


# Evaluation of Patient's Knowledge of Atorvastatin Information in Patient Information Leaflets: A Pre-Post Intervention Study in Thailand

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**Purpose:** This study aimed to evaluate the effect of using atorvastatin PIL on patients' medication knowledge, perceptions of the PIL usefulness, their anxiety about the medication, and factors related to these aspects.

**Patients and Methods:** A pre-post intervention study was conducted in outpatients at a university hospital. Patients prescribed atorvastatin were enrolled using systematic random sampling. Participants were asked to complete [Self-Administered Questionnaire](#) to assess atorvastatin knowledge at baseline. An atorvastatin-PIL produced by the manufacturer was introduced to the participants as the intervention. One month after receiving the PIL, the participants were re-assessed. Ten questions were developed to assess atorvastatin knowledge and visual analog scale (VAS) was used to assess perceived benefits of using the PIL and patient anxiety about the medication. Multiple linear regression was used to assess the related factors.

**Results:** Of 450 questionnaires distributed, 370 were returned. Atorvastatin knowledge significantly increased with mean score of  $5.06 \pm 1.92$  at baseline to  $8.34 \pm 1.79$  at 1-month after intervention. Reading all sections of the PIL ( $p=0.017$ ) and working for civil service ( $p=0.006$ ) were associated with higher knowledge scores at baseline and after intervention. Low educational level was associated with lower knowledge scores at baseline ( $p=0.002$ ), but experience of allergy ( $p=0.042$ ) was associated with higher knowledge scores after the intervention. Patients had high level of perceived usefulness from the PIL (average scores= $8.87 \pm 1.83$ ) and low level of anxiety (average scores= $3.69 \pm 3.06$ ). Reading all sections of the PIL ( $p=0.007$ ) and taking more than 5 medications ( $p=0.012$ ) were related to perceived usefulness of the PIL. Females ( $p<0.001$ ) and herbal supplement users ( $p=0.048$ ) were related to anxiety about the medication.

**Conclusion:** PILs could improve medication knowledge in patients. Patients' perceptions of benefits of PILs were high and anxiety about medication was low. Use of PILs should be encouraged to improve patients' knowledge and appropriate use of medications.

**Keywords:** patient information leaflet, medication knowledge, atorvastatin, perceived benefits, anxiety

## Introduction

In recent years, it has become increasingly important to improve patient's knowledge about their diseases and medications to help them to make involved decisions about their treatment. Patients typically need both basic and specific information about their medicines and treatment,<sup>1</sup> which includes discussing the adverse effects of their medicines.<sup>1,2</sup> Many studies have found that patients lack essential knowledge about

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their medications such as the correct use of medicines, potential side effects, and how to self-monitor while taking medicines.<sup>3–5</sup> Patients report that although they are provided with medicine information by their healthcare providers during consultation, many of them forget that information after the consultation.<sup>6,7</sup>

Statins are widely prescribed for dyslipidemia and coronary heart disease (CAD) and are normally used long-term. Atorvastatin has been the most extensively used statin worldwide.<sup>8</sup> In Thailand, atorvastatin 40 mg is included on the National List of Essential Medicines 2012 (NLEM) and the prescribing volume is high in many hospitals. Although atorvastatin is very effective at lowering cholesterol levels, it sometimes induces adverse drug reactions (ADRs).<sup>9–12</sup> The low adherence rate for statins within the first year of use has been reported to be mainly due to patient concerns about statin ADRs.<sup>13–15</sup> A lack of knowledge about atorvastatin can reduce patient confidence and lower adherence.

Written drug information is provided to patients to help increase the amount of drug information that they retain.<sup>16</sup> Patient information leaflets (PILs) have an important role to play during counseling by including patients in decision making about their medications.<sup>17,18</sup> A number of studies have investigated the effect of PILs on patients' knowledge<sup>19,20</sup> and medication anxiety, as well as their potential to influence patients to discontinue therapy due to fear of possible ADRs.<sup>16</sup> However, most of these studies are short-term studies, focused on PILs produced by the researchers, or conducted in small populations. Few studies have investigated any association of improvement in patients' knowledge with the usefulness and emotions involved in the use of PILs in large populations.

