# Clinical Outcomes of Selective Nerve Root Block in Patients with Degenerative Lumbar Spinal Stenosis with Radiculopathy and Lumbar Disc Herniation with Radiculopathy: A Single-Arm Prospective Longitudinal Study

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## Abstract

**Objective:** To evaluate the clinical outcomes of selective nerve root block (SNRB) in patients with degenerative lumbar spinal stenosis with radiculopathy and lumbar disc herniation with radiculopathy, focusing on pain relief and functional improvement over a 6-month follow-up period.

**Materials and Methods:** For this single-arm prospective longitudinal study, 64 patients with clinically and radiologically confirmed degenerative lumbar spinal stenosis with radiculopathy and/or lumbar disc herniation with radiculopathy, who had undergone SNRB at Somdej Phra Sangkharat 17th Hospital between August 2023 and May 2024, were enrolled. Pain severity was assessed using the visual analogue scale (VAS), and the patients' functional disability was evaluated with the Oswestry Disability Index (ODI). Outcomes were measured at the baseline, as well as 24 hours, 2 weeks, 3 months, and 6 months post-injection. Repeated measures ANOVA was used to compare outcomes across follow-up time points.

**Results:** Among the 64 patients (65.6% female, mean age 57.97±12.17 years), the most common lesion level was L4 to L5 (95.3%). Mean VAS scores had decreased significantly from the baseline (7.95±0.86) to 24 hours (1.11±0.85), 2 weeks (1.64±0.75), 3 months (2.96±1.03), and 6 months (4.16±1.23) post-SNRB ($p<0.001$). Mean ODI had also decreased from 47.72±10.99 at baseline to 11.84±7.07 at 2 weeks and 26.41±13.51 at 6 months ($p<0.001$). However, 78.1% of patients had reported a recurrence of symptoms at 6 months.

**Conclusion:** SNRB was associated with significant short- to mid-term improvements in pain and functional outcomes among patients with degenerative lumbar spinal stenosis with radiculopathy and lumbar disc herniation with radiculopathy. However, symptom recurrence was common at 6 months, suggesting that SNRB may provide temporary symptom control rather than definitive long-term treatment.

**Keywords:** Selective nerve root block (SNRB); Lumbar spinal stenosis; Lumbar disc herniation; Radiculopathy; Visual analogue scale

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Degenerative lumbar spinal stenosis (DLSS) and lumbar disc herniation (LDH) are common causes of low back pain associated with lumbar radiculopathy. These conditions are frequently encountered in both working-age adults and elderly populations, particularly in aging societies where the proportion of older individuals continues to increase worldwide, including in Thailand. Such disorders may adversely affect quality of life, functional capacity, and activities of daily living, and

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**What is already known about this topic?**

Degenerative lumbar radicular disorders are common spinal conditions among older adults and are frequently associated with chronic low back pain, radicular leg pain, and neurogenic claudication. Surgical treatment is generally considered for patients with severe symptoms or progressive neurological deficits; however, many patients prefer conservative management because of advanced age, medical comorbidities, or concerns regarding operative risks. SNRB has been used as a minimally invasive treatment approach to reduce inflammation around affected nerve roots and may provide temporary pain relief and functional improvement in selected patients.

**What does this study add?**

This single-arm prospective longitudinal study demonstrated that patients with degenerative lumbar radicular disorders experienced improvement in pain intensity and functional disability during the first 6 months following SNRB. However, symptom recurrence was commonly observed at 6 months after treatment. The findings suggest that SNRB may provide temporary symptom control as part of a conservative treatment strategy in selected patients who are unwilling or unsuitable for surgery.



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may also contribute to substantial socioeconomic burden at the individual, family, and healthcare system levels. DLSS results from degenerative changes of spinal structures, including the intervertebral discs, facet joints, and ligamentum flavum, leading to narrowing of the spinal canal or neural foramina with subsequent compression of the affected nerve roots. In contrast, LDH occurs when the nucleus pulposus protrudes through the annulus fibrosus, resulting in direct mechanical compression and inflammatory irritation of the nerve root. Consequently, patients may develop radicular pain, numbness, or lower extremity weakness[1,2]. Current management strategies for lumbar radiculopathy include both nonoperative and surgical treatments. Conservative treatment, consisting of analgesic medications, anti-inflammatory drugs, physical therapy, and activity modification, is generally considered the first-line approach in most patients. However, some patients continue to experience persistent pain or functional limitation despite appropriate conservative management, necessitating consideration of more targeted interventions prior to surgical treatment. In this context, selective nerve root block (SNRB) has gained increasing attention as a minimally invasive procedure that may serve both diagnostic and therapeutic purposes[3].

