

# Prevalence, factors influencing and knowledge about adherence to lipid-lowering therapy among hyperlipidemia patients

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## ABSTRACT

**Background:** Hyperlipidaemia is a significant risk factor for cardiovascular disease. However, adherence to lipid-lowering therapy is often unsatisfactory due to a combination of patient factors, therapy, socio-economic and health system-related factors.

**Aims:** To identify the prevalence of adherence to lipid-lowering therapy, the factors contributing to non-adherence and knowledge regarding hyperlipidaemia and its' treatment among Malaysian patients with hyperlipidemia.

**Methods:** A quantitative study using a cross-sectional survey was carried out in an urban primary care clinic in August 2015. Patients on lipid-lowering therapy for  $\geq 1$  year aged  $\geq 18$  years were selected using simple random sampling. Consenting patients answered a self-administered questionnaire (in Malay/English) which included socio-demographic profile, hyperlipidaemia profile, adherence to lipid-lowering therapy (using the Morisky Medication Adherence Scale-8; score  $\geq 6$  taken as adherent), reasons leading to non-adherence, knowledge regarding hyperlipidaemia and its' treatment, and use of non-allopathic medicine.

**Results:** The response rate was 90.7%. The prevalence of adherence to lipid-lowering therapy was 82.4%. "The most common reasons for non-adherence was being worried about side effect of lipid-lowering agent (71.4%), followed by the need to take too many drugs in a day (61.4%) and negative influences by friends, relative and mass media (60%)". Factors associated with non-adherence include male gender, on longer duration of therapy, less frequency of follow-up, less number of follow-up clinics, taking medication at night/random timing and having lower knowledge scores.

**Conclusion:** Overall the prevalence of adherence was high in patients with hyperlipidaemia. Interventions to boost adherence should target those who were identified as non-adherent.

## KEY WORDS:

*Adherence, hyperlipidaemia, lipid lowering therapy, knowledge, prevalence*

## INTRODUCTION

Hyperlipidaemia is a significant risk factor for cardiovascular diseases worldwide. In Malaysia, cardiovascular disease (CVD) is the leading cause of death in both men and women. The local National Cardiovascular Disease-Acute Coronary Syndrome (NCVD-ACS) Registry showed that most patients (96.8%) had at least one established CVD risk factor-hypertension (72.6%), dyslipidaemia (55.9%) and/or diabetes mellitus (55%).<sup>1</sup> The 4th National Health and Morbidity Survey 2011 showed that 35.1% (6.2 million) of adults aged 18 years and above had hyperlipidaemia among which 8.4% know they have it and 26.6% don't know they have it. Many large scaled international studies, including 4S, PLAC1, PLAC11, ACAP, KAPS, REGRESS and WOSCOPS, have repeatedly reinforce the benefit of lipid level lowering in hyperlipidaemia and in primary prevention of coronary heart disease (CHD).

Optimal adherence is defined as patients taking their medications as prescribed, i.e.at correct dosage, time and frequency. Non-adherence to medication leads to disease relapse, complications and affects treatment efficacy and response.<sup>2</sup> According to World Health Organization (WHO), non-adherence with long term treatment for chronic disorders including hyperlipidaemia leads to compromised health benefits and additional wastage on the already scarce economy that include wasted time and money, and uncured disease.<sup>3</sup> It is said that primary prevention with statins for cardiovascular disease were likely to be cost effective and increased the patient's quality of care and life.<sup>4</sup> Despite the bountiful evidence for lipid lowering benefits, there are problems with adherence, with reaching target lipid levels and delay on the physician aspects on optimising treatment of hyperlipidaemia.<sup>5</sup> Problem with non-adherence has been present since the early 1970's.<sup>6</sup> A systematic review estimated the adherence rate of long term medication to be between 40% to 50% which is lower than the figures obtained for short term therapy at 70% to 80%.<sup>7</sup>

Studies regarding adherence to lipid lowering therapy are abundant overseas but sadly lacking in Malaysia. A study overseas showed that 39.4% of patients abandon the long term drugs indicated by the family doctor leaving an adherence rate of only about 60%.<sup>8</sup> Another study by Folgerdiena M.d.V. et al.<sup>9</sup> showed that adherence rate

