CHAPTER IV
RESULTS

This chapter is divided into two parts. The first part describes questionnaire development. The second part focuses on the effectiveness of the strategy used to promote knowledge and understanding of drug allergy and drug allergy card and drug allergy card carrying behavior of drug allergic patients.

1. Questionnaire development

This part consisted of two questionnaire tests including content validity test and reliability test.

1.1 Content validity test

The result showed that the average score of totally 43 questions (100%) in the questionnaires were 0.88. It meant that all questions were related to objectives of the study or experts agreed with those questions. (See Appendix G)

As result of the evaluation from four experts, the questionnaire was suggested to be revised in 3 items as shown below.

1.1.1 Part I: demographic data

1.1.1.1 Question 11 that was "How severity do you think about your drug allergic symptoms?". The experts suggested that the answers should include "Not sure/ Cannot remember" into the alternative choices.

1.1.1.2 Question 12 that was "Have you ever re-administered **the drug with previous history of drug allergy?**". The experts suggested that the answers should include "Not sure/ Cannot remember" into the alternative choices.

1.1.2 Part IV: Patient's behavior of drug allergy card carrying and the prevention of re-occurring of drug allergy

1.1.2.1 Question 4 that was "Have you ever purchased drug on your own?". The experts suggested that the question should be "Have you ever received drug from non-healthcare professionals?".

After question revision, five drug allergy patients who were serviced at out-patient pharmacy department, Srinagarind Hospital were recruited to test the questionnaire. Patients who completed the questionnaires were subsequently interviewed to determine the understanding of questions in the questionnaire.

1.2 Reliability test

After testing and modifying questionnaire, it was tested again in thirty patients for reliability. Both tests showed values exceeded 0.7, thus satisfying the Nunnally's criterion (Nunnally 1978) The results showed as follows:

1.2.1 The knowledge and understanding of drug allergy and drug allergy card were tested and re-tested, then calculating the Pearson Product-Moment Coefficient correlation. The coefficient of stability for this part of questionnaire was 0.75. (Appendix H)

1.2.2 The attitudes toward drug allergy and drug allergy card of drug allergic patients were analyzed using SPSS for Window version 16.0. For all 15 items, the internal consistency for the attitudes reached a Cronbach's alpha coefficients of 0.82 (range 0.79-0.84). (Table 2)

Table 2 Internal consistency (Cronbach's alpha) of each question

Questions (Items)	Cronbach's alpha coefficient if item deleted
Overall	0.82
Question 1	0.83
Question 2	0.84
Question 3	0.84
Question 4	0.81
Question 5	0.80
Question 6	0.80
Question 7	0.79
Question 8	0.83
Question 9	0.82
Question 10	0.80
Question 11	0.80
Question 12	0.81
Question 13	0.80
Question 14	0.81
Question 15	0.80

2. Main study

This study was conducted during May 1 - October 10, 2009. There were 1,085 study samples, recruited into the study. This study was consisted of two phases; Phase 1: Brochure development from May 1 - July 31, 2009, and Phase 2: Prospective Intervention study from August 1 - October 10, 2009.

The results of the main study were reported into 4 sections as follows:

Section 1 Response rate and demographic data of the respondents

Section 2 Characteristics of drug allergy

Section 3 Knowledge and understanding of drug allergy and drug allergy card of drug allergic patients and their associated factors

Section 4 Behavior of drug allergy card carrying and the prevention of re-occurring drug allergy of drug allergic patients and their associated factors

Attitudes towards drug allergy and drug allergy card of drug allergic patients and their associated factors were reported altogether at the last part of the results.

2.1 Section 1 Response rate and demographic data of the respondents

2.1.1 Response rates

2.1.1.1 Phase 1 (Brochure development)

There were 985 drug allergic patients who were invited to complete the study questionnaire as shown in Table 3. Of the total 985 pre-test questionnaires which were distributed to the patient by mail during May, 2009, a 38.8% response rate by mail (382/985) was obtained with 78.2% overall valid response rate (299/382) (Table 4).

After receiving pre-test questionnaires, brochures with post-test questionnaires were distributed to those 299 valid respondents by mail during June, 2009. Of the total of 299 post-test questionnaires distributed, 179 responded (59.87%) consisting of 89 (59.73%) and 90 (60.0%) respondents by pattern 1 brochure and pattern 2, respectively (Figure 5 and Figure 6). The valid response rate of post-test questionnaires was 100% (179/ 179).

Table 3 Number of patients distributed pre-test questionnaires by mail

Group of patients	No. of patients (%)
Drug allergy patients in the fiscal year 2007	230 (23.4)
Drug allergy patients in the fiscal year 2008	388 (39.4)
Patients who were diagnosed with anaphylaxis, EM, SJS, and TEN	269 (27.3)
Patients who were diagnosed with MP rash	98 (9.9)
Total	985 (100)

EM = erythema multiforme, SJS= Stevens-Johnson syndrome, TEN= toxic epidermal necrolysis

Table 4 Response Rate and number a valid response rate for pre-test questionnaire

Group of patients	No. of questionnaires		No. of valid Respondents (%)
	Sent	Returned (Response rate)	
Drug allergy patients in the fiscal year 2007	230	104 (45.2)	94 (31.4)
Drug allergy patients in the fiscal year 2008	388	159 (41.0)	141 (47.2)
Patients who were diagnosed with anaphylaxis, EM, SJS, and TEN	269	91 (33.8)	60 (20.1)
Patients who were diagnosed with MP rash	98	28 (28.6)	4 (1.3)
Total	985	382 (38.8)	299 (100)

EM = erythema multiforme, SJS= Stevens- Johnson syndrome,
TEN = toxic epidermal necrolysis

Table 5 Number of patients distributing post-test questionnaires and response rate of postal questionnaires in relation to brochure pattern

Group of patients	No. of Brochure pattern 1 and questionnaires		No. of Brochure pattern 2 and questionnaires		Total
	sent	Returned (Response rate)	sent	Returned (Response rate)	
Drug allergy patients in the fiscal year 2007	47	27 (57.4)	47	29 (61.7)	56
Drug allergy patients in the fiscal year 2008	70	46 (60.0)	71	44 (62.0)	90
Patients who were diagnosed with anaphylaxis, EM, SJS, and TEN	30	15 (50.0)	30	15 (50.0)	30
Patients who were diagnosed with MP rash	2	1 (50.0)	2	2 (100.0)	3
Total	149	89 (59.7)	150	90 (60.0)	179

EM = erythema multiforme, SJS= Stevens- Johnson syndrome,
TEN = toxic epidermal necrolysis

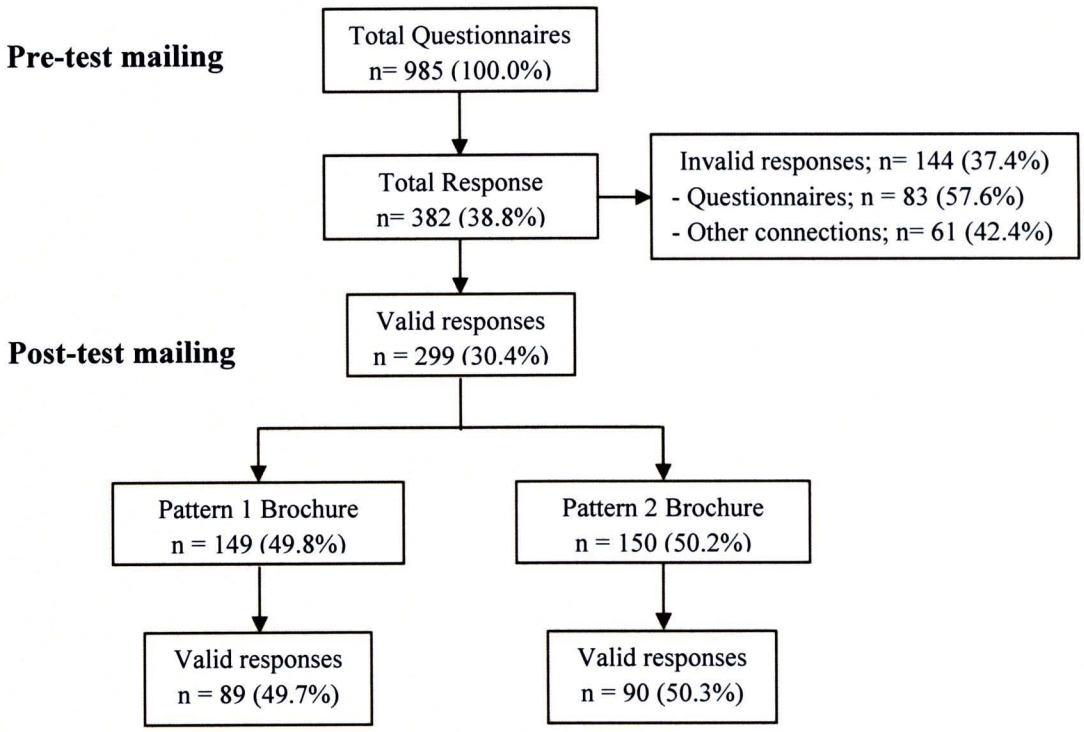

Figure 5 Flow chart of questionnaires distribution and response by mail in Phase 1

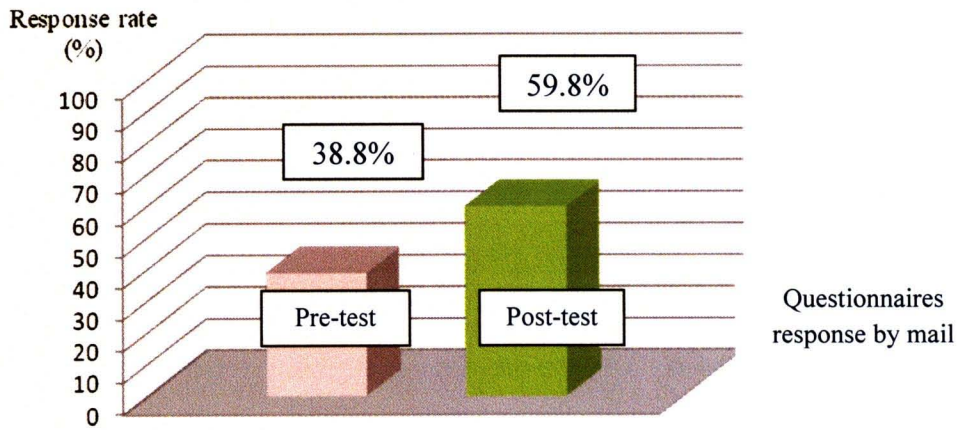

Figure 6 Response rates for pre-and post-test questionnaires by mail

There were 144 invalid responses (37.4%) including 83 cases (57.64%) by questionnaires and 61 cases (42.36%) by other connections (telephone and postcards). Invalid questionnaires due to refuse history of drug allergy (n = 44, 53.01%), lack of completion (n = 20, 24.09%), questionnaires returned to

sender (n =12, 14.46%), and dead during study period (n = 7, 8.43 %). Other response connections included 43 postcard returned to sender (70.5%) and 18 callings (29.5%) (Table 6).

Table 6 Invalid respondents

Causes	Mail questionnaires (%)	Other connections (%)		Total (%)
		Telephone	Postcard	
Incomplete questionnaires	20 (24.4%)	-	-	20
Refuse history of drug allergy	43 (52.4%)	6 (33.3%)	-	49
Dead during study period	7 (8.5%)	12 (66.7%)	5 (11.6%)	24
Mails/ postcards returned to sender	12 (14.6%)	-	38 (88.4%)	50
Total	82 (57.3%)	18 (12.6%)	43 (30.0%)	143

2.1.1.2 Phase 2 (Prospective intervention study)

There were 100 patients received either one pattern of the brochures and three questionnaires including pre-test questionnaires (T1), immediate post-test questionnaires (T2), and one-month period questionnaires (T3) from the pharmacist (Table 7). Both T1 and T2 were totally returned to the pharmacist after the intervention, but only four patients did not return T3 by mail to the pharmacist (Table 8). One of whom received pattern 1 brochure, whereas the others received pattern 2 brochures (Figure 7).

Table 7 Number of patients distributed questionnaires by pharmacist

Questionnaires	No. of patients (%)		
	Brochure pattern 1	Brochure pattern 2	Total
Pre- test questionnaires	50 (50.0%)	50 (50.0%)	100
Immediate post-test questionnaires	50 (50.0%)	50 (50.0%)	100
One-month period post-test questionnaires	49 (49.0%)	50 (50.0%)	100

Table 8 Response rate and number of valid response rate

Questionnaires	No. of questionnaire		No. of valid Respondents (%)
	Sent	Returned (Response rate)	
Pre-test questionnaires (T_1)	100	100 (100.0%)	100 (100.0%)
Immediate post-test questionnaires (T_2)	100	100 (100.0%)	100 (100.0%)
One-month period post-test questionnaires (T_3)	100	96 (96.0%)	96 (96.0%)

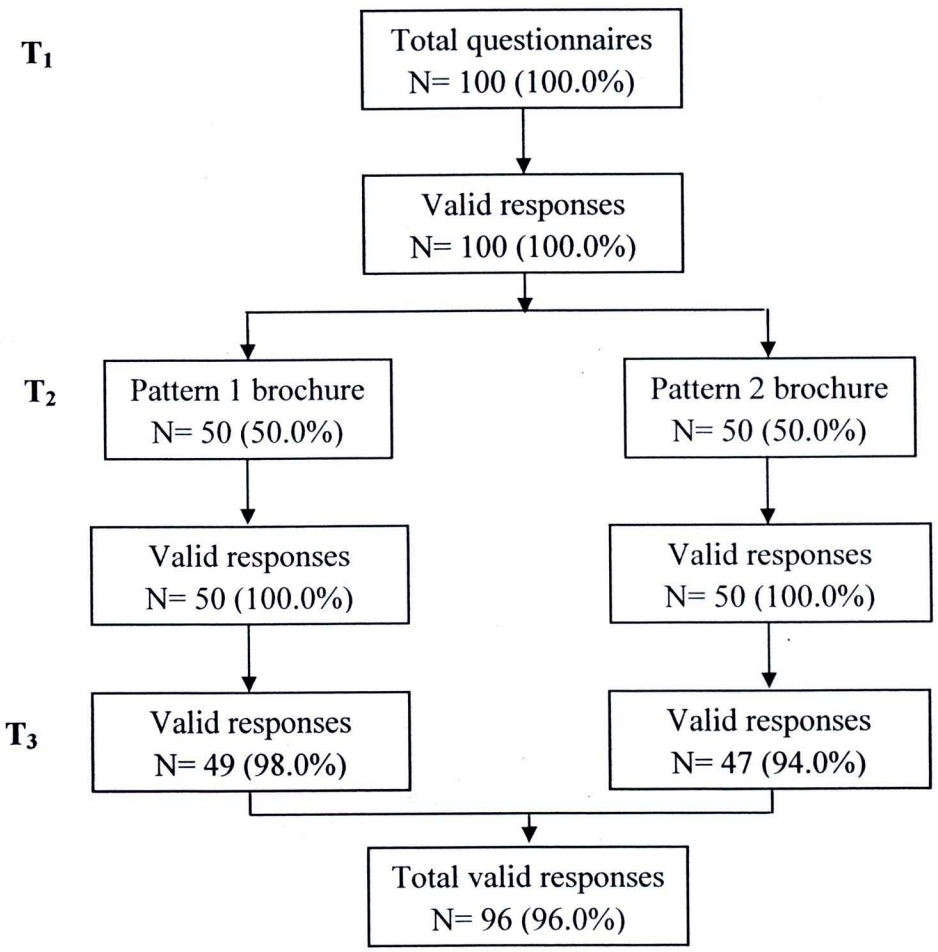

Figure 7 Flow chart of questionnaires distribution and questionnaire response in Phase 2

2.1.2 Demographic data

Table 9 showed demographic data of patient in both study. The majority of the patients in this study were female (59.9%) who aged between 41 - 60 years old (45.2%) with the mean age of 48.59 ± 17.15 years old. Mainly, the educational level of the patients was none or primary school (36.5%). Mostly, the occupation of the patients was non-healthcare professionals (95.3%) and total income was lower than 5,000 Baht per month (42.7%). There was no significant difference in any of patient characteristics between Phase 1 and Phase 2.

2.1.2.1 Phase 1 (Brochure development)

In Phase 1, a total of 179 post-test questionnaires were returned and recruited for the study: 89 had taken pattern 1 brochures (Group 1) and 90 had taken pattern 2 brochures (Group 2). The baseline characteristics of the patients were shown in Table 10. There were no significant differences among the groups in gender, age, education level, occupation, and income. The majority of the patients in group 1 and 2 were aged between 41 and 60 years (41.6% and 51.1%) with average of 47.89 ± 18.27 years and 47.46 ± 17.30 years. Mainly, education level in group 1 was none or primary school (41.6%), while in group 2 was bachelor degree (35.6%). Most of the participants were non-healthcare professionals (93.3% and 97.8%) which were none-occupation or student (32.6% and 35.6%) and had income less than 5,000 Baht per month (51.7% and 34.9%) (Table 9).

2.1.2.2 Phase 2 (Prospective intervention study)

In Phase 2, most of the patients whom received pharmacist counseling plus pattern 1 or pattern 2 brochures in this phase were out-patient (81.0%). Mainly, the patients were aged between 41 - 60 years old (44.0%) with average age of 49.37 ± 16.67 years old. The majority of the patients were female (61.0%). The most common educational level was none or primary school (36.0%). Mainly, the patients were non-healthcare professionals which was agriculturist or labor (32.9%) with monthly income lower than 5,000 Baht (41.6%) (Table 9).

