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# Use of herbal products and associated factors among patients with non-communicable diseases in a rural northern Thai community: A cross-sectional study

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## ABSTRACT

This cross-sectional study investigated the prevalence of herbal product use and associated factors among patients with non-communicable diseases (NCDs) in the community of Phayao province via home visits. Data were collected from 361 patients at three sub-district health-promoting hospitals using a developed structured questionnaire. Descriptive analysis and multivariable logistic regression were established. The results showed that 61.2% of patients used herbal products, totaling 398 items, with herbal extracts being the most common (30.4%). The primary purpose was treating or relieving symptoms of illness. Factors associated with increased herbal use included age over 60 years (aOR 2.11; 95% CI 1.14–3.91), monthly income below 10,000 THB (aOR 3.47; 95% CI 1.27–9.52), former smoking status (aOR 5.78; 95%CI 1.31–25.50), use of multiple health centers (aOR 2.46; 95% CI 1.55–3.92), receiving treatment at private hospitals/clinics (aOR 6.08; 95% CI 1.15–32.07), and obtaining information about herbal products from social media (aOR 3.49; 95%CI 1.87–6.52). Herbal product use is prevalent among rural patients with NCDs in Thailand. Influencing factors include patient characteristics (older age, former smoking), socioeconomic status, healthcare utilization patterns, and information sources. Healthcare providers should be aware of these trends to ensure safe and effective patient care for NCDs in rural settings.

**Keywords:** herbal product; non-communicable disease; community

## 1. INTRODUCTION

In Thailand, traditional medicine, such as Thai traditional medicine and traditional Chinese medicine, is a popular alternative treatment option. Herbs and herbal products are used mainly in traditional medicines. In the last few years, herbal products have been promoted by the Thai government, and more items have been listed in the National List of Essential Medicine (Department of Thai Traditional and Alternative Medicine, 2016; Ministry of

Public Health, 2017; The Office of the National Economic and Social Development Council, 2017; The National Committee on Drug System Development, 2023). Moreover, the COVID-19 pandemic, emerging infectious diseases, and the inadequacy of approved medicines has resulted in the increasing importance of herbs and herbal products. Many herbs and herbal products can be easily obtained. They are locally available and inexpensive. Many herbs are even grown in household gardens. Herbal products are available in drug stores, convenience stores, and online shopping platforms. Herbs and herbal products are sought and used not only for curing but also for nourishment and protection. Some people use herbal products because they do not believe in the benefits of conventional medicine. They may experience the negative effects of conventional medicine, cannot afford conventional medicine or health facilities, and/or want to try new options (Tangkiatkumjai et al., 2014).

An important factor that increases the use of herbal products instead of conventional medicine is the presence of chronic diseases, particularly in patients who regularly use conventional medicines to manage and control their conditions (Peltzer & Pengpid, 2019; Kanjanahattakij et al., 2019). However, the use of herbal products may have positive or negative effects on health (Prasopthum et al., 2022; Kanjanahattakij et al., 2019). For example, easily accessible products may be used by patients without sufficient understanding or concern for efficacy and safety issues. Negative effects might include the reduced effectiveness of conventional drugs and potential toxicity of herbal products or conventional medicines due to herb-drug interaction (Ploylearmsang et al., 2022; Prasopthum et al., 2022). It has been reported that patients who take bisoprolol with peppermint oil may experience reduced blood pressure control from the medication. The use of *Curcuma longa* in patients taking amlodipine and enalapril may result in a decrease in drug concentration and an increased risk of bleeding when combined with aspirin (Ploylearmsang et al., 2022).

Non-communicable diseases (NCDs) are important features that encourage the use of herbal products. NCDs are referred to as diseases with long-term medical conditions, and the disease progressions are slow. Most NCDs are non-infectious and are the result of many factors including genetic, environmental, sociodemographic, self-management, and medical conditions (Budreviciute et al., 2020). A prior study found that 35.9% of Thai NCD patients use herbal products (Peltzer & Pengpid, 2019). The common purposes of herbal use in patients with NCDs include disease control (reduced blood pressure, blood sugar, and lipid-lowering) and health restoration (Peltzer & Pengpid, 2019; Ploylearmsang et al., 2022; Wiwatkunupakarn et al., 2024). Patients with type 2 diabetes mellitus frequently reported using pandan leaf and bitter gourd to reduce blood sugar (Ploylearmsang et al., 2022). *Allium sativum* was reported as a widely used herb for the reduction of blood pressure (Wiwatkunupakarn et al., 2024).

The difference in herbal use behavior between patients living in rural and urban areas was reported in a previous study. The prevalence of herbal use in patients with hypertension in rural areas was higher than in urban settings. Rural patients with hypertension reported a significantly longer duration of herb use and a significantly higher proportion of using unapproved herbal products. Rural patients are more likely to take their medications at the wrong time. Although a previous study reported patients mostly used herbs in combination with standard treatment, 11.5% of herbal use patients switched between herbs and medication, and 1.6% discontinued medication use (Wiwatkunupakarn et al., 2024).

