

# Impact of Chronic Stress on Cardiovascular System: Libyan Conflict Health Perspective.

## Part one: Types of Chronic Stresses

Abdalla Salem Elhwuegi, Lamis Ali Teebar

Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, University of Tripoli, Tripoli, Libya

### Abstract

Recent studies have provided clear and convincing evidence that chronic stress contributes significantly to the pathogenesis and expression of cardiovascular diseases (CVDs). This bibliography is a systematic review on the impact of chronic stress on the cardiovascular system with a special reflection on the Libyan conflict. It is divided into two parts, Part 1 deals with types of chronic stresses, while Part 2 deals with mechanisms involved in chronic stress and their treatments. Medline/PubMed, Google Scholar, and Scopus databases were used to search for peer-reviewed papers dealing with the review theme. Stress can be classified into acute stress and chronic stress. Chronic stress can stem from underlying factors such as economic stress, social isolation stress, posttraumatic stress, and job strain stress. Economic stress is emerging as an important determinant of perceived health where different studies have found an inverse trend between risk factor burden and cardiovascular disease prevalence in urban and rural communities in high-, middle-, and low-income regions. Social stress is another factor that has been reported to be associated with a 2–3 fold increase in the incidence of CVD. Moreover, multiple studies have shown that patients suffering from posttraumatic stress disorder have increased resting heart rate, increased startle reaction, and increased blood pressure as responses to traumatic events. CVD is one of the health outcomes whose links with work stress have been well established based on numerous prospective studies.

**Keywords:** Chronic stresses, mechanisms of chronic stresses, treatments of chronic stresses

### INTRODUCTION

Any individual experiences stressful situations in his/her life including undesirable experiences and events. Stress, at various levels, has serious psychological and physical effects that appear in the form of physical, psychological disorders, and chronic diseases such as heart diseases.<sup>[1,2]</sup> Worldwide, cardiovascular diseases (CVDs) are responsible for 31% of all deaths each year, making it the number one cause of death. A wide variety of psychological and psychosocial stresses have been associated with CVDs. Such stresses include but are not limited to chronic life stress, socioeconomic status, social isolation, job strain, and major anxiety.<sup>[3]</sup> Relatively, recent scientific studies have found increased mortality rates among heart patients suffering from psychological and emotional stress in comparison with patients without similar stressors.<sup>[3,4]</sup> Furthermore, stresses affect the recovery of individuals with CVDs and increase their risk of further heart problems.<sup>[5]</sup> Once diagnosed with psychological disorders, patients with

CVDs must be treated safely and effectively with careful management.

The intermediate processes through which psychological stress increases the risk of CVDs are not completely understood. An appreciation of these processes is important for treating psychological stress in order to reduce CVD risk and its consequences. Pathophysiological mechanisms have been proposed to explain these relationships, including sympathetic nervous system activation, hypothalamic–pituitary–adrenal axis dysregulation, platelet activation, and

**Address for correspondence:** Dr. Abdalla Salem Elhwuegi,  
Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy,  
University of Tripoli, Tripoli, Libya.  
E-mail: hwuegi@hotmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**How to cite this article:** Elhwuegi AS, Teebar LA. Impact of chronic stress on cardiovascular system: Libyan conflict health perspective. Part one: Types of chronic stresses. *Libyan Int Med Univ J* 2018;3:31-5.

