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The aim of the present study is to examine the relation between understanding of emotions and cardiovascular related diseases, namely coronary heart disease, diabetes mellitus and obesity. Coronary heart disease is a type of cardiovascular disease that usually coexists with other diseases, such as diabetes mellitus and obesity. The uniqueness of this study lies in the fact that examined the relationship between the cardiovascular related diseases named above and the understanding of emotions in the context of Emotional Intelligence (EI). The latter consists of a wide range of psychological factors that reflect many aspects of human thought and behavior, providing a very comprehensive picture of each person. The experimental design through the observed variables were approached, has not been applied in previous studies internationally. The study was conducted in 300 participants during a 3 year period. All participants completed a self-report questionnaire, assessing various aspects of EI, such as self-emotion appraisal, other emotion appraisal, emotion regulation and use of emotions. As hypothesized, coronary heart disease is a prognostic factor of regulation of emotions. The results of this study extend and reinforce the findings of previous studies, which emphasize on the relationship of cardiovascular related diseases and psychological characteristics, such as anxiety and anger, being aspects of EI. Additionally, this work fills a gap in the relevant Greek literature, as a first attempt to examine the correlation of EI with cardiovascular related diseases. New approaches are needed to improve primary prevention, early detection and clinical management of those diseases. Furthermore, this study focused on the need to cultivate and improve EI of patients, in order to eliminate the effects of the diseases.

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Abstract

The aim of the present study is to examine the relation between understanding of emotions and cardiovascular related diseases, namely coronary heart disease, diabetes mellitus and obesity. Coronary heart disease is a type of cardiovascular disease that usually coexists with other diseases, such as diabetes mellitus and obesity. The uniqueness of this study lies in the fact that examined the relationship between the cardiovascular related diseases named above and the understanding of emotions in the context of Emotional Intelligence (EI). The latter consists of a wide range of psychological factors that reflect many aspects of human thought and behavior, providing a very comprehensive picture of each person. The experimental design through the observed variables were approached, has not been applied in previous studies internationally. The study was conducted in 300 participants during a 3 year period. All participants completed a self-report questionnaire, assessing various aspects of EI, such as self-emotion appraisal, other emotion appraisal, emotion regulation and use of emotions. As hypothesized, coronary heart disease is a prognostic factor of regulation of emotions. The results of this study extend and reinforce the findings of previous studies, which emphasize on the relationship of cardiovascular related diseases and psychological characteristics, such as anxiety and anger, being aspects of EI. Additionally, this work fills a gap in the relevant Greek literature, as a first attempt to examine the correlation of EI with cardiovascular related diseases. New approaches are needed to improve primary prevention, early detection and clinical management of those diseases. Furthermore, this study focused on the need to cultivate and improve EI of patients, in order to eliminate the effects of the diseases.

Key words

Emotional intelligence, Coronary heart disease, Diabetes mellitus, Obesity, Understanding of emotion, Regulation of emotion, Negative emotions

Introduction

While there is a lot of interesting scientific study of the brain and nervous system for the understanding of emotions, it hasn't yet produced a simple model that can guide a physician in managing the emotions of a person in favor of his health. Numerous studies have confirmed that, on the one hand, negative emotions and thoughts may cause disease. On the other hand, positive emotions can improve or eliminate disease. Disease, such as coronary heart disease, diabetes mellitus and obesity, can be a result of long lasting negative thoughts, such as stress, anger, anxiety or resentment. The relation, between these negative emotions and various diseases has been well documented. Research, however, on the relation between understanding of emotions and disease is lacking. The present study is an attempt to examine the relation between emotional understanding and cardiovascular related diseases, namely coronary heart disease, diabetes mellitus and obesity. Establishing which diseases are independent risk factors for understanding of emotions, could have a significant impact on emotional health, through the treatment of these cardiovascular related diseases. Furthermore, the better understanding of human emotions will lead scientists to design treatments that will be more effective than current treatments. Emotions were studied within the theoretical context of Emotional Intelligence (EI), which affects people's physical and mental health (Goleman, 1995; 1998).

Emotions and coronary heart disease

Coronary heart disease is a significant public health issue, due to its high prevalence and mortality rate (National Institutes of Health, 2012). A number of clinical and experimental studies indicate that strong emotions, especially negative emotions, such as hostility, anger, depression and anxiety, precipitate coronary heart disease (Tunstall-Pedoe, 2001). On the one hand, coronary heart disease patients have difficulty in coping with stress and depression and experience negative emotions, like anger or frustration. On the other hand, positive emotions,

especially hope, contribute to health benefits and lead to lower levels of coronary heart disease (Carr, 2008; Koelsch, Enge & Jentschke, 2012).