This article was accepted: 11 April 2017

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actually decreased with duration of lipid lowering treatment enforced, from 81% in year one of treatment for hyperlipidaemia to 77% and 75% respectively in year two and year three of treatment. The declining rate of adherence to lipid lowering therapy is further confirmed by a study by Berglund E. et al. in 2013 which states that adherence to lipid lowering therapy is poor and adherence decreases with time.<sup>8</sup> A study by Yang C.C et al. found that at end of first year of treatment, discontinuation rate of statin was 15%.<sup>10</sup> A Japanese study in 2014 noted non-adherent rates exceeding 50% i.e. at 58% for patients with chronic disease with costs, increased dosing frequency and fewer drugs significantly associated with non-adherence.<sup>11</sup>

Therefore, with the specific objectives of this study, this study wishes to provide some light on what is the adherence rate of patients taking lipid lowering therapy, which can subsequently provide insights on strategies to increase adherence rates in these patients in a Malaysian setting.

## MATERIALS AND METHODS

This was a cross-sectional study using a self-administered survey questionnaire in a primary care clinic in University Malaya Medical Centre among respondents that are either fully, partially or non-subsidized. Data collection was done over a month period from 1st -30th August 2015.

For the study population, the inclusion criteria included adults 18 years and above, having hyperlipidaemia and on lipid lowering agents for at least a year, and able to understand Malay or English Language. The exclusion criteria was having cognitive or active mental illness.

A minimum of 384 patients with hyperlipidaemia will be required taking into account 5% margin of error and 95% confidence interval. Simple random sampling using a coin toss was done to select participants for this study.

The pre-tested questionnaire (instrument) was developed to include socio-demographic data, hyperlipidaemia profile, MMAS-8 (Morisky Medication Adherence Scale-8 with score of 6 to 8 accepted as adherent and < 6 as non-adherent), reasons leading to non-adherence which includes therapy related reasons (6 items), health-care team and system related reasons (4 items), socio-economic reasons (3 items) and patient's related reasons (3 items) while chronic conditions related reasons (the other major non-adherence related reasons) will be captured in the questions under hyperlipidaemia profile like the type and number of chronic conditions, and knowledge about hyperlipidaemia, lipid lowering medications and components of fasting lipid profile. [For the knowledge section with a total of 16 questions, one point is given for each correct answer scored on knowledge regarding hyperlipidaemia and lipid lowering therapy medication and one point if all components of lipid profile answered correctly, and zero if otherwise answered. Therefore, a respondent will be able to draw a maximum of 16 points and minimum of 0 points. It will include three domains of knowledge about hyperlipidaemia (8 items), lipid lowering medications (7 items) and component of fasting lipid profile (1 item)].

Content validation was done with an expert panel of two endocrinologists, two primary care specialist and a statistician. Face validation with 15 patients was also done to validate the questionnaire for this study. Pilot study involving 10 participants was done to ensure readability, answerability and best possible method to conduct the study without interrupting the normal clinic flow. Corrections were made to the questionnaire post validation and pilot study.

At least 40 patients were selected on each day of chronic disease follow-up at the primary care clinic of this tertiary teaching hospital on Wednesday, Thursday and Friday afternoons. Once identified, the nature and objective of study was explained to respondents. A patient information sheet was given to the patient. The guarantee of strict confidentiality was made to the patient. Informed consent was to be taken before filling of the questionnaire. Once patient consents, the patient were recruited into the study. The participants were told that their participation is anonymous and entirely voluntary. The researcher will be around to clarify any doubt(s) that may exist. Baseline data like height and weight was taken. Patient's case notes and results on the computer were reviewed for current lipid levels to look at whether target lipid level has been achieved.

Ethics approval was obtained from University Malaya Medical Centre Medical Ethics Committee on 31st December 2014 (Approval No. 201412-869).

