinese residents in other locations (2.0%–4.4% in Taiwan, and 1.8%–4.2% in Singapore). We identified only

Table 1. Studies on the prevalence of dementia in Chinese populations

Reference	Location	Population	Age (Years)	Diagnostic criteria	Age and dementia prevalence rate (%)
Zhang *et al.* 1990[14]	Mainland China, Shanghai	Community *n* = 5055	65+	DSM-III	65+: 4.6
Kua *et al.* 1991[15]	Singapore	Community *n* = 612	65+	GMS-AGECAT	65+: 1.8
Liu *et al.* 1994[23]	Taiwan	Community *n* = 555	50+	DSM-III-R	70-79: 4.6 80-92: 11.5
Liu *et al.* 1995[16]	Taiwan	Community *n* = 5297 (65+, 1469)	41-88	DSM-III-R	65+: 2.0
Kua *et al.* 1995[13]	Singapore	Community *n* = 200	65+	GMS-AGECAT	65+: 2.5
Liu *et al.* 1996[9]	Taiwan	Community *n* = 1016	65+	DSM-III-R	65+: 4.4
Chiu *et al.* 1998[22]	Hong Kong	Community *n* = 1034	70+	DSM-IV	70+: 6.1
Lin *et al.* 1998[20]	Taiwan	Community *n* = 555	65+	Dementia: ICD-10NA AD: NINCDS-ADRDA VaD: NINDS-AIREN	65+: Dementia: 3.7 Age standardized: Dementia: 4.0 AD: 2.0 VaD: 0.9
Liu *et al.* 1998[12]	Taiwan	Rural community *n* = 1736	65+	DSM-III-R	65+: 2.5
Wang *et al.* 2000[6]	Mainland China, Beijing	Community *n* = 3728	65+	DSM-III-R ICD-10 Hachinski Ischemic Score	65+: Dementia: 3.5 AD: 1.9 VaD: 1.4
Chiam *et al.* 2004[10]	Singapore	Population-based *n* = 1092	60+	GMS-AGECAT	60+: 4.2
Zhang *et al.* 2005[7]	Mainland China, Beijing, Shanghai, Chengdu, Xi'an	Community *n* = 34807 (65+, 20655)	55+	AD: NINCDS-ADRDA VaD: NINDS-AIREN	65+: AD: 4.8 VaD: 1.1
Li *et al.* 2007[21]	Mainland China, Beijing	Community *n* = 1593	60+	ICD-10 & DSM-IV	60+: 2.5 65+: 3.2
Sahadevan *et al.* 2008[11]	Singapore	Community *n* = 8849 (60+ *n* = 6323) (65+, 3445)	50+	DSM-IV	60+: 2.1 65+: 3.6

(Continued)

Table 1. Studies on the prevalence of dementia in Chinese populations

Reference	Location	Population	Age (Years)	Diagnostic criteria	Age and dementia prevalence rate (%)
Ng et al. 2010[17]	Singapore	Population-based n = 501	60+	GMS-AGECAT	65+: 4.2
Chen et al. 2012[19]	Mainland China: 1. Anhui 2. Shanghai, Shanxi, Guangdong, Heilongjiang	Community 1. n = 2917 2. n = 3327	65+	GMS-AGECAT	65+: 1. Anhui: 7.2 2. Four provinces: 9.9
Haibo et al. 2013[18]	Mainland China: Shanghai	Community n = 13942	65+	DSM-IV	65+: 9.1
Jia et al. 2013[8]	Mainland China: Changchun, Beijing, Zheng-zhou, Guiyang, Quangzhou	Community n = 10276	65+	Dementia: DSM-IV, AD: NINCDS-ADRDA, VaD: NINDS-AIREN	65+: dementia: 5.1 AD: 3.2 VaD: 1.5

one study from Hong Kong which reported a prevalence of 6.1% in people aged 70+[22]. This prevalence is similar to that reported from Taiwan, which was 4.6% in people aged 70–79, and 11.5% in people aged 80 to 92[23]. Furthermore, the prevalence in Mainland China has increased markedly in recent years, from 2.3%–4.6% up to 2008 to 5.1%–9.9% in 2011–2013.