In Thailand, the pharmaceutical manufacturers of atorvastatin produce a PIL for all packages, but there have been no studies to test the benefits and the effect of PILs on patients' knowledge, as well as effects on patients' anxiety. The Thai-PILs produced by manufacturers have not been evaluated by health authorities or consumers to explore how much understanding and knowledge is received from PILs. This study used PILs produced by manufacturers, which is different from other studies that have used PILs produced by the researchers.<sup>19–21</sup> Thus, this study was conducted to assess patients' knowledge about atorvastatin at baseline and after reading the PILs, and to determine the factors affecting their knowledge. In addition, patients' opinions about the benefits of using PILs and their anxiety after using the PILs were investigated.

## Methods

### Study Design and Setting

This was a pre-post interventional study conducted in outpatient clinics at Queen Sirikit Heart Center, a university hospital in the Northeastern Thailand between February to October 2017.

### Participants

Patients aged 18 years and older who had taken atorvastatin and were able to complete the questionnaire were selected using a systematic random sampling method. Patients who were prescribed atorvastatin were identified by their prescriptions. These prescriptions were reviewed by the hospital pharmacists. Every second patient waiting for pharmacy service that had atorvastatin-containing prescriptions were selected and invited to take part in the study by the researcher. The sample size for the pretest-posttest study was calculated by using an alpha error at 0.05, a power of 0.90 ( $\beta = 0.1$ ), and an effect size of 0.20. The approximate sample size was 263. To achieve adequate response from calculated sample size, we distributed a total of 450 questionnaires at the Queen Sirikit Heart Center.

### Study Instruments

#### Questionnaire Development and Testing

The pre-test questionnaire consisted of two sections: (1) participants' demographic data including age, gender, education level, occupation, health care program status and past medical history and (2) atorvastatin knowledge test consisting of 10 multiple choice questions about the name of the medicine, indication, contraindication, precaution, dosage regimen, administration, ADRs and ADR monitoring, and storage.

The post-test questionnaire consisted of two sections: (1) the atorvastatin knowledge test and (2) patients' behavior survey on the use of PILs and their opinions on potential benefits and anxiety after reading the PILs. A visual analog scale from 0 (least) to 10 (most) was used to assess patients' perception of benefits and anxiety score.<sup>21,22</sup>

The questionnaire was tested for content validity by three pharmacists who had experience in medicine information. The index of consistency was 0.97 indicating good content validity. The questionnaire was then piloted with 15 patients to ensure its readability and ease of understanding.<sup>23</sup> After

piloting, the questionnaire was modified to be used for the actual study.

## Atorvastatin PILs

The atorvastatin PIL used in this study was produced by the originator manufacturer and was available inside medicine boxes or packages. The PIL, printed on 2-sided paper, contained 6 main topics as follows: what is the medicine and what is it used for; precautions before using the medicine; how to take the medicine; possible side effects; how to store the medicine, and information about the manufacturer. The PIL was written in Thai with simple language for lay people's understanding, and was not available online.

## Data Collection

The pre-test questionnaire and a cover letter explaining the aims of the study were distributed to participants at out-patient clinics in the hospital by a researcher. Informed consent was obtained from each participant. The pre-test questionnaire was returned to the researcher directly after completion. The researcher then provided participants with a PIL of atorvastatin and suggested they read it at home. The post-test was performed after one month. The post-test questionnaire was sent to the participants by mail one week before deadline with an enclosed atorvastatin PIL. The participants were instructed to read the PIL again, complete the post-test questionnaire and return the questionnaire by mail. If the questionnaires were not returned within one-week, non-responders received a personal contact by phone and a reminder letter.

## Data Analysis

For the atorvastatin knowledge test, each correct answer was worth one point (total score=10). The scores were divided into pass (total score  $\geq 8$  points) and not pass (total score  $< 8$  points) categories based on Bloom's cut-off point about knowledge/attitude/practice assessment and a previous study of knowledge assessment in Thai patients.<sup>21,24</sup> Descriptive statistics are used to describe the demographic data. The atorvastatin knowledge scores and the scores of the perceived benefits and anxiety about medication after reading the PIL are presented as mean  $\pm$  standard deviation (S.D.). Pre-test and post-test atorvastatin knowledge scores were compared by using Paired sample *t*-test. Chi-square test was used to compare sub-groups for categorical data, and Mc Nemar's test was used for comparison of pre-test and post-test within groups.

