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Patient Perception, Preference and Participation

Perceptions of cause of illness in acute myocardial infarction patients: A longitudinal study

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ABSTRACT

Objective: To assess change in patient's attributions of illness over the long term in patients with acute myocardial infarction (AMI).
Methods: 178 patients were asked during the index hospitalization and 2–2.5 years after discharge whether they thought each of 13 possible factors may have contributed to their illness. Two dichotomous variables, conventional attribution (attribution to traditional risk factors, CA) and psychosocial attribution (PA), were defined and assessed for each patient.
Results: General stress, cigarette smoking, and heredity were the most commonly mentioned attribution for the AMI. The proportion of individuals with positive CA increased at follow up. There was little congruence between patients' attributions and actual self-reported risk factors, either at baseline or at follow up. Age, education, country of birth, and anxiety were found as independent predictors of illness attribution. The participation in a cardiac prevention and rehabilitation program (CPRP) did not contribute to a significant change in CA attributions.
Conclusion: Substantial proportions of patients have a poor understanding of the causes of their AMI both at onset of the illness and 2–2.5 years later, notwithstanding CPRP.
Practice implications: The health care system can ill afford complacency with regards patient education and understanding.

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1. Introduction

The current approach to the prevention of heart disease and to the rehabilitation of patients with established disease emphasizes the psychosocial factors as well as the more conventional medical aspects [1–3]. These factors include social, personal, psychological and cognitive factors [1]. The cognitive factor – i.e., the perceptions and beliefs that a person has regarding his/her illness – may play an important role in determining a person's mode of coping with his or her illness. Therefore, this factor may have a crucial impact on patients' recovery and wellness [3,4].

Leventhal proposed a comprehensive theoretical cognitive model for explaining patients' behavior, incorporating perception of cause as one of its major determinants [4]. Most studies in this area have shown that psychosocial factors, especially stress, are very commonly cited causes of illness, in addition to the conventional risk factors such as smoking, hyperlipidemia, sedentary lifestyle and poor diet [1,5–8]. Studies focusing on the associations between cardiac patients' perceptions of the possible cause of their illness and various outcome measures showed that, in most cases, the more the illness was attributed to conventional factors under the patient's behavioral control, the more the patient was likely to perform health promoting behaviors [9,10], including participation in a cardiac prevention and rehabilitation program (CPRP) [11]. Further, patients who attribute their illness to factors such as fate, luck or stress have returned more slowly to work [12] and have had a higher recurrence of acute myocardial infarction [13]. Identification and characterization of patients who tend to attribute their illness only to psychological factors and refrain from attributing their illness to the conventional risk factors may enable health care professionals to direct recommended interventions to the vulnerable population [14].

Few studies have targeted the change in patients' perception of cause of illness over time [1,15]. Cameron et al. [1] reported little change in attributions over a six month period in a small sample

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(n = 65), but did not address associations with possible facilitators such as joining a CPRP.

The objectives of this study are the following:

1. To assess patients' attributions of potential causes of their illness (acute myocardial infarction) and their possible determinants at the time of initial hospitalization.
2. To assess changes in the attributions over a 2-year period following the acute event and determinants of this change (e.g., participation in CPRP).

2. Methods

Ethical approval was obtained from the hospital institutional review board. Signed informed consent was obtained from all participants.

2.1. Study population

The study population consisted of all patients who were admitted between July 2001 and June 2002 to the intensive coronary care unit at Meir Medical Center, located in the central region of Israel. In order to attain a larger sample size we also recruited patients from two wards randomly selected from the five internal medicine wards. When the Intensive Coronary Care Unit at our hospital is full, patients with chest pain are admitted to the Internal Medicine wards. Limitations of manpower precluded the inclusion of all five such wards. Patients were included in the study if they met the following inclusion criteria: (1) admission for acute myocardial infarction based on ECG changes and cardiac enzyme elevations as confirmed in the letter of discharge. Patients with previous MI were included only if they had not previously participated in CPRP; (2) having no severe physical or mental disability that would prevent participation in a prevention and rehabilitation program for heart patients; (3) able to be interviewed in Hebrew. Of 288 patients who met the inclusion criteria, 7 died in the 2 years after admission. Of the 281 eligible patients, 178 consented to be interviewed twice, 41 refused interviews, and 62 patients were discharged from the hospital before they could be interviewed for a response rate of 64%.

