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Medications and Associated Symptoms/Problems after Coronary Artery Bypass Surgery

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Among the more than 253,000 patients that underwent coronary artery bypass surgery (CABS); over half were over the age of 65.¹ Older individuals often present for surgery with multiple chronic diseases and multiple prescription and nonprescription medications. These factors, in addition to age related physiological changes, make this population at risk for medication related problems.² In addition, these problems may be compounded by symptoms experienced during the post-operative period.

Common postoperative symptoms include chest incision symptoms (pain, discomfort), shortness of breath, loss of appetite,³ fatigue,^{3,4} and difficulty sleeping.^{3,5,6} Psychological symptoms such as depression/sadness and anxiety/uneasiness have also been identified post-CABS.⁷⁻⁹ Many of these symptoms are reported for weeks and months after surgery.¹⁰⁻¹² A patient's ability to discern between postoperative symptoms and new medication side effects may result in reluctance to adhere to the medication regimens. Medication adherence is critical for optimal recovery from surgery and secondary prevention of coronary artery disease.

While much research has been done on medication regimens and symptoms in the post-operative CABS period, little data has been reported regarding the relationship between post-operative medications and post-operative symptoms following CABS. As more people age 65 and older choose to undergo revascularization procedures, examining this relationship has become more important. Therefore the purpose of this secondary analysis was to describe the frequently used postoperative medications and examine the relationship between postoperative symptoms and medication side effects in CABS patients. The specific aims of this study are: Aim 1: Describe frequently occurring medications used by CABS patients in the preoperative period and at three and six weeks and three months post-operatively. Aim 2: Describe medication use and selected symptoms/problems at three and

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six weeks and three months postoperatively. Selected symptoms/problems were specific for each medication based on documented side effects of that medication.

BACKGROUND

Evidence based secondary prevention of coronary artery disease after CABS includes specific medications. The American College of Cardiology (ACC) guidelines recommend aspirin to maintain graft patency, statins for hyperlipidemia management, beta-blocker and amiodarone therapy to reduce the incidence of atrial fibrillation following CABS.¹³ Angiotensin-converting enzyme inhibitor drugs have also been shown to reduce myocardial infarction, angina, transient ischemic attack, and ischemic stroke 1 year after CABS.¹⁴ Studies have reported general compliance with these guidelines. Fox, Kibiro, Eichhofer, Curzen¹⁵ reported that in a study of 100 post CABS patients, 92% were prescribed aspirin, 70% B-blockers, 73% statins, and 26% ACE inhibitors. In a much larger study (n=2302) of patients who underwent CABS, 92% were prescribed aspirin, 79% B-blockers, 92% statins, and 55% ACE inhibitors.¹⁶

Medication Side Effects

Secondary prevention medications are generally tolerated well with few side effects. Among surveyed primary care patients, (n=661) approximately 25% experienced an adverse drug event¹⁷ with those adverse events most frequently associated with beta-blockers, ACE inhibitors, and calcium-channel blockers. Medication side effects were reported by 34% of the patients attending a hypertension clinic (n=221) with the most common complaints as dizziness (9%), ankle swelling (7%), and 3 – 5% reporting headache, fatigue, chest discomfort and cough.¹⁸

The most common complaint associated with statin medications are musculoskeletal problems such as joint aches, weakness, and cramps.¹⁹ Other symptoms reported by statin users include insomnia, gastrointestinal problems, headache, and dizziness. Medication side effects including fatigue and depression are associated with beta-blockers while ACE inhibitor users report fatigue and depression as well as insomnia.¹⁹ Medication side effects associated with antiarrhythmic therapy includes largely gastrointestinal complaints such as constipation, anorexia, and nausea. Chronic cough is a complaint noted in patients receiving ACE inhibitor medication.²⁰