Data was analysed using a combination of statistical methods that include univariate and multivariate binary logistic regression and chi square using SPSS 23.0. Binary logistic regression test was done on socio-demographic, hyperlipidaemia factors, and knowledge scores to look at predictors of non-adherence to lipid lowering therapy. Factors that had p-value of <0.05 in the univariate analysis were then entered into multivariate analysis to look at the final predictors of non-adherence to lipid lowering therapy. Chi square test was done to look at the association between adherence and achievement of target lipid levels (Based on discussion with expert panel and noting of results of which identified more than 80% of respondent with co-morbidities like hypertension, diabetes mellitus, stroke and coronary heart disease and less than 20% of respondent with no other co-morbidities except for hyperlipidaemia, a target lipid level of 1.8-2.6 mmol/L was set for the former and 3.4-4.1mmol/L for the latter. This is based on the 2011 Malaysian CPG on dyslipidaemia.<sup>1</sup> A p-value of < 0.05 was taken as significant.

## RESULTS

A total of 452 respondents were approached of whom 420 agreed to participate. Of the 420 respondents, 10 did not return the questionnaire and 12 submitted incomplete questionnaire, giving a response rate of 90.7%. Finally, 398 completed questionnaires were used for analysis.

The mean age was 59.1 years (age range 18 to 84 years). There were more male respondents compared to female respondents (53% vs 47%). Chinese ethnicity respondent formed the highest respondent (43.7%), followed by Malay, Indian and those from other ethnic groups.

Table I: Socio-demographic profile of respondents

Variable	n (%)
<b>Age (Mean +/- SD)</b>	59.1 +/- 10.2
18-30 years	6 (1.5)
31-40 years	9 (2.3)
41-50 years	37 (9.3)
51-60 years	126(31.7)
61-70 years	182(45.7)
71-80 years	33 (8.3)
81 years and above	5 (1.2)
<b>Ethnicity</b>	
Malay	129(32.4)
Chinese	174(43.7)
Indian	87(21.8)
Others	8 (2.1)
<b>Gender</b>	
Male	211 (53)
Female	187 (47)
<b>Marital status</b>	
Single	5 (1.3)
Married	290(72.9)
Divorced	23 (5.8)
Widow/widower	80 (20)
<b>Level of subsidy</b>	
Full	318 (80)
Partial/none	80 (20)
<b>Household income(RM)</b>	
Below 2500	150(37.7)
2500-5000	108(27.1)
5001-7500	79(19.8)
7501-10000	52(13.1)
10001 and above	9 (2.3)
<b>Educational level</b>	
No formal education	50(12.6)
Primary	60(15.1)
Secondary	223(56.0)
Tertiary	65(16.3)
<b>Smoking status</b>	
Never smoked	326(81.9)
Smoked before	72(18.1)
<b>Smoking during the last one month (n=72)</b>	
Smoke in the last one month	22(30.6)
Did not smoke in the last one month	50(69.4)

Majority of the respondents are married (72.9%) with only 1.26% single. Majority of the respondents (80%) were fully subsidised (government employees, government pensioners, students in public institution of higher learning and disabled patients), therefore receiving their treatment without incurring any cost. Most of the respondents (37.7%) had household income of less than RM2,500 while only 2.3% of respondents had household income above RM10,000. Majority of participants had secondary level of education (56%) with only 12.6% of respondents did not attend formal schooling. Most of the respondents (81.9%) are non-smoker. Of the 72 respondents that smoked before, only 22 smoked in the last one month. Table I showed the socio-demographic profile of the respondents.

The majority of participant has been having hyperlipidaemia for a period of 5 to 10 years (71.1%). This roughly corresponds to majority of respondents that are on lipid lowering therapy for the same duration (70.4%). Most of the respondents took their lipid lowering therapy at night (75.4%) while 10% took their medication in the morning. The majority of respondents (81.4%) have other co-morbid conditions (other than hyperlipidaemia) with only 18.6% of respondents having no other co-morbidities. Of those with co-morbidities, 42% of respondents have three co-morbidities. Majority of the respondents had two follow-up a year for their hyperlipidaemia (56%) with only 5.2% having one follow-up annually. Majority of respondents had their follow-up in a single clinic (74.6%). Most of the respondent were on four or more medications (42.2%) while 16.3% of respondents

