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Coronary Heart Disease Risk Factors

Concordance Between Patients and Partners Before and After Bypass Grafting Surgery

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Background: Coronary heart disease (CHD) risk factor reduction is required to maximize the benefits to be gained from coronary artery bypass grafting. Risk factor reduction after surgery, however, is often incomplete and adherence rates are poor. The health behaviors of the cardiac partner can be supportive or can act to undermine the patient's motivation for change in risk factors. Concordance in health behaviors in couples can make it more difficult for patients to engage in positive lifestyle changes. **Objectives:** The aims of this study were to increase understanding of the role of concordance in CHD risk factors and common medical conditions in patients and partners before and 4 months after bypass grafting and to examine changes in the pattern of concordance over time. **Methods:** A prospective study of patients' and partners' CHD risk factors was conducted in the outpatient clinic before and at home 4 months after bypass grafting. **Results:** There was significant concordance for preoperative physical activity, body mass index, and diabetes mellitus, and postoperatively, there was significant concordance for smoking status, physical activity, body mass index, cholesterol, and diabetes mellitus. There were significant associations between patients' preoperative and postoperative physical activity and cholesterol and between the partners' preoperative and postoperative physical activity. There was a significant change in the pattern of concordance for physical activity from preoperation to postoperation, with more patients but not partners increasing their physical activity levels. **Conclusions:** Results revealed significant concordance in CHD risk factors and common medical conditions in patients and partners before and 4 months after coronary artery bypass grafting. This indicates that the behaviors of some couples can make it more difficult for patients to change their lifestyle. The health professionals involved in educating patients before and after bypass grafting need to target the patient and partner as a couple to help achieve more successful risk factor reduction.

KEY WORDS: adherence, concordance, coronary artery bypass surgery, couples, risk factors

Cardiovascular disease (CVD) is a leading cause of mortality and morbidity both in developed and developing countries.[1–3] In the United States, in 2008, the death rate attributable to CVD was 244.8 per 100 000, with 1 in 6 deaths caused by coronary heart disease (CHD).[3,4] In the United Kingdom, in 2009, 180 626 people died of CVD and 2.7 million people were living with CHD.[5] In Scotland alone, the age standardized mortality rate for CHD was 50.4 per 100 000 in 2009.[1] Although the incidence of CHD is declining, its impact is projected to rise[4,5] owing to an increased survival after a cardiac event and an increasingly elderly population.[2,6] This raises new challenges in managing CHD and secondary prevention,[7,8] including ways of supporting individuals to manage their preventive health behaviors as part of self-management.[9]

Patients with advanced coronary artery disease may be recommended coronary artery bypass grafting (CABG) surgery. In 2009, in the United States, more than 416 000 patients underwent bypass grafting.[4] The benefits of CABG include relief of angina, improvement in quality of life, and increase in life expectancy

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in high-risk patients.[10–15] Recent data suggest that the rate of relief of angina 5 years after CABG is 84%.[16,17] Fifteen years after CABG, 62% of patients may experience recurrent myocardial ischemia, 36% of patients may have a myocardial infarction, and 28% of patients may require repeat CABG or require percutaneous coronary intervention.[18] Therefore, CABG is palliative and not curative.[19] Aggressive CHD risk factor reduction is required to maximize the benefits and to reduce the need for further coronary intervention.[20]

Coronary heart disease risk factor reduction preoperatively can be suboptimal.[21] Boatman et al[22] found that hypertension (79%), low-density lipoprotein cholesterol (59%), diabetes mellitus (47%), smoking (33%), and obesity (50%) were suboptimally controlled in patients. Postoperatively, adherence to CHD risk factor reduction can help to reduce the progression of heart disease in both native and grafted coronary arteries.[23] Elevated blood cholesterol, diabetes mellitus, and elevated triglycerides contribute significantly to graft failure.[24] Despite the importance of behavioral change (ie, smoking cessation, taking a healthy diet, and regular exercise),[25,26] risk factor reduction after CABG is often incomplete[27,28] and adherence rates are poor.[29–31] Although CABG can act as a trigger for some patients to modify their CHD risk factors, motivation to change is often short-lived and decreases over time,[25,32] especially on completion of cardiac rehabilitation.[33,34]

Patients having CABG often rely on their spouses (partners) or family members for assistance during recovery.[35,36] Support from both professionals and partners is needed to help patients stop smoking, adopt a healthier diet, and increase physical activity.[37,38] Supportive relationships and the home environment are especially important because lifestyle change takes place in a social context.[39–41] Studies have shown that when patients and partners have similar positive exercise behaviors, patients receive more support, but when they differ in exercise levels, patients receive less support.[38] The health behaviors of cardiac partners can therefore be supportive or act to undermine the patients' motivation for behavior change. It can be particularly difficult for patients to stop smoking when their partners smoke or for them to change to a low-fat diet in a family who consume a high-fat diet.[42] Research has shown that when one spouse improves lifestyle behaviors, the other is more likely to do so.[43]

