



## Original Article

# Frequency and predictors of non-adherence to lifestyle modifications and medications after coronary artery bypass grafting: A cross-sectional study



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## ABSTRACT

**Background:** Non-adherence to dietary recommendations, exercise and prescribed drug regimens, in coronary heart disease (CHD) patients following coronary artery bypass grafting (CABG), is a major health care issue worldwide.

**Aims and objectives:** The primary objective of this study was to investigate the frequency and predictors of non-adherence to lifestyle changes and medication among CHD patients after undergoing CABG surgery.

**Method:** The sample of this cross sectional descriptive study was 265 patients who underwent isolated primary CABG. Participants who met the eligibility criteria were provided with a pre-coded questionnaire 4 weeks or more after surgery. Adherence was assessed on the basis of patient's self-report. Significance of results was analyzed using Chi square test.

**Results:** Roughly half of the patients were non-adherent to dietary recommendations ( $n = 120$ , 45.3%) and exercise ( $n = 109$ , 41.1%) while about one third ( $n = 69$ , 26%) were non-adherent to prescribed medications. Unwillingness to adopt a new lifestyle and more than one social gathering per week, were found to be statistically significant predictors of non-adherence to diet ( $p$ -values  $< 0.001$ ). Reluctance to follow exercise regimen, busy schedule, and fear that exercise will aggravate heart issues were commonly reported as reasons for non-compliance to exercise. As for non-adherence to medication, forgetfulness, affordability of drugs and too many medications to take were important predictors.

**Conclusion:** Non-adherence to lifestyle modifications and medication is an emerging problem worldwide. It is essential for medical health professionals to discuss these predictors and address them individually. Our findings highlight the need for a healthy physician and patient relationship.

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## 1. Introduction

Coronary heart disease (CHD) is a major cause of morbidity and mortality throughout the world.<sup>1,2</sup> World Health Organization (WHO) predicts 11.1 million deaths will occur from CHD in 2020.<sup>3</sup> Coronary artery bypass grafting (CABG) has been the mainstay of treatment for revascularization in CHD patients, since 1960, in providing symptomatic relief and increasing life expectancy.<sup>4</sup> According to the American and European guidelines CABG has been assigned as Class 1A indication for multi-vessel revascularization.<sup>5</sup> An overall mortality after CABG has been estimated to be 3.4%.<sup>6</sup> Secondary prevention of CHD and rehabilitation of cardiac

patients after revascularization is of utmost importance in reducing the mortality associated with this disease and achieving the best possible physical, mental and social wellbeing.

A growing body of literature has shown that interventions in lifestyle, favorable modification of risk factors and selective use of prophylactic drugs can lessen the risk of non-fatal and fatal events in CHD patients.<sup>7</sup> Recent guidelines clearly define the importance of dietary modification, exercise and treatment with prophylactic drugs.<sup>8</sup> However, the key issue for these recommendations to have benefit in general population remains patient's adherence. Adherence, as defined by WHO is the extent to which a person's behavior (taking medication, following a diet, and/or executing lifestyle changes) corresponds with agreed recommendations from a health care provider.<sup>9</sup> Adherence to lifestyle interventions and prescribed drugs is the most important factor to prevent

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secondary cardiac events and leads to improved satisfaction and quality of life.<sup>10,11</sup>

Non-adherence after CABG is a complex problem and a major health care issue worldwide. It may result in poor health outcome and places a substantial burden on national economies by increasing health care costs. It serves as an obstacle in the attainment of treatment goals and may actually worsen the disease. Despite the presence of guidelines for many years, several studies have shown that there is a considerable gap between the recommendations and actual clinical practice.<sup>12,13</sup> Several factors have been shown to influence non-compliance. These include living alone, poor patient-physician relationship, lack of knowledge regarding the importance of adherence, busy schedules, beliefs regarding exercise and medication and psychological factors such as anxiety and depression.<sup>14–16</sup> Multiple daily dosing, excessive costs, forgetfulness, and fear of side effects have been reported to be the most important factors leading to non-compliance to medication.<sup>17</sup> Many studies have reported the prevalence of non-compliance among CHD patients after CABG, with respect to lifestyle modification and pharmacological treatment all over the world. However, there is paucity of data with regards to non-adherence after coronary revascularization (post CABG) in our part of the world. Additionally, only a few studies have looked into the possible predictors of non-adherence to diet, exercise, and medication.