Stress is one of the most predisposing factors of people with coronary heart disease. Between 20% and 40% of all middle-aged women and men report stress-related symptoms in population studies (Tibblin et al., 1990). The relation between anxiety and coronary heart disease has been the subject of several studies, most of which indicate that stressful events are associated with coronary heart disease. Sudden and profound emotional stress, namely, death of relatives, domestic abuse, severe arguments, medical diagnoses, devastating financial loss, can trigger acute heart failure in individuals who are free from cardiac disease (Engel, 1971). Social relationships, size and diversity of networks, and positive support from others have also received empirical attention as psychosocial factors linked to coronary heart disease. Studies show that greater conflict in close relationships predicted myocardial infarction for both genders (De Vogli, Chandola, Marmot, 2007). With respect to the stressful aspects of relationships, the Stockholm Female Coronary Risk Study reported that marital stress nearly tripled the risk for recurrent events (Orth-Gomér et al., 2000), and a followup analysis concluded that it was the combination of work and marital stress that was the strongest predictor of recurrent disease (Orth-Gomér, Leineweber, 2005). Two analyses conducted with the Whitehall II cohort study found that both job strain and effort-reward imbalance were positively associated with the occurrence of coronary heart disease for men and women (Kuper, Marmot, 2003; Kuper et al., 2002). An analysis of the Framingham Offspring study reported that more demanding and stressful jobs increased risk of coronary heart disease incidents mainly in women (Eaker et al., 2004).

Apart from anxiety disorders, numerous studies confirm the prominence of depressive symptoms and major depression in patients with coronary heart disease (Panagiotakos et al., 2002;

Musselman, Evans & Nemeroff, 1998; Goldston, Baillie, 2008; Rozanski, Blumenthal & Kaplan, 1999). A strong suggestion of a dose-response relationship between depression and coronary heart disease was identified (Hemingway, Marmot, 1999). Depression meeting diagnostic criteria was associated with a higher risk of coronary heart disease compared to depressive symptoms (Rugulies, 2002; Van der Kooy et al., 2007). For both genders, the somatic symptoms of depression, such as fatigue, may be more closely related to clinical coronary heart disease events. These somatic symptoms may be a marker of early coronary heart disease, poor general health, and/or sickness behavior related to systemic inflammatory processes (Reichenberg et al., 2001).

The personality of an individual has profound effects on the peripheral physiology, due to modulatory influence of brain structures on peripheral organs and tissues through the autonomic, the endocrine and the immune system. These modulatory influences are relevant for the understanding of coronary heart disease (Carney, Freedland, Veith, 2005; Kemp et al., 2010). Personality is associated with factors that cause disease and may lead to behaviors that protect or diminish health, or may relate to the successful implementation of health-related coping efforts and adherence to treatment regimens (Caspi, Roberts, & Shiner, 2005; Contrada, Cather & O'Leart, 1999; Ozer, Benet-Martinez, 2006). Heart activity is directly and indirectly modulated by personality or behavioural factors (Chechetto, 2004; Craig, 2005). Type A behaviour, Type D behaviour, anger and hostility or inadequate coping style have all been shown to influence risk of coronary heart disease (Littman, 1993; Denollet, Brutsaert, 1998; Knox, Follmann, 1993). Hostility is an enduring personality trait that includes emotional (anger) as well as attitudinal (cynicism and mistrust of others) and behavioral (overt and repressed aggression) components (Cook, Medley, 1954), and numerous cross-sectional and prospective studies have highlighted hostility as a robust independent risk factor for coronary heart disease and all-cause mortality in humans (Miller et al., 1996; Niaura et al., 2002; Chida, Steptoe, 2009). Relative to negative

psychological factors, positive factors have received relatively little study in relation to coronary heart disease. Optimism, a dispositional tendency to expect positive outcomes, was associated with reduced risk for myocardial infarction and coronary heart disease mortality in the Women's Health Initiative study (Tindle et al., 2009).