The Phayao Province Development Plan 2018–2022 (2020 revision) identifies NCDs as a major healthcare issue in Phayao (Provincial Administration Committee Integrated Phayao Province, 2018) that affect patients' health and daily lives, both physically and mentally (Sangsrijan et al., 2018). Additionally, the COVID-19 pandemic caused many people's incomes to be negatively impacted. Therefore, using herbal products instead of conventional medicines could be another way to reduce healthcare expenditures and decrease conventional medicine consumption, which minimizes adverse drug reactions from these medicines (Güngör & Baykal, 2023). No reports exist about herbal products used among patients with NCDs in Phayao communities. As the number of NCD cases rises continuously, herbal product use among these patients might affect treatment or disease conditions.

This study aimed to investigate the prevalence of herbal product use and related factors among patients with NCDs in Phayao province. The patterns, purposes of herbal usage, and types of herbal product use were also examined. An observational cross-sectional study was conducted. The findings should provide useful information for healthcare providers and policymakers, particularly those in primary care units and community hospitals, to inform future herbal product promotion plans among patients with NCDs.

## 2. MATERIALS AND METHODS

This study aimed to investigate the prevalence, behavior, and factors associated with the use of herbal products among NCD patients living in Phayao province, northern Thailand. In this study, herbal use is defined as the use of herbs, herbal products, and dietary supplements for medicinal, supplementary, and cosmetic purposes in the previous six months. Data were collected through home visits in the areas of three sub-district health-promoting hospitals, including Pasang, Mae Ing, and Rongkamluang, located in Muang Phayao district, Phayao province, from November 2022 to February 2023.

A cross-sectional study using a structured questionnaire was conducted. After development and validation, the questionnaire was administered via face-to-face interviews. The study protocol was designed to prevent ethical issues and was approved by the University of Phayao Human Ethics Committee (approval ID: UP-HEC 1.2/012/65) prior to the commencement of the study.

### 2.1 Sample and sampling procedure

The sample size was determined based on the number of NCD patients in Phayao province (Ministry of Public Health, 2016). The sample size was calculated using Cochran's method (Israel, 2003) and was determined to be at least 353 patients with NCDs to detect an expected proportion of 35.9% for herbal use among these groups. The required sample size to identify the factors related to herbal product use was calculated from 10

events per variable for at least 20 variables (Peduzzi et al., 1996); a minimum of 200 patients was required. To prevent missing data collection, the sample size was set to 360. The inclusion criteria in this study included NCD patients who were diagnosed at least 6 months prior and were living in Phayao. Exclusion criteria comprised patients who had impaired communication, those without a caretaker and those who refused to participate in the study.

According to data from the Phayao Provincial Public Health Office, there are 95 sub-district health-promoting hospitals (Phayao Provincial Public Health Office, 2022a, 2022b). Information obtained by the Provincial Administration Committee Integrated Phayao Province shows no demographic differences within the population of Phayao (Budreviciute et al., 2020). Therefore, three sub-district health-promoting hospitals were considered.

A two-stage sampling method was employed in this study. First, three sub-district health-promoting hospitals were randomly selected from the 95 such hospitals in Phayao province using an online random number generator. Second, a total of 120 patients were randomly sampled from each selected hospital, with the number of patients from each village proportionate to the total number of NCD patients in that village.

### 2.2 Questionnaire development and validation

A structured questionnaire was developed for data collection, covering three main areas: (i) respondent demographic data, (ii) the behavior of using herbal products, and (iii) the factors influencing the use of herbal products. The questionnaire items were validated by three experts (two from the Division of Social and Administrative Pharmacy and one from the Department of Applied Thai Traditional Medicine, University of Phayao) using the Item-Objective Congruence (IOC) method. Items with an IOC score below 0.5 were revised or removed. The mean IOC of all items was 0.73 (SD 0.29). Before data collection, the questionnaire was pilot tested by trained research assistants using face-to-face interviews with 10 NCD patients.

### 2.3 Data collection and analysis

Demographic characteristics, pattern of herbal products use, and key factors influencing the use of herbal products were collected using the developed questionnaire.

Demographic characteristics and data on herbal product use behavior were presented using descriptive statistics. For the analysis of factors associated with herbal product use among patients with NCDs, variables with a p-value less than 0.2 in the univariable logistic regression analysis were included in the multivariable logistic regression model. A p-value of below 0.05 was considered statistically significant.

To assess the accuracy and discriminative ability of the final model, a receiver operating characteristic (ROC) curve analysis was performed. The area under the ROC curve (AUC) and its 95% confidence interval were calculated to quantify the model's predictive performance, with higher AUC values indicating better discrimination. All statistical analyses, including the ROC curve analysis, were performed using Stata version 18.

## 3. RESULTS AND DISCUSSION

### 3.1 Participants and prevalence of herbal product usage

This study collected data from a total of 361 participants with NCDs from three districts of Phayao province. Most of the participants, specifically 68.98%, were female, and most (74.52%) were over 60 years old of age. The average age of all participants was 66 years (SD 10.35). More than half of the participants (60.94%) had attained only a primary education, while 13.30% had no formal education. In addition, 74.79% reported a monthly income of less than 10,000 THB, and 7.20% had no income at all. The median number of underlying diseases was 2 (IQR 1–3). Hypertension was the most prevalent condition (89.20%), followed by dyslipidemia (59.83%) and diabetes mellitus (39.34%). Regarding healthcare utilization, 58.73% of participants accessed only one health care service, while 29.92% accessed two services. A maximum of five different services was reported among participants. Most patients sought care at sub-district health-promoting hospitals which are the primary care level of the hospital, while 16.90% received care at general hospitals. Further demographic details of the participants are presented in Table 1.