Considering the absolute importance of adherence and increasing burden of mortality from CHD in Asia, the primary objective of this study was to investigate the frequency and predictors of non-adherence to lifestyle changes and medications among CHD patients after undergoing CABG surgery.

## 2. Methodology

In this cross-sectional descriptive survey, patients who underwent isolated primary CABG at two tertiary care hospitals in Pakistan were included. Non-randomized convenient sampling was done at two tertiary care hospitals. This study was conducted during a 12-month period from June 2015 to June 2016 after approval from the Institutional Review Board of Dow University of Health Sciences. The eligible patient had to be an adult over 18 years of age who underwent surgery 4 or more weeks prior to the filling of the questionnaire handed out to them on their follow-up visit. Patients who were prescribed one or more targeted drug classes at discharge or prior to the survey were included. Patients who were unable or reluctant to provide informed consent or left the questionnaire incomplete; Patients with unfavorable short term prognosis such as cancer patients or patients with end stage renal disease; subjects with preexisting medical conditions, other than diabetes, hypertension or hyperlipidemia, that required the use of additional medications were excluded. Patients with severe degenerative joint disease and documented mental disorder were also excluded from the study.

A total of 345 CABG surgeries were performed during the study time period, out of which 293 patients were eligible for our study. Of these 293 patients 280 gave informed consent to participate in the study. However, 11 patients were lost for the follow-up and 4 patients left the questionnaire incomplete, which yielded the final sample to be 265 patients. Therefore, the co-operation rate was 94.6%. Participants who met the eligibility criteria were provided detailed information about the study. A pre-coded questionnaire formulated in English as well as the native language was handed out to the patients. For assistance of patients who found it difficult to fill out the questionnaire, two interviewers who remained unaware of the outcome of interest were trained to carry out the task so as to minimize interviewer bias.

The questionnaire was pilot tested and thoroughly reviewed and validated by two cardiologists to ensure relevance of the questions included. The questionnaire was divided into 4 sections. The first section inquired about patient's demographic and baseline characteristics including age, gender, marital status, use of tobacco and number of social gatherings per week. Patient's medical records were reviewed to seek data on co-morbidities such as Diabetes, Hypertension and Hyperlipidaemia, and any prior history of stroke.

In the second section, patient's adherence to dietary modification was assessed. Non-compliance to diet was defined as people not meeting even one of the following dietary recommendations twice or more than twice a week (as reported by themselves): Consumption of less than approximately 300mg of dietary cholesterol per day, cut back on foods and beverages with added sugar, consumption of food with little or no added salt (aim to eat 1500mg to no greater than 2300mg of sodium per day). Furthermore, predictors for non-compliance were assessed through dichotomous questions about willingness to adopt a new lifestyle, having a partner/family member follow along, belief that poor lifestyle can increase risk of future heart attacks, and feeling of excessive restrictions leading to non-adherence. More than 1 social gathering per week was also included as a possible predictor of dietary non-compliance.

Third section of the questionnaire dealt with determining adherence to exercise prescription and possible factors that could affect adherence. Based on recommendations from Coronary Artery Bypass Surgery Safe Exercise Guidelines,<sup>18</sup> Individuals with moderate activity that is, non-stop walking at a comfortable pace for 30–60 min a day for at least 3 days per week were considered to be compliant. To determine factors that rendered them noncompliant, respective patients were asked whether they felt reluctant to follow an exercise regimen, had a hectic daily schedule, felt fatigued after exercising or simply believed that exertion might aggravate their heart condition. Additionally, patients were asked if they had a partner/friend accompanying them in their exercise routine. Patient's knowledge about correlation of lack of exercise and risk of future heart attacks was also assessed.

In the following section, adherence toward medication was gauged by the Morisky Scale 8.<sup>19</sup> A patient having score of 3–8 was considered noncompliant. Factors for noncompliance were sought by inquiring patients regarding their inability to follow their medicine prescription. They were asked if they skip doses because they seldom forget to take medicines, have been prescribed a lot of medicines, fear their side effects, or find them expensive. Unavailability of a partner to keep track of the drug regimen was considered a predictor of noncompliance.