Medication Adherence

Medication side effects or symptoms perceived as medication side effects may impact medication adherence, however, it is critical that patients take their prescribed medications. Postoperative CABS patients taking half or less of their prescribed medications had nearly twice the unadjusted death rate at two years (8.0% versus 4.2%) compared to those patients that took all of their medications.²¹ In patients (n=5938) with three or more chronic conditions, 33.8% reported that they skipped medication doses or stopped taking a medicine because of side effects.²² Elderly patients undergoing CABS generally have comorbid conditions which require medication therapy in addition to the new secondary prevention medications that may be prescribed. Cheung, Wong, and Lau¹⁸ reported that age was significantly associated with the number of medications ($r=0.45$, $p<.001$) taken by patients attending a hypertension clinic. The total number of medications was significantly associated ($p=.019$) with underadherence among older patients (n=147) taking 3 or more medications.²³

MATERIALS AND METHODS

Design

This study is a secondary analysis of a two-group repeated measures experimental randomized controlled trial (RCT) that tested the effects of a symptom management home care intervention on recovery outcomes and functioning in elderly CABS patients following hospital dismissal. The primary study (Symptom Management Intervention in Elderly CABS Patients, PI Zimmerman, 1 R01 NR07759) measured physical and psychosocial functioning variables at time of discharge, 3 and 6 weeks and 3 and 6 months postoperative. Both groups received the usual standard of care. The intervention group received a 6 week symptom management recovery intervention which was delivered via the Health Buddy (HB®) telehealth device that is attached to the subject's telephone line. Power analysis was conducted for the parent study and recommended a sample size of 123 subjects in each group providing 80% power for detecting a small-to medium effect between groups. A complete description and results of this study has been reported.²⁴

Participants

The sample for this secondary analysis consisted of subjects (n=232) who were recruited from 4 Midwestern hospitals. Inclusion criteria included: a) 65 years or older and who had undergone CABS; b) oriented to person, place, and time; c) not visually impaired, able to hear, and able to speak and read English; d) have a phone with a non-rotary phone service; e) discharged within seven days after surgery; and f) no physical impairments that would limit their physical functioning after surgery. Subjects were excluded if they were not dismissed to their home. Because medication data were collected from all subjects in the primary study, subjects from both the intervention and control groups were included in this analysis.

Procedure

Data were collected preoperatively from patient medical records. All follow-up data were collected by the same research nurse at 3 and 6 weeks and 3 months following surgery. Postoperative medications were obtained through self-report during follow-up phone interviews. Subjects were asked to name the medications that they were taking at each time period.

Instruments

Demographic data and patient characteristics were collected from patient medical records and self-report.

The Cardiac Symptom Survey (CSS), was used to measure cardiac-related symptoms: angina, shortness of breath, fatigue, depression, problems sleeping, incision pain, leg swelling, fluttering/rapid heartbeats (palpitations), anxiety, and poor appetite.²⁵ Only the symptom presence (presence/absence of each symptom) data from the CSS was used in this study. Subjects were asked if they had experienced each symptom in the past week. The dichotomous response (yes/no) was recorded. Content validity of the CSS has been established through interviews and questionnaires with CABS patients and nurse researchers, and literature reviews and confirmed by a panel of cardiovascular clinical nurse specialists. In addition, responsiveness to change was demonstrated with CABS patients (n=90).²⁵

Postoperative Problems—Information on postoperative problems was quantitatively collected from the subjects on the follow-up questionnaires at 3 and 6 weeks and 3 months.

In each follow-up phone call interviews, subjects asked from a list of problems to identify which (if any) postoperative problems or complications they have experienced. Examples of problems included rhythm problem, fluid in lungs, pneumonia, infection, constipation, nausea, and neuromuscular problems. A frequency and percent for each problem at each time period was recorded.

Data Analysis

Statistical Package for the Social Sciences 16.0 (SPSS Inc, Chicago, Ill) was used for data analysis. Analyses for Aim 1 were completed using descriptive statistics to describe the frequency and percentage of each medication at the four time points. Analyses for Aim 2 were completed using Chi square analyses to compare the proportion of patients that received and did not receive a medication with the presence of side effects common to that medication. Fisher's Exact Test was used when expected cell counts were less than 5 in the Chi-square analysis.