Kolmogorov–Smirnov test was used to assess normal distribution of the data. For factors associated with pre-test and post-test knowledge scores (univariate analysis), independent *t*-test and one-way ANOVA or Mann Whitney *U*-test and Kruskal–Wallis test, where appropriate, were used to compare the knowledge scores between groups. Multivariate linear regression analysis was used to evaluate the factors that might affect pre-test and post-test knowledge scores, and factors related to benefit and anxiety scores after reading the PIL. P-value less than 0.05 indicated statistical significance. All data were analyzed using IBM SPSS for Windows version 19.0.

## Ethical Approval

The study protocol was approved by the Khon Kaen University Ethics Committee for Human Research (HE591091) and conducted in accordance with the Declaration of Helsinki.

## Results

### Demographic Data

A total of 450 participants completed pre-test questionnaires and 370 of them returned completed post-test questionnaires; hence the response rate was 82.2%. Most of the respondents were male ( $n=231$ , 62.4%), with a mean age of  $58.35 \pm 7.62$  years old (range = 32–83). The majority of respondents had a bachelor's degree or higher ( $n=154$ , 41.7%) and most of them worked as civil servants ( $n=169$ , 45.8%). The majority of respondents had more than one underlying disease ( $n=156$ , 42.2%), received more than five concomitant drugs ( $n=162$ , 44.4%), and had used atorvastatin for more than one year ( $n=257$ , 70.6%).

### Comparison of Atorvastatin Knowledge Between Pre-Test and Post-Test

The average score on the knowledge pre-test (baseline) was  $5.06 \pm 1.92$ , and the post-test was  $8.34 \pm 1.79$ . There was a significant difference in the total score before and after reading PILs ( $p < 0.001$ ). In the pre-test, respondents gave correct answers about atorvastatin including the name of the medicine ( $n=143$ , 38.6%), serious ADRs ( $n=139$ , 37.6%), contraindications ( $n=122$ , 33.0%), ADR monitoring ( $n=86$ , 23.2%), and the effect of the medicine on glucose level ( $n=36$ , 9.7%). The percentage of correct answers for each question was less than 80%, of which the highest percentage was 79.7% ( $n=295$ ). The question

that had the lowest percentage of correct answers was “how does this medicine affect sugar level” (n=36, 9.7%).

After reading the PIL, more than 70% of respondents gave correct answers for almost all questions, except for information of serious ADRs (n=137, 37.0%). The number of respondents who gave correct answers about the effect of the medicine on glucose level increased to 277 (74.9%). The questions that showed the most improvement in the proportion of correct responses from the pre-test to the post-test were “What does this medicine affect the sugar levels?” (9.7% at baseline vs 74.9% at 1 month), “What organ that you should check after receiving this medication 6 and 12 weeks and every 6 months” (23.2% at baseline vs 73.5% at 1 month), and “What is the contraindication of this drug?” (33.0% at baseline vs 85.1% at 1 month). However, the number of respondents answering the question “What is the

symptom that you should stop taking and going to the doctor?” correctly was slightly reduced from 139 pre-test (37.6%) to 137 post-test (37.0%) (Table 1).

Figure 1 shows the results for atorvastatin knowledge categorized by a passing score at  $\geq 8$  points. At baseline, the number of atorvastatin users with a passing score was 34 (9.2%), which was significantly less than the 296 respondents (80.0%) who achieved a passing score 1 month after receiving the PIL ( $p<0.001$ ).