SNRB is a procedure involving the injection of a local anesthetic combined with corticosteroid around the suspected symptomatic nerve root under fluoroscopic or computed tomography guidance, allowing targeted delivery of medication to the affected nerve root. The proposed therapeutic effect of corticosteroids is related to suppression of inflammatory processes, reduction of nerve root edema, and inhibition of inflammatory mediators, which may contribute to alleviation of radicular pain. In addition, the local anesthetic component may assist in confirming the symptomatic nerve root, thereby providing both diagnostic and therapeutic value[3-5]. Previous studies have suggested that SNRB may provide symptomatic improvement and functional benefit in patients with lumbar radiculopathy, particularly in the short- to intermediate-term period. Kanaan et al. reported that therapeutic SNRB was associated with avoidance of surgery in approximately 54% of patients, while nearly 29% experienced symptom improvement lasting longer than 6 months following a single injection[4]. Sakai et al. demonstrated that more than 60% of elderly patients with lumbar canal stenosis experienced symptomatic improvement after SNRB, with the procedure being performed without major complications[6]. In addition, Arun-Kumar et al. reported that SNRB was associated with significant pain reduction in patients with lumbar disc prolapse, although the duration of symptom relief varied among individuals[7]. Although surgical treatment remains the standard management option for patients with severe symptoms or neurological deficits, SNRB may be considered a minimally invasive alternative in selected patients due to its relatively low complication rate, lower cost, and potential to delay or reduce the need for surgery in some cases[8].

Therefore, the present study aimed to evaluate the clinical outcomes of SNRB in patients with degenerative lumbar spinal stenosis with radiculopathy and LDH with radiculopathy using a single-arm prospective longitudinal study design. The study was conducted to assess changes in pain severity and functional outcomes following treatment. The findings of this study may provide additional clinical information regarding the role of SNRB in routine practice and may contribute to treatment decision-making in appropriately selected patients.

## Materials and Methods

### Methods

The present study was a single-arm prospective longitudinal study conducted to evaluate the clinical outcomes of SNRB in patients with degenerative lumbar radicular disorders. The study was performed at Somdej Prasangkarach 17th Hospital between August 1, 2023, and May 31, 2024. All participants were followed for 6 months after the procedure to assess clinical outcomes.

### Population and Samples

Sample size: According to the study by Sakai et al.[6], the overall efficacy rate of SNRB in patients aged 80 years and older with LCS had been 61%. Based on this finding, the required sample size was calculated using the formula for estimating a single population proportion, with the following parameters: alpha ($\alpha$)=0.05, standard normal value (Z)=1.96, prevalence (P)=0.61, and absolute precision (d)=0.12. At a 95% confidence interval, the calculated sample size was determined to be 64 patients.

Inclusion criteria: Patients aged 55 years or older.

Exclusion criteria: Patients with psychiatric disorders, inability to complete the 6-month follow-up period, acute LDH requiring urgent surgical intervention, history of spinal trauma, cauda equina syndrome, and lower extremity pain secondary to other conditions such as polymyalgia rheumatica or peripheral vascular disease (Figure 1).