Table II : Hyperlipidaemia profile of respondents

Variable	n (%)
<b>Duration of hyperlipidaemia</b>	
1 to 5 years	101(25.4)
> 5 years to 10 years	283(71.1)
> 10 years	14(3.5)
<b>Duration on lipid lowering therapy</b>	
1 to 5 years	111(27.9)
> 5 years to 10 years	280(70.4)
> 10 years	7(1.7)
<b>Timing of taking lipid lowering medication(s)</b>	
Morning	40(10)
Afternoon	0(0)
Night	100(75.4)
No specific timing/ random	58(14.6)
<b>Presence of concurrent medical illness</b>	
No	74(18.6)
Yes	324(81.4)
<b>Number of concurrent medical illness(n=324)</b>	
One	104(32.1)
Two	69(21.3)
Three	136(42.0)
Four or more	15(4.6)
<b>Frequency of follow-up in a year</b>	
One	21(5.2)
Two	223(56)
Three or more	154(38.8)
<b>Number of follow-up clinic(s) treating hyperlipidaemia</b>	
One	297(74.6)
Two or more	101(25.4)
<b>Number of medications per day</b>	
One	65(16.3)
Two	78(19.6)
Three	87(21.9)
Four or more	168(42.2)
<b>Type of lipid lowering therapy</b>	
Statin	350(87.9)
Fibrate	82(20.6)
Exetimibe	10(2.5)
<b>Achievement of target lipid levels</b>	
Yes	242(60.8)
No	156(39.2)

were on lipid lowering therapy only i.e. on a single medication. Majority of the patients were on statins (350 respondents, either alone or in combination). Majority of respondents (60.8%) managed to achieve target lipid levels. Table II indicates the hyperlipidaemia profile of the respondents.

The prevalence of adherence to lipid lowering therapy in this study is 82.4%. Therefore, the non-adherent rate is only 17.6%.

The main reason for non-adherence is being worried about the side effect of lipid lowering agent (71.4%), followed by the need to take too many drugs in a day (61.4%) and negative influences by friends, relative and mass media (60%),

respectively. The latter reason included being warned by relatives and friends about the severe side effects of drugs and myth about these drugs causing kidney problem, and constant non-evidence based claims by a few Western cardiologist about the dangers of statins through the social media. Therapy related reasons were the main reason dimensions leading to non-adherence with health care team and system related reasons were the least likely reasons of non-adherence. Table III illustrates the reasons leading to non-adherence.

In the univariate analysis, factors significantly associated with non-adherence include gender, level of subsidy, education level, duration of hyperlipidaemia, duration on lipid lowering therapy, timing of medications, number of

Table III: Reasons leading to non-adherence

Reasons	n=70	(%)
<b>Therapy</b>		
1. Worried about side effects	50	71.4
2. Experience the side effect (e.g. myalgia, insomnia)	40	57.1
3. Medication not effective to bring down the lipid(cholesterol/fat) levels	6	8.6
4. Too many drugs to take in a day	43	61.4
5. Frequent prescription changes	0	0
6. Concern about generic(non-original) medication	4	5.7
<b>Health care team and system</b>		
7. Inadequate explanation and education about hyperlipidaemia and its medications	4	5.7
8. Poor frequency of follow up	0	0
9. Seeing different doctor at follow-up	6	8.6
10. Not trusting your doctor	0	0
<b>Socio-economic</b>		
11. Can't afford the cost	2	2.9
12. Negative influence by friends, relative, mass media	42	60
13. No time to collect prescription from pharmacy	8	11.4
<b>Patient</b>		
14. Medication not needed to lower the high lipid(cholesterol/fat) levels	0	0
15. Did not think that hyperlipidemia is life threatening	14	20.0
16. Prefer to use complementary and/or alternative medicine like fish oil, garlic, traditional Chinese medicines, herbal therapy, homeopathy etc.	32	45.7
<b>Others</b>		
17. Other reasons-going for surgery, went outstation, refused to see doctors outstation, logistic problem	25	35.7