Among 361 participants, 221 individuals (61.22%) reported using herbal products, while 140 patients (38.78%) did not. This data suggests that the number of participants using herbal products was approximately 1.6 times greater than those who did not use them. A significant difference in herbal product use was observed according to income, participants with an incomes lower than 10,000 THB reported the highest prevalence of use (68.52%), compared to those with higher incomes (36.92%) those with no earnings (46.15%) ($p$<0.001). Furthermore, the frequency of herbal product use increased with the number of healthcare services attended, 48.58% among those visiting only one healthcare service, 74.07% among those visiting two and 92.68% among those visiting three or more services ($p$<0.001). However, No significant differences in herbal product use were found by gender, age group, education level, occupation, health care coverage schemes, smoking, alcohol consumption, number of disease or type of disease.

**Table 1.** Demographic characteristics of patients with NCDs and herbal products use (n = 361)

| Characteristics | Total n = 361 | Herbal product usage: n (%) | | *P-value** |
|---|---|---|---|---|
| | | Use (n = 221) | Non-use (n = 140) | |
| **Gender** | | | | |
| Male | 112 (31.02) | 67 (30.32) | 45 (32.14) | 0.715 |
| Female | 249 (68.98) | 154 (69.68) | 95 (67.86) | |

**Table 1.** Demographic characteristics of patients with NCDs and herbal products use (n = 361) (continued)

| Characteristics | Total n = 361 | Herbal product usage: n (%) | | *P*-value* |
|---|---|---|---|---|
| | | Use (n = 221) | Non-use (n = 140) | |
| **Age (years old)** | | | | |
| Less than 60 | 92 (25.48) | 49 (22.17) | 43 (30.71) | 0.070 |
| 60 or more | 269 (74.52) | 172 (77.83) | 97 (69.29) | |
| **Educational level** | | | | |
| No formal education | 48 (13.30) | 28 (12.67) | 20 (14.29) | 0.158 |
| Lower than primary school | 220 (60.94) | 144 (65.16) | 76 (54.29) | |
| Primary school | 60 (16.62) | 30 (13.57) | 30 (21.43) | |
| Higher than primary school | 33 (9.14) | 19 (8.60) | 14 (10.00) | |
| **Occupation** | | | | |
| None | 154 (42.66) | 95 (42.99) | 59 (42.14) | 0.546 |
| Agriculture/cattleman/fishery | 129 (35.73) | 83 (37.56) | 46 (32.86) | |
| Self-employed/merchant | 25 (6.93) | 15 (6.79) | 10 (7.14) | |
| Other | 53 (14.68) | 28 (12.66) | 25 (17.86) | |
| **Average monthly income** | | | | |
| No income | 26 (7.20) | 12 (5.43) | 14 (10.00) | <0.001 |
| Lower than 10,000 THB | 270 (74.79) | 185 (83.71) | 85 (60.71) | |
| More than 10,000 THB | 65 (18.01) | 21 (10.86) | 41 (29.29) | |
| **Medical benefit scheme** | | | | |
| Universal coverage scheme | 341 (94.46) | 208 (94.12) | 133 (95.00) | 0.721 |
| Other | 20 (5.54) | 13 (5.88) | 7 (5.00) | |
| **Caregiver** | | | | |
| None | 349 (96.68) | 212 (95.93) | 137 (97.86) | 0.319 |
| Yes | 12 (3.32) | 9 (4.07) | 3 (2.14) | |
| **Smoking** | | | | |
| Never | 303 (83.93) | 180 (81.45) | 123 (87.86) | 0.079 |
| Former smoking | 27 (7.48) | 22 (9.95) | 5 (3.57) | |
| Current smoking | 31 (8.59) | 19 (8.60) | 12 (8.57) | |
| **Alcohol consumption** | | | | |
| Never | 247 (68.42) | 143 (64.71) | 104 (74.29) | 0.130 |
| No drinking in the previous 6 months | 13 (3.60) | 10 (4.52) | 3 (2.14) | |
| Current drinking | 101 (27.98) | 68 (30.77) | 33 (25.78) | |
| **Number of underlying diseases** | | | | |
| 1 disease | 105 (29.09) | 62 (28.05) | 43 (30.71) | 0.808 |
| 2 diseases | 149 (41.27) | 91 (41.18) | 58 (41.43) | |
| 3 diseases | 82 (22.71) | 50 (22.62) | 32 (22.86) | |
| 4 diseases | 20 (5.54) | 14 (6.33) | 6 (4.29) | |
| 5 diseases | 5 (1.39) | 4 (1.81) | 1 (0.71) | |
| **Number of current health center services** | | | | |
| 1 health center | 212 (58.71) | 103 (46.61) | 109 (77.86) | <0.001 |
| 2 health centers | 108 (29.92) | 80 (36.20) | 28 (20.00) | |
| 3 health centers or more | 41 (11.36) | 38 (17.19) | 3 (2.14) | |

* Chi-square test

## 3.2 Type and pattern of herbal product usage

Among the 221 NCD patients who reported using herbal products, a total of 49 different types of herbal products were identified, amounting to 398 individual items. Products derived from herbal extracts were the most commonly used, accounting for 30.4% of all items. Examples include herbal patches, essential oil-based balms, herbal toothpaste, herbal massage oils, natural extracts of vitamin C, and fish oil. This was followed by herbal remedy products in form of reconstituted powders for oral solutions targeting digestive system conditions (13.3%) and circulatory system condition (12.6%). Herbal products that combined two or more types of non-extract-based products accounted for 11.8%, and

Kariyat (*Andrographis paniculata*) accounted for 6.5%. Additionally, there were 45 other herbal products, each with a usage rate of less than 5%. The types of herbal products used among NCD patients are presented in Table 2.

