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Association of high body lead store with severe intracranial carotid atherosclerosis

Tsong-Hai Lee^a, Mei-Chun Tseng^b, Chi-Jen Chen^c, Ja-Liang Lin^{d,*}

^aStroke Service, Department of Neurology and Stroke Center, Chang Gung Memorial Hospital, Linkou Medical Center and Chang Gung University College of Medicine, Taoyuan, Taiwan
^bDepartment of Business Management, National Sun Yat-Sen University, Kaohsiung, Taiwan
^cDepartment of Radiology, Taipei Medical University-Shuang Ho Hospital, Taipei, Taiwan
^dDepartment of Nephrology, Division of Clinical Toxicology, Chang Gung Memorial Hospital, Linkou Medical Center and Chang Gung University College of Medicine, No. 5, Fuxing St., Xizhi, New Taipei City 223 Taiwan

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ABSTRACT

Objective: Lead is involved in the pathogenesis of atherosclerosis and hypertensive disease and may be related to cerebrovascular disease. We studied the association of body lead level with stroke subtypes and severity of cerebral atherosclerosis in order to identify the significance of lead exposure to cerebrovascular disease.

Methods: From April, 2002 to March, 2005, we studied the lead level in all patients receiving digital subtraction angiography. Diameter stenosis at extracranial carotid, intracranial carotid and vertebrobasilar system was calculated according to the NASCET criteria. A blood sample and a mobilization test of 72-h urine sample were collected for lead measurement.

Results: In a total of 213 subjects, 19 were free of stroke (blood lead level = 4.62 ± 2.41 µg/dL, body lead stoen = 39.04 ± 20.81 µg) and 194 were stroke patients (4.89 ± 2.75 µg/dL, 45.13 ± 29.8 µg; all stroke vs. non-stroke, P > 0.05). In the 153 subjects with atherosclerotic origin, body lead stoen but not blood lead level in the intracranial carotid system was significantly higher in ≥50% group than <50% group (blood lead: 5.61 ± 3.02 µg/dL vs. 4.80 ± 2.50 µg/dL, Student's t-test, P = 0.129; body lead stoen: 51.7 ± 27.0 µg vs. 41.9 ± 23.5 µg, Student's t-test, P = 0.038, multivariate logistic regression, odds ratio = 1.02, 95% CI: 1.00–1.03, P = 0.403). However, there was no significant association between lead level and stenotic severity in extracranial and vertebrobasilar systems (P > 0.05).

Conclusion: Our study demonstrated that long-term lead exposure as measured by body lead stoen might carry a potential risk of intracranial carotid atherosclerosis.

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全文

- Introduction

1. Introduction

Previous studies indicated that lead has specific toxicities in the proliferation, fibrinolysis, and extracellular matrix formation of vascular endothelial and smooth muscle cells, resulting in vascular disorders such as atherosclerosis in experimental animals (Kaji, 2004). Lead may induce aortic atherosclerosis in pigeons (Revis et al., 1981) and stimulate the proliferation of cultured rabbit aortic smooth muscle cells in varying degrees (Lu et al., 1990). Lead can also stimulate the proliferation of the vascular smooth muscle cells and fibroblasts (Fujiwara et al., 1995) and inhibit the repair process of damaged endothelial cell layer (Fujiwara et al., 1997) in *in vitro* studies. Animal study showed that lead may cause severe injury to endothelium of brain vasculature (Bradbury and Deane, 1988;

Linnamagi and Kaasik, 1995) and induces cerebral microvascular dysfunction with following changes in cerebral blood flow (Linnamagi and Kaasik, 1995). Hence, it is likely that lead is involved in the pathogenesis of cerebral atherosclerosis and may be related to cerebrovascular disease.

Cerebrovascular disease or stroke has been one of the first three leading causes of death in the past four decades in Taiwan (Jeng and Su, 2007) and is more common in Taiwanese than in Whites (Hu et al., 1992; Goldstein et al., 2006). The distribution of cerebral atherosclerosis in stroke patients is different between races, and atherosclerosis of the larger extracranial arteries is more prevalent in Whites, while occlusive disease of the intracranial arteries is more often seen in patients of Black or oriental origin (Feldmann et al., 1990; Leung et al., 1993; Liu et al., 1996; Jeng and Su, 2007). Regarding stroke subtype, small vessel occlusion and large artery atherosclerosis are related to atherosclerosis, while strokes of cardiogenic embolism and other determined etiology are less related. Hemorrhagic stroke is more common in oriental people

* Corresponding author. Tel.: +886 3 3281200 ext 140; fax: +886 3 3288840.
E-mail address: thlee@adm.cgmh.org.tw (J.-L. Lin).

