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Original article

Self-Identified Effective Strategies for the Management of Adverse Drug Reactions to First-Line Anti-Tuberculosis Drugs

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Running title: Self-Identified ADR Management

Abstract

Objective: Adverse drug reactions are important factors in patients' discontinuation of antituberculosis drugs. Therefore, managing adverse drug reactions is vital to reducing the risk of tuberculosis transmission due to premature discontinuation of medications and increasing the chances of treatment success. We sought to explore self-identified, effective strategies for managing adverse drug reactions among newly diagnosed pulmonary tuberculosis patients.

Materials and Methods: This was a cross-sectional survey investigating the symptom management of adverse drug reactions among newly diagnosed pulmonary tuberculosis patients using first-line antituberculosis drugs.

Results: Participants (n=394) reported the three highest-rated, self-identified, and effective strategies based on mean scores, enabling them to continue taking antituberculosis drugs, were: 1) Applying cold powder to manage itching (mean±S.D. = 3.58±0.79), 2) Eating sour fruit to manage nausea (mean±S.D.= 3.11±0.87), and 3) Eating small, frequent meals to manage decreased appetite (mean±S.D.=3.15±0.69).

Conclusion: Self-identified effective strategies for adverse antituberculosis drug reactions can help patients continue taking antituberculosis drugs, decreasing disease severity.

Keywords: Adverse drug reaction, antituberculosis drugs, newly diagnosed pulmonary tuberculosis, self-identified effective strategies.

Introduction

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis*, which most often affects the lungs and is one of the top 10 causes of death worldwide from a single infectious agent¹. Globally, in 2024, there was an estimated total TB incidence of 10.7 million people. Of those, 8.3 million people were diagnosed with new causes and TB relapses. Eighty-four percent of these patients were diagnosed with pulmonary TB¹. TB continues to be an essential public health problem in Thailand. In 2024, the WHO ranked Thailand among the 30 countries with the highest TB burden¹. In Thailand, the Department of Disease Control (DDC) reported 80,932 diagnosed cases of TB in 2024, with a treatment success rate of 76.4%². This is less than the 90% success rate targeted by

the WHO¹. Various reasons have been given to explain the lower success rate, such as a lack of follow-up, transfer-in and transfer-out, relapses, and adverse drug reactions (ADRs) to antituberculosis drugs³.

ADRs are one of the reasons that newly diagnosed patients with pulmonary TB discontinue their antituberculosis drugs; thus, controlling ADR symptoms is a severe concern. The WHO has defined ADRs as a response to a harmful and unintended drug that occurs at doses typically used in humans for the prevention, diagnosis, or therapeutic treatment of disease or the modification of physiological function⁴.

ADRs are categorized as type A or B⁵. Type A: predictable adverse effects associated with an agent and related to the dose according to ideal body weight. Type B: reactions are atypical or unexpected reactions that cannot be anticipated based on the known pharmacology of medicine⁶. In this study, we focused on type A ADRs because the severity of type A can be effectively decreased using self-management strategies. According to the WHO, the recommended standardized antituberculosis regimens contain four medications as “first-line” drugs: isoniazid (H), rifampicin (R), pyrazinamide (Z), and ethambutol (E) for treating newly diagnosed pulmonary TB patients. The recommended treatment consists of an intensive phase and a continuation phase, with a 2-month initial phase with four drugs (RHZE) and a 4-month continuation phase with two drugs (RH)⁷.

The prevalence of ADRs in patients diagnosed with pulmonary TB from taking first-line antituberculosis drugs ranges from 8 % to 85 %⁸. Variations in the incidence of ADRs may result from multiple factors, such as differences in physician definitions, patient reporting practices, clinician detection, frequency of laboratory testing, and comorbid conditions⁸. The symptoms of ADRs, such as nausea, vomiting, peripheral neuropathy, and others, lead to patient discontinuation of antituberculosis drugs.⁸ In addition, a study in Ghana reveals that ADRs led 84.6% of patients to skip or miss medication and 15.4% to quit taking their prescriptions completely⁹. The incidence of minor or mild ADRs in patients treated with first-line antituberculosis drugs ranged from 5% to 20%, leading to treatment discontinuation¹⁰. Furthermore, a systematic analysis revealed that fear of ADRs contributed to Ethiopia's 21.3% rate of non-adherence to TB therapy¹¹. Thus, ADRs lead to patient hospital admissions¹². In contrast, patients who can adhere to the regimen of

antituberculosis drugs with effective ADR management strategies increase their chances of being cured, decrease the incidence and severity of symptoms, and lower transmission¹³.