The median number of herbal products used per patient was two, with a maximum of six items per patient. Among all herbal product items, 49.2% were reported as being used regularly, while 50.8% were used occasionally.

The majority of all herbal product items (270 items, 67.8%) were obtained through purchases, with 81.8% of the purchased items (221 items) costing no more than 100 THB each. Additionally, 32.2% (128 items) of herbal products were sourced from personal gardens or received without need for purchase. The primary sources of herbal products included personal cultivation, gifts from acquaintances, as well as purchases from local markets, shopping stores, convenience stores, and drugstores.

**Table 2.** The list of all types of herbs and herbal products used in patients with NCDs (n = 398 items)

| Herb/herbal product | n (%) |
|---|---|
| Products derived from herbal extracts | 121 (30.4) |
| Thai traditional herbal powder for gastrointestinal disorders | 53 (13.3) |
| Thai traditional herbal aromatic powder for increasing blood flow | 50 (12.6) |
| Crude herbal mixture | 47 (11.8) |
| Kariyat *(Andrographis paniculata)* | 26 (6.5) |
| Kratom *(Mitragyna speciosa)* | 10 (2.5) |
| Ginger *(Zingiber officinale)* | 9 (2.3) |
| Cannabis *(Cannabis sativa L.)* | 7 (1.8) |
| Thai traditional herbal powder for musculoskeletal pain | 7 (1.8) |
| Snake grass *(Clinacanthus nutans)* | 6 (1.5) |
| Phlai | 5 (1.3) |
| Hop headed barleria | 5 (1.3) |
| Pandan leaf | 4 (1.0) |
| Jiaogulan | 4 (1.0) |
| *Aloe vera* | 3 (0.8) |
| Mulberry leaf | 3 (0.8) |
| Curcumin | 2 (0.5) |
| Bitter gourd | 2 (0.5) |
| Tamarind | 2 (0.5) |
| Reishi mushroom | 2 (0.5) |
| Bael | 2 (0.5) |
| Betel nut | 1 (0.2) |
| Bitter leaf | 1 (0.2) |
| Black galanga | 1 (0.2) |
| Black sesame | 1 (0.2) |
| Butterfly pea | 1 (0.2) |
| Chrysanthemum | 1 (0.2) |
| Coffee mixed with herbs | 1 (0.2) |
| Collagen | 1 (0.2) |
| Fingerroot | 1 (0.2) |
| Green tea mixed with herbs | 1 (0.2) |
| Guava leaf | 1 (0.2) |
| Hemp | 1 (0.2) |
| Kaffer lime | 1 (0.2) |
| Laurel clock vine | 1 (0.2) |
| Lime | 1 (0.2) |
| Longan | 1 (0.2) |
| Lotus root | 1 (0.2) |
| Neem | 1 (0.2) |
| Peperomia | 1 (0.2) |
| River-spiderwort | 1 (0.2) |
| Sacha inchi | 1 (0.2) |
| Senna | 1 (0.2) |
| Sodium chloride* | 1 (0.2) |
| Traditional fermented tea leaf | 1 (0.2) |
| Veld grape | 1 (0.2) |
| Wax leaved climber | 1 (0.2) |
| Wormwood | 1 (0.2) |
| Yanang leaf | 1 (0.2) |

### 3.3 Purposes of herbal product usage

The primary reason for choosing herbal products among the 221 patients with NCDs was to treat or alleviate symptoms of illness or abnormal conditions of the body (78.1%). Other common reasons included disease prevention and body nourishment (16.1%), and beauty purposes (5.5%). Other purposes that are not specified above included using herbal products as needed or for a refreshing sensation. The purposes and usage patterns of herbal products among respondents are detailed in Table 3. On the other hand, among the 140 patients with NCDs who had not use any herbal products in the past year, the main reasons for non-use were negative attitudes toward herbal products (77.1%), concerns related to their disease conditions or medication concerns (41.4%), and a lack of knowledge about herbal use (19.3%).

The majority of the NCD patients (97.5%) in this study were knowledgeable about herbal products. The most common sources of information about herbal products were television (75.1%), followed by relatives or acquaintances (61.2%), radio (54.0%), and social media (26.9%).

In contrast, only 19.1% of participants received herbal product information from medical staff at the hospital and just 4.4% obtained information from the pharmacist at drugstores.