## Factors Associated with Atorvastatin Knowledge

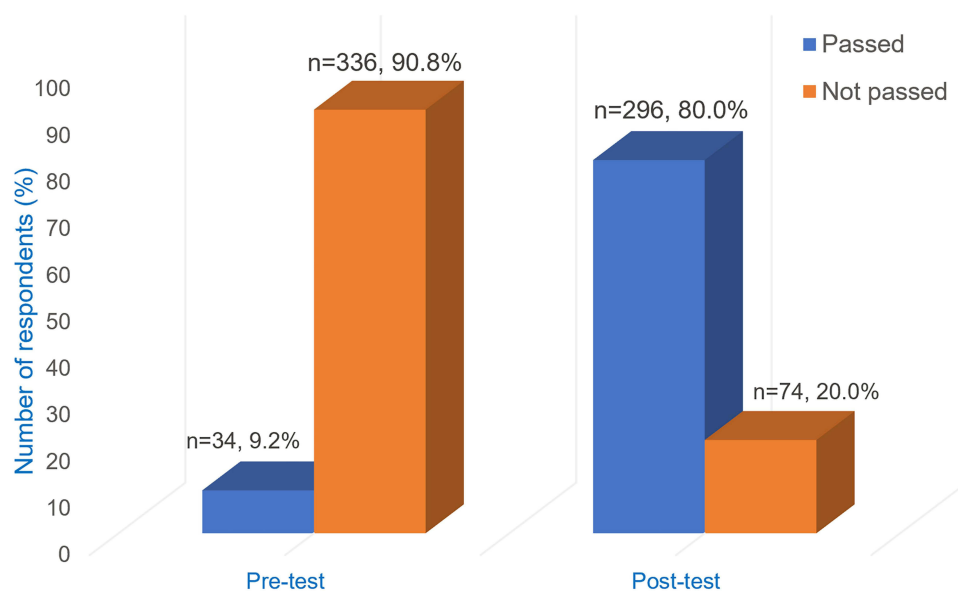
At both baseline and for the post-test, the mean score of respondents with bachelor's degree or higher was significantly higher than other educational levels ( $p<0.001$ ) and

**Table 1** Percentage of Respondents Giving Correct Answers to Atorvastatin Knowledge at Baseline and at 1-Month

Question	Correct Answer	Number of Respondents Who Answered Correctly (N= 370)		
		Pre-test N (%)	Post-test N (%)	Change N (%)
Q1: What is generic name of this medicine?	Atorvastatin	143(38.6)	331(89.5)	+188 (50.9)
Q2: What is indication of this medicine?	Decrease blood cholesterol	295(79.7)	352(95.1)	+57 (15.4)
Q3: What is contraindication of this medicine?	Hepatic disease	122(33.0)	315(85.1)	+193 (52.1)
Q4: Can pregnant and breastfeeding women take this medicine?	No	248(67.0)	354(95.7)	+106 (28.7)
Q5: How should you take this medicine?	Take it at the same time every day	261(70.5)	333(90.0)	+72 (19.5)
Q6: What should you do if you miss a dose?	Take as soon as you remember, or with a next dose	291(78.6)	350(94.6)	+59 (16.0)
Q7: What symptoms should stop you taking the medicine and go to the doctor?	Muscle pain and fever with unknown cause	139(37.6)	137(37.0)	-2 (0.6)
Q8: How should you keep this medicine?	Keep this medicine under 30°C	253(68.4)	341(92.2)	+88 (23.8)
Q9: What organ should be checked after receiving this medicine for 6 and 12 weeks and every 6 months?	Liver	86(23.2)	294(79.5)	+208 (56.3)
Q10: How does this medicine affect sugar levels?	An increase of blood sugar	36(9.7)	277(74.9)	+241 (65.2)
Total mean score (Mean $\pm$ S.D.)		5.06 $\pm$ 1.92	8.34 $\pm$ 1.79	3.27 $\pm$ 2.24
Median (IQR)		5 (4–6)	9 (8–9)	$p<0.001^a$

**Notes:** <sup>a</sup>Paired samples t-test was used to compare atorvastatin knowledge score between pre-test and post-test. Bold value indicates statistical significance at  $p$ -value $<0.05$ .

**Abbreviations:** N, number of respondents; IQR, interquartile range.



-  $p < 0.001$  when pre-test and post-test data were compared by Mc Nemar test  
 -  $p = 0.002$  when the number of respondents who passed and not passed the score at 8/10 were compared by Pearson Chi-Square test.

**Figure 1** Atorvastatin knowledge between pre-test and post-test categorized by a passing score at  $\geq 8$  points.

there was no statistical difference between post-test and pre-test scores. Civil servants also had significantly higher mean scores than other careers in the pre-test and post-test ( $p < 0.001$ ) with no significant difference between post-test and pre-test scores.

