

## The Relationship between Cognitive Appraisal and Adherence to Medical Regimens in Type 2 Diabetic Patients

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### ABSTRACT

**Introduction:** Non-adherence to medical regimen has remained a challenge to the medical profession as well as to social sciences. To achieve positive results, the factors negatively impacting patient adherence to medical regimens (i.e., diet, drug and exercise regimen) must be scrutinized in detail. The objective of this research was to explore the relationship between cognitive appraisal and adherence to medical regimens in type 2 diabetic patients.

**Methods:** In this correlational study, 218 type 2 diabetes patients receiving treatment at the Diabetes Clinic affiliated with Gonabad University of Medical Sciences were selected through non-probability (convenience) sampling from April 2012 to May 2013. Two valid and reliable questionnaires of cognitive appraisal and adherence to medical regimens were completed by each patient. The data were analyzed using SPSS ver 13.

**Results:** A relationship was observed between perceived cognitive and adherence to some aspects of medical regimen. Also direct relationship was observed between perceived cognitive in form challenge and adherence of diet in patients with diabetes. There was no statistically significant relationship between aspects of cognitive appraisal and adherence to the drug regimen.

**Conclusion:** The results suggest that interventions undertaken to improve adherence to medical regimen, particularly to drug regimen in patients with type 2 diabetes, should be focused on enriching cognitive appraisal. Nurses need to help patients perceive diabetes as less of a threat and in fact should empower them, so as to look upon it as more of a challenge.

## Introduction

Type 2 diabetes is one of the most prevalent chronic diseases. The number of people with type 2 diabetes worldwide is constantly on the rise. Prevalence of diabetes worldwide in 2011 was estimated to be 8.3% and is predicted to rise to 9.9% by the year 2030. Diabetes mellitus has become a major health problem in the South Asian region as it is estimated to increase in prevalence to over 151% between the years 2000 and 2030.<sup>1,2</sup> In Iran, the prevalence of diabetes is

estimated to be standing at 8.7% in people ranging from 15 to 64 years.<sup>3</sup> Even in more industrialized and developed countries, the increasing number of new cases diagnosed with type 2 diabetes and the complications is becoming a major health concern.<sup>3,4</sup>

A significant clinical problem faced in the treatment of people with diabetes is their non-adherence to self-managed regimens.<sup>5,6</sup> Although all the elements of self-management are important for effective self-management of diabetes, diet, exercise and medication, much literature has been focused

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specifically on the issue of adherence.<sup>6,7,8,9</sup> Better self-management activities such as a higher medication adherence would improve health outcome and consequently health care costs would decrease.<sup>7</sup>

Non-adherence to medical regimen has remained a challenge to the medical profession as well as to social sciences. Despite of many studies about non-adherence in the past few decades, it has almost remained unchanged.<sup>8</sup>

In order to better understand the reasons behind this and to achieve positive results, the factors negatively impacting patient adherence to medical regimens (i.e., diet, drug and exercise regimen) must be scrutinized in detail.<sup>9,10</sup> It is well established that many patients either intentionally or unintentionally fail to adhere to their prescribed treatments, and understanding the contributing factors to patients' adherence to their therapeutic regimen is essential for achieving positive results. Identifying these determinants enhance nursing performance and improve patient adherence to the prescribed health regimen.<sup>10</sup> Wu in a 2009 study on factors affecting the failure of diabetics in dealing with their medical regimen has listed physiological, psychological, socio-cultural, economic and environmental factors.<sup>11</sup>