Only four studies provided information on the prevalence of specific types of dementia. The prevalence of AD was higher than that of VaD in Mainland China. Furthermore, the prevalence of AD was different in three studies from Mainland China; one reported 1.9%[6] and the other two reported 3.2%[8] and 3.5%[7]. The prevalence of VaD was similar in all three studies from Mainland China, from 1.1% to 1.5%[6-8]. Lower prevalence of AD (2.0%) and VaD (0.9%) was reported in Taiwan[20].

Incidence of Dementia

We identified five studies on the incidence of dementia, four from Mainland China and one from Taiwan (Table 2). All of the studies were community-based with a follow-up of 2–7.5 years. Different criteria were used for determining a diagnosis of dementia. The Taiwan study[24] used ICD-10, while two of the Mainland China studies[21, 25] used two diagnostic criteria: the DSM and the 10/60 dementia diagnosis criteria[25] used in developing countries (10/60)

and the ICD-10 and the DSM-IV[21]. The other two studies used the GMS-AGECAT[26] and DSM-III-R[27], respectively.

The reported measures of incidence also differed. Two studies reported cumulative incidence and one provided information to calculate incidence[21, 24, 27], while the other two reported incidence density, expressed as the number of cases per 1 000 person-years[25-26]. We converted cumulative incidence to incidence density to facilitate comparison. The incidence of dementia for people aged 65 and above ranged from 11 to 24 per 1 000 person-years. The incidence also varied according to the diagnostic criteria used. The incidence was 11 to 18 per person-years using the ICD-10[24] and DSM-IV criteria[21]. There was a higher incidence (22.9 per 1 000 person-years) using the DSM-III-R criteria[27]. A notable increase in incidence was found when dementia cases were diagnosed by 10/66 criteria (24 per 1 000 person-years) compared to other criteria (11–12 per 1 000 person-years)[25]. The age-standardized prevalence for those aged ≥65 years living in an urban area was 25 per 1 000 person-years and in a rural area was 44 per 1 000 person-years using 10/66 diagnostic criteria, and the corresponding figures were 17 per 1 000 person-years (urban) and 18 per 1 000 person-years (rural) using the DSM-IV[25], and was 14.7 per 1 000 person-years

Table 2. Studies on the incidence of dementia in Chinese populations

Reference	Location	Population	Age (years)	Followup years	Diagnostic criteria	Incidence rate
Liu *et al.* 1998[24]	Taiwan	Community n = 2175	65+	2	Dementia: ICD-10 AD: NINCDS-ADRDA: VaD: NINDS-AIREN	Dementia: 12 per 1000 person-years (PY) AD: 5 per 1000 PY, VaD: 4 per 1000 PY
Deng *et al.* 2006[27]	Mainland China, Chongqing	Community n = 2632	60+	2	Dementia: DSM III-R	Dementia: 22.9 per 1000 PY
Li *et al.* 2007[21]	Mainland China, Beijing	Community n = 1403	60+	2	Dementia: ICD-10 & DSM-IV	60+: 9 per 1000 PY 65+: 11 per 1000 PY
Chen *et al.* 2011[26]	Mainland China, Anhui	Community n = 1526	65+	7.5	Dementia: GMS-AGECAT	Age standardized: 14.7 per 1000 PY
Prince *et al.* 2012[25]	Mainland China	Community n = 2162	65+	3-5	Dementia: DSM-IV and 10/60	10/60: 24 per 1000 PY for rural & urban 10/60: Rural: 44 per 1000 PY, age standardized: 37.5 per 1000 PY Urban: 25 per 1000 PY, age standardized: 31.2 per 1000 PY DSM-IV: Rural: 18 per 1000 PY, Urban: 17 per 1000 PY