When patients and partners report similar health behaviors (eg, they are both smokers or both nonsmokers), this is known as concordance. Discordance is when patients and partners do different things (eg, the patient may smoke but the partner does not).[37,44] Several large studies of concordance between marital partners in cardiovascular risk factors and risk of disease have been conducted, with mixed results.[38,43,45–51] For example, the Framingham Heart Study,[46] a large population-based survey of risk factor concordance in patients and spouses, found positive correlations for smoking, systolic and diastolic blood pressure, lipids, and weight but no significant increase in concordance from the longitudinal data examined. Pyke et al[39] identified spousal concordance in CHD risk factors and found high concordance for changes in risk factors over time.

Studies of couples from different European countries have revealed that risk estimates at 10 years are strongly correlated in married couples, with the risk of one member explaining about two-thirds of the cardiovascular risk of the other.[45] Furthermore, Hippisley-Cox and Pringle[52] found that hypertension risk doubles when a spouse is diagnosed as hypertensive, independent of age, diabetes, or body mass index (BMI). Di Castelnuovo et al[53] revealed in a systematic review that the most strongly correlated within-pairs risk factors were for smoking and BMI. Significant positive correlations were also found for diastolic blood pressure, triglycerides, total and low-density lipoprotein cholesterol, weight, and waist-to-hip ratio.[53]

Additional evidence of spousal concordance has come from studies examining single risk factors, such as smoking,[54,55] systolic and diastolic blood pressure,[56] and physical activity.[38] Whereas some risk factors (eg, blood pressure) have been studied extensively, others such as alcohol consumption, obesity, and BMI have been less frequently studied.[57–59] It seems that a limited number of studies have examined concordance of CHD risk factors in defined patient populations, with only one recent study examining concordance in CHD risk factors in CABG patients and their partners.[37] Results revealed spousal concordance for BMI, smoking, exercise, dietary fat, and fiber intake. This indicated that the shared lifestyles of the marital partners may result in increased risk for female partners of men with CHD. However, the risk factors were examined in a subset of patients post-CABG and no longitudinal data were examined.

The present study aimed to increase understanding of the role of concordance in CHD risk factors and common medical conditions in patients and partners before and 4 months after bypass grafting. Three research questions were identified: (1) What is the extent of concordance in CHD risk factors and common medical conditions in patients and partners before and 4 months after bypass grafting? (2) Are there significant associations between the patients' (and partners') preoperative and postoperative CHD risk factors and common medical conditions? (3) Are there significant changes in the pattern of concordance in CHD risk factors between the patients and partners from before to 4 months after operation? In the study, patient and partner concordance (or discordance) for CHD risk factors was identified, as described in Table 1.

TABLE 1 Concordant and Discordant Patients' and Partners' Coronary Risk Factors

		Patients With Coronary Heart Disease	
		Yes	No
Partners	Yes	Couples: both said yes	Couples: patient said no, partner said yes
	No	Couples: partner said no, patient said yes	Couples: both said no

Adapted from Macken et al 2000[37]

We did not distinguish between men and men because of the small number of female patients and male partners in the study.

Methods

This prospective study assessed CABG patients' and their partners' CHD risk factors in the outpatient (OP) clinic before surgery (time point 1) and at home 4 months after surgery (time point 2). The first time period was selected to allow for data collection early in the preoperative period (between 2 and 3 months before CABG). The follow-up period was selected because patients normally see the cardiac surgeon 3 months after surgery and, provided they have made an uncomplicated recovery, would start a cardiac rehabilitation program about this time and plan to return to work 4 months after surgery.

The patients' and partners' CHD risk factors were assessed as part of a wider multifactorial, exploratory prospective study.[60] Patients included were scheduled for a first-time elective CABG procedure, were 80 years or younger, had moderate to severe coronary artery disease (defined as stenosis >70%, or 50% if left main stem disease), and were married or cohabiting. Partners and other close family members were all regarded as partners provided they lived in the same household as the patient and had been identified by them as the main carer. Partners were excluded if they had a history of CHD because they would have a personal motivation for behavior change. Both patients and partners were excluded if there were major comorbidities such as stroke, cancer, or renal or liver failure or if there were communication or psychological problems likely to affect their ability to consent or participate. Those who met the inclusion criteria were recruited from the cardiac surgery OP clinic of a regional cardiology center in Scotland between 2003 and 2004.