Among the more important psychological factors is cognitive appraisal, a psychological process that impacts an individual's confrontation and guides his/her adaptive behaviors.<sup>12</sup> It consists of two sub-processes called primary and secondary appraisal perception. Primary cognitive appraisal consists of interpreting a situation as threatening, challenging, gratifying and frustrating, whereas secondary cognitive appraisal is assessment of solutions for adaptive resources; in fact it is centered on finding a response to the question of "what should be done?" Answering such a question gains in importance especially when, the individual's primary cognitive appraisal of a situation is either interpreted as any of the

feelings of threatening, challenging, gratifying or frustrating. Put in other words, the secondary cognitive appraisal is a cognitive-evaluative process which focuses on reducing injuries and or on finding ways to access better adaptation. Moreover, it incorporates meaningful evaluation of cognitive, emotional and behavioral resources in order to suitably manage stressors.<sup>6</sup>

Potential coping resources include physical resources such as personal health and vitality, social resources like social networks and support systems, psychological resources as in beliefs to maintain hope, problem solving skills, self-confidence and conscience, and financial resources such as money, tools and equipment.<sup>6</sup> When an individual interprets a stimulus as a threat, that stimulus will lead to stress. To set oneself free from that stress, the individual will utilize emotional responses such as a change of situation, denial or avoidance which from the view point of medical regimen may lead to non-adherence. When a stimulus is interpreted as a challenge or conflict, the individual responds to it by using a problem-solving process, in which case, it might lead to an adherence of the medical regimen.<sup>12</sup> Studies by Thomas and Carpenter have confirmed the effect of cognitive appraisal on adherence to medical regimens.<sup>10,12</sup>

Although a lot of studies have been conducted on adherence to medical regimen in other countries, it seems that the dominant local health conditions generally affect an adherence to regimen.<sup>13</sup> Therefore studies in other countries maybe not true for another countries. Moreover, other population-based studies have shown adherence to be closely related to factors ranging from demography, psychosocial conditions, healthcare provider and medical systems to treatment models for various diseases.<sup>14</sup> No published study on this subject was found in Iranian literature. Therefore, the present study was done in order to investigate the relationship between cognitive appraisal and an adherence to

medical regimen in Iranian patients with diabetes.

## Materials and methods

In this correlational study, 218 patients with diabetes under treatment at the specialized diabetes clinic of the 22 Bahman Hospitals, affiliated to Gonabad University of Medical Sciences, Iran, were selected through non-probability (convenience) sampling from April 2012 to May 2013. The inclusion criteria were based on patients' records: 1- having type 2 of diabetes; 2- being 18 up to 90 years and 3- receiving health care from the said diabetes clinic. The exclusion criteria were: 1- having psychiatric disorders 2- having anxiety disorders 3- having history of psychiatric and anxiety disorders. After acquiring the required permissions from the research center of Gonabad University of Medical Sciences and the specialized diabetes clinic of the 22 Bahman Hospital, the researchers visited the diabetes center.

Patients who were willing to participate in the study were provided with information about the study and its objectives and were assured of the confidentiality of the data after which the participants signed consent forms of voluntary participation in the study. To determine the sample size, the pilot study was conducted with 23 patients. In the correlation formula, the sample size was determined with respect to  $B = 0.1$  and  $0.2$  while the significance level was set at  $\alpha = 0.01$ . Cognitive appraisal was assessed through the Cognitive Appraisal of Health Scale questionnaire (CAHS) designed by Kessler.<sup>15</sup> In this questionnaire; the primary cognitive appraisal section includes 23 questions in five subscales: threat (5 items), challenge (6 items), harm/loss (8 items) and benign/irrelevant (4 items). However, the secondary cognitive appraisal is comprised of 5 questions. All the items were scored on the basis of Likert scale from 1 to 5 being 1- Do

not agree at all; 2- Somewhat agree; 3- Not decided; 4- Agree; 5- Completely agree. The total score of the primary cognitive appraisal ranged from 23 to 115. It was 5 to 25 for the secondary cognitive appraisal. Adherence to medical regimen was examined through a self-report questionnaire of self-care activities employed by Carpenter.<sup>6</sup> This questionnaire has been designed to assess adherence to the medical regimen of three aspects i.e., medication, exercise and diet. It includes nine questions, 3 items on medicine, 2 on exercise and 4 on diet. The score for the answers to each question given in seven consecutive days is graded from 0 - 7. The total score for adherence to medical regimen is considered in a scale of 0 and 49. The validity of the questionnaires was confirmed by content validity. After inspection and correction of mistakes, a reconfirmation was requested for from Dr. Kessler - the original designer of the CAHS. Then, the original questionnaire and its Persian translation form were given to 10 faculty members of the Nursing and Midwifery College of Gonabad.

