

## Abstract

**Background:** Insomnia is described as an unsatisfactory level of sleep that is commonly found in clinical practice. There are serious impacts on health. Approximately 43% of the Thai population has insomnia. The Athens Insomnia Scale-Thai (AIS-Thai) is a useful questionnaire to assess for insomnia.

**Objectives:** This study aimed to use the developed AIS-Thai for screening and diagnosing patients at an outpatient neurological department for pathological insomnia.

**Materials and Methods:** The participants who met all DSM-5 criteria of insomnia disorder and the participants without insomnia were enrolled in a cross-sectional questionnaire-based study. The participants in both groups completed the AIS-Thai. The ROC curve was conducted to identify the cut-off score of the AIS-Thai for identifying pathological insomnia.

**Results:** A total of 60 participant, who met all DSM-5 criterions of insomnia disorder, were included, 50 with insomnia and 10 without insomnia. The cut-off score for insomnia was calculated at 6 points (sensitivity of 75%, specificity of 100%), equal to the original AIS. Our study also found that ischemic stroke patients had higher sleep disturbances than non-stroke patients.

**Conclusion:** This study demonstrates that the AIS-Thai would be useful for detecting pathological insomnia in outpatient department settings, with a cut-off score of 6 points.

**Keywords:** Athens Insomnia Scale, Insomnia, Thai version, Utilization

# Utilization of the Athens Insomnia Scale-Thai Version (AIS-Thai) among Thai People

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## Introduction

Insomnia is described as an unsatisfactory level of sleep, such as difficulty falling asleep, difficulty maintaining sleep or early-morning awakening and unable to return to sleep, and these sleep issues are related to daily functioning.<sup>1</sup> In general population, the prevalence of insomnia ranges from 20% to 40%. The prevalence of sleeping disorders was 34% to 56% in Europe, while the prevalence in Asia was slightly lower, at 23% in Japan. In Europe, difficulty maintaining asleep was the most frequent issue, whereas difficulties inducing sleep were more prevalent in Japan.<sup>2</sup>

Previous research on insomnia in an elderly Thai population, a random of persons over 60 years of age, found that the prevalence of insomnia was 43.6%.<sup>3</sup> Snoring, excessive daytime somnolence, and waking up during the night were all common sleep issues in Thai people. Some individuals struggled with depression and impaired attention.<sup>4,5</sup>

Sleep disorders have a serious impact on health. Increased sympathetic nervous system activity and decreased parasympathetic nervous system activity are the physiological alterations associated with insomnia. Chronic physiologic alterations cause hypertension, cardiovascular problems, weakened immune systems, and psychological illnesses.<sup>6-8</sup>

There are several self-rating instruments available to assess subjective insomnia. The Insomnia Severity Index (ISI)<sup>9</sup>, the Athens Insomnia Scale (AIS)<sup>10</sup>, and the Pittsburgh Sleep Quality Scale Index (PSQI)<sup>11</sup> are three commonly used measures. It was determined through a meta-analysis that all three of these screening instruments for insomnia had high diagnostic accuracy and were useful for

diagnosing insomnia (sensitivity and specificity of each instrument were, respectively, ISI: 88% and 85%, AIS: 91% and 87%, PSQI: 94% and 76%).<sup>12</sup>

The ISI is a seven-question self-report scale that contains psychological components, is frequently used in clinical studies, and classifies severity as absence of insomnia, mild, moderate, or severe insomnia.<sup>9</sup> The PSQI has a total of 19 self-reported questions. It can be used in clinical practice and research activities to distinguishing good and poor sleepers.<sup>11</sup> The AIS, which includes eight self-rated questions based on ICD-10 criteria and includes physiological components, is highly useful in both clinical and research settings.<sup>10</sup> Thus, the AIS is effective for diagnosing insomnia, capable of assessing the severity of insomnia<sup>13</sup>, and applicable in both clinical and academic settings.

The original AIS version's cut-off score for diagnosing insomnia is 6 points.<sup>10</sup> The AIS had a well-developed Thai translation (AIS-Thai) by Chalardsakul P, et al., unpublished data in 2021. The AIS-Thai questionnaire shows high reliability for both intra- and inter-rater analysis. From that pilot study, pathological insomnia in the AIS-Thai provides a cut-off score of 7, with a sensitivity of 78% and a specificity of 100%.<sup>14</sup> This study aimed to utilize the previously developed AIS-Thai for screening patients at our outpatient neurological department to reidentify the cut-off level for pathological insomnia.