Measurement of Coronary Heart Disease Risk Factors

In the absence of a suitable standardized measure for assessing patients' and partners' CHD risk factors, we devised a series of questions to identify smoking status, physical activity levels, BMI, and total blood cholesterol, in accordance with the published literature. Alcohol consumption, hypertension, and diabetes mellitus were identified because they contribute to the individual's overall level of cardiovascular risk.[61] Subjects were classified as follows: 1, current smokers (currently smoking, on a regular daily basis, ≥1 cigarettes per day); 2, ex-smokers (smoked cigarettes in the past); or 3, nonsmokers (never smoked cigarettes).[62] Categories 2 and 3 were recoded as "no" to smoking and category 1 remained as "yes" to smoking, to permit additional statistical analysis. Subjects were asked about the total number of cigarettes smoked per day and the total number of years smoked,[63] recorded as continuous variables.

Physical activity was assessed by self-report. This method is frequently used in clinical practice because it is practical and low cost.[64] The patients and partners were asked about the amount of moderate-intensity physical activity undertaken in a week, such as brisk walking, cycling, or climbing stairs,[65] categorized as follows: 1, very active, 30 minutes of physical activity 5 or more days per week; 2, fairly active, 30 minutes of physical activity 2 to 3 days per week; 3, not very active, 30 minutes of physical activity less than once per week; 4, inactive, no physical activity per week for cardiac reasons; and 5, inactive, no physical activity per week for noncardiac reasons. Categories 1 and 2 were later recoded as "yes," physically active, and categories 3, 4, and 5 were recoded as "no," not physically active. Patients and partners were also asked if they had attended a cardiac rehabilitation program before or after CABG, which was counted in their reports of physical activity.

Body mass index was assessed by self-report, calculated as an index of obesity using weight in kilograms divided by the square of the height in meters (kg/m^2).[66] Body mass index was categorized as follows: 1, less than 18.5 kg/m^2, underweight; 2, 18.5 to 24.9 kg/m^2, normal weight; 3, 25.0 to 29.9 kg/m^2, overweight; 4, 30.0 to 34.9 kg/m^2, obese; and 5, 35.0 kg/m^2 or greater, very obese, as indicators of CVD. Categories 1 and 2 were later recoded as "no" to high BMI and categories 3, 4, and 5 were recoded as "yes" to high BMI. The BMI correlates with total body fat; a BMI of greater than 25.0 kg/m^2 increases the risk of CVD.[67] The patients and partners were asked about blood cholesterol, that is, whether they had been told that it was high (yes/no; a high blood cholesterol was defined as a level of ≥5.0 mmol/L), and to indicate if they were taking cholesterol-lowering drugs.

Alcohol consumption was identified by asking about the quantity and type of alcohol consumed in a week. Hypertension was identified by asking the patients and partners if they had high blood pressure (yes/no). Blood pressure was also measured in mm Hg (in patients), in accordance with the procedure outlined by the British Hypertension Society.[61] High blood pressure was defined as a systolic blood pressure of 140 mm Hg or greater and/or a diastolic blood pressure of 90 mm Hg or greater.[61] A diagnosis of diabetes mellitus was documented as yes/no. Diabetes is important because patients who have diabetes often have poorer outcomes after CABG.[68,69] In total, 7 patient and partner variables and 1 additional patient variable, that is, a premature family history of CHD, were documented. A premature family history of CHD is defined as the number of male relatives who had myocardial infarction or angina before the age of 55 years and the number of female relatives who had a myocardial infarction or angina before the age of 60 years, categorized in accordance with the age thresholds identified by Chow et al.[70] A familial clustering of CHD significantly increases risk of disease in all first degree relatives.[71,72] The degree of risk varies, though, according to age at presentation, the number of relatives affected, and the degree of genetic concordance.[70]

Marital status was classified as married/cohabitating or widowed/divorced/separated. Years of education were recorded because this variable has been shown to be important in studies of cardiac patients and partners.[73,74] Employment status was documented in accordance with the Office of Population Census and Statistics.[75] Social deprivation was categorized as follows: 1 = most affluent to 7 = most deprived.[76] Data on clinical history (ie, symptoms of angina and breathlessness, Canadian Cardiovascular Society grade, New York Heart Association class, left ventricular ejection fraction, and number of diseased vessels) were obtained from the patients themselves and also from their clinical records.