follow-up clinics, frequency of follow-ups in a year and knowledge scores. In multivariate analysis, those more likely to be non-adherent were males (OR=1.31, CI=1.02-1.74), taking their lipid lowering medications for a longer period of time [i.e. of more than 5 years (OR=1.37, CI=1.09-1.72) and more than 10 years (OR =1.48, CI=1.24-1.74)], taking their lipid lowering medications at night (OR=1.71, CI=1.54-1.96) or non-specific timing(OR=1.63 CI=1.46-1.83), those with less frequency of follow-ups in a year [one follow-up in a year (OR=1.63, CI=1.51-1.92) and two follow-ups in a year (OR =1.47, CI=1.22-1.87)], less number of follow-up clinics(OR=1.61,CI=1.37-2.11) and lower knowledge scores[those with higher knowledge scores (OR=0.78, CI=0.48-0.94, p-value=0.032) were 0.78 times less likely to be non-adherent for each added point on the knowledge section]. Table IV shows the factors associated with non-adherence to lipid lowering therapy.

## DISCUSSION

This study found that the prevalence of adherence was 82.4%. Factors that are associated with non-adherence to lipid lowering therapy include male gender, on longer duration of lipid lowering therapy, fewer follow-ups and number of clinics visited, lower knowledge scores and taking their medication at night or random/non-specific timing. The main reason dimensions leading to non-adherence among respondents with low adherence in order of frequency is therapy related factors followed by social-economic related factors, followed by patient related factors and finally by healthcare team and system related factors.

The prevalence to adherence is 82.4% which is quite respectable. This compares favourably to 4 international studies that showed adherence rate of over 80%.<sup>12,13,14,15</sup> This shows the positive health seeking behaviour and forever proactiveness of respondents in changing their lifestyle to fight CHD, the number one killer in Malaysia.<sup>16</sup> Possibly being in an urban population with an abundance of education materials including in the internet, being more educated, having frequent follow-ups with the increased opportunity for shared decision making and greater therapeutic relationship with the treating physician had contributed to this positive outcomes. Adherence to medication is noted to be the key step in prevention of this huge disease burden on mankind, either in term of health, economy and family disintegration as demonstrated by this study in Ireland on chronic disease like osteoporosis.<sup>17</sup>

However, two different studies on adherence had a different story to tell. The first study showed a markedly higher adherence rate of 92.2% among diabetic patients in a study in Thailand.<sup>18</sup>

The higher level of adherence in this study could perhaps be caused by the fact that patients in this study were already being followed-up in the diabetes clinic and therefore being made more aware of the importance of adherence.

The second study was done way back in 1997 in Melaka which reported a non-compliance rate for chronic diseases of 56% i.e. much lower than the adherence rate of 82.4% achieved in this current study.<sup>6</sup> The difference in findings could be explained by the fact that with the availability of

