

CHAPTER -VI



DISCUSSION

Medication adherence is defined as patients' knowledge relating to directions on drug administration, ability to keep scheduled clinical visit and monitoring of treatment outcome. In most studies non-adherence is considered to occur when patients do not take their medications 80 to 120% of the prescribed drugs. A 20% deviation was allowed in assessing adherence in clinical practice since the deviation of action of many drugs were appreciably longer than the prescribed intervals between the doses thus giving an opportunity for patient to skip a dose or without loss of therapeutic action or rebound effect (Haynes et al., 1982; Cramer *et al.*, 2008).

Estimation of persistence by examining the percentage of drugs taken does not provide accurate information whether the right dose was taken by the patient at the right time. For an example, a patient took two tablets a day instead of twice a day as prescribed would give the same percentage of persistence (Jean-Jacques Parienti *et al.*, 2010).

Assessment of adherence can be approached from different angles. One approach is based on the methods used to study the aspects of drug taking behavior during certain period of time and the way they took them. Examples of this approach include patient questioning, pill count and medication event monitoring system (Kristie *et al.*, 2010; Eluwa *et al.*, 2012). Therapeutic outcomes may be misleading method to assess a dosage regimen due to inter individual variability in response. In our study patients survey and intervention at the counselling center were used to assess patients' medication adherence to improve the accuracy and reliability of the results. It includes direct patient questioning on the knowledge of drug and disease as well as pill count to estimate the persistence level of drug taking. Although both the methods have their own limitations. The combination of them helps to improve the validity of the assessment of adherence. These methods are also easy to perform especially in busy outpatient health care settings.

Patient medication adherence

High prevalence of patient medication non-adherence with chronic therapies has been reported in many overseas studies (Cramer *et al.*, 2008; Bates *et al.*, 2009; Yi Yang *et al.*, 2009; Brooke Aggarwal *et al.*, 2010; Wong *et al.*, 2011). There are also a large number of research studies which aimed to identify factors to predict non-adherence. However, due to inconsistent results from these studies, it has been proposed that various factors might interact to affect a patient's drug taking behavior and therefore must be

considered in that respect. Besides, it is essential to consider all factors relevant to patients, disease/therapy, and environment/setting in assessing medication adherence.

Local data on prevalence of medication and non-adherence with hypolipidemic drugs is lacking. Our study included a patient survey to examine the prevalence of medication non-adherence with hypolipidemic drugs and its associated factors. Understanding these would help us formulate the most appropriate intervention strategy to take the problem of non-adherence.

Baseline characters and pre-treatment risk factors

When base line characters of hyperlipidemia patients were analyzed between the groups it was found that 74 to 75% of patients were in the age group of 40 to 60 years. There was no significant difference in age distribution indicating that subject sample in both groups is homogenous.

Females were more often affected than males as there were 42 to 57% in the study group. This is similar to the hospital based studies of (Cocchi *et al.*, 1996), in which majority of patients were females (36%).

Socioeconomic status is an important risk factor, indirectly reflecting the medication adherence of the hyperlipidemia patients. Socioeconomic status was determined by Kuppuswamy classification based on three variables in urban community namely education, occupation and income (Mishra *et al.*, 2005). In the present study hyperlipidemia was commonly encountered in middle socioeconomic class (56 to 59%) followed by lower class (34 to 38%). Hyperlipidemia patients with high socioeconomic status were least in number (7%). It was similar to the results of study conducted by Vijaykumar *et al.* (Vijayakumar *et al.*, 2009) that middle socioeconomic class is high risk factor for hyperlipidemia. There was no significant difference found in socioeconomic status in study groups.

In the present study, the duration of the hyperlipidemia and hypolipidemic treatment was also similar between the two groups 7.6 ± 7.4 of referral center compared to 8.0 ± 6.8 of paid clinic groups. This observation is supported by a study conducted at France the mean duration of hyperlipidemia patients was 8.0 ± 6.2 years (Margus *et al.*, 2010). The average numbers of drugs were found to be 1.6 ± 0.7 , 1.4 ± 0.6 in our study

which is in agreement with that reported from studies conducted in France, mean number were 1.8 ± 0.4 (Patrickka *et al.*, 2012).