文章架構

全文

- Introduction
 - Method
 - Result
 - Discussion

303

T.-W. Lee et al. / NeuroToxicity

intracranial and extracranial atherosclerosis with high accuracy. However, due to the invasiveness and ethical concern, the angiographic study is unable to apply in every stroke patient, and it is likely that we studied a group of patients with high risk of atherosclerosis. Third, we examined both single blood lead level and 72-h urine lead amount to calculate body lead store for this study. The body lead store can represent the chronic exposure to lead and is able to examine the long-term influence of lead on atherosclerosis. Our study suggests that body lead store might be more sensitive than single blood lead level in the prediction of atherosclerosis.

In conclusion, our study showed that long-term exposure to lead might carry a potential risk of intracranial carotid atherosclerosis.

Conflict of interest

Authors have nothing to declare.

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1. Introduction

Previous studies indicated that lead can produce toxicity in the proliferation, fibrinolysis, and extracellular matrix formation of vascular endothelial and smooth muscle cells, resulting in vascular disorders such as atherosclerosis in experimental animals (Kajiwara et al., 2004). Lead may induce aortic atherosclerosis in pigeons (Reed et al., 1981) and stimulate the proliferation of cultured rabbit aortic smooth muscle cells in varying degrees (Lu et al., 1990). Lead can also stimulate the proliferation of the vascular smooth muscle cells and fibroblasts (Fujiwara et al., 1995) and inhibit the repair processes of damaged endothelial cell layer (Fujiwara et al., 1997) in vitro and in vivo experiments. Animal study showed that lead may cause severe injury to the endothelium of brain vasculature (Bradbury and Deane, 1988; Bradbury et al., 1990).

atherosclerosis and in atherosclerosis-related stroke subtypes.

2. Materials and methods

2.1. Patient enrollment

From April, 2002 to March, 2005, we conducted this cross-sectional study in all patients receiving cerebral digital subtraction angiography in the Department of Neurology, Chang Gung Memorial Hospital, Linkou Medical Center. All patients received chest X-ray, electrocardiogram, complete blood count (hemoglobin, hematocrit, platelet, leucocyte), blood glucose, electrolytes,

3. Results

During the study period, a total of 221 patients received cerebral angiography. Of them, 116 patients had extracranial carotid stenosis ($\geq 50\%$ diameter stenosis), 63 had intracranial carotid stenosis, 97 had vertebrobasilar stenosis, and 64 had $< 50\%$ stenosis in all vascular territory. Three subjects had blood lead level and body lead store exceeding three standard deviations of the corresponding measure, and five subjects did not receive complete blood and urine lead collection; these eight subjects

4. Discussion

Previous autopsy study reported a positive association between tissue lead level and risk of heart-related mortality (Voors et al., 1982). Some cohort studies found a positive association of blood lead level due to environmental exposures with the risk of cardiovascular and stroke mortality (Menke et al., 2006; Schobert et al., 2006), with the prevalence of peripheral artery disease

Linnamagi and Kaasik, 1995) and induces cerebral microvascular dysfunction with following changes in cerebral blood flow (Linnamagi and Kaasik, 1995). Hence, it is likely that lead is involved in the pathogenesis of cerebral atherosclerosis and may be related to cerebrovascular disease.

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or TIA were classified into non-atherosclerosis group, if the vascular lesion was due to etiologies other than atherosclerosis, such as vascular anomaly and vasculopathy due to radiation.