Data were entered into an SPSS version 24.0 dataset, and coded for further analysis. The frequencies and significance of factors of noncompliance to dietary modification, exercise and medication were individually calculated through Chi-square test for dichotomous variables with *p* value <0.05 holding significance. Estimates of each predictor (odds ratios and 95% confidence intervals) were calculated. Qualitative variables were expressed as frequencies and percentages. Quantitative variables were expressed as mean ± standard deviation.

## 3. Results

Out of 280, 265 patients (94.6%) filled the questionnaire about adherence to lifestyle modifications and medication after CABG. The mean follow-up time period was  $5.7 \pm 1.3$  weeks. 45.3% (*n*=120) and 41.1% (*n*=109) were non-adherent to dietary recommendations and exercise respectively, while only 26%

( $n=69$ ) of these patients were non-adherent to prescribed medications (Fig. 1).

The demographic data of the patients is presented in Table 1. Mean age of patients was  $67.2 \pm 13.4$  years. Table 2 describes how different predictors influenced adherence to a healthy diet. 53% ( $n=64$ ) of the non-compliant patients did not believe that poor diet can increase the chances of future heart attacks (OR 7.1; 95% CI 3.9–12.9;  $p < 0.001$ ). Among patients who attended  $>1$  social gatherings in a week ( $n=161$ , 60.7%), only about 36% ( $n=58$ ) were compliant to dietary changes, so this factor was found to be significantly associated with non-compliance (OR 9.1; 95% CI 4.9–16.7;  $p < 0.001$ ). A large number of compliant patients ( $n=107$ , 73.8%) claimed to have someone while a large number of non-compliant patients ( $n=49$ , 40.8%) reported absence of a partner or friend to follow a diet plan with (OR 1.9; 95% CI 1.2–3.3;  $p=0.01$ ). Reluctance to follow an exercise routine was faced by 21% of the patients and was found to be a significant predictor of non-compliance (OR 14; 95% CI 6.3–31.4;  $p < 0.001$ ) (Table 3). A majority of the compliant patients ( $n=94$ , 60.2%) did not have a partner or friend to perform physical activities with, so the association of this factor with non-compliance was found to be insignificant ( $p=0.41$ ) (Table 3). Busy schedule (OR 9.2; 95% CI 5.2–16.4;  $p < 0.001$ ) and fear that exercise will aggravate heart issues (OR 2.7; 95% CI 1.5–5;  $p < 0.001$ ) were two factors found to have a significant association with non-adherence to exercise. Predictors of non-compliance to medications are shown in Table 4. It illustrates that patients not having a partner to remind them of their medications were less compliant as compared to the ones having a partner (OR 4.8; 95% CI 2.6–8.8;  $p < 0.001$ ). Forgetfulness (OR 16.7; 95% CI 6–46.5;  $p < 0.001$ ), affordability of drugs (OR 2.1; 95% CI 1.1–4.1;  $p=0.026$ ) and too many medications to take (OR 2.4; 95% CI 1.3–4.4;  $p=0.003$ ) were found to be significant predictors (Table 4).

#### 4. Discussion

Our study shows that the prevalence of noncompliance to lifestyle modifications and medications after CABG is high. This poses a great threat to the long term clinical outcomes, overall health care costs and competence in our already sparse resources. There have been several studies that have analyzed the frequency of non-compliance and pondered over the root causes of this situation.<sup>14,20</sup> Our study is congruent with most of these predictors, while at the same time amalgamating the three different foci of changes after CABG, namely; medication, diet and exercise.

Several factors play a role in the nonadherence to lifestyle modifications. Lifestyle modifications after CABG helps the patient be better equipped to avoid future risk to their health so it is

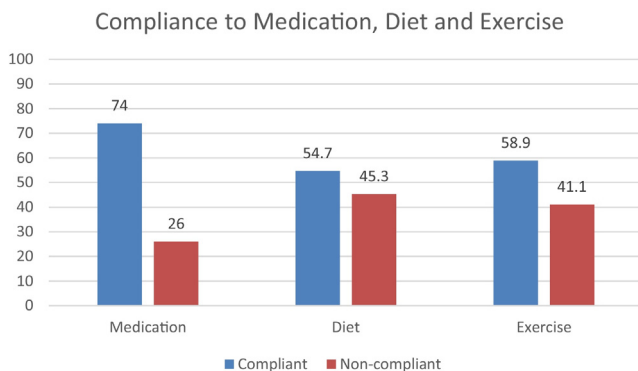
**Table 1**  
Demographics of the patients.