In order to take into account the correlation of repeated observations within individuals, a second analysis was conducted using generalized estimating equations (GEE). A binomial distribution for residuals and a logit link were specified as appropriate for the dichotomous outcome, and the working correlation matrix was unstructured. Symptom occurrence was modeled as a function of time period and the two medications having that symptom as a documented side effect. To avoid imposing linearity on the relation of time and symptom occurrence, time was treated as a categorical variable. Each model also included the twoway interactions of each medication with each other and with time. Neuromuscular problems, constipation, and nausea were not included in these analyses due to extremely small frequency of occurrence after 3 weeks.

RESULTS

Characteristics of Participants

The mean age of the patients was 71.2 (± 4.91), and had a mean hospital length of stay (LOS) of 5.45 ± 1.2 days. The majority of patients were male (83%), and underwent on-pump CABS (75%). Risk factors experienced by these patients included a history of hypercholesterolemia (74.1%), hypertension (73.7%), family history of CAD (70.1%), and history of tobacco use (51%). The mean number of medications that patients were prescribed was lowest 3 months after surgery (5.6) and highest at time of discharge from the hospital (7.7). (See Table 1)

Description of Frequently Occurring Medications

Aim 1—Describe frequently occurring medications used by CABS patients in the preoperative period and to examine post-operative medication use at three and six weeks as well as at three months post-operatively. The most frequently reported preoperative medications were aspirin, a statin (or cholesterol lowering med), and a beta-blocker. (Table 2) Percentages reflect the proportion of subjects that stated they were taking that medication at each time point. These remained the most frequently used medications from preoperative to three months postoperative. Over the first three months, aspirin use rose from 65.5% preoperative to 89.4% at six weeks postoperative, and then decreased slightly to 85.7% at three months. The use of cholesterol lowering medications increased from 56.5% preoperative to >85% postoperative. Beta-blocker use rose from 44% preoperatively to 68% at 3 weeks. A slight decline was noted at 6 weeks (62.8%) and 3 months (55.6%). Other medications of note were antiarrhythmics and ACE inhibitors. The use of antiarrhythmic medication rose from 3.0% preoperative to peak at 37.7% three weeks after surgery. In this

study the use of ACE inhibitors remained fairly consistent with 34.1% receiving the medication preoperative and 33.6% at three months postoperative.

Medications and Associated Symptoms/Problems

Aim 2—Describe medication use with occurrences of symptoms/problems at three and six weeks and three months postoperatively. Those symptoms/problems were targeted for each drug based on documented side effects of each medication.

Symptoms such as fatigue, shortness of breath, poor appetite, and depression are symptoms that may also occur as side effects of cardiac medications. In this sample, fatigue was reported most frequently and dissipated over time from 52.2% at 3 weeks after surgery to 30.2 and 27.5% at 6 weeks and 3 months, respectively. (Table 3) Similar patterns were noted for sleep problems, poor appetite and depression symptoms.

Postoperative problems that could occur as a result of surgery were also assessed. Problems that could also be a medication side effect included constipation, neuromuscular problems, and nausea. Similar to the symptoms trajectory, these problems were also experienced most frequently during the early recovery period (3 weeks) and dissipated over time. (Table 3)

At each time point, chi square statistics were used to compare patients using a medication and those not using a medication and the experience of symptoms and problems associated with that specific medication therapy. The proportions of patients using beta blockers and not using beta blockers were very similar in the reported frequency of fatigue and depression at 3 and 6 weeks and 3 months after CABS. (Table 4) For example three weeks after surgery, 53.5% of patients taking beta blockers reported fatigue compared to 52.1% of patients not taking beta blockers. Similarly, no significant differences were found between the proportions of patients taking ACE inhibitors and those not taking ACE inhibitors for the common side effects of fatigue, sleep problems, and depression. (Table 5) No significant differences were found between the patients taking cholesterol lowering agents or statins and those not taking cholesterol lowering agents or statins for the common side effects of neuromuscular and sleep problems, and poor appetite. (Table 6) No significant differences were found between the patients taking antiarrhythmic medication and those not taking antiarrhythmic medication for the common side effects of constipation, poor appetite, and nausea. (Table 7)