In the present study, the prescribing patterns of hypolipidemic drugs are as follows. Statins was the highest prescribed drug 21.7%, 16.8% Fibrates, 9.3% Nicotinic acid, 3.6% Bile acid sequestrants, and 0.4% of cholesterol absorption inhibitors were the least. Prescription pattern of antilipidemic drugs were similar to other studies (Machado *et al.*, 2008; Robert bartas *et al.*, 2012)

Prevalence of non-adherence with hypolipidemic drugs

Since the prevalence of non-adherence with hypolipidemic agents mentioned in the literature was reported to be about 50%, ranging from 20-80% (Jackevicius *et al.*, 2002; Ye *et al.*, 2007; Bates *et al.*, 2009; Agarwal *et al.*, 2009; Meltem Refiker Ege *et al.*, 2011; Wong *et al.*, 2011; Bell *et al.*, 2011) in the present study the prevalence of nonadhernece with hypolipidemic was investigated.

In our study also the prevalence of non-adherence was about 20% (overall 19.0%, 21.4% in referral center group, 16.9% in paid clinic group, $p=0.10$). Our finding is on the lower side of the range reported in other studies (Evangelos *et al.*, 2008; Benner *et al.*, 2009; Leigh Anne Nelson *et al.*, 2011). This may be related to the fact that non-adherence was especially prevalent amongst the newly diagnosed hyperlipidemia patient e.g. within the first year of diagnosis who were not included in our survey and those patients with higher motivation in drug taking might be more likely to participate in this study.

In the present study adherence rate decreased with increasing number of hypolipidemic drugs. 87% of the patients taking one hypolipidemic drug were considered to be adherent compared to 70% taking two or three hypolipidemic drugs and 36% taking two or three hypolipidemic drugs and other chronic drug use. This is similar to studies on large patient population in clinical practice (Wong *et al.*, 2011), showing increase in number of drugs decreases adherence to drugs. Although the prevalence of non-adherence in patients attending the two different hospital settings was similar, patients attending referral center had a more complex pattern of non-adherence. Almost 26% of patients from the referral center had attempted to modify their regiments in addition to having poor knowledge about them. This is in contrast to only 2% of patients from the paid clinic with the same problem ($p=0.001$). This could be explained by a number of

factors. Patients in the referral center group were older; more debilitated and received more medications than the paid clinic group patients. It requires a higher level of skills to schedule the more complicated dosing regimen properly. Besides, the inadequate communication between physician and patients in referral center group might also explain patients' poor knowledge. This miscommunication occurred most frequently when physician modified treatment regimen. As a result, patient might still follow the wrong regimen from the previous visit. Among patients assessed in the counselling center, over half of them (58%) had poor knowledge of the regimen change initiated by their doctor during their hospital visit. This is clearly an important area that we should target in developing intervention strategies to tackle the problem of non-adherence.

Factors influencing medication adherence

In the study using a structured questionnaire incorporating the above factors information was collected from patients and their effects on adherence was examined. The various factors which are known to affect patient medication adherence were organized into three major categories:

- a) Patient characters
- b) Disease/treatment
- c) Health system.

Patient characters

Most studies have shown inconsistent results regarding the effects of patient characteristics on medication adherence (*Brunton et al., 2011; Colleen et al., 2012; Elizabeth et al 2012*). Many researchers also claimed that patient characteristics such as age, sex, education, and race cannot predict adherence (*Almas et al., 2006*). In our study, nearly all patient demographics variables were not significantly different when comparing adherent and non-adherent patients. The only factor with significant difference was working status. Full-time working status was found to predict good drug adherence. This finding suggests that busy lifestyle was not a reason to explain medication non-adherence provided the regimen is compatible with patient's daily routines. The positive effect of working status on adherence was not related to educational level and appeared to be independent of healthcare setting. It is plausible that high adherence levels amongst full-time worker might be related to an increased level of

motivation to attain satisfactory disease control due to their responsibilities in work and/or family. Similar results were found in a study by Kim and his colleagues (Kim *et al.*, 2006).