**Table 3.** Purposes and patterns of herbal product usage in NCDs patients (n = 398 items of herbal product)

| Description | n (%) |
|---|---|
| **Purposes of using herbal products** | |
| Treatment of symptom and disease | 311 (78.1) |
| Disease prevention and body nourishment | 64 (16.1) |
| Beauty | 22 (5.5) |
| Other | 10 (2.5) |
| **Frequency of using herbal products** | |
| Regularly use | 196 (49.2) |
| Occasionally used | 202 (50.7) |
| **Sources of herbal products** | |
| Grow own or receiving without purchase | 128 (32.2) |
| Purchase | 270 (67.8) |
| **Frequency of herbal purchase (once in every) (n = 270)** | |
| First-time purchase | 23 (8.5) |
| Less than 1 month | 14 (5.2) |
| 1–3 months | 89 (33.0) |
| 4–6 months | 52 (19.3) |
| 6 months – 1 year | 73 (27.0) |
| More than 1 year | 19 (7.0) |
| **Expenditure on herbal products (n = 270)** | |
| Less than 100 THB | 221 (81.8) |
| 100–500 THB | 40 (14.8) |
| 501–1000 THB | 4 (1.5) |
| More than 1000 THB | 5 (1.8) |

### 3.4 Factors influencing herbal product usage

The multivariable logistic regression analysis revealed several factors significantly associated with herbal product use among patients with NCDs in this study (Table 4). The ROC of the last model was 0.81 (95% CI 0.76–0.85). Patients aged 60 years or older were more likely to use herbal products compared to those under 60 (aOR 2.11; 95% CI 1.14–3.91). Patients with a monthly income below 10,000 THB had higher odds of using herbal products than those with no income (aOR 3.47; 95% CI 1.27–9.52). Former smokers were more likely to use herbal products compared to current smokers (aOR 5.78; 95% CI 1.31–25.50), while those who never consumed alcohol had lower odds of herbal product use than current drinkers (aOR 0.51; 95% CI 0.28–0.93). Receiving healthcare services from multiple health centers was associated with increased herbal product use (aOR 2.46; 95% CI 1.55–3.92). Patients who received treatment at a private hospital or clinic had significantly higher odds of using herbal products compared to those who did not (aOR 6.08; 95% CI 1.15–32.07). The source of information about herbal products also influenced their use. Patients who received information from television were less likely to use herbal products (aOR 0.25; 95% CI 0.13–0.48), while those who obtained information from social media had higher odds of using herbal products (aOR 3.49; 95% CI 1.87–6.52).

These findings suggest that patient demographics, health behaviors, healthcare utilization patterns, and sources of herbal product information all contribute to shaping herbal product use among patients with NCDs in this rural Thai community.

**Table 4.** Factors associated with the use of herbal products by patients with NCDs (n = 361)

| Factors | Crude odd ratio (95% CI) | *P*-value | Adjusted odd ratio (95% CI) | *P*-value |
|---|---|---|---|---|
| **Age (year old)** | | | | |
| less than 60 | reference | | reference | |
| 60 or more | 1.56 (0.96–2.51) | 0.071 | 2.11 (1.14–3.91) | 0.018 |
| **Average monthly income** | | | | |
| No income | reference | | reference | |
| Lower than 10,000 THB | 2.54 (1.13–5.72) | 0.025 | 3.47 (1.27–9.52) | 0.016 |
| More than 10,000 THB | 0.68 (0.27–1.72) | 0.417 | 1.29 (0.42–3.93) | 0.654 |
| **Smoking** | | | | |
| Current smoking | reference | | reference | |
| Former smoking | 2.78 (0.83–9.32) | 0.098 | 5.78 (1.31–25.50) | 0.020 |
| Never | 0.92 (0.43–1.97) | 0.839 | 1.59 (0.65–3.90) | 0.313 |
| **Alcohol consumption** | | | | |
| Current drinking | reference | | reference | |
| No drinking in the previous 6 months | 1.62 (0.42–6.27) | 0.487 | 0.42 (0.08–2.33) | 0.323 |
| Never | 0.67 (0.41–1.08) | 0.103 | 0.51 (0.28–0.93) | 0.027 |
| **Number of current health center that patients receive a service** | 3.20 (2.15–4.76) | <0.001 | 2.46 (1.55–3.92) | <0.001 |
| **Seeking care in private hospital or clinic** | | | | |
| No | reference | | reference | |
| Yes | 11.26 (2.65–47.83) | 0.001 | 6.08 (1.15–32.07) | 0.033 |
| **Receiving herbal information via television** | | | | |
| No | reference | | reference | |
| Yes | 0.31 (0.17–0.54) | <0.001 | 0.25 (0.13–0.48) | <0.001 |
| **Receiving herbal information via social media** | | | | |
| No | reference | | reference | |
| Yes | 2.08 (1.24–3.46) | 0.005 | 3.49 (1.87–6.52) | <0.001 |

ROC = 0.81 (95% CI 0.76–0.85)
Reference = reference category (the comparator for the odds ratios)