The reliability of the questionnaires was achieved after the pilot study with 23 diabetic patients. The reliability coefficient of the subscales of threat, challenge, harm/loss and benign/irrelevant calculated by the Cronbach Alpha formula were 0.63, 0.87, 0.74 and 0.66 respectively. The Cronbach Alpha reliability coefficient for primary and secondary cognitive appraisal was 0.71 and 0.79, respectively. In addition, the reliability coefficient of the whole questionnaire of cognitive appraisal was calculated to be 0.78.

Another point worthy of mention is that the AIC level from the patients' history (This information routinely record in all patients' files) was recorded in demographic questionnaire. The reliability coefficient of the whole questionnaire of adherence to the medical regimen after the pilot study was calculated to be 0.73 by using Cronbach Alpha.

Having explained the purpose of the study, the researcher helped the participants to complete the questionnaires.

After data collection, the answers to both questionnaires were coded. In order to understand the relationship between cognitive appraisal and adherence to medical regimen and its components, the Pearson correlation coefficient was employed. T-test and ANOVA were performed to compare the level of adherence to medical regimen based on age, sex, education, income, duration of illness, job and health insurance using SPSS Ver.13.

## Results

71 (32.6) of the patients were male and 147 (67.4) of the patients were women, both with a mean age of 55 (11.1) and range: 33-85 years. The majority of subjects 87.6% were married and 5.5% of them had no partner; other demographic and disease-related characteristics are listed in Tables 1 and 2. Scores related to medical adherence of patients is given in Table 3. The results of the study showed that there is a direct relationship between primary cognitive appraisal as a challenge and adherence of exercise and diet regimen in patients with diabetes. And there is a reverse relationship between the primary cognitive appraisal of threat and adherence of exercise and diet regimen in these patients. However, there was no statistically significant correlation between cognitive appraisal (primary and secondary) and the drug regimen. Cognitive appraisal as a challenge was noted as a more effective factor in adherence to total medical regimen in patients with diabetes ( $r=0.610$ ).

Patients' scores for cognitive appraisal regimen are given in Table 4. On comparing primary and secondary aspects of cognitive appraisal it was found that secondary cognitive appraisal was more effective to adherence of total medical regimen. The Pearson's correlation results are given in Table 5. The results of the independent-

samples t-test, one-way ANOVA and Pearson correlation coefficient showed that age, marital status, education level, gender, insurance, employment, and the level of A1C hemoglobin were not important factors in adherence to medical regimen.

## Discussion

The results of the present study showed that there is a positive correlation between primary cognitive appraisal in the form of challenge and secondary cognitive appraisal and one side and the adherence to medical exercise and diet regimen in patients with diabetes on the other. Nevertheless, there was no statistically significant relationship

**Table 1.** Sample demographics, diabetes clinic

Demographic variable	N (%)
<b>Marital status</b>	
Single	4 (1.8)
Married	191 (87.6)
Widowed	12 (5.5)
Divorced	6 (2.8)
Missing	5 (2.3)
<b>Gender</b>	
Male	71 (32.6)
Female	147 (67.4)
<b>Education level</b>	
Academic	15 (6.9)
Primary, Pre High, High school	141 (64.7)
No formal educational	62 (28.4)
<b>Occupation</b>	
Disabled	2 (.9)
Retired	13 (6.0)
Worker	10 (4.6)
Homemaker	135 (61.9)
Business	19 (8.7)
Unemployed	2 (0.9)
Others	33 (15.1)
Missing	4 (1.9)
<b>Health insurance</b>	
Yes	212 (98.1)
No	4 (1.9)
<b>Accompanying diseases</b>	
Yes	162 (74.3)
No	54 (24.8)
Missing	2 (2)