Table 9 Patient Characteristics

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 and Phase 2
	Phase 1				Phase 2 (n= 100)		
	Group 1 (n=89)	Group 2 (n= 90)	Total N (n= 179)	p-value			
Sex							
Female	54 (60.7)	52 (57.8)	106 (59.2)	0.693[a]	61 (61.0)	167 (59.9)	0.771[a]
Male	35 (39.3)	38 (42.2)	73 (40.8)		39 (39.0)	112 (40.1)	
Total	89 (49.7)	90 (50.3)	179 (100.0)		100 (100.0)	279 (100.0)	
Age (years)							
≤ 20	8 (9.0)	9 (10.0)	17 (9.5)	0.457[a]	5 (5.0)	22 (7.9)	0.478[a]
21- 40	22 (24.7)	16 (17.8)	38 (21.2)		22 (22.0)	60 (21.5)	
41- 60	36 (40.4)	46 (51.1)	82 (45.8)		44 (44.0)	126 (45.2)	
> 60	23 (25.8)	19 (21.1)	42 (23.5)		29 (29.0)	71 (25.4)	
Total	89 (49.7)	90 (50.3)	179 (100.0)		100 (100.0)	279 (100.0)	
Mean ± S.D.	47.89±18.27	47.46±17.30	47.89±17.55	0.871[c]	49.37±16.67	48.59±17.15	0.434[c]
Median ± IQR	51±24	50±19	51±21	0.796[d†]	50±24	51±23	0.622[d†]
Min-Max	5- 83	6- 79	5- 83		5-83	5- 83	
Education level							
None or Primary school	37 (41.6)	28 (31.1)	65 (36.3)	0.435[a]	36 (36.0)	101 (36.5)	0.583[a]
Secondary or high school	24 (27.0)	25 (27.8)	49 (27.4)		28 (28.8)	77 (27.8)	
Bachelor degree	23 (25.8)	32 (35.6)	55 (30.7)		32 (32.0)	87 (31.4)	
Master & higher	5 (5.6)	5 (5.6)	10 (5.6)		2 (2.0)	12 (4.3)	
Total	89 (49.7)	90 (50.3)	179 (100.0)		98 (100.0)	277 (100.0)	
Missing					2	2	

Table 9 Patient Characteristics (Cont.)

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 and Phase 2
	Phase 1				Phase 2		
	Group 1 (n=89)	Group 2 (n= 90)	Total N (n= 179)	p-value	(n= 100)		
Occupation							
Non-healthcare professional	83 (93.3)	88 (97.8)	171 (95.5)	0.169[b]	93 (95.9)	263 (95.3)	0.893[b]
Government officers	23 (26.1)	30 (33.3)	53 (29.8)		24 (24.7)	77 (27.9)	
Agriculturists	16 (18.2)	13 (14.4)	29 (16.3)		25 (46.3)	54 (19.6)	
Students	8 (9.1)	10 (11.1)	18 (10.1)		7 (7.2)	25 (9.1)	
Commercials	9 (10.1)	6 (6.7)	15 (8.4)		12 (12.4)	27 (9.8)	
Labors	8 (9.1)	3 (3.3)	11 (6.2)		7 (7.2)	18 (6.5)	
Employees	4 (4.5)	7 (7.8)	11 (6.1)		6 (6.2)	17 (6.2)	
State enterprise	1 (1.1)	1 (1.1)	2 (1.1)		0 (0.0)	2 (0.7)	
Monks	1 (1.1)	3 (3.3)	4 (2.2)		0 (0.0)	4 (1.4)	
None	12 (13.5)	15 (16.7)	27 (15.2)		12 (12.4)	39 (14.1)	
Healthcare professional	6 (6.7)	2 (2.2)	8 (4.5)		4 (4.1)	12 (4.3)	
Total	89 (49.7)	90 (50.3)	179 (100.0)		97 (100.0)	276 (100.0)	
Missing					3	3	
Income (Baht/ month)							
< 5,000	45 (51.7)	30 (34.9)	75 (43.4)	0.137[a]	37 (41.6)	112 (42.7)	0.840[a]
5,001- 10,000	14 (16.1)	15 (17.4)	29 (16.8)		19 (21.3)	48 (18.3)	
10,001- 20,000	13 (14.9)	18 (20.9)	31 (17.9)		15 (16.8)	46 (17.6)	
≥ 20,001	15 (17.2)	23 (26.7)	38 (22.0)		18 (20.3)	56 (21.4)	
Total	87 (50.3)	86 (49.7)	173 (100.0)		89 (100.0)	262 (100.0)	
Missing	2	4	6		11	17	

S.D. = Standard deviation, IQR= Interquartile range

[a]Comparing frequency between groups or phases used Chi- square test. [b]Comparing frequency between groups or phases used Fisher's exact test.

[c]Comparing mean difference between groups or phases used Independent t-test. [d]Comparing mean difference between groups or phases used Mann Whitney U test.

Health status of the patients in both study phases showed that 42.3% of the patients had one underlying disease (1.32 ± 1.12) but most of them (33.0%) had no drug use. These characteristics had no significant difference between Phase 1 and Phase 2 (Table 10). The majority underlying disease of the patients classify by organ systems was cardiovascular system (22.6%), followed by muscle skeletal system (12.9%), and endocrine and metabolism (12.2%) (Table 11). The top tree frequencies of underlying disease were hypertensions (14.3%), Diabetes mellitus (9.9%), and peptic ulcer (7.6%) (Table 12). The most frequently drug used was Antihypertensive and CVS drugs (32.1%) (Table 13).

In Phase 1, there were no significant differences among the group in number of underlying disease and drug use. Patients in both groups had at least 1 underlying disease (34.8% and 42.2%). Mostly, group 1 patients were taken between 1 and 2 drugs (30.7%) while the other group had no drug use (34.8%) (Table 10).

Table 11 showed the patients' underlying diseases classify by organ systems, which disorder of cardiovascular system, endocrine system and musculo-skeletal system were mostly exposed (21.5%, 13.3%, and 11.7%, respectively). The top three frequencies of underlying disease were hypertension, Diabetes mellitus, and Allergic rhinitis (13.6%, 12.0%, and 7.9%, respectively) (Table 12) which Antihypertensive and CVS drugs (34.4%) were most accounted for the drug used in patients (Table 13).

In Phase 2, the majority of the patients had at least one underlying disease (49.0%) which cardiovascular systems (25.4%) was the major organ system involved, followed by muscle skeletal system (16.1%) and gastrointestinal system (12.7%) (Table 10 and Table 11). The most common underlying disease was hypertension (16.1%), followed by peptic ulcer (10.2%) and gout (5.9%) (Table 12). Most of the patients (33.0%) had no drug use but drugs which were commonly used for underlying disease were antihypertensive and CVS drugs (27.2%) (Table 10 and Table 13).

Table 10 Number of underlying disease and total drug use

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 And Phase 2
	Phase 1				Phase 2		
	Group 1 (n=89)	Group 2 (n= 90)	Total N (n= 179)	p-value	(n= 100)		
No. of underlying disease							
0	25 (28.1)	19 (21.1)	44 (24.6)	0.677[a]	21 (21.0)	65 (23.3)	0.224[a]
1	31 (34.8)	38 (42.2)	69 (38.5)		49 (49.0)	118 (42.3)	
2	21 (23.6)	21 (23.3)	42 (23.5)		15 (15.0)	57 (20.4)	
≥ 3	12 (13.5)	12 (13.3)	24 (13.4)		15 (15.0)	39 (14.0)	
Total	89 (49.7)	90 (50.3)	179 (100.0)		100 (100.0)	279 (100.0)	
Mean ± S.D.	1.29±1.15	1.37±1.14	1.35±1.15	0.665[b]	1.28±1.04	1.32±1.12	0.721[b]
Median ± IQR	1±2	1±1	1±1	0.627[c*]	1±1	1±1	0.791[c*]
Min-Max	0-4	0-6	0-6		0-4	0-6	
No. of total drug use (items)							
0	26 (29.5)	31 (34.8)	59 (33.0)	0.828[a]	33 (33.0)	92 (33.0)	0.478[a]
1-2	27 (30.7)	26 (29.2)	53 (29.6)		27 (27.0)	80 (28.7)	
3-4	22 (25.0)	18 (20.2)	40 (22.3)		18 (18.0)	58 (20.8)	
≥ 5	13 (14.8)	14 (15.7)	27 (15.1)		22 (22.0)	49 (17.6)	
Total	89 (49.7)	90 (50.3)	179 (100.0)		100 (100.0)	279 (100.0)	
Mean ± S.D.	2.28±2.30	2.07±2.12	2.07±2.12	0.519[b]	2.36±2.49	2.20±2.30	0.470[b]
Median ± IQR	2±3	2±3	2±3	0.568[c*]	2±4	2±3	0.690[c*]
Min-Max	0-10	0-8	0-10		0-10	0-10	
Missing	1	1	2				

S.D. = Standard deviation, IQR= Interquartile range

[a]Comparing frequency between groups or phases used Chi-square test.

[b]Comparing mean difference between or phases groups used Independent t-test.

[c]Comparing mean difference between or phases groups used Mann Whitney U test.

Table 11 Number of patients according to underlying disease classified by organ systems

Organ systems	No. of patients (%)		
	Phase 1	Phase 2	Total
Cardiovascular system	68 (21.5)	30 (25.4)	98 (22.6)
Muscle skeletal system	37 (11.7)	19 (16.1)	56 (12.9)
Endocrine and metabolism	42 (13.3)	11 (9.3)	53 (12.2)
Gastrointestinal system	30 (9.5)	15 (12.7)	45 (10.4)
Hematology and Oncology	29 (9.2)	11 (9.3)	40 (9.2)
Disorders of the eyes, ears, nose, and throat	29 (9.2)	5 (4.2)	34 (7.8)
Kidney an urinary tract	17 (5.4)	7 (5.9)	24 (5.5)
Infectious diseases	17 (5.4)	6 (5.1)	23 (5.3)
Nervous system	17 (5.4)	5 (4.2)	22 (5.1)
Respiratory system	14 (4.4)	1 (0.8)	15 (3.5)
Immunologic disorders	9 (2.8)	6 (5.1)	15 (3.5)
Dermatologic disorders	7 (2.2)	2 (1.7)	9 (2.1)
Total	316 (100)	118 (100)	434 (100.0)

Patients could exposed more than 1 disease

Table 12 Top ten frequencies of underlying disease

Underlying diseases	No. of patients (%)		
	Phase 1	Phase 2	Total
Hypertensions	43 (13.6)	19 (16.1)	62 (14.3)
Diabetes mellitus	38 (12.0)	5 (4.2)	43 (9.9)
Peptic ulcer	21 (6.6)	12 (10.2)	33 (7.6)
Allergic rhinitis	25 (7.9)	3 (2.5)	28 (6.5)
Gout	19 (6.0)	7 (5.9)	26 (6.0)
Hyperlipidemia	17 (5.4)	4 (3.4)	21 (4.8)
Thyroid disorders	14 (4.4)	6 (5.1)	20 (4.6)
Asthma	14 (4.4)	1 (0.8)	15 (3.5)
Systemic lupus eryhtematosus (SLE)	9 (2.8)	6 (5.1)	15 (3.5)
Osteoarthriris	7 (2.2)	6 (5.1)	13 (3.0)
Osteoporosis	6 (1.6)	4 (3.4)	10 (2.3)
Benign Prostatic Hypertrophy (BPH)	5 (1.6)	5 (4.2)	10 (2.3)
Others	98 (31.0)	40 (33.9)	138 (31.8)
Total	316 (100.0)	118 (100.0)	434 (100.0)

Patients could exposed more than 1 disease

Table 13 Numbers of patients according to concomitant drugs classified by drug groups

Drug groups	No. of patients (%)		
	Phase 1	**Phase 2**	**Total**
Antihypertensive and CVS drugs	142 (34.4)	52 (27.2)	194 (32.1)
Vitamin and minerals	62 (15.0)	35 (18.3)	97 (16.1)
Gastrointestinal system	32 (7.7)	34 (17.8)	66 (10.9)
Endocrine drugs	33 (8.0)	6 (3.1)	39 (6.5)
Antiretroviral drugs	22 (5.3)	9 (4.7)	31 (5.1)
Corticosteroid	13 (2.1)	12 (6.3)	25 (4.1)
NSAIDs and DMARDs	12 (2.9)	7 (3.7)	19 (3.1)
Antituberculosis drugs	15 (3.6)	3 (1.6)	18 (3.0)
Antiepileptic drugs	12 (2.9)	5 (2.6)	17 (2.8)
Antidepressant and tranquillizers	8 (1.9)	5 (2.6)	13 (2.2)
others	62 (15.0)	23 (12.0)	85 (14.1)
Total	413 (100)	191 (100.0)	604 (100.0)

Table 14 showed patient characteristics of health care services. In Phase 1, in the last 1 year, patients sought treatment 1-3 times from healthcare (32.2%) which hospital was the most frequently source (80.1%). Patients always had taken drug allergy history by healthcare professionals (53.2%) and hospital was the major source of drug allergy information (88.9%).

In Phase 2, in the last 1 year, patients sought treatment 4-6 times from healthcare (30.3) which hospital was the most frequently source (74.5%). About half of patients always had taken drug allergy history by healthcare professionals (50.5%) and hospital was the major source of drug allergy information (54.0%).

Table 14 Patient health care characteristics

Characteristics	No. of patients (%)	
	Phase 1 n= 299	**Phase 2 n= 100**
Frequency of healthcare patients seeking for treatment in the last 1 year		
None	15 (5.1)	8 (8.1)
1-3 times	95 32.2)	23 (23.2)
4-6 times	63 (21.4)	30 (30.3)
7-9 times	28 (9.5)	8 (8.1)
more than 10 times	94 (31.9)	30 (30.3)
Missing	4	1
Sources of healthcare patient seeking for treatment		
Hospital	237 (80.1)	73 (74.5)
Clinic	28 (9.5)	7 (7.1)
Drug store	20 (6.8)	12 (12.2)
Community health centre	11 (3.7)	6 (6.1)
Missing	3	2
Frequency of drug allergy history interviewing by healthcare provider		
Always	157 (53.2)	50 (50.5)
Often	46 (15.6)	15 (15.2)
Sometimes	84 (28.5)	18 (18.2)
Never	8 (2.7)	16 (16.2)
Missing	4	1
Sources of drug allergy information*		
Never	18 (6.1)	26 (26.3)
Hospital	248 (88.9)	68 (54.0)
Drug leaflet or brochure	83 (29.7)	11 (8.7)
Clinic	56 (21.1)	20 (15.9)
Medias	52 (18.6)	8 (6.3)
Drug store	34 (12.2)	12 (9.5)
Friend or family member	32 (11.5)	7 (5.6)
Missing	2	1

*Multiple responses allowed

There was no significant difference in any of patient characteristics between Group 1 and Group 2 in Phase 1 and between Phase 1 and Phase 2, therefore the knowledge and understanding between two groups in Phase 1 and between Phase 1 and Phase 2 were comparable without bias.

2.2 Section 2 Characteristics of drug allergy

Table 15 and Table 16 presented characteristics of drug allergy of both study phases which were reported by patients and rechecked with data from pharmacy department and medical record and hospital databases. The majority of patients in pre- test phase could tell how many allergic drugs they had (88.2%), of which 61.6% had only one drug allergic and the maximum number of allergic drug was five. The database also found that 78.9% of the patients had only one drug allergy and the maximum number of allergic drug was seven. Almost half of the patients thought that their severity of allergic reactions to drugs were serious (47.3%) which was differed from database that 70.3% of the patients were non-serious reactions. About 18.0% of the patients had re-exposed to previous allergic drug, presented in the same severity (42.9%). Over 61.8% of the patients had or used to have drug allergy cards and around 60% of the patient had friends or relatives to notify their drug allergy card carrying or inform healthcare professionals about their drug allergy. The comparison of drug allergy characteristics between Phase 1 and Phase 2 showed no significant difference excepted for number of drug allergy reported by patients and the availability of drug allergy card ($p = 0.020$ and $p< 0.001$, respectively).

In Phase 1, there were no significant differences between group 1 and 2 patients in the ability to tell the number of their allergic drug, severity of allergic reactions to drugs, history of re-exposed to previous allergic drug, history of recurrent drug allergy, severity of recurrent allergic reactions to drugs, and having a person to notify drug allergy card carrying or inform healthcare professionals about their drug allergy (Table 15).

In Phase 2, the majority of the patient had one drug allergy (72.7%) which was correlated to data from medical record (77.0%) (Table 15 and Table 16). Half of them (50.0%) thought that the severity of the symptom was serious. Approximately 16.0% of the patients had recurrent drug allergy. The majority of the patients never had drug allergy card (69.4%) and did not have any person to notify them about drug allergy card carrying (54.1%).

