



Original Article

Associations Between Sensory Loss and Depressive Symptoms in a Longitudinal National Study of Ageing Adults in Thailand

Supa Pengpid^{1,2,3}, Karl Peltzer^{*1,4,5} 

¹. Department of Health Education and Behavioral Sciences, Faculty of Public Health, Mahidol University, Bangkok, Thailand

². Department of Public Health, Sefako Makgatho Health Sciences University, Pretoria, South Africa

³. Department of Healthcare Administration, College of Medical and Health Science, Asia University, Taichung, Taiwan

⁴. Department of Psychology, University of the Free State, Bloemfontein, South Africa

⁵. Department of Psychology, College of Medical and Health Science, Asia University, Taichung, Taiwan

* Corresponding Author: Department of Psychology, College of Medical and Health Science, Asia University, Taichung, Taiwan. Tel: +66 (0) 611755154, Email address: kfpeletzer@gmail.com

ABSTRACT

Article history

Received 22 Oct 2023

Accepted 7 Nov 2023

Citation: Pengpid S, Peltzer K. Associations between sensory loss and depressive symptoms in a longitudinal national study of ageing adults in Thailand. *Elderly Health Journal*. 2023; 9(2): 73-78.

Introduction: Sensory loss and depressive symptoms (DS) may be an increasing concern in ageing adults. Some previous studies in China found bidirectional associations between sensory loss and DS, but we lack information on this relationship in Southeast Asia. The purpose of this study was to assess the bidirectional association between sensory loss and DS in a longitudinal study in Thailand.

Methods: The responses of participants (≥ 45 years) of two consecutive waves (2015 and 2017) of the Health, Aging and Retirement in Thailand (HART) study were analysed. Sensory loss was assessed with self-reported questions and DS with the Center for Epidemiological Studies Depression scale.

Results: The analytic baseline sample included 3708 participants (median = 66 years) who responded to the 2015 and 2017 survey. The prevalence of vision, hearing and dual sensory loss were 25.4%, 13.3% and 7.9%, respectively, and the prevalence of DS was 12.3%. In the final model, adjusted for relevant confounders, vision, hearing, and sensory loss at baseline were positively associated with incident DS (AOR: 1.34, 95% CI: 1.01 to 1.74; AOR: 1.71, 95% CI: 1.23 to 2.38; and AOR: 1.80, 95% CI: 1.20 to 2.69, respectively). DS at baseline was not significantly associated with incident vision, hearing or dual sensory loss.

Conclusion: Baseline vision, hearing, and dual sensory loss increase the odds of incident DS, but baseline DS did not significantly increase the odds of incident vision, hearing, or dual sensory loss among ageing adults in Thailand.

Keywords: Longitudinal Study, Depressive Symptoms, Sensory Loss, Thailand

Introduction

Globally, the prevalence of 'disabling' hearing loss requiring rehabilitation is 5%, of which almost 80% reside in low- and middle-income countries. The prevalence of hearing loss increases with age, among people over 60 years of age, more than 25 percent hearing loss is accompanied by disability (1). In

Thailand, the prevalence of subjective hearing impairment among older adults was 12% (2).

Around 2.2 billion people worldwide suffer from visual impairment (near or far away), and most of the people with visual impairment and blindness are 50 years old or older (3). Among ageing adults (≥ 50

years) in Thailand, the proportion of visual impairment or blindness was 14.5% (4), and subjective vision impairment was 15% (≥ 60 years) (2).

Major depressive disorders are a major public health burden worldwide, including in Asian countries (5, 6). The global prevalence of depressive symptoms (DS) was 12.1% (5, 6). In some local studies in Thailand the prevalence of DS among older adults ranged from 18.5% (7) to 28.5% (8).

Few longitudinal studies have investigated the association between vision, hearing and dual sensory loss and depression (9). For example, in Korea, vision, hearing, and dual sensory impairment were significantly associated with incident DS (10), and in China, baseline vision loss and dual sensory loss, but not hearing loss, were associated with incident DS (11). Even fewer studies have investigated the bidirectional association between depression and vision, hearing, and dual sensory loss (9). For example, in China, Wu (12) discovered a bidirectional association between DS and hearing loss, and Liu et al., (9) showed a bidirectional association between vision, hearing and dual sensory loss and DS. We do not know of any studies investigating bidirectional associations between vision, hearing and dual sensory loss and DS in rapidly ageing Southeast Asia, including Thailand, which led to this study. This study therefore sought to investigate the bidirectional association between sensory loss and DS in a cohort study in Thailand.

