Stress and Social Support in Cardiovascular Disease

Kristina Orth-Gomér

Contents

Abstract

The concept and the impact of inadequate social networks and poor social support on health have been intuitively known since long. But it was not until the 1970s that the significance of social relations was demonstrated, for the first time in the Alameda county study in California.

Within a few years, several population-based prospective studies came to the same conclusion: Poor social networks and support increased total and cardiovascular mortality. This was true even in the North Karelia, Eastern Finland, but only in men. In North Karelian women, and also in other groups of women, the function of the social relationships appeared to be more important than the

K. Orth-Gomér (✉)
Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden
e-mail: kristina.orth-gomer@ki.se

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structure. North Karelia is a part of rural Finland, situated directly at the border between Russia and Finland.

In Stockholm, women patients with coronary disease and social isolation modified the role of depression so that only when they exist together, the factors worsen prognosis and accelerate progression of coronary artery disease, as measured by quantitative coronary angiography (QCA). Similarly using QCA methodology, we could show that exhaustion, more clearly than depression, worsened prognosis in women. The stress burden originating from the family was more important than the stress burden of the job, although almost all of the Stockholm women were employed outside home. Therefore, we designed a cognitive behavioral intervention to reduce women's stress. In a randomized controlled trial, this proved to both prolong women's lives and attenuate their negative emotions.

Altogether around 800 women patients have been followed for up to 20 years. They have been examined with a variety of psychosocial measures. Of psychosocial measures, vital exhaustion was best fitting to the pattern of coronary artery atherosclerosis progression and also seemed to yield the best fit to the multivariate model of disease progression. Their precise psychobiological mechanisms remain unclear. However, multivariate evaluations suggest that standard coronary risk factors partly "explain" and metabolic, hemodynamic, immunologic, and autonomic imbalances contribute to the final and complete remaining psychobiological pathogenic pathways.

Keywords
Cardiovascular disease • Stress • Social network • Social support • Depression

Introduction

This chapter will review the epidemiological evidence of social support in cardiovascular disease (CVD) with a focus on methods to measure and quantify this support. In addition, clinical and pathogenic issues around coronary heart disease will be examined, and preventive psychosocial interventions aimed at strengthening social support in CVD will be outlined.

The Concept of Social Support

"A lonely man is a strong man" is an old saying in Scandinavia: "A strong man makes his own decisions without being in any way influenced by external cues. He is independent, and therefore his decisions are clear and sound." This may be true in the cold and dark regions of Northern Sweden. This may be true for the inhabitants of Kiruna in Northern Sweden and for people living in Rovaniemi in Northern Finland or Tromso in North Norway. These places are all situated around the North Peak of Scandinavia above the 65th northern latitude and above the Northern Polar Circle.

However, not even in these regions, where populations are scarce, where the sun and the daylight vanish from November to February, where the children are happy when the first snow comes so that they can ski to school and see the road in the reflection of the white snow, not even where the distances are so long that you will easily travel a hundred kilometers to visit a friend or look after an old relative, not even in these regions are lonely men strong men. Life is hard; winters are dark, long, and cold; and people do not talk more to each other than is absolutely necessary. But still, people know that social ties are vital, that one cannot survive without them, and that they need to be cherished and cultivated. Social supports are as vital to the people in the depopulated North, as they are to the much more densely inhabited regions around Copenhagen, Denmark, or Malmö, Sweden (Janlert et al. 1992).

Social supports can be divided, on one hand, into the purely quantitative assessment of social networks and the qualitative and functional assessment of support on the other hand. Both aspects of social support constitute the basic human need for social contact and for closeness (Ruberman et al. 1984).

The concept of social supports is almost as old as the Old World. Aristotle argued around 350 years BCE that "friendship was a basic human need, along with food, shelter and clothing. A totally loveless life – a life without friends of any sort – is a life deprived of much needed good." Much later, in 1599, Paracelsus, a physician, alchemist, and natural scientist, prescribed "love as the best possible cure for several diseases" (Rose 1992).

The first modern scientific evidence of a link between social support and health was provided by Emil Dürkheim (1858–1917) in his extensive sociological studies on the origins of suicide and self-destructive behavior. He found that marriage and religion were the best protectors against such deviant self-destructive behavior. Kropotkin, a Russian ethologist and psychobiologist, gave support to this notion by stating in 1908 that "mutual help and support is a factor of great significance for the maintenance of life and health in animals and in humans" (Stamler 1980).