In the assessment of patients' knowledge on disease and treatment, it was found that significantly more non-adherent patients regarded drug as wastage of money if they did not think they were suffering with hyperlipidemia (39% vs 27%, $p=0.002$). This indicates that poor knowledge of patients on the nature of disease and therapy and inability to appreciate the benefits of maintaining adequate lipid levels in reducing long-term risks could have important impacts on adherence levels. Although their responses to direct questions on long-term nature of hypolipidemic therapy were similar between adherent and non-adherent groups, the knowledge problem became more obvious when they were asked to prioritize its value under money terms.

Moreover, patients attending paid clinics were found to have better health knowledge than that attending referral center. This may be related to the high educational level of paid clinic patients although previous studies (Micheal Ho *et al.*, 2009) showed a lack of relationship between the two. Another possible explanation comes from differences in healthcare settings. Provision of education on disease and treatment by physicians was likely to be less in the referral center than in the fee-for-service paid clinics. It has also been suggested that physician-patient relationship may affect a patient's motivation to participate in treatment (Jing Jin *et al.*, 2008). This could in turn influence patient's willingness to learn about the disease and treatment. The communication and relationship between physicians and patients in referral center group was compromised by the limited hospital visit than paid clinic group. This relationship may be further weakened by the fact that patients did not see the same physician at each visit in the referral center.

Disease / treatment factors

The asymptomatic nature of hyperlipidemia could contribute to poor medication adherence (Wiegand *et al.*, 2012). Many patients have negative attitudes toward taking medications, especially if they "feel well" (Jing Jin *et al.*, 2008). Numerous studies have also shown the negative impact of the complexity of treatment regimen on adherence (Kiortsis *et al.*, 2000).

Our study showed that non-adherent patients were prescribed significantly more hypolipidemic medications than adherent patients (1.7 vs 1.5, $p < 0.001$). It is not difficult to appreciate that patients may find it difficult to schedule the increasing number of medications. In this respect, both the number of tablets and complexity of the regimens as indicated by number of drug doses per day can also influence adherence. A large number of studies have confirmed that adherence level fell with increasing number of drug doses per day (Nancy, 2008; Zhang, Yuting *et al.*, 2010). Bo Hovstadius and colleagues (Bo Hovstadius *et al.*, 2011) observed that once-daily and twice-daily regimens were associated with significantly better adherence (73% and 70%, respectively) than three-time-daily (52%) and four-time-daily (42%) regimens. Although we did not specifically examine the effects receiving monotherapy, the adherence rate for the Bile acid sequesterant was comparatively less than that with other drug classes. Due to the short-acting nature of this drug, Bile acid sequesterant has to be taken four times in a day. Thus, our findings are consistent with that of other research (Wiegand *et al.*, 2012) and support the use of longer-acting drugs to reduce frequency of dosing and improve adherence level.

Several studies examining adherence related issues have identified adverse effects as a significant reason for patient non-adherence (Kim *et al.*, 2002; Jing Jin *et al.*, 2008; Michael Ho *et al.*, 2009). Jing Jin and colleagues (Jing *et al.*, 2008) concluded that those adverse effects of medications can influence everyday social life which can lead to a reduction or termination of medication.

In our survey, not only the presence of adverse effects (26.7% in adherence group vs 40.1% in non-adherence group, $p < 0.001$) but also the number of types of adverse effects complained (0.2 in adherence group vs 0.8 in non-adherence group, $p = 0.02$) had a negative effect on adherence. Adverse effects become an important issue in the management of hyperlipidemia since majority of patients did not have symptoms prior to commencement of therapy which greatly decrease patient's motivation to continue with the therapy. Besides, patient must continue the therapy for years before they can avoid the sequel such as myocardial infarction or cerebrovascular accident. To patients, these intangible, delayed benefits do not always outweigh the immediate adverse complaints from taking medication. The presence of adverse effects from drugs may also induce fear

in patients. Studies indicate that anxiety about the adverse effects of medications significantly increased non-adherence levels (Kim *et al.*, 2002; Patricia *et al.*, 2004; Bates *et al.*, 2009). This fear can also come from misunderstandings of adverse effects from medications (Jing Jin *et al.*, 2008; Michael Ho *et al.*, 2009), which often due to lack of or inappropriate counselling. Therefore, education of possible adverse effects from medications and proper management should be included in the intervention strategy to improve adherence.