Procedure

After approval was obtained from the university and the local National Health Service Research and Ethics Committees, the patients and partners were recruited a month before the patient's appointment to see the cardiac surgeon. Information about the study and a consent form were mailed out with the patient's OP clinic appointment card. A total of 208 information packs were sent out over a 4-month period, and 88 were returned; approximately 23% of patients and partners agreed to participate in the study, indicated by them returning the signed consent form. They were then contacted by the researcher and arrangements were made to distribute the questionnaires (containing questions about sociodemographics, CHD risk factors, and common medical conditions). The patients and partners were instructed to complete the questionnaires separately and to refrain from discussing their answers. Before the main study, the questionnaires were piloted with 10 patients with CHD and their partners. In the main study, the questionnaires were completed in the OP clinic or at home; a reminder was sent if these were not returned in 2 weeks. After the patients' CABG, subjects were contacted by the researcher and arrangements were made to distribute the questionnaires for completion 4 months after surgery.

Statistical Analysis

The paired-samples *t* test was used for comparison of the patients' and partners' sociodemographics, CHD risk factors, and common medical conditions when data were continuous, and the χ^2 statistic was used for categorical data. Concordance in CHD risk factors and common medical conditions was examined using the McNemar test for nominal data[77] and Pearson product-moment correlations for continuous data.[78] Associations between the patients' (and partners') preoperative and postoperative CHD risk factors were examined using the McNemar test for nominal level measurement,[77] and the paired-samples *t* test was used for continuous data.[78] Changes in the pattern of concordance in CHD risk factors between patients and partners from before to 4 months after the operation were examined using the McNemar-Bowker test (ie, improvement, no change, or deterioration). The McNemar-Bowker test is an extension of the McNemar test that allows more than 2 paired categories to be compared.[79] The 3 categories used to identify changes (ie, improvement, no change, or deterioration) in the pattern of concordance were later collapsed into 2 categories (change or no change), and the McNemar test was applied for consistency.[77] The patient and partner data were treated as paired rather than independent observations in accordance with the recommendations of Kenny et al[80] and Clark-Carter.[77] All analyses were performed using SPSS version 14, and $P < .05$ was taken to indicate statistical significance. A sample size of 40 patients and partners is necessary to detect any significant changes in CHD risk factors and common medical conditions, assuming an α level of .05 (1 tailed). With a sample size of 40, the power to detect a significant change is 80% in the presence of a medium effect size. Given that the sample size in this study is much larger, the power for the analyses described here is even greater.

Results

Sociodemographics, Coronary Heart Disease Risk Factors, and Common Medical Conditions

Eighty-four patients and partners participated in the study. There were 79 patient-partner pairs and 5 patient-family pairs, including 2 daughters and a sister, a son, and a brother. Most patients were male (85%); the patients were significantly older than the partners (mean age, 64.54 vs 61.05 years) (Table 2); they had similar years of education. More patients than partners were retired, and more patients belonged to professional and intermediate (semiprofessional) occupations, compared with nonmanual, manual, and unskilled occupations (Table 2). Twenty-three percent of subjects belonged to social deprivation class 6 to 7 (1 = most affluent to 7 = most deprived).[76] More patients had a diagnosis of hypertension and diabetes mellitus, compared with the partners (Table 2). The patients' mean (SD) systolic blood pressure was 132.85 (17.0) mm Hg and mean (SD) diastolic blood pressure was 72.37 (10.73) mm Hg. Sixty-three percent of the patients were prescribed antihypertensive medications, and 20% of patients were taking oral hyperglycemic agents or insulin therapy for diabetes mellitus.

Details of Surgery, Recovery, and Rehabilitation

Sixty-one patients (73%) had a premature history of CHD. The patients' clinical history, details of surgery, recovery, and rehabilitation are in Table 2. At 4 months follow-up, there were 80 patient and partner pairs

TABLE 2 Summary of Sociodemographics, Common Medical Conditions, and Clinical History

Characteristics	Patients	Partners	*P* Value
Age, mean (median, range), y	64.54 (65, 40–80)	61.05 (63, 24–80)	<.001
Gender			
Male	71 (85)	11 (13)	<.001
Female	13 (15)	73 (87)	
Years of education, mean (median, range)	11.57 (10, 9–21)	11.04 (10, 9–22)	.742
Employment			
Employed	17 (20)	31 (37)	.030
Unemployed	7 (8)	11 (13)	
Retired	60 (71)	42 (50)	
Occupation			
Professional-intermediate	26 (31)	11 (13)	.046
Skilled nonmanual-manual	19 (23)	20 (24)	
Partly skilled-unskilled	39 (46)	53 (63)	
Social deprivation			
Depcat 1–2	24 (28)	–	
Depcat 3–5	41 (49)	–	
Depcat 6–7	19 (23)	–	
Hypertension	53 (63)	7 (8)	<.001
Diabetes mellitus	19 (23)	2 (2)	<.001
Angina	78 (93)	–	
Age onset, mean (median, range), y	60.00 (40–79)	–	
Breathlessness	46 (55)	–	
Myocardial infarction	32 (38)	–	
Age at first MI, mean (median, range), y	60.50 (32–75)	–	
Number of first MI	27 (32)	–	
CCS			
CCS 1–2	42 (50)	–	
CCS 3–4	47 (56)	–	
Missing or no chest pain	6 (7)	–	
NYHA			
Class 1–2	32 (38)	–	
Class 3–4	36 (43)	–	
Missing	5 (6)	–	
Left ventricular ejection fraction			
>50%	55 (65)	–	
30%–49% (moderate impairment)	20 (24)	–	
<29% (severe impairment)	2 (3)	–	
Missing	7 (8)	–	
Number of diseased vessels			
Single-vessel disease	7 (8)	–	
2-vessel disease	28 (34)	–	
3-vessel disease	43 (51)	–	
Missing	6 (7)	–	
Waiting time for surgery, d	63	–	