Table 15 Characteristics of drug allergy reported by patients

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 and Phase 2
	Phase 1				Phase 2		
	Group 1 (n=89)	Group 2 (n= 90)	Total (n=179)	p-value			
Number of drug allergy (Items)							
Cannot remember	12 (14.0)	14 (16.3)	26 (15.1)	0.970 [b]	6 (6.1)	32 (11.8)	0.020 [b]
1	48 (55.8)	47 (54.7)	95 (55.2)		72 (72.7)	167 (61.6)	
2-3	23 (26.7)	23 (26.7)	46 (26.7)		20 (20.2)	66 (24.4)	
≥ 4	3 (3.5)	2 (2.3)	5 (2.9)		1 (1.0)	6 (2.2)	
Total	86 (100.0)	86 (100.0)	172 (100.0		99 (100.0)	271 (100.0)	
Mean ± S.D.	1.29±0.91	1.24± 0.89	1.26±0.89	0.735 [c]	1.22± 0.71	1.25±0.83	
Median (range)	1 (4)	1 (4)	1 (4)	0.743 [d*]	1 (5)	1 (5)	
Min-Max	1-4	1-4	1-4		1-5	1-5	
Missing	3	4	7		1	8	
Severity of drug allergy							
Serious	43 (48.9)	38 (42.7)	81 (45.8)	0.735 [b]	50 (50.0)	131 (47.3)	0.537 [a]
Moderate	34 (38.6)	36 (40.4)	70 (39.5)		35 (35.0)	105 (37.9)	
Mild	7 (8.0)	11 (12.4)	18 (10.2)		13 (13.0)	31 (11.2)	
Cannot remember/ Not sure	4 (4.5)	4 (4.5)	8 (4.5)		2 (2.0)	10 (3.6)	
Total	88 (100.0)	89 (100.0)	177 (100.0)		100 (100.0)	277 (100.0)	
Missing	2	1	2			2	

Table 15 Characteristics of drug allergy reported by patients (Cont.)

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 And Phase 2
	Phase 1				Phase 2		
	Group 1 (n=89)	Group 2 (n= 90)	Total (n=179)	p-value			
History of taking drug with previous drug allergy history							
Never	73 (82.0)	65 (72.2)	138 (77.1)	0.285 [a]	78 (78.8)	216 (77.7)	0.859 [a]
Yes	13 (14.6)	21 (23.3)	34 (19.0)		16 (16.2)	50 (18.0)	
Not sure/ cannot remember	3 (3.4)	4 (4.4)	7 (3.9)		5 (5.1)	12 (4.3)	
Total	89 (100.0)	90 (100.0)	179 (100.0)		99 (100.0)	278 (100.0)	
Missing					1		
History of recurrent drug allergy							
Yes	13 (81.2)	22 (88.0)	35 (85.4)	0.662 [b]	16 (76.2)	51 (82.3)	0.721 [a]
Not sure/ cannot remember	3 (18.8)	3 (12.2)	6 (14.6)		5 (23.8)	11 (17.7)	
Total	16 (100.0)	25 (100.0)	41 (100.0)		21 (100.0)	62 (100.0)	
Severity of recurrent drug allergy							
Same severity	8 (50.0)	12 (48.0)	20 (47.6)	0.582 [b]	7 (33.3)	27 (42.9)	0.872 [b]
More severity	2 (12.5)	7 (28.0)	9 (21.4)		5 23.8)	14 (22.2)	
Less severity	2 (12.5)	3 (12.0)	5 (11.9)		3 (14.3)	8 (12.7)	
Unidentified	1 (6.2)	0 (0.0)	1 (2.4)		1 (4.8)	2 (3.2)	
Not sure/ cannot remember	3 (18.8)	3 (12.0)	6 (14.3)		5 (23.8)	11 (17.5)	
Total	17 (100.0)	25 (100.0)	42 (100.0)		21 (100.0)	63 (100.0)	

Table 15 Characteristics of drug allergy reported by patients (Cont.)

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 And Phase 2
	Phase 1				Phase 2		
	Group 1 (n=89)	Group 2 (n= 90)	Total (n=179)	p-value			
Drug allergy card availability							
No	21 (23.9)	18 (20.2)	39 (22.0)	0.736 [b]	68 (69.4)	107 (38.9)	<0.001 [b]
Yes	63 (71.6)	68 (76.4)	131 (74.0)		29 (29.6)	160 (58.2)	
Used to	4 (4.5)	3 (3.4)	7 (4.0)		1 (1.0)	10 (3.6)	
Total	88 (100.0)	89 (100.0)	177 (100.0)		98 (100.0)	275 (100.0)	
Missing	1	1	2		2	4	
Drug allergy card carrying notified person							
No	41 (46.6)	36 (41.4)	77 (44.0)	0.487 [a]	53 (54.1)	130 (47.6)	0.110 [b]
Yes	47 (53.4)	51 (58.6)	98 (56.0)		45 (45.9)	143 (52.4)	
Total	88 (100.0)	87 (100.0)	175 (100.0)		98 (100.0)	273 (100.0)	
Missing	1	3	4		2	6	

[a]Comparing frequency between groups used Chi-square test
[b]Comparing frequency between groups used Fisher's exact test
[c]Comparing mean difference between groups used Independent t-test
[d]Comparing mean difference between groups used Mann Whitney U test

Table 16 Numbers of allergic drug identified by pharmacy and Medical Record and Statistics database

Characteristics	No. of patients (%)					Total N (%)	p-value Phase 1 And Phase 2
	Phase 1				Phase 2		
	Group 1 (n=89)	Group 2 (n= 90)	Total (n=179)	p-value			
Number of drug allergy (Items)							
1	70 (78.7)	73 (81.1)	143 (79.9)	0.868 [b]	77 (77.0)	220 (78.9)	0.835[a]
2-3	15 (16.9)	14 (15.6)	29 (16.2)		19 (19.0)	48 (17.2)	
≥ 4	4 (4.5)	3 (3.3)	7 (3.9)		4 (4.0)	11 (3.9)	
Total	89 (100.0)	90 (100.0)	179 (100.0)		100 (100.0)	279 (100.0)	
Mean ± S.D.	1.37±0.92	1.32± 0.87	1.32±0.80	0.718 [c]	1.35± 0.77	1.35±0.86	
Median (range)	1 (6)	1(6)	1 (6)	0.674 [d]	1 (4)	1(6)	
Min-Max	1-7	1-7	1-7		1-5	1-7	
Severity of drug allergy							
Non-serious**	62 (69.7)	63 (70.0)	125 (69.8)	0.961[a]	71 (71.0)	196 (70.3)	0.838[a]
Serious*	27 (30.3)	27 (30.0)	54 (30.2)		29 (29.0)	83 (29.7)	
Total	89 (100.0)	90 (100.0)	179 (100.0)		100 (100.0)	279 (100.0)	

* Serious drug allergy= anaphylaxis, erythema multiforme, Stevens' Johnson syndrome, toxic epidermal necrolysis

**Non-serious drug allergy = others

[a]Comparing frequency between groups used Chi-square test

[b]Comparing frequency between groups used Fisher's exact test

[c]Comparing mean difference between groups used Independent t-test

[d]Comparing mean difference between groups used Mann Whitney U test

2.3 Section 3 Knowledge and understanding of drug allergy and drug allergy card of the patients and their associated factors

This section was consisted of 3 parts according to study objectives as followed

Part 1: Phase 1 (Brochure development) and Phase 2 (Prospective intervention study)

Part 2: Comparison of knowledge and understanding of drug allergy and drug allergy card of the patients between Phase 1 and Phase 2

Part 3: Factors associated with knowledge and understanding of drug allergy and drug allergy card of the patients

Part 1: Phase 1 (Brochure development) and Phase 2 (Prospective intervention study)

2.3.1 Knowledge and understanding of drug allergy and drug allergy card of the patients

Phase 1 (Brochure development)

A total of 299 patients completed pre-test questionnaires, but only 179 of them (59.9%) had finished post- test questionnaires. Five questions were tested for patients' knowledge and understanding of drug allergy and drug allergy card. The accuracy in patients' knowledge and understanding of drug allergy were presented in Table 17. The pre-test and the post-test accuracy of each questions had no significant differences between two groups, excepted for post-test of question 5. Group 1 patients were significantly had more accuracy in the importance of allergy card than Group 2 patients (21.3% vs 10.1%, P = 0.040). Comparisons of the accuracy between pre-and post test in each groups were found significant differences for Group 2. Question 1 presented that the patients were able to tell name of the allergic drug in post-test (72.2%) than pre-test (63.3%) with statistical difference (P = 0.021). Again, difference was found in Question 3 where Group 2 patients were able to tell the management of drug allergy in pre-test than post-test (93.3% vs 84.4%, P = 0.057).

The characteristics of the answers between pre- and post-test of two groups were described in Table 18. Question 1: Both patient groups who were able to tell name of the allergic drug, most of them could complete all drug names in pre-and post-test (Pre-test: 55.1% vs 55.6, Post-test: 59.6% vs 62.2%). The top three

drugs which patients claimed they were allergic to were penicillins (21.9%), sulfonamides (9.6%), and tetracycline (4.8%) (Table 22). After data validation with patients' medical record and pharmacy database, the top three drugs which patients could not specify drug name were penicillins (8.1%), sulfonamides (6.5%), ceftriaxone (6.5%), ibuprofen (4.1%), diclofenac (4.1%), carbamazepine (4.1%), and phenytoin (4.1%) (Table 23).

Question 2: Both patient groups who were able to tell drug allergy symptoms in pre-test (Table 18), majority of Group 1 patients were partially completed drug allergy symptoms (24.7%) whereas Group 2 patients completed all drug allergy symptoms with other symptoms reported (26.7%). In post-test, majority of Group 1 patients could complete all drug allergy symptoms (27.3%) whereas Group 2 completed all drug allergy symptoms with other symptoms reported (24.4%) and partially completed drug allergy symptoms with other symptoms (24.4%) (Table 18). Of a 1,068 reported drug allergy symptoms (Table 24), major organ system which were most involved was skin and appendages (54.0%). The top three drug allergy symptoms which were most reported were skin rashes (24.7%), pruritus (16.3%), and redness and edema of the face (7.9%). Skin rashes that were most identified by the patients, were rash (16.8%) and urticaria (8.0%). Table 25 demonstrated false drug allergy symptoms that patients reported. The top three symptoms were sweating (15.9%), nausea (14.3%), and vomiting (14.0%). The accuracy rate of drug allergy symptoms by patients' reports was calculated based on the total drug allergy symptoms by the following formula;

$$\textit{The accuracy rate} = \frac{\textit{Numbers of accuracy report}}{\textit{Total numbers of drug allergy symptoms}} \times 100$$

In pre-test, the accuracy rate in Group 1 and Group 2 were 9.2% and 10.4%, respectively. and in post-test, the accuracy rate in Group 1 and Group 2 were 9.5% and 10.3%, respectively.

Question 3: the majority of patient in both group were able to identify the correct management of drug allergy which were stop taking the drug and consulting healthcare professional (Pre-test: 72.9% vs 68.7%; Post-test: 76.2% vs 84.9%) and stop taking the drug and taking another drug for the reaction (Pre-test: 21.2% vs 20.5%; Post-test: 14.3% vs 10.5%) (Table 18).

Question 4: the prevention of recurrent drug allergy consisted of four minor statements, answered in "Yes" or "No" boxes. The majority of the patients thought that to prevent recurrent drug allergy, they should avoid taking known allergic drug (Pre-test: 98.8% vs 97.7%; Post- test: 98.9% vs 96.7%), notify healthcare professional about their drug allergy history (Pre-test: 96.6% vs 100.0%; Post-test: 98.9% vs 100.0%), and carry drug allergy card (Pre-test: 92.9% vs 96.5%; Post-test: 100.0% vs 95.6%). Also, most of the patients thought that reducing the dose of allergic drug was an incorrect answer (Pre-test: 89.5% vs 91.0%; Post-test: 93.3% vs 96.7%). For Group 1 patients, the significant differences between pre-and post-test were found in reducing the dose of allergic drug ($P< 0.001$) and carrying drug allergy card ($P= 0.031$) (Table 18).

Question 5: the importance of drug allergy card consisted of five minor statements, answered in "Yes" or "No" boxes. There was no significant difference between groups and tests. The majority of the patients thought that the importance of drug allergy card were reminding the name of allergic drug (Pre-test: 96.6% vs 100.0%; Post-test: 96.6% vs 97.8%), informing healthcare professionals about their drug allergy (Pre-test: 97.7% vs 98.9%; Post-test: 98.9% vs 98.9%), and preventing recurrent drug allergy (Pre-test: 98.9% vs 96.6%; Post-test: 98.9% vs 95.6%). But patients were most misunderstood that drug allergy card could prevent allergic reaction due to drug with other combination out of the record (Pre-test: 79.5% vs 72.7%; Post-test: 71.9% vs 73.3%) (Table 18).

Table 17 The accuracy in patients' knowledge and understanding of drug allergy of Phase 1

Questions	Frequency (%)				p-value			
	Group 1 (n=89)		Group 2 (n= 90)		pre	post	Group 1	Group 2
	Pre-test	Post-test	Pre-test	Post-test	Group1,2[a]	Group1,2[a]	pre-post[b]	pre-post[b]
Question 1 Name of the allergic drug								
Yes	55 (61.8)	59 (66.3)	57 (63.3)	65 (72.2)	0.832	0.390	0.219	**0.021**
No	34 (38.2)	30 (33.7)	33 (36.7)	25 (27.8)				
Missing								
Question 2 Symptoms of allergic reactions								
Yes	68 (76.4)	70 (78.7)	77 (85.6)	76 (84.4)	0.119	0.318	0.727	1.000
No	21 (23.6)	19 (21.3)	13 (14.4)	14 (15.6)				
Missing								
Question 3 The management of drug allergy								
Yes	82 (92.1)	79 (88.8)	76 (84.4)	84 (93.3)	0.110	0.284	0.508	**0.057**
No	7 (7.9)	10 (11.2)	14 (15.6)	6 (6.7)				
Missing								
Question 4 The prevention of recurrent drug allergy								
Yes	71(83.5)	80 (89.9)	76 (88.4)	83 (92.2)	0.362	0.584	0.18	0.388
No	14 (16.5)	9 (10.1)	10 (11.6)	7 (7.8)				
Missing	8							
Question 5 The importance of drug allergy card								
Yes	12 (13.8)	19 (21.3)	15 (17.2)	9 (10.1)	0.530	**0.040**	0.359	0.238
No	75 (86.2)	70 (78.7)	72 (82.8)	80 (89.9)				
Missing	2		3	1				

[a]Comparing frequency between group 1 and group 2 used Chi-square test

[b]Comparing frequency between pre-and post-test used McNemar test

Table 18 Characteristic of patients' answers in Phase 1

Characteristics	No. of patients (%)						p-value	
	Pre- test Phase			Post-test Phase			Group 1	Group 2
	Group 1 (n=89)	Group 2 (n= 90)	p-value	Group 1 (n=89)	Group 2 (n= 90)	p-value	Pre-Post	Pre-Post
Question 1 Name of the allergic drug								
Unknown	22 (24.7)	25 (27.8)	0.868[b]	18 (20.2)	18 (20.0)	0.870[b]	0.668[c]	0.170[c]
Drug name was completed	49 (55.1)	50 (55.6)		53 (59.6)	56 (62.2)			
Drug name was less than database	8 (9.0)	7 (7.8)		6 (6.7)	8 (8.9)			
Drug name was more than database	7 (7.9)	7 (7.8)		11 (12.4)	7 (7.8)			
Drug name was not relevant to database	3 (3.4)	1 (1.1)		1 (1.1)	1 (1.1)			
Question 2 Symptoms of allergic reactions								
Unknown	2 (2.2)	1 (1.1)	0.265[b]	1 (1.1)	1 (1.1)	0.360[b]	0.111[c]	0.180[c]
Not remember/ not sure	3 (3.4)	0 (0.0)		2 (2.3)	0 (0.0)			
All completed drug allergy symptoms	21 (23.6)	21 (23.3)		24 (27.3)	17 (18.9)			
Completed drug allergy symptoms with other symptoms	11 (12.4)	24 (26.7)		11 (12.5)	22 (24.4)			
Partial completed drug allergy symptoms	22 (24.7)	17 (18.9)		18 (20.5)	13 (14.4)			
Partial drug allergy symptoms with other symptoms	13 (14.6)	14 (15.6)		18 (20.5)	22 (24.4)			
In corrected drug allergy symptoms	12 (13.5)	10 (11.1)		9 (10.2)	10 (11.1)			
In corrected drug allergy symptoms with other symptoms	4 (4.5)	2 (2.2)		3 (3.4)	4 (4.4)			
Other symptoms	1 (1.1)	1 (1.1)		2 (2.3)	1 (1.1)			
Missing				1				

Table 18 Characteristic of patients' answers in Phase 1 (Cont.)