Previous studies have shown that doctors counseled patients to change or reduce medication when encountering ADRs from first-line antituberculosis drugs¹⁴. Similarly, Amalba and Bugri found that all the patients with ADR symptoms were handled by healthcare professionals⁹. In cases of mild to moderate adverse reactions (e.g., dizziness), the Centers for Disease Control and Prevention (CDC) recommends using conservative management (e.g., treating dizziness with rest and oral fluids) and considering continuing treatment under observation. Moreover, Prasad et al. found that the symptoms-based approach to managing minor ADRs to first-line antituberculosis drugs does not require a stoppage of treatment¹⁵. The management reassured the patients, changing or reducing medication and a small amount of food in cases of gastrointestinal upset.

There are a limited number of studies related to the ADRs of first-line antituberculosis drugs in Thailand, and we found only one with a focus on symptom experience and symptom management strategies regarding the ADRs of antituberculosis drugs, but not specific to first-line antituberculosis drugs¹⁶. Therefore, research on the self-identified effective strategies for managing ADRs related to first-line antituberculosis drugs among newly diagnosed pulmonary TB patients was needed. This study's results will help decrease the number of relapses in patients who continue taking antituberculosis drugs.

We used a symptom management model created by Dodd et al. to guide this study. According to this model, symptom management has three interactive components: symptom experience, symptom management strategies, and outcome. The symptoms experienced address deviations from an individual's perception of their routine and their self-report about the severity and symptom effects, evaluation, and response to a symptom. Symptom management strategies are aspects of the individual's management strategies. The guidelines for investigators in choosing suitable intervention strategies are described as the "what, where, why, how much, to whom, and how," and intended to minimize the symptom experience. The outcomes component is what the individual may experience as the result of the symptom experience and/or symptom management strategies. This includes functional status, emotional status, self-care, costs, QOL, morbidity, and

comorbidity¹⁷. In this research, we focused on the components of symptom management strategies because patients can manipulate these components themselves. Consequently, we sought to explore self-identified effective strategies for managing ADRs among newly diagnosed patients with pulmonary TB.

Nurses and other healthcare providers caring for patients newly diagnosed with pulmonary TB may have no ADR experience, especially if it is the first time caring for those receiving antituberculosis drugs. Data on self-identified effective strategies for managing ADRs in newly diagnosed pulmonary TB patients would enable nurses to care for such patients more successfully. Therefore, this survey-based study addressed two research questions.

Research question 1: What are the self-identified effective strategies used to manage ADR symptoms among patients taking first-line antituberculosis drugs?

Research question 2: How does the use of multiple self-identified effective strategies compare to the use of a single strategy in managing ADR symptoms among patients taking first-line antituberculosis drugs?

Materials and Methods

Study Design

A cross-sectional survey was conducted to assess any self-identified effective strategies for ADR symptom management among newly diagnosed patients with pulmonary TB.

Participants and Study Setting

Participants attending a TB clinic at one of seven hospitals in Bangkok, Thailand, were recruited by purposive sampling. The inclusion criteria were: (1) Patients diagnosed with newly diagnosed pulmonary TB and currently undergoing treatment with a 2HRZE/4HR regimen at any point during the six-month course, (2) Aged 25 – 59 years, (3) Experienced at least one ADR symptom after receiving first-line antituberculosis drugs, (4) Speaks, reads, and understands the Thai language, (5) Had no cognitive impairment or disease complications, and (6) Willing to

participate. Participants were excluded if they had an active symptomatic illness (i.e., chest pain or coughing up blood or mucus) or were on antiretroviral therapy for HIV treatment.

Sample Size

The sample size was determined following the Taro Yamane (1973) sample size determination formula of $n = \frac{N}{1 + N(e)^2}$ where: N is the population size (3,325). A population size of 3,325 was derived from the newly diagnosed TB cases in Bangkok, Thailand, according to the National Tuberculosis Information Program report², and (e) is the significance level (0.05%), resulting in a sample size of 358, which included an added 10% (36 participants) to protect against data loss and the risk of having a sample size lower than the acceptable minimum¹⁸. To acquire the required statistical power, 394 participants were involved in the research.