For the post-test, respondents who were taking less than 3 medications were more likely to have a higher mean score than others ( $p = 0.006$ ). Respondents who had received atorvastatin for more than one year or respondents who used herbal supplements had significantly higher scores ( $p = 0.009$ ,  $p = 0.015$  respectively). For both the pre-test and post-test, respondents who read all the content of the PIL were found to have greater mean scores compared to those who read some parts of the PIL ( $p = 0.002$  and  $p = 0.001$ , respectively) (Table 2).

Multiple linear regression analysis found that, at baseline, respondents who had educational levels of primary school and high school had lower pre-test scores than those of bachelor's degree or higher ( $\beta = -0.395$ ,  $p < 0.001$  and  $\beta = -0.175$ ,  $p = 0.002$ , respectively). Agriculturists had higher pre-test scores than unemployed or students ( $\beta = 0.142$ ,  $p = 0.031$ ). Respondents who indicated reading all contents of the PILs had a greater pre-test score than those who read only some parts of the PIL ( $\beta = 0.121$ ,  $p = 0.017$ ). After 1 month of receiving the PIL, civil servants had a greater post-

test score than unemployed and students ( $\beta = 0.280$ ,  $p < 0.001$ ). Likewise, respondents who indicated they read all contents of the PILs ( $\beta = 0.141$ ,  $p = 0.006$ ) and who had an allergic history ( $\beta = -0.101$ ,  $p = 0.042$ ) had higher post-test scores. Respondents who had been taking the medicine for at least one year had a higher mean difference than those who had been taking the medicine less than one year ( $\beta = 0.130$ ,  $p = 0.012$ ) (Table 3).

## Benefit Scores and Anxiety Scores After Using the PILs

A visual analog scale (VAS) was used to determine patients' perceptions of the benefits of PILs and their anxiety after reading the PIL. The mean  $\pm$  sd PIL benefit score was  $8.87 \pm 1.83$  and the anxiety score was  $3.69 \pm 3.06$  (score range = 0–10). Patients who read all content of the PIL rated the benefits of the PIL with a higher score than those who read some parts of the PIL ( $p = 0.007$ ). Patients who had more than 5 concomitant medications rated the PIL benefit score significantly lower than those who had less than 3 concomitant drugs ( $p = 0.012$ ). For patients' anxiety scores about atorvastatin after reading the PIL, females had significantly more anxiety than males ( $p < 0.001$ ). In addition, patients who used herbal medicines were more likely to be anxious than those who had never used them. ( $p = 0.048$ ) (Table 4).