This study examines the prevalence of herbal use among patients with NCDs in the communities of Phayao province, specially within the context of home visits. The majority of participants were older females who lived in rural areas. The survey results revealed a relatively high prevalence of herbal product use among this group (61.2%). This prevalence is higher than that reported in a previous study conducted at Thai healthcare facilities, where only 35.9% of participants used herbal products. The difference may be attributed to variations in study methodology, such as home interviews in the present study compared to hospital-based interview by healthcare personnel in earlier research. Moreover, differences in the research locations could influence participants' lifestyles, attitudes, and herbal product usage behaviors. Additionally, 'herbal use' in this study was defined as the use of all herbs, herbal products, and dietary supplements for medicinal, supplementary, and cosmetic purposes, which may differ from the previous study that focused solely on the use of herbs for medical purposes (Peltzer & Pengpid, 2019). However, the prevalence of herbal product use in this study was comparable to a previous study conducted in Phayao province, where the prevalence rate was 87.7% (Mueangchang, 2016). The data from both the current study and the previous study indicate that patients with NCDs in rural areas have a high prevalence of herbal product use. Similarly, medical herbs were shown to be the most prevalent alternative medicine used by patients with NCDs in an urban setting (Nailwal et al., 2021). Furthermore, the recent coronavirus disease 2019 (COVID-19) pandemic, which resulted in reduced or lost income for many individuals, may have influenced people to seek herbal medications as an alternative to treat, prevent, and relieve various health conditions.

Several types of herbal products were identified in this study, including those derived from herbal extracts, Thai traditional herbal medicine, and crude herbal mixtures, which were used both for the treatment and prevention of various illnesses among patients. Consistent with previous findings among rural Thai populations, the medicinal plants consumed by patients with NCDs were used as preventive or therapeutic options for conditions, such as diabetes, hypertension, chronic respiratory conditions, and kidney disease (Nguanchoo et al., 2023). Most of the herbal products reported in this study were sourced from plants cultivated in personal gardens or received from acquaintances and relatives. The cost of purchasing was inexpensive, typically below 100 THB per item. Although these herbs are usually considered safe and affordable, their use among patients with chronic conditions warrants caution. For example, the use of cannabis should be carefully considered in individuals at high risk for cardiovascular events (Yang et al., 2022). Herb-drug interactions also require consideration; concomitant use of ginger with anti-diabetic medications can increase the risk of hypoglycemia

(Stanger et al., 2012; Spolarich & Andrews, 2007). Additionally, ginger enhances the adverse effects of anticoagulants and antiplatelets (Hui et al., 2009).

Our findings indicate that several factors are associated with herbal use among patients with NCDs. Patients aged 60 or older were nearly twice as likely to use herbal products compared to younger groups. However, this study did not examine the specific reasons behind this association. The controversial impact of this factor may arise from variances in environment and personal experience (Nailwal et al., 2021). Nevertheless, older people typically have a higher prevalence of underlying illnesses compared to younger people. According to the results by Nguanchoo et al. (2023), this population may use herbal medicine as an alternate treatment (Nguanchoo et al., 2023). Patients with NCDs who had an average monthly income less than 10,000 THB were more likely to use herbal products compared to those with no income (aOR 2.54, 95% CI: 1.13–5.72). Patients with a monthly income higher than 10,000 THB demonstrated greater use of herbal products compared to those with no income (aOR 1.29, 95% CI: 0.42–3.93). However, this observation did not reach statistical significance due to the limited sample size of this group. This finding was consistent with previous studies conducted among patients with NCDs (Almogbel et al., 2022; Oyebode et al., 2016).

Smoking and alcohol consumption were significant factors associated with the use of herbal products among patients with NCDs. Former smokers were about six times more likely to use herbal products compared to current smokers. Health problems that could be the cause of stopping smoking may justify the selection of herbal products. In contrast, patients who do not consume alcohol are less likely to use herbal products compared to patients who currently consume alcohol. Further clarification remains necessary to identify the actual underlying cause.

The results also revealed a positive correlation between the increasing number of healthcare facilities and the likelihood that patients would use herbal products for medical treatment. In addition, patients who chose to receive treatment at a private hospital or clinic were approximately six times more likely to consume herbal supplements compared to patients who did not receive care at a private hospital. The simple reason is the greater financial resources or willingness to invest in for personal healthcare among this group of patients.

Awareness of herbal product information was a contributing factor to the use of herbal products. This study revealed that patients who receive information about herbal remedies from television were less likely to use herbal products, while those who accessed herbal product information through social media tended to have a higher prevalence of use among patients with NCDs. Advertising laws strictly control television advertising, whereas social media content is less monitored. However, the type and content of media that affect herbal use behavior were not identified in this study.

In addition, receiving information about herbal products from multiple channels may cause misunderstandings, resulting in the use of incorrect herbal products. Data from previous studies found that the perception of herbal product information from various channels was an additional factor affecting the attitudes, beliefs, thoughts, and motivation of people to use herbal products, which may result in the use of incorrect herbal products (Mueangchang, 2016; Deenoo et al., 2019). Our findings revealed that the sample group used several channels for obtaining herbal products. Products are sourced primarily from markets, shops, convenience stores, neighbors, relatives, or acquaintances and planted at home or in gardens. Patients tend to select herbal products without getting the correct advice from healthcare professionals. As a result, regularly used medications may cause undesirable interactions. Additionally, there could be adverse effects on several physiological systems.

To prevent the use of improper herbal products, it is important to enforce advertising regulations on social media, overseen by the Thai FDA. Moreover, accurate and reliable information regarding the proper use of herbal supplements should be clearly presented on social media platforms.