Instruments

We developed a symptom management questionnaire based on the Symptom Management Model¹⁷ and the results of a relevant literature review. Content validity was determined by five experts: one infectiology instructor, one pharmacy instructor, one registered nurse, and two nursing instructors. The Content Validity Index (CVI) was calculated for the instrument. The CVI of the symptom management questionnaire was 0.89 in this study, which is acceptable if the $CVI \geq 0.80$ ¹⁹. Then, a pilot study was undertaken at a hospital to assess the feasibility of using the proposed instruments, and to evaluate data collection by researchers using face-to-face interviews at the TB clinic. Purposive sampling was employed to recruit a sample of 30 patients. The pilot study results were acceptable and demonstrated that the data collection procedures were feasible. The information for each instrument is as follows:

1. Demographic data questionnaire: the demographic information included biological sex, age, marital status, education, occupation, and type of health care coverage.
2. Symptom management questionnaire: the 35-item symptom management questionnaire was employed to assess self-identified effective strategies across two dimensions: management implementation and effectiveness. In this study, we defined “self-identified effective strategies” as the management methods that patients reported using based on their own experiences. The effectiveness of these strategies was then assessed by patients' self-ratings of how well each action

relieved their symptoms¹⁷. Perceived effectiveness was assessed using a two-step process. Participants first indicated whether they used each specific strategy (0 = no, 1 = yes). The internal consistency of this usage measure, as determined by Kuder-Richardson 20, was 0.96²⁰. For strategies that were utilized, participants rated effectiveness on a 5-point Likert scale from 1 (not at all effective) to 5 (extremely effective). A score of 1 indicated that the strategy was used but provided no or minimal relief. Participants who did not use a given strategy were excluded from the mean effectiveness calculations to avoid bias and ensure that the results reflected the actual user experience. Mean scores were categorized as follows: 4.50–5.00 (highest), 3.50–4.49 (high), 2.50–3.49 (moderate), 1.50–2.49 (low), and 1.00–1.49 (lowest).²¹ The internal consistency for the effectiveness scale, as measured by Cronbach's alpha, was acceptable at 0.97²⁰.

Data Collection

In this research, the researchers used a multi-stage sampling method. Stage 1: The 50 districts of Bangkok were divided into three zones based on location, using basic urban planning data: inner, middle, and outer districts²². Stage 2: The sample proportion was calculated to determine the sample size for each district, based on the population, using quota sampling. Stage 3: Hospital affiliations were identified to ensure broad representation. A non-replacement lottery method was then used to select specific affiliations²³. Stage 4: Within the selected affiliations, public hospitals in Bangkok were randomly selected based on affiliation using simple random sampling²³. Finally, in Stage 5, the researchers selected the sample group using purposive sampling based on the inclusion criteria²³.

Study team members screened medical records to determine study eligibility and collect patients' diagnoses at the TB clinics in selected hospitals in Bangkok, Thailand. Participants who met the inclusion criteria were approached personally by the primary investigator. Before obtaining consent, the primary investigator highlighted, in layman's terms, the advantages and dangers of the study and discussed the protection of participants' rights. All individuals who agreed to participate signed a consent form after being given a written description and further verbal information about the research project. Then, participants were asked to complete the two questionnaires during face-to-face interviews. Participants were able to refuse or leave without any consequences. The data-

gathering period was from January to April 2020. All information was protected and kept confidential on a password-protected computer.

Ethical Considerations

Prior to any research activities, ethics approval was obtained from five internal review boards (IRBs) at seven hospitals.

Data Analysis

The statistical analysis was conducted using a standard professional statistical software package. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize the demographic data and the self-identified effective strategies. An independent t-test was performed to compare mean scores between single and multiple strategies.

RESULTS

Sample Characteristics

A total of 394 respondents were recruited, all of whom completed the study. Most participants were male (62.2%), and the mean age of all participants was 42.3 ± 11.2 years. Over half of the participants were married (58.1%); over one-third had completed secondary school (36%), and less than 13% had completed college. In addition, almost half of the participants were unemployed (41.9%), and nearly half (47.2%) received the Universal Coverage Scheme (Table 1).

Research question 1: What self-identified effective management strategies are used to manage ADR symptoms among patients taking first-line antituberculosis drugs?