## Material and Methods

### 1. Participants

Participants were the patients who visited the outpatient Neurological Department of Phramongkutklao Hospital. All participants were informed and consented. The participants were

questioned about symptoms of insomnia, according to the DSM-5 criteria for insomnia disorder.<sup>1</sup> The participants had to satisfy all criterions of DSM-5 insomnia disorder. A total of 60 participants were included: 50 with symptoms of insomnia and 10 without any symptoms of insomnia. This questionnaire survey was conducted from August 2022 to December 2022.

## 2. Measures

Insomnia symptoms over the past month were measured using the Thai version of the AIS<sup>14</sup>, a validated eight-item self-report rating questionnaire. A sum score is calculated with a range of 0-24 points, with higher scores indicating worse insomnia symptoms. A cut-off scores to distinguishing healthy participants from those who having insomnia was 7 points.

## 3. Ethical consideration and statistical analysis

A cross-sectional questionnaire-based study was conducted after receiving approval from the Institutional Review Board Royal Thai Army Medical Department (R025q/63). Informed consent was obtained from each participants prior to participation, all of individuals who response to questionnaire were remained anonymous.

Demographic characteristics were described as mean with standard deviation (SD), number, and percent. We also described a plotted receiver-operator curve (ROC) with a mean (95% confidence interval (95% CI)) area under the curve (AUC) to determine an AIS-Thai cut-off score for screening and diagnosing pathological insomnia. Additionally, we compared the stroke and non-stroke with insomnia.

The statistical analyses were computed using SPSS version 27.0 for Windows. The *p*-value of less than 0.05 indicated statistical significance.

## Results

A total of 60 volunteers were participated. Mean age was 61.8 years old (SD 14.6). Male was 27 cases (45%). Three commonest co-morbidities were dyslipidemia (68.3%), hypertension (50%) and stroke (45%). Compared between the insomnia group and non-insomnia group, it was found that stroke was more common [26 cases (52%) versus 1 case (10%), *p*-value 0.015]. The demographic characteristics were summarized in Table 1.

Table 1 Demographic characteristics

Patients characteristics	Total (n = 60)	Insomnia (n = 50)	Non-insomnia (n = 10)	<i>p</i> -value
Age (year): mean ± SD	61.8 ± 14.6	63.4 ± 13.0	53.8 ± 19.5	0.197
Gender M : F (n)	27 : 33	22 : 28	5 : 5	0.728
BMI (Kg/m <sup>2</sup> )	23.3 ± 5.8	23.3 ± 6.0	23.0 ± 5.1	0.302
Employed (n, %)	53 (88.3 %)	45 (90%)	8 (80%)	0.369
DM (n, %)	13 (21.7%)	11 (22%)	2 (20%)	0.629
HT (n, %)	30 (50%)	25 (50%)	5 (50%)	1.000
DLP (n, %)	41 (68.3%)	33 (66%)	8 (80%)	0.385
Stroke (n, %)	27 (45%)	26 (52%)	1 (10%)	0.015*
Smoking (n, %)	8 (13.3%)	8 (16%)	0	0.210
Alcohol (n, %)	11 (18.3%)	8 (16%)	3 (30%)	0.262

\*Statistical significance by Fisher's exact test

M; male, F; female, BMI; body mass index, DM; diabetes mellitus, HT; hypertension, DLP; dyslipidemia