The Biological Effect of Social Networks and Social Supports on Heart Disease

The effect of social support on the heart has been intuitively known for centuries. However, modern cardiology demands empirical evidence. In both the research and clinical settings, the effects of social support on the heart have required verification. The following population- and patient-based longitudinal studies describe this.

Population-Based Studies of Social Networks and CVD

Jim House et al. (1988) in a summarizing review compared health effects of social networks in cigarette smokers. They looked at longitudinal, representative population-based cohorts in the USA from Alameda County (Berkmann and Syme 1979),

Tecumseh (Michigan; House et al. 1982), Evans County (South Georgia; Blazer 1982), East Boston, Iowa, and New Haven (House et al. 1988). They also described the findings from European studies, including North Karelia in Finland (Kaplan et al. 1988), Gothenburg in Sweden (Orth-Gomer et al. 1993), and the SC ULF study (Orth-Gomer et al. 1987), based on a representative sample of all Swedish men and women, aged 15–75. All study groups were followed for several years, looking at the same medical end points. All these longitudinal studies generally agreed on the same broad conclusion, namely, that while the magnitude of the health risks was about the same, social networks consistently promoted health, that is, more frequent social contacts were prospectively associated with better physical and mental health. The conclusions were clear and unambiguous (Orth-Gomer 1987). However, it was difficult to understand what the counts of friends, neighbors, work mates, etc. really meant. It was hard to know which impacted psychological function or which were the personality characteristics of individuals who were sensitive to the variations in social ties. As a result, the literature was further explored and a set of psychometric investigations were carried out, aimed at finding or developing active and more easily interpreted examination methods for the role of social support. The Interview Schedule for Social Interaction (ISSI; Henderson et al. 1980) was found. This survey instrument was designed as an interview instrument to assess the availability and perceived adequacy for any individual of a number of facets of social relationships. The instrument is sufficiently valid and reliable and also sensitive to predictable variations between sociodemographic groups, so its use can be justified in clinical and epidemiological studies, both in psychiatry and general medicine.

Psychometric Studies of Social Supports

The ISSI had the functional approach that we were looking for, but it was very cumbersome to use. In a pilot study, we developed a paper and pencil test, paying particular attention to psychometric properties, including split-half reliability, face validity, and internal consistency (Orth-Gomer and Unden 1987; Undén 1991).

The resulting scale had 13 items, 6 describing "attachment" and 7 describing "social integration." The instrument has now been implemented in several population-based cohorts, such as in young men in North Sweden, Gampöjka; in 50-year-old men in Göteborg (Janlert et al. 1992); and in women with clinically manifest CVD in Stockholm (Orth-Gomér et al. 1998, 2000; Horsten et al. 2000).

Functional Measures of Social Supports

The Northern part of Scandinavia has been identified as an extremely isolated region (Zapf 2009). Our experience from the Northern part of Scandinavia confirms the special emotional profile, which could be ascribed to the harsh living conditions in that region. As a part of the MONICA project, we described the social support

profiles in different age and gender groups in the most Northern part of Sweden. We used the self-report measures that were agreed upon in the multicenter MONICA studies, thus disentangling size and density of social networks from the quality and function of social support. In most cohorts, we found the former scale, *social integration*, to be predictive of health outcomes in the expected direction.

That is, the more numerous and more frequent social contacts were associated with better health outcomes. One group in the North stood out on another dimension, namely, that of attachment, meaning the quality and function of close emotional ties, relationships which are found within the family or with very close friends. The items were concerned with whether there is someone to "hold you for comfort," and whether there is "someone to share happiness with, someone that would be happy just because you are...."

The young men in Northern Sweden were nicknamed "*Gampöjka*." They were the only ones left when everybody else in the village had moved to the cities in the South (such as Stockholm). These young men actually confirmed that they had few or no relationships providing them with a sense of "attachment." In addition they were mostly unemployed and without family, many of them living with a widowed mother. There was literally none to hold them for comfort as all the young women from the north had gone south (Janlert et al. 1992).