In the longitudinal GEE analysis, none of the interactions between medication and time period were significant. To simplify presentation of results, models without these interaction terms were fit, results of which are presented in Table 8. ACE inhibitors were found to have a significant main effect on occurrence of sleep problems ($p = .028$). Over the entire 3-month period, those taking an ACE inhibitor were about one-fourth as likely to have sleep problems ($OR = .26$) as were those not taking the medication. There were no other significant effects involving any medication. The effect of time was significant for all four symptoms, with the odds of having fatigue, depressive symptoms, or sleep problems decreasing to half or less by 6 weeks and 3 months (OR ranging from .34 to .55). Odds of having appetite problems were about one-third as likely at 6 weeks as at 3 weeks and dropped to near zero by 3 months. (Table 8)

DISCUSSION

To maximize the postoperative benefit of CABS, ACC guidelines recommend that aspirin and statin therapy be initiated.¹³ In this study over 85% of patients were on aspirin therapy and reported taking cholesterol lowering medications three months after surgery. (Table 2)

This result is similar to recent research^{21, 26} but differs from the study done by Kulik et al.²⁷ which showed a decline in prescriptions for statins at 90 days post CABS surgery.

The ACC guidelines indicate the use of ACE inhibitors for patients post ST elevated myocardial infarction (STEMI) who have a left ventricular ejection fraction (LVEF) of 0.40 or less and who have either symptomatic heart failure or diabetes.¹³ The use of ACE inhibitors early after CABS (within seven days or less), did not improve outcomes in low risk patients (those with ejection fraction of $>.40$).²⁸ Only 9.7% (n=22) of the post-CABS patients in this study had an ejection fraction $<.40$. ACE inhibitors were used by 34.1% of patients preoperatively and remained similar postoperatively (33.6 – 38.6%). This suggests that patients receiving this therapy preoperatively continued after their CABS.

The incidence of postoperative atrial fibrillation is greater in elderly patients^{29,30} with beta-blocker use recommended to prevent this rhythm disturbance post-CABS.¹³ Consistent with this literature, beta blockers were reported in 68% of subjects in this sample three weeks after surgery with a slight decline at 6 weeks (63%) and 3 months (56%). In addition, 37.7% reported taking antiarrhythmic medications three weeks after surgery with a similar decline in use at six weeks (15.9%) and three months (7.2%). This may indicate resolution of postoperative arrhythmias over time.

Patients reported experiencing symptoms (fatigue, sleep problems, depression, and poor appetite) as well as clinical problems (constipation, nausea, neuromuscular problems) after surgery. Crane, Oles, and Kennedy-Malone³¹ examined the relationship between beta blockers and side effects in older women post-myocardial infarction. In their study, no significant differences were found in mean depression or fatigue scores between beta-blocker users and non-users. Similarly, this study did not find significant data to suggest that patients taking medications reported more associated symptoms/problems at 3 and 6 weeks, or at 3 months following surgery. Patients experience symptoms after surgery, but these symptoms did not appear to be side effects from medications.

STUDY LIMITATIONS

Limitations of this study are those that are inherent with secondary analysis including the use of data that had been collected for a different reason and analyses to answer a different question. Additional limitations of the study included the use of client self reported symptoms, postoperative problems, and medication data. The use of a telephone follow-up to collect medication data could also result in error as patients could misreport on new, unfamiliar medications. Female patients comprised only 18% of the sample.

CONCLUSIONS/NURSING IMPLICATIONS

More than 80% of elderly patients in this study reported using aspirin and cholesterol lowering medication and more than half used beta blockers in the first 3 months after CABS. Secondary prevention medications have been associated with improved outcomes after CABS.²¹ After surgery, patients are often highly motivated to avoid further interventions and receptive to methods that improve long term health. Nurses can capitalize on this motivation by educating patients prior to hospital dismissal. Medication education typically includes indications, administration, dosage, and common side effects. Reinforcing the benefits of secondary prevention medications is critical. Providing elderly patients with written information that is easy to understand assists in retention of medication knowledge. In addition, referring patients to credible on-line resources for additional information and education reinforcement may be helpful.

Initial medication education should be followed with medication assessment and review at each office visit. Patients do not always communicate medication-related symptoms to their physicians.²² It is imperative that health care professionals initiate conversations about medication regimens and adherence. Patients with poor cognition and higher medication use were more likely to be nonadherent.²³ Follow-up phone calls to review medications and assess adherence and side effects may also improve medication knowledge and adherence. George, Elliott, and Stewart³² reported that periodic follow-up and medication review are important interventions to improve medication adherence in elderly patients.