**Table 2.** HbA1c level and time since last level, diabetes clinic (n=218)

Variable	Mean (SD)	Range
Hemoglobin A1c Level, (n=218)	9.32 (1.83)	5.40– 13.30
Time (days) since last level (n=104)	164.14 (119.98)	1 – 700

**Table 3.** Patients' scores for adherence to treatment regimen, diabetes clinic (n=218)

Variable	Minimum	Maximum	Mean (SD)
General diet	3.00	10.00	5.71 (1.89)
Specific diet	1.00	14.00	8.43 (2.45)
Exercise	0.00	14.00	6.88 (5.04)
Oral medication	0.00	7.00	6.28 (1.65)
All	11.00	42.00	27.30 (7.38)

**Table 4.** Patients' scores for cognitive appraisal regimen, diabetes clinic (n=218)

Variable	Minimum	Maximum	Mean (SD)
Threat	5.00	57.00	15.60 (4.60)
Challenge	8.00	30.00	5.78 (18.64)
Harm/loss	8.00	40.00	25.60 (5.63)
Benign/irrelevant	4.00	17.00	10.12 (2.77)
Secondary	6.00	24.00	15.05 (4.35)

**Table 5.** Pearson correlation coefficient between cognitive appraisal and adherence to treatment regimen variables, diabetes clinic

Primary appraisal Component	General diet	All	Oral medication	Exercise	Specific diet
<b>Threat</b>	-0.185**	-0.088	-0.051	-0.041	-0.122
<b>P</b>	0.001	0.107	0.074	0.061	0.081
<b>Challenge</b>	0.817**	0.330**	0.380**	0.130	0.610**
<b>P</b>	0.001	0.001	0.001	0.064	0.001
<b>Harm/loss</b>	-0.386**	0.006	-0.180**	0.072	-0.205**
<b>P</b>	0.001	0.062	0.001	0.057	0.001
<b>Benign/irrelevant</b>	0.471**	0.110	0.258**	0.041	0.342**
<b>P</b>	0.001	0.061	0.001	0.075	0.001
<b>Total primary appraisal</b>	0.319**	0.196**	0.175*	0.175	0.293**
<b>P</b>	0.001	0.001	0.001	0.066	0.001
<b>Secondary appraisal</b>	0.513**	0.349**	0.307**	0.112	0.484
<b>P</b>	0.001	0.001	0.001	0.059	0.071

\*B(CI 95%), Confidence interval, \*\* B(CI 99%), Confidence interval

between primary and secondary cognitive appraisal and drug regimen. When the stimulus is interpreted by the individual as a challenge it causes behavioral responses on the part of the individual which might result in the adherence to the medical regimen.

Whereas when an individual interprets a stimulus as a threat, that stimulus turns into a stressor. To release him or herself from that stress, the individual will employ effective responses such as a change in condition and a denial or avoidance which in the case of medical regimen may lead to non-adherence. Secondary cognitive appraisal as said before focuses on reducing injury and gaining compatibility which in turn result in an adherence to medical regimen.<sup>12</sup>

In a 2008 study by Carpenter, cognitive appraisal as a challenge had a direct and positive correlation with adherence to the total medical regimen. In addition, secondary cognitive appraisal was inversely associated with dietary adherence. A statistically significant relationship between perception and cognitive aspects of compliance with drug regimen and exercise programs did not exist.<sup>6</sup> The findings of the present study are in line with those of Thomas and Heydari on the topic of adherence to medical regimen in patients with heart failure. As in both studies, the results suggested that the cognitive appraisal of self-conception and its dimensions, of challenge had a positive relationship with adherence to medical regimen in patients with heart failure.<sup>10,12</sup>