Characteristics	No. of patients (%)						p-value	
	Pre-test Phase			Post-test Phase			Group 1	Group 2
	Group 1 (n=89)	Group 2 (n= 90)	p-value	Group 1 (n=89)	Group 2 (n= 90)	p-value	Pre-Post	Pre-Post
Question 3 The management of drug allergy								
Do nothing and continue using the drug	0 (0.0)	2 (2.4)	0.068[b]	1 (1.2)	0 (0.0)	0.369[b]	0.291[c]	0.564[c]
Continue using the drug and taking another drug for the reaction	1 (1.2)	0 (0.0)		2 (2.4)	0 (.0)			
Reduce the dose of the drug	1 (1.2)	3 (3.6)		0 (0.0)	1 (1.2)			
Stop taking drug and doing nothing	3 (3.5)	4 (4.8)		5 (6.0)	3 (3.5)			
Stop taking the drug and consulting healthcare professional	62 (72.9)	57 (68.7)		64 (76.2)	73 (84.9)			
Stop taking the drug and taking another drug for the reaction	18 (21.2)	17 (20.5)		12 (14.3)	9 (10.5)			
Missing	4	7		5	4			
Question 4 The prevention of recurrent drug allergy								
Avoiding taking allergic drug								
Yes	85 (98.8)	86 (97.7)	1.000[b]	88 (98.9)	87 (96.7)	0.621[b]	1.000[d]	1.000[d]
No	1 (1.2)	2 (2.3)		1 (1.1)	3 (3.3)			
Missing	3	1						
Reducing the dose of allergic drug								
Yes	9 (10.5)	8 (9.0)	0.742[a]	6 (6.7)	3 (3.3)	0.330[b]	**<0.001**[d]	0.180[d]
No	77 (89.5)	81 (91.0)		83 (93.3)	87 (96.7)			
Missing	3	1						

Table 18 Characteristic of patients' answers in Phase 1 (Cont.)

Characteristics	No. of patients (%)						p-value	
	Pre-test Phase			Post-test Phase			Group 1	Group 2
	Group 1 (n=89)	Group 2 (n= 90)	p-value	Group 1 (n=89)	Group 2 (n= 90)	p-value	Pre-Post	Pre-Post
Notifying healthcare professional about drug allergy history								
Yes	86 (96.6)	87 (100.0)	0.246[b]	88 (98.9)	90 (100.0)	0.497[b]	-	-
No	3 (3.4)	0 (0.0)		1 (1.1)	0 (0.0)			
Missing		3						
Carrying drug allergy card								
Yes	79 (92.9)	83 (96.5)	0.329[b]	89 (100.0)	86 (95.6)	0.121[b]	**0.031**[d]	1.000[d]
No	6 (7.1)	3 (3.5)		0 (0.0)	4 (4.4)			
Missing	4	4						
Question 5 The importance of drug allergy card								
Reminding the name of the allergic drug								
Yes	84 (96.6)	87 (98.9)	0.368[b]	86 (96.6)	88 (97.8)	0.682[b]	1.000[d]	1.000[d]
No	3 (3.4)	1 (1.1)		3 (3.4)	2 (2.2)			
Missing	2	2						
Informing healthcare professionals about drug allergy								
Yes	86 (97.7)	87 (98.9)	0.623[b]	88 (98.9)	89 (98.9)	1.000[b]	1.000[d]	1.000[d]
No	2 (2.3)	1 (1.1)		1 (1.1)	1 (1.1)			
Missing	1	2						

Phase 2 (Prospective intervention study)

The number of patient in pre-test (T_1), immediate pot-test (T_2), and one- month period post-test (T_3) were 100, 100, and 96, respectively. Five questions were tested for patients' knowledge and understanding of drug allergy and drug allergy card. The accuracy in patients' knowledge and understanding of drug allergy were presented in Table 19. There were significant differences between tests in three questions. Question 1: patients were able to tell name of the allergic drug increasingly between T_1 (77.0%) vs T_2 (93.0%) and the result was remained after one-month period (93.8%) with statistical difference ($P < 0.001$ and $P < 0.001$, respectively). Similar result was found in Question 4 where T_2 (96.0%) and T_3 (95.8%) were able to tell the management of drug allergy accurately than T_1 (86.0%) ($P = 0.013$ and $P = 0.021$, respectively). Furthermore, Question 5 showed a significant difference between T_1 vs T_2 and T_2 vs T_3 about the importance of drug allergy card. T_2 (30.0%) was significantly had more accuracy in the importance of allergy card than T_1 (5.0%) and T_3 (12.6%) ($P < 0.001$ and $P = 0.009$, respectively).

The characteristics of the answers between pre- and post-test of two groups were described in Table 20. Question 1: patients who were able to tell name of the allergic drug, most of them could complete all drug names (T_1 =91.1%, T_2= 94.8%, and T_3= 93.5%) with no significant difference between tests. The top three drugs which patients claimed they were allergic to were penicillins (22.3%), sulfonamides (12.5%), and tetracycline (5.4%) (Table 22). After data validation with patients' medical record and pharmacy database, the most common drugs which patients could not specify drug name was diclofenac (14.3%) (Table 23).

Question 2: majority of the patients who answered this question, were able to complete all drug allergy symptoms (T_1 =41.0%, T_2= 45.0% and T_3= 38.5%) with no significant difference between tests (Table 20). Of a 324 reported drug allergy symptoms (Table 26), major organ system which was most involved was skin and appendages (55.2%). The top three drug allergy symptoms which were most reported were skin rashes (27.5%), pruritus (19.1%), and redness and edema of the face (5.2%). Skin rashes that were most identified by the patients, were rash (20.1%) and urticaria (7.4%). Table 27 demonstrated false drug allergy symptoms that patients reported, which cough (13.0%) and diarrhea (13.0%) were most frequently reported.

The accuracy rate of drug allergy symptoms by patients' reports was calculated based on the total drug allergy symptoms using a similar formula as Phase 1. The accuracy rate in T_1, T_2, and T_3 were 36.1%, 37.6%, and 36.1%, respectively.

Question 3: the majority of the patients were able to identify the correct managements of drug allergy which were stopping the drug and consulting healthcare professionals (T_1 = 71.0%, T_2 = 82.0% and T_3 = 75.0%) and stopping the drug and taking another drug for the reaction (T_1 = 19.0%, T_2 = 15.0% and T_3 = 17.7%) with no statistical difference (Table 20).

Question 4: There was no significant difference in any minor statements between tests. The majority of the patients thought that to prevent recurrent drug allergy, they should avoid taking known allergic drug (T_1 = 98.0%, T_2 = 100.0% and T_3 = 95.0%), notify healthcare professional about their drug allergy history (T_1 = 98.0.0%, T_2 = 100.0% and T_3 = 98.9%), and carry drug allergy card (T_1 = 97.0%, T_2 = 98.0% and T_3 = 100.0%). Also, most of the patients thought that reducing the dose of allergic drug was an incorrect answer (T_1 = 91.0%, T_2 = 96.0% and T_3 = 95.8%) (Table 20).

Question 5: The majority of the patients thought that the importances of drug allergy card were reminding the name of allergic drug (T_1 = 100.0%, T_2 = 100.0% and T_3 = 95.0%), informing healthcare professionals about their drug allergy (T_1 = 98.0%, T_2 = 100.0% and T_3 = 95.0%), and preventing recurrent drug allergy (T_1 = 98.0%, T_2 = 99.0% and T_3 = 95.0%). The significant differences were found in two statements, which were "drug allergy card is a shortcut for faster medication service" and "drug allergy card could prevent allergic reaction due to drug with other combination out of the record". For both statements, the percentage of corrected answers in T_2 were higher than T_1, significantly (24.0% vs. 54.0%, $P<0.001$ and 14.0% vs. 36.0%, $P< 0.001$ (Table 20)

Table 19 The accuracy in patients' knowledge and understanding of drug allergy of Phase 2

Questions	No. of patients (%) n= 100			p- value[a]		
	T_1	T_2	T_3	p (T_1,T_2)	p (T_1,T_3)	p (T_2,T_3)
Question 1 Name of the allergic drug						
Yes	77 (77.0)	93 (93.0)	90 (93.8)	**<0.001**	**<0.001**	1.000
No	23 (23.0)	7 (7.0)	6 (6.2)			
Missing			4			
Question 2 Symptoms of allergic reactions						
Yes	95 (95.0)	99 (99.0)	95 (99.0)	0.125	0.125	1.000
No	5 (5.0)	1 (1.0)	1 (1.0)			
Missing			4			
Question 3 The management of drug allergy						
Yes	92 (92.0)	96 (96.0)	91 (94.8)	0.289	0.549	1.000
No	8 (8.0)	4 (4.0)	5 (5.2)			
Missing			4			
Question 4 The prevention of recurrent drug allergy						
Yes	86 (86.0)	96 (96.0)	91 (95.8)	**0.013**	**0.021**	1.000
No	14 (14.0)	4 (4.0)	4 (4.2)			
Missing			5			
Question 5 The importance of drug allergy card						
Yes	5 (5.0)	30 (30.0)	12 (12.6)	**<0.001**	0.077	**0.009**
No	95 (95.0)	70 (70.0)	83 (87.4)			
Missing			5			

T_1 = Pre-test, T_2 = Immediate post- test, T_3 = One-month period post-test

[a]Comparing frequency between pre-and post-test used McNemar test

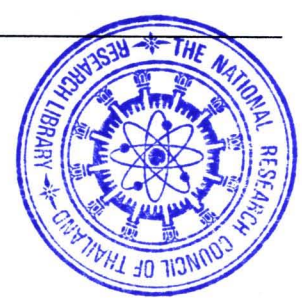

Table 20 Characteristic of patients' answers in Phase 2

Characteristics	No. of patients (%)			p-value
	T_1 (n=100)	T_2 (n=100)	T_3 (n=100)	
Question 1 Name of the allergic drug				
Drug name was completed	72 (91.1)	92 (94.8)	86 (93.5)	0.096[a]
Drug name was less than database	5(6.3)	4 (4.1)	4 (4.3)	0.096[b]
Drug name was more than database	2 (2.5)	1 (1.0)	2 (2.2)	0.593[c]
Missing			4	
Question 2 Symptoms of allergic reactions				
All completed drug allergy symptoms	41 (41.0)	45 (45.0)	37 (38.5)	0.078[a]
Completed drug allergy symptoms with other symptoms	15 (15.0)	12 (12.0)	14 (14.6)	0.954[b]
				0.117[c]
Partial completed drug allergy symptoms	30 (30.0)	36 (36.0)	30 (31.2)	
Partial drug allergy symptoms with other symptoms	9 (9.0)	6 (6.0)	12 (12.5)	
In corrected drug allergy symptoms symptoms	5 (5.0)	1 (1.0)	2 (2.1)	
In corrected drug allergy symptoms with other symptoms	0 (0.0)	0 (0.0)	1 (1.0)	
Missing			4	
Question 3 The management of drug allergy				
Continue using the drug and taking another drug for the reaction	1 (1.0)	0 (0.0)	0 (0.0)	0.317[a]
				0.355[b]
Stop taking drug and doing nothing	9 (9.0)	3 (3.0)	4 (4.3)	0.808[c]
Stop taking the drug and consulting healthcare professional	71 (71.0)	82 (82.0)	75 (75.0)	
Stop taking the drug and taking another drug for the reaction	19 (19.0)	15 (15.0)	17 (17.7)	
Missing			4	
Question 4 The prevention of recurrent drug allergy				
Avoiding taking allergic drug				
Yes	98 (98.0)	100(100.0)	95 (95.0)	0.500[d]
No	2 (2.0)	0 (0.0)	0 (0.0)	0.500[e]
Missing			5	
Reducing the dose of allergic drug				
Yes	9 (9.0)	4 (4.0)	4 (4.2)	0.180[d]
No	91 (91.0)	96 (96.0)	91 (95.8)	0.227[e]
Missing			5	
Notifying healthcare professional about drug allergy history				
Yes	98 (98.0)	100(100.0)	94 (98.9)	0.500[d]
No	2 (2.0)	0 (0.0)	1 (1.1)	1.000[e]
Missing			5	

Table 20 Characteristic of patients' answers in Phase 2 (Cont.)

Characteristics	No. of patients (%)			p-value
	T_1 (n=100)	T_2 (n=100)	T_3 (n=100)	
Carrying drug allergy card				
Yes	97 (97.0)	98 (98.0)	95(100.0)	1.000[d]
No	3 (3.0)	2 (2.0)	0 (0.0)	0.250[e]
Missing			5	
Question 5 The importance of drug allergy card				
Reminding the name of the allergic drug				
Yes	100 (100.0)	100 (100.0)	95 (95.0)	-
No	0 (0.0)	0 (0.0)	0 (0.0)	
Missing			5	
Informing healthcare professionals about drug allergy				
Yes	98 (98.0)	100 (100.0)	95 (95.0)	0.500[d]
No	2 (2.0)	0 (0.0)	0 (0.0)	0.500[e]
Missing			5	
Shortcut for faster medication services				
Yes	76 (76.0	46 (46.0)	59 (62.1)	**<0.001**[d]
No	24 (24.0)	54 (54.0)	36 (37.9)	0.059[e]
Missing			5	
Preventing recurrent drug allergy				
Yes	98 (98.0)	99 (99.0)	95 (95.0)	1.000[d]
No	2 (2.0)	1 (1.0)	0 (0.0)	0.500[e]
Missing			5	
Preventing allergic reactions to drug with other combination out of drug allergy recorded				
Yes	86 (86.0)	64 (64.0)	74 (77.9)	**<0.001**[d]
No	14 (14.0)	36 (36.0)	21 (22.1)	0.152[e]
Missing			5	

T_1 = Pre- test, T_2 = Immediate post- test, T_3 = One- month period post- test.
Comparing frequency between [a]T_1-T_2, [b]T_1-T_3, and [c]T_2-T_3 used Marginal homogeneity test.
Comparing frequency between [d]T_1-T_2, [e]T_1-T_3, and used McNemar test.

Table 21 The most frequently reported of allergic drug group from patients

Drug group	No. of drugs (%)
Phase 1	
General antiinfectives for systemic uses	192 (65.8)
Musculo- skeletal System	60 (20.5)
Central Nervous System	13 (4.5)
Antineoplastic and immunomodulating drugs	5 (1.7)
Cardiovascular system	2 (0.7)
Others	20 (6.8)
Total	**292 (100.0)**
Phase 2	
General antiinfectives for systemic uses	85 (75.9)
Musculo-skeletal System	14 (12.5)
Central Nervous System	4 (3.6)
Contrast agents	2 (1.8)
Antineoplastic and immunomodulating drugs	1 (0.9)
Others	6 (5.4)
Total	**112 (100.0)**

Table 22 The most frequently reported of allergic drug name from patients

Drug name	No. of drugs (%)	Drug name	No. of drugs (%)
Phase 1		**Phase 2**	
penicillins	64 (21.9)	penicillins	25 (22.3)
sulfonamide	28 (9.6)	sulfonamides	14 (12.5)
tetracycline	14 (4.8)	tetracycline	6 (5.4)
ibuprofen	12 (4.1)	co-trimoxazole	5 (4.5)
co-trimoxazole	10 (3.4)	amoxycillin	4 (3.6)
amoxycillin	10 (3.4)	phenytoin	3 (2.7)
diclofenac	9 (3.1)	ampicillin	3 (2.7)
clindamycin	8 (2.7)	clindamycin	3 (2.7)
penicillin V	7 (2.4)	cephalexine	2 (1.8)
ceftriaxone	7 (2.4)	erythromycin	2 (1.8)
allopurinol	7 (2.4)	doxycycline	2 (1.8)
cloxacillin	6 (2.0)	ibuprofen	2 (1.8)
paracetamol	6 (2.0)	aspirin	2 (1.8)
carbamazepine	5 (1.7)	paracetamol	2 (1.8)
others	99 (33.9)	mefenamic acid	2 (1.8)
		allopurinol	2 (1.8)
		penicillin V	2 (1.8)
		penicillin G	2 (1.8)
		others	29 (25.9)
Total	**292 (100.0)**	**Total**	**112 (100.0)**

[a]penicillins= unidentified penicillins

[b]sulfonamides = co-trimoxazole+ unidentified sulfonamides

Table 23 The most frequent allergic drugs which patients cannot identify drug name

Drug name	No. of drugs (%)	Drug name	No. of drugs (%)
Phase 1		**Phase 2**	
penicillins	10 (8.1)	diclofenac	3 (14.3)
sulfonamides	8 (6.5)	penicillins	2 (9.5)
ceftriaxone	8 (6.5)	amoxycillin	2 (9.5)
ibuprofen	5 (4.1)	ceftriaxone	2 (9.5)
diclofenac	5 (4.1)	co-trimoxazole	2 (9.5)
carbamazepine	5 (4.1)	tetracycline	2 (9.5)
phenytoin	5 (4.1)	doxycycline	2 (9.5)
phenobarbital	4 (3.3)	tolperisone	2 (9.5)
xenetic	4 (3.3)	Others	13 (61.9)
isoniacid	3 (2.4)		
cephalexin	3 (2.4)		
Others	63 (51.2)		
Total	**123 (100.0)**	**Total**	**21 (100.0)**

[a]penicillins= penicillin G Sodium+penicillin V+ unidentified penicillins
[b]sulfonamides = co-trimoxazole+ unidentified sulfonamides

Table 24 Number of drug allergy symptoms classified by organ system in Phase 1

Organ systems	No. of reports (%)	
	Patients' reported n= 1068	**Database n= 737**
Skin and appendages disorder		
Rash	179 (16.8)	102 (13.8)
Maculopapular rash	-	44 (6.0)
Erythematous rash	-	34 (4.6)
Urticaria	85 (8.0)	81 (11.0)
Total skin rash	**264 (24.7)**	**261 (35.4)**
Pruritus	174 (16.3)	65 (8.8)
Blister	59 (5.5)	43 (5.8)
Buring skin	44 (4.1)	16 (2.2)
Scaly skin	36 (3.4)	6 (0.8)
Steven- Johnson syndrome	-	33 (4.5)
Fixed drug eruption	-	6 (0.8)
Exfoliative dermatitis	-	4 (0.5)
Erythema multiforme	-	3 (0.4)
DRESS syndrome	-	3 (0.4)
Toxic epidermal necrolysis	-	2 (0.3)
Total	**577 (54.0)**	**442 (60.0)**

Patients reported more than 1 symptom

Table 24 Number of drug allergy symptoms classified by organ system in Phase 1 (Cont.)