2.4. Measurement of lead

In the present study, we examined the single blood lead level and total 72-h urine lead amount (body lead store) before cerebral angiography. Body lead store was determined according to our previous method (Lin et al., 2003) which used the mobilization test developed by Emerson (1963) and modified by Behringer et al. (1986). Each subject emptied his or her bladder on the first day of

and body lead store when compared to other determined etiology (Student's *t*-test, $P = 0.001$ and 0.043 , respectively), but there was no significance in multivariate logistic regression analysis ($P > 0.5$). Hemorrhagic stroke had significantly lower blood lead level than large artery atherosclerosis in univariate analysis (Student's *t*-test, $P = 0.009$), but not in multivariate analysis after adjustment for age, sex, HT, DM, cholesterol, triglyceride, uric acid, smoking and alcohol consumption ($P = 0.05$).

To study the association between atherosclerotic severity and lead level, the eight subjects with hemorrhagic stroke were excluded from analysis. Table 2 shows that in the 205 subjects, 52

Several strengths and limitations of this study should be considered. First, our analysis showed that among different stroke subtypes, large artery atherosclerosis tends to have higher blood lead level and body lead store, though with no statistical significance. The statistical insignificance might be due to a small sample size. Second, we used the gold standard of digital subtraction angiography to examine cerebral vasculature. The detailed cerebral artery study can make a clear classification of TOAST stroke subtypes and allow us to evaluate the severity of

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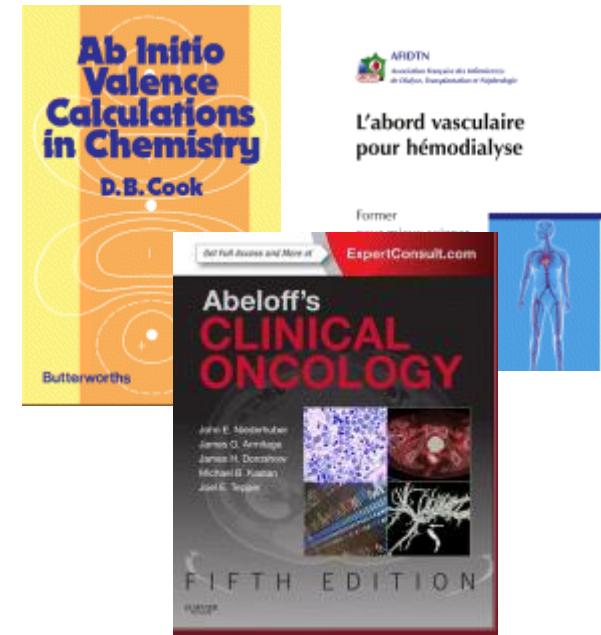
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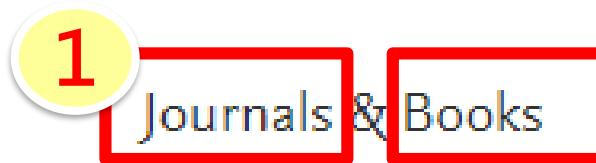
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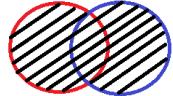
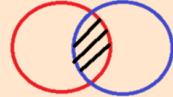
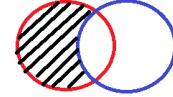
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Article type	Explanation
Review articles	Substantial overview of original research, usually with a comprehensive reference list. Note: Not a book review.
Research articles	Complete report on original research.
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Book chapters	Individual chapter of a book.

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	AND	必須出現兩個字詞，例如"Cognitive architecture" AND robots
	NOT	排除一個字詞，例如 lung NOT cancer 或 lung - cancer 目的為排除某類文獻的可能性
<ul style="list-style-type: none">• 布林邏輯的使用順序是 NOT, AND, OR• 可用括號清楚標示集合概念, 如 a OR (b AND c)		