### 3.5 Study strengths and limitations

The current study investigated the prevalence and pattern of herbal product consumption among patients with NCDs in rural areas through home visits. The factors related to the usage of herbal medicine were also explored. This study provided a comprehensive overview and generated valuable insights regarding the use of herbal products among patients with NCDs.

However, several limitations should be mentioned. First, data collection was conducted randomly from sub-district health-promoting hospitals, which may have resulted in a sample group with limited diversity. Therefore, future research should expand data collection to include a wider variety of hospitals and healthcare settings to obtain more representative samples covering several chronic NCDs. Second, the data collection did not show a distributed age range because home visits were the primary method of data collection, and elderly patients are more likely to be at home. This study may represent herbal use in elderly NCD patients. Therefore, further study should aim to include a broader age range to better capture patterns of herbal use across different life stages. Third, this study did not collect in-depth information regarding whether participants informed their healthcare providers about their use of herbal products when accessing medical care. As a result, healthcare providers may not have been able to provide advice on the proper use of herbal products. Thus, it is recommended that healthcare professionals routinely inquire about herbal product use and provide appropriate education, especially for patient with NCDs. Moreover, accurate and evidence-based knowledge about herbal product use should be promoted through social media channels, which are the major source of herbal information reported in this research. This study did not evaluate the appropriateness of herbal product use, negative effects, or experience with adverse events. These issues should be studied further in the area due to the high prevalence of herbal product use.

## 4. CONCLUSION

The prevalence of herbal product use among patients with NCDs in the rural community was found to be high. Factors associated with an increased likelihood of herbal product use included being over 60 years of age, having a monthly income of less than 10,000 THB, being a former smokers, utilizing services from multiple health centers, choosing to receive treatment at a private hospital or clinic, and obtaining

information about herbal products from social media. In contrast, non-use of alcohol and obtaining information from television were associated with reduced herbal product use in this population. Healthcare providers should be mindful of these trends to ensure safe and effective patient care, especially for patients with NCDs in rural settings.

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## REFERENCES

Almogbel, E. S., AlHotan, F. M., AlMohaimeed, Y. A., Aldhuwayhi, M. I., AlQahtani, S. W., Alghofaili, S. M., Bedaiwi, B. F., & AlHajjaj, A. H. (2022). Habits, traditions, and beliefs associated with the use of complementary and alternative medicine among diabetic patients in Al-Qassim Region, Saudi Arabia. *Cureus*, *14*(12), Article e33157. https://doi.org/10.7759/cureus.33157

Budreviciute, A., Damiati, S., Sabir, D. K., Onder, K., Schuller-Goetzburg, P., Plakys, G., Katileviciute, A., Khoja, S., & Kodzius, R. (2020). Management and prevention strategies for non-communicable diseases (NCDs) and their risk factors. *Frontiers in Public Health*, *8*, Article 574111. https://doi.org/10.3389/fpubh.2020.574111

Deenoo, S., Mattavangkul, C., Kawitu, K., & Sinwannakool, S. (2019). Factor related to herbal use behavior for self-care among people in Phasi-Chareon district. *Journal of Nursing, Siam University*, *20*(39), 99–109. https://doi.org/10.14456/jnsu.v20i39.220474 [in Thai]

Department of Thai Traditional and Alternative Medicine. (2016, June 17). *National master plan on development of Thai herbs* (Report No. 1). Ministry of Public Health. https://www.dtam.moph.go.th/images/download/dl0021/MasterPlan-Thaiherb.pdf [in Thai]

Güngör, Ö., & Baykal, H. (2023). Attitudes toward herbal medicine for COVID-19 in healthcare workers: A cross-sectional observational study. *Medicine*, *102*(38), Article e35176. http://dx.doi.org/10.1097/MD.0000000000035176

Hui, H., Tang, G., & Go, V. L. W. (2009). Hypoglycemic herbs and their action mechanisms. *Chinese Medicine*, *4*, Article 11. https://doi.org/10.1186/1749-8546-4-11

Israel, G. D. (2003, August 2). *Determining sample size*. University of Florida Cooperative Extension Service. Institute of Food and Agriculture Sciences, EDIS. https://web.tarleton.edu/academicassessment/wp-content/uploads/sites/119/2022/05/Samplesize.pdf

Kanjanahattakij, N., Kwankhao, P., Vathesatogkit, P., Thongmung, N., Gleebbua, Y., Sritara, P., & Kitiyakara, C. (2019). Herbal or traditional medicine consumption in a Thai worker population: Pattern of use and therapeutic control in chronic diseases. *BMC Complementary and Alternative Medicine*, *19*, Article 258. https://doi.org/10.1186/s12906-019-2652-z

Ministry of Public Health. (2016, July 25). *The national strategy* (Report No. 2018–2037). Public Health Part. https://waa.inter.nstda.or.th/stks/pub/2017/20171117-MinistryofPublicHealth.pdf

Ministry of Public Health. (2017, July 26). *Standard reporting group: Major non-communicable diseases*. Public Health Part. https://hdcservice.moph.go.th/hdc/reports/page.phpcat_id=6a1fdf282fd28180eed7d1cfe0155e11&fbclid=IwAR3yAKvZVpjKTgcq_NOHuIxUEJuTKQvFiQn6mT8iNxvGAPcaqS6PaUdgxeY