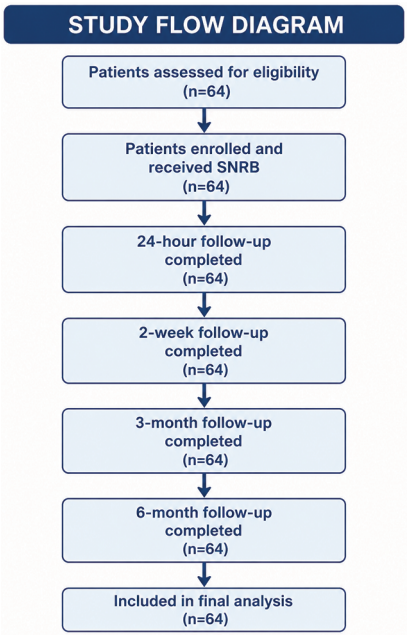


**Figure 1.** Study flow diagram of patient enrollment and follow-up after selective nerve root block (SNRB).

## Variables and Definitions

Diagnostic criteria: Patients were eligible for inclusion if they presented with clinical symptoms consistent with degenerative lumbar radicular disorders, including unilateral or bilateral radicular leg pain, neurogenic claudication, lower extremity numbness, or neurological symptoms corresponding to lumbar nerve root compression. All diagnoses were confirmed using magnetic resonance imaging (MRI), which demonstrated degenerative lumbar pathologies corresponding to the patients' clinical manifestations. These pathologies included lumbar spinal canal stenosis, lateral recess stenosis, foraminal stenosis, and/or concomitant degenerative LDH.

SNRB was performed by an orthopedic spine surgeon using a transforaminal approach under fluoroscopic guidance. After sterile skin preparation and local infiltration with 1% lidocaine, a 22-gauge spinal needle was advanced toward the affected lumbar nerve root. Correct needle placement was confirmed using anteroposterior and lateral fluoroscopic views before injection. A mixture consisting of 1 mL of triamcinolone acetonide (40 mg/mL) and 1 mL of 1% lidocaine was injected around the affected nerve root. All patients received a single injection during the study period.

Outcomes: The primary outcome of the study was pain intensity evaluated using the 10-cm visual analogue scale (VAS-leg), in which scores ranged from 0 (no pain) to 10 (worst imaginable pain). Pain assessments were performed at baseline before the procedure and subsequently at 24 hours, 2 weeks, 3 months, and 6 months after SNRB.

The secondary outcome was functional disability assessed using the Oswestry Disability Index (ODI, version 2.1a). The ODI is a validated questionnaire used to assess disability related to lumbar spine disorders, with total scores ranging from 0 to 100, in which higher scores indicate greater functional impairment. ODI assessments were conducted at baseline, 2 weeks, 3 months, and 6 months following the procedure.

Recurrence: Symptom recurrence at the 6-month follow-up was defined as the return or worsening of radicular pain or neurogenic claudication after an initial period of clinical improvement following SNRB. Recurrence was considered present if the patient required additional outpatient visits, escalation of analgesic medications, repeat spinal injection, or consideration for surgical intervention at any time during the 6-month follow-up period.

Complications: Procedure-related complications were defined as any adverse events occurring within 30 days after SNRB, including new neurological deficits, infection, bleeding or hematoma formation, allergic reactions, or any other clinically significant adverse events identified during follow-up evaluation.

Exposure: The exposure of interest in the present study was the SNRB, performed as a minimally invasive intervention for the management of degenerative lumbar radicular disorders.

## Statistical Analysis

Descriptive statistics were used to summarize baseline demographic and clinical characteristics of the participants. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Repeated measures analysis of variance (ANOVA) was used to compare changes in pain intensity and functional disability scores across different follow-up time points. Pain severity was assessed using the VAS, and functional disability was assessed using the ODI. Outcome measurements were obtained at baseline and during follow-up at 24 hours, 2 weeks, 3 months, and 6 months after SNRB. Because ODI was not assessed at 24 hours, ODI analyses included baseline, 2-week, 3-month, and 6-month assessments only. Assumptions of normality and sphericity were evaluated before performing repeated measures ANOVA. Greenhouse-

Geisser correction was applied when the assumption of sphericity was violated. Recurrence and complication rates were analyzed descriptively and reported as frequency and percentage during each follow-up period. All statistical analyses were performed using Stata, version 10.1 (StataCorp LP, College Station, TX, USA). A two-sided p-value less than 0.05 was considered statistically significant.

### Ethical Approval

The present study was approved by the Human Research Ethics Committee, Office of Public Health, Suphan Buri Province, Ministry of Public Health, Thailand (Full Board review, Approval No. 57/2566). Written informed consent was obtained from all participants before enrollment in the study.