Emotions and diabetes mellitus

According to the World Health Organization, approximately 220 million people worldwide have type 2 diabetes mellitus (World Health Organization, 2009). It has been definitely established that emotions play a role in the fluctuation of sugar level in cases of diabetes (Daniels, 1939; Daniels, 1944). There is also considerable growing evidence that such factors may be important in the precipitation of the condition. Patients with type 2 diabetes mellitus have a higher risk level for depression and suffer from high levels of emotional stress compared to healthy controls (Schram, Baan & Pouwer, 2009; Kokoszka et al., 2009). Anxiety and fear are the most frequent emotional disorders among diabetic patients, which have been confirmed by the results of many studies (Peyrot & Rubin, 2000; Pibernik-Okanovic et al., 2005; Thomas, et al., 2003). Numerous studies have confirmed that the course of depression in patients with diabetes is more severe, and the relapses of depression episodes are more frequent, especially in patients with unbalanced diabetes. Data from the National Heath and Nutrition Examination Survey indicate that attaining good diabetes control is possible in only approximately 40% of patients (Saddine et al., 2006). The prevalence of depression among patients with diabetes is 1.5 to 3 times higher than in the general population (Gavard, Lustman & Clouse, 1993; Nichols & Brown, 2003).

The studies show that diabetic patients experience various types of psychosocial and emotional problems due to which the monitoring of own state of health is not the priority in life (Beverly et al., 2011; Anderson et al., 2001). In patients with diabetes, depression has been related to an

131 increased risk of diabetic vascular complications (de Groot et al., 2001), poor glycemic control
132 (Lustman et al., 2000), and non-adherence to treatment and self-management behaviors
133 (Gonzalez et al., 2007; Egede, 2005; Gonzalez et al., 2008). According to the assessments by
134 researchers, 1 in 8 diabetic patients suffers from fully symptomatic depression (Anderson et al.,
135 2001; Katon et al., 2004), whereas as many as 1 in 5 of the remaining patients show symptoms of
136 depression (Anderson et al., 2001). Patients with diabetes complications report primarily the
137 deterioration of the quality of life caused by emotional disorders (Boulanger et al., 2009;
138 Boutoille et al., 2008; Moreira et al.. 2009; Winkley et al., 2009). In about a half of diabetic
139 patients hospitalized due to cardiovascular diseases, concomitant depressive and anxiety
140 symptoms were also noted (Boulanger et al., 2009; Chazova, Voznesenskaia & Golitsyna, 2007;
141 Hermanns et al., 2005). The patients with diabetes are associated with difficulty in expressing
142 positive emotions and a strong belief for non-expression of emotions (Saxena et al., 2012).
143 Studies dealing with the role of emotional expression in diabetes have observed that expressed
144 emotion is a significant predictor of glucose control in diabetes (Koenigsberg et al., 1993).

145 On the other hand, recent studies indicate that, when an emotional intelligence program was
146 administered to diabetic patients, has positive effects glycemic control, quality of life and well-
147 being of the individuals (Yalcin et al., 2008; Karahan & Yalcin, 2009). The investigators' purpose
148 was to improve EI skills of the patients with a twelve week emotion intelligence workshop, as it
149 has been already established that high EI is positively correlated with well-being, quality of life
150 and improvements of their anxiety and burnout levels. In other words, patients with high EI seem
151 to be less vulnerable to psychological disorders, as compared with patients with low EI levels
152 (Mavroveli et al., 2007). It has been shown that people with high levels of EI can manage their
153 emotions more effectively, can be more successful at solving emotional problems and managing
154 stress, and can as a result be more productive and positive in their family and social relations

(Matthews, Zeidner, 2000). They have also been reported to use more effective coping strategies in the solution of problems and to be more successful in terms of emotional awareness and control. Furthermore, it is supported that health care providers can be better educated on EI and understanding of emotions, so that they can use them into everyday diabetes care (Brooks, 2006). Various techniques (supportive or counseling therapy, cognitive behavior therapy) and skills (coping skills, problem-solving skills training, stress management) can be used (Winkley et al., 2006; Adili et al., 2006; van der Ven, 2003) in order to improve EI of diabetes patients and their health care providers. Researchers have suggested that more optimistic patients, who exhibit stronger beliefs in self-sufficiency and have a generally more positive disposition, have higher levels of health-related quality of life and feel less so-called toxis emotions, including anger, guilt, pessimism and denial (Rose et al., 2002).

Emotions and obesity

Obesity rates and associated co-morbidity are increasing globally (Finucane et al., 2011) and are attributed to detrimental lifestyle practices (Bulló et al., 2011; Marcellini et al., 2009). Socio-demographic factors appear to interplay with lifestyle to drive obesity. Obesity rates tend to be higher among the socioeconomically deprived (Marcellini et al., 2009; Lazarou et al., 2007; Ball & Crawford, 2006) and the less educated (Marcellini et al., 2009, Barrington et al., 2010; Lawder et al., 2010; Worthy et al., 2010). There is growing interest in the psychology of health (Ryff, Singer & Love, 2004; Urry et al., 2004), lifestyle (Kyrozis et al., 2009) and obesity (Stewart-Knox, 2005). That obesity is common among those diagnosed with clinical psychosis (McElroy et al., 2204, Weber-Hamann et al., 2002) has sparked the notion that obesity may be linked to psychological health and well-being. Previous studies of obesity and psychological well-being among healthy adults have almost exclusively considered depression and to a lesser extent stress. Research which has considered waist circumference and depression and/or stress has indicated a