Variables	Outcome ( $n=265$ )
Mean age (years)	$67.2 \pm 13.4$
Males	157 (59.2%)
Married	203 (76.6%)
Smokers	79 (29.8%)
No of social gatherings $>1$ week	161 (60.7%)
Diabetes	146 (55.1%)
Hypertension	122 (46%)
Prior stroke	12 (4.5%)
Hyperlipidaemia	113 (42.6%)

extremely important to divulge in the patient the importance of diet and exercise.<sup>21</sup> As mentioned in several other studies, a healthy patient – physician relationship cannot be stressed enough. According to our study, majority of the patients who are noncompliant have difficulties in accepting a new lifestyle. This could be due to the drastic changes burdened on them after a previously unhampered lifestyle. This results in a feeling of negativity regarding lifestyle changes, with the belief that so many restrictions being imposed on them 'have no point'. Patients sometimes also feel that their autonomy is threatened.<sup>22</sup> Moreover, some patient's express frustration and disappointment with the care and treatment they experienced during the transition from hospital to home. This learned helplessness can be substantially negated by intervention by healthcare professionals to increase motivational levels. According to the curvilinear relationship between anxiety and learning and the Health Belief model (HBM), goals set by the doctors should be easier to accomplish.<sup>23</sup> This would go a long way in helping patients adhere to a diet plan with an optimistic approach. Furthermore, our results also illustrate that patients who believe that poor diet and failure to exercise would increase their chances of a heart attack, have a much higher compliance than those who are not aware of the risks associated. These patients are apprehensive of going through another ordeal of a heart attack and therefore stick to diet plans in order to prevent it. Alm-Roijer et al.<sup>24</sup> recommend giving an insight to the patient about the precariousness of their health in order to bridge the gap of noncompliance.

Data showed that patients who had multiple social gatherings in a week also found it difficult to concord to a diet plan. Peer pressure, limited options available in restaurants and eateries for a restricted low-fat diet, and lack of willpower while having a good time with friends are some of the reasons these patients could not adhere to a diet regime. A previous study has also shown that lack of support by peers harbors a negative impact on the patient regarding their abstinence and ultimately leads to noncompliance.<sup>25</sup> We recommend maintaining healthy relationships and interacting with people who have similar goals, which would help the patient be better self-disciplined and hence adhere to proper diet.

One notable point that could be a predictor for noncompliance of patients is their busy schedule which results in an inability to perform physical activity. Since exercise requires a minimum of half an hour, patients find it difficult to spare time after an already hectic day. Even if time is not a constraint in some cases, exercise can make them fatigued due to which there is a reluctance to continue. Furthermore, in a country like ours, where gyms are not located closer to homes and group exercising programs are few, patients find it difficult to maintain their physical workouts at home. This seems to be a prevalent factor in other studies as well.<sup>15</sup> Moreover, we discovered a belief in certain patients that exercise would aggravate cardiac issues. We believe that this misconception resulted from lack of instructions given post op and hence the patients rely on the obvious logic that exercise causes shortness of



**Fig. 1.** Frequency of post-CABG patients who were compliant and non-compliant ( $n=265$ ) to different factors.

**Table 2**  
Predictors for non-compliance to diet.

Variables	Non-compliant (n = 120)	Compliant (n = 145)	OR	95% CI	p-Value
Unwillingness to adopt a new lifestyle	67 (55.8%)	23 (15.9%)	6.7	3.8–11.9	<0.001
Disbelief that poor diet can drastically increase chances of future heart attacks	64 (53.3%)	20 (13.8%)	7.1	3.9–12.9	<0.001
Absence of Partner or family member who supports	49 (40.8%)	38 (26.2%)	1.9	1.2–3.3	0.01
Too many restrictions so no point	97 (80.8%)	20 (13.8%)	26.4	13.7–50.8	<0.001
Social gatherings > 1 per week	103 (85.8%)	58 (40%)	9.1	4.9–16.7	<0.001