Organ systems	No. of report (%)	
	Patients' reported n= 1068	Database n= 737
Respiratory system disorder		
Bronchospasm	39 (3.7)	72 (9.8)
Hyperventilation	39 (3.7)	2 (0.3)
Total	**78 (7.3)**	**74 (10.0)**
Musculo- skeletal system disorder		
Myalgia	35 (3.3)	6 (0.8)
Total	**35 (3.4)**	**6 (0.8)**
Cardiovascular disorder, general		
Tachycardia	49 (4.6)	6 (0.8)
Hypotension	-	4 (0.5)
Palpitations	55 (5.1)	3 (0.4)
Total	**104 (9.7)**	**13 (1.8)**
Neurological disorder		
Dizziness, faint	33 (3.1)	6 (0.8)
Syncope	18 (1.7)	6 (0.8)
Total	**51 (4.8)**	**12 (1.6)**
Gastro-intestinal system disorder		
Hepatitis	-	4 (0.5)
Nausea	-	4 (0.4)
Vomiting	-	3 (0.4)
Diarrhea	-	2 (0.3)
Total	**-**	**13 (1.8)**
Hematological disorder		
Agranulocytosis	-	1 (0.1)
Total	**-**	**1 (0.1)**
Other systems		
Anaphylaxis	-	47 (6.4)
Anaphylactic shock	-	16 (2.2)
Edema of lips or tongue	76 (7.1)	51 (6.9)
Periorbital edema	63 (5.9)	37 (5.0)
Rediness and edema of face	84 (7.9)	23 (3.1)
Peripheral edema	-	2 (0.3)
Total	**223 (20.9)**	**176 (23.9)**

Patients reported more than 1 symptom

Table 25 False drug allergy symptoms reported by patients classified by organ System in Phase 1

Organ systems	No. of symptoms (%) n= 258
Skin and appendages disorder	
Sunburn	14 (5.4)
Musculo-skeletal system disorder	
Muscle weakness	35 (13.6)
Pinpain	20 (7.8)
Respiratory system disorder	
Slow breathing	15 (5.8)
Cough	11 (4.3)
Gastro-intestinal system disorder	
Nausea	37 (14.3)
Vomiting	36 (14.0)
Diarrhea	4 (1.6)
Black feces	2 (0.8)
Vomiting of blood	5 (1.9)
Yellowish discoloration of the eyes or skin	
Others	
Sweating	41 (15.8)
Fever	22 (8.5)
Pale	16 (6.2)

Patients reported more than 1 symptom

Table 26 Number of drug allergy symptoms classified by organ system in Phase 2

Organ systems	No. of symptom (%)	
	Patients' reported n= 324	Database n= 263
Skin and appendages disorder		
Rash	65 (20.1)	16 (6.1)
Maculopapular rash	-	29 (11.0)
Erythematous rash	-	11 (4.2)
Urticaria	24 (7.4)	28 (10.6)
Total skin rash	**89 (27.5)**	**84 (31.9)**
Pruritus	62 (19.1)	32 (12.2)
Blister	14 (4.3)	8 (3.0)
Burning skin	8 (2.5)	5 (1.9)
Scaly skin	6 (1.9)	3 (1.1)
Fixed drug eruption	-	3 (1.1)
Exfoliative dermatitis	-	2 (0.8)
DRESS syndrome	-	2 (0.8)
Total	**179 (55.2)**	**139 (52.9)**

Patients reported more than 1 symptom

Table 26 Number of drug allergy symptoms classified by organ system in Phase 2 (Cont.)

Organ systems	No. of symptom (%)	
	Patients' reported n= 324	**Database n= 263**
Respiratory system disorder		
Bronchospasm	25 (7.7)	35 (13.3)
Hyperventilation	7 (2.2)	-
Total	**32 (9.9)**	**35 (13.3)**
Musculo-skeletal system disorder		
Myalgia	**8 (2.5)**	**1 (0.4)**
Total		
Cardiovascular disorder, general		
Tachycardia	15 (4.6)	-
Hypotension	-	1 (0.4)
Palpitations	8 (2.5)	1 (0.4)
Shock	4 (1.2)	1 (0.4)
Total	**27 (8.3)**	**3 (1.1)**
Neurological disorder		
Dizziness, faint	8 (2.5)	1 (1.0)
Syncope	3 (0.9)	1 (1.0)
Total	**11 (3.4)**	**2 (0.8)**
Gastro-intestinal system disorder		
Hepatitis	-	1 (1.0)
Total	-	**1 (1.0)**
Hematological disorder		
Agranulocytosis	-	1 (0.3)
Eosinophilia	-	2 (2.0)
Total	-	**3 (1.1)**
Other systems		
Anaphylaxis	-	20 (7.6)
Anaphylactic shock	-	2 (0.8)
Edema of lips or tongue	17 (5.2)	20 (7.6)
Periorbital edema	19 (5.9)	12 (4.6)
Redness and edema of face	17 (5.2)	8 (3.0)
Peripheral edema	1 (0.3)	1 (0.4)
Oral ulceration	6 (1.9)	7 (2.7)
Ulceration at genitalia	1 (0.3)	1 (0.4)
Conjunctivitis	1 (0.3)	2 (0.8)
Fever	4 (1.2)	4 (1.5)
Chill	1 (0.3)	2 (0.8)
Total	**67 (20.7)**	**79 (30.0)**

Patients reported more than 1 symptom

Table 27 False drug allergy symptoms reported by patients classified by organ system in Phase 2

Organ systems	No. of symptoms (%) n= 46
Skin and appendages disorder	
Sunburn	2 (4.3)
Musculo-skeletal system disorder	
Muscle weakness	4 (8.7)
Pinpain	2 (4.3)
Respiratory system disorder	
Slow breathing	2 (4.3)
Cough	6 (13.0)
Gastro-intestinal system disorder	
Nausea	5 (10.9)
Vomiting	5 (10.9)
Diarrhea	6 (13.0)
Vomiting of blood	1 (2.2)
Yellowish discoloration of the eyes or skin	1 (2.2)
Others	
Sweating	5 (10.9)
Fever	5 (10.9)
Pale	2 (4.3)

Patients reported more than 1 symptom

According to the most reported of allergic drugs, the most frequently reported of drug allergy symptoms were showed in Table 28 and Table 29. In phase 1, the most common allergic drug was penicillins which caused rash, urticaria, bronchospasm; 29, 23, and 22 cases, respectively (Table 28). In phase 2, penicillins was also found as the most common causative drug caused urticaria, pruritus, bronchospasm, maculopapular rash; 10, 10, 9, and 8 cases, respectively (Table 29).

Table 28 The most frequently reported of drug allergy symptoms classified by drug name in Phase 1

Drug names	Drug allergy symptoms (Number of patients)		
penicillins	rash (29)	urticaria (23)	bronchospasm (22)
sulfonamides	rash (12)	urticaria (6)	burning skin (5)
tetracycline	rash (6)	urticaria (4)	pruritus (3)
ibuprofen	urticaria (3)	pruritus (3)	anaphylaxis (3)
co-trimoxazole	rash (6)	erythematous rash (3)	MP rash (2)
	angioedema (2)	pruritus (2)	fever (2)
	urticaria (2)	SJS (2)	
amoxycillin	rash (3)	urticaria (3)	angioedema (2)
	MP rash (2)	bronchospasm (2)	anaphylaxis (2)
cloxacillin	rash (2)	urticaria (2)	pruritus (2)
	angioedema (1)		
ceftrixone	rash (3)	MP rash (2)	urticaria (1)
	palpitation (1)	shock (1)	redness and face edema (1)
	tachycardia (1)		
clindamycin	MP rash (2)	rash (2)	urticaria (2)
	periorbital edema (1)	bronchospasm (1)	SJS (1)
	pruritus (1)		
diclofenac	pruritus (4)	angioedema (4)	periorbital edema (3)
	shock (3)	bronchospasm (2)	redness and face edema (2)
	anaphylaxis (2)		
paracetamol	angioedema (3)	rash (2)	periorbital edema (2)
	bronchospasm (2)	urticaria (2)	erythematous rash (1)
	pruritus (1)	tachycardia (1)	SJS (1)
allopurinol	SJS (5)	rash (4)	fever (3)
carbamazepine	rash (5)	SJS (3)	erythematous rash (2)
	MP rash (2)	fever (2)	

penicillins= unidentified penicillins
sulfonamides = unidentified sulfonamides
MP rash= maculopapular rash, SJS= Stevens' Johnson syndrome

Table 29 The most frequently reported of drug allergy symptoms classified by drug name in Phase 2

Drug names	Drug allergy symptoms (Number of patients)			
penicillins	urticaria (10)	pruritus (10)	bronchospasm (9)	MP rash (8)
	angioedema (7)			
sulfonamides	pruritus (6)	MP rash (4)	bronchospasm (3)	rash (3)
	urticaria (3)	angioedema (3)		
tetracycline	bronchospasm (3)	angioedema (1)	blister (1)	rash (1)
	urticaria (1)	periorbital edema (1)	dizziness, faint (1)	anaphylaxis (1)
	redness and face edema (1)			
co-trimoxazole	urticaria (2)	pruritus (2)	angioedema (2)	
amoxycillin	pruritus (3)	bronchospasm (2)	MP rash (2)	urticaria (2)
	rash (1)	anaphylaxis (1)	angioedema (1)	burning skin (1)
phenytoin	MP rash (3)	bronchospasm (2)	fever (1)	
ampicillin	angioedema (2)	rash (1)	MP rash (1)	erythematous rash (1)
	bronchospasm (1)	periorbital edema (1)	redness and face edema (1)	
clindamycin	rash (1)	MP rash (1)	pruritus (1)	burning skin (1)
	bronchospasm (1)			

penicillins= unidentified penicillins
sulfonamides = unidentified sulfonamides
MP rash= maculopapular rash

Table 30 showed the most common drugs that caused drug allergy symptoms of both phases. In Phase 1, the majority of drug allergy symptoms, including rash, brochospasm, pruritus, and periorbital edema were resulting from penicillins in 56, 35 27, and 18 patients, respectively, except that co-trimoxazole was the most causative drug of erythematous rash in 6 patients. In Phase 2, penicillins was the most common causative drug of all drug allergy symptoms; brochospasm (8 patients), pruritus (10 patients), maculopapular rash (7 patients), urticaria (9 patients), anaphylaxis (7 patients), and angioedema (7 patients).

Table 30 The most frequently reported of causative drugs classified by drug allergy symptoms

Symptoms	Causative drug (Number of patients)			
Phase 1				
rash	penicillins (56)	co-trimoxazole (19)	carbamazepine (7)	
erythematous rash	co-trimoxazole(6)	penicillins (4)	allopurinol (3)	
brochospasm	penicillins (35)	ibuprofen (9)	co-trimoxazole (7)	
pruritus	penicillins (27)	co-trimoxazole (10)	ibuprofen (7)	
periorbital edema	penicillins (18)	diclofenac (8)	ibuprofen (8)	co-trimoxazole (5)
Phase 2				
bronchospasm	penicillins (8)	tetracycline (3)	ceftriaxone (3)	sylfonamides (3)
	aspirin (3)			
pruritus	penicillins (10)	sulfonamides (4)	co-trimoxazole (3)	
maculopapular rash	penicillins (7)	sulfonamides (3)	phenytoin (3)	co-trimoxazole (3)
urticaria	penicillins (9)	sulfonamides (3)	ceftriaxone (2)	amoxycillin (2)
	erythromycin (2)	co-trimoxazole (2)	tetracycline (2)	ketoconazole (2)
anaphylaxis	penicillins (7)	ampicillin (2)	ceftriaxone (2)	aspirin (2)
angioedema	penicillins (7)	amoxycillin (2)	ampicillin (2)	ceftriaxone (2)
	erythromycin (2)	sulfonamides (2)	co-trimoxazole (2)	

penicillins= unidentified penicillins
sulfonamides = unidentified sulfonamides

The scores of knowledge in Phase 1

The knowledge scores were calculated, and the total score was five. Comparisons mean total score of knowledge and understanding between groups showed no significant differences in both pre-and post-test (P = 0.540 and P = 0.947, respectively). But the significant differences were found in the comparisons between mean total score of pre-and post-test in both groups (Group 1: Mean difference± S.D.= 0.247 ± 0.830, P = 0.007 and Group 2: Mean difference ± S.D. = 0.189±0.847, P= 0.039) (Table 31).

The score were categorized into three levels: Low (0-1), average (2-3), and good (4-5) and compared between pre-and post-test in each groups. The significant differences were found in both groups, where the majority of the patients had good knowledge level in post-test than in pre-test for both group (Group 1: 48.3% vs. 56.2%, P = 0.041 and Group 2: 48.9% vs. 58.9%, P = 0.012) (Figure 8 and Figure 9).

There were no significant differences between two patterns of brochures in improving patients' knowledge. Therefore, either of brochures was implicated in Phase 2 of the study.

Table 31 Score of patients' drug allergy knowledge and understanding in Phase 1

Score	No. of patients (%)						p-value
	Group 1 (n= 89)			Group 2 (n= 90)			
	Pre-test	Post-test	Mean difference (95% CI)	Pre-test	Post-test	Mean difference (95% CI)	
5	5 (5.6)	12 (13.5)		7 (7.8)	5 (5.6)		0.441[c], 0.540[d†]
4	38 (42.7)	38 (42.7)		37 (41.1)	46 (51.1)		0.654[e], 0.947[f†]
3	25 (28.1)	22 (24.7)		31 (34.4)	31 (34.4)		
2	14 (15.7)	13 (14.6)		10 (11.1)	7 (7.8)		
1	6 (6.7)	4 (4.5)		4 (4.4)	1 (1.1)		
0	1 (1.1)	0 (0.0)		1 (1.1)	0 (0.0)		
Mean±S.D.	3.21±1.07	3.46±1.04	0.247±0.830	3.33±1.00	3.52±0.77	0.189±0.847	
Median±IQR	3±1	4±1	(0.072,0.422)	3±1	4±1	(0.012,0.366)	
p-value		0.006[a], 0.007[b*]			0.037[a], 0.039[b*]		

[a] Comparing mean/ median between pre-and post-test in each patient group using Paired samples test

[b] Comparing mean/ median between pre-and post-test in each patient group using Wilcoxon signed-rank test

[b] Comparing mean/ median between pre-and post-test in each patient group using Wilcoxon signed-rank test

[c] Comparing mean/ median difference of pre-test between group 1 and group 2 using Independent samples test

[d] Comparing median difference of pre-test between group 1 and group 2 using Mann Whitney U test

[e] Comparing mean/ median difference of post-test between group 1 and group 2 using Independent samples test

[f] Comparing mean/ median difference of post-test between group 1 and group 2 using Mann Whitney U test

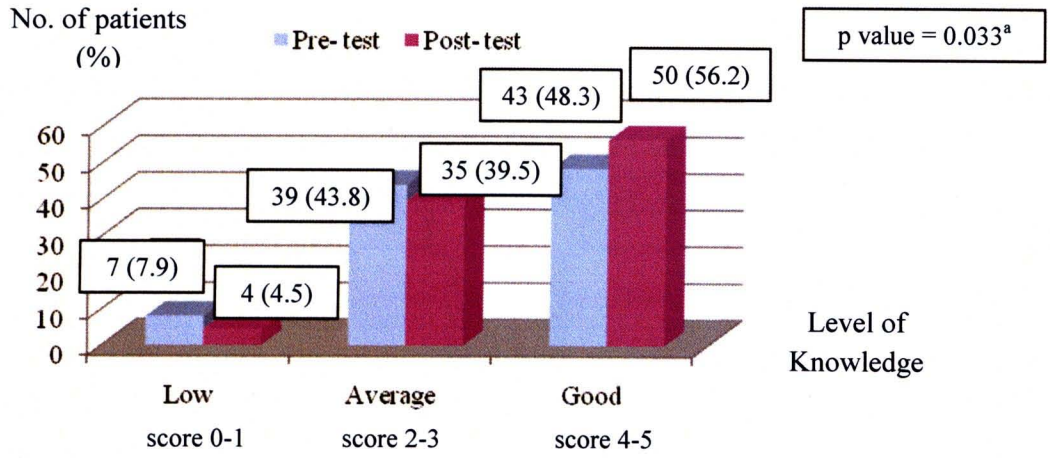

Figure 8 Level of drug allergy knowledge and understanding in group 1 patients

[a]Comparison level of knowledge between pre-and post-test using Marginal homogeneity test

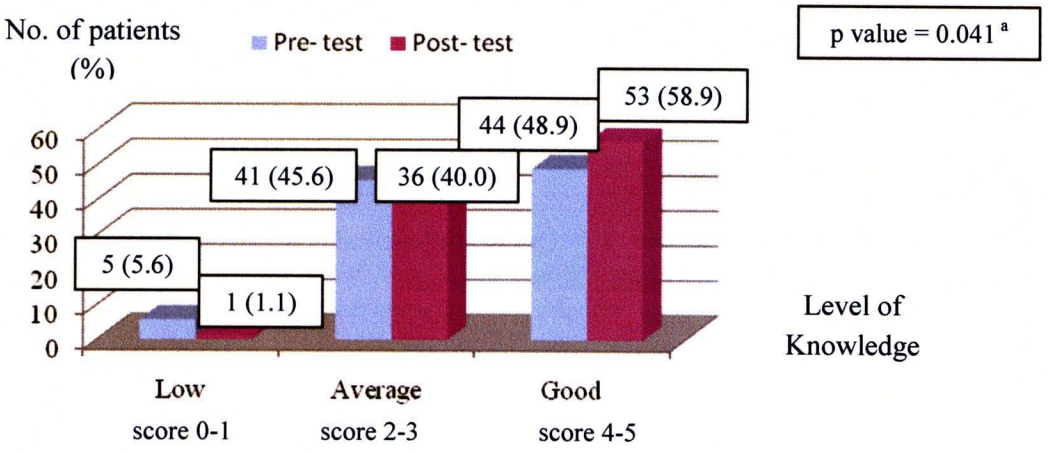

Figure 9 Level of drug allergy knowledge and understanding in group 2 patients

[a] Comparison level of knowledge between pre-and post-test using Marginal homogeneity test

The scores of knowledge in Phase 2

The knowledge scores were calculated, and the total score was five. The significant differences were found in the comparisons of mean total score between T_1 vs. T_2, T_1 vs. T_3, and T_2 vs. T_3 (Mean difference ± S.D., p-value: 0.600 ± 0.829, $P < 0.001$; 0.396 ± 0.814, $P < 0.001$; 0.219 ± 0.823, $P = 0.012$) (Table 32).