Abbreviations: CCS, Canadian Cardiovascular Society; MI, myocardial infarction; NYHA, New York Heart Association.
Data are presented as n (%), unless otherwise indicated. Depcat indicates social deprivation categories where 1 = most affluent to 7 = most deprived.

remaining. Two patients died while on the waiting list for CABG, 1 patient died within 24 hours of surgery, and 1 patient had surgery postponed; all their partners withdrew from the study. Two (2%) patients had attended cardiac rehabilitation programs before CABG and 50 (62%) patients attended cardiac rehabilitation postoperatively. None of the partners actively participated in the patient's cardiac rehabilitation program; 2 partners attended cardiac rehabilitation postoperatively to provide transport for the patients.

Preoperative and Postoperative Coronary Heart Disease Risk Factors

The CHD risk factors of the patients and partners are presented in Table 3. Preoperatively, 11% of patients and 19% of partners were smokers compared with 5% of patients and 15% of partners postoperatively. Preoperatively, 12% of patients and 39% of partners were physically active compared with 41% of patients and 23% of partners who were physically active postoperatively. Preoperatively, 65% of patients and 54% of partners were overweight, obese, or very obese (ie, BMI >25.0 kg/m^2) compared with 60% of patients and 50% of partners who had a BMI greater than 25.0 kg/m^2 postoperatively. Preoperatively, 63% of patients and 1% of partners reported having an elevated blood cholesterol compared with 37% of patients and 1% of partners postoperatively (Table 3).

Concordance/Discordance in Coronary Heart Disease Risk Factors and Common Medical Conditions

The patients and partners were significantly concordant for preoperative physical activity and BMI and history of diabetes mellitus. Of the 49 (58%) concordant pairs for physical activity, 8 both said yes to being physically active preoperatively and 41 both said no. In the 35 (42%) discordant pairs, 4 patients said yes to being physically active and 31 partners said no (Table 4). Of the 55 (65%) concordant pairs for BMI, 45 both said yes to having a high BMI preoperatively, that is, being overweight, obese, or very obese, and 10 both said no. In the 29 (35%) discordant pairs, 20 patients said yes to having a high BMI and 9 partners both said no (Table 4). Of the 65 (77%) concordant pairs for diabetes mellitus, 1 both said yes to having diabetes preoperatively and 64 both said no. In the 19 (23%) discordant pairs, 18 patients said yes to having diabetes and 1 partner both said no (Table 4). No significant concordance was found for preoperative smoking status (Table 4) or smoking history, number of cigarettes smoked per day, or alcohol consumption (Table 5).

There were statistically significant results for preoperative cholesterol and a history of hypertension. There were a higher proportion of discordant pairs. Of the 62 (74%) discordant pairs for cholesterol, 62 patients said yes to having a high cholesterol preoperatively and 0 partners said no (Table 4). In the concordant pairs for cholesterol, 1 both said yes to having a high cholesterol and 21 both said no. Of the 58 (69%) discordant pairs for hypertension, 56 patients said yes to having high blood pressure preoperatively and 2 partners said no (Table 4). In the concordant pairs for hypertension, 5 both said yes to having high blood pressure and 21 both said no.