179 link between greater waist circumference and depression (Rice, Katzel & Waldstein, 2010;
180 Zaninotto et al., 2010; Beydoun et al., 2009; Toker, Shirom & Melamed, 2008). Obesity and
181 depression represent critical public health challenges of particular significance in children and
182 youth. Obesity is associated with poor health outcomes that include insulin resistance,
183 cardiovascular disease and early mortality (Gordon-Larsen et al., 2004).

184 According to the emotion regulation strategy (Christensen, 1993; Macht, Haupt, & Ellgring,
185 2005; Macht & Simons, 2000), the individuals' emotional state per se also affect their eating
186 behavior, in other words, people eat in order to decrease an unpleasant feeling. For example,
187 some people eat in order to relieve sadness (Booth, 1994). Since obese people often suffer from
188 depressive symptoms and low self-esteem (Yanovski, 1993; Cartwright, Wardle et al, 2003), their
189 increased food intake could be also explained as a false coping strategy used to reduce their
190 negative affects (Bruch, 1973; Kaplan & Kaplan, 1957). In obese people, negative affects, such
191 as anger (Kenardy, Arnow & Agras, 1996), boredom (Abraham & Beumont, 1982), anxiety
192 (Meyer, Waller & Waters, 1998), stress (Wallis, Hetherington, 2004), depression and loneliness
193 (Ganley, 1989) indeed tend to increase food intake and lead to the overconsumption of food.

194 Unhealthy eating habits are one of the contributing factors to the etiology of obesity (Martyn-
195 Nemeth et al., 2009). It is stated that eating behavior is a significant predictor of one's nutritional
196 status throught its influence on body weight. Body mass index is one of the common indicators
197 used to determine one's nutritional status in research studies (Grodner et al., 2004). Researchers
198 support that healthy nutritional status reflects physical, intellectual and emotional health
199 (Grodner, 2004; Currie, 2009). A recent study highlights the two most common phenomena in the
200 current obesity epidemic, which are stress-related emotional eating, as well as overeating as a
201 form of addiction (Levitan et al., 2010). This study found that high caloric and highly palatable

foods have the strongest influence on negative mood states and addictive behaviors. Other studies showed that obese individuals have greater urge to eat in response to negative emotions than normal weight ones (Ozier et al., 2008). Increased stress has been associated with high-fat food consumption, decreased fruit and vegetable intake and decreased breakfast consumption (Cartwright et al., 2003). It can be supported that low levels of control of emotions may be related to high levels of emotional eating that can lead to obesity (Moon, Berenbaum, 2009).

Emotional Intelligence

EI is a relatively new subject of study, though its roots go back to the time of Darwin, who pointed out that emotional expression was essential for survival and that emotions serve a biological purpose (Darwin, 1872). Until the last century, the understanding of intelligence was strictly related to cognitive functions, such as learning and memory. However, by the 1900s, scientists had begun to understand that non-cognitive aspects of intelligence also exist. Thorndike (1920) described a type of social intelligence that was related to a person's ability to understand and manage other people and to engage in adaptive social interactions. In 1940, David Wechsler also advocated non-intellective factors, when measuring total intelligence. In 1983, Howard Gardner published a work entitled "Frames of Mind: The Theory of Multiple Intelligences". He argued that people have more than one type of intelligences, which are, as important, as traditional intelligence in predicting performance and success in life. He divided intelligence into seven separate domains: visual-spatial; verbal-linguistic; logical-mathematical; bodily-kinaesthetic; musical-rhythmic; interpersonal and intrapersonal. Gardner's 'interpersonal' and 'intrapersonal' intelligences became the subject of further studies (Goleman, 1995), which have sought to identify intellectual ability that incorporated social, personal and emotional skills.

The term EI was first used in the doctoral thesis of Wayne Payne (1986), entitled: "A Study of Emotion: Developing Emotional Intelligence", where he defined EI as the ability to express emotions openly. In 1995, Daniel Goleman published his book "Emotional Intelligence: Why It Can Matter More than IQ". It was after this publication that the term became widely used. Salovey and Mayer (1990) defined EI as the ability to perceive emotion, integrate emotion to facilitate thought, understand emotions and regulate emotions to promote personal growth. There are two different constructs of EI, trait EI and ability EI. Trait EI concerns emotion-related self-perceptions measured by self-report questionnaires and ability EI concerns emotion-related cognitive abilities that ought to be measured by maximum performance questionnaires (Petrides, Furnham, 2001). Hein (2005), while introducing his definition of Emotional Intelligence, explains EI as an innate ability, which can be either developed or damaged by experiences of life.