The score were categorized into three levels: Low (0-1), average (2-3), and good (4-5) and compared between tests. The significant differences were found in two pairs: T_1 vs. T_2 and T_1 vs. T_3. The majority of T_2 (88.0%) and T_3 (87.5%) had good knowledge level in post-test than in T_1 (63.0%) ($P< 0.001$ and $P< 0.001$, respectively) (Figure 10).

Table 32 Score of patients' drug allergy knowledge and understanding in Phase 2

Score	No. of patients (%)			Mean difference	p-value
	T_1 (n=100)	T_2 (n=100)	T_3 (n=100)	(95% CI)	
5	3 (3.0)	28 (29.0)	8 (8.3)	0.615±0.838[a]	<0.001[d], <0.001[e†]
4	58 (58.0)	59 (59.0)	76 (79.2)	(0.445, 0.784)	
3	29 (29.0)	12 (12.0)	10 (10.4)	0.396±0.814[b]	<0.001[f], <0.001[g†]
2	10 (10.0)	1 (1.0)	1 (1.0)	(0.231, 0.561)	
1	0 (0.0)	0 (0.0)	1 (1.0)	0.219±0.823[c]	0.011[h], 0.012[i†]
0	0 (0.0)	0 (0.0)	0 (0.0)	(0.052, 0.386)	
Mean ± S.D.	3.53±0.73	4.15±0.66	3.93±0.57		
Median ± IQR	4±1	4±1	4±0		

T_1 = Pre- test, T_2 = Immediate post- test, T_3 = One- month period post- test.
[a,b,c] Mean difference and 95% Confidence Interval between T_1-T_2, T_1-T_3, and T_2-T_3 respectively.
Comparing score between [d]T_1-T_2, [f]T_1-T_3, and [h]T_2-T_3 used Paired samples test test.
Comparing score between [e]T_1-T_2, [g]T_1-T_3, and [i]T_2-T_3 used Wilcoxon Signed Ranks test.

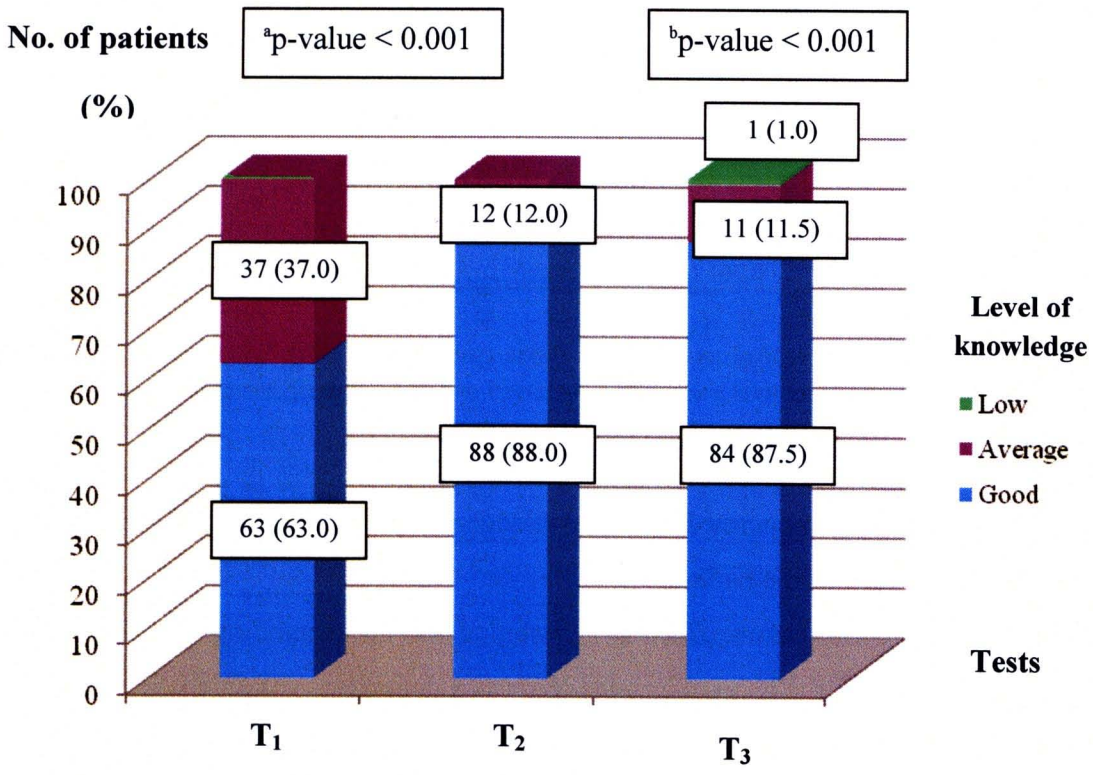

Figure 10 Level of patients' knowledge an understanding of drug allergy and drug allergy card

T_1 = Pre-test, T_2 = Immediate post-test, T_3 = One-month period post-test.
Comparing frequency of level between $^{a}T_1$-T_2, $^{b}T_1$-T_3 tests used Marginal Homogeneity test.

Part 2 The comparison of knowledge and understanding between Phase 1 and Phase 2

The mean total score of pre-and post-test from both phase were compared as showed in Table 33. In pre-test, the mean total score between both phases did not tend to significantly different ($p = 0.050$). Therefore, the comparison of post-test between both phases was performed. The result showed that post-test score of Phase 2 (4.14 ± 0.65) was significantly higher than Phase 1 (3.49 ± 0.91) ($p < 0.001$).

Table 33 Comparisons of knowledge scores between Phase 1 and Phase 2

	Pre-test			Post-test		
	Phase 1	**Phase 2**	**p-value**	**Phase 1**	**Phase 2***	**p-value**
Mean±S.D.	3.27±1.03	3.54±0.72	0.012[a]	3.49±0.91	4.14±0.65	<0.001[a]
Median±IQR	3±1	4±1	0.050[b†]	4±1	4±1	<0.001[b†]
Mean difference (95% CI)	0.266 (0.058, 0.474)			0.648 (0.462, 0.834)		

*Immediated post-test score.

[a]Comparing mean/ median of total score between Phase 1 and Phase 2 using Independent sample t-test.

[b]Comparing mean/ median of total score between Phase 1 and Phase 2 using Mann Whitney U test.

Part 3 Factors associated with knowledge and understanding of drug allergy and drug allergy card of the patients.

To analyze the factors affecting knowledge and understanding of drug allergy and drug allergy card, the level of knowledge was a dependent variable which was re-categorized into two levels: low and average level and good level.

In Phase 1, the factors were analyzed by univariate and multivariate statistical analysis (Table 34 and Table 35). The factors associated with good level of knowledge were high educational level (P =0.016), income more than 10,000 Baht per month (P= 0.009), having one drug allergy (P= 0.022), and having drug allergy card (P= 0.003). After adjusting those four independent factors by multivariate analysis (Table 35), the patients who were in secondary school or higher had good level of knowledge more than none or primary school (OR= 2.62; 95%CI 1.01-6.67; P= 0.044) and patients who had 1 allergic drug had high level of knowledge (OR= 2.55; 95%CI 1.20-5.40; P= 0.015).

In Phase 2, the factors affecting knowledge and understanding of drug allergy and drug allergy card were analyzed by univariate analysis, but no meaningful statistical was found (Table 34).

Table 34 Univariate predictors of patients' knowledge and understanding in drug allergy and drug allergy card

Characteristics	Phase 1				Phase 2			
	No. of patients (%)		Total N	p value	No. of patients (%)		Total N	p value
	Low and Average	Good			Low and Average	Good		
Age, mean years±S.D.	50.21±18.290	45.71±17.137	47.67±17.740	0.093[a]	54.50±13.534	48.67±17.001	49.37±16.673	0.258[a]
Age, median (range)	52.50 (5-83)	50.00 (7-78)	51.00 (5-83)	0.058[bt]	56.50 (28-80)	49.50 (5-83)	50.00 (5-83)	0.281[bt]
Age group (years)								
< 30	13 (38.2)	21 (61.8)	34 (19.0)	0.127[c]	1 (7.1)	13 (92.9)	14 (14.0)	0.619[d]
30-60	41 (39.8)	62 (60.2)	103 (57.5)		6 (10.5)	51 (89.5)	57 (57.0)	
>60	24 (57.1)	18 (42.9)	42 (23.5)		5 (17.2)	24 (82.8)	29 (29.0)	
Total	78 (43.6)	101 (56.4)	179 (100.0)		12 (12.0)	88 (88.0)	100 (100.0)	
Gender								
Male	32 (43.8)	41 (56.2)	73 (40.8)	0.954[c]	5 (12.8)	34 (87.2)	39 (39.0)	1.000[d]
Female	46 (43.4)	60 (56.6)	106 (59.2)		7 (11.5)	54 (88.5)	61 (61.0)	
Total	78 (43.6)	101 (56.4)	179 (100.0)		12 (12.0)	88 (88.0)	100 (100.0)	
Education level								
None or primary school	36 (55.3)	29 (44.7)	65 (36.3)	**0.016[c]**	6 (17.6)	28 (82.4)	34 (36.2)	0.341[d]
Secondary school or higher	42 (36.8)	72 (63.2)	114 (63.7)		6 (10.0)	54 (90.0)	60 (63.6)	
Total	78 (43.6)	101 (56.4)	179 (100.0)		12 (12.8)	82 (87.2)	94 (100.0)	
Missing data							2	
Occupational								
None-healthcare professionals	74 (43.3)	97 (56.7)	171 (95.5)	0.552[d]	10 (11.2)	79 (96.3)	89 (95.7)	0.401[d]
Healthcare professionals	4 (50.0)	4 (50.0)	8 (4.5)		1 (25.0)	3 (75.0)	4 (4.3)	
Total	78 (43.6)	101 (56.4)	179 (100.0)		11 (11.8)	82 (88.2)	93 (100.0)	
Missing data							3	

Table 34 Univariate predictors of patients' knowledge and understanding in drug allergy and drug allergy card (cont.)

Characteristics	Phase 1				Phase 2			
	No. of patients (%)		Total N	p value	No. of patients (%)		Total N	p value
	Low and Average	Good			Low and Average	Good		
Income (Baht per month)								
<10,000	54 (51.9)	50 (48.1)	104 (60.1)	**0.009**[a]	7 (12.5)	49 (87.5)	56 (62.9)	0.755[d]
≥10,000	22 (31.9)	47 (68.1)	69 (39.9)		5 (15.2)	28 (84.8)	33 (37.1)	
Total	76 (43.9)	97 (56.1)	173 (100.0)		12 (13.5)	77 (86.5)	89 (100.0)	
Missing data			6			11	11	
Underlying disease								
No	14 (31.8)	30 (68.2)	44 (24.6)	0.070[c]	1 (4.8)	20 (95.2)	21 (21.0)	0.451[d]
Yes	64 (47.4)	71 (52.6)	135 (75.4)		11 (13.9)	68 (86.1)	79 (79.0)	
Total	78 (43.6)	101 (56.4)	179 (100.0)		12 (12.0)	88 (88.0)	100 (100.0)	
No. of Drug use (Items)								
None	23 (39.0)	36 (61.0)	59.9 (32.9)	0.155[c]	2 (6.1)	31 (93.9)	33 (33.0)	0.580[d]
1-2	27 (50.9)	26 (49.1)	53 (29.6)		4 (14.8)	23 (85.2)	27 (27.0)	
3-4	13 (32.5)	27 (67.5)	49 (22.3)		3 (16.7)	15 (183.3)	18 (18.0)	
≥5	15 (55.6)	12 (44.4)	27 (15.2)		3 (13.6)	19 (86.4)	22 (22.0)	
Total	78 (43.6)	101 (56.4)	179 (100.0)		12 (12.0)	88 (88.0)	100 (100.0)	
No. of Allergic drug (Items)								
1	30 (31.6)	65 (68.4)	95 (65.1)	**0.022**[c]	9 (12.5)	63 (87.5)	72 (77.4)	1.000[d]
≥2	26 (51.0)	25 (49.0)	51 (34.9)		2 (9.5)	19 (90.5)	21 (22.6)	
Total	56 (38.4)	90 (61.6)	146 (100.0)		11 (11.8)	82 (88.2)	93 (100.0)	
Cannot remember and Missing data			33		1	6	7	

Table 34 Univariate predictors of patients' knowledge and understanding in drug allergy and drug allergy card (cont.)

Characteristics	Phase 1				Phase 2			
	No. of patients (%)		Total N	p value	No. of patients (%)		Total N	p value
	Low and Average	Good			Low and Average	Good		
Severity of drug allergy symptom leveling by patients								
Mild	9 (50.0)	9 (50.0)	18 (10.7)	0.581[c]	2 (15.4)	11 (84.6)	13 (13.3)	0.754[d]
Moderate	31 (44.3)	39 (55.7)	70 (41.4)		5 (14.3)	30 (85.7)	35 (35.7)	
Serious	31 (38.3)	50 (61.7)	81 (47.9)		5 (10.0)	45 (90.0)	50 (51.0)	
Total	71 (42.0)	98 (58.0)	169 (100.0)		12 (12.2)	86 (87.8)	98 (100.0)	
Missing data			10			2	2	
Severity of drug allergy symptom from OPD card								
None-serious	56 (44.8)	69 (55.2)	54 (30.2)	0.335[c]	8 (11.3)	63 (88.7)	29 (29.0)	0.741[d]
Serious	20 (37.0)	34 (63.0)	125 (69.8)		4 (13.8)	25 (86.2)	71 (71.0)	
Total	76 (42.5)	103 (57.5)	179 (100.0)		12 (12.0)	88 (88.0)	100 (100.0)	
Drug allergy card availability								
No	25 (64.1)	14 (35.9)	39 (22.0)	**0.003**[c]	-	-	-	-
Yes and used to have	52 (37.7)	86 (62.3)	138 (78.0)					
Total	77 (43.5)	100 (56.5)	177 (100.0)					
Missing data			2					

[a]Comparing mean/median between level of knowledge used Independent t test

[b]Comparing mean/median between level of knowledge used Mann Whitney U test

[c]Comparing frequencies between level of knowledge used Chi-square test

[d]Comparing frequencies between level of knowledge used Fisher's exact test

Table 35 Factors associated with level of knowledge and understanding in drug allergy and drug allergy card of drug allergic patients in Phase 1 (Logistic Regression analysis)

Variable	Crude OR	95% CI	Adjusted OR	95% CI	p-value
Educational level					
None/ primary school	1		1		
Secondary school or higher	2.13	1.14-3.95	2.62	1.01-6.67	**0.044**
Income (Baht per month)					
<10,000	1		1		
≥10,000	2.31	1.22-4.36	1.23	0.49-3.09	0.660
No. of Allergic drug (Items)					
≥2	1		1		
1	2.25	1.12-4.52	2.55	1.20-5.40	**0.015**
Availability of drug allergy card					
No	1		1		
Yes and used to have	2.95	1.41-6.19	2.39	0.93-6.02	0.067

Adjust for educational level, income, number of drug allergy, and availability of drug allergy card

2.4 Section 4 Behavior of drug allergy card carrying and the prevention of re-occurring drug allergy of the patients and their associated factors

This section consisted of 2 parts as follows:

Part 1 Behavior of drug allergy card carrying and the prevention of Re-occurring drug allergy

Part 2 Factors associated with drug allergy card carrying behavior

2.4.1 Part 1 Behavior of drug allergy card carrying and the prevention of re-occurring drug allergy

Phase 1 (Brochure development)

Of the total of 179 respondents, 89 (49.7%) were in Group 1 and 90 (50.3%) were in Group 2. The behaviors were measured based on seven statements using rating scales: always, sometimes, and never as shown in Table 36.