Fifty-Year-Old Men in Göteborg

In a more representative Swedish population-based cohort study, a thousand men born in 1913 in Göteborg were approached. This was actually the first epidemiological study carried out in Sweden, and the results were both reassuring and alarming. In these men, their social contact networks were examined along with a set of carefully validated measures of standard risk factors. At baseline examination, they were all 50 years old. In a long-term follow-up study, social networks and social interaction predicted mortality independent of other standard risk factors. The results showed that more social contacts were associated with lower mortality. These findings were the first population-based social network-related results outside the USA, and their significance was discussed in terms of the need for more accurate, functional measures – and the need for psychosocial interventions.

In a collaborative study, we had the opportunity to approach the next generation of 50-year-old Göteborg men, those born in 1933. We carefully prepared interviewers to cautiously present our functional scale to the Göteborg men. We thought that some of the questions might be perceived as offensive. This had already happened before. Some men, taking the test, had become really angry, "this is none of your business," and torn the papers apart. But we needed not to worry about that. Every single item was filled out. Non-response was minimal. At 6-year and at 15-year follow-up, our hypotheses were confirmed.

Both the quantitative and the qualitative measures of social supports were independent predictors of CVD (Orth-Gomér et al. 1993).

Stockholm Women: Their Social Supports and Cardiovascular Disease

Coronary heart disease is traditionally thought of to be a man's disease. Women have been previously thought to be free from heart disease; they were even thought to be immune. Although about as many women as men are found to die from cardiovascular causes, women have not been present in the intensive coronary care units, where the acutely ill patient is monitored during the first 48 h, or so, after onset of symptoms. Thus, this might be a reason for this erroneous perception.

It was argued that women patients were not properly cared for and that they did not get full access to the technical equipment and treatment methods, which men had been blessed with during the past decades of advances in cardiology. Men in their 60s are usually found in the CCU, but aged-matched women are usually not, possibly due to the relative protection against CVD, at least during the first years of their menopause. Thus, while most women menstruate until around age 51, their endogenous estrogen provides protection against atherosclerosis and coronary disease for many years after the cessation of menses.

Women's coronary risk factors, which are counteracted by estrogen, continue to increase in frequency and effect after menopause, so that about the age of 70, women's experience of heart disease matches that of men at same age. At that age women are no longer a rare occurrence in the CCUs. As women seem to develop their heart disease about 10 years later in life than men, they ought to have access to preventative and state-of-the-art interventions as much as men do, unless older age is somehow an obstacle.

Women, of course, differ from men, also in other aspects of health and disease. We know that the average life expectancy is higher in women than in men and that the gender gap is to a large extent due to differences in coronary disease incidence. In most countries, this gender gap is about 5 years (such as in Western Europe and in the USA), but there are Eastern European countries, like Russia, in which the gender gap is approaching 15 years. Little is known about the precise causes. However, it is generally agreed that women's burden of disease is higher than men's, in particular if calculated as disability-adjusted life years (DALYs) and comprising all causes for disability, such as depression, anxieties, and sleep disturbances.

The age gap between sexes may also influence the psychosocial environment, as in the case of access to social supports. Elderly women are more often living alone; they are more often widowed, divorced, or separated. In a New England population survey of mental health-related factors, women differed from men in identifying their most important support person. About 60 % of men, – but only 25 % of women – named their spouse. Note that men and women came from the same population. This finding may be quite relevant for women's hearts. We found, in Stockholm women coronary patients, below age 65, that depression and social isolation worsened the prognosis of women's heart disease (Horsten et al. 2000) similarly

as had previously been found in men (Orth-Gomer et al. 1998). However, when examining the causes of distress, important gender differences were identified.

Women who had poor marital relationships, we called it marital stress, had three times the risk of getting a recurrent coronary attack, as compared to women patients without marital stress with the best prognosis found in women who had a good job and a happy marriage (Orth-Gomér et al. 2000). In a subgroup analysis, this latter group was found to be even more "health prone." In coronary angiographic examination with subsequent quantitative evaluation (QCA), which was repeated after a 3-year follow-up period, coronary artery disease did not progress as expected. In contrast, in this particular group of women patients, their CAD actually regressed as if they had been on systematic statin therapy. However, none of them was taking any statins at all. These were not used until much later in Swedish patients.

New Psychosocial Intervention Trial

Based on these findings, a clinical trial of cognitive psychosocial intervention was designed (Blom 1997; Orth-Gomér 2012). Stockholm women patients were highly motivated to cardiac rehabilitation, provided it did not happen in the customary male setting. We had barely ended the collection of data for the observational Stockholm Female Coronary Risk study, when we were asked by patients to offer them rehabilitation. They came to us and said: "You should do something for us! Look how the men patients get to exercise – while their pretty physical therapists are surveying them on their bikes! However, we do not want to share their program, we do not want to sweat with them! We would like our own program, and we would like to talk rather than exercise!"