Over a number of years, various studies showed that health and general well-being are improved dramatically through the adaptation and adoption of good EI practices. In 1988, Eysenck found that smoking was less of a factor in predicting death from cancer and cardiovascular disease than emotional stress. People unable to handle stress experienced 40% higher death rates than those more capable of managing stress (Eysenck, 1988). Another study indicated that a 22% lower risk of heart disease was related to higher levels of positive emotions. The researchers concluded that, while further study was required, increased positive feelings and reduced depression might be indicated as a preventative factor for heart disease (Davidson et al.,, 2010). Scientists also found that, diabetics who used emotional management techniques were able to reduce their HbA1 levels (McCraty, Atkinson & Conforti, 1999). In another study was concluded that 95% of male University students who did not characterise their parents positively (loving, open) and indicated that they were not caring, experienced diseases in midlife (Russek, Schwartz, 1997). The good news is that through the adoption and practice of EI competencies, through good emotional self-

management techniques has shown to produce positive results in helping improve the health of people.

Focused on several components of trait EI, such as emotion appraisal, use and regulation of emotions, the study aims to examine, whether the scores on psychometric tools for measuring trait EI are associated with the occurrence of specific cardiovascular related diseases in Greek urban population. Emotional intelligence can be affected by many factors. The exploration of these factors and determination of the predictive values of these variables may be helpful in conducting EI research in the area of hospitalized patients. This study will be significant in the understanding of the factors that influence EI.

Following the evidence presented above, attesting to a link between EI and disease, the hypothesis made in the present study was that individuals who suffer from coronary heart disease, diabetes mellitus or obesity, would have low rates of EI and present difficulty in dealing with their emotions. In other words, it is expected that the perceived ability to use, regulate and express emotions would be associated with decreased incidence of coronary heart disease, diabetes mellitus and obesity. Hospitals may offer some courses and arrange guidance and counseling services to enable the patients to improve their EI skills, in order to be more healthful, to lead a more stress free life, to realise better relationships. With the potential to realise such health benefits, treating emotional distress in patients can prevent or delay the onset of sickness, or helps patients heal more quickly, by improving their EI. Although it is a limited study, it will provide a basis for further research in this field.

Materials & Methods

Sample

The data is gathered from selected hospitals in Athens, Greece. Three hundred hospitalized patients were recruited for participation in this study by convenience method. Written informed consents were obtained from all studied subjects. The characteristics of the subjects measured, included age, gender, body mass index and prevalence of coronary heart disease and diabetes mellitus. The clinical data was collected from medical files. The study examined the relationship between emotional intelligence and cardiovascular related diseases among hospitalized patients. Four (predictor) variables and four dependent (criterion) variables were examined. The independent variables were the cardiovascular related diseases and gender. The dependent variables were the four subscales of the questionnaire assessing EI. Four models were conducted. The research question that guided the study was: "Do cardiovascular related diseases affect the prediction of emotional intelligence among hospitalized patients?". The scientific board of the General Hospital of Greece "KAT" signed the ethics approval for this study on the 19/01/2009, Protocol number: 17.

Definition of cardiovascular related diseases

Coronary heart disease: Coronary heart disease patients were characterized those who had a documented history of myocardial infarction, accompanied by angiographic evidence of coronary artery disease and/or positive treadmill ECG test (Scanlon et al., 1999).

Diabetes mellitus (type 2). Diabetes mellitus patients were characterized those who had recurrent or persistent hyperglycemia, and were diagnosed by fasting plasma glucose level $\geq$ 7.0 mmol/l (126 mg/dl) or plasma glucose $\geq$ 11.1 mmol/l (200 mg/dL) two hours after a 75 g oral glucose load or glycated hemoglobin (HbA1c) $\geq$ 6.5% (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1997).

Obesity. Obesity was defined by Body Mass Index (BMI). BMI is calculated by dividing the subject's mass by the square of his or her height (kilograms/meter^2). The WHO definition is a BMI greater than or equal to 30 is obesity (World Health Organization, 1998).