Methods

Study design

The study used a longitudinal population-based household survey design of the Health, Aging and Retirement in Thailand (HART) study.

Sampling and procedure

Using a national multistage sampling design (1 = 6 strata of regions, 2 = capital and other district of the province, 3 = villages or blocks, and 4 = one household member), one randomly selected household member (≥ 45 years), being the inclusion criterium, was interviewed face-to-face in their homes; further sampling details have been published previously (13). Responses of participants (≥ 45 years) from two consecutive waves (2015 and 2017) of the HART study were analysed, the response rate was 72.3%. The analytic sample of 3708 participants that responded to both the 2015 and 2017 surveys formed the final study sample.

Measures

Outcome variables

Vision loss: 1) "Have you been diagnosed by a doctor with visual impairment?" (Yes/No), 2) "Have you ever been diagnosed by a doctor with blindness (1 eye), blindness (2 eyes)?" (Yes/No), and 3) "How would you rate your current vision/eyesight?" from

"0 = very poor to 100 = excellent", "poor was classified as 0-50 and good as 60-100."

Hearing loss: 1) "Have you been diagnosed by a doctor with hearing impairment?" (Yes/No), 2) "Are you using a hearing device or aid?" (Yes/No), and 3) "How would you rate your current hearing ability?" from "0 = very poor to 100 = excellent", poor was classified as "0-50 and good as 60-100".

Dual sensory loss was defined as both vision and hearing loss.

DS (10 or more scores) were measured with the Center for Epidemiologic Studies Depression Scale (CES-D-10) (14); Cronbach's alpha was 0.78 in wave 1 and 0.72 in wave 2. The CES-D has been validated in Thailand, with ≥ 10 scores having high sensitivity and specificity for depression (15, 16).

Covariates

The potential confounders that were considered included socio-demographic indicators, health compromising behaviour, physical chronic conditions, and social participation.

Socio-demographic variables: sex, age, education, religion, marital status, and annual personal income quartile (17).

Tobacco smoking, "Have you ever smoked cigarettes?" (response format: "1 = yes, and still smoke now, 2 = yes, but quit smoking, and 3 = never") (17).

Alcohol use, "Have you ever drunk alcoholic beverages such as liquor, beer or wine?" (response format: "1 = yes, and still drinking now, 2 = yes, but do not drink now, and 3 = never") (17).

Physical activity was classified as past-week exercise: "none = inactivity, 1-149 min/week = low activity, and ≥ 150 min/week = high activity" (18).

Physical comorbidity (≥ 1 comorbidity) included medically diagnosed "hypertension, diabetes, lung diseases, emphysema, cardiovascular diseases, heart disease, heart failure, rheumatism, arthritis, bone diseases, kidney diseases, cancer, and liver diseases." (19).

Social engagement included formal engagement (at least one of 6 activities; Cronbach's alpha was 0.7) and informal social engagement (at least once/month of 2 items) (17).

Data analysis

The proportion of vision, hearing, and dual sensory loss at baseline is shown with frequency statistics. Chi-square tests are applied to test for differences among groups at baseline. The first logistic regression model estimated odds ratios (OR) and confidence intervals (CI) for baseline vision, hearing and dual sensory loss and incident DS, and the second model compared baseline DS and incident hearing, vision, and dual sensory loss. Three logistic regression models are presented for incident hearing, vision and dual sensory loss and incident DS: the first is unadjusted, the second is adjusted for annual income quartile, sex, age, religion, highest educational level, and marital



status, and the third is adjusted in addition to model 2 variables with levels of physical activity, physical comorbidity, smoking, social engagement, and alcohol use. Significance level was set at $p < 0.05$. Statistical analyzes were done with Stata SE 15.0 (College Station, TX, USA).

Ethical considerations

“The Ethics Committee in Human Research, National Institute of Development Administration – ECNIDA (ECNIDA 2020/00012) approved the study, and participants provided written informed consent.”