“”	搜尋完整相似詞組，例如：輸入 "heart attack"，將會搜尋heart attack、heart-attack、heart attacks 之結果。
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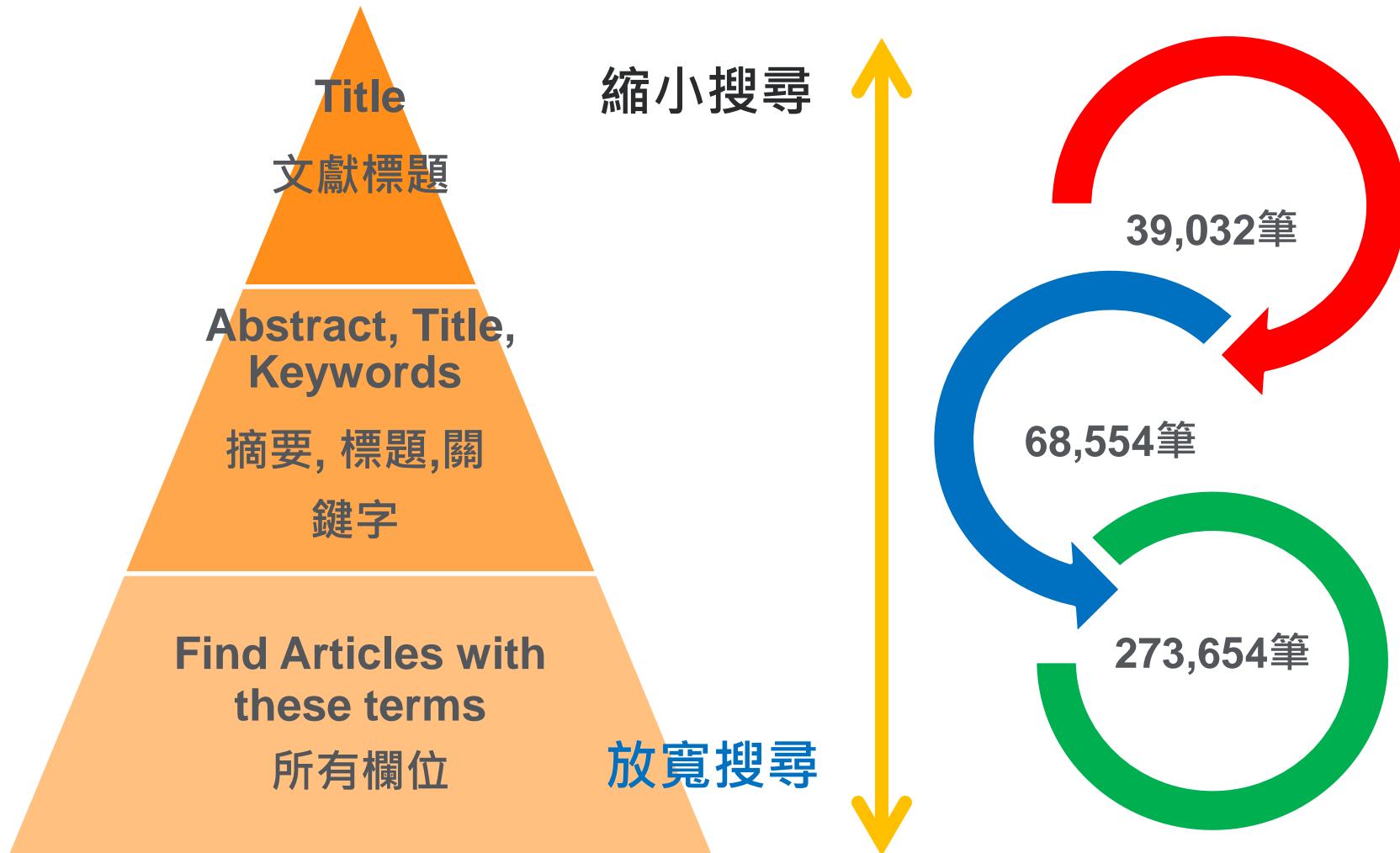
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Marital history and survival after a heart attack

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Deepika Bhatnagar, Inderpreet Kaur, Ashok Kumar

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Homicide by heart attack?

Legal Medicine, Volume 11, Supplement 1, April 2009, Pages s531-s532

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Research article
Social Science & Medicine, Volume 170, December 2016, Pages 114-123

Outline  大綱
Highlights 重點標示
Abstract 摘要
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2. Methods
3. Results
4. Discussion
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Volume 170, December 2016, Pages 114-123

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Matthew E. Dupre ^{a, b, c}, Alicia Nelson ^b
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Table 1
Table 2
Table 3

Highlights

- Deepens our understanding of how social relationships impact disease prognosis.
- Marital status is a robust indicator of survival after a heart attack.
- Risks from past marital loss are not ameliorated with remarriage.
- Implications for health policy and practice are discussed.

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Volume 170, December 2016, Pages 114-123



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Highlights

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- Deepens our understanding of how social relationships impact disease prognosis.