The SWITCHD study (Stockholm Women's Intervention Trial for Coronary Heart Disease) included 237 consecutively admitted women patients with coronary heart disease. It was the very first randomized controlled trial to follow the CONSORT criteria and to show evidence of a significant benefit of psychosocial intervention on hard clinical outcomes. The 1-year behavioral therapy program focused on how to reduce stress, mostly from poor interpersonal relations; at follow-up there was a threefold reduction in long-term mortality (mean follow-up 7 years). Mean age in both groups was 61 years at baseline, around half of the women had a transmural myocardial infarction, most of them had no or little symptoms of cardiac failure (NYH = 1 or 2) and angina pain (Canadian classification) was rare. Almost all patients were on daily pharmacotherapy (i.e., statins, beta blockers, diuretics, and ASA). The most pronounced effect was found in the group of women who received both CBT and statins; their mortality rate was <1 % in 7 years. Women without both statins and the rehab program had 20 % mortality and the other two groups were intermediate (Orth-Gomér et al. 2009).

Psycho-cardiology

The turn of the new century, between 2000 and 2004, became a marker for a new line of scientific concepts (Wang et al. 2005). Our original work on the "ESC clinical guidelines for CVD prevention in clinical practice" focused on psychosocial risk factors. These clinical guidelines were published for the first time in December 2003, together with consecutive publications in other journals (De Backer et al. 2003), and provided a new perspective of understanding from the patient's perspective after an acute coronary event. Behavioral and psychosomatic medicine then became recognized specialities, which were taken seriously and acknowledged by the research community.

A year later, another important event occurred, the publication of the INTERHEART study. Largely the same psychosocial risk factors were cited as in the guidelines (see below). In addition, for the first time, coronary risk that could be attributed to psychosocial factors was estimated to be around 30 %. As the INTERHEART study included some 16,000 CVD patients and an equal number of controls, representing over 50 countries, the results were robust and significant. In addition, other risk factors detrimental to cardiac health were identified. These included: Low SES, emotional stress from work and family, lack of social support, and social isolation, along with the accompanying negative emotions (depression, exhaustion, hopelessness, anger, and hostility), were definite, scientifically based coronary risk factors (Yusuf et al. 2004).

Traditionally, an important part of cardiac rehabilitation is physical exercise. More recently "rehabilitation has been found to be as much about reducing anxiety and depression as it is about lifestyle change." Of the ten core components of an ideal rehabilitation program, psychosocial management ought to be considered the most important.

The other nine core components can be addressed with lifestyle change. However, although patients are carefully instructed, with great detail about what they should do in order to prevent heart disease, little is said about how it is done. Therefore, failure of cardiac rehabilitation could be attributed to this aspect of lack of psycho-education. It is well known that the modern, life-saving acute heart disease care constitutes a heavy burden on the healthcare system. The acute phase is characterized by high impact and resourceful intensive care. An acute patient with severe central chest pain, especially if it is a male patient, will be treated using the best and newest technology and personnel skills. Often, even before the patient has reached the hospital, his acute EKG will be transmitted from the ambulance and interpreted by the cardiologist or related specialist who is on call in the clinic. Yet an important question remains: Why are patients not following this excellent expert advice? The pattern is clear: Cardiologists of today have realized that patients have both body and mind and that both need to be cared for. But they may not be able to fully meet the needs of the important "mental half" of the body-mind complex. Help ought to be obtained from psycho-cardiology.

A Clinical Case of Sudden Cardiac Death

My personal experience with cardiologic acute care made a significant impact.

On an August afternoon, I went swimming in the cold Baltic Sea, with a neighbor, a healthy man in his 60s. Afterwards he felt uneasy and suddenly got such intense chest pain that he couldn't walk. We were out in the archipelago so I was worried about how transporting him to a clinic would go. While I was still talking to the ambulance driver, I heard the sound of a helicopter over our heads, which came to pick him up. The pilot landed in the garden right next to us, a coronary care nurse came out of the helicopter, and she briefly viewed the EKG and then inserted a needle and gave him a needle shot. The pain subsided and he was immediately taken to the closest cardiology clinic, which was about 100 km away.