For the ten leading patient-reported ADR symptoms, the self-identified effective strategies are presented below, ranked by mean effectiveness scores: 1) Applying prickly heat cooling powder to manage itching (mean = 3.58; standard deviation (S.D.) = 0.79), 2) Eating general sour fruits, such as lemon, lime or orange juice, to manage nausea (mean = 3.11; S.D. = 0.87), 3) Eating small, frequent meals to manage decreased appetite (mean = 3.15; S.D. = 0.69), 4) Self-massage to manage numbness of the hands and feet (mean = 3.13; S.D. = 0.83), 5) Bathing regularly to manage rash (mean = 3.33; S.D. = 1.15), 6) Resting to manage fatigue (mean = 3.02; S.D. = 0.76), 7) Eating

small, frequent meals to manage nausea and vomiting (mean = 2.83; S.D. = 0.93), 8) Avoiding foods that aggravate symptoms to manage joint pain (mean = 3.75; S.D. = 0.88), 9) Avoiding drinks that may cause sleep disturbances (mean=3.60; S.D. =1.14), and 10) Applying balm to manage muscle pain (mean = 3.50; S.D. = 0.70) (Table 2).

Research question 2: How does the use of multiple self-identified effective strategies differ from the use of a single strategy in managing ADR symptoms among patients taking first-line antituberculosis drugs?

We compared the mean effective scores of single and combined strategies across various ADR symptoms. For each strategy, the mean and S.D. were used to rank. 1) Applying cooling powder with lotions had a higher mean score (mean =3.75; S.D. = 0.39) than using cooling powder alone (mean = 3.58; S.D. = 0.79) for managing itching, 2) Eating general sour fruit, such as lemon, lime or orange juice, and drinking more water had a higher mean score (mean =3.67; S.D. =1.44) than eating sour fruits only (mean = 3.11; S.D. =0.87) for managing nausea, 3) Eating small, frequent meals and eating a variety of general foods had a higher mean score (mean =3.50; S.D. = 0.70) than eating small, frequent meals only (mean = 3.15; S.D. =.69) for managing decreased appetite, 4) Self-massage and eating a diet with high energy density had a higher mean score (mean =3.28; S.D. = 0.80) than using self-massage only (mean = 3.13; S.D. = 0.83) for managing numbness of the hands and feet, 5) Bathing regularly and using body lotions (mean =2.50; S.D. = 0.70) had a lower mean score than only using regular bathing (mean = 3.33; S.D. = 1.15) for managing rash. In summary, the comparison of mean scores between using a single strategy and multiple strategies showed no statistically significant differences (p-value > .05), as detailed in Table 3.

DISCUSSION

The high mean scores for self-identified strategies indicate that patients prioritise strategies that are both accessible and manageable. The strategies' inherent practicality likely explains their high effectiveness ratings, as they empower patients to manage minor symptoms independently. By removing the financial burden and the logistical need for hospital visits for minor ailments, these patient-led approaches provide a model for ADR management²⁴.

Research Question 1: What self-identified effective management strategies are used to manage ADR symptoms among patients taking first-line antituberculosis drugs?

In answer to Research Question 1, the ten self-identified effective strategies were organized into three core domains as follows:

1. Dietary strategies include eating general sour fruit, eating small and frequent meals, avoiding foods that aggravate symptoms, and avoiding drinks that may cause sleep disturbances. When TB patients experience nausea, we suggest they consume general sour fruit or fruit juice such as oranges, lemons, limes, or orange juice between 1 and 4 hours after taking TB medication²⁵ because those fruits contain flavonoids. These natural compounds act as antioxidants that help prevent the destruction of cells and body tissues from free radicals and free oxygen, reducing gastric irritation from antituberculosis drugs²⁶. For patients with decreased appetite, we suggest eating six small meals daily instead of three larger ones²⁷ because this stimulates the metabolism and improves glucose and insulin control, resulting in an increased appetite²⁸. Moreover, eating more frequent, smaller meals may avoid impaired proximal gastric accommodation, overcome abnormal secretions of gastric acid and gut hormones, and promote redistribution of calories via the increased frequency of the smaller meals, which may aid in preventing vomiting, and limit the gastric emptying associated with large meals²⁹. If the TB patient experiences joint pain, we suggest avoiding foods that aggravate symptoms (e.g., poultry, bamboo shoots) because bamboo shoots, beef, and poultry can precipitate uric acid crystallization, which initiates, amplifies, and sustains an intense inflammatory attack of humoral and cellular mediators³⁰. For patients who experience sleep disturbances, we suggest avoiding tea or coffee after 2 pm and limiting any caffeine intake before bedtime³¹ since caffeine is an adenosine receptor antagonist. It mainly operates on A1 and A2 receptors related to sleep, arousal, and cognition-related brain activities³².