Postoperative symptom management knowledge may also enhance medication adherence. Patients in this study reported experiencing postoperative symptoms which are similar to medication side effects. However, the proportion of patients experiencing symptoms was similar, regardless of medication use or non-use. Health care professionals must work with postoperative patients to explore methods of symptom management while remaining on prescribed medications.

Future research studies should include potential factors which may impact medication use and postoperative symptom recognition. The influence of variables such as type of health care provider managing medications, number of medications the patient is taking, co-morbidities, and age need further study.

Interventions designed to educate patients about common postoperative symptoms and problems, symptom management, and medication side effects are critical. Written information as well as frequent follow-up is especially important with older patients. Nurses in a variety of settings; hospital, home health care, and in clinics can provide support and education to assist patients to adhere to medications and manage symptoms following CABS.

References

1. Lloyd-Jones D, Adams R, Carnethon M, et al. Heart disease and stroke statistics -- 2009 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2009;119(3):480–486. [PubMed: 19171871]
2. Simonson W, Feinberg JL. Medication-related problems in the elderly: defining the issues and identifying solutions. *Drugs Aging* 2005;22(7):559–569. [PubMed: 16038571]
3. Zimmerman L, Barnason S, Nieveen J, Schmaderer M. Symptom management intervention in elderly coronary artery bypass graft patients. *Outcomes Manag* 2004;8(1):5–12. [PubMed: 14740578]
4. Tranmer JE, Parry MJ. Enhancing postoperative recovery of cardiac surgery patients: a randomized clinical trial of an advanced practice nursing intervention. *West J of Nurs Res* 2004;26(5):515–532. [PubMed: 15359055]
5. Redeker N, Ruggiero J, Hedges C. Patterns and predictors of sleep pattern disturbance after cardiac surgery. *Res NursHealth* 2004;27:217–224.
6. Savage LS, Grap MJ. Telephone monitoring after early discharge for cardiac surgery patients. *Am J Crit Care* 1999;8(3):154–159. [PubMed: 10228656]
7. Goyal TM, Idler EL, Krause TJ, Contrada RJ. Quality of life following cardiac surgery: impact of the severity and course of depressive symptoms. *Psychosom Med* 2005;67(5):759–765. [PubMed: 16204435]
8. Mallik S, Krumholz HM, Lin ZQ, et al. Patients with depressive symptoms have lower health status benefits after coronary artery bypass surgery. *Circulation* 2005;111(3):271–277. [PubMed: 15655132]
9. Moore SM. A comparison of women's and men's symptoms during home recovery after coronary artery bypass surgery. *Heart Lung* 1995;24(6):495. [PubMed: 8582825]