2.2. Data collection and definition of variables

Patients were interviewed during hospitalization as soon as possible after they were stable (2–5 days after admission) with standardized questionnaires using hand-held palm computers. The data collected included socio-demographic characteristics, questions on the causal attribution of illness, emotional state and quality of life. Follow-up telephone interviews were carried out 2–2.5 years after the initial interview between July 2003 and October 2004.

To assess causal attribution, the participants were asked whether they thought each of 13 possible contributing factors, as listed in Fig. 1, had caused their illness (yes, no). The possible causes listed were (1) well-established conventional risk factors: smoking, hyperlipidemia, diabetes, hypertension, overweight, lack of physical activity, hereditary factors, old age, and (2) psychosocial risk factors: stress/problems at home, stress/problems at work, general stress, and a traumatic life event as well as strenuous physical work. For patients responding negatively to all risk factors, "other" or "don't know" was offered as a final option. Two dichotomous variables, conventional attribution (CA) and psychosocial attribution (PA), were defined for each patient. Patients were classified with positive CA if they attributed at least one of the conventional risk factors to their illness. Patients were classified with positive PA if they attributed at least one of the psychosocial risk factors to their illness. Thus each patient received two dichotomous scores, one for CA (yes/no) and the other for PA (yes/no). In addition, patients were questioned regarding their own conventional risk factors (hyperlipidemia, hypertension, diabetes, smoking, obesity, sedentary lifestyle, and heredity; yes/no for each variable).

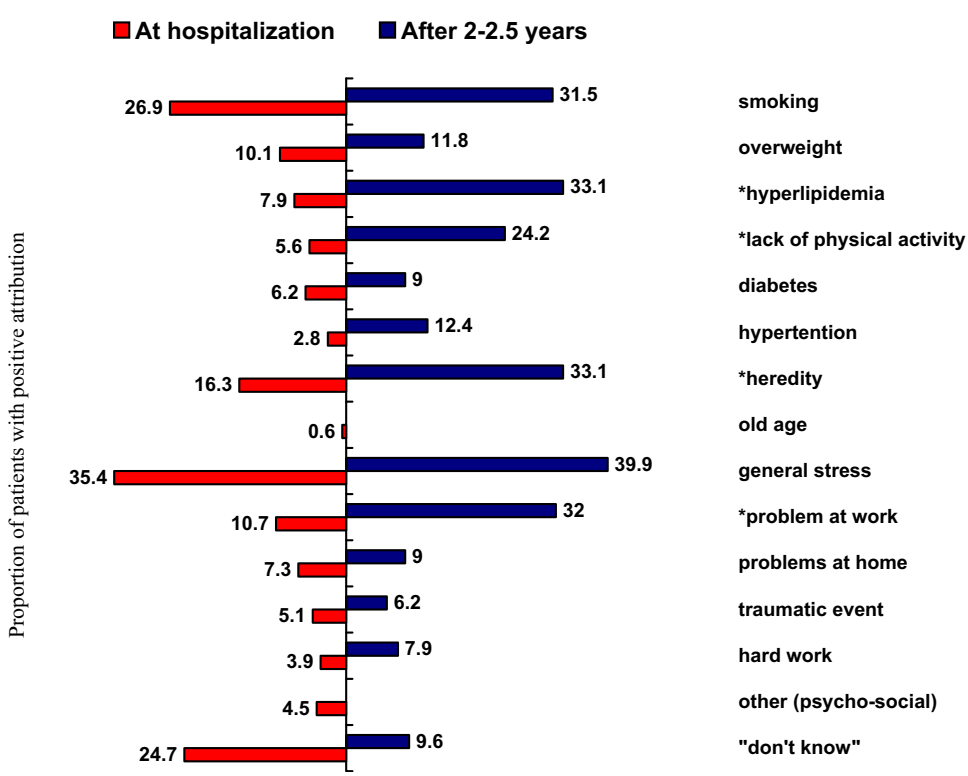

Fig. 1. The proportion of acute MI patients who attributed their illness to each of 13 possible causes upon initial admission and 2–2.5 years later.