Measures

The Greek version of the self-report Wong & Law EI Scale (WLEIS) was used in order to assess EI (Kafetsios, Zampetakis, 2008). The scale consists of 16 items and four dimensions that are consistent with Mayer and Salovey's (1990) definition of EI. The self-emotion appraisal dimension (4 items) assesses an individual's self-perceived ability to understand their emotions (e.g., "I have a good understanding of my own emotions"). The others' emotion appraisal dimension (4 items) assesses a person's tendency to be able to perceive other peoples' emotions (e.g., "I am sensitive to the feelings and emotions of others"). The use of emotion dimension (4 items) concerns the self-perceived tendency to motivate one self to enhance performance (e.g. "I always set goals for myself and then try my best to achieve them"). The regulation of emotion dimension (4 items) concerns individuals' perceived ability to regulate and control their own emotions (e.g., "I am able to control my temper and handle difficulties rationally"). The scale is categorized with a 7-likert scale (1=strongly disagree, 2=disagree, 3=moderately disagree, 4=neither agree nor disagree, 5=moderately agree, 6=agree, 7=strongly agree). Validity of the Greek version of the WLEIS questionnaire was established by Kafetsios and Zampetakis (2008). The findings suggested that the WLEIS items for EI measurement can serve effectively as a reasonable estimate of their dimensions, and that the dimensions in turn can represent an underlying multidimensional EI construct. Cronbach Alpha reliability coefficients of the Greek version of the WLEIS factors were found to be 0.70, 0.71, 0.78, and 0.78.

Data analysis methods

Various analyses were done to the gathered data at the end of the study. Normality of distribution was assessed using the Kolmogorov-Smirnov test. Comparison between two groups was performed with Student's t tests or Mann–Whitney U tests, whether they follow the normal distribution or not. Pearson's Chi-square calculations were used to compare qualitative variables represented as frequencies. A step-wise multiple linear regression analysis was conducted to evaluate to what extent CHD and cardiovascular related risk factors predict emotional intelligence. All tests were two-sided and $P<0.05$ was considered statistically significant. Statistical analyses (Mann-Whitney U-test, Pearson $\chi 2$ test, Cronbach Alpha and Multiple Linear Regression) were performed using SPSS 17.0 (IBM SPSS, Inc., Chicago, USA).

Results

The mean age of male participants was 69.19 years (SD = 10.39) and 70.32 (SD = 10.06) for the female participants. It was found that 112 men (50.0%) had coronary heart disease and 45 (20.1%) had diabetes mellitus. In women, coronary heart disease and diabetes mellitus were found in 38 patients (50.0%) and 17 patients (22.4%), respectively. The percentages of coronary heart disease and diabetes mellitus patients did not differ by gender ($p=1.000$; $p=0.672$). Women had a significantly higher BMI than men (29.01 vs. 27.47 kg/m^2, $p<0.05$). The psychological characteristics of the two groups are summarized in Table 1. There was no other statistically significant difference between men and women.

In order to examine whether cardiovascular diseases may be good predictors of aspects of EI, a multiple linear regression analysis was conducted on the data (see Table 2). In this analysis, the outcome measure was the EI subscale (self emotion appraisal, other emotion appraisal, use of emotion and regulation of emotion). For this purpose, four models of multiple regression analysis were conducted using the backward elimination method. The independent variables were the three cardiovascular diseases (coronary heart disease, diabetes mellitus, obesity) and gender. In the four multiple linear regression models, the coefficient for coronary heart disease is -0.735, -0.756, -0.973 and -1.328, respectively. This means that, when the disease is present, there is a predicted decrease in the self emotion appraisal of 0.735, 0.756, 0.973 and 1.328. Because the relationship is significant, we are confident of an actual linear association between coronary heart disease and the aspects of EI attributed to hospitalized patients. In the second model, the regression coefficient for diabetes mellitus is negative, (-0.291) indicating that the presence of the disease decreases the other emotion appraisal by 0.291 and the relationship is statistically significant ($p<0.001$). A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above indicates a multicollinearity problem (O'Brien, Robert, 2007). In table 3, VIF are less

than 5 and tolerance more than 0.20, indicating that the models have not multicollinearity problems.

As presented in Table 3, in the regression models, the ANOVA F statistic tests whether the model as a whole is significant. The p-value for all regression models is <0.001. The models are highly significant, and it can be concluded that these four independent variables (coronary heart disease, diabetes mellitus, obesity and gender) together predict the dependent variables. But any model is only as good as it is able to predict the actual outcome with accuracy. The Adjusted R^2 is a measure of how well the model is able to predict the changes in the actual data. In most cases of Linear Regression the R^2 value lies between 0 and 1. In social and behavioral science models typically low values are acceptable, with values over 0.2 indicating a satisfactory fit between the predictions and actual data. The Adjusted R^2 statistic in the fourth model means that 30.6% (Adj R^2=0.306) of the variation in the regulation of emotion can be explained by coronary heart disease. The remaining 69.4% can be explained by other factors that are not in the model. Very low values (< 0.2) in the first three models (0.137, 0.171 and 0.186) indicate that the variables in these models, do not explain the outcome satisfactorily. Durbin-Watson Statistic for all four models was near to the ideal value of 2 indicating that errors are not correlated, whereas values from 1.75 to 2.25 are considered acceptable (Montgomery, Peck & Vining, 2001).