AD: Alzheimer's disease; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth edition; GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy; ICD 10: the 10th revision of the International Statistical Classification of Diseases and Related Health Problems; NINCDS-ADRDA: the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association; NINDS-AIREN: the National Institute of Neurological Disorders and Stroke-Association Internationale pour la Recherche et l'Enseignement en Neurosciences; 10/60: 10/60 dementia diagnosis criteria used in developing countries; PY: person-years; VaD: Vascular dementia.

using the GMS-AGECAT for people living in urban and rural areas[26].

Risk Factors for Dementia

There were only seven studies on the risk factors for dementia in Chinese populations published in English (Table 3). The following risk factors were studied: age, gender, education, occupation, socioeconomic status (SES), alcohol consumption, smoking, depression, living arrangements, angina, bone mineral density, and plasma leptin level.

Age and gender Four studies, three from Mainland China[21, 25,26] and one from Taiwan[24], reported an increased risk of dementia with increasing age. The risk was higher in women than in men [Odds Ratio (OR) = 2.5 [95%

confidence interval (CI): 1.2–5.1][26], and men living in rural areas were less likely to be at risk than women [OR = 0.4 (95% CI: 0.2–0.7)][25]. However, another study did not find any difference in risk between men and women[21].

Education and occupation Two studies, one from Mainland China[21] and one from Taiwan[24], reported an association of illiteracy with a higher risk of dementia, based on primary school education. Another study from Mainland China reported that literacy is related to a lower risk compared to illiteracy in elderly people living in a rural area, but not in people living in an urban area[25]. Furthermore, a study from Mainland China reported that those who attended primary school were more likely to be at risk than those with a high school or above education [OR

Table 3. Studies on risk factors in Chinese studies worldwide

Reference	Region	Population	Age (years)	F-up years	Outcomes	Covariates	Results
Liu et al. 1998[24]	Taiwan	Community n = 2175	65+	2	Dementia: ICD-10; AD: NINCDS-ADRDA; VaD: NINDS-AIREN	Age, sex, education, occupation, living area	Age 75+ vs 65-74: Dementia: RR=3.7, 95% CI (2.2-6.1); AD: RR=5.4, 95% CI (2.4-12.1); Literacy vs illiteracy: Dementia: RR=0.6, 95% CI (0.3-1.2). Sex and occupation were not significantly related to risk of dementia.
Deng et al. 2006[27]	Mainland China: Chongqing	Community n = 2632	60+	2	Dementia: DSM-III-R	Age, sex, education, smoking, history of stroke, MMSE	Light-moderate alcohol drinking vs no drinking[a]: Dementia: OR=0.5, 95% CI (0.3-0.9); AD: OR=0.6, 95% CI (0.6-0.7); VaD: OR=0.3, 95% CI (0.2-0.5) Dementia: light-moderate wine: OR=0.7, 95% CI (0.5-0.9); spirits: OR=0.9, 95% CI (0.6-1.2); beer: OR=2.5, 95% CI (1.2-5.0). No significant differences for AD and VaD.
Li et al. 2007[21]	Mainland China: Beijing	Community n = 1593	60+	2	Dementia: ICD-10 & DSM-IV	Crude	Age: RR=7.7, P<0.05; Illiterate vs >5y education: RR= 2.7, P<0.05. Sex was not related to risk of dementia.
Chen et al. 2008[29]	Mainland China: Hefei	Community n = 1293	65+	1	Dementia: GMS-AGECAT	Age, sex, education, CVD	Severe depression[b] (level 4) was related to a high risk of dementia. HR=5.4, 95% CI (1.7-17.8)
Chen et al. 2011[26]	Mainland China, Anhui	Community n = 1526	65+	7.5	Dementia: GMS-AGECAT	Age, sex, BMI, SES, education, living area, lifestyle, smoking, psychosocial factors	Age (years): OR=1.04, 95%CI (1.0-1.1); men: OR=2.5, 95% CI (1.2-5.1); primary vs ≥high school: OR=2.5, 95% CI (1.2-5.1); current smoking vs never: OR=2.4, 95% CI (1.2-4.7); angina: OR=2.6, 95% CI (1.0-6.6); living with more people[c] vs alone: OR=0.4, 95% CI (0.2-0.8). No other factors were significantly related to risk of dementia.
Zhou et al. 2011[28]	Mainland China, Chongqing	Community n = 2286	65+	5	AD: NINCDS-ADRDA	Age, sex, education	Bone mineral density[d]: compared to the highest Q4, lowest Q1 (RR=2.7, 95% CI: 1.5-4.7), Q2 (RR=2.1, 96% CI: 1.2-3.8); plasma leptin level (RR=0.93, 95% CI: 0.91-0.957); current smoking (RR=207, 96% CI: 1.3-3.1); daily drinking (RR=1.7, 95% CI: 1.1-2.8).
Prince et al. 2012[25]	Mainland China	Community n = 1526	65+	3–5	Dementia: 10/60	Age, sex, education, occupation, lifestyle, assets[e]	Rural: age: RR=1.6, 95% CI (1.3-2.0); men: OR=0.4, 95% CI (0.3-0.7); more assets[e] vs fewer: OR=0.8, 95% CI (0.7-0.97) Urban: age: RR=1.5, 95% CI (1.2-2.0); higher education (5 categories): OR=0.7, 95% CI (0.6-0.9)