In terms of drug regimen, there was no significant relationship between the dimensions of cognitive appraisal and adherence to such regimen. These results are consistent with the findings of Carpenter.<sup>6</sup> The results of our study showed that primary cognitive appraisal as a threat and harm/loss has a negative correlation and in the form of challenge and benign/irrelevant has a direct and positive correlation with diet adherence. In Carpenter's study, primary cognitive appraisal in the form of

threat had a negative correlation and in the form of challenge had a direct and positive correlation with adherence to the medical regimen. Moreover, the findings of this study are in line with those of Heydari on the adherence to the medical regimen in patients with heart failure.<sup>10</sup>

The results of our research showed that the primary cognitive appraisal in the form of harm/loss has a negative correlation and that in the form of challenge and benign/irrelevant has a positive correlation with adherence to exercise programs.

However, there was no significant association with adherence to exercise programs and the primary cognitive appraisal of threat. These findings are also consistent with the results of Thomas and Heydari. Moreover, in the Carpenter study, no statistically significant relationship was reported between cognitive appraisal and its aspects with adherence to drug regimen and exercise programs.<sup>6</sup>

In this study, there was a direct and positive correlation between secondary cognitive appraisal and adherence to diet regimen and exercise programs, but no statistically significant correlation was found with drug regimen. Secondary cognitive appraisal includes the evaluation of coping resources and options, and asks "What can I do?" The answer to this question is important when there is primary cognitive appraisal in the form of harm, threat or challenge.<sup>6,15</sup> In the present study, primary cognitive appraisal as a challenge had a direct and positive correlation with adherence to exercise program and diet regimen. In the form of threat and harm/loss, it had a negative correlation with adherence to exercise program and diet regimen.

The relationship between the variables of the primary and secondary perception confirms the statements of CAHS.<sup>6,16</sup> The findings of the present research indicate that the cognitive appraisal in the form of challenge was more effective in adherence to medical regimen than the same as a threat,

harm/loss or benign/irrelevant. These findings are consistent with those of Carpenter and Ahmad.<sup>6,17</sup>

The results also showed that there is no relationship between adherence to medical regimen and age, sex, marital status, duration of diabetes, and the level of A1C hemoglobin. In the same way, Carpenter's results showed that there was no meaningful relationship between adherence to medical regimen and factors such as age, sex, marital status, and duration of diabetes.<sup>6</sup> Some studies show that age and gender and psychological factors had important effects on adherence to medical regimen.<sup>18-20</sup>

Based on the results of the present study, the mean of adherence to drug regimen in diabetics was 6.28. For adherence to general nutrition regimen and exercise programs, it stood at 14.14 and 6.88, respectively.

However, in Carpenter's study, these were 6.64, 7.90, and 2.85 in the same order, in patients with diabetes.<sup>6</sup> In a study on drug regimen by Jin, the main cause of reduction of the same has been a usage of several drugs simultaneously.<sup>21</sup> In support of the same, Delamater has reported that among the factors related to adherence to drug regimen, adherence was more common in simple prescriptions rather than in complicating ones.<sup>14</sup> Wang argues that sticking to drug regimen in diabetics is less common than that in other chronic diseases.<sup>22</sup> Chao claims that an adherence to drug regimen is very vital in diabetics especially for achieving a desirable control on blood sugar level.<sup>23</sup> Non-adherence to drug regimen decreases the efficiency of the treatment and increases the medical costs.