Health system factors

The healthcare system has potential to influence patient medication adherence. System-related factors include quality, availability, accessibility, support for education of patients, information management, and training provided to health service providers. The system can direct physicians' schedules, dictate appointment lengths, allocate resources, set fee structures, and establish organizational priorities (Wiegand *et al.*, 2012).

In our study, the non-adherence rate in patients attending referral center and paid clinics were not different. However, it was observed that patients from these two groups had significant differences in their thoughts and drug-taking behavior. This was evidenced from their patterns of non-adherence, their responses in reporting adverse effects from medications, management of adverse effects, health knowledge and beliefs, functional status, comments on provision of health advice by physician, and their satisfaction with medical services.

Based on current body of knowledge and on assumptions, we have made interesting observations amongst patients attending these two different healthcare settings. For example, it is to be considered that the more frequent hospital visit in paid clinic allow regular reinforcement of the importance of treatment and control by the same physician which can promote a patient's health knowledge and beliefs as well as their motivation to continue drug taking. To this end, we observed that patients attending the paid clinic were more knowledgeable about their treatment regimen. Compared to patients attending the referral center, we found that a lower percentage of the referral center patients were expecting to receive health advice from physicians. They were also less likely to be given education by their healthcare providers and less satisfied with the explanation provided, if any, than the paid clinic patients. Based on these findings, it can

be assumed that patients who expect provision of health advice may be provided information by physician. On the other hand, physician providing appropriate, easy-to-understand health advice may improve the awareness of patients about the need to receive this information, thus setting up a positive cycle of information provision, enquiry, and reinforcement. Such a possibility was also evidenced from patients' responses on the reasons for not consulting their physicians before they self-modified the regimen. Fourteen percent of these referral center group patients stated they were afraid of their physicians while another 17% claimed their physicians were too busy to care about how they took the drugs.

In addition to differences in expectation, differences in patients' health beliefs between the two groups can also be reflected from their responses on the management of adverse effects from medications. Seven percent of the referral center group patients would stop the drug taking compared to 4% from the paid clinic group ($p=0.03$). Another thirty-seven percent of the referral center patients would just ignore the adverse effect and wait till subsequent hospital visit to inform their physicians in contrast to only 0.6% in paid clinic group ($p<0.001$). In line with this observation, more referral group patients would seek advice from neighbors, friends to tackle the problem compared to paid clinic group patients (11% vs 5%, $p<0.001$). On the other hand, a large proportion of the paid clinic patients would consult physician immediately if they experience adverse effects compared to referral center group (89% vs 37%, $p<0.001$). Therefore, patients attending paid clinic seem to have a better knowledge and attitude towards the management of adverse effects from their medications. Besides, patient satisfaction with medical services was also significantly better in paid clinic. The related areas include consideration of patient's preference (72% vs 26%, $p<0,001$), discussion of primary health issues (74% vs 22%, $p<0.001$), feeling of ease to discuss with physicians about their treatment (89% vs 61%, $p<0.001$), willingness of physicians to listen to them (92% vs 68%, $p<0.001$), friendliness of physicians (94% vs 81%, $p<0.001$), and overall satisfaction with the service (87% vs 68%, $p<0.001$). Another factor which may also influence patients' satisfaction and relationship with physicians is whether a patient receives care from the same physician on each visit a better adherence has been demonstrated when patients receive care from the same physician over time (Brunton, 2011). In the referral center

group, care is provided by team approach and patient may not be arranged to see the same physician on each visit. This may further compromise the relationship between physicians and patients in referral center group. All the above findings demonstrate a better physician-patient relationship in the paid clinic group.