In sum, the model suggests that participants with higher rates of regulation of emotion tend to suffer from coronary heart disease. In that case, knowledge of one's coronary heart disease condition would be sufficient to determine the value of his ability to regulate his emotions. It also suggests that diabetes mellitus, obesity and gender have no observable effect on the aspects of EI. Certainly, additional research is warranted to focus on a variety of related questions

concerning causality: does coronary heart disease decrease regulation of emotion of hospitalized patients, or does low regulation of emotion influence the incidence of coronary heart disease?

Discussion

The purpose of this study was to examine the relationship between EI and cardiovascular related diseases. As hypothesized, coronary heart disease was found to be good predictor of the regulation of emotion, which is an aspect of trait EI. The variables were perfectly related in a negative linear sense. Neither regression nor correlation analyses can be interpreted as establishing cause-and-effect relationships. They can indicate only how or to what extent variables are associated with each other.

It is likely that people suffering from coronary heart disease have lack of understanding of their emotions and score low in questionnaires assessing EI. Similar to other psychological variables, such as anxiety and depression, low EI may cause damage to the cardiovascular system through physiological alterations and by influencing lifestyle choices and practices (Haines, Cooper & Meade, 2001; Krantz, McCeney, 2002; Steptoe, 2000). One possible explanation for this result may be that people, who have low EI, don't have the ability to regulate and control their emotions, for example their temper, and they experience often negative emotions. They don't have the ability to stop and think before acting, and to pause and consider the best course of action in the present situation. Hostility, anger or other uncontrolled negative emotions, relate to multiple behavioral risk factors, including smoking, alcohol consumption, sodium consumption, and exercise behavior (Everson, Lynch, et al., 1997; Leiker & Hailey, 1988; Miller et al., 1998; Scherwitz et al., 1992).

A number of specific positive emotions (optimism, control of specific emotions, joy, contentment, interest, love) have been proposed as potentially important to health (Fredrickson, 2000). These emotions promote cognitive flexibility and innovation, whereas negative emotions serve to narrow attention to specific cognitive processes (Fredrickson, 2001, Aspinwall, Taylor,

1997; Isen, 1999). Individuals facing stress and adversity may be more likely to utilize adaptive means of coping when positive emotion is high (Aspinwall, Taylor, 1997) and negative emotion is low. Some studies have shown that positive emotions promote immune functioning, while at the same time emotion inhibition compromise it (Cohen et al., 2003; Stone et al., 1987; Pennebaker, 1990). Positive emotions can also facilitate recovery to resting cardiovascular levels following arousal by negative emotions (Fredrickson, Levenson, 1998; Fredrickson et al., 2000). Furthermore, positive emotions such as interest and engagement may facilitate attention to health-relevant information, participation in treatment planning, and involvement in lifestyle intervention programs. Future research is needed to examine the possibility that positive emotions predict health behaviors, and to explore the mechanisms that may explain these effects.

The results of this study clearly indicate the role of emotions in maintaining good health. Emotions are often helpful, but sometimes destructive. Among other things, a major challenge is to find ways of understanding one's emotions so that one retains their helpful features while limiting their potentially destructive aspects (John, Gross, 2004). There is evidence to suggest that unresolved negative emotions, such as emotionally stressful events or an outburst of anger, can trigger acute life-threatening cardiac events (Mittleman et al., 1995). It seems reasonable to assume that high EI would be associated with better stress management, better situation selection as to maximize pleasant feelings and lower levels of phychological distress (Austin et al., 2005). Both theory and research findings suggest a link between emotinional intelligence and emotional well-being. Persons who are able to understand and regulate their emotions will have greater feeling of emotional well-being, greater optimism and less depression (Bar-On, 1997, Salovey & Mayer, 1990). On the other hand, persons who are poor at perceiving and regulating their emotions may actually tend to have less social support and be more sensitive to the effects of stress (Ciarrochi, Chan & Bajgar, 2001; Goleman, 1995).