10. Barnason S, Zimmerman L, Nieveen J, et al. Relationships between fatigue and early postoperative recovery outcomes over time in elderly patients undergoing coronary artery bypass graft surgery. *Heart Lung* 2008;37(4):245–256. [PubMed: 18620100]
11. DiMattio MJ, Tulman L. A longitudinal study of functional status and correlates following coronary artery bypass graft surgery in women. *Nurs Res*. 2003;52(2):88–97.
12. Miller KH, Grindel CG. Comparison of symptoms of younger and older patients undergoing coronary artery bypass surgery. *Clin Nurs Res* 2004;13(3):179–193. [PubMed: 15245634]
13. Eagle KA, Guyton RA, Davidoff R, et al. ACC/AHA 2004 guideline update for coronary artery bypass graft surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1999 Guidelines for Coronary Artery Bypass Graft Surgery). *Circulation* 2004;110(14):e340–437. [PubMed: 15466654]
14. Oosterga M, Voors AA, Pinto YM, et al. Effects of quinapril on clinical outcome after coronary artery bypass grafting (The QUO VADIS Study). *Am J Cardiol* 2001;87(5):542–546. [PubMed: 11230836]
15. Fox DJ, Kibiro M, Eichhofer J, Curzen NP. Patients undergoing coronary revascularization: A missed opportunity for secondary prevention? *Postgrad Med J* 2005;81:401–403. [PubMed: 15937208]
16. Turley AJ, Roberts AP, Morley R, Thornley AR, Owens WA, de Belder MA. Secondary prevention following coronary artery bypass grafting has improved but remains sub-optimal: the need for targeted follow-up. *Interact Cardiovasc Thorac Surg* 2008;7(2):231–234. [PubMed: 18234766]
17. Gandhi TK, Weingart SN, Borus J, et al. Adverse drug events in ambulatory care. *N Engl J Med*. 2003;348(16):1556–1564. [PubMed: 12700376]
18. Cheung BMY, Wong YL, Lau CP. Queen Mary Utilization of Antihypertensive Drugs Study: side-effects of antihypertensive drugs. *J Clin Pharm Ther*. 2005;30(4):391–399. [PubMed: 15985053]
19. Aschenbrenner, DS.; Venable, SJ. *Drug Therapy in Nursing*. 3rd Ed.. Wolters Kluwer Health/Lippincott Williams & Wilkins; Philadelphia, PA: 2009.
20. Lombardi C, Crivellaro M, Dama A, Senna G, Gargioni S, Passalacqua G. Are physicians aware of the side effects of angiotensin-converting enzyme inhibitors?: a questionnaire survey in different medical categories. *Chest* 2005;128(2):976–979. [PubMed: 16100194]
21. Goyal A, Alexander JH, Hafley GE, et al. Outcomes Associated With the Use of Secondary Prevention Medications After Coronary Artery Bypass Graft Surgery. *Ann Thorac Surg* 2007;83(3):993–1001. [PubMed: 17307447]
22. Wilson IB, Schoen C, Neuman P, et al. Physician-patient communication about prescription medication nonadherence: a 50-state study of America's seniors. *J Gen Intern Med* 2007;22(1):6–12. [PubMed: 17351835]
23. Gray SL, Mahoney JE, Blough DK. Medication adherence in elderly patients receiving home health services following hospital discharge. *Ann Pharmacother* 2001;35:539–545. [PubMed: 11346058]
24. Barnason S, Zimmerman L, Nieveen J, et al. Influence of a symptom management telehealth intervention on older adults early recovery outcomes following coronary artery bypass surgery (CABS). *Heart Lung* 2009;38:364. [PubMed: 19755186]
25. Nieveen JL, Zimmerman LM, Barnason SA, Yates BC. Development and testing of the Cardiac Symptoms Scale in postoperative coronary artery bypass graft surgical patients. *Heart Lung* 2008;37(1):17–27. [PubMed: 18206523]
26. Brackbill ML, Sytsma C. Secondary prevention of hyperlipidemia after coronary artery bypass graft: From acute care to primary care. *Am J Crit Care* 2004;13:411–415. [PubMed: 15470857]
27. Kulik A, Levin R, Ruel M, Mesana TG, Solomon DH, Choudhry NK. Patterns and predictors of statin use after coronary artery bypass graft surgery. *J Thorac Cardiovasc Surg* 2007;134(4):932–938. [PubMed: 17903510]
28. Rouleau JL, Wanica WJ, Baillot R, et al. Effects of angiotensin-converting enzyme inhibition in low-risk patients early after coronary artery bypass surgery. *Circulation* 2008;117:24–31. [PubMed: 18071079]

29. Almassi GH, Schowalter T, Nicolosi AC, et al. Atrial fibrillation after cardiac surgery: a major morbid event? *Ann Surg* 1997;226(4):501. [PubMed: 9351718]
30. Mathew JP, Fontes ML, Tudor IC, et al. A multicenter risk index for atrial fibrillation after cardiac surgery. *JAMA*. 2004;291(14):1720–1729. [PubMed: 15082699]
31. Crane PB, Oles KS, Kennedy-Malone L. Beta-blocker medication usage in older women after myocardial infarction. *J Am Acad Nurse Pract*. 2006;18(10):463–470. [PubMed: 16999711]
32. George J, Elliott RA, Stewart DC. A systematic review of interventions to improve medication taking in elderly patients prescribed multiple medications. *Drugs Aging* 2008;25(4):307. [PubMed: 18361541]