Patients' *Emotional state* was assessed by two scales of the Symptoms Checklist-90 (SCL90) [16] using a validated Hebrew version [17]. This instrument measures current psychopathology using nine primary symptom constructs. In the current study we used the depression and anxiety scales which are the two most frequently reported emotional states among patients with coronary heart disease [18,19]. Each item of the questionnaire is rated by the patient on a five-point scale ranging from 1 (none) to 5 (extreme). Separate averages for anxiety (10 items) and depression (13 items) were calculated for each patient.

Patients' *Quality of life* was assessed at admission using the validated Hebrew language version of the Medical Outcome Study 36-Item Short Form [20], which measures self perception of quality of life during the four weeks prior to the index hospitalization. Two variables, physical quality of life (PQL) and mental quality of life (MQL), were defined for each patient on a scale ranging from 0 to 100, with 100 representing the highest level of functioning possible.

Socio-demographic characteristics included gender, age, country of birth, marital status, level of education, income, population group (Jewish, Arab), and religiosity (Jewish religious identity is commonly defined and measured in terms of three categories: religious [orthodox and ultraorthodox], traditional, and secular [21]), which were recorded upon hospitalization.

Follow-up interview: At follow-up, 2–2.5 years after initial hospitalization, the participants were again asked whether they thought each of the 13 possible contributing factors had caused their illness and if they had participated in a CPRP.

2.3. Data analysis

Statistical analyses were carried out using SPSS-17 software. In univariate analyses, chi-square tests for categorical variables and the *t*-tests for continuous variables were used to evaluate differences between respondents and non-respondents and to assess the associations between attribution variables (CA, PA) and socio-demographic variables. Associations between the attribution variables and emotional state and quality of life were assessed by the nonparametric Mann–Whitney test since the original data and the transformed data did not conform to a normal distribution. The stability of the attributions over 2–2.5 years of follow up was measured by the McNemar's test for paired proportions.

In order to explore the associations of the patients' personal characteristics with perceptions of the causes of illness at the baseline admission, logistic regressions were performed separately for CA and PA, using a backward stepwise procedure with an exit significance level of $P > .2$. The predictor variables included were the socio-demographic characteristics (gender, age, place of birth, marital status, religiosity, level of education, income, and population group), the number of traditional cardiovascular risk factors as reported by the patients, emotional state (anxiety and depression) and quality of life (PQL and MQL). In order to explore whether patients' personal characteristics and participation in a rehabilitation program predicted a change of perceptions of the causes of illness, backward stepwise logistic regression was performed separately for CA and PA and each of the risk factors that showed a statistically significant change over the 2–2.5 year follow up.

3. Results

A comparison between respondents ($n = 178$) and non-respondents who were eligible for inclusion ($n = 103$) showed lower representation of Arab patients (42.4% of the Arabs were interviewed vs. 66% of the Jews ($P = .01$)). No significant differences in age, gender, country of birth, marital status, and health maintenance organization (HMO) were found between respondents and non-respondents.

Table 1
Characteristics of study participants ($n = 178$).

Variable	(*n*)	Interviewed (178)
Age (mean + SD)		55.6 + 11.0
Gender (%)		
Male	155	87.1
Female	23	12.9
Country of birth (%)		
Israel	92	51.7
Asia	23	12.9
Europe/America	51	28.7
North Africa	12	6.7
Marital status (%)		
Married	162	91.0
Other	16	9.0
Population group (%)		
Jews	164	92.1
Arabs	14	7.9
Education (mean + SD)		12.8 + 3.4
Monthly income – NIS[a] (%)		
≤6000		32.6
6001–8000		20.0
>8000		47.4
Work status[b] (%)		
Employed	130	73.0
Not employed	48	27.0
Religious observance (%)		
Secular	118	66.3
Traditional	45	25.3
Religious	15	8.4
Anxiety (mean + SD)	178	1.58 + .66
Depression (mean + SD)	178	1.87 + .75
PQL (mean + SD)	178	48.56 + 9.82
MQL (mean + SD)	178	50.93 + 7.07

[a] Average monthly wage of employees in Israel in 2002 was equals to 7570 NIS.
[b] 85% ($N = 111$) of the patients returned to work after the index hospitalization.

The demographic characteristics of the study population are described in Table 1.