Postoperatively, there was significant concordance for smoking status, physical activity, BMI, cholesterol, and diabetes mellitus. Of the 64 (80%) concordant pairs for smoking postoperatively, 2 both said yes to being current smokers and 62 both said no. In the 16 (20%) discordant pairs, 3 patients said yes to being current smokers, whereas 13 partners said no (Table 4). Of the 48 (60%) concordant pairs for physical activity postoperatively, 16 both said yes to being physically active and 32 both said no. In the 32 (40%) discordant pairs, 25 patients said yes to being physically active, whereas 7 partners said no (Table 4). Of the 54 (68%) concordant pairs for BMI postoperatively, 42 both said yes to having a high BMI, that is, being overweight, obese, or very obese, and 12 both said no. In the 26 (32%) discordant pairs, 18 patients said yes to having a high BMI and 8 partners said no (Table 4). Of the 42 (53%) concordant pairs for high cholesterol postoperatively, 0 both said yes to having a high cholesterol and 42 both said no. In the 38 (47%) discordant pairs, 37 patients said yes to having

TABLE 3 Patients' and Partners' Preoperative and Postoperative Coronary Heart Disease Risk Factors

		Risk Factors			
	n	Current Smoker, n	Physically Active, n	BMI (>25.0 kg/m^2), n	Elevated Cholesterol, n
Preop					
Patients	84	11	12	65	63
Partners	84	19	39	54	1
Postop					
Patients	80	5	41	60	37
Partners	80	15	23	50	1

Abbreviations: BMI, body mass index; Postop, postoperative; Preop, preoperative.

TABLE 4 Concordance in Coronary Heart Disease Risk Factors and Common Medical Conditions Between Patient and Partner Pairs

Variable	Concordant Pairs			Discordant Pairs			McNemar Test *P*
	n (%)	Both Yes	Both No	n (%)	Patient Yes, Partner No	Patient No, Partner Yes	
Smoking (yes/no)							
Preoperative (n = 84)	64 (76)	5	59	20 (24)	6	14	.058
Postoperative (n = 80)	64 (80)	2	62	16 (20)	3	13	.011[a]
Physical activity (yes/no)							
Preoperative (n = 84)	49 (58)	8	41	35 (42)	4	31	<.001[a]
Postoperative (n = 80)	48 (60)	16	32	32 (40)	25	7	.001[a]
Body mass index (high) (yes/no)							
Preoperative (n = 84)	55 (65)	45	10	29 (35)	20	9	.031[a]
Postoperative (n = 80)	54 (68)	42	12	26 (32)	18	8	.038[a]
Cholesterol (told high) (yes/no)							
Preoperative (n = 84)	22 (26)	1	21	62 (74)	62	0	<.001
Postoperative (n = 80)	42 (53)	0	42	38 (47)	37	1	<.001[a]
Hypertension (yes/no)							
Preoperative (n = 84)	26 (31)	5	21	58 (69)	56	2	<.001[a]
Postoperative (n = 80)	–	–	–	–	–	–	–
Diabetes mellitus (yes/no)							
Preoperative (n = 84)	65 (77)	1	64	19 (23)	18	1	<.001[a]
Postoperative (n = 80)	61 (76)	1	60	19 (24)	19	0	<.001[a]
Associations between patients' and partners' preoperative and postoperative risk factors							
Smoking							
Patients	74 (92)	4	70	6 (8)	5	1	.109
Partners	77 (96)	14	63	3 (4)	2	1	.500
Physical activity							
Patients	46 (57)	9	37	34 (42)	2	32	<.001[a]
Partners	63 (79)	22	41	17 (21)	16	1	<.001[a]
Body mass index							
Patients	76 (95)	59	17	4 (5)	3	1	.313
Partners	74 (92)	47	27	6 (7)	3	3	.656
Cholesterol							
Patients	49 (61)	33	16	31 (39)	27	4	<.001[a]
Partners	80 (100)	1	79	0 (0)	0	0	1.000

[a]Statistically significant (1 tailed).

TABLE 5 Concordance for Alcohol Consumption and Smoking Between Patient and Partner Pairs

Variable	Patients		Partners		Correlation Coefficient	
	n (%)	Mean (SD)	n (%)	Mean (SD)	*r*	*P*
Drinker/units of alcohol per week						
Preoperative (n = 84)	54 (64)	13.22 (12.39)	40 (48)	7.79 (6.22)	−0.13	0.480
Postoperative (n = 80)	46 (58)	14.67 (13.05)	43 (54)	7.88 (6.70)	−0.09	0.648
Current smoker/number per day						
Preoperative	11 (13)	23.45 (10.83)	19 (24)	19.74 (8.35)	0.44	0.379
Postoperative	5 (6)	22.00 (9.08)	18 (23)	19.67 (8.17)	−1.00[a]	0.001[a]
Smoking history						
Total number of years smoked		42.18 (8.12)		38.37 (2.37)	0.67	0.144

[a]Significant correlation coefficients.

a high cholesterol and 1 partner said no (Table 4). Of the 61 (76%) concordant pairs for diabetes mellitus postoperatively, 1 both said yes to having diabetes and 60 both said no. In the 19 (24%) discordant pairs, 19 patients said yes to having diabetes and 0 partners said no (Table 4). There was significant concordance postoperatively for the number of cigarettes smoked per day (Table 5), indicating that the patients and partners smoked a similar number of cigarettes. No concordance was found for alcohol consumption postoperatively.