Besides the effect on patients' knowledge and health beliefs, healthcare system may also affect the communication and relationship between physicians and patients. Research has shown that improvement in physician-patient communication is a factor in increasing adherence, especially when it is related to increasing understanding and satisfaction on the part of the patient (Foley *et al.*, 2005; Eaton *et al.*, 2006; Casebeer *et al.*, 2009; Traylor *et al.*, 2010). Satisfaction with patient-physician relationship and other aspects of medical encounters have resulted in important health beliefs that can alter adherence (Tanya Bezreh *et al.*, 2012). Modifying treatment recommendations to reflect patient preferences can enhance adherence. The incorporation of patient preferences regarding benefits and risks into health decisions depends on the ability of the patient or physician to determine and communicate those preferences.

In the present study, adherent patients reported better satisfaction with the medical service than non-adherent patients. The areas involved were consideration of patient's preference in formulating treatment plan (47% vs 35%, $p=0.00$), patient's sense of ease to discuss with physicians about their treatment (74% vs 65%, $p=0.02$), and willingness of physicians to listen to them (79% vs 70%, $p=0.01$). This is consistent with previous findings about the impact of positive physician-patient relationship on adherence. Relating to the details of provision of health advice during medical visits, significantly more adherent patients reported that their physicians had explained about the disease (45% vs 34%, $p=0.01$), the possible adverse effects from medications (32% vs 23%, $p=0.03$), and necessary practical dietary (56% vs 47%, $p=0.3$) and lifestyle (53% vs 42%, $p=0.01$) modifications in disease management to them compared to non-adherent group. These findings help us prioritize the types of health information to be included in the educational intervention in clinical practice.

In the present study, the effect of patients, functional status on adherence was examined. Functional status is an important measure of a patient's health status.

Dartmouth COOP functional health assessment charts were used for assessment. These charts were originally developed by Nelson (Nelson *et al.*, 1983; Nelson *et al.*, 1990).

The World Organization of National Colleges, Academies and Academia Associations of General Practitioners/Family Physicians (WONCA) decided to modify them and promote their use in clinical practice as well as in research. The revision was completed in 1990 and the official name was the Dartmouth COOP functional health assessment charts/WONCA, shortened to COOP/WONCA charts (Scholten *et al.*, 1992). The charts formed an instrument covering a core set of functional aspects including physical fitness, feelings, daily and social activities, changes in health, and overall health. Patients were asked to rate against a 5-point scale for each aspect. It has been used mainly to determine the functional status in chronically ill patients. The reliability and validity of the charts were supported by different studies (Nelson *et al.*, 1983; Nelson *et al.*, 1987; Nelson *et al.*, 1990). According to a study comparing the COOP/WONCA charts with other health status measures including Nottingham Health Profile, The Medical Outcomes Study 36-item Short-Form Health Survey (SF-36), and the Euro quality of life (QOL) instrument, the COOP/WONCA exhibited a good performance profile including reliability, construct validity, and discriminative ability as the other four measures (Essink-Bot *et al.*, 1997). Compared to other instruments, the COOP/WONCA charts were easy to use and interpret by the assessors and subjects who are being assessed.

Among the six aspects in the functional status assessment, the ratings for social activities was found to be marginally better in adherent than non-adherent patients (percentage with moderate to very good ratings 98% vs 89%, $p=0.3$). This finding suggests that adherent patients had fewer limitations in their social activities with family, friends, neighbors, or groups. They might also reflect a better family and/or social support in the adherent patients. In this regard, social factors have been identified to positively affect patient medication adherence in different studies (Elliott *et al.*, 2008). Other important patient characteristics focused factors include their understanding and acceptance of the disease (Patel *et al.*, 2005; Jing *et al.*, 2008), perception of the health risk related to the disease (Schedlbauera *et al.*, 2007; Steven Baroletti *et al.*, 2010), awareness of the costs and benefits of treatment (ATP III Final Report, 2002; Alan

Delamater, 2006; Kathryn Ruddy *et al.*, 2009 ; Chapman *et al.*, 2010), active participation in monitoring (Rolley *et al.*, 2008; Elizabeth *et al.*, 2012), and decision-making in relation to management of the disease (Annie Cushing *et al.* , 2007; Brunton, 2011).