**Received:** 21-06-2018 **Accepted:** 09-08-2018 **Published:** 10-09-2018

#### Access this article online

##### Quick Response Code:



**Website:**  
journal.limu.edu.ly

**DOI:**  
10.4103/LIJ.LIJ\_25\_18

inflammation.<sup>[6]</sup> Behavioral factors have also been implicated, such as nonadherence to prescribed medical therapies and physical inactivity.<sup>[7]</sup>

In light of the foregoing discourse and the fact that Libyan community has been exposed to different types of stresses, it was decided to study the associations between stress and the incident and prognosis of CVD worldwide with a special reflection on the Libyan conflict. This work is divided into two parts, Part 1 deals with types of chronic stress, while Part 2 deals with mechanisms involved in chronic stress and their treatments. Medline/PubMed, Google Scholar, and Scopus databases were used to get peer-reviewed papers dealing with the review theme. The words/strings used for search and inclusion criteria included but not limited to stress, cardiovascular diseases, and relationship to stress, psychological stress, types of chronic stress, mechanisms of chronic stress, treatments of chronic stress, Libya, Libyan patients, Libyan conflict. Thirty references were used in writing the first part of this paper.

## TYPES OF STRESSES

The World Health Organization (WHO) defines mental health as *“a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.”*<sup>[8]</sup> On the other hand, stress is *“any uncomfortable emotional experience accompanied by predictable biochemical, physiological and behavioral changes.”*<sup>[9]</sup> Stress is classified in general as acute and chronic stress.

### Acute stress

Acute stress can be beneficial at times, producing a boost that provides the drive and energy to help people get through situations such as examinations or work deadlines.<sup>[9]</sup>

### Chronic stress

Chronic stress is defined as *“external or internal negatively influences that the individual is exposed to, leading to psychological, biological and behavioral disorders, which may place him or her at risk of diseases (psychosomatic disorders), that may hinder the path of his/her daily life.”*<sup>[10]</sup> It is generally agreed that untreated chronic stress can result in serious health conditions. The effects of a stressful situation may differ greatly between individuals depending on the intrinsic and extrinsic resources available to them. Many types of chronic stresses are described in the literature according to their underlying cause; we will limit our discussion to economic, social isolation, posttraumatic, and work stresses.

#### Economic stress

Many studies have used the INTERHEART Risk Score to quantify the risk factor burden for CVD. INTERHEART Risk Score is a validated score that includes data on age, sex, and status with respect to smoking, diabetes, high blood pressure, and family history of heart disease, waist-to-hip

ratio, psychosocial factors, diet, and physical activity.<sup>[11]</sup> Scores range from 0 to 48, with higher scores indicating a greater risk factor burden.

One of the largest studies that assessed the risk of the economic stress on the cardiovascular system was done by the Prospective Urban Rural Epidemiologic (PURE) cohort study involving >150,000 adults in 17 high-, middle-, and low-income countries. Participants were followed up for the risk factor burden, the incidence of cardiovascular disease, related case fatality rates, and mortality using the INTERHEART Risk Score.<sup>[12]</sup> It was found that mean INTERHEART Risk Score was highest in high-income countries, intermediate in middle-income countries, and lowest in low-income countries. However, the rates of major cardiovascular events (e.g., death from cardiovascular causes, myocardial infarction, stroke, or heart failure) were lower in high-income countries than in middle- and low-income countries (case fatality rates 6.5%, 15.9%, and 17.3% in high-, middle-, and low-income countries, respectively). In addition, they found that urban communities had a higher risk factor burden than rural communities but lower rates of cardiovascular events and case fatality rates (13.52% vs. 17.25%). The study concluded that the high burden of risk factors in urban and high-income countries may have been lessened by better control of risk factors and more frequent use of proven pharmacologic therapies and revascularization.<sup>[12]</sup> A similar conclusion was derived in a recent study that included 46,285 Chinese individuals,<sup>[13]</sup> where an inverse trend between risk factor burden and cardiovascular disease prevalence in urban and rural communities in high-, middle-, and low-income regions of China were reported. It might be relevant to point out that the availability and affordability of medicine and medical services might play a crucial role as a study gathered from 596 communities in 18 countries participating in the PURE study revealed that secondary prevention medicines (aspirin,  $\beta$ -blockers, angiotensin-converting enzyme inhibitors, and statins) are unavailable and unaffordable for a large proportion of communities and households in upper middle-income, lower middle-income, and low-income countries, which have very low use of these medicines.<sup>[14]</sup> In Libya, there is a shortage of essential drugs in governmental hospitals and polyclinics with increased prices of essential medicines in the private sector. The impact of these shortages on the general health of the population is not known and goes against the WHO's targets of 50% use of key medicines by 2025.