Results

Participants

The analytic sample at baseline included 3708 participants (median: 66 years, 57 -76 years interquartile range) who participated in the 2015 and 2017 surveys. The prevalence of vision, hearing and dual sensory loss were 25.4%, 13.3% and 7.9%, respectively, and the prevalence of DS was 12.3%. The prevalence of DS was higher in people with vision, hearing, and dual sensory loss than in people without vision, hearing, and dual sensory loss. Participants with vision, hearing, and dual sensory loss were not married, had lower incomes, were older, had lower education, and had physical comorbidity than those without vision, hearing, and dual sensory loss. The prevalence of vision, hearing and dual sensory loss was higher among past smokers and former alcohol users than among never or current smokers or drinkers. Buddhists and those with adequate physical activity had a lower prevalence of hearing loss and dual sensory loss than Muslims or other and those with inadequate physical activity. Socially engaged people had a lower prevalence of dual sensory loss than those who were not socially engaged (see Table 1).

Associations between sensory loss categories and incident DS

In the logistic regression model, adjusted for demographic, social and health variables, vision, hearing, and sensory loss at baseline were positively associated with incident DS (AOR: 1.34, 95% CI: 1.01 to 1.74; AOR: 1.71, 95% CI: 1.23 to 2.38; and AOR: 1.80, 95% CI: 1.20 to 2.69, respectively) (see Table 2).

Associations between DS and incident vision, hearing, and sensory loss

DS at baseline was not significantly associated with incident vision, hearing, or dual sensory loss (see Table 3).

Discussion

This is the first study investigating the longitudinal bidirectional associations between vision, hearing and sensory loss and DS in Southeast Asia. We found that baseline vision, hearing, and dual sensory loss increased the risk of DS two years later, but we did not find a significant association between baseline DS and incident vision, hearing, and dual sensory loss. These associations were adjusted for various confounders, including demographic, social, and health indicators.

Consistent with previous studies (10, 11), we found a unidirectional association between vision, hearing and sensory loss and incident DS. The link between sensory loss and depression may be explained by several factors, including the experience of greater social isolation, lower mobility, lower social engagement, and lower health care utilization in people with sensory loss than in those without sensory loss leading to depression (9, 20-22). However, we did not find a bidirectional association between problem depression and incident vision, hearing, and dual sensory loss, unlike two studies in China with a four-year follow-up (9, 12). It is possible that effects of sensory loss on DS are more immediate (2 years) than the effects of DS on sensory loss (2 years), as found in the China studies (4 years).

The prevalence of vision loss (25.4%) was higher than in a previous study among older adults in Thailand (15%), while the found prevalence of hearing loss (13.3%) was slightly higher (12%) (2). In China (9), a similar measure of hearing and vision loss among ageing adults was used, and the proportion of those with vision loss (36.7%), hearing loss (16.9%) and dual sensory loss (10.1%) was higher than in our study in Thailand.

The prevalence of DS in this sample of ageing adults in Thailand (12.3%) was similar to the global estimates for adults (12.1%) (5, 6), lower than for older adults in two previous studies in Thailand (18.5%-28.5%) (7, 8), and for ageing adults in China (using the same measure, 37.1%) (9).