Drug allergy carrying behavior was assessed only 98 patients, who had or used to had drug allergy cards. Most of the patients from both groups always carried drug allergy cards in pre-and post-test with no statistical significance (Pre-test: 84.6% vs. 80.6%, P=0.742 and Post-test 79.0% vs. 81.2%, P= 0.909). For patients

who neglect of carrying or showing their drug allergy cards (Figure 11), the most common mentioned reasons were remembering names of the allergic drugs (29.2%), forgetfulness (20.6%), carrying but did not show (20.2%), and never had drug allergy card (20.2%). Post-test findings showed a significant difference between groups in the identification or notification about drug allergy at healthcare services. A 78.8% of Group 2 patients always behaved those which was higher than 66.2% of Group 1 patients (P= 0.037) (Table 36).

The comparisons between pre-and post-test in both groups found the significant differences in receiving drugs from non-healthcare professionals. Patients in both groups increasingly chose never receiving drugs from non-healthcare professionals after the intervention (Group 1: 59.3% vs. 74.4%, P= 0.002 and Group 2: 56.6% vs. 83.3%, P< 0.001). The other behaviors found no significant difference (Table 36).

Phase 2 (Prospective intervention study)

After pharmacist counseling, all 100 patients received drug allergy card. Most of the patients from T_1, T_2 and T_3 always carried drug allergy cards (83.3%, 94.9%, and 92.6%). The significant differences were found between T_1 vs. T_2 and T_1 vs. T_3 in every statement, except for drug allergy card carrying and drug allergy card identifying or notifying about drug allergy at healthcare services (Table 37).

The top three reasons for not always carry or show drug allergy card to healthcare professionals were remembering names of the allergic drugs (45.4%), forgetfulness (24.2%), and drug allergy card were carried but did not show (Figure 12).

Table 36 Behavior of drug allergy card carrying and the management of drug allergy in drug allergic patients in Phase 1

Behaviors	No. of patients (%)						p-value between groups	
	Group 1			Group 2			Pre-test	Post-test
	Pre-test	Post-test	p-value[a]	Pre-test	Post-test	p-value[a]		
Drug allergy card carrying								
Always	55 (84.6)	49 (79.0)	0.439	54 (80.6)	52 (81.2)	0.467	0.742[b]	0.909[b]
Sometimes	9 (13.8)	12 (19.4)		10 (14.9)	11 (17.2)			
Never	1 (1.5)	1 (1.6)		3(4.5)	1 (1.6)			
Total	65	62		67	64			
Never had drug allergy card and Missing	24	27		23	26			
Drug allergy card identifying or notifying about drug allergy at healthcare services								
Always	58 (65.9)	53 (66.2)	0.537	62 (74.7)	67 (78.8)	0.330	0.205[a]	**0.037**[b]
Sometimes	21 (23.9)	24 (30.0)		11 (13.3)	12 (14.1)			
Never	9 (10.2)	3 (3.8)		10 (12.0)	6 (7.1)			
Total	88	80		83	85			
Missing	1	9		7	5			
Asking drug names which were given from healthcare professionals								
Always	29 (34.5)	33 (40.2)	0.267	42 (51.2)	45 (52.3)	1.000	0.093[a]	0.215[a]
Sometimes	38 (45.2)	36 (43.9)		27 (32.9)	27 (31.4)			
Never	17 (20.2)	13 (15.9)		13 (15.9)	14 (16.3)			
Total	84	82		82	86			
Missing	5	7		8	4			

Table 36 Behavior of drug allergy card carrying and the management of drug allergy in drug allergic patients in Phase 1 (Cont.)

Behaviors	No. of patients (%)						p-value between groups	
	Group 1			Group 2			Pre-test	Post-test
	Pre-test	Post-test	p-value[a]	Pre-test	Post-test	p-value[a]		
Receiving drugs from non-healthcare professionals								
Always	5 (5.8)	1 (1.3)	**0.002**	4 (4.8)	3 (3.4)	**<0.001**	0.872[b]	0.160[b]
Sometimes	30 (34.9)	19 (24.4)		32 (38.6)	12 (13.6)			
Never	51 (59.3)	58 (74.4)		47 (56.6)	73 (83.0)			
Total	86	78		83	88			
Missing	3	11		7	2			
Asking healthcare professionals about the prevention of recurrent drug allergy								
Always	27 (31.8)	30 (36.6)	0.251	31 (37.3)	37 (42.5)	0.327	0.596[a]	0.664[a]
Sometimes	32 (37.6)	30 (36.6)		32 (38.6)	31 (35.6)			
Never	26 (30.6)	22 (26.8)		20 (24.1)	19 (21.8)			
Total	85	82		83	87			
Missing	4	7		7	3			
Asking healthcare professionals about the management of drug allergy								
Always	31 (36.5)	32 (39.0)	0.906	37 (43.5)	42 (48.3)	0.101	0.452[a]	0.356[a]
Sometimes	38 (44.7)	33 (40.2)		30 (35.3)	33 (37.9)			
Never	16 (18.8)	17 (20.7)		18 (21.2)	12 (13.8)			
Total	85	82		85	87			
Missing	4	7		5	3			

Table 36 Behavior of drug allergy card carrying and the management of drug allergy in drug allergic patients in Phase 1 (Cont.)

Behaviors	No. of patients (%)						p-value between groups	
	Group 1			Group 2			Pre-test	Post-test
	Pre-test	Post-test	p-value[a]	Pre-test	Post-test	p-value[a]		
Asking healthcare professionals when adverse drug event occurred								
Always	42 (48.8)	46 (58.2)	0.150	45 (54.9)	49 (61.2)	0.106	0.720[a]	0.557[a]
Sometimes	33 (38.4)	23 (29.1)		27 (32.9)	25 (31.2)			
Never	11 (12.8)	10 (12.7)		10 (12.2)	6 (7.5)			
Total	86	79		82	80			
Missing	3	10		8	10			

[a]Comparing frequency between pre-and post-test in each patient group using Marginal Homogeneity test

[b]Comparing frequencies between two groups used Chi-square test

[c]Comparing frequencies between two groups used Fisher's exact test

Table 37 Behavior of drug allergy card carrying and the management of drug allergy in drug allergic patients in Phase 2

Behaviors	No. of patients (%)			p-value		
	T_1 (n=100)	T_2 (n=100)	T_3 (n=100)	[a]T_1-T_2	[b]T_1-T_3	[c]T_2-T_3
Drug allergy card carrying						
Always	25 (83.3)	93 (94.9)	88 (92.6)	0.317	0.083	0.248
Sometimes	5 (16.7)	5 (5.1)	5 (5.3)			
Never	0 (0.0)	0 (0.0)	2 (2.1)			
Total	30 (100.0)	98 (100.0)	95 (100.0)			
Never had drug allergy card	70	0	0			
Missing		2	5			
Drug allergy card identifying or notifying about drug allergy at healthcare services						
Always	62 (84.9)	89 (90.8)	90 (95.7)	0.450	0.072	0.197
Sometimes	7 (9.6)	8 (8.2)	3 (3.2)			
Never	4 (4.0)	1 (1.0)	1 (1.1)			
Total	73 (100.0)	98 (100.0)	94 (100.0)			
Missing	27	2	6			
Asking drug names which were given from healthcare professionals						
Always	44 (46.8)	68 (68.7)	54 (58.1)	**< 0.001**	**0.005**	0.232
Sometimes	21 (22.3)	22 (22.2)	28 (30.1)			
Never	29 (30.9)	9 (9.1)	11 (11.8)			
Total	94 (100.0)	99 (100.0)	93 (100.0)			
Missing	6	1	7			

Table 37 Behavior of drug allergy card carrying and the management of drug allergy in drug allergic patients in Phase 2 (Cont.)

Behavior	No. of patients (%)			p-value		
	T_1 (n=100)	T_2 (n=100)	T_3 (n=100)	[a]T_1-T_2	[b]T_1-T_3	[c]T_2-T_3
Receiving drugs from non- healthcare professionals						
Always	1 (1.1)	1 (1.0)	1 (1.1)	**0.001**	**0.002**	0.433
Sometimes	27 (28.4)	12 (12.1)	8 (8.5)			
Never	67 (70.5)	86 (86.9)	85 (90.4)			
Total	95 (100.0)	99 (100.0)	94 (100.0)			
Missing	5	1	6			
Asking healthcare professionals about the prevention of recurrent drug allergy						
Always	36 (37.9)	67 (69.8)	51 (54.3)	**<0.001**	**0.003**	0.066
Sometimes	32 (33.7)	20 (20.8)	32 (34.0)			
Never	27 (28.4)	9 (9.4)	11 (11.7)			
Total	95 (100.0)	96 (100.0)	94 (100.0)			
Missing	5	4	6			
Asking healthcare professionals about the management of drug allergy						
Always	40 (42.1)	75 (76.5)	65 (69.9)	**<0.001**	**<0.001**	0.777
Sometimes	23 (24.2)	17 (17.3)	25 (26.9)			
Never	32 (33.7)	6 (6.1)	3 (3.2)			
Total	95 (100.0)	98 (100.0)	93 (100.0)			
Missing	5	2	7			

Table 37 Behavior of drug allergy card carrying and the management of drug allergy in drug allergic patients in Phase 2 (Cont.)

Behaviors	No. of patients (%)			p-value		
	T_1 (n=100)	T_2 (n=100)	T_3 (n=100)	[a]T_1-T_2	[b]T_1-T_3	[c]T_2-T_3
Asking healthcare professionals when adverse drug event occurred						
Always	55 (57.3)	80 (81.6)	69 (74.2)	**<0.001**	**0.001**	0.447
Sometimes	24 (25.0)	13 (13.0)	22 (23.7)			
Never	17 (17.7)	5 (5.1)	2 (2.2)			
Total	96 (100.0)	98 (100.0)	93 (100.0)			
Missing	4	2	7			

T_1 = Pre-test, T_2 = Immediate post-test, T_3 = One-month period post-test

Comparing frequency between [a]T_1-T_2, [b]T_1-T_3, and [c]T_2-T_3 used Marginal homogeneity test

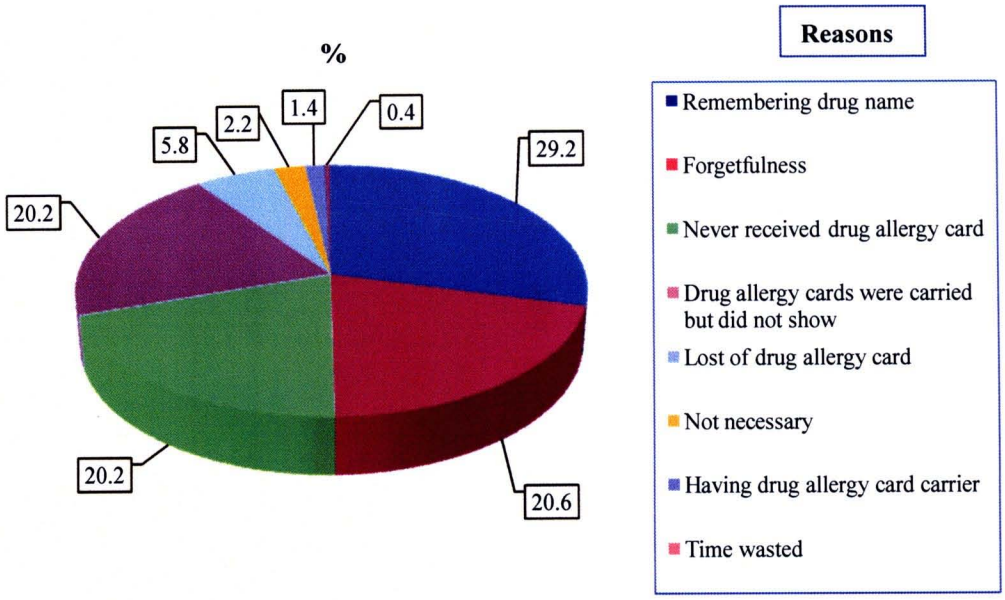

Figure 11 Reasons of drug allergy card carrying neglected in Phase 1

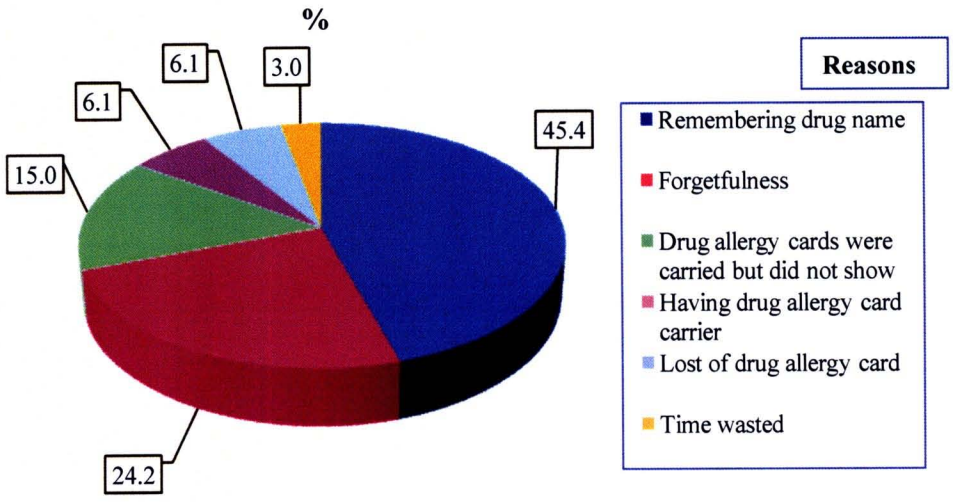

Figure 12 Reasons of drug allergy card carrying neglected in Phase 2

2.4.2 Part 2 Factors associated with drug allergy card carrying behavior

Phase 1

The factors affecting patients' behavior in drug allergy card carrying were assessed by univariate analysis. The patients who had total income per month lower than 5,000 Baht (87.5%) and between 10,001-20,000 Baht (88.9%) were more likely to always carried drug allergy cards than the other groups (P = 0.041) more than the other groups. Other variables related to this behavior were not statistically significant (Table 38).

Table 38 Univariate predictors of patients' behavior of drug allergy card carrying in Phase 1

Characteristics	No. of patients			Total N	P-value
	Always	Sometimes	Never		
Age, mean years±S.D.	48.35±17.036	48.35±17.775	42.00±8.485	48.60±17.193	0.874[a]
Age, median (range)	52 (6-83)	50 (12-78)	42 (36-48)	51.00 (6-83)	0.840[b†]
Age group (years)					
< 30	18 (78.3)	5 (21.7)	0 (0.0)	23 (18.3)	0.967[c]
30-60	58 (79.5)	13 (17.8)	2 (2.7)	73 (57.9)	
>60	30 (83.3)	5 (16.7)	0 (0.0)	30 (23.8)	
Total	101 (80.2)	23 (18.3)	2 (1.6)	126 (100.0)	
Missing data				12	
Gender					
Male	40 (87.0)	6 (13.0)	0 (0.0)	46 (36.5)	0.337[c]
Female	61 (72.6)	17 (21.2)	2 (2.5)	80 (63.5)	
Total	101 (80.2)	23 (18.3)	2 (1.6)	126 (100.0)	
Missing data				12	
Educational level					
None/ primary school	42 (85.7)	6 (12.2)	1 (2.0)	49 (38.9)	0.219[c]
Secondary school or higher	33 (70.2)	13 (27.7)	1 (2.1)	47 (37.3)	
Total	101 (80.2)	23 (18.3)	2 (1.6)	126 (100.0)	
Missing data				12	
Occupation					
None healthcare professional	22 (71.0)	8 (25.8)	1 (3.2)	31 (24.6)	0.082[c]
Healthcare professional	4 (100.0)	0 (0.0)	0 (0.0)	4 (3.2)	
Total	101 (80.2)	23 (18.3)	2 (1.6)	126 (100.0)	
Missing data				12	

Table 38 Univariate predictors of patients' behavior of drug allergy card carrying In Phase 1 (Cont.)

Characteristics	No. of patients			Total N	P-value
	Always	Sometimes	Never		
Income (Baht per month)					
<5,000	49 (87.5)	6 (10.7)	1 (1.8)	56 (46.3)	**0.041**[c]
5,000-10,000	13 (76.5)	3 (17.6)	1 (5.9)	17 (14.0)	
10,001-20,000	16 (88.9)	2 (11.1)	0 (0.0)	18 (14.9)	
>20,000	19 (63.3)	11 (36.7)	0 (0.0)	30 (24.8)	
Total	97 (80.2)	22 (18.2)	2 (1.6)	121 (100.0)	
Missing data				17	
Underlying disease					
No	27 (87.1)	3 (9.7)	1 (3.2)	31 (24.6)	0.225[c]
Yes	74 (77.9)	20 (21.1)	1 (1.1)	95 (75.4)	
Total	101 (80.2)	23 (18.2)	2 (1.6)	126 (100.0)	
Missing data				12	
No. of Drug use (Items)					
None	33 (76.7)	8 (18.6)	2 (4.7)	43 (34.1)	0.905[c]
1-2	27 (81.8)	6 (18.2)	0 (0.0)	33(26.2)	
3-4	23 (79.3)	6 (20.7)	0 (0.0)	29 (23.0)	
≥5	18 (85.7)	3 (14.3)	0 (0.0)	21 (16.7)	
Total	101 (80.2)	23 (18.2)	2 (1.6)	126 (100.0)	
Missing data				12	
No. of Allergic drug (Items)					
1	50 (75.8)	15 (22.7)	1 (1.5)	66 (62.3)	0.246[c]
≥2	35 (87.5)	5 (12.5)	0 (0.0)	40 (37.7)	
Total	85 (80.2)	20 (18.2)	1 (1.6)	106 (100.0)	
Cannot remember and Missing data				32	
Severity of drug allergy symptom					
Mild	12 (92.3)	1 (7.7)	0 (0.0)	13 (10.7)	0.182[c]
Moderate	36 (70.6)	14 (27.5)	1 (2.0)	51 (42.1)	
Serious	49 (86.0)	7 (12.3)	1 (1.8)	57 (47.1)	
Total	97 (80.2)	22 (18.2)	2 (1.7)	121 (100.0)	
Missing data				17	
Drug allergy card carrying					
Notified person					
No	35 (76.1)	11 (23.9)	0 (0.0)	46 (37.1)	0.340[c]
Yes	64 (82.1)	12 (15.4)	2 (2.6)	78 (62.9)	
Total	99 (79.8)	23 (18.5)	2 (1.7)	124 (100.0)	
Missing data				14	

[a]Comparing mean/ median between frequency of behavior used ANOVA.