**Table IV: Factors associated with non-adherence to lipid lowering therapy (adherence=0, non-adherence 1)**

Variable	Adherence level		Univariate analysis			Multivariate analysis		
	Adherence (n=328) (%)	Non adherence (n=70) (%)	Odds Ratio	Confidence interval	P value	Odds Ratio	Confidence interval	P value
<b>Age 62.1 +/- 12.4 (Mean +/- SD)</b>	57.7 +/- 13.7	1.7	0.74-2.34	0.14				
<b>Ethnicity</b>								
Malay	97(75.2)	32(24.8)	1.00(reference)					
Chinese	151(86.8)	32(24.8)	0.92	0.67-1.21	0.73			
Indian	74(85.1)	13(14.9)	0.98	0.81-1.32	0.53			
Others	6(75)	2(25)	0.87	0.52-1.43	0.87			
<b>Gender</b>								
Male	167(79.1)	44(20.9)	1.47	1.17-1.78	0.032	1.31	1.08-1.74	0.014
Female	161(86.1)	26(13.9)	1.00(reference)					
<b>Marital status</b>								
Single	2(40)	3(60)	1.00(reference)					
Married	244(84.1)	46(15.9)	0.95	0.67-1.41	0.21			
Divorced	7(30.4)	16(69.6)	0.84	0.64-1.03	0.17			
Widow/widower	75(93.8)	5(6.2)	0.88	0.56-1.34	0.61			
<b>Level of subsidy</b>								
Full	294(92.5)	24(7.5)	1.00(reference)					
Partial/none	34(42.5)	46(57.5)	1.42	1.13-1.74	0.046	0.76	0.42-1.14	0.19
<b>Household income</b>								
Below 2500	125(83.3)	25(16.7)	1.15	0.96-1.46	0.124			
2500-5000	85(78.7)	23(21.3)	1.43	0.35-2.13	0.56			
5001-7500	63(79.7)	16(20.3)	1.03	0.65-1.17	0.13			
7501-10000	47(90.4)	5(9.6)	1.24	0.73-1.67	0.58			
10001 and above	8(89)	1(11)	1.00(reference)					
<b>Educational level</b>								
No formal education	20(40)	30(60)	1.00(reference)					
Primary	25(41.7)	35(58.3)	0.65	0.33-0.98	0.047	0.57	0.12-1.04	0.657
Secondary	219(98.2)	219(1.8)	0.55	0.43-0.72	0.042	0.84	0.52-1.36	0.927
Tertiary	64(98.5)	64(1.5)	0.43	0.24-0.76	0.03	0.75	0.31-1.27	0.88
<b>Duration of hyperlipidaemia</b>								
1 to 5 years	48(72.7)	18(27.3)	1.00(reference)					
>5 years to 10 years	256(84.8)	46(15.2)	0.72	0.54-0.98	0.042	0.86	0.71-1.12	0.654
> 10 years	24(80)	6(20)	0.56	0.23-0.88	0.037	0.81	0.61-1.15	0.124
<b>Duration on lipid lowering therapy</b>								
1 to 5 years	90(89.1)	11(10.9)	1.00(reference)					
>5 years to 10 years	229(80.9)	54(19.1)	1.43	1.13-1.86	0.002	1.37	1.09-1.72	0.001
> 10 years	9(64.3)	5(35.7)	1.71	1.36-1.99	0.001	1.48	1.24-1.74	0.001
<b>Timing of medication(s)</b>								
Morning	35(87.5)	5(12.5)	1.00(reference)					
Night	247(82.3)	53(17.7)	1.65	1.34-1.98	0.039	1.71	1.54-1.96	0.034
No specific timing/random (including taking both in the morning and night)	46(79.3)	12(20.7)	1.61	1.40-1.86	0.043	1.63	1.46-1.83	0.04
<b>Concurrent medical illness</b>								
Nil	42(56.8)	32(43.2)	1.32	0.78-1.71	0.45			
One or more	286(88.3)	38(11.7)	1.00(reference)					
<b>Frequency of follow-up in a year</b>								
One	12(57.1)	9(42.9)	1.89	1.63-2.24	0.016	1.63	1.51-1.92	0.021
Two	181(81.2)	42(18.8)	1.24	1.12-1.42	0.009	1.47	1.22-1.87	0.017
Three or more	135(87.7)	19(12.3)	1.00(reference)					
<b>Number of follow-up clinic(s)</b>								
One	241(81.1)	56(18.9)	1.21	1.05-1.43	0.002	1.61	1.37-2.11	1.37-2.11
Two or more	87(86.1)	14(13.9)	1.00(reference)					
<b>Number of medications per day</b>								
One	48(73.8)	17(26.2)	1.64	0.74-2.83	0.27			
Two	38(48.7)	40(51.3)	1.26	0.67-1.89	0.34			
Three	60(69.0)	27(31.0)	1.85	0.90-2.56	0.67			
Four or more	104(61.9)	64(38.1)	1.00(reference)					
<b>Knowledge scores (Mean +/- SD)</b>	13.4 +/- 1.2	9.7 +/- 1.4	0.75	0.53-0.90	0.048	0.78	0.48-0.94	0.032

abundant health-related material and evidence based clinical practice guidelines, patients in this current age have a higher health literacy and therefore are more adherent.

The main reason dimensions leading to non-adherence among respondents with low adherence in reducing order of frequency is

- therapy related factors
- social and economic related factors
- patient related factors
- healthcare team and system related factors

These figures could be explained by the fact due to the easy availability and access to lipid lowering drugs here and the numerous visitations to the doctor in a year which provide opportunities for reinforcement of education, therefore boosting adherence. If comparing with studies looking at adherence to lipid lowering therapy only, majority list side effects<sup>8,12,14</sup> (therapy related factors), cost<sup>12,15,19</sup> (socio-economic related factors), polypharmacy<sup>14</sup> (therapy related factors), less satisfied with physicians' explanation of treatments<sup>14</sup> (health care team and system related factor) and negative influences<sup>14</sup> (socio-economic related factors) as reasons for non-adherence. Therefore, this involves mixtures of above dimensions due to the difference in the time the studies were conducted and differing study population.