#### Social Isolation, Lack of Social Support, and Loneliness Stresses

On average, social factors are associated with a 2–3 fold increase in incidence of CAD over time. Adults who have low social contact (socially isolated) or feel unhappy about their social relationships (lonely) are at increased risk of premature mortality.<sup>[15]</sup> One of the early clinical studies carried out in 2002<sup>[16]</sup> found that the total peripheral resistance (which may subject the heart to more chronic stress) was higher in lonely than nonlonely participants, whereas cardiac contractility,

heart rate, and cardiac output were higher in nonlonely versus lonely participants. Lonely individuals also reported poorer sleep patterns than nonlonely individuals. Moreover, there were greater age-related increases in blood pressure and poorer sleep quality in lonely than nonlonely older adults. These results were very early indications of two potentially predisease mechanisms that warranted special attention: cardiovascular activation and sleep dysfunction.<sup>[16]</sup>

Many studies evaluated social isolation and prognosis in patients with preexisting CAD. One of these studies,<sup>[17]</sup> observed a nearly threefold increase in subsequent cardiac events in post-MI patients reporting a low-level emotional support, substantiating a report by William *et al.*, 1992,<sup>[18]</sup> who observed a similar increase in mortality over 5 years among CVD patients who were unmarried or had no significant social support network.

Many studies have shown that culture is an important additional factor that can affect CVD prevalence. In an early study in 1992 involving 3809 Japanese-Americans in California, classified two groups according to the degree to which they retained a traditional Japanese culture, the most traditional group of Japanese-Americans had a CVD prevalence as low as that observed in Japan, whereas the group that was most culturally adapted had a 3–5 fold excess in CVD prevalence.<sup>[19]</sup> In another famous study, the rate of development of CVD was assessed in Roseto town which was a cohesive and homogeneous community of three generations of Italian immigrants.<sup>[20]</sup> Initially, CVD incidence was significantly lower in Roseto, but as the distinguishing social characteristics of the Roseto community disappeared over time, the lower CVD incidence increased.

Loneliness and social isolation may affect health independently through their effects on patients behavior. Individual behaviors (e.g., smoking and physical inactivity) were analyzed from 8688 participants who were lonely or socially isolated<sup>[21]</sup> and data on blood pressure, cholesterol, and inflammatory markers were analyzed. Both social isolation and loneliness in participants were associated with a greater risk of being inactive, smoking, as well as reporting multiple health-risk behaviors. Social isolation was also positively associated with higher blood pressure, C-reactive protein, and fibrinogen levels.<sup>[21]</sup>

In conclusion, many studies have provided convincing evidence that social isolation can increase the incidences of CVD. During the last 7 years in the Libyan conflict, many citizens have been displaced from their hometown. This would be expected to result in social isolation because of local differences in cultural ideas and beliefs. The potential of these changes on the health of Libyan peoples is not known and cannot be predicted unless extensive epidemiological studies are carried out by all levels of those who are concerned with health including universities, government, and medical associations.

#### Posttraumatic Stress Disorder

Posttraumatic stress disorder (PTSD) involves the onset of psychiatric symptoms after exposure to a traumatic event.