[a]Light-moderate alcohol drinking,1-21 units/week for men or 1-14 for women; no drinking, <1 unit/week (1 unit = 8 g ethanol). [b]GMS-AGECAT, level 0: well; level 1-2: subcases; level ≥3: cases. [c]spouse or grand/children or /parents. [d]similar to bone loss rate. [e]Number of household assets: car, TV, refrigerator, telephone, mains water, mains electricity, and plumbed toilet. AD: Alzheimer's disease; BMI: Body Mass Index; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth edition; ICD 10: the 10th revision of the International Statistical Classification of Diseases and Related Health Problems; NINCDS-ADRDA: the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association; NINDS-AIREN: the National Institute of Neurological Disorders and Stroke-Association Internationale pour la Recherche et l'Enseignement en Neurosciences; GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy; SES: Social Economic Status; VaD: Vascular dementia; 10/60: 10/60 dementia diagnosis criteria used in developing countries[36].

= 2.1 (95% CI: 1.0–4.4)][26]. We found only one study on an association between occupation and risk for dementia, which reported that occupational attainment was not related to the risk in Chinese populations, and this was similar in other populations[25].

Alcohol and smoking We identified two studies on alcohol consumption in relation to the risk of dementia, both from Mainland China. Light-to-moderate alcohol consumption, defined as 1–18 units/week for men and 1–14 units/week for women (1 unit = 8 g alcohol) was associated with a lower risk compared to those not drinking alcohol [OR = 0.5 (95% CI: 0.3–0.8)], and a similar risk was reported in patients with AD [OR = 0.3 (95% CI: 0.2–0.5)] and VaD [OR = 0.6 (95% CI: 0.6–0.7)][27]. The other study reported that daily alcohol consumption, defined as 5 or more 12-oz cans or bottles of beer, 6-oz glasses of wine or shots of liquor, was associated with an increased risk of AD [Hazard Ratio (HR) = 1.7 (95% CI: 1.1–2.8)][28]. These results suggested that moderate alcohol consumption is protective and heavy drinking is a risk for dementia. Only two studies on smoking were identified from Mainland China. Compared to those who never smoked, current smokers were at higher risk of dementia [OR = 2.4 (95% CI: 1.2–4.7)][26] and AD [Relative Risk (RR) = 2.0, (95% CI: 1.3–3.1)][28].