Table 1. Baseline sample characteristics of participants, Thailand, 2015

Variables	Subcategories	Vision loss		p	Hearing loss		p	Dual sensory loss		p
		No N (%)	Yes N (%)		No N (%)	Yes N (%)		No N (%)	Yes N (%)	
All		2765 (74.6)	943 (25.4)		3214 (86.7)	495 (13.3)		3415 (92.1)	293 (7.9)	
Age (in years)	< 65	1367 (81.0)	320 (19.0)	< 0.001	1548 (91.8)	139 (8.2)	< 0.001	1618 (95.9)	69 (4.1)	< 0.001
	65 or more	1398 (69.2)	623 (30.8)		1665 (82.4)	356 (17.6)		1797 (88.9)	224 (11.1)	
Sex	Female	1452 (73.4)	527 (26.6)	0.073	1735 (87.7)	244 (12.3)	0.051	1829 (92.4)	150 (7.6)	0.436
	Male	1313 (75.9)	416 (24.1)		1478 (855)	251 (14.5)		1586 (91.7)	143 (8.3)	
Education	≤ Elementary	2291 (73.6)	820 (26.4)	0.003	2667 (85.7)	444 (14.3)	< 0.001	2846 (91.5)	265 (8.5)	< 0.001
	> Elementary	468 (79.5)	121 (20.5)		539 (91.5)	50 (8.5)		562 (95.4)	27 (4.6)	
Marital status	Not married	1061 (70.5)	445 (29.5)	< 0.001	1263 (83.9)	243 (16.1)	< 0.001	1351 (89.7)	155 (10.3)	< 0.001
	Married/cohabiting	1702 (77.4)	498 (22.6)		1948 (88.5)	252 (11.5)		2062 (93.7)	138 (6.3)	
Religion	Muslim or other	214 (70.2)	91 (29.8)	0.066	246 (80.7)	59 (19.3)	< 0.001	266 (87.2)	39 (12.8)	< 0.001
	Buddhist	2549 (74.9)	852 (25.1)		2965 (87.2)	436 (12.8)		3147 (92.5)	254 (7.5)	
Income quartile	Low	619 (68.7)	282 (31.3)		728 (80.8)	173 (19.2)		787 (87.3)	114 (12.7)	
	Lower middle	687 (73.9)	243 (26.1)	< 0.001	799 (85.9)	131 (14.1)	< 0.001	854 (91.8)	76 (8.2)	< 0.001
	Upper middle	748 (77.2)	221 (22.8)		868 (89.6)	101 (10.4)		915 (94.4)	54 (5.6)	
	High	711 (78.3)	197 (21.7)		818 (90.1)	90 (9.9)		859 (94.6)	49 (5.4)	
Alcohol use	Never	2207 (73.6)	791 (26.4)		2597 (86.6)	401 (13.4)		2755 (91.9)	243 (8.1)	
	Past	196 (73.7)	70 (26.3)	0.002	212 (79.7)	54 (20.3)	< 0.001	235 (88.3)	31 (11.7)	< 0.001
	Current	362 (81.5)	82 (18.5)		404 (91.0)	40 (9.0)		425 (95.7)	19 (4.3)	
Smoking tobacco use	Never	2203 (74.4)	760 (25.6)		2585 (87.2)	378 (12.8)		2740 (92.5)	223 (7.5)	
	Past	206 (70.3)	87 (29.7)	0.029	234 (79.9)	59 (20.1)	0.002	258 (88.1)	35 (11.9)	0.028
	Current	356 (78.8)	96 (21.2)		394 (87.2)	58 (12.8)		417 (92.3)	35 (7.7)	
Physical activity	None	1621 (47.9)	542 (25.1)		1864 (86.2)	299 (13.8)		1972 (91.2)	191 (8.8)	
	1-149 min./week	691 (73.5)	249 (26.5)	0.689	805 (85.6)	135 (14.4)	0.033	871 (92.7)	69 (7.3)	0.019
	≥ 150 minutes/week	453 (74.9)	152 (25.1)		544 (89.9)	61 (10.1)		572 (94.5)	33 (5.5)	
Social engagement	No	1704 (73.9)	603 (26.1)	0.192	1992 (86.3)	315 (13.7)	0.433	2109 (91.4)	198 (8.6)	0.043
	Yes	1058 (75.8)	338 (24.2)		1218 (87.2)	178 (12.8)		1302 (93.3)	94 (6.7)	
Physical comorbidity	No	1572 (80.0)	393 (20.0)	< 0.001	1760 (89.6)	205 (10.4)	< 0.001	1857 (94.5)	108 (5.5)	< 0.001
	Yes	1193 (68.4)	550 (31.6)		1453 (83.4)	290 (16.6)		1558 (89.4)	185 (10.6)	
Depressive symptoms	No	2270 (75.9)	719 (24.1)	0.004	2635 (88.2)	354 (11.8)	< 0.001	2786 (93.2)	203 (6.8)	< 0.001
	Yes	290 (69.4)	128 (30.6)		340 (81.3)	78 (18.7)		369 (88.3)	49 (11.7)	



Table 2. Odds ratios for associations between vision, hearing and dual sensory loss and incident depressive symptoms (DS), Thailand 2015-2017

