




## Original Article

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

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## ABSTRACT

### Article history

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**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 ( $\geq 45$  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 ( $\geq 50$

years) in Thailand, the proportion of visual impairment or blindness was 14.5% (4), and subjective vision impairment was 15% ( $\geq 60$  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 ( $\geq 45$  years), being the inclusion criterium, was interviewed face-to-face in their homes; further sampling details have been published previously (13). Responses of participants ( $\geq 45$  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  $\geq 10$  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  $\geq 150$  min/week = high activity" (18).

Physical comorbidity ( $\geq 1$  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 (%)	
<b>All</b>		2765 (74.6)	943 (25.4)		3214 (86.7)	495 (13.3)		3415 (92.1)	293 (7.9)	
<b>Age (in years)</b>	< 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)	
<b>Sex</b>	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 (85.5)	251 (14.5)		1586 (91.7)	143 (8.3)	
<b>Education</b>	≤ 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)	
<b>Marital status</b>	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)	
<b>Religion</b>	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)	
<b>Income quartile</b>	Low	619 (68.7)	282 (31.3)	< 0.001	728 (80.8)	173 (19.2)	< 0.001	787 (87.3)	114 (12.7)	< 0.001
	Lower middle	687 (73.9)	243 (26.1)		799 (85.9)	131 (14.1)		854 (91.8)	76 (8.2)	
	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)	
<b>Alcohol use</b>	Never	2207 (73.6)	791 (26.4)	0.002	2597 (86.6)	401 (13.4)	< 0.001	2755 (91.9)	243 (8.1)	< 0.001
	Past	196 (73.7)	70 (26.3)		212 (79.7)	54 (20.3)		235 (88.3)	31 (11.7)	
	Current	362 (81.5)	82 (18.5)		404 (91.0)	40 (9.0)		425 (95.7)	19 (4.3)	
<b>Smoking tobacco use</b>	Never	2203 (74.4)	760 (25.6)	0.029	2585 (87.2)	378 (12.8)	0.002	2740 (92.5)	223 (7.5)	0.028
	Past	206 (70.3)	87 (29.7)		234 (79.9)	59 (20.1)		258 (88.1)	35 (11.9)	
	Current	356 (78.8)	96 (21.2)		394 (87.2)	58 (12.8)		417 (92.3)	35 (7.7)	
<b>Physical activity</b>	None	1621 (47.9)	542 (25.1)	0.689	1864 (86.2)	299 (13.8)	0.033	1972 (91.2)	191 (8.8)	0.019
	1-149 min./week	691 (73.5)	249 (26.5)		805 (85.6)	135 (14.4)		871 (92.7)	69 (7.3)	
	≥ 150 minutes/week	453 (74.9)	152 (25.1)		544 (89.9)	61 (10.1)		572 (94.5)	33 (5.5)	
<b>Social engagement</b>	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)	
<b>Physical comorbidity</b>	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)	
<b>Depressive symptoms</b>	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)		Hearing
	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	
	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)	0.854	1 (Reference)	0.252	1 (Reference)	0.176
	Yes	0.97 (0.74 to 1.29)		0.85 (0.63 to 1.13)		0.82 (0.61 to 1.09)	
Hearing loss	No	1 (Reference)	0.631	1 (Reference)	0.326	1 (Reference)	0.317
	Yes	1.09 (0.78 to 1.51)		0.84 (0.59 to 1.19)		0.83 (0.58 to 1.19)	
Dual sensory loss	No	1 (Reference)	0.567	1 (Reference)	0.409	1 (Reference)	0.376
	Yes	1.12 (0.77 to 1.62)		0.85 (0.57 to 1.26)		0.84 (0.56 to 1.24)	

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.

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## 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.”

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