In India, consultation time in referral center group patients is usually shorter than that offered by paid clinic physician. Because referral center group patients consult by a team, it is difficult for the same physician to maintain enduring relationship with his/her patients. Hence, patients who visit the referral center would be less likely to receive social influence or control from the provider. In both perspectives, interaction between physicians and patients takes a pivotal role. It advocates empowering patients' knowledge (Foley *et al.*, 2005; Pauline *et al.*, 2012). According to present study, physician advice and concern were significantly and substantially less likely in the referral center than in paid clinic group, as experienced by patients. There were obviously structural constraints in the referral center group that forbid high levels of physician advice and concern. These constraints might stem from high level of patient demand but low level of resources available for individual patients using public medical care. Besides the remarkable differences between referral center and paid clinic settings, some differences were significant for different levels of dysfunction and age. A patient with a higher level of dysfunction received more advice and concern from the physician. Moreover, an older patient received more physician concern and advice particularly on interaction involving the medication.

Strategies to improve medication non-adherence

The general characteristics of successful intervention for non-adherence should underscore the following issues.

- (i) Firstly, the maneuver must be individualized or personalized as much as possible it should enlist patient's active participation, and reflect their special needs and preferences.
- (ii) The intervention should maximize the effects of different components to improve adherence rather than a single intervention in isolation. It should also have component of continual or periodic reinforcement which is crucial to long-term success (Barbara Turner *et al.*, 2006; Sandra van Dulmen *et al.*, 2007; Micheal Ho *et al.*, 2009).

Intervention at Pharmacist-managed Counselling Center

Given the characteristic healthcare system in India, the mode of care provided in the referral and paid clinics are very different. The tertiary care hospitals provide acute and chronic care to the majority of the rural population. The majority of patients with chronic diseases such as hyperlipidemia are managed in the referral center. The overload of patients attending this referral center has resulted in long patient waiting time for the first consultation and long intervals between hospital visits. Patients are usually followed-up every 16-24 weeks (i.e. 2-3 visits annually) with each consultation lasting for approximately 5-15 minutes. Besides reviewing previous hospital notes and assessing patient's conditions, physician has to order appropriate laboratory tests or other investigations as well as schedule patients' next follow-up appointment within the limited patient contact time. It is thus very difficult for them to spare time to conduct any patient education. In contrast, patients attending paid clinics are generally followed-up more frequently with shorter interval between visits. Patients can also request walk-in consultation service if they have any complaints or problems in taking the medications.

Our findings suggest that the problem of patient medication non-adherence should be properly addressed given the current mode of care in referral center which is applicable in many developing or even developed countries. With the ever-growing constraints of shrinking healthcare budgets, the cost of physician time must be weighed against the value of adherence counselling. Cost-effectiveness should also be considered in developing intervention strategy to improve patient adherence. Against this background, we have adopted a multi-disciplinary team approach in our overall strategy to improve chronic care management at our hospital.

Pharmacists are in an appropriate position to conduct patient education because of their specialized training on pharmaceuticals. Hence, pharmacist can take up the responsibilities to assess and monitor patient adherence, provide appropriate counselling, and then feedback the relevant information and recommendations on regimen modification to the physician. Apart from identifying patients especially those who fail to attain treatment target for pharmacist intervention, physicians will only need to make simple comments and reinforcement during each patient visit to strengthen the effect of intervention by pharmacist. Nurses in the hospital can also help identify patients with

problem of non-adherence especially those who frequently default hospital visit or who comes for an earlier visit due to running out of drugs. Besides the provision of education and counselling, pharmacist, as part of the medical team, also helps improve the communication and relationship between physicians and patients which is one of the major pitfalls in the current referral center mode of care compared to paid clinic. This is especially important when patients are not seen by the same physician on each visit as in the referral center.