Overall, the respondent knowledge was good most probably due to respondents being more educated and having been on treatment for many years, therefore having the opportunity for reinforcements of knowledge at follow-up visits, and having the recognition of the need of adherence to medications to prevent devastating complication like myocardial infarction and stroke. Studies done previously have showed mixed results between knowledge levels and adherence. Studies by Lira K.B. et al.<sup>20</sup> and Sheeny A.S. et al.<sup>21</sup> showed that despite high knowledge levels reaching about 50%, increased knowledge does not affect adherence. In contrast, a study by Nielsen D. et. al. in 2009<sup>22</sup> showed that increased knowledge level improves adherence to osteoporosis medications. However, patients in this study had received education about their chronic disease that may have increased their knowledge level and subsequently their adherence. Two other studies also had positive outcomes on adherence by enhancement in knowledge levels. First was a local study in Selangor in 2013 that showed that increase in knowledge levels boosted adherence among patients with Type 2 Diabetes Mellitus attending primary care health facilities.<sup>23</sup> Second was an overseas study published way back in 1995 in BMJ that showed that providing brief education about medications prior to discharge from hospital in elderly patients boosted adherence significantly.<sup>24</sup>

Factors that are associated with non-adherence to lipid lowering therapy include male gender, on longer duration of lipid lowering therapy, fewer follow-ups and number of clinics visited, lower knowledge scores and taking their medication at night or random/ non-specific timing. Therefore, there is a need to focus on this group during consultation in order to improve adherence. Previous studies

on lipid lowering therapy mainly suggest that female tend to be more non adherent, less follow-ups reduces the adherence rate while noting that duration of therapy not affecting adherence.<sup>8,12,13,25,26,27</sup> Perhaps ensuring at least 2-3 follow-ups a year for this group of patients and consistent reminders about benefits of lipid lowering therapy and importance of adherence at follow-ups may help to improve the adherence rate in this group of patients.

There is also the need to tactfully address common reasons leading to non-adherence like fear about side effects, misconceptions about the treatment and illness and polypharmacy at these follow-ups. Future research into this study should look at ways to enhance adherence rate of patients identified as non-adherent. This could be done by having patients with known non-adherence attending a short course that emphasises knowledge about hyperlipidaemia and its treatment and then running a randomised controlled trial to see whether improved knowledge increases adherence. Other components of non-adherence for e.g. psychosocial factors could be explored in future studies as done in hypertensive patients in a study in 2005 which stated that a psychosocial marker, i.e. patient satisfaction is positively correlated with adherence.<sup>28</sup>

There were a few strengths noted from this study. First, its uniqueness as one of the first few study looking at adherence to lipid lowering therapy in Malaysia. Second, the high respondent rate which indicate the willingness of patient to participate in this study. Thirdly, questions in the knowledge section has been mould into a learning process, where after answering the question, when time is available the researcher explains the correct answer to the participants, therefore eliminating some common myths and misconceptions.

A few limitations have been noted from this study as well. First, was this study was done on the urban population, thereby limiting generalisability to the rural and semi-urban population. Secondly, the questionnaires were only printed in the Malay language and English language. This may contribute to selection bias. Thirdly, the possibility of recall bias and interviewer bias. Lastly, there are better sampling method than simple random sampling method using coin toss method that was used in this study. This can be overcome in the future by the use of table of random numbers, computer randomisation methods or improvised version/method using the coin toss method.

## CONCLUSION

This study showed a high adherence rate of 82.4% Factors that are associated with non-adherence including the male gender, those on longer duration of therapy, those taking medications in the night or non-specific/random timing, those with less doctor visits and poorer knowledge scores. This study also found that respondent's knowledge regarding hyperlipidaemia and its treatment are good.

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