3.1. Patients' perception of illness at the time of hospitalization

When asked about the possible causes of their illness, an illness attribute was identified by 75.3% of the patients; 51.7% attributed at least one conventional risk factor, and 46.1% at least one

Table 2
Distribution of causal attributions during hospitalization among acute myocardial infarction patients.

	n	%[a]		
Classic attributions				
Smoking	48	19.4	**136 (55. 1%) CA**	247 (100%) Total attributions
Hereditary factors	29	11.7		
Overweight	18	7.3		
Hyperlipidemia	14	5.7		
Diabetes	11	4.4		
Lack of physical activity	10	4.1	**111 (44.9%) PA**	
Hypertension	5	2.0		
Old age	1	.5		
Psychosocial attributions				
General stress	63	25.5		
Stress/problems at work	19	7.7		
Stress/problems at home	13	5.3		
Traumatic event	9	3.6		
Hard work	7	2.8		
Do not know	52			

[a] Calculated as a percentage of all attributions (patients could make more than one attribution) after exclusion of "Don't know".

Table 3
Prevalence of self reported conventional risk factors and congruent conventional attributions, at baseline and after 2–2.5 years.

Variable	% (*n*) of all patients with risk factor	% (*n*) of those with risk factor with congruent attribution at baseline	% (*n*) of those with risk factor with congruent attribution after 2 years
Current smoking	51.7 (92)	51.1 (47)	55.4 (51)
Overweight	45.2 (80)	20.0 (16)	23.8 (19)
Sedentary lifestyle	62.4 (111)	7.2 (8)	27.9* (31)
Hyperlipidemia	39.3 (70)	17.1 (12)	51.4* (36)
Hypertension	34.3 (61)	8.2 (5)	34.4* (21)
Diabetes	20.8 (37)	29.7 (11)	43.2 (16)

* $P < .05$

psychosocial factor. For all possible causes presented, 24.7% of the patients responded negatively and indicated "Don't know" rather then offering an unlisted cause; 4.5% offered an unlisted cause of a large variety (e.g., "evil eye", fate, a recent quarrel with a neighbor). In all these cases the causes were non-conventional and were tabulated with the PA.

General stress was the most commonly mentioned cause for the coronary event (35% of patients), followed by cigarette smoking (27%) and heredity (16%) (Fig. 1). Only 8%, 7%, 6% and 3% of patients attributed their acute event to dyslipidemia, overweight, lack of exercise and hypertension, respectively. The distribution of the attributions is described in Table 2.

Based on the self-reported risk factor status among the acute myocardial infarction patients upon admission, 96.1% of the patients had one or more conventional risk factors. Patients with positive PA had on average 3.35 risk factors vs. 2.52 among those with negative attribution. Patients with more risk factors were more likely to make conventional attributions. Specifically for each conventional risk factor, 51% of the smokers, 30% of those with diabetes, 20% of the obese, 17% of those with hyperlipidemia, 8% of the hypertensives and 7% of the sedentary attributed their risk factors as a cause of their acute event (Table 3).

Table 4
Univariate associations of socio-demographic variables, emotional state and quality of life with the classic risk factor (CA) and psychosocial attributions (PA) at baseline.

	Positive CA, *n* (%)	Positive PA, *n* (%)
Socio-demographic variables		
Gender		
Male	82 (52.9)	67 (43.2)*
Female	8 (43.5)	15 (65.2)
Age		
<54	53 (61.6)**	42 (48.8)
55–64	27 (50.9)	25 (47.2)
>65	12 (30.8)	15 (38.5)
Place of birth		
Israel	54 (58.7)	35 (38.0)**
Asia or North Africa	15 (42.9)	24 (68.6)
America or Europe	23 (45.1)	23 (45.1)
Religiosity		
Secular	67 (56.8)	50 (42.4)
Religious or traditional	25 (41.7)	32 (53.3)
Level of education (years)		
<12	43 (41.7)**	51 (49.5)
>12	49 (65.3)	31 (41.3)
Income (NIS per month)		
<6000	30 (52.6)	22 (38.6)
6001–8000	13 (37.1)	21 (60.0)
>8000	48 (57.8)	38 (45.8)
Emotional state		
Anxiety		
Low (<1.375, median)	45 (47.9)	26 (27.7)***
High (>1.375)	47 (56.0)	56 (66.7)
Depression		
Low (<1.636, median)	40 (50.0)	25 (31.3)***
High (>1.636)	52 (53.6)	57 (58.8)
Quality of life		
PQL		
Low (<51.205, median)	44 (49.4)	43 (48.3)
High (>51.205)	48 (53.9)	39 (43.8)
MQL		
Low (<53.105, median)	47 (52.8)	54 (60.7)***
High (>53.105)	45 (50.6)	28 (31.5)

* $P < .05$.
** $P < .01$.
*** $P < .001$.