2. Topical application strategies include applying prickly heat cooling powder or balm. When TB patients experience itching as an ADR, we suggest applying prickly heat cooling powder after a bath at least two times per day because the cooling powder may stimulate the transient receptor potential melastatin-8 (TRPM8). TRPM8 is a cold receptor hypothesized to inhibit itch signal transmission, thus relieving itchiness³³. If TB patients experience muscle pain, we suggest applying balm at least twice daily because balm, a topical medication containing menthol, is a

selective activator of transient receptor potential TRPM8 channels, resulting in a cooling sensation. In addition, the balm acts as a counterirritant to reduce pain sensation³⁴.

3. Physical strategies include self-massage, bathing, and taking rest. If a TB patient experiences numbness, we suggest self-massage because it is a sensory integration technique that affects the activity of the autonomic nervous system, stimulates blood flow throughout the body, and allows more oxygen to reach the affected extremities³⁵. For rashes, we suggest bathing at least twice a day since a shower or bath may help prevent the skin from absorbing the oils that cause allergic reactions resulting in a rash³⁶. If patients feel fatigued, we suggest resting in the morning and afternoon. Antituberculosis drugs cause liver injury; the initial sign of this injury is fatigue. Rest is beneficial since it can help lower the risk of liver burden, reduce the patient's metabolic rate, enhance blood flow, and accelerate liver recovery³⁷.

Research question 2: How does the use of multiple self-identified effective strategies differ from the use of a single strategy in managing ADR symptoms among patients taking first-line antituberculosis drugs?

The use of dual strategies increased mean effectiveness scores in most symptoms; however, this did not constitute a statistically significant advantage over single-strategy management.

1. Dietary strategies include eating general sour fruit and drinking more water. To manage nausea, we suggest TB patients consume general sour fruit or fruit juice, such as oranges, or lemons, limes, or orange juice, between 1 and 4 hours after taking TB medication²⁵. Patients should also drink at least 6-8 glasses a day of water, and they should consume liquids slowly and frequently³⁸ because nausea is caused by increased gastric tachyarrhythmia, an abnormal electrical rhythm of the stomach, vagal withdrawal, and/or an improved sympathetic nervous system³⁹. Moreover, consuming sour fruit promotes the production of gastrointestinal and pancreatic secretions that help digestion and help avoid or reduce nausea⁴⁰. For decreased appetite, we suggest eating six small meals daily, instead of three larger ones, and eating a variety of general foods because the effect may describe the increased consumption noticed when various foods with varied sensory properties are consumed at the same time²⁷. The impact of meal variety may affect both the physiological and psychological processes that promote meal termination.

2. Topical application strategies also had a higher mean score in combination. Specifically, applying prickly heat cooling powder and using body lotions at least two times a day had a higher mean score in managing itchiness than either strategy alone. Applying prickly heat cooling powder stimulates the TRPM8; conversely, using cold powder and lotions may improve enhanced skincare and barrier repair⁴¹. Lotions with skin-similar lipids, combined with cold powders, will restore skin barrier function, increase skin hydration, and become an effective skin moisturizing option, which is also associated with the relief of itching⁴².

3. Physical strategies include self-massage and eating a diet with a high energy density for managing numbness of the hands and feet. Dietary nutrients are required for survival and maintaining normal body functions; macronutrients provide most of the energy needed, whereas micronutrients play a critical role in metabolism. While dietary nutrients cannot replace conventional therapies, a balanced diet rich in macronutrients may help slow the progression and severity of numbness in the hands and feet⁴³. In addition, self-massage has been found to enhance blood circulation, thus assisting in the reduction of hand and foot numbness³⁵.

The study's results inform nursing practice by highlighting effective, patient-led ADR management strategies. Integrating these findings into routine counselling enables nurses to support newly diagnosed TB patients in selecting relevant, accessible interventions, ultimately fostering greater self-reliance in managing symptoms.