Variable	Sub-category	Model 1		Model 2		Model 3		sensory loss
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	
Depressive symptoms	No	1 (Reference)		1 (Reference)		1 (Reference)		Vision
	Yes	1.43 (1.09 to 1.86)	0.009	1.33 (1.01 to 1.75)	0.039	1.34 (1.01 to 1.74)	0.044	
	No	1 (Reference)		1 (Reference)		1 (Reference)		
	Yes	1.84 (1.36 to 2.57)	< 0.001	1.73 (1.24 to 2.40)	< 0.001	1.71 (1.23 to 2.38)	0.002	Hearing
	No	1 (Reference)		1 (Reference)		1 (Reference)		Dual
	Yes	2.06 (1.40 to 3.03)	< 0.001	1.84 (1.23 to 2.76)	0.003	1.80 (1.20 to 2.69)	0.005	

Model 1: unadjusted; Model 2: adjusted for age, sex, marital status, education and income; Model 3: adjusted for Model 2 variables plus physical activity, smoking, alcohol use, physical comorbidity, and social engagement

Table 3. Odds ratios for associations between depressive symptoms (DS) and incident vision, hearing and dual sensory loss, Thailand 2015-2017

Variable	Sub-category	Model 1		Model 2		Model 3	
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Vision loss	No	1 (Reference)		1 (Reference)		1 (Reference)	
	Yes	0.97 (0.74 to 1.29)	0.854	0.85 (0.63 to 1.13)	0.252	0.82 (0.61 to 1.09)	0.176
Hearing loss	No	1 (Reference)		1 (Reference)		1 (Reference)	
	Yes	1.09 (0.78 to 1.51)	0.631	0.84 (0.59 to 1.19)	0.326	0.83 (0.58 to 1.19)	0.317
Dual sensory loss	No	1 (Reference)		1 (Reference)		1 (Reference)	
	Yes	1.12 (0.77 to 1.62)	0.567	0.85 (0.57 to 1.26)	0.409	0.84 (0.56 to 1.24)	0.376

Model 1: unadjusted; Model 2: adjusted for age, sex, marital status, education and income; Model 3: adjusted for Model 2 variables plus physical activity, smoking, alcohol use, physical comorbidity, and social engagement

Conclusion

Baseline physical vision, hearing, and dual sensory loss increase the risk of incident DS, but baseline DS did not increase the risk of incident vision, hearing, and dual sensory loss among ageing adults in Thailand. Health care providers should be aware that sensory loss has an accompanying effect that can contribute to DS.

Study limitations

Study limitation include that sensory loss as assessed by self-report, and DS was only assessed with a screening instrument.

Conflict of interest

The authors declare that they have no competing interests.

Acknowledgement

“The Health, Aging and Retirement in Thailand (HART) study is sponsored by Thailand Science Research and Innovation (TSRI) and the National Research Council of Thailand (NRCT).

Funding

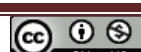
“The Health, Aging and Retirement in Thailand (HART) study is sponsored by Thailand Science Research and Innovation (TSRI) and the National Research Council of Thailand (NRCT).”

Authors' contributions

“All authors fulfill the criteria for authorship. SP, and KP conceived and designed the research, performed statistical analysis, drafted the manuscript, and made critical revisions of the manuscript for key intellectual content. All authors read and approved the final version of the manuscript and have agreed to the authorship and order of authorship for this manuscript.”

References

1. World Health Organization. Deafness and hearing loss [Internet]. [cited 10 Aug 2023]; Available from: https://www.who.int/health-topics/hearing-loss#tab=tab_1
2. Vicerra PMM. Self-determination and physical functioning as mediators of the association between self-reported sensory impairments and happiness



among older adults. *Experimental Aging Research*. 2022; 48(3): 274-286.