3.2. Relationship of perception of illness with the demographic characteristics, emotional state, and quality of life in the period before and during the hospitalization

Univariate analyses (Table 4) and multivariable logistic model (Table 5) pointed to significant associations of age and education as well as the number of the patient's self-reported conventional risk factors with conventional attribution (CA). Older and less educated patients were less likely to make conventional attributions. Place of birth, depression, anxiety and quality of life showed no such associations.

As for the prediction of psychosocial attribution, univariate analysis showed significant associations of gender, place of birth, depression, anxiety and MQL with PA (Table 4). The multivariable logistic model (Table 5) showed that country of birth was independently associated with PA; those born in Asia/North Africa were more likely to attribute their illness to psychosocial factors than patients born in Israel, the Americas or Europe. Among the emotional health variables studied, the level of anxiety was the only predictor of PA. PQL was also independently associated with PA.

Table 5
The association of socio-demographic characteristics, emotional state, and quality of life with conventional and psychosocial attributions at baseline assessed by using backward stepwise logistic regression.

Variable	*B*	Wald test (*Z*-ratio)	Odds ratio[a] (95% CI)	*P* value
Conventional risk factor attribution				
Age	−.035	4.652	.96 (.93–.99)	.031
Education	.179	10.478	1.19 (1.07–1.3)	.001
Number of risk factors	.267	5.026	1.30 (1.03–1.64)	.025
Nagelkerke *R* square = .220				
Psychosocial attribution				
Country of birth (2df)				.014
Asia/North Africa	1.510	8.035	4.52 (1.59–12.85)	.005[b]
Europe/America	.603	2.24	1.82 (.831–4.02)	.134[b]
Anxiety	1.69	17.578	5.45 (2.46–12.04)	<.001
PQL	.046	4.42	1.04 (1.00–1.09)	.035
MQL	−.038	1.838	.963 (.91–1.01)	.175
Nagelkerke *R* square = .317				

[a] *Values*: CA and PA −1 = positive attribution, 0 = negative attribution; age in years; education in years; gender 1 = male, 2 = female.
[b] Country of birth as dummy variables with Israeli-born as the referent category Income introduced as an interval variable; number of self-reported risk factors harbored by the respondent as an interval variable; depression, anxiety, PQL and MQL all introduced as continuous variables.

3.3. Change in attributions after 2 years

Two years post admission, changes were detected in patients' attributions of the causes of their illness. The proportion of patients attributing their illness to any of the factors listed (including "other") increased from 75.3% to 90.4%. Specifically, the proportions of patients attributing their illness to conventional risk factors increased from 51.7% to 77.5%, and for the psychosocial factors from 46.1% to 64.0%. The number of absolute attributions to conventional factors and to psychosocial factors also increased over the follow-up period (from 136 to 276 and from 111 to 169, respectively).

There were some considerable changes in attributions (Fig. 1): 4-fold increases in hyperlipidemia (from 8% to 33%), leading a sedentary lifestyle (from 6% to 24%), and hypertension (from 3% to 12%), a 2-fold change in attributing the acute event to heredity (from 16% to 33%), and a tripling of attributions to problems at work (from 11% to 32%). The leading cause to which patients attributed their illness remained stress (40%) followed by, in this order, heredity (33%), hyperlipidemia (33%), smoking (32%), and problems at work (32%). There was little change in attribution for smoking, overweight and diabetes in which patient behaviors were critical components.

We also assessed whether a subsequent hospital admission for coronary-related conditions or procedures during follow-up contributes to patients' perceptions. An analysis comparing the attributions to CA and PA between patients who were re-admitted ($n = 68$) vs. those not ($n = 110$) showed no significant between-group differences at baseline, at 2 years, or in change of attribution over the follow up period.

When we focused on self-reported risk factor status (Table 3), there was again no real change among the smokers, the overweight patients, or the diabetic patients. Almost half of the smokers, more than half the diabetic patients, and three quarters of the overweight patients did not see their risk factor as associated with the acute event. Although there were 3–4-fold increases in risk perception for lack of exercise (7–28%), hyperlipidemia (17–51%) and hypertension (8–34%), lack of knowledge or denial of the significance of CA remained commonplace.