Socioeconomic status We identified only one study on SES expressed as having more household assets, defined as having a car, refrigerator, telephone, water, electricity, and plumbed toilet. This study reported that elderly people with more household assets (higher SES) were at a lower risk of dementia than those with fewer household assets[25].

Living arrangements We identified only one study on living arrangements in relation to the risk of dementia. Elderly people who were living with other family members (spouse and/or children, grandchildren, or parents) were at a lower risk of dementia than those living alone [OR = 0.4 (95% CI: 0.2–0.8)][26].

Morbidity Few studies have focused on the influence of morbidity on the risk of dementia in Chinese populations. One study reported that patients with angina were more likely to have dementia [OR = 2.6 (95% CI: 1.0–6.6)][26]. Another study found that depression was associated with a higher risk of dementia [RR = 5.4 (95% CI: 1.7–17.8)][29]. In addition, lower bone mineral density was reported to be associated with a higher risk of AD in both men and women [RR = 2.7 (95% CI: 1.6–4.5)][28].

Biomarkers A high plasma leptin level was associated with a lower risk of AD among both men and women [RR = 0.9 (95% CI: 0.93–0.95)][28].

Prognosis of Dementia

Two studies from Mainland China focused on the prognosis of dementia among those aged ≥65 years (Table 4). Wen and colleagues reported that the mortality of dementia was 14.4 per 1 000 person-years, with an age-standardized mortality of 16 per 1 000 person-years. A lower mortality was reported in AD and VaD patients, and the age-standardized mortality from AD was higher than that from VaD, 8.3 *versus* 5.3 per 1 000 person-years[30].

Mortality rates of dementia and its various subtypes were significantly associated with age, education, residential area, and marital status. Higher education, living in urban areas, and being married were related to a lower mortality among dementia patients. Among AD patients, in comparison with those with <1 year of schooling, those who had 1 to 6 years of schooling had a relative risk (RR) of mortality of 0.3 (95% CI: 0.2–0.4), and those with >6 years of schooling had an RR of 0.2 (95% CI: 0.2–0.3). Compared to people living in urban areas, people in rural areas were at a higher risk of mortality, RR=1.6 (95% CI: 1.2–2.1), and those who were unmarried were at 5 times higher risk of mortality, RR = 5.4 (95% CI: 3.3–9.0) compared to those who were married. The VaD patients showed a pattern similar to the AD patients[30].

In another study, Prince and colleagues reported a much higher mortality, ranging from 168 to 216 per 1 000 person-years depending on the area of residence[25]. In line with the finding by Wen and colleagues, this study also reported a higher mortality in dementia patients living in rural areas (216 per 1 000 person-years) than those living in urban areas (168 per 1 000 person-years). Furthermore, among dementia patients who lived in rural areas, younger age, men, and higher SES (more assets) were associated with lower mortality, whereas among those living in urban areas, younger age, and higher education were related to a lower risk of mortality[25].

Discussion

We found a higher prevalence of dementia in Mainland China than in Taiwan, Hong Kong, and Singapore, and no difference in its incidence between Mainland China

Table 4. Studies on progression of dementia in Chinese populations

Reference	Region	Population	Age (years)	F-up years	Diagnostic criteria	Covariates	Mortality and prognostic factors
Wen et al. 2011[30]	Mainland China, Beijing	Dementia patients n = 5743	55+	4	DSM-IV	Age, sex, region	65+: age standard: dementia: 14.4 per 1000 PY AD: 8.3 per 1000 PY Education: 1-6 years (RR=0.3, 95% CI 0.2-0.4); >6 year (RR=0.2, 95% CI 0.16-0.3) vs <1 year education; rural vs urban (RR=1.6, 95% CI 1.2-2.1); unmarried vs married (RR=5.4, 95% CI 3.3-9.0) VaD: 5.3 per 1000 PY VaD patients have prognostic factors similar to AD.
Prince et al. 2012[25]	Mainland China	Dementia patients n = 1526	65+	3–5	Dementia: 10/60	Age, sex, education, occupation, lifestyle, assets*	Rural: 216 per 1000 PY **Older age**: RR=1.6, 95% CI (1.3-2.0); **men**: OR=0.4, 95% CI (0.3-0.7); **more assets*** vs fewer: OR=0.8, 95% CI (0.7-0.97) Urban: 168 per 1000 PY **Older age**: RR=1.5, 95% CI (1.2-2.0); higher **education**: OR=0.7, 95% CI (0.6-0.9)