Table 1
Demographic and Clinical Characteristics of the Sample (n=232)

Variable	n (%)	%
Gender		
Male	194	83
Female	40	17
Type of Procedure		
Coronary Artery Bypass Surgery	173	75
Off-pump Coronary Artery Bypass Surgery	57	24.6
Other	2	0.9
Risk Factors		
Hypercholesterolemia	172	74.1
Hypertension	171	73.7
Family History of Coronary Artery Disease	162	70.1
Tobacco Use	118	51
Diabetes	54	23.3
Ejection Fraction		
<40%	22	9.7
≥40%	205	90.3
Additional Variables	Mean (S.D.)	Range
Length of Stay	5.45 (1.2)	3 – 10
Age	71.2 (4.9)	65 - 86
Number of medications prior to CABS	6.4 (3.6)	0 - 19
Number of medications at dismissal	7.7 (3)	2 - 19
Number of medications 3 weeks after CABS	6.7 (2.1)	0 - 15
Number of medications 6 weeks after CABS	6 (2.1)	0 - 13
Number of medications 3 months after CABS	5.5 (1.9)	0 - 11
Body Mass Index	28.5 (4.63)	18.7 – 45.5
Charlson Comorbidity Index	1.1 (1.2)	0 - 6
Duke Activity Status Index	33.76 (14.9)	4.5 – 58.2

Table 2
Frequency (%) of Patients reporting Medication Use Preoperatively, 3 and 6 weeks, and 3 months post-CABS

	Preoperative (n=232) f (%)	3 Weeks (n=228) f (%)	6 Weeks (n=226) f (%)	3 Months (N=223) f (%)
Aspirin	152 (65.5)	201 (88.2)	202 (89.4)	191 (85.7)
Cholesterol Lowering Medication	131(56.5)	202 (88.6)	198 (87.6)	194 (87)
Beta-blocker	102 (44)	155 (68)	142 (62.8)	124 (55.6)
Antiarrhythmic	7 (3.0)	86 (37.7)	36 (15.9)	16 (7.2)
Angiotensin Converting Enzyme Inhibitor	79 (34.1)	88 (38.6)	78 (34.5)	75 (33.6)

Table 3
Symptoms/Problems reported at 3 and 6 weeks and 3 months post-CABG (n=232)

Symptoms/Problems	3 Weeks f (%)	6 Weeks f (%)	3 Months f (%)
Fatigue	121 (52.2)	68 (30.2)	61 (27.5)
Sleep Problems	88 (38.6)	58 (25.7)	45 (19.4)
Poor appetite	78 (33.6)	30 (13.3)	6 (2.7)
Depression	39 (16.8)	17 (7.6)	19 (8.6)
Constipation	37 (15.9)	6 (2.5)	1 (0.4)
Neuromuscular Problems	14 (6.0)	9 (3.9)	6 (2.2)
Nausea	6 (2.6)	4 (1.7)	1 (0.4)

Table 4
Beta-blocker Use and Associated Symptoms (n= 232)

Symptoms/Problems	Beta-blocker f (%)	No Beta-blocker f (%)	Test statistic	
			X ²	p value
Fatigue				
3 Weeks	83 (53.5)	38 (52.1)	.04	.83
6 Weeks	47 (33.1)	21 (25)	1.6	0.2
3 Months	34 (27.4)	27 (27.3)	.001	.98
Depression				
3 Weeks	28 (18.1)	11 (15.1)	.314	.58
6 Weeks	11 (7.7)	6 (7.1)	.028	.87
3 Months	8 (6.5)	11 (11.1)	1.53	.22

Table 5

Angiotensin Converting Enzyme (ACE) Inhibitor Use and Associated Symptoms/Problems

	ACE inhibitor f (%)	No ACE inhibitor f (%)	Test Statistic	
			X ²	p value
Fatigue				
3 Weeks	50 (56.8)	71 (50.7)	.80	.37
6 Weeks	27 (34.6)	41 (27.7)	1.16	.28
3 Months	17 (22.7)	44 (29.7)	1.25	.26
Sleep Problems				
3 Weeks	31 (35.2)	57 (40.7)	.69	.40
6 Weeks	18 (23.1)	40 (27)	.42	.52
3 Months	13 (17.3)	32 (21.6)	.57	.45
Depression				
3 Weeks	14 (15.9)	25 (17.9)	.14	.70
6 Weeks	4 (5.1)	13 (8.8)	.98	.32
3 Months	7 (9.3)	12 (8.1)	.09	.76