[b]Comparing mean/ median between frequency of behavior used Kruskal Wallis test.

[c]Comparing frequencies between frequency of behavior used Fisher's exact test.

Phase 2 (Prospective intervention study)

Table 39 presents the factors which correlated to drug allergy card carrying behavior. Univariate analysis was used to predict the associations. The dependent variable was drug allergy card carrying behavior which was re- categorized into level: always and sometimes. No meaningful statistics was found in any variables.

Table 39 Univariate predictors of patients' behavior of drug allergy card carrying in Phase 2

Characteristic	No. of patients (%)		Total N	p-value
	Always	Sometimes		
Age, mean years±S.D.	49.24±17.053	48.80±7.981	49.37±16.673	0.955[a]
Age, median (range)	50 (5-83)	50 (36-58)	50 (5-83)	0.827[bt]
Age group (years)				
< 30	14 (100.0)	0 (0.0)	14 (14.3)	0.206[c]
30-60	51 (91.1)	5 (8.9)	51 (57.1)	
>60	28 (100.0)	0 (0.0)	28 (28.6)	
Total	93 (94.9)	5 (5.1)	98 (100.0)	
Missing data			2	
Gender				
Male	37 (97.4)	1 (2.6)	38 (38.8)	0.646[c]
Female	56 (93.3)	4 (6.7)	60 (61.2)	
Total	93 (94.9)	5 (5.1)	98 (100.0)	
Missing data			2	
Educational level				
None/ primary school	33 (94.3)	2 (5.7)	35 (35.7)	1.000[c]
Secondary school or higher	60 (95.2)	3 (4.8)	63 (64.3)	
Total	93 (94.9)	5 (5.1)	98 (100.0)	
Missing data			2	
Occupation				
None-healthcare professionals	4 (100.0)	0 (0.0)	4 (4.1)	1.000[c]
Healthcare professionals	89 (94.7)	5 (5.3)	94 (95.9)	
Total	93 (94.9)	5 (5.3)	98 (100.0)	
Missing data			2	
Income (Baht per month)				
<10,000	52 (94.5)	3 (5.5)	55 (63.2)	1.000[c]
≥10,000	30 (93.8)	2 (6.2)	32 (36.8)	
Total	82 (94.3)	5 (5.7)	87 (100.0)	
Missing data			17	
Underlying disease				
No	19 (90.5)	2 (9.5)	21 (21.4)	0.291[c]
Yes	74 (78.6)	3 (3.9)	77 (78.6)	
Total	93 (94.9)	5 (5.1)	98 (100.0)	
Missing data			2	

Table 39 Univariate predictors of patients' behavior of drug allergy card carrying In Phase 2 (Cont.)

Characteristic	No. of patients (%)		Total N	p-value
	Always	Sometimes		
No. of Drug use (Items)				
None	30 (93.8)	2 (6.2)	32 (32.7)	0.715[c]
1-2	26 (96.3)	1 (3.7)	27 (27.6)	
3-4	18 (100.0)	0 (0.0)	18 (18.4)	
≥5	19 (90.5)	2 (9.5)	21 (21.4)	
Total	93 (94.9)	5 (5.1)	98 (100.0)	
Missing data			2	
No. of Allergic drug (Items)				
1	67 (95.7)	3 (4.3)	70 (76.9	0.326[c]
≥2	19 (90.5)	2 (9.5)	21 (23.1)	
Total	86 (94.5)	5 (5.5)	91 (100.0)	
Cannot remember and Missing data			9	
Severity of drug allergy symptom				
Mild	12 (100.0)	0 (0.0)	12 (12.5)	0.789[c]
Moderate	34 (97.1)	1 (2.9)	35 (36.5)	
Serious	46 (93.9)	3 (6.1)	49 (51.0)	
Total	92 (95.8)	4 (4.2)	96 (100.0)	
Missing data			4	
Drug allergy card carrying notified person				
No	51 (98.1)	1 (1.9)	52 (54.2)	0.176[c]
Yes	40 (90.9)	4 (9.1)	44 (45.8)	
Total	91 (94.8)	5 (5.2)	96 (100.0)	
Missing data			4	

[a]Comparing mean between frequency of behavior used Independent t-test
[b]Comparing median between frequency of behavior used Mann Whitney test
[c]Comparing frequencies between two groups used Fisher's exact test

Attitudes towards drug allergy and drug allergy card of the patients and their associated factors

This part combined patients in Phase 1 and Phase 2, who completed attitude section in the questionnaire. A total of 348 questionnaires were analyzed and results were divided into two parts as follows:

Part 1 Attitudes towards drug allergy and drug allergy card of the patients

The attitudes were measured by fifteen statements which were developed and consisted of both positive and negative statements. The negative statements were:

statement number (2, 4, 6, 8, 10, and 12), which were translated while entering data on SPSS program for analysis and presented in translating form. The attitudes were measured on 5-point likert Scale; lowest score was 1 and highest score was 5. The attitude mean score was classified, based on Best criteria (Best, 1959); poor (1.00-1.79), fair (1.8-2.59), moderate (2.60-3.39), good (3.40-4.19), and very good (4.20-5.00). Table 40 showed the frequency, mean ± S.D., and level of patients' attitudes towards drug allergy and drug allergy card. The attitudes were very good for seven statements; seven statements were good, and one statement was fair.

The highest mean (4.79 ± 0.46) was score from statement number 1, which the majority of the patients (80.9%) had strongly agreed, and 18.6% of the patients had agreed that they should pay attention to their drug allergy. The second highest mean was score from statement 13 (4.58 ± 0.52), which the majority of the patients (59.1%) had strongly agreed and 39.5% had agreed that drug allergy education would assure them in medication. The lowest mean attitude score was found for statement number 8 (2.14 ± 1.04), which the majority of the patients (44.7%) had agreed and 28.7% had strongly agree that drug allergy limiting their opportunities in drug utilization for underlying disease.

The statement number 6 had the highest mean score (4.09 ± 1.20) for negative statements, which the majority of the patients (47.4%) had strongly disagreed and 35.9% had disagreed that recognizing drug allergy is unimportant to them. The second highest mean (4.09 ± 1.01) for negative statement was score from statement number 10, which the majority of the patients (50.4%) had disagreed and 36.7% had strongly disagreed that drug allergy card carrying is unnecessary burden.

Table 41 showed frequency, mean ± S.D., and level of overall attitudes toward drug allergy and drug allergy card. The lowest possible score for attitude was 15 and the highest possible was 75. Therefore, the range (75-15= 60) was divided into three equal parts, and leveled as low (15-35), moderate (36-55), and high (56-75). The overall level was high (57.69 ± 5.20). Of a total 322 patients, the majority of the patients (68.6%) had high level (60.42 ± 3.36) and 31.4% had moderate level (51.72 ± 3.08).

Part 2 Factors associated with patients' attitudes toward drug allergy and drug allergy card

The factors associating with attitudes toward drug allergy and drug allergy card were analyzed by univariate and multivariate statistical analysis which attitude level was a dependent variable.

Univariable analysis (Table 42) showed that the factors associating with high attitude level were high educational level (P= 0.006), income≥ 10,000 baht per month (P= 0.006), and good knowledge level in pre-test (P< 0.001). Other variables did not show any statistical significance related to attitudes. After adjusting those four factors by multivariate analysis, demonstrated significant factor for high attitude level were higher income per month (OR= 2.01; 95% CI 1.03- 3.95; P= 0.042) and good level of knowledge in pre-test (OR= 5.83; 95% CI 1.69-21.11; P= 0.007) (Table 43).

Table 40 Frequency, mean, S.D and level of patients' attitudes

	Statements	No. of patients in each scale (%)					Total	Mean±S.D. [b]	Level[c]
		1	2	3	4	5	N		
1.	You should pay attention to drug allergy.	1 (0.3)	1 (0.3)	0 (0.0)	64 (18.6)	279 (80.9)	345	4.79±0.46	Very good
13.	Drug allergy education would assure you in medication.	0 (0.0)	0 (0.0)	5 (1.3)	135 (39.5)	202 (59.1)	342	4.58±0.52	Very good
9.	Drug allergy card is a safety tool for the prevention of recurrent drug allergy.	5 (1.5)	2 (0.6)	6 (1.7)	130 (37.9)	200 (58.3)	343	4.51±0.70	Very good
3.	You should always receive your drug allergy from healthcare professionals (Doctors, Pharmacists, or Nurse)	0 (0.0)	5 (1.5)	12 (3.5)	128 (37.2)	199 (57.8)	344	4.51±0.64	Very good
15.	Pharmacists should provide more drug allergy education.	1 (0.3)	3 (0.9)	5 (1.5)	166 (48.5)	167 (48.8)	342	4.45±0.60	Very good
11.	You should always carry drug allergy card.	4 (1.2)	8 (2.3)	9 (2.6)	134 (38.8)	190 (55.1)	345	4.44±0.76	Very good
5.	You expect that healthcare professionals could prevent and reduce the recurrent of drug allergy.	3 (0.9)	5 (1.4)	16 (4.6)	146 (42.2)	176 (50.9)	346	4.41±0.72	Very good
7.	Preventing the recurrent of drug allergy would reduce your healthcare cost	9 (2.6)	22 (6.4)	35 (10.2)	134 (39.1)	143 (41.7)	343	4.11±1.00	Good
6.	Recognizing of drug allergy is unimportant to you.	161 (47.4)	122 (35.9)	8 (2.4)	23 (6.8)	26 (7.6)	340	4.09±1.20	Good
10.	Drug allergy card carrying is unnecessary burden.	125 (36.7)	172 (50.4)	11 (3.2)	17 (5.0)	16 (4.7)	341	4.09±1.01	Good

Table 40 Frequency, mean, S.D and level of patients' attitudes (Cont.)

	Statements	No. of patients in each scale (%)					Total	Mean±S.D. [b]	Level[c]
		1	2	3	4	5	N		
4.	Notifying healthcare professionals about your drug allergy was wasting your time.	115 (33.7)	175 (51.3)	17 (5.0)	23 (6.7)	11 (3.2)	341	4.06±0.97	Good
12.	The prevention of recurrent drug allergy is not your direct responsibility.	116 (34.2)	137 (40.4)	30 (8.8)	39 (11.5)	17 (5.0)	339	3.87±1.15	Good
14.	Drug allergy education should be a direct responsibility of the pharmacist.	2 (0.6)	58 (17.0)	41 (12.0)	134 (39.2)	107 (31.3)	342	3.84±1.07	Good
2.	Drug allergy doesn't affect your health or quality of life.	135 (39.7)	94 (27.6)	25 (7.4)	39 (11.5)	47 (13.8)	340	3.68±1.44	Good
8.	Drug allergy limits your opportunity in drug utilization for underlying disease.	12 (3.6)	30 (8.9)	48 (14.2)	151 (44.7)	97 (28.7)	338	2.14±1.04	Fair

[a]Scales on table; 1= Strongly disagree, 2= Disagree, 3= Not sure, 4= Agree, and 5= Strongly agree

[b]The negative statements (2, 4, 6, 8, 10, and 12) were translated while entering data on SPSS program for analysis and presented in translating form.

[c]Levels of attitudes; Very good (4.20-5.00), Good (3.40- 4.19), Moderate (2.60-3.39), Fair (1.80- 2.59), and Poor (1.00-1.79)

Table 41 Frequency, mean, S.D., and level of overall attitudes

Levels	Mean ± S.D.	Median (range)	No. of patients (%)
High	60.42±3.36	60.00 (56-70)	221 (68.6)
Moderate	51.72±3.08	53.00 (43-55)	101 (31.4)
Total	57.69±5.20	57.50 (43-70)	322 (100.0)

Level of overall attitudes; High (56-75), Moderate (36-55), and Low (15-35)

Table 42 Univariate predictors of patients' attitudes towards drug allergy and drug allergy card

Characteristics	Levels		Total N	p-value
	Moderate	High		
Age, mean years ± S.D.	44.86±20.011	46.73±17.781	46.37±18.510	0. 402[a]
Age, median (range)	50.00 (4-83)	49.00 (3-83)	49.00 (3-91)	0.690[bt]
Age group (years)				
< 30	27 (37.50)	45 (62.5)	72 (22.4)	0.259[c]
30-60	48 (27.6)	126 (72.4)	174 (54.0)	
>60	26 (34.2)	50 (65.8)	76 (23.6)	
Total	101 (31.4)	221 (68.6)	322 (100.0)	
Missing data			77	
Gender				
Male	47 (36.7)	81 (63.3)	128 (39.8)	0.093[c]
Female	54 (27.8)	140 (72.2)	194 (60.2)	
Total	101 (31.4)	221 (68.6)	322 (100.0)	
Missing data			77	
Educational level				
None/ primary school	46 (41.1)	66 (58.9)	112 (34.8)	**0.006**[c]
Secondary or higher	55 (26.2)	155 (73.8)	210 (65.2)	
Total	101 (31.4)	221 (68.6)	322 (100.0)	
Missing data			77	

Table 42 Univariate predictors of patients' attitudes towards drug allergy and drug allergy card (Cont.)

Characteristics	Levels		Total N	p-value
	Moderate	High		
Occupation				
None-healthcare professionals	97 (31.2)	214 (68.8)	311 (96.6)	0.746[d]
Healthcare professionals	4 (36.4)	7 (63.6)	11 (3.4)	
Total	101 (31.4)	221 (68.6)	322 (100.0)	
Missing data			77	
Income (Baht per month)				
<10,000	75 (35.9)	134 (64.1)	209 (71.6)	**0.006**[c]
≥10,000	16 (19.3)	67 (80.7)	83 (28.4)	
Total	91 (31.2)	201 (68.8)	292 (100.0)	
Missing data			6	
Underlying disease				
No	28 (30.4)	64 (69.6)	92 (28.6)	0.820[c]
Yes	73 (31.7)	157 (68.3)	230 (71.4)	
Total	101 (31.4)	221 (68.6)	322 (100.0)	
Missing data			77	
No. of Drug use (Items)				
None	37 (28.9)	91 (71.1)	128 (39.9)	0.314[c]
1-2	26 (32.1)	55 (67.9)	81 (25.2)	
3-4	26 (39.4)	40 (60.6)	66 (20.6)	
≥5	11 (23.9)	45 (76.1)	46 (14.3)	
Total	100 (31.2)	221 (68.6)	321 (100.0)	
Missing data			78	
No. of Allergic drug (Items)				
1	60 (31.7)	129 (68.3)	189 (69.2)	0.600[c]
≥2	24 (28.6)	60 (71.4)	84 (30.8)	
Total	84 (30.8)	189 (69.2)	273 (100.0)	
Cannot remember and Missing data			126	
Severity of drug allergy symptom				
Mild	15 (39.5)	23 (60.5)	38 (12.3)	0.368[c]
Moderate	37 (32.2)	78 (67.8)	115 (37.1)	
Serious	44 (28.0)	113 (72.0)	157 (50.6)	
Total	96 (31.0)	214 (69.0)	310 (100.0)	
Missing data			89	

Table 42 Univariate predictors of patients' attitudes towards drug allergy and drug allergy card (Cont.)

Characteristic	Level		Total N	p-value
	Moderate	High		
Level of knowledge (Pre-test)				
Low	9 (69.2)	4 (30.8)	13 (4.0)	**<0.001**[c]
Average	53 (38.1)	86 (61.9)	139 (43.2)	
Good	39 (22.9)	131 (77.1)	170 (52.8)	
Total	101 (31.4)	221 (68.6)	322 (100.0)	
Missing data			77	

[a]Comparing mean/ median between frequency of attitude level used
[b]Comparing mean/ median between frequency of attitude level used Mann Whitney U.
[c]Comparing frequencies between two groups used Chi- square test
[d]Comparing frequencies between two groups used Fisher's exact test
Attitude levels; moderate (36-55) and high (56-75)
Level of knowledge; Low (0-1), Average (2-3), and good (4-5)

Table 43 Factors associated with level of attitudes towards drug allergy and drug allergy card of the patients (Logistic Regression Analysis)

Variable	Crude OR	95% CI	Adjusted OR	95% CI	p value
Educational level					
None/ primary school	1		1		
Secondary school or higher	1.96	1.21-3.19	1.22	0.69-2.16	0.500
Income (Baht per month)					
<10,000	1		1		
≥10,000	2.34	1.27-4.33	2.01	1.03-3.95	**0.042**
Level of Knowledge					
Low	1		1		
Average	3.65	1.07-12.45	3.09	0.87-11.06	0.082
Good	7.56	2.21-25.88	5.83	1.69-21.11	**0.007**

Adjusted for educational level, Occupation, income, and level of knowledge