## Results

A total of 64 patients were included in the present study, and all participants completed the scheduled follow-up assessments throughout the 6-month study period. Among the participants, 42 patients (65.6%) were female. The mean age was 57.97±12.17 years. The mean body weight, height, and body mass index (BMI) were 64.57±12.74 kg, 160.20±6.99 cm, and 25.12±4.47 kg/m², respectively. The average monthly income was 10,471.88±9,385.31 Baht, and the mean duration of low back and radicular leg pain before treatment was 26.23±31.83 months. Most participants were married (60.9%), had completed secondary school or vocational education (42.2%), and were self-employed, vendors, or daily wage workers (43.8%). Comorbid diseases were present in 60.9% of patients. The most commonly affected spinal level was L4-L5 (95.3%), followed by L5-S1 (76.6%) and L3-L4 (46.9%). Lumbar spinal canal stenosis was identified in 79.7% of patients while concomitant degenerative LDH was observed in 20.3% of cases. The mean baseline VAS score was 7.95±0.86, and the mean baseline ODI score was 47.72±10.99 (Table 1). As shown in Table 2, pain intensity demonstrated significant improvement following SNRB. The mean VAS score decreased from 7.95±0.86 at baseline to 1.11±0.85 at 24 hours after injection. The mean score remained lower than baseline throughout the follow-up period, with values of 1.64±0.75 at 2 weeks, 2.96±1.03 at 3 months, and 4.16±1.23 at 6 months after treatment. Repeated measures ANOVA demonstrated statistically significant differences in VAS scores across follow-up time points ($p<0.001$). The magnitude of the treatment-time effect was large (partial $\eta^2=0.938$). Functional disability outcomes also improved after treatment. The mean ODI score decreased from 47.72±10.99 at baseline to 11.84±7.07 at 2 weeks after the procedure. Although ODI scores gradually increased during later follow-up periods, the scores remained lower than baseline values, with mean scores of 17.97±9.68 at 3 months and 26.41±13.51 at 6 months. Repeated measures ANOVA demonstrated statistically significant differences in ODI scores across follow-up time points ($p<0.001$) (Figure 2). At the 6-month follow-up evaluation, 50 patients (78.1%) met the predefined criteria for symptom recurrence, including recurrent radicular pain or neurogenic claudication requiring additional outpatient visits,

**Table 1.** The general characteristics of the patients (n=64)

| General information | Value |
|---|---|
| Sex; n (%) | |
| Female | 42 (65.6) |
| Male | 22 (34.4) |
| Age (years); mean±SD | 57.97±12.17 |
| Weight (kg); mean±SD | 64.57±12.74 |
| Height (cm); mean±SD | 160.20±6.99 |
| Body mass index (kg/m$^2$);mean±SD | 25.12±4.47 |
| Monthly income (Baht); mean±SD | 10,471.88±9,385.31 |
| Duration of low back and leg pain (months); mean±SD | 26.23±31.83 |
| Marital statuses; n (%) | |
| Married | 39 (60.9) |
| Widowed | 7 (10.9) |
| Single | 18 (28.1) |
| Education levels; n (%) | |
| No formal education/primary school | 19 (29.7) |
| Secondary/vocational certificate/diploma | 27 (42.2) |
| Bachelor's degree or higher | 18 (28.1) |
| Occupations; n (%) | |
| Farmer/other | 23 (35.9) |
| Self-employed/vendor/laborer | 28 (43.8) |
| Government officer | 5 (7.8) |
| Unemployed | 8 (12.5) |
| Comorbidities; n (%) | |
| Absent | 25 (39.1) |
| Present | 39 (60.9) |
| Lesion levels; n (%) | |
| L3-L4 | 30 (46.9) |
| L4-L5 | 61 (95.3) |
| L5-S1 | 49 (76.6) |
| Primary diagnoses; n (%) | |
| Lumbar spinal stenosis | 51 (79.7) |
| Herniated nucleus pulposus | 13 (20.3) |
| Visual analogue scale before injection; mean±SD | 7.95±0.86 |
| Oswestry Disability Index before injection; mean±SD | 47.72±10.99 |