Physiological responses are reminders of the trauma that include increase in heart rate, blood pressure, tremor, and other symptoms of autonomic arousal.<sup>[22]</sup>

One of the early famous studies that investigated the relationship between PTSD and CVD was the National Vietnam Veterans Readjustment Study (NVVRS) which was conducted in the late 1980's. In essence, 15.2% of the men and 8.5% of the women who served in Vietnam suffered from PTSD 15 years after their military service.<sup>[23]</sup> Multiple studies have shown that patients suffering from PTSD have increased resting heart rate, increased startle reaction, and increased heart rate and blood pressure as responses to traumatic slides, sounds, and scripts. Furthermore, there is much convincing evidence that PTSD is the cause of many chronic illnesses. Boscarino<sup>[24]</sup> looked at the prevalence of chronic diseases among Vietnam veterans 20 years after exposure to severe stress and found that 67.5% of veterans with PTSD suffered from chronic diseases as compared to 48.6% of veterans without PTSD. Furthermore, PTSD has also been linked with an increased rate of smoking and alcohol intake.<sup>[25]</sup> Smoking has been linked to cardiovascular morbidity and mortality, and alcohol has been associated with increased blood pressure and heart rate. Thus, the basal increase in heart rate seen in PTSD patients could be attributed to the increased consumption of alcohol and smoking in this population. Soldier's Heart (suggested by Dr. Jacob Mendez Da Costa, a Philadelphia physician) is an American civil war term linking PTSD with increased propensity for CVD.<sup>[26]</sup>

#### Work Stress

Job strain, involving a combination of high job demands and low control at work, is one of the most widely studied definitions of psychosocial stress.<sup>[3]</sup> CVD is one of the health outcomes whose links with work stress have been well established based on numerous prospective studies. Research on work stress began in the late 1970s and early 1980s when Karasek launched the job strain model and proposed that high psychological demands combined with low individual control over those demands leads to physiological strain and increased risk of CVD.<sup>[27]</sup> In 2002, the WHO stated that *"There is some evidence to suggest that general strategies to reduce stress in the adult environment (e.g., in the workplace) may be beneficial in reducing CVD risk."*<sup>[28]</sup>

All sectors in Libyan institutions suffer from widespread corruption. In fact, Libya has been classed as the 171<sup>st</sup> least corrupt nation out of 175 countries, according to the 2017 Corruption Perceptions Index.<sup>[29]</sup> Bribery and favoritism are common practice in all sectors, and people have to cope with unfair competition. This factor would have resulted in severe stress in all work environments, the magnitude of which is virtually not known.

#### CONCLUSION

In our literature survey, we found only one article related to mental health of Libyan conflict.<sup>[30]</sup> This article estimated cases of severe PTSD and depression and related health service

requirements using modeling from existing epidemiological data. No actual epidemiological studies on the current Libyan health status were found. Thus, there is no doubt that Libyans are suffering from different types of chronic stresses that will result in illnesses and different psychological injuries of unknown magnitude. The significance of these effects cannot be realized unless different epidemiological studies are carried out in different parts of the country. The teamwork of all who are involved in health services including governmental and private institutions are needed.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### REFERENCES