Limitations

Due to the specific setting and cultural factors, such as temperature or food consumption habits in Bangkok, Thailand, the results of this study may lack worldwide generalizability. Additionally, data were obtained based on self-reports, which may have resulted in inflated or underestimated values. Because the instrument to assess these variables was used only once in a Thai setting, more validation and reliability testing in a Thai context are required. Moreover, these studies did not differentiate between management strategies in the intensive phases and continuation phases of the 6-month regimen. Based on these results, the self-identified effective symptom management techniques for ADRs in newly diagnosed pulmonary TB patients in the entire country's population should be investigated in both the intensive and continuation phases. Finally, the lack of clinical data (e.g., ADR severity, dosage, comorbidities) may influence

perceived effectiveness. Therefore, findings should be interpreted with caution, and future studies should include clinical records to account for these variables.

CONCLUSION

In a Thai cultural context, based on Dodds et al.¹⁷, self-identified strategies for the management of ADRs among Thai pulmonary TB patients receiving antituberculosis drugs have proven effective. Nurses and other healthcare providers can encourage the use of similar local cultural practices to manage ADRs and may potentially support medication adherence.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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Ethical approval and informed consent statements

Prior to any research activities being undertaken, ethics approval was obtained from five internal review board (IRB) ethics committees of seven hospitals: 1. Chulalongkorn University 2. Siriraj Hospital 3. Lerdsin Hospital 4. Nopparat Rajathanee Hospital 5. Four additional hospitals involved in this study, Taksin Hospital, Sirindhorn Hospital, Venerable Thawisak Jutindharo Hospital, and the Bangkok Metropolitan Administration's Lat Krabang Hospital, are affiliated with the Bangkok Metropolitan Administration and covered by a single IRB.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Table 1 Demographic Characteristics (N=394)

Characteristics	Number	%
Gender		
Male	245	62.2
Female	149	37.8
Age range (years)		
25-29	74	18.8
30-49	179	45.4
50-59	141	35.8
Mean = 42.3; Standard deviation = 11.2		
Marital status		
Single	134	34.2
Widowed	11	2.8
Divorced	14	3.6
Married	230	58.1
Separate	5	1.3
Education		
Non-educated	9	2.3
Primary school	152	38.5
Secondary school	142	36.0
Diploma	48	12.2
College or more	43	11.0
Occupation		
Unemployed	106	26.9
Employee	165	41.9
Merchant	39	9.9
Company Employee	73	18.5
Government Service	11	2.8
Type of healthcare coverage		
Universal Coverage Scheme	186	47.2
Civil Servants Medical Benefits Scheme	19	4.8
Social Security Scheme	172	43.7
Pay by Yourself	17	4.3

Table 2 The Three Highest-Rated Self-Identified Effective Strategies based on Mean Scores (N=394)

Symptom (n)*	Specific first-line antituberculosis drug	The three highest-rated self-identified effective strategies based on mean scores**(n)	mean $\pm$ S.D.	Interpretation***
1. Itching (111)	Related to: Isoniazid(H) Rifampicin(R) Pyrazinamide(Z) Ethambutol(E)	1. Applying prickly heat cooling powder (12) 2. Bathing regularly (5) 3. Using body lotions (26)	3.58 $\pm$.79 3.36 $\pm$.89 3.19 $\pm$.98	High High Moderate
2. Nausea (94)	Related to: Isoniazid(H) Rifampicin(R) Pyrazinamide(Z) Ethambutol(E)	1. Eating general sour fruit (36) 2. Resting (20) 3. Drinking more water (10)	3.11 $\pm$.87 3.05 $\pm$.99 3.00 $\pm$ 1.18	Moderate Moderate Moderate
3. Decreased Appetite (85)	Related to: Isoniazid(H) Rifampicin(R) Pyrazinamide(Z) Ethambutol(E)	1. Eating small and frequent meals (28) 2. Eating a variety of general foods (14) 3. Eating spicy food (7)	3.15 $\pm$.69 3.00 $\pm$ 1.01 2.86 $\pm$ 1.06	Moderate Moderate Moderate
4. Numbness of the hands and feet (79)	Related to: Isoniazid(H)	1. Self-massage (32) 2. Eating a diet with high energy density (17) 3. Applying balm (5)	3.13 $\pm$.83 3.12 $\pm$.99 2.00 $\pm$ 1.22	Moderate Moderate Low
5. Rash (70)	Related to: Isoniazid(H) Rifampicin(R) Pyrazinamide(Z) Ethambutol(E)	1. Bathing regularly (10) 2. Applying prickly heat cooling powder (6) 3. Using body lotions (15)	3.33 $\pm$ 1.15 2.83 $\pm$ 1.16 2.53 $\pm$.99	Moderate Moderate Moderate