Therefore, non-adherence is an important issue in patients with chronic diseases.<sup>7</sup> The mean level of A1c hemoglobin was 9.33 in the present study which is more than that of other studies.<sup>23,24</sup> According to the guidelines proposed for achieving treatment aims in diabetics, it is recommended that the level of A1c hemoglobin be kept at less than seven percent.<sup>25</sup> Achieving standard levels of A1c

hemoglobin is an indication of more adherence to the medical regimen.<sup>24</sup>

Anderson argues that diabetes is a self-managed chronic disease and 99% of the medical regimen consists of self-care activities. Diabetics have to learn self-care activities such as diet and drug regimen in order to effectively control their own blood sugar.<sup>26</sup> Inadequate self-management is also connected with undesirable clinical outcomes in diabetics.<sup>27</sup> Huang has reported that the application of adaptive strategies is one of the most influential factors related to diabetes control and the overall health of those patients.<sup>1</sup> Furthermore, several studies have highlighted the importance of educating patients to change their lifestyles and to have a better adherence to drug and diet regimen, as well as to exercise programs.<sup>23, 28, 29</sup>

Adherence to the medical regimen and also cognitive appraisal of the individuals are variable constructs which can be attributed as a limitation in the present study so these results cannot be generalized. Researchers can do other studies based on education and counseling about appraisal perception programs.

## Conclusion

These findings show the necessity of paying attention to the psychological aspects of mental health by nurses when caring for patients with diabetes. Nurses should adopt measures such as providing training and advice for patients with diabetes, so that these people not only do not take their own medical regimen as a threat but face it consciously and strongly as a challenge. With the help of counseling and educational programs, the patients can be taught how to fight with their diseases through problem-solving activities. Managers and policy makers in the fields of nursing and public health should make arrangements available for the psychological support and counseling of patients with diabetes,

alongside their routine medical therapy and care.

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### Ethical issues

None to be declared.

### Conflict of interest

The authors declare no conflict of interest in this study.

### References

1. Klausmann G, Hramiak I, Qvist M, Mikkelsen KH, Guo X. Evaluation of preference for a novel durable insulin pen with memory function among patients with diabetes and health care professionals. *Patient Prefer Adherence* 2013; 7 (1): 285-92.
2. Jayawardena R, Ranasinghe P, Byrne NM, Soares MJ, Katulanda P, Hills AP. Prevalence and trends of the diabetes epidemic in South Asia: a systematic review and meta-analysis. *BMC Public Health*. 2012; 12 (1): 380.
3. Ghaderpanahi M, Fakhrzadeh H, Sharifi F, Badamchizade Z, Mirarefin M, Pour Ebrahim R. Association of physical activity with risk of type 2 diabetes. *Iran J Public Health* 2012; 40 (1): 86-93.
4. Leach MJ, Segal L, Esterman A, Armour C, McDermott R, Fountaine T. The diabetes care project: an Australian multicenter, cluster randomized controlled trial [study protocol]. *BMC Public Health* 2013; 13: 1212.
5. Stankoviü Ž, Jašoviü- GašiuM, Lepiü-Toševski D. Psychological problems in patients with type 2 diabetes – Clinical Considerations. *Vojnosanit Pregl* 2013; 70 (12): 1138–44.
6. Carpenter RD. Cognitive appraisal of perceived threat of diabetes and adherence to self-management behaviors [dissertation]. Morgantown, West Virginia: School of Nursing; 2008.
7. Park KA, Kim JG, Kim BW, Kam S, Kim KY, Ha SW, Hyun ST. Factors that affect medication adherence in elderly patients with diabetes mellitus. *Korean Diabetes J* 2010; 34 (1): 55-65.
8. Kardas P, Lewek P, Matyjaszczyk M. Determinants of patient adherence: a review of systematic reviews. *Front Pharma col* 2013; 4: 91.
9. Lehane E, McCarthy G. Intentional and unintentional medication non-adherence: a comprehensive framework for clinical research and practice? a discussion paper; *Int J Nurs Stud* 2007; 44 (8): 1468-77.
10. Heydari A, Ahrari S, Vaghee S. The relationship between self-concept and adherence to medical regimens in patients with heart failure; *J Cardiovasc Nurs* 2011; 26 (6): 475-480.
11. Health Quality Ontario. Behavioural interventions for type 2 diabetes: an evidence-based analysis. *Ont Health Technol Assess Ser* 2009; 9 (21): 1-45.
12. Thomas CM. The influence of self-concept on adherence to recommended health regimens in adults with heart failure. *J Cardiovasc Nurs* 2007; 22 (5): 405-16.
13. Karamanidou C, Clatworthy J, Wenman J, Horne R. A systematic review of the prevalence and determinants of non adherence to phosphate-binding medication in patients with end-stage renal disease. *BMC nephrology* 2008; 9 (1): 2.
14. Delamater A M. Improving patient adherence. *Clinical Diabetes* 2006; 24 (2): 71-77.