SD=standard deviation

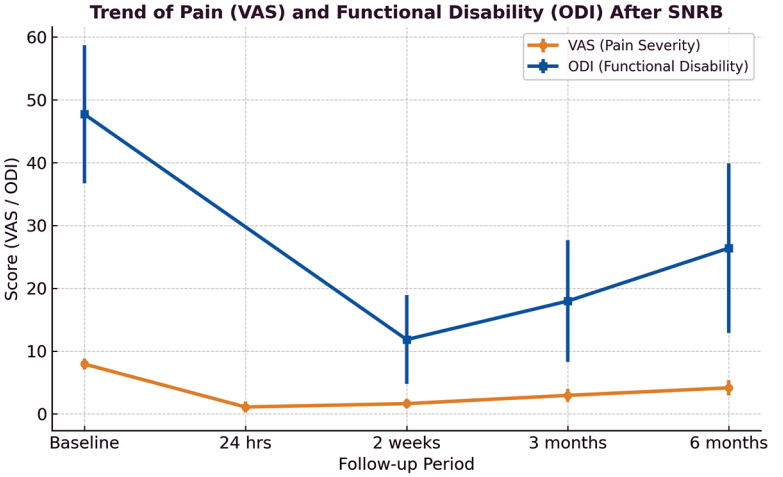


**Figure 2.** Changes in visual analogue scale (VAS) and Oswestry Disability Index (ODI) scores during follow-up after selective nerve root block (SNRB).

**Table 2.** Comparison of VAS and ODI scores among patients with degenerative lumbar radicular disorders following selective nerve root block (SNRB)

| Outcome | Baseline | 24 hours | 2 weeks | 3 months | 6 months | Mean difference at 6 months (95% CI) | p-value |
|---|---|---|---|---|---|---|---|
| VAS | 7.95±0.86 | 1.11±0.85 | 1.64±0.75 | 2.96±1.03 | 4.16±1.23 | −3.79 (−4.12 to −3.46) | <0.001 |
| ODI | 47.72±10.99 | - | 11.84±7.07 | 17.97±9.68 | 26.41±13.51 | −21.31 (−24.88 to −17.74) | <0.001 |

VAS=visual analogue scale; ODI=Oswestry Disability Index; CI=confidence interval
ODI analyses included baseline, 2 weeks, 3 months, and 6 months only

**Table 3.** Recurrence and complications during follow-up after selective nerve root block (SNRB)

| Variable | n (%) | | | | p-value |
|---|---|---|---|---|---|
| | 24 hours | 2 weeks | 3 months | 6 months | |
| Recurrence | 0 (0.0) | 0 (0.0) | 0 (0.0) | 50 (78.1) | N/A |
| Complications | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | N/A |

N/A=not applicable

escalation of analgesic medications, repeat spinal injection, or consideration for surgical intervention. No major complications or serious adverse events were observed during the study period. In addition, no patients developed neurological deficits, infection, bleeding or hematoma, or allergic reactions following the procedure (Table 3).

## Discussion

The present study demonstrated statistically significant reductions in both pain intensity (VAS) and functional disability (ODI) following SNRB throughout the 6-month follow-up period compared with baseline values. The VAS scores showed a marked decrease within the first 24 hours after treatment, followed by a gradual increase during subsequent follow-up periods. A similar trend was observed for ODI scores.

The mean VAS score decreased substantially from 7.95 at baseline to 1.11 within 24 hours after injection and gradually increased to 4.16 at 6 months. Nevertheless, the mean VAS score remained significantly lower than the pretreatment value throughout the follow-up period. These findings were consistent with the study by Yeom et al., which demonstrated that SNRB was associated with significant pain reduction in patients with lumbar radiculopathy[5]. Similarly, Riew et al. reported that nerve root injection was associated with a reduced need for surgical intervention in some patients with lumbar radicular pain[9]. The observed improvement in pain scores may be related to the anti-inflammatory effects of corticosteroids, including suppression of inflammatory mediators and reduction of nerve root edema, while the local anesthetic component may contribute to short-term interruption of nociceptive signal transmission. However, although VAS scores remained lower than baseline values at 6 months, a gradual increase in pain scores over time was observed. This trend may reflect the progressive nature of degenerative lumbar spinal disorders, in which persistent structural compression may continue

despite temporary reduction of nerve root inflammation following injection[10]. The present findings were generally comparable to those reported by Vad et al., who demonstrated that transforaminal epidural steroid injection was associated with short-term improvement in pain and functional outcomes among patients with lumbosacral radiculopathy[11].

The ODI scores also showed significant improvement, decreasing from a mean of 47.72±10.99 before injection to 11.84±7.07 at 2 weeks, 17.97±9.68 at 3 months, and 26.41±13.51 at 6 months, despite a gradual increase over time. These findings suggest that improvement in pain following SNRB may be associated with improvement in functional status and activities of daily living. These findings are comparable to those of Mahesh Babu et al.[12], who reported a reduction in the Roland-Morris Disability Questionnaire (RMDQ) score from 20.07% to 9.6% at 6 months. Such findings may be related to the temporary reduction of nerve root inflammation and irritation following injection.