Abstract

摘要

Heart disease is the leading cause of death in the United States and nearly one million Americans will have a heart attack this year. Although the risks associated with a heart attack are well established, we know surprisingly little about how

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Keywords

關鍵字

Marital status; Survival; Heart attack; Aging

1. Background 2. Methods 3. Results 4. Discussion

全文架構

References

摘要

Addo and Licher, 2013 Fenaba R. Addo, Daniel T. Licher
Marriage, marital history, and Black–White wealth differentials among

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Marital history and survival after a heart attack

Matthew E. Dupre^{a, b, c}, Alicia Nelson^b

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chronic conditions, limitations, etc.) or the development of illness (i.e., disease incidence). Only a handful of studies examine the role of marital status after the onset of illness (Burnley, 1999, Chandra et al., 1983, Kilpi et al., 2015, Lammintausta et al., 2013, Nielsen and Mard, 2010) and no existing studies consider which aspects of the marital life course are important to survival after a

F. Kilpi, H. Konttinen, K. Silventoinen, P. Martikainen
Living arrangements as determinants of myocardial infarction incidence and survival: a prospective register study of over 300,000 Finnish men and women

Soc. Sci. Med., 133 (2015), pp. 93-100

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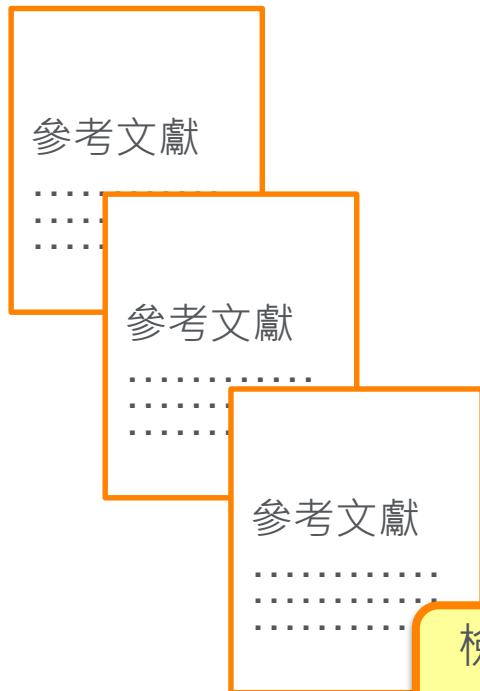
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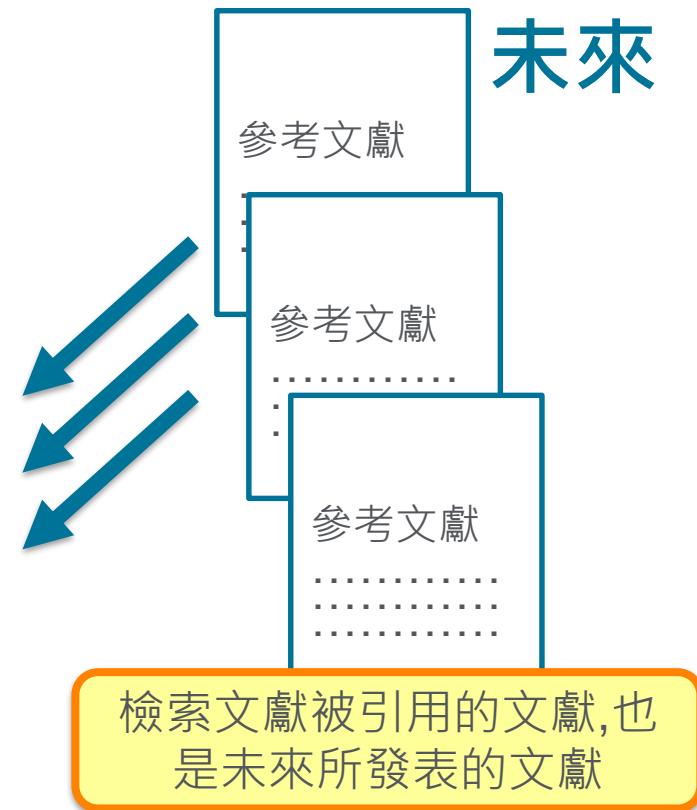
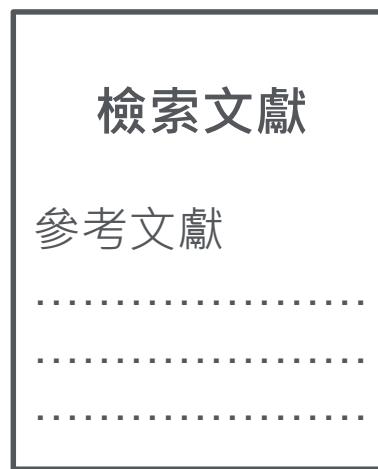
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Marital history and survival after a heart attack
Matthew E. Dupre^{a, b, c, g, *}, Alicia Nelson^b
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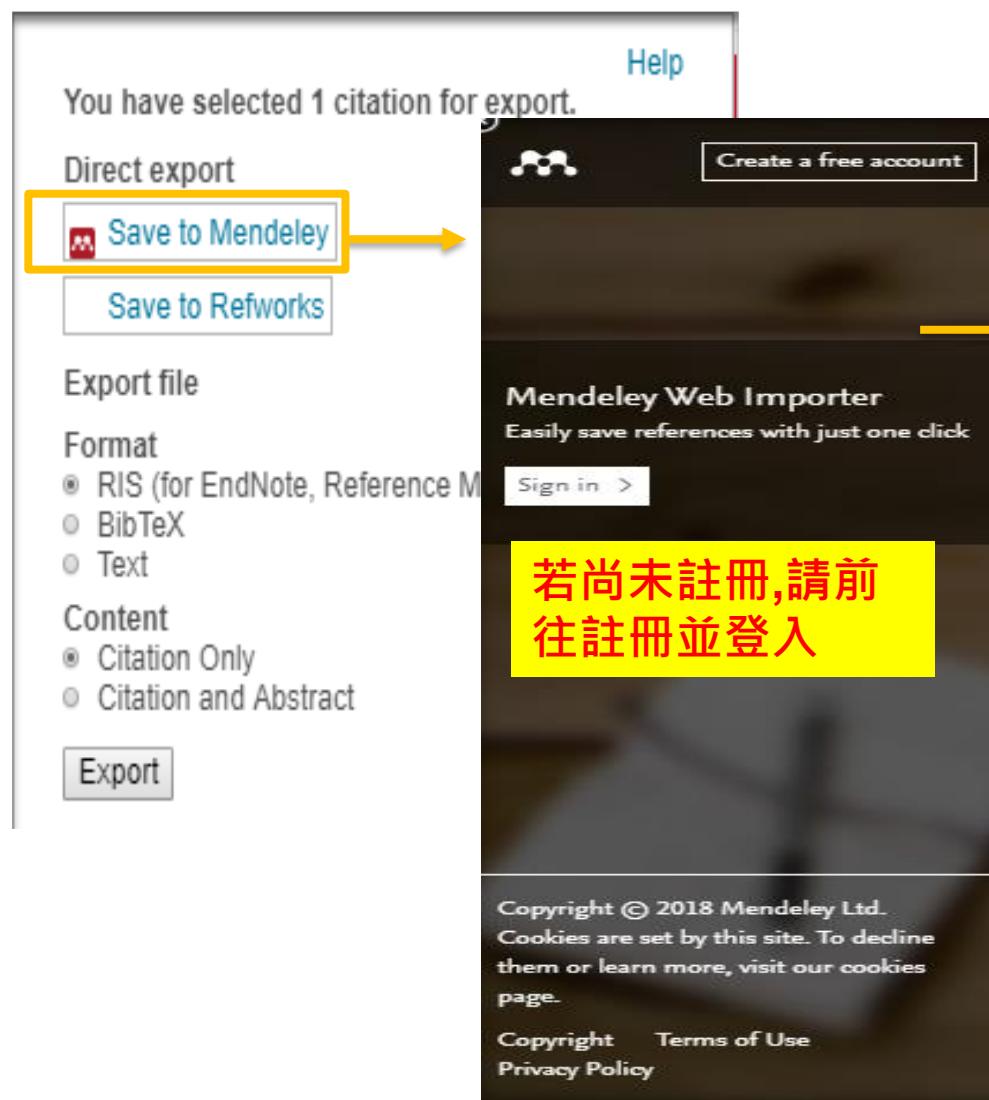
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Dupre M, Nelson A
Social Science & Medicine
2016 vol: 170 pp: 114-123