**Table 2** Comparison of Factors Affecting Pre-Test, Post-Test and Mean Difference of Atorvastatin Knowledge Score

	N	Pre-test Score		Post-test Score		Mean Difference	
		Mean±SD	p-value	Mean±SD	p-value	Mean±SD	p-value
Gender (n=370)							
Male	231	4.95±1.91	0.131 <sup>a</sup>	8.25±1.86	0.272 <sup>c</sup>	3.30±2.26	0.717 <sup>a</sup>
Female	139	5.26±1.92		8.47±1.67		3.22±2.22	
Age (n=370)							
< 45	22	5.82±1.56	0.058 <sup>b</sup>	8.68±1.73	0.327 <sup>d</sup>	2.86±2.03	0.639 <sup>b</sup>
45–60	204	5.14±1.93		8.40±1.71		3.26±2.33	
> 60	144	4.84±1.93		8.19±1.92		3.35±2.15	
Education level (n=369)							
Primary school	129	4.43±2.00	<0.001 <sup>b</sup>	7.65±2.21	<0.001 <sup>d</sup>	3.22±2.74	0.729 <sup>b</sup>
High school	86	4.92±1.58		8.35±1.71		3.43±1.88	
Bachelor's degree or higher	154	5.71±1.79		8.92±1.13		3.20±1.95	
Careers (n=369)							
None and students	28	3.93±1.80	<0.001 <sup>b</sup>	8.14±2.07	<0.001 <sup>d</sup>	4.21±2.39	0.051 <sup>b</sup>
Agriculturists	111	4.78±1.81		7.73±2.09		2.95±2.54	
Business employees	61	4.70±2.12		7.85±2.17		3.15±2.30	
Civil servants	169	5.60±1.75		8.95±1.05		3.36±1.93	
Underlying diseases (n=370)							
I	214	4.90±1.95	0.056 <sup>a</sup>	8.22±1.89	0.076 <sup>c</sup>	3.32±2.28	0.601 <sup>a</sup>
> I	156	5.29±1.86		8.49±1.66		3.20±2.20	
Concomitant drugs (n=365)							
< 3	40	5.33±2.08	0.527 <sup>b</sup>	8.88±1.45	0.006 <sup>d</sup>	3.55±2.07	0.527 <sup>b</sup>
3–5	163	5.11±1.80		8.42±1.73		3.31±2.04	
> 5	162	4.96±2.00		8.09±1.92		3.13±2.46	
Duration of atorvastatin therapy (n=364)							
< 1 year	107	5.22±1.91	0.306 <sup>a</sup>	8.01±2.11	0.116 <sup>c</sup>	2.79±2.45	0.009 <sup>a</sup>
≥ 1 years	257	5.00±1.90		8.46±1.63		3.46±2.14	
Using herbs (n=370)							
No	316	5.07±1.94	0.969 <sup>a</sup>	8.24±1.86	0.015 <sup>c</sup>	3.18±2.28	0.053 <sup>a</sup>
Yes	54	5.06±1.77		8.87±1.24		3.81±1.90	
Previous experience of allergy (n=370)							
No	343	5.08±1.86	0.707 <sup>a</sup>	8.38±1.77	0.085 <sup>c</sup>	3.30±2.21	0.359 <sup>a</sup>
Yes	27	4.89±2.55		7.78±2.06		2.89±2.67	
Reading behavior to current PILs (n=362)							
Read all sections	136	5.48±1.90	0.002 <sup>a</sup>	8.82±1.25	0.001 <sup>c</sup>	3.27±2.29	0.740 <sup>a</sup>
Read some sections	226	4.84±1.91		8.10±1.92		3.35±2.10	

**Notes:** <sup>a</sup>Independent samples t-test was used to compare difference in knowledge score between two categories. <sup>b</sup>One way ANOVA was used to compare difference in knowledge score between three categories or more. <sup>c</sup>Mann–Whitney test <sup>d</sup>Kruskal–Wallis Test. Bold values indicate statistical significance at p-value <0.05.

**Abbreviations:** PILs, patient information leaflets; N, number of respondents.



**Table 3** Adjusted Linear Regression for Atorvastatin Knowledge at Pre-Test, Post-Test, and Change in Knowledge Score

Factor	b	SE <sub>b</sub>	β	t	95% Confidence Interval		p-value
					Lower	Upper	
Pre-test score*							
Primary school grade	−1.593	0.290	−0.395	−5.500	−2.162	−1.023	<0.001
High school grade	−0.803	0.260	−0.175	−3.082	−1.315	−0.290	0.002
Read PILs for all contents	0.481	0.201	0.121	2.395	0.086	0.875	0.017
Agriculturists	0.595	0.274	0.142	2.172	0.056	1.133	0.031
	Constant 5.459; SE <sub>est</sub> = ± 1.82782						
	R = 0.331; Adjusted R <sup>2</sup> = 0.100; F = 11.010; p-value = <0.0001						
Post-test score**							
Civil servants	0.973	0.176	0.280	5.520	0.626	1.320	<0.001
Read PILs for all contents	0.503	0.181	0.141	2.774	0.146	0.859	0.006
Previous experience of allergy	−0.667	0.326	−0.101	−2.046	−1.309	−0.026	0.042
	Constant 7.883; SE <sub>est</sub> = ± 1.63						
	R = 0.353; Adjusted R <sup>2</sup> = 0.117; F = 16.985; p-value = <0.0001						
Mean difference***							
Use the medicine at least 1 year	0.631	0.251	0.130	2.513	0.137	1.125	0.012
	Constant 0.130; SE <sub>est</sub> = ± 2.22492						
	R = 0.130; Adjusted R <sup>2</sup> = 0.017; F = 6.317; p-value = 0.012						

**Notes:** b denotes the variable estimate, SE<sub>b</sub> denotes the standard error of the variable estimate,  $\beta$  denotes the standardized estimate, a denotes adjust pre-test mean score variable. \*Adjusted for gender, age, underlying disease. \*\*Adjusted for gender, underlying disease, concomitant drugs, using herbs. \*\*\*Adjusted for career, using herbs. Bold value indicates statistical significance at p-value <0.05.