On this basis, a patient counselling center was established in an out-patient setting to deliver the structured intervention to improve patient medication adherence. In planning our intervention, we adopted the framework of the PRECEDE model (Ransdell, 2001; Adeyinka Tella, 2011) which emphasized the importance of multidimensional education. Pharmacist evaluates all the possible “Predisposing factors including patient’s knowledge, values, attitudes and beliefs about the disease, and therapy which might affect adherence in the initial assessment. The counselling strategy is then formulated to address these issues. During the process, pharmacist builds up a trusting relationship with patients by posing non-threatening questions, encouraging their comments and preferences about the management plan, and communicating their concerns and preferences about the management plan, and communicating their concerns and preferences to physicians. Pharmacist educates patients on the skills to schedule the dosing and helps them incorporate regimen to daily routines. The counselling center opens on all weekdays. Moreover, patients are given the telephone number of the counselling pharmacist and are encouraged to call the pharmacist in case they have problems in drug taking or experience suspected adverse effects from the drugs. Finally, regular reinforcement is crucial to the long-term success of the intervention. They are encouraged to give simple reinforcement in their patient visits to augment the effectiveness of the intervention. On the other hand, pharmacist would arrange a telephone follow-up 4 weeks after the initial patient visit to the counselling center for monitoring of the progress and appropriate reinforcement before patients were reassessed at counselling center on patient’s subsequent physician visit usually scheduled 12-16 weeks later. Some of these patients required more than one visit to the counselling center if their adherence remained suboptimal on reassessment.

The impact of pharmacist participation to manage patients with hyperlipidemia has been studied by Suzanne Shuk Ching Lee. Patients in the intervention group had significantly lower LDL levels at the end of a six-month study period compared to control Group (Suzanne Shuk Ching Lee et al 2004). In an intervention study, incorporation of approaches to improve adherence has also been shown to lead to good control of hyperlipidemia. There was a clear treatment plan for each patient: patients and physicians were set specific LDL level target: the treatment schedule was well defined, specifying at what stage extra drugs had to be added: motivation of patients and physicians was high. These components have thus set the stage for a successful program to control LDL cholesterol irrespective of the agent used (Schedlbauer et al., 2004).

Our intervention at the patient counselling center has not only improved patient adherence level but also their clinical outcomes. On average, each patient had 1.3 visits at the counselling center. The non-adherence rate decreased from 100% to 20% by a single pharmacist education session. The percentage further improved to 3% after the third education session. The intervention also had positive impact on surrogate endpoints. Comparing to patient's own values during the previous 12 months, the total cholesterol and LDL-cholesterol levels reduced from 6.3 ± 1.7 mmol/L to 5.2 ± 0.2 mmol/L ($p < 0.001$) and from 3.9 ± 0.7 mmol/L to 2.9 ± 0.6 mmol/L ($p < 0,001$) respectively 1 year after patient was discharged from counselling center. Besides, similar improvements were observed in other disease control indicators. The percentage of patients who reached recommended target values for to reduce risk of cardiovascular events also increased during the same period. Furthermore, the healthcare resources utilization including rate of hospitalization and emergency room attendance, as well as duration of hospitalization was reduced by the intervention program.

Outcome of this study is useful to the practicing physicians in designing an appropriate therapeutic regimen as well set up of patient counseling center at different health care settings to improve medication adherence of patients in India. Patient counseling by pharmacists also enabled the doctors to spend more time on patient to improve the quality of healthcare system with better patient care and therapeutic outcomes. This study demonstrated high levels of satisfaction with counselling services provided by pharmacists. Pharmacists and physicians working cooperatively with the

patient can promote the correct use of and access to medicines while emphasizing the importance of medication adherence to ensure a control of hyperlipidemia and prevention of cardiovascular and cerebrovascular diseases. A pharmacoeconomic model evaluation of the pharmacist intervention will provide information on the impact of health care resources.