Mueangchang, W. (2016). *Factors related to self treatment with herbal remedies of people in Mea Chai district, Phayao province* [Master's thesis, Thammasat University]. TU Digital Collections. https://doi.org/10.14457/TU.the.2016.1625 [in Thai]

Nailwal, D., Reddy B, V., & Gupta, A. (2021). Patterns and predictors of complementary and alternative medicine use in people presenting with the non-communicable disease in an urban health facility, North India. *Journal of Public Health Research*, *10*, Article 2109. https://doi.org/10.4081/jphr.2021.2109

Nguanchoo, V., Balslev, H., Sadgrove, N. J., & Phumthum, M. (2023). Medicinal plants used by rural Thai people to treat non-communicable diseases and related symptoms. *Heliyon*, *9*(1), Article e12758. https://doi.org/10.1016/j.heliyon.2022.e12758

Oyebode, O., Kandala, N.-B., Chilton, P. J., & Lilford, R. J. (2016). Use of traditional medicine in middle-income countries: A WHO-SAGE study. *Health Policy and Planning*, *31*(8), 984–991. https://doi.org/10.1093/heapol/czw022

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology*, *49*(12), 1373–1379. https://doi.org/10.1016/S0895-4356(96)00236-3

Peltzer, K., & Pengpid, S. (2019). The use of herbal medicines among chronic disease patients in Thailand: A cross-sectional survey. *Journal of Multidisciplinary Healthcare*, *2019*(12), 573–582. https://doi.org/10.2147/JMDH.S212953

Phayao Provincial Public Health Office. (2022a, August 13). *Number of service units under the office of the permanent secretary*. Ministry of Public Health Classified by Level of Nursing Facility. https://pyo.hdc.moph.go.th/hdc/reports/report.php?source=hospital/hospital1.php&cat_id=b415510618e13273b2f2918587f86e5d&id=67c3037f24c14781b03159583f5b7a58

Phayao Provincial Public Health Office. (2022b, August 13). *Summarize the number of outpatient data of sub-district health-promoting hospitals*. Ministry of Public Health Classified by Level of Nursing Facility. https://pyo.hdc.moph.go.th/hdc/reports/so_report.php?id=06c37818472cadb8a40faa8732bde66a&tb_name=service

Ploylearmsang, C., Kanjanasilp, J., Tadtiyanant, J., & Sisala, P. (2022). Promoting rational herb-drug use through pharmacy-led advice and home visits in NCD patients. *Pharmacy Practice*, *20*(4), Article 2747. https://doi.org/10.18549/PharmPract.2022.4.2747

Prasopthum, A., Insawek, T., & Pouyfung, P. (2022). Herbal medicine use in Thai patients with type 2 diabetes mellitus and its association with glycemic control: A

cross-sectional evaluation. *Heliyon*, *8*(10), Article e10790. https://doi.org/10.1016/j.heliyon.2022.e10790

Provincial Administration Committee Integrated Phayao Province. (2018, July 3). *Phayao provincial development plan (2018–2022) Annual Review 2020*. Provincial Administration Committee Integrated Phayao Province. http://www.oic.go.th/FILEWEB/CABINFOCENTER66/DRAWER028/GENERAL/DATA0000/00000715.PDF

Sangsrijan, S., Opasanant, P., & Katehom, M. (2018). Factors influencing health security of non-communicable diseases patients in Phayao province. *Journal of Nursing and Health Care*, *36*(3), 117–126. [in Thai]

Spolarich, A. E., & Andrews, L. (2007). An examination of the bleeding complications associated with herbal supplements, antiplatelet and anticoagulant medications. *Journal of Dental Hygiene*, *81*(3), Article 67.

Stanger, M. J., Thompson, L. A., Young, A. J., & Lieberman, H. R. (2012). Anticoagulant activity of select dietary supplements. *Nutrition Reviews*, *70*(2), 107–117. https://doi.org/10.1111/j.1753-4887.2011.00444.x

Tangkiatkumjai, M., Boardman, H., & Walker, D.-M. (2014). Herbal and dietary supplement use in Bangkok: A survey. *Journal of Complementary and Integrative Medicine*, *11*(3), 203–211. https://doi.org/10.1515/jcim-2013-0016

The National Committee on Drug System Development. (2023, May 4). *The national lists of essential medicines 2023*. Herbal products Division. https://herbal.fda.moph.go.th/

The Office of the National Economic and Social Development Council. (2017, May 4). *The twelfth national economic and social development plan (2017–2021)*. The Office of the National Economic and Social Development Council. https://www.nesdc.go.th/ewt_dl_link.php?nid=9641&filename=index

Wiwatkunupakarn, N., Aramrat, C., Sanguanwai, P., Choksomngam, Y., Gilder, M. E., Jiraporncharoen, W., McGready, R., & Angkurawaranon, C. (2024). The use of herbal medicine for hypertension in rural and urban Thailand: A cross-sectional study. *Journal of Herbal Medicine*, *47*, Article 100916. https://doi.org/10.1016/j.hermed.2024.100916

Yang, P. K., Odom, E. C., Patel, R., Loustalot, F., & Coleman King, S. (2022). Nonmedical marijuana use and cardiovascular events: A systematic review. *Public Health Reports*, *137*(1), 62–71. https://doi.org/10.1177/0033354920988285