**Table 2** The median (minimum-maximum) score of the AIS-Thai for each item

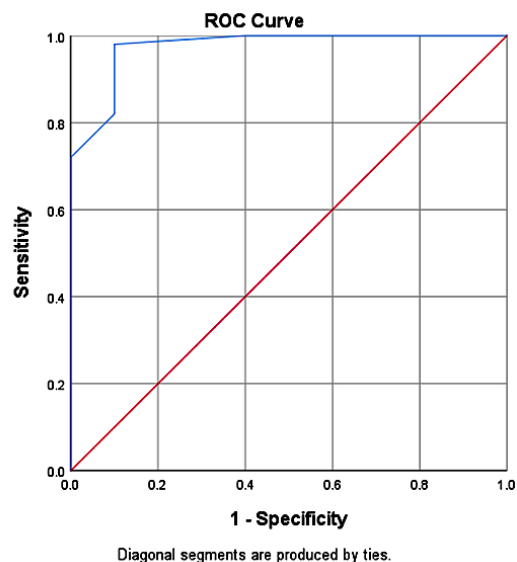
Items	Total (n = 60)	Insomnia (n = 50)	Non-insomnia (n = 10)	p-value
1: Sleep induction	1 (0-3)	2 (0-3)	0 (0-0)	<0.001*
2: Awakenings during the night	1 (0-3)	1 (0-3)	0 (0-1)	<0.001*
3: Awakenings earlier than desired	1 (0-3)	1 (0-3)	0 (0-2)	<0.001*
4: Total sleep duration	1 (0-3)	1 (0-3)	0 (0-1)	<0.001*
5: Overall quality of sleep	1 (0-3)	1 (0-3)	0 (0-0)	<0.001*
6: Sense of well-being during the day	1 (0-3)	1 (0-3)	0 (0-1)	0.001*
7: Functioning (physical and mental) during the day	1 (0-3)	1 (0-3)	0 (0-1)	<0.001*
8: Sleepiness during the day	1 (0-3)	1 (0-3)	0 (0-2)	0.361
Total score	8 (0-23)	10 (2-23)	1 (0-6)	<0.001*

\*Statistical significance by Wilcoxon Signed Rank test

According to Table 2, participants with insomnia had higher median scores for each item and the overall AIS-Thai score than participants without insomnia, which were 10 and 1, respectively. Patients with insomnia tended to have problems with sleep induction.

The ROC curve was conducted to identify the cut-off score of the AIS-Thai for screening and diagnosing of pathological insomnia. The cut-off score for insomnia was calculated at 6 points, with a sensitivity of 75% and specificity of 100%, the AUC was 0.974 (95% CI 0.928-1.000), with a *p*-value of < 0.001 and a standard error of 0.024, Figure 1.

Insomnia participants had history of previous ischemic stroke 52% (26/50), while normal healthy participants had stroke 10% (1/10), with *p*-value of 0.015. We compared each item of the AIS-Thai between stroke and non-stroke patients, as shown in Table 3. It was recognized that individuals with stroke tended to have more severe score than non-stroke: median score 10 versus 8, respectively. For the item "awakening at nighttime", the score was slightly different, but it reached a statistically significant worse score in the stroke group than the non-stroke group, a *p*-value of 0.019, Table 3.



**Figure 1** The ROC for the cut-off score of the AIS-Thai for screening insomnia

**Table 3** The comparison of each item between stroke and non-stroke patients

Items	Stroke (n = 27)	Non-stroke (n = 33)	p-value
	Median (min-max)	Median (min-max)	
1: Sleep induction	2 (0-3)	1 (0-3)	0.091
2: Awakenings during the night	1 (0-3)	1 (0-3)	0.019*
	Mean score 1.52	Mean score 1.00	
3: Awakenings earlier than desired	1 (0-3)	1 (0-3)	0.893
4: Total sleep duration	1 (0-3)	1 (0-3)	0.050
5: Overall quality of sleep	1 (0-3)	1 (0-3)	0.338
6: Sense of well-being during the day	1 (0-3)	1 (0-3)	0.625
7: Functioning (physical and mental) during the day	1 (0-3)	1 (0-3)	0.704
8: Sleepiness during the day	1 (0-3)	1 (0-3)	0.448
Total scores	10 (0-23)	8 (0-19)	0.202

\*Statistical significance by Wilcoxon Signed Rank test

## Discussion

In this study, we aimed to use the developed AIS-Thai for screening and diagnosing pathological insomnia in patients who had symptoms of insomnia that met all the DSM-5 criteria for insomnia disorder. Our study demonstrated the cut-off score at 6 points on the AIS-Thai with a high sensitivity of 75%, and specificity of 100% for diagnosing pathological insomnia. The cut-off score was equal to the original AIS (6 points).<sup>10</sup> The AIS-Thai seems to be a practically instrument for using in Thai population.

Additionally, our study found that ischemic stroke patients had higher sleep disturbances than non-stroke patients. Ischemic stroke patients had problems with awakenings during the night.