Table 6

Cholesterol Lowering Agents Use and Associated Symptoms/Problems

	Cholesterol lowering agent f (%)	No Cholesterol lowering agent f (%)	<u>Test Statistic</u>	
			X ²	p value
Neuromuscular				
Problems				
3 Weeks	13 (6.4)	1 (3.8)		.51 *
6 Weeks	7 (3.5)	2 (7.1)		.31 *
3 Months	5 (2.6)	1 (3.4)		.57 *
Sleep Problems				
3 Weeks	80 (39.6)	8 (30.8)	.76	.38
6 Weeks	53 (26.8)	5 (17.9)	1.02	.31
3 Months	38 (19.6)	7 (24.1)	.32	.56
Poor appetite				
3 Weeks	67 (33.2)	11 (42.3)	.86	.36
6 Weeks	24 (12.1)	6 (21.4)	1.85	.17
3 Months	6 (3.1)	0		.43 *

* Fisher's Exact test used due to expected frequency cell counts <5 in Chi Square analysis

Table 7**Antiarrhythmic Use and Associated Symptoms/Problems**

Symptom/Problem	Antiarrhythmic f (%)	No antiarrhythmic f (%)	Test Statistic	
			X ²	p value
Constipation				
3 Weeks	15 (17.4)	22 (15.5)	.15	.70
6 Weeks	3 (8.3)	3 (1.6)		.053*
3 Months	1 (6.2)	0		.07*
Poor appetite				
3 Weeks	32 (37.2)	46 (32.4)	.55	.46
6 Weeks	5 (13.9)	25 (13.2)		.54*
3 Months	0	6 (2.9)		.64*
Nausea				
3 Weeks	2 (2.3)	4 (2.8)		.59*
6 Weeks	0	4 (2.1)		.50*
3 Months	0	1 (0.5)		.93*

* Fisher's Exact test used due to expected frequency cell counts <5 in Chi Square analysis

Table 8

Tests of medication effects using generalized estimating equations

	Odds Ratio ^a	95% C.I.	p ^b
Fatigue			
Beta-blocker	1.427	(.870, 2.340)	.545
ACE Inhibitor	1.559	(.851, 2.857)	.300
6 Weeks	.386	(.284, .523)	<.001 ^b
3 Months	.336	(.234, .484)	
ACE Inhibitor X Beta-blocker	.625	(.287, 1.361)	.236
Depression			
Beta-blocker	.700	(.332, 1.477)	.215
ACE Inhibitor	.860	(.349, 2.124)	.651
6 Weeks	.388	(.233, .647)	<.001 ^c
3 Months	.426	(.267, .681)	
ACE Inhibitor X Beta-blocker	1.010	(.310, 3.285)	.987
Sleep Problems			
ACE Inhibitor	.262	(.076, .909)	.028
Cholesterol lowering	.909	(.458, 1.805)	.170
6 Weeks	.547	(.403, .742)	<.001 ^c
3 Months	.384	(.264, .558)	
ACE Inhibitor X Cholesterol lowering	3.216	(.876, 11.799)	.078
Appetite			
Cholesterol lowering	.877	(.400, 1.924)	.553
Antiarrhythmic	1.212	(.262, 5.620)	.871
6 Weeks	.294	(.202, .426)	<.001 ^c
3 Months	.053	(.023, .121)	
Cholesterol lowering X Antiarrhythmic	.778	(.158, 3.835)	.758

^aParameter estimates are shown as odds ratio, the exponentiated form of the regression coefficients.

^bProbabilities are from the test of model effects. Confidence intervals are calculated using standard errors of individual parameters.

^cOmnibus test of effect of time. Odds ratios for 6 weeks and 3 months should be interpreted relative to 3 weeks (coded as the reference category), which would have an odds ratio of 1.