3. World Health Organization. Blindness and vision impairment [Internet]. 2023 [cited 24 Aug 2023]; Available from: <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>
4. Isipradit S, Sirimaharaj M, Charukamnoetkanok P, Thonginnetra O, Wongsawad W, Sathornsumetee B, et al. The first rapid assessment of avoidable blindness (RAAB) in Thailand. *PLoS One*. 2014; 9(12): e114245.
5. Ferrari AJ, Charlson FJ, Norman RE, Patten SB, Freedman G, Murray CJ, et al. Burden of depressive disorders by country, sex, age, and year: findings from the global burden of disease study 2010. *PLoS Medicine*. 2013; 10(11): e1001547.
6. Ferrari AJ, Charlson FJ, Norman R, Flaxman AD, Patten SB, Vos T, et al. The epidemiological modelling of major depressive disorder: application for the Global Burden of Disease Study 2010. *PLoS One*. 2013; 8(7): e69637.
7. Charoensakulchai S, Usawachoke S, Kongbangpor W, Thanavirun P, Mitsiriswat A, Pinijnai O, et al. Prevalence and associated factors influencing depression in older adults living in rural Thailand: A cross-sectional study. *Geriatrics Gerontology International*. 2019; 19(12): 1248-53.
8. Haseen F, Prasartkul P. Predictors of depression among older people living in rural areas of Thailand. *Bangladesh Medical Research Council Bulletin*. 2011; 37(2): 51-6.
9. Liu W, Yang C, Liu L, Kong G, Zhang L. Bidirectional associations of vision loss, hearing loss, and dual sensory loss with depressive symptoms among the middle-aged and older adults in China. *Journal of Affective Disorders*. 2022; 301: 225-32.
10. Han JH, Lee HJ, Jung J, Park EC. Effects of self-reported hearing or vision impairment on depressive symptoms: a population-based longitudinal study. *Epidemiology and Psychiatric Sciences*. 2019; 28(3): 343-55.
11. Xie T, Liu D, Guo J, Zhang B. The longitudinal effect of sensory loss on depression among Chinese older adults. *Journal of Affective Disorders*. 2021; 283: 216-22.
12. Wu C. Bidirectional Association between depression and hearing loss: evidence from the china health and retirement longitudinal study. *Journal of Applied Gerontology*. 2022; 41(4): 971-81.
13. Anantanasuwong D, Theerawanviwat D, Siripanich P. Panel survey and study on health and aging, and retirement in Thailand. In: Gu D, Dupre M, editors. Encyclopedia of gerontology and population aging. Springer, Cham; 2019.
14. Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *American Journal of Preventive Medicine*. 1994; 10(2): 77-84.
15. Nilmanut S, Kuptniratsaikul V, Pekuman P, Tosayanonda O. The study of the center for epidemiologic studies-depression scale (CES-D) in Thai people Siriraj hospital. *ASEAN Journal of Rehabilitation Medicine*. 1997; 6(3): 25-30.
16. Mackinnon A, McCallum J, Andrews G, Anderson I. The center for epidemiological studies depression scale in older community samples in Indonesia, North Korea, Myanmar, Sri Lanka, and Thailand. *The Journals of Gerontology*. 1998; 53(6): 343-52.
17. Anantanasuwong D, Pengpid S, Peltzer K. Prevalence and associated factors of successful ageing among people 50 years and older in a national community sample in Thailand. *International Journal of Environmental Research and Public Health*. 2022 27; 19(17): 10705.
18. World Health Organization. Guidelines on physical activity and sedentary behavior [Internet]. 2020 [cited 27 Aug 2023]; Available from: <https://iris.who.int/bitstream/handle/10665/336656/9789240015128-eng.pdf?sequence=1>
19. Pengpid S, Peltzer K, Anantanasuwong D. Bidirectional association between probable depression and multimorbidity among middle-aged and older adults in Thailand. *Journal of Multidisciplinary Healthcare*. 2023; 16: 11-19.
20. Mick P, Parfyonov M, Wittich W, Phillips N, Guthrie D, Kathleen Pichora-Fuller M. Associations between sensory loss and social networks, participation, support, and loneliness: analysis of the Canadian longitudinal study on aging. *Canadian Family Physician Medecin de Famille Canadien*. 2018; 64(1): e33-e41.
21. Lipsitz LA, Manor B, Habtemariam D, Iloputaife I, Zhou J, Travison TG. The pace and prognosis of peripheral sensory loss in advanced age: association with gait speed and falls. *BMC Geriatrics*. 2018; 18(1): 1-8.
22. Cosh S, Carriere I, Nael V, Tzourio C, Delcourt C, Helmer C, et al. The association of vision loss and dimensions of depression over 12 years in older adults: Findings from the Three City study. *Journal of Affective Disorders*. 2019; 243: 477-84.