The Stockholm archipelago consists of 25,000 smaller and bigger islands, and we were lucky not to be on the most remote island. I got into my car and drove as quickly as I could. This was clearly a life-threatening situation and I wanted to be nearby if anything was needed. When I got to the hospital, the catheterization was already done. On his bed was a photo of the right coronary artery *before* – and one *after* the intervention. He had received a few stents at the place of his right coronary "narrowings" and his life was saved.

If he had not been so efficiently cared for, if he had not been so quickly and professionally managed, he might have died from sudden cardiac death. This condition hits more men than women, especially men who are under age 65. Typically these patients have such sudden symptoms that they do not even make it to the emergency room, rather they tend to die on the way to the hospital.

By definition symptoms of chest pain hit the patient as might lightning from a clear sky, although may have had some nausea or tightness during the preceding hours. The underlying coronary artery disease is usually not impressive. On the contrary, the extent of coronary disease is often lower than expected. The demonstrated mechanism of sudden cardiac death is most likely cardiac arrhythmia. Commonly, it appears to start with ectopic activity, generated in the ventricles of the heart. The ectopic beats become more and more frequent and more and more malignant in character and finally they change into ventricular tachycardia and at last ventricular fibrillation. At that stage, of course, the heart muscle does not contract to pump the blood into the circulatory system. Within a few minutes, the patient is dead.

I looked at my watch. My neighbor had received the first treatment within 12 min and the stents within an hour after his first cardiac symptoms! Not long ago we had been out swimming in the Baltic Sea! I was stunned that the acute hospital care could be so efficient. Later I learned that this has become a fairly standard procedure, particularly as early symptoms and instant treatment are so crucial for successful therapy in acute coronary disease.

If there is a suspicion of coronary artery "narrowing" or occlusion, the well-equipped and trained personnel of the ambulance will communicate during the

transportation, giving their opinion, which is almost always right, directly to the clinic. This is how the angiographic laboratory can be prepared while the patient is arriving to the emergency unit. Specially trained nurses will assist the cardiologist throughout the procedures. They are instructed, well trained, often constituting of underestimated, poorly paid, highly competent professionals.

Conclusion

The introduction of intensive coronary care units (CCUs) have reduced the acute mortality risks of myocardial infarction in hospitalized patients to about half. At the same time, new surgery and catheterization techniques have been implemented. Much experience was gathered, which lead to the development of stents, a devise which is inserted into the coronary artery narrowing to keep it open and maintain blood flow. Third –and probably most important for survival – the introduction of efficient pharmacotherapy for prevention of death after an acute heart attack is perhaps the most effective measure.

Today virtually all post-AMI patients are taking preventative drugs every day, for the rest of their lives. First, the beta blockers were introduced on the market. They were shown to help against angina pain, reduce blood pressure and relieve symptoms of heart failure, and even postpone mortality (reference needed). Furthermore, coenzyme A reductase inhibitors – statins – were introduced in order to lower LDL cholesterol. But they were also found to have a substantial beneficial effect on all cause and heart disease-related mortality, which could not be explained by effects on LDL only (reference needed). In subsequent studies, statins were found to have antithrombotic effects which were more important than could be shown with any other drug (reference needed). In the recent SWITCHD study, it appears as if the statins might reinforce the effects of the cognitive stress reduction program (Orth-Gomer' et al. 2009).

What are the possible explanations for this finding? This finding could be based on patients' greater motivation and discipline when taking our cognitive stress-reducing program. But it could also be due to patients becoming more trustful and having more faith and being psychologically more receptive when taking the statins. This effect then would interact with the cognitive stress reduction program by strengthening its efficiency.

In women patients who had received both statins and CBT, mortality was less than 1 %, whereas in the other three groups, women who were taking only one –or none – of the two therapy options, mortality rates over 7 years were between 15 % and 20 %. Thus an interactive effect was noted between statins, the most potent of the pharmacological preventive therapies and CBT and the most potent of the psychosocial treatment modalities.

Altogether around 800 women patients have been followed for 20 years with the same psychosocial measures using QCA, we showed that low social support, depression, and exhaustion accelerate the atherosclerotic process in the coronary arteries, worsen prognosis, and seem to yield the best fit to the multivariate model

of disease progression (Orth-Gomér et al. 2015). Compelling evidence has accumulated for a wide range of psychosocial risk factors, which are now ready to be implemented in clinical practice.

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