In addition to statistical significance, the reductions in VAS and ODI scores observed in the present study may suggest clinically meaningful improvement. Previous studies have reported that the minimal clinically important difference (MCID) for VAS in lumbar radiculopathy is approximately 1.5 to 2 points, while the MCID for ODI is approximately 10 to 12 points. The magnitude of score reduction observed during follow-up exceeded these reported thresholds. However, interpretation of clinical significance should be made with caution because the present study was conducted without a control group.

Improvements in physical function following SNRB may be associated with temporary relief of radicular pain and reduced nerve root irritation, which may contribute to improved functional recovery during short- to medium-term follow-up. These findings suggest that SNRB may be considered a conservative treatment option in selected patients, particularly in those who are not immediate surgical candidates or who have medical comorbidities limiting surgical intervention. The sustained reduction in ODI scores over 6 months may be related to the anti-inflammatory effects of corticosteroids, including suppression of inflammatory mediators and reduction of nerve root edema around the affected foraminal region. These findings were generally consistent with previous studies reporting symptomatic and functional improvement following SNRB in patients with lumbar spinal canal stenosis.

However, the present study also demonstrated a relatively high recurrence rate of pain, with recurrent symptoms observed in 78.1% of patients within 6 months. This finding suggests that, although SNRB may provide favorable short-term outcomes, symptom recurrence may occur over time in a substantial proportion of patients. Therefore, additional treatment strategies, including continued conservative treatment or surgical decompression, may still be required in selected patients, particularly those with recurrent symptoms or persistent structural compression.

## Limitation and recommendation

First, this was a single-center study with a relatively small sample size, which may limit the generalizability of the findings to other clinical settings or populations. Second, the follow-up period was limited to 6 months, which may not fully reflect long-term clinical outcomes or recurrence patterns following SNRB. Third, because the study was designed as a single-arm prospective longitudinal study without a control group, the observed clinical improvements may have been partially influenced by the natural course of disease, placebo effects, concurrent medications, or other conservative treatments received during follow-up. In addition, the study population included mixed degenerative lumbar radicular pathologies, including lumbar spinal canal stenosis and degenerative LDH, which may have differed in treatment response. A mixed-effects longitudinal model may have provided greater flexibility for handling within-subject correlation and unequal follow-up structures; however, repeated measures ANOVA was selected because all participants completed scheduled follow-up assessments, and outcome measurements were obtained at fixed time points.

Future multicenter studies with larger sample sizes, longer follow-up periods, and comparative study designs are recommended to further evaluate the clinical outcomes of SNRB and to identify factors associated with symptom recurrence and long-term treatment response.

## Conclusion

SNRB was associated with short- to mid-term improvements in pain intensity and functional outcomes among patients with degenerative lumbar radicular disorders during the 6-month follow-up period. However, symptom recurrence was frequently observed at 6 months after treatment, suggesting that the beneficial effects of SNRB may decrease over time in some patients. Therefore, SNRB may serve as a minimally invasive treatment option for temporary

symptom control in selected patients who are unwilling or are not suitable for surgical intervention.

## Acknowledgement

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## Author Contributions

YD contributed to study conception and design, data collection, statistical analysis, interpretation of data, manuscript drafting, and final approval of the manuscript.

## Clinical Trial Registration

This study was not registered in a clinical trial registry because it was conducted as a single-arm prospective interventional study without randomization.

## Conflicts of Interest

The author declares no conflict of interest.

## Data Available Statement

Due to institutional and ethical restrictions, the datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author upon reasonable request

## Ethics Approval and Consent to Participate

This study was approved by the Human Research Ethics Committee, Office of Public Health, Suphan Buri Province, Ministry of Public Health, Thailand (Full Board review; Approval No. 57/2566). Written informed consent was obtained from all participants before enrollment in the study.

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This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Use of Artificial Intelligence

Institutional language translation services from Khon Kaen University together with artificial intelligence-assisted tools, were used only for language translation and grammatical improvement. The author reviewed and approved all final contents and takes full responsibility for the manuscript.

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