Approximately 50% of patients have insomnia during first few months after developed stroke.<sup>15,16</sup> The causes of insomnia in stroke patients are environmental factors, comorbidities, and direct brain injury. Sleep problems and insomnia were caused by the lesions at the pontomesencephalic and thalamic regions. Additionally, REM or non-REM were affected by supratentorial, left or right

hemisphere, or paramedian stroke.<sup>16</sup>

Insomnia might increase the risk of stroke, although the mechanisms are still unclear. Neuroinflammation might be the causes.<sup>16</sup> Approximately 54% of insomnia patients have an increased risk of stroke.<sup>15,16</sup> Thus, stroke-related brain damage induces insomnia, and vice versa, insomnia might increase the risk of stroke.

This study had some limitations. First, the study had a small number of participants. Second, there were no recorded medications previously used to treat insomnia, in contrast to the PSQI questionnaire. Third, because the AIS-Thai was not utilized to determine the severity of insomnia, we still lack data on the cut-off score for severity.

Future studies, using the AIS-Thai to determine the prevalence of insomnia in particular populations, such as stroke patients, would be useful. Using the AIS-Thai to assess and follow up on the treatment effects of insomnia might also be beneficial. Additionally, developing the cut-off score for determining the severity of insomnia may aid the physicians in diagnosing and treating the patients with insomnia.

## Conclusion

This study demonstrates that the AIS-Thai would be useful for detecting pathological insomnia in outpatient department settings, with a cut-off score of 6 points.

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Appendix 1. Athens Insomnia Scale-Thai (AIS-Thai)<sup>14</sup>HN \_\_\_\_\_ ชาย หญิง อายุ \_\_\_\_\_ ปี ครั้งที่ 1 2

## แบบสอบถามภาวะนอนไม่หลับฉบับภาษาไทย

## Athens Insomnia Scale: Thai version

แบบสอบถามฉบับนี้มีวัตถุประสงค์เพื่อให้ท่านประเมินตนเองเกี่ยวกับปัญหาการนอนไม่หลับของท่าน กรุณาทำเครื่องหมาย (โดยการวงกลมตัวเลข) ได้รายการด้านล่างนี้เพื่อระบุระดับของปัญหาการนอนไม่หลับ ซึ่งเกิดขึ้นอย่างน้อยสามครั้งต่อสัปดาห์ในช่วงเดือนที่ผ่านมา

## 1. การเข้านอน (เวลาตั้งแต่ปิดไฟจนท่านหลับ)

0	1	2	3
ไม่มีปัญหา	ช้าเล็กน้อย	ช้ามาก	ช้ามากที่สุดหรือไม่หลับเลย

## 2. ตื่นในช่วงกลางคืน

0	1	2	3
ไม่มีปัญหา	มีปัญหาน้อย	มีปัญหามาก	มีปัญหามากที่สุดหรือไม่หลับเลย

## 3. ตื่นนอนเร็วกว่าที่ท่านต้องการ

0	1	2	3
ไม่เร็วเกินไป	เร็วกว่าที่คาดไว้เล็กน้อย	เร็วกว่าที่คาดไว้มาก	เร็วกว่าที่คาดไว้มากที่สุดหรือไม่หลับเลย

## 4. ระยะเวลาในการนอนทั้งหมด

0	1	2	3
เพียงพอ	ไม่เพียงพอเล็กน้อย	ไม่เพียงพออย่างมาก	ไม่เพียงพอมากที่สุดหรือไม่หลับเลย

## 5. คุณภาพการนอนโดยรวม (ไม่ว่าจะนอนนานเท่าไรก็ตาม)

0	1	2	3
น่าพึงพอใจ	ไม่น่าพึงพอใจ	ไม่น่าพึงพอใจอย่างมาก	ไม่น่าพึงพอใจมากที่สุดหรือไม่หลับเลย

## 6. รู้สึกง่วงระหว่างวัน

0	1	2	3
ปกติ	ลดลงเล็กน้อย	ลดลงอย่างมาก	ลดลงอย่างมากที่สุด

## 7. ประสิทธิภาพการทำงาน (ของร่างกายและจิตใจ) ในระหว่างวัน

0	1	2	3
ปกติ	ลดลงเล็กน้อย	ลดลงอย่างมาก	ลดลงอย่างมากที่สุด

## 8. ความรู้สึกง่วงระหว่างวัน

0	1	2	3
ไม่มีเลย	เล็กน้อย	มาก	มากที่สุด