Of the population analyzed at follow up, 85 of 178 (47.8%) had participated in a formal cardiac rehabilitation program. The multivariable logistic model of changes in attribution, which included this variable (Table 6), showed only education to be significantly independently associated with change in perception of conventional risk factors; the less educated patients were more likely to increase attribution of their illness to any conventional risk factor. Women and less depressed patients showed less change (not nominally statistically significant), whereas there was no independent effect of participation in CPRP. There was an inverse association of age and anxiety with increased psychosocial attribution; younger patients and less anxious patients were more likely at follow-up to increase attribution of their illness to PA. Again, CPRP made no contribution. When we focused on change in attribution separately for lack of physical activity, hypertension, and hyperlipidemia among those with the risk factor at baseline, the main finding of interest was an association between participation in CPRP and change in attribution to lack of physical activity; those who participated in CPRP were more likely to increase attribution with regard to sedentary lifestyle (OR = 2.96, 95%CI = 1.22–7.9, $P = .01$). There were no other statistically significant associations between participation in CPRP and a change in causal attribution of the myocardial infarction. In addition, country of birth and religiosity were independently associated with change in attribution to hypertension; those born in the Americas or Europe were more likely to change their attribution to hypertension than patients born in Israel, Asia or North Africa (OR = 5.13, 95%CI = 1.18–22.2, $P = .03$); religious or traditional patients were more likely to change their attribution to hypertension than secular patients (OR = 5.31, 95%CI = 1.11–25.3, $P = .01$). No significant predictors of change in attribution to hyperlipidemia were found.

Table 6
Backward stepwise logistic regression to predict change in attributions by socio-demographic characteristics, emotional state, quality of life and participation in CPRP.

Variable	*B*	Wald test (*Z*-ratio)	Odds ratio[a] (95% CI)	*P* value
Conventional risk factor attribution ($n = 178$)				
Sex	.889	3.186	2.43 (.917–6.45)	.074
Education	−.179	10.241	.836 (.749–.933)	.001
Depression	−.399	2.659	.671 (.415–1.08)	.103
Nagelkerke *R* square = .108				
Psychosocial attribution ($n = 178$)				
Age	−.036	4.985	.964 (.934–.996)	.026
Anxiety	−.743	5.521	.476 (.256–.884)	.01
PQL	−.031	2.711	.970 (.935–1.00)	.10
Nagelkerke *R* square = .077				

[a] *Values*: CA and PA −1 = positive change in attribution, 0 = other; age in years; education in years; gender 1 = male, 2 = female; country of birth introduced as 2 dummy variables with Israeli-born as the referent category; religiosity 0 = secular, 1 = religious or traditional; participation in CPRP 1 = no. 2 = yes; depression, anxiety, PQL and MQL all introduced as continuous variables.

4. Discussion and conclusion

4.1. Discussion

Patients' perception of the causes of their illness has been found to be an important factor impacting behavior and outcomes [9–12]. We report here a comprehensive study of patients' attributions of their illness and the associations between these attributions and demographic characteristics, emotional state, and quality of life. The current study incorporated a consecutive sample of patients admitted with acute myocardial infarction in a longitudinal design. The same patients were re-studied at 2–2.5 years after the index hospitalization to measure the impact of time, participation in CPRP and subsequent follow-up care on these attributions. Here we focused on the contribution of joining a formal cardiac rehabilitation program to change in patients' attributions of perceived causes of illness over time.

We divided perceived causes into two categories. The first category comprised conventional risk factors such as smoking, overweight and hyperlipidemia. The second category included psychosocial risk factors such as stress, traumatic events and difficult working conditions.

Our principal findings point to associations between patient characteristics and their perception of the causes of the disease. Younger age and higher levels of education were found to be independently associated with initially attributing the illness to conventional risk factors whereas country of birth and anxiety were found to be associated with relating the illness to psychosocial factors. We infer from these findings that patients who are older, less educated, Asian or North African-born, and whose level of anxiety is high, represent groups who would benefit the most from interventions to increase their awareness of conventional risk factors.