**Table 3**  
Predictors for non-compliance to exercise.

Variables	Non-compliant (n = 109)	Compliant (n = 156)	OR	95% CI	p-Value
Reluctance to follow exercise regimen	47 (43.1%)	8 (5.1%)	14	6.3–31.4	<0.001
Too busy schedule to perform physical activity	86 (78.9%)	45 (28.8%)	9.2	5.2–16.4	<0.001
Fear that it will aggravate heart issue	35 (32.1%)	23 (14.7%)	2.7	1.5–5	<0.001
Feel fatigued after exercising	26 (23.8%)	17 (10.9%)	2.6	1.5–5	0.005
Lack of exercise can increase future chances of heart attack	False = 88 (80.7%)	False = 64 (41%)	6	3.4–10.7	<0.001
Absence of a friend/partner to perform physical activities with	71 (65.1%)	94 (60.2%)	1.2	0.7–2	0.41

**Table 4**  
Predictors of non-compliance to medication.

Variables	Non-compliant (n = 69)	Compliant (n = 196)	OR	95% CI	p-Value
Forget	21 (30.4%)	5 (2.5%)	16.7	6–46.5	<0.001
Too many medicines	27 (39.1%)	41 (20.9%)	2.4	1.3–4.4	0.003
Fear Side effects	3 (4.3%)	4 (2%)	2.2	0.5–10	0.30
Expensive	18 (26.1%)	28 (14.2%)	2.1	1.1–4.1	0.026
Unmarried or having no partner	32 (46.4%)	30 (15.3%)	4.8	2.6–8.8	<0.001

breath and increased heart rate which might be perceived as a worsening functional capacity. Therefore, it is important for physicians to not only explain the absurdity of these beliefs, but also devise individual plans for the patients so each of them finds it less cumbersome to adhere to a proper timetable and plan.<sup>26</sup> Several aspects of the patients' life has to be given attention in order to make him capable of having the best possible outcome after CABG.

Our study showed that apart from non-adherence to dietary regimen and exercise, non-adherence to medications is an equally important problem that warrants attention. Marriage and having a partner or family member to support the patient seems to be a global reason for the increased compliance in these patients. Other studies have also proved the claim that living alone results in a more sedentary lifestyle and lack of motivation to be more receptive to lifestyle changes and follow prescriptions.<sup>27,28</sup> We found out that the moral and physical support and encouragement offered by a partner, creates a positive outlook to the changes these patients have to make after CABG. Moreover, the constant 'nagging' and reprimands by the partner in cases of slacking from exercise or diet control have also been reported as factors for increased compliance.<sup>28</sup> Moreover, Khanderia et al.<sup>29</sup> surveyed adults following CABG for 6 to 24 months regarding adherence behavior toward medications and concluded that the most commonly reported non-adherent behavior was forgetting to take the medications. This finding further proves that having a partner or family member as a constant reminder would serve to increase adherence by a substantial amount. Our finding regarding marriage and increased compliance also proves that the patient's partner and family members need to be guided on how to deal with patients and manage their frustration, to motivate them and convince them to adopt the recommended lifestyle in the most encouraging way possible.

Another cause resulting in nonadherence to medications after CABG is the prescription of too many drugs. There is underutilization of combination pills and since adherence is inversely proportional to the frequency of dosing,<sup>30,31</sup> complicated dosing plans reduce compliance. The patients who encountered these problems chose to skip certain drugs rather than discussing this problem with their doctor. Simplifying instructions<sup>32</sup> and writing the prescription down for the patient<sup>33,34</sup> would effectively make it easier for the patient to take the correct dosage on time. Another reason for nonadherence in other studies seems to be the fear of side effects to these numerous medications faced by the patient,<sup>17</sup> but our study failed to prove its significance.

Since post CABG medications are taken long term, some physicians tend to overlook the burden of affording the drugs which is particularly important in our set up, more so because the patients would rather spend that money on basic life support. Costs should therefore be considered when prescribing medicines.<sup>35</sup> Moreover, it is important to discuss with the patient the benefits of each drug and relay in them the confidence that medication is crucial in their post CABG clinical outcome. The patients should be made to realize that investing in medication is a necessary task and not merely an option<sup>36</sup> and that the consequences of noncompliance can be even more serious and costly and may also result in therapeutic failure.