The relationship between coronary heart disease and emotional intelligence was also examined in another Greek sample of 56 coronary heart disease patients (Kravvariti, Maridaki-Kassotaki & Kravvaritis, 2009). The researchers indicated that various aspects of EI, such as decreased ability to use and regulate emotions as well as frequency of negative expressiveness are associated with incidence of coronary heart disease. Similarly, researchers have found that negative emotions, such as depression and anxiety, are negatively associated with occurrence of coronary artery disease in Greek urban population while taking into account already identified highly significant risk factors for the disease, namely, age, gender, cigarette smoking, presence of hypertension, obesity and family history of coronary artery disease (Panagiotakos et al., 2002; O'Donnell, Elosua, 2008). These researchers argued that perceived ability to use, regulate and express emotions as well as frequent expression of positive emotions would be associated with decreased incidence of coronary heart disease (Saxena et al., 2012). The present study is in line with these previous findings. Both studies provide a useful step towards this direction by providing evidence that there is a link between understanding of emotions and coronary heart disease. Lack of understanding of emotions may be a precursor of disease. Through behavioral and physiological pathways, specific negative emotions, such as hostility and anger, may increase coronary risk, whereas control of emotions may represent health protective factors. Future research, however, is needed in order for the present findings to be generalized to a greater sample.

It is seen in the literature that many questionnaires assessing EI have already been developed and used in different studies. However, the variability of these scales causes confusion among the researchers. In addition, the selection of inappropriate questionnaires may affect the results of the studies negatively (Aslan, Erkus, 2008). Within this context, in the present study, the EI scale

used have been examined for its reliability and foun reliable. It can be concluded that since this scale is short and easy to apply, it can be used in hospitalized patients.

444 **Conclusions**

445 Finally, the present finding may have practical implications. It is important to highlight that as
446 long as studies support that EI can be taught and developed (Boyatzis, Cowan & Kolb, 1995), it
447 means that the brain centres for emotion may be capable of change in patients with coronary
448 heart disease. If, for example, patients with coronary heart disease are trained to control and
449 manage their emotions and improve their EI, their problem may be eliminated. It would be
450 interesting for future research to examine whether or not EI could make a comparable
451 contribution to health and recognize the changes needed in hospitals that might be of interest to
452 both cardiologists and psychologists.

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Table 1(on next page)

Table 1

Mean scores, standard deviations and statistical significance for the psychological characteristics of the two groups.

Table 1. Mean scores, standard deviations and statistical significance for the psychological characteristics of the two groups.

EI (WLEIS)	**Men (n=224)**	**Women (n=76)**	**P-value**
Self emotion appraisal	5.93 ± 1.00	5.88 ± 0.97	0.586
Other emotion appraisal	5.81 ± 1.04	5.77 ± 0.95	0.416
Use of emotions	5.83 ± 1.11	5.74 ± 1.19	0.747
Regulation of emotions	5.63 ± 1.25	5.65 ± 10.7	0.604

Table 2(on next page)

Table 2

Multiple linear regression analyses and related statistics for the effect of cardiovascular related diseases on emotions.

Table 2. Multiple linear regression analyses and related statistics for the effect of cardiovascular related diseases on emotions.

	B	95% Confidence Interval	t	Tolerance	VIF	P-value
Self emotion appraisal						
CHD	-0.735	-0.945 to -0.525	-6.892	1.000	1.00	**<0.001**
Constant	6.287				0	
Other emotion appraisal						
CHD	-0.756	-0.972 to -0.540	-6.898	0.954		**<0.001**
Diabetes mellitus	-0.291	-0.558 to -0.025	-2.152	0.954	1.04	**0.032**
Constant	6.234				8	
Use of emotions					1.04	
CHD	-0.973	-1.205 to -0.742	-8.265	1.000	8	**<0.001**
Constant	6.298					
Regulation of emotions						
CHD	-1.328	-1.557 to -1.100	-11.452	1.000	1.00	**<0.001**
Constant	6.298				0	
					1.00	
					0	

Table 3(on next page)

Table 3

Multiple Correlation Coefficient R^2, Durbin-Watson and ANOVA F statistics for multiple linear regression analysis.

Table 3. Multiple Correlation Coefficient R^2, Durbin-Watson and ANOVA F statistics for multiple linear regression analysis.

	R^2	Adj R^2	Durbin-Watson	F (Sig)
Self emotion appraisal	0.137	0.135	2.021	47.496 (<0.001)
Other emotion appraisal	0.171	0.166	2.008	30.689 (<0.001)
Use of emotions	0.186	0.184	1.916	68.318 (<0.001)
Regulation of emotions	0.306	0.303	2.080	131.146 (<0.001)