Associations Between Subjects' Preoperative and Postoperative Coronary Heart Disease Risk Factors

The results revealed significant associations between patients' preoperative and postoperative physical activity and cholesterol, but not smoking status or BMI (Table 4). For example, 46 (57%) of 80 patients had similar preoperative and postoperative levels of physical activity and 34 (42%) patients had different levels of physical activity. Forty-nine (61%) of 80 patients had similar preoperative and postoperative cholesterol levels, and 31 (39%) patients had different cholesterol levels. There was also a significant association between the partners' preoperative and postoperative levels of physical activity (Table 4). Sixty-three (79%) of 80 partners had similar preoperative and postoperative levels of physical activity and 17 (21%) partners with different levels of physical activity.

Changes in Concordance From Before to 4 Months After Operation

There was a significant change in the pattern of concordance for physical activity from preoperation to postoperation (P = .007), but not for smoking (P = .453) or BMI (P = .754) (McNemar Test for change or no change). Similarly, when the pattern of concordance for physical activity was examined using the McNemar-Bowker test (for improvement, no change, or deterioration), there was a significant change from preoperation to postoperation (P < .001), but not for smoking (P = .407) or BMI (P = .607). In 37 of 80 patient and partner pairs, there was no significant change in concordance for physical activity (ie, neither patient nor partner showed a change). In 43 of 80 patients and partners, 25 patients were physically active (improved) and 1 patient was physically inactive (deteriorated); 6 partners were physically activity (improved) and 11 partners were physically inactive (deteriorated). More patients than partners were physically active postoperatively. In 72 of 80 patient and partner pairs, neither patient or nor partner showed a change in smoking behavior. In the 8 patients and partners in whom there was a change, 4 patients stopped smoking (ie, improved their behavior) and 1 patient restarted smoking (deteriorated), and 1 partner stopped smoking (improved) and 2 partners restarted smoking (deteriorated). Most patients and partners were nonsmoking preoperatively, so they did not need to change their behavior. In 70 of 80 patient and partner pairs, there was no significant change in concordance for BMI (ie, neither patient nor partner showed a change). In 10 of 80 patients and partners, 3 patients lost weight (improved) and 1 patient gained weight (deteriorated), whereas 3 partners lost weight (improved) and 3 partners gained weight (deteriorated). Most patients and partners were overweight, obese, or very obese preoperatively and postoperatively.

Discussion

The aim of this study was to increase the understanding of the role of concordance in CHD risk factors and common medical conditions in patients and partners before and 4 months after CABG. Our postoperative results for concordance in smoking status, BMI, and total number of cigarettes smoked per day are consistent with Macken et al.[37] Other studies have found spousal concordance for smoking[54,55] and BMI.[59] Our findings for BMI also concur with the findings of Di Castelnuovo et al,[53] who identified concordance in weight and fat distribution between spouses. Other research has shown that obesity-related behaviors are strongest in married couples and couples who have lived together for more than 2 years, suggesting that the shared household environment may increase the likelihood of becoming obese.[81] Our findings for spousal concordance in physical activity are broadly consistent with those of Macken et al,[37] who found significant concordance for the frequency of exercise. They found no significant concordance for current exercise program and duration of exercise. We did not record data on the duration of exercise, and we counted patients' participation in exercise rehabilitation in our reports of physical activity, so a direct comparison of the results is not possible.

The "shared household environment" is often used to explain concordance in health behaviors in couples. When people marry, they share the same environment, income, and social network, which is thought to confer shared risks and benefits.[41] Another explanation suggested by Meyler et al[41] for health concordance in couples is "assortative mating" (ie, people are more likely to marry someone who shares similar characteristics as themselves such as demographics, attitudes, and behaviors).[41] Researchers have been inconsistent in indicating whether concordance in health behaviors is a result of a cohabitation effect, or assortative mating, or both.[41,50,82] It was not possible, given the short-term follow-up, in our study to determine whether concordance in CHD risk factors was a result of one or some of these things, and we had no information on length of marriage/cohabitation. Previous studies have come to different conclusions.[37]

Our findings for alcohol consumption are consistent with those of Graham and Braun,[57] who found no significant concordance for alcohol in couples. Our findings for hypertension and preoperative cholesterol are consistent with those of Macken et al[37] but contrary to other studies' findings.[44,56] We found a greater proportion of patients and partners both said no to having diabetes mellitus. Other studies have found no significant spousal concordance for diabetes mellitus.[53] One explanation for the differences in study findings may be our method of analysis (ie, we conducted between-pairs analysis and other investigators examined within-pairs analysis). Another explanation could be the different methodologies used. For example, some investigators measured systolic and diastolic blood pressure, whereas others, including ourselves, used self-reports of high blood pressure (and measurement of the patients' blood pressure). Other investigators have examined specific cholesterol components such as triglycerides and total and low-density lipoprotein cholesterol, whereas others, including ourselves, used self-reports of high blood cholesterol.