Heart disease is the leading cause of death in the United States and nearly one million Americans will have a heart attack this year.
Although the risks associated with heart disease are well established

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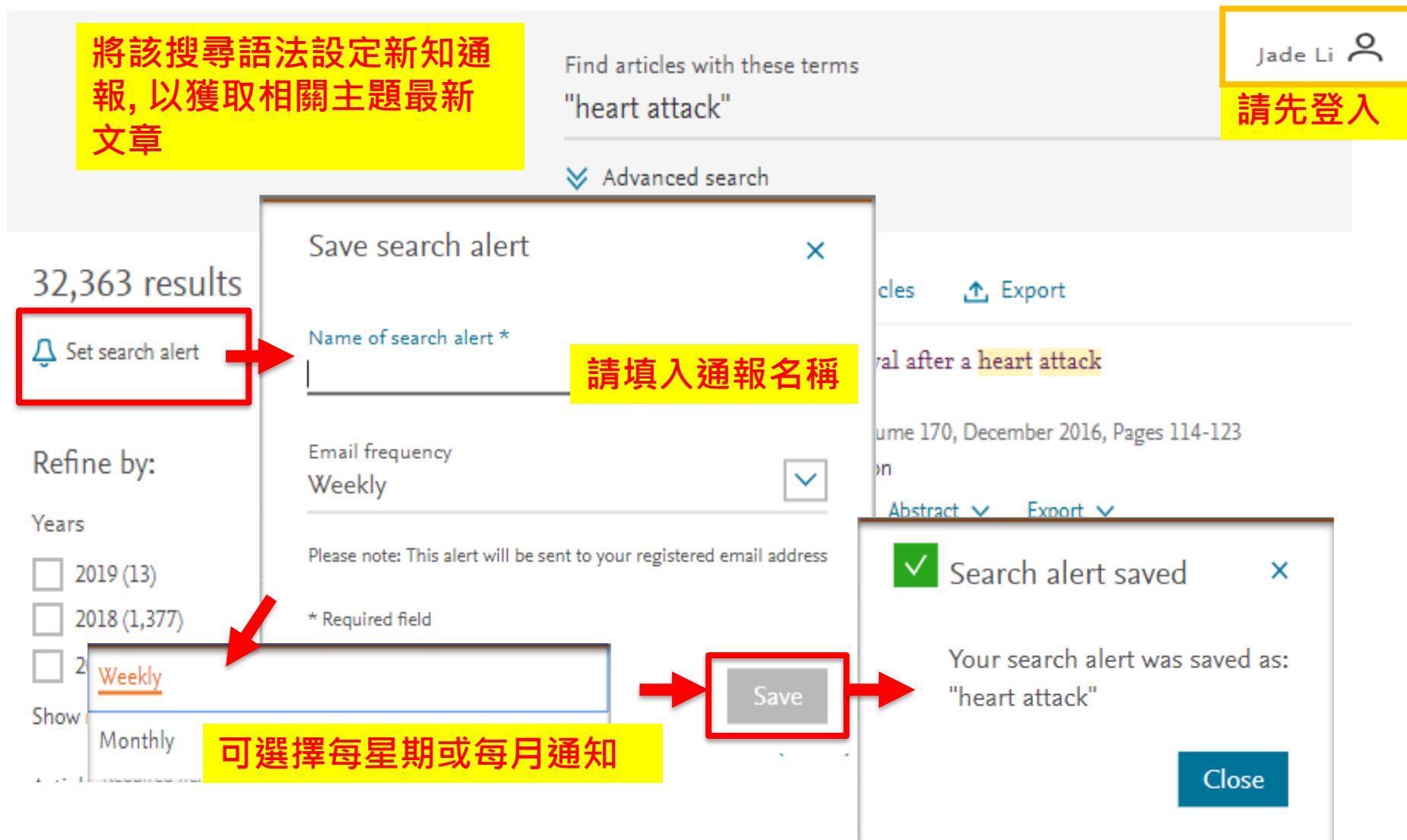
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