## 5. Limitations

It must be noted that our study has several limitations. Previous history of smoking has not been co related with current change in habits or inability to do so. We have not considered the adherence to different types of drugs as some have more side effects that result in worsening compliance and could have led to potential confounding bias. Also, this study is only conducted till after 4



weeks of CABG and it cannot be derived whether the compliant patients now may become non-complaint later as symptoms improve. There is also a chance that patients may over report adherent behavior because this study is solely self-reported. Self-reported measures may include factor of information bias by patient's inaccurate recall or by social desirability, whereby patients present an overall optimistic estimation of medications use to their health professionals. However, investigations based on self-reporting have been proven to be reliable.<sup>37</sup> Another limitation in our study is that the study sample represents a small population selected via convenience sampling and the study subjects were recruited from only two tertiary care hospitals in Karachi which limits generalizability and leads to selection bias. Larger scale studies covering more tertiary care hospitals over a larger geographical area or cohort studies taking these predictors into account should be undertaken to draw better conclusions.

## 6. Conclusion

It can be concluded that noncompliance to lifestyle modifications and medication is an emerging problem worldwide. Despite the importance of secondary prevention, behavioral modifications among patients remain suboptimal. With the rise in heart diseases due to sedentary lifestyles and improper diet in our time, it is absolutely essential for medical health professionals to discuss these predictors and address them individually. Our findings highlight the need for a healthy physician and patient relationship in order to provide better understanding to the patients regarding their disease and its long-term implications. A comprehensive transition care model needs to be constructed in order to guide development of effective interventions.

## Conflicts of interest

The authors have none to declare.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at ([doi:10.1016/j.ihj.2017.05.017](https://doi.org/10.1016/j.ihj.2017.05.017))