**Table 4** Factors Associated with PIL Benefit Scores and Patients' Anxious Scores (Multiple Linear Regression)

Factor	b	SE <sub>b</sub>	β	T	95% Confidence Interval		p-value
					Lower	Upper	
PIL benefit score							
Read all of the PIL	0.533	0.198	0.142	2.696	0.144	0.923	0.007
Concomitant medications > 5	− 0.491	0.194	−0.133	−2.533	−0.872	−0.110	0.012
	Constant 8.877; SE <sub>est</sub> = ± 1.79353						
	R = 0.204; Adjusted R <sup>2</sup> = 0.036; F = 7.615; p-value = 0.001						
Anxiety score after reading the PILs							
Female	1.375	0.329	0.219	4.175	0.727	2.023	<0.001
Herbal user	0.906	0.456	0.104	1.986	0.009	1.803	0.048
	Constant 3.022; SE <sub>est</sub> = ± 2.97637						
	R = 0.248; Adjusted R <sup>2</sup> = 0.056; F = 11.232; p-value <0.001						

**Notes:** b denotes the variable estimate, SE<sub>b</sub> denotes the standard error of the variable estimate,  $\beta$  denotes the standardized estimate. All factors with p<0.20 from the univariate analysis were included in the multiple linear regression analysis. Bold value indicates statistical significance at p-value <0.05.

## Discussion

### Atorvastatin Knowledge

Our study was conducted to assess patients' knowledge of atorvastatin after PIL reading. The atorvastatin knowledge score at 1 month after receiving the PIL had a statistically significant increase when compared to the baseline. Several previous studies have reported similar results that reading PILs increased patients' knowledge.<sup>20,25–27</sup> Patients' knowledge 1-month after receiving the PIL was tested. Patients had been encouraged to open the post-test envelope and they could read while they answered the test. In the pre-test, information about indication, missed-dose management, and how to take the medication was basic knowledge that most patients knew (more than 70%). Patients had perceived their illness and treatment information and these issues were frequently provided by the healthcare professionals.<sup>28,29</sup> However, the information about risks of medications and ADRs is not generally provided to patients.<sup>30</sup>

Only one-third of patients in our study knew about the name of the medicine, serious ADRs, and contraindications. Hence, patients should be informed about these topics. A high number of patients answered incorrectly on the effect of atorvastatin on blood sugar level. This question examined respondents' willingness to read all of the PIL because this information was only provided in a sub-topic in the PIL. After receiving the PIL, the number of patients who answered correctly significantly increased in all questions, except ADR monitoring and management. The most common and correct response in the pre-test was "fever and pain/sore muscles that is not caused by physical work" while respondents answered, "diarrhea and indigestion" for the post-test. It is possible that the patients were confused about the side effect information on the PIL since a previous study suggested that patients might confuse conflicting information between consultation from physicians, pharmacists, and written medication information, or information overload.<sup>31</sup> A few studies found that using different ways of presenting side effect information: natural frequencies, percentages, and positive framing could lead to consumers' misunderstanding and affect risk appraisal processes.<sup>32,33</sup> Therefore, healthcare professionals should focus on this issue before providing the information to patients.

Studies about improved medication knowledge have been conducted with different study designs, types of interventions, and post-intervention periods. Although verbal information is considered as the primary source of medical knowledge,<sup>28,29</sup> results of some comparative studies have

found that written information combined with verbal information is more effective than verbal information alone in knowledge improvement.<sup>20,34</sup> In contrast, other studies have found no difference between combined written and verbal information and written information alone.<sup>25</sup> The results from the current study are consistent with a previous study conducted in Thailand that showed knowledge about non-steroidal anti-inflammatory drugs was increased 1-month after receiving PILs. Moreover, other studies have found that this increased knowledge could be sustained at 2–3 month follow-ups.<sup>35,36</sup>