A compelling reason for considering concordance in CHD risk factors was the statistically significant association found between patients' preoperative and postoperative physical activity and cholesterol and the significant association between partners' preoperative and postoperative physical activity. This highlights the importance of implementing prevention strategies early in the preoperative period. Despite guideline recommendations,[83,84] cardiac rehabilitation programs were not widely available to our patients preoperatively. The active involvement of partners in the patient's rehabilitation program was minimal preoperatively and postoperatively.

Our finding of significant changes in the pattern of concordance for physical activity indicated that more patients were physically activity after CABG. Improvement in physical activity is to be expected after CABG because of surgery and/or the benefits of participation in cardiac rehabilitation.[11,85] The patient's participation in cardiac rehabilitation was counted in the measure of physical activity. Our finding is consistent with that of Pyke et al,[39] who found concordance for changes in risk factors, and the Nurse-coordinated multidisciplinary, family-based, ambulatory, preventive cardiology programme (EUROACTION) study of couples attending a hospital-based rehabilitation program.[86] Our finding of no significant changes in the pattern of concordance for BMI was disappointing; most patients remained overweight, obese, or very obese postoperatively. Our results are consistent with the Framingham Heart Survey,[46] which found no significant increase in concordance from the longitudinal data examined. Our finding of no significant changes in the pattern of concordance for smoking was not unexpected, as most patients were nonsmoking postoperatively. It was of concern, though, that even 5 patients were smoking 4 months after CABG given the importance of secondary prevention.[20,87] The couples who both said yes to smoking and those who were discordant in smoking habits could be important groups to consider for referral for smoking cessation.

Taken together, our results extend understanding of concordance in CHD risk factors before and after CABG. The strengths of the study are in its longitudinal design, with analyses of CHD risk factors and common medical conditions in patients and partners before and after CABG. Although other studies have examined CHD risk factors and the risk of disease in spouses, this has seldom been done in studies of CABG patients and partners. We included both married and cohabitating partners; cohabitating couples have not always been considered in concordance research.

Implications

The study findings lend support to the need to target interventions at patients and partners as couples, rather than at patients as individuals and partners as

What's New and Important

- Significant concordance was found for preoperative physical activity, body mass index (BMI), and diabetes mellitus.
  Postoperatively, there was significant concordance found for smoking, physical activity, BMI, and number of cigarettes smoked per day.
- There were significant associations found between patients' preoperative and postoperative physical activity and cholesterol and a significant association between partners' preoperative and postoperative physical activity.
- There was a significant change in the pattern of concordance for physical activity between the patients and partners from before to 4 months after coronary artery bypass grafting (CABG).
  Results highlight the importance of targeting education for both patients and partners before and after CABG to help achieve more successful coronary heart disease risk factor reduction.

individuals.[80] Such interventions provide the opportunity to influence the shared environment in ways that build on couple's strengths, helping to optimize adherence to treatment recommendations and self-care guidelines. Other implications for practice include the need for greater prevention after CABG and the better preparation of patients for surgery. Previous studies have shown that patients and partners (or families) could be better supported in the waiting period for cardiac surgery.[88–92]

Limitations

There are several limitations to this study. First, the sample was composed of predominantly male patients and female partners, but this is typical of most cardiac studies. Second, we used a nonstandard questionnaire to assess CHD risk factors in the absence of a prevalidated instrument suitable for use with both patients and partners. The questions used, however, were derived from previous well-validated studies. Third, the self-report method was used to assess concordance in CHD risk factors and common medical conditions. Fourth, our analysis focused on between-pairs analysis rather than within-pairs analysis. Fifth, the sample size was small, and this might have obscured some relationship influences on behavior change. Further studies are needed to replicate our findings and to measure objectively CHD risk factors and common medical conditions of patients and partners before and after CABG.

Conclusion

Our study revealed significant concordance for CHD risk factors and common medical conditions in patients and partners before and 4 months after CABG. This indicates that the behaviors of some partners can make it more difficult for patients to change their lifestyle. Some pairs were discordant, and this can be problematic, that is, the partner smoking can make it more difficult for the patient to stay stopped. The health professionals involved in education of patients before and after bypass grafting need to target the patient and partner as a couple to help achieve more successful risk factor reduction.

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