15. Kessler, T. The cognitive appraisal of health scale: development and psychometric evaluation. *Res Nurs Health* 1998; 21 (1): 73-82.
16. Folkman S. Personal control and stress and coping processes: a theoretical analysis. *Journal of Personality and Social Psychology* 1984; 46 (4): 839-52.
17. Ahmad MM. Psychometric evaluation of the cognitive appraisal of health scale in patients with prostate cancer. *J Adv Nurs* 2005; 49 (1): 78-86.
18. Chang HY, Chiou C J, Lin SH, Tai TY. A population study of the self-care behaviors and their associated factors of diabetes in Taiwan: results from the 2001 National health Interview survey in Taiwan. *Prev Med* 2005; 40 (3): 344-8.
19. Barbour KA, Miller NH. Adherence to exercise training in heart failure: a review. *Heart Fail Rev* 2008; 13 (1): 81-9.
20. Cherrington A, Wallston KA, Rothman RL. Exploring the relationship between diabetes self-efficacy, depressive symptoms, and glycemic control among men and women with type 2 diabetes. *J Behav Med* 2010; 33 (1): 81-9.
21. Jin J, Sklar GE, Min Sen Oh V, Chuen Li S. Factors affecting therapeutic compliance: a review from the patient's perspective. *Ther Clin Risk Manag* 2008; 4 (1): 269-286.
22. Wang Y, Lee J, Toh MP, Tang W E, Ko Y. Validity and reliability of a self-reported measure of medication adherence in patients with type 2 diabetes mellitus in Singapore. *Diabet Med* 2012; 29 (9): e338-44.
23. Chao J, Nau DP, Aikens JE. Patient-reported perceptions of side effects of anti-hyperglycemic medication and adherence to medication regimens in persons with diabetes mellitus. *Clinical Therapeutics* 2007; 29 (1): 177-80.
24. Carpenter R. Appraisal of perceived threat of diabetes and the relation to adherence for adults in appalachia. *Journal of Health Care for the Poor and Underserved* 2012; 23 (2): 726-28.
25. Inzucchi SE, Bergenstal RM, Buse J B, Diamant M, Ferrannini E, Nauck M, Peters AL, et al. Management of hyperglycaemia in type 2 diabetes: a patient-centered approach. Position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetologia* 2012; 55 (6): 1577-96.
26. Al Hayek AA, Robert AA, Al Dawish MA, Zamzami MM, Sam AE, Alzaid AA. Impact of an education program on patient anxiety, depression, glycemic control, and adherence to self-care and medication in Type 2 diabetes. *J Family Community Med* 2013; 20 (2):77-82.
27. Ho PM, Rumsfeld JS, Masoudi FA, McClure DL, Plomondon ME, Steiner JF, Magid DJ. Effect of medication nonadherence on hospitalization and mortality among patients with diabetes mellitus. *Arch Intern Med* 2006; 166 (17): 1836-41.
28. Chen CC, Tseng CH, Cheng SH. Continuity of care, medication adherence, and health care outcomes among patients with newly diagnosed type 2 diabetes: a longitudinal analysis. *Med Care* 2013; 51(3): 231-7.
29. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002; 346 (6): 393-403.