### Factors Related to Atorvastatin Knowledge

Factors related to atorvastatin knowledge score at baseline showed an association of higher education level and higher knowledge score. Occupation was also related to atorvastatin knowledge score. After reading the PIL, education level and occupation maintained their association with the atorvastatin knowledge score and there was no difference between pre-test and post-test scores. Previous studies confirm that the level of education influences patients' knowledge.<sup>37,38</sup> A previous study found that patients with a higher level of education preferred to read PILs.<sup>26</sup> After reading the PIL, patients who were taking 3 concomitant drugs or less had a higher mean knowledge score. Patients receiving multiple medications are more likely to be confused about their medications,<sup>39</sup> which could lead those patients being unable to remember the details for all of their medications. Surprisingly, patients who had previous experience with allergy had lower post-test scores than those who had not. This finding was not consistent with a previous qualitative study that found previous experiences of allergies and side effects were factors that contributed to consumers reading written drug information.<sup>40</sup> The possible reason for the difference in our study was that patients who had experienced allergies might only pay attention to ADRs or allergic issues, rather than all the details contained in the PILs. We found that patient reading behavior was a factor influencing the knowledge score both at baseline and after receiving the PIL, with particularly high knowledge scores in those who read all of the contents of the PIL. Good medication knowledge was also associated with longer duration of medication use. It is possible that patients who had received more than one year of medication treatment were familiar with the details of their medicines provided



by their healthcare professionals such as the drug name, how to take, and any possible side effects.

## Perceived Benefits of Using the PILs and Patient's Anxiety About Medications

PILs are useful for educating patients regarding medications.<sup>41</sup> Our study showed a high level of positive attitude regarding PIL benefits. A previous study showed 42.3% of respondents stated that the information in the patient package inserts was useful.<sup>42</sup> A study in Thailand also found high usefulness scores and low anxiety scores among patients after reading the developed PIL. Higher educational level was found as a significant factor for higher usefulness scores, and type of medicines was associated with lower anxiety score.<sup>21</sup> Whilst the current study found that patients who read all sections of the PIL had a better opinion about benefit of the PILs than those who read some sections of the PIL. Our findings show that patients who had poly-pharmacy (more than 5 concomitant items) gave lower PIL benefit scores. This may be because the provision of more than 5 PILs might overload patients' and affect their reading behavior, thus they might not be interested in the usefulness of PILs. Our study also found low levels of anxiety in patients after reading PILs so that information about possible risks of medications did not reduce or influence patients' anxiety about their treatment.<sup>43–45</sup>

## Implication of the Study

As PILs can improve patients' knowledge on taking medicines accurately, PILs produced by manufacturers should be supported and approved by health authorities before distribution to consumers. User testing, as a method of consumer assessment of PILs, should be used to test for comprehension to ensure that consumers can easily understand the whole PIL. Future research could assess the impact of PILs on patients' behavior, such as medication adherence and safety awareness about taking medicines.

## Limitations of the Study

Our study was conducted in only one university hospital. Thus, we cannot generalize the results to the wider Thai population. The study design did not compare between a control group and intervention group. The effect of the PILs was evaluated in patients 1-month after receiving the PILs, which is similar to previous studies of short-term knowledge assessment.<sup>21,46</sup> Thus, the long-term effects of PILs on patients' knowledge are not known. Patients

reading the PIL or accessing additional sources of medicine information while completing the post-test questionnaire could not be controlled. Using a VAS to assess perceptions about the benefits of PILs and medication anxiety has a limitation caused by variation in judgment among individuals, and patients might have experienced some difficulty in finding a point on the line of a VAS that best represented their perception.<sup>47</sup>

## Conclusion

Reading PILs could increase patients' medicine knowledge. The factors that were associated with this increased knowledge were higher education level, reading the entire PIL, and prior experience of an allergic response. Moreover, longer duration of medication use was an important factor in improving patient's knowledge. Patients had a good perception about PIL benefits and had less anxiety after reading the PIL. The availability of qualified PILs in Thailand should be promoted by the health authorities and pharmaceutical manufacturers to support the appropriate use of medicines. Moreover, healthcare professionals could provide PILs in counseling practice to ensure that patients understand the information without causing excessive anxiety about taking medicines.

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