## References

- WHO. The global burden of disease: 2004 update.
- Heart disease and stroke statistics – 2009 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2009;119:21–181.
- Association AH. *International Cardiovascular Disease Statistics*. Dallas: American Heart Association; 2009.
- Van Domburg RT, Kappetein AP, Bogers AJ. The clinical outcome after coronary bypass surgery: a 30-year follow-up study. *Eur Heart J*. 2009;30(4):453–458.
- Hillis LD, Smith PK, Anderson JL, et al. ACCF/AHA guideline for coronary artery bypass graft surgery: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2011;124:e652–e735.
- Sheikh MR, Khan MS, Saeed Z, et al. Outcome of coronary artery bypass grafting in a tertiary-care center in Pakistan. *Asian Cardiovasc Thorac Ann*. 2015;23(3):276–281.
- Clark AM, Hartling L, Vandermeer B, et al. Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Ann Intern Med*. 2005;143:659–672.
- Smith SC, Allen J, Blair SN, et al. AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorsed by national heart, lung and blood institute. *Circulation*. 2006;113(19):2363–2372.
- Adherence to Long-Term Therapies: Evidence for Action. In: Sabaté E, ed. Geneva, Switzerland: World Health Organization; 2003.
- Taylor RS, Brown A, Ebrahim S, et al. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. *Am J Med*. 2004;116:682–692.
- Smeltzer SC, Bare BG, Hinkle J, 11th ed. *Brunner & Sudarth's Text book of Medical Surgical Nursing*, vol. 1 Lippincott William; 2008:874.
- EUROASPIRE. A European Society of Cardiology survey of secondary prevention of coronary heart disease principal results. EUROASPIRE Study group. *Eur Heart J*. 1997;18:1569–1582.
- EUROASPIRE II Study Group. Lifestyle and risk factor management and use of drug therapies in coronary patients from 15 countries. Principal results from EUROASPIRE II. Euro Heart Survey Programme. *Eur Heart J*. 2001;22:554–572.
- Nahapetyan A. *Relationship Between Patients Knowledge About Post Operative Risk Factors After Coronary Artery Bypass Graft Surgery and Adherence to Medication and Lifestyle Changes in Armenia*. College of Health Sciences. American University of Armenia; 2007.
- Bock BC, Albrecht AE, Traficante RM, et al. Predictors of exercise adherence following participation in a cardiac rehabilitation program. *Int J Behav Med*. 1997;4(1):60–75.
- Glazer KM, Emery CF, Frid DJ, Banyasz RE. Psychological predictors of adherence and outcomes among patients in cardiac rehabilitation. *J Cardiopulm Rehabil*. 2002;22(1):40–46.
- Jin J, Sklar GE, Oh VMS, et al. Factors affecting therapeutic compliance: a review from the patient's perspective. *Ther Clin Risk Manag*. 2008;4(1):269–286.
- Sukala B. *Coronary Artery Bypass Surgery Safe Exercise Guidelines [Online]*. Available: <http://www.drbillssukala.com.au/exercise/coronary-artery-bypass-surgery-exercise-guidelines/>.
- Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens (Greenwich)*. 2008;10(May (5)):348–354.
- Khan MS, Bawany FI, Mirza A, et al. Frequency and predictors of noncompliance to dietary recommendations among hypertensive patients. *J Commun Health*. 2014;39:732–736.
- Daubenmier JJ, Weidner G, Sumner MD, et al. The contribution of changes in diet, exercise, and stress management to changes in coronary risk in women and men in the multisite cardiac lifestyle intervention program. *Ann Behav Med*. 2007;33:57–68.
- Young L, Barnason S. Older patient's perception and experience with lifestyle changes following cardiac revascularization. *J Clin Med*. 2014;10(1):30–37.
- Ben-Zur H, Rappaport B, Ammar R, et al. Coping strategies, life style changes, and pessimism after open-heart surgery. *Health Soc Work*. 2000;25:201–209.
- Alm-Roijer C, Stagmo M, Uden G, et al. Better knowledge improves adherence to lifestyle changes and medications in patients with coronary heart disease. *Eur J Cardiovasc Nurs*. 2004;3:321–330.
- McAllister S, Buckner EB, White-Williams C. Medication adherence after heart transplantation: adolescents and their issues. *Prog Transplant*. 2006;16:317–323.
- Allen K, Morey MC. Chapter2: Physical Activity and Adherence.
- Griffo R, Ambrosetti M, Tramarin R, et al. Effective secondary prevention through cardiac rehabilitation after coronary revascularization and predictors of poor adherence to lifestyle modification and medication. Results of ICAROS survey. *Int J Cardiol*. 2014;167:1390–1395.
- Sher T, Brawn L, Domas A, et al. The partners for life program: a couples approach to cardiac risk reduction. *Fam Process*. 2014;53(1):131–149.
- Kandheria U, Townsend K, Erickson SR, et al. Medication adherence following coronary artery bypass graft surgery: assessment of beliefs and attitudes. *Ann Pharmacother*. 2008;42:192–199.
- Claxton AJ, Cramer J, Pierce C. A systematic review of the associations between dose regimens and medication compliance. *Clin Ther*. 2001;23(8):1296–1310.
- Improving Prescription Medicine Adherence Is Key To Better Health Care*. PhRMA; 2011.
- Vermeire E, Hearnshaw H, Van Royen P. Patient adherence to treatment: three decades of research. A comprehensive review. *J Clin Pharm Ther*. 2001;26(5):331–342.
- Segador J, Gil-Guillen VF, Orozco D, et al. The effect of written information on adherence to antibiotic treatment in acute sore throat. *Int J Antimicrob Agents*. 2005;26(1):56–61.
- Dowse R, Ehlers M. Medicine labels incorporating pictograms: do they influence understanding and adherence? *Patient Educ Couns*. 2005;58(1):63–70.
- Allan GM, Lexchin J, Wiebe N. Physician awareness of drug cost: a systematic review. *PLoS Med*. 2007;4(9):e283.
- Kjellgren KI, Ahlner J, Säljö R. Taking antihypertensive medication—controlling or co-operating with patients? *Int J Cardiol*. 1995;47(3):257–268.
- Gehi AK, Ali S, Whooley MA. Self-reported medication adherence and cardiovascular events in patients with stable coronary artery heart disease: the heart and soul study. *Arc Intern Med*. 2007;167(16):1798–1803.