Among less educated and older patients it is possible that lack of knowledge and poor awareness of risk factors contribute to misconceptions regarding the role of conventional risk factors in the genesis of the disease. The role of country of birth in determining the nature of illness attribution to PA suggests the contribution of cultural differences. Israel is composed of a multi-

ethnic mix and there is increasing awareness of the importance of cultural background in determining health behavior and conceptions [22–25]. Our findings are consistent with a study of cancer patients in Israel, in which the authors report differences in perceptions and causal attributions, between 'Western' patients and that of the 'Oriental' ones. The authors explained that patients whose origins were Western were more science-oriented and active compared with the more fatalistic and passive patients of Oriental origin [22]. Our findings underscore the importance of this variable which should be addressed in a more comprehensive format in future studies in our group.

The relationship between high levels of anxiety and the attribution of the illness to psychosocial causes may indicate that patients with preexisting high levels of anxiety felt that this was an important element in the development of their own illness.

There was also significant congruence between the number of self reported conventional risk factors and conventional attributions at baseline. This finding emphasizes the importance of educating patients regarding their conventional risk factors.

The increase in the number of conventional factors identified as well as in the proportion of individuals relating their attacks to conventional risk factors at the end of 2–2.5 years following the acute episode, suggests that some effective learning took place during that period. The fact that stress was the most commonly mentioned cause for the coronary event is compatible with other findings in the literature as well as with folk attitudes toward disease [1,5–8]. This observation is consistent with the substantial recognition of stress as a primary risk factor, which derives from a western lifestyle [26] Our observation that stress remains the primary attribution over a period of time shows the strength of that attribution and suggests that impacting on one's beliefs and perceptions is complicated and requires appropriate interventions.

The limited existing literature suggests that attributions of illness among cardiac patients persist over time [1,15]. Our data, consisting of the largest group followed to date, confirms those observations. Although we report some changes among all the patients, when we focused on patients' causal attributions with reference to their actual self-reported risk factor profile, only three of the six attributions were associated with change. There was no significant change in attribution among the smokers, the diabetics, or the overweight patients. Although change was substantial for sedentary lifestyle, hyperlipidemia and hypertension, lack of knowledge or denial remained commonplace.

Even among patients participating in a high quality comprehensive program of cardiac rehabilitation [27], which included intensive education about causal risk factors, changes of attribution to CA were small. Participation in CPRP was associated with increased attribution only with regard to sedentary lifestyle, and even then three fourths did not acknowledge an association. It appears that the current CPRP in our institution, which follows AHA guidelines [28], has failed in this regard.

The current study generates new questions worthy of further exploration: first, the fact that country of birth and religiosity were independently associated with change in attribution to hypertension underscores the importance of including and exploring social–cultural variables in future studies. Second, since social support has positive effect on the promotion of health following cardiac event [29] future studies should consider the contribution of social support to patients' attributions. Third, exploring these issues among different ethnic groups is an important need. The Arab population in Israel, which is more vulnerable having a higher incidence of coronary heart disease [30–32], was insufficiently addressed in our study, due to the small number of Arab patients that participated. Research that identifies culture-based beliefs among the Arab population is necessary.

4.2. Conclusion

Substantial numbers of patients have poor understanding of the causes of their AMI both at onset of the illness and 2–2.5 years later. Some groups such as older, less educated, Asian or North Africa-born, and those whose level of anxiety is high are vulnerable populations, which probably would benefit the most from interventions to increase their awareness of conventional risk factors. Participation in CPRP which includes education about causal attribution has little contribution over the long term to change in patients understanding regarding their own risk factors.

4.3. Practice implications

The health care system can ill afford complacency with regards patient education and understanding. The development of improved methodologies for patient understanding of their illness is essential. A major recommendation proceeding from our study relates to the need for appropriate interventions in CPRP to change perceptions in vulnerable populations. The main recommendation is to examine whether the combination of appropriate intervention changes illness perception, increases awareness of conventional risk factors and affects subsequent behaviors. A recommended intervention, whose effectiveness is emphasized in the literature, is based on the "self-regulation model" of Leventhal [33]. The intervention explores the patient's beliefs about the cause of the AMI. Attention is given to addressing common misconceptions, such that stress is singularly responsible for the event and broadening the patient's causal model by including the importance of lifestyle factors in the etiology of AMI.

In summary, the present study has demonstrated that substantial proportion of AMI patients has a poor understanding of the cause of their illness. Participation in CPRP which includes health education has little contribution over the long term in patients understanding regarding their own risk factors. The health care system can ill afford complacency with regards patient education and understanding.

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