- Havranek EP, Mujahid MS, Barr DA, Blair IV, Cohen MS, Cruz-Flores S, *et al.* Social determinants of risk and outcomes for cardiovascular disease: A Scientific statement from the American Heart Association. *Circulation* 2015;132:873-98.
- Dimsdale JE. Psychological stress and cardiovascular disease. *J Am Coll Cardiol* 2008;51:1237-46.
- Steptoe A, Kivimäki M. Stress and cardiovascular disease. *Nat Rev Cardiol* 2012;9:360-70.
- Brotman DJ, Golden SH, Wittstein IS. The cardiovascular toll of stress. *Lancet* 2007;370:1089-100.
- Pajak A, Jankowski P, Kotseva K, Heidrich J, de Smedt D, De Bacquer D, *et al.* Depression, anxiety, and risk factor control in patients after hospitalization for coronary heart disease: The EUROASPIRE III study. *Eur J Prev Cardiol* 2013;20:331-40.
- Nabi H, Kivimäki M, Batty GD, Shipley MJ, Britton A, Brunner EJ, *et al.* Increased risk of coronary heart disease among individuals reporting adverse impact of stress on their health: The Whitehall II prospective cohort study. *Eur Heart J* 2013;34:2697-705.
- Marmot M, Brunner E. Cohort profile: The Whitehall II study. *Int J Epidemiol* 2005;34:251-6.
- World Health Organization | Mental Health: A State of Well-Being; 2017. Available from: [http://www.who.int/features/factfiles/mental\\_health/en/](http://www.who.int/features/factfiles/mental_health/en/). [Last accessed on 2017 Nov 16].
- Baum A. Stress, intrusive imagery, and chronic distress. *Health Psychol* 1990;9:653-75.
- Baum A, Poslusny DM. Health psychology: Mapping biobehavioral contributions to health and illness. *Annu Rev Psychol* 1999;50:137-63.
- McGorrian C, Yusuf S, Islam S, Jung H, Rangarajan S, Avezum A, *et al.* Estimating modifiable coronary heart disease risk in multiple regions of the world: The INTERHEART modifiable risk score. *Eur Heart J* 2011;32:581-9.
- Yusuf S, Rangarajan S, Teo K, Islam S, Li W, Liu L, *et al.* Cardiovascular risk and events in 17 low-, middle-, and high-income countries. *N Engl J Med* 2014;371:818-27.
- Yan R, Li W, Yin L, Wang Y, Bo J, PURE-China Investigators. *et al.* Cardiovascular diseases and risk-factor burden in urban and rural communities in high-, middle-, and low-income regions of china: A large community-based epidemiological study. *J Am Heart Assoc* 2017;6. pii:e004445.
- Khatib R, McKee M, Shannon H, Chow C, Rangarajan S, Teo K, *et al.* Availability and affordability of cardiovascular disease medicines and their effect on use in high-income, middle-income, and low-income countries: An analysis of the PURE study data. *Lancet* 2016;387:61-9.
- Holt-Lunstad J, Smith TB, Baker M, Harris T, Stephenson D. Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspect Psychol Sci* 2015;10:227-37.
- Cacioppo JT, Hawkley LC, Crawford LE, Ernst JM, Burleson MH, Kowalewski RB, *et al.* Loneliness and health: Potential mechanisms. *Psychosom Med* 2002;64:407-17.
- Berkman LF, Leo-Summers L, Horwitz RI. Emotional support and survival after myocardial infarction. A prospective, population-based study of the elderly. *Ann Intern Med* 1992;117:1003-9.
- Williams RB, Barefoot JC, Califf RM, Haney TL, Saunders WB, Pryor DB, *et al.* Prognostic importance of social and economic resources among medically treated patients with angiographically documented coronary artery disease. *JAMA* 1992;267:520-4.
- Marmot MG, Syme SL. Acculturation and coronary heart disease in Japanese-Americans. *Am J Epidemiol* 1976;104:225-47.
- Egolf B, Lasker J, Wolf S, Potvin L. The roseto effect: A 50-year comparison of mortality rates. *Am J Public Health* 1992;82:1089-92.
- Shankar A, McMunn A, Banks J, Steptoe A. Loneliness, social isolation, and behavioral and biological health indicators in older adults. *Health Psychol* 2011;30:377-85.
- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders 4<sup>th</sup> edition Text Revision (DSM-IV-TR). Washington, D.C.: American Psychiatric Association; 2000.
- Schlenger WE, Kulka RA, Fairbank JA, Hough RL, Kathleen Jordan B, Marmar CR, *et al.* The prevalence of post-traumatic stress disorder in the Vietnam generation: A multi-method, multisource assessment of psychiatric disorder. *J Trauma Stress* 1992;5:333-63.
- Boscarino JA. Diseases among men 20 years after exposure to severe stress: Implications for clinical research and medical care. *Psychosom Med* 1997;59:605-14.
- Beckham JC, Moore SD, Feldman ME, Hertzberg MA, Kirby AC, Fairbank JA, *et al.* Health status, somatization, and severity of posttraumatic stress disorder in Vietnam combat veterans with posttraumatic stress disorder. *Am J Psychiatry* 1998;155:1565-9.
- Wooley CF, Jacob Mendez DaCosta: Medical teacher, clinician, and clinical investigator. *Am J Cardiol* 1982;50:1145-8.
- Kivimäki M, Kawachi I. Work stress as a risk factor for cardiovascular disease. *Curr Cardiol Rep* 2015;17:630.
- Li J, Loeberbroks A, Bosma H, Angerer P. Work stress and cardiovascular disease: A life course perspective. *J Occup Health* 2016;58:216-9.
- Libya Corruption Rank; 2003-2018. Available from: <https://www.tradingeconomics.com/libya/corruption-rank>. [Last accessed on 2018 May 13].
- Charlson FJ, Steel Z, Degenhardt L, Chey T, Silove D, Marnane C, *et al.* Predicting the impact of the 2011 conflict in Libya on population mental health: PTSD and depression prevalence and mental health service requirements. *PLoS One* 2012;7:e40593.