*Participants can report more than one symptom, ** Possible range for symptom management score was 1 to 5, *** mean scores were interpreted using five levels of self-identified effectiveness: 4.50–5.00 (highest), 3.50–4.49 (high), 2.50–3.49 (moderate), 1.50–2.49 (low), 1.00–1.49 (lowest), S.D.=standard deviation

Table 2 (Continued)

Symptom (n)*	Specific first-line antituberculosis drug	The three highest-rated self-identified effective strategies based on mean scores ^b (n)	mean $\pm$ S.D.	Interpretation***
6. Fatigue (57)	Related to: Isoniazid(H) Rifampicin(R) Pyrazinamide(Z) Ethambutol(E)	1. Resting (45) 2. Eat a diet with high energy density (5) 3. <i>Drinking sugar-sweetened beverages</i> (2)	3.02 $\pm$.76 3.00 $\pm$.70 2.00 $\pm$ 1.73	Moderate Moderate Low
7. Vomiting**** (53)	Related to: Isoniazid(H) Rifampicin(R) Pyrazinamide(Z) Ethambutol(E)	1. Eating small and frequent meals (12) 2. Drinking more water (5)	2.83 $\pm$.93 2.80 $\pm$.83	Moderate Moderate
8. Joint pain (53)	Related to: Pyrazinamide(Z)	1. Avoiding foods that aggravate symptoms (8) 2. Avoiding putting weight on the painful area (14) 3. Self-massage (6)	3.75 $\pm$.88 3.43 $\pm$.64 3.00 $\pm$.89	High High Moderate
9. Sleep disturbances (50)	Related to: Isoniazid(H)	1. Avoiding drinks that may cause sleep disturbances (5) 2. Reduce activities before bedtime (5) 3. Keep a quiet and calm environment (11)	3.60 $\pm$ 1.14 3.60 $\pm$.54 3.36 $\pm$.80	High High Moderate
10. Muscle pain (48)	Related to: Pyrazinamide(Z)	1. Applying balm (2) 2. Thai-massage (3) 3. Self-massage (28)	3.50 $\pm$.70 2.67 $\pm$ 1.15 2.52 $\pm$.84	High Moderate Moderate

*Participants can report more than one symptom, ** Possible range for symptom management score was 1 to 5, *** mean scores were interpreted using five levels of self-identified effectiveness: 4.50–5.00 (highest), 3.50–4.49 (high), 2.50–3.49 (moderate), 1.50–2.49 (low), 1.00–1.49 (lowest), **** Participants reported only two self-identified effective strategies, S.D.=standard deviation

Table 3 Descriptive Comparison of Mean Effectiveness Scores: Single versus Combined Management Strategies

Symptom	Single strategy*	Mean $\pm$ S.D.	Combined strategies*	Mean $\pm$ S.D.	p-value**
1. Itching	Applying prickly heat cooling powder	3.58 $\pm$.79	Applying prickly heat cooling powder and using body lotions	3.75 $\pm$.39	.550
2. Nausea	Eating general sour fruit	3.11 $\pm$.87	Eating general sour fruit and drinking more water	3.67 $\pm$ 1.44	.320
3. Decreased Appetite	Eating small and frequent meals	3.15 $\pm$.69	Eating small and frequent meals and eating a variety of general foods	3.50 $\pm$.70	.192
4. Numbness of the hands and feet	Self-massage	3.13 $\pm$.83	Self-massage and eating a diet with high energy density	3.28 $\pm$.80	.589
5. Rash	Bathing regularly	3.33 $\pm$ 1.15	Bathing regularly and using body lotions	2.50 $\pm$.70	.085

*Possible range for the symptom management score was 1 to 5, **p-values were calculated using the independent t-test to compare means between the two groups