* Number of household assets: car, TV, refrigerator, telephone, mains water, mains electricity, and plumbed toilet.

DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth edition; PY: person-years.

and Taiwan (data were not available for Hong Kong and Singapore). It appears that the only factor that influenced the difference in incidence was the diagnostic criteria. The incidence of dementia of 11 to 18 per 1 000 person-years for people aged 65+ in studies published in English is only slightly higher than the estimated incidence from the pooled results of studies published both in Chinese and in English (9.9 per 1000 person-years) from 1990 to 2010[31].

A possible explanation of the higher prevalence of dementia in Mainland China than in the other locations may be due to the variations in race, culture, and custom between ethnic groups as well as the different climates and levels of pollution. In addition, the lifestyle, living situation, education, medical services, and life experience of the older person may also contribute to this variation. However, a similar incidence was observed from Taiwan and Mainland China, suggesting that these influences are limited, and that differences in survival may play a role. Second, the difference could also be explained by the

timing of estimation of the prevalence, since a number of recent reviews have shown an increase in the prevalence of dementia in Chinese as well as in the world[31-32], and studies published in English journals from Mainland China are more recent than studies from other locations.

In line with findings in the literature, the occurrence of dementia was consistently associated with increasing age, being female, less education, smoking, and heavy alcohol consumption in Chinese populations. Other risk factors associated with dementia included depression, angina, and lower bone mineral density, while living with family members and higher levels of plasma leptin were considered protective factors.

We were only able to find one study on risk factors from Taiwan and none from Hong Kong and Singapore. While determining the prevalence of dementia is important, especially in health-care planning, it is also important to determine what factors contribute to the increased risk of dementia. Factors such as age or family history cannot be

prevented; identifying modifiable risk factors can help in finding more efficacious prevention or slowing down the development of dementia.

Methodological differences were noted in identifying the risk factors for dementia. There was no uniformity in the definition and classification of alcohol consumption and education. For example, one study defined alcohol drinking in units of grams of alcohol consumed, while another measured the number of drinks per ounce of alcohol consumed. For education, some studies used illiteracy and another used primary school education to define low levels of education.

The only two studies on the prognosis of dementia reported different mortality rates. While the mortality among dementia patients reported by Wen *et al.* is higher or similar to earlier studies from the USA, Europe, and China (published in Chinese), Prince *et al.* reported a much higher mortality rate. A possible explanation could be the difference in the composition of the study populations, because it has been shown that age, gender, education, comorbidity, genetic predisposition, and residential area are relevant factors for the prognosis of dementia[25, 30, 33-35]. Another reason could be the difference in diagnostic criteria used in case ascertainment, which could result in different disease severity, therefore affecting the mortality rate[35].

This review shows that the prevalence and incidence of dementia in Chinese populations are comparable to most other ethnic groups in the world, although there is a higher prevalence in Mainland China than in other locations, which may be due to that the studies from Mainland China are more recent than those from other locations. The magnitude of prevalence and incidence depends on the diagnostic criteria used and the time of study. Age, gender, education, smoking, and alcohol consumption are all associated with risk of dementia. A few studies have focused on prognosis and reported apparently different mortality rates. More studies on the incidence, risk factors, and prognosis of dementia in Chinese populations are required.

ACKNOWLEDGEMENTS

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