## ملخص المقال باللغة العربية

تأثير الضغط المزمن على الجهاز القلبي الوعائي: منظور الصحة للصراع الليبي.

الجزء الأول: أنواع الضغط المزمن.

**المؤلف:** عبدالله سالم الهويجي، لميس علي تيبار

قسم علم الأدوية والصيدلة السريرية، كلية الصيدلة، جامعة طرابلس، ليبيا.

**المؤلف المسؤول:** عبدالله سالم الهويجي ، قسم علم الأدوية والصيدلة السريرية، كلية الصيدلة، جامعة طرابلس،

ليبيا

البريد الإلكتروني: hwuegi@hotmail.com

قدمت الدراسات الحديثة أدلة واضحة ومقنعة على أن الضغط المزمن يساهم بشكل كبير في الأمراض القلبية الوعائية. هذه الدراسة هي مراجعة منهجية لتأثير الضغط المزمن على نظام القلب والأوعية الدموية مع تأمل خاص في الصراع الليبي. قسم هذا البحث إلى جزئين، الجزء الأول يتحدث عن أنواع الضغوطات المزمنة، في حين أن الجزء الثاني يتناول الآليات التي تسبب الضغط المزمن وعلاجاتها. تم استخدام Medline/PubMed و scholar google وقواعد بيانات Scopus للبحث عن الأبحاث المناظرة التي تتناول موضوع المراجعة. يمكن تصنيف الضغوطات بصفة عامة إلى ضغط حاد وضغط مزمن. يمكن أن ينبع الضغط المزمن من العوامل الكامنة مثل الضغط الاقتصادي، وضغوط العزلة الاجتماعية، الضغط اللاحق للصدمة، والضغط الوظيفي. يظهر الضغط الاقتصادي كمحدد هام للصحة العامة للفرد، حيث وجدت دراسات مختلفة اتجاهاً عكسياً بين عبء عامل الخطر وانتشار الأمراض القلبية الوعائية في المجتمعات الحضرية والريفية في المناطق ذات الدخل المرتفع والمتوسط والمنخفض. الضغط الاجتماعي هو عامل آخر تم التأكيد على أنه يرتبط بزيادة 2 إلى 3 أضعاف في حدوث الأمراض القلبية الوعائية. وعلاوة على ذلك، أظهرت دراسات متعددة أن المرضى الذين يعانون من اضطراب ما بعد الصدمة قد زاد معدل ضربات القلب لديهم أثناء الراحة، وزيادة ضغط الدم كرد فعل للأحداث الصادمة. الضغط المزمن في العمل هو أحد عوامل التأثير على القلب والأوعية الدموية.

**الكلمات المفتاحية:** الضغوط المزمنة، آليات الضغوط المزمنة، علاج الضغوط المزمنة.