

Apr 12th, 5:00 PM - 5:45 PM

## Stress: A Roundtable

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Stressed Out:

How Physiological Stress Affects the Heart

Ola Olaleye, Jessica Arroyo, Jarely Mejia, and Jessica Daniel

Collin College

### Abstract

This paper explores the effects and links between the deterioration of the cardiovascular system and heart disease due to physiological stress. Furthermore, this document will divulge the links between high blood pressure (hypertension) and physiological stress as well as obesity and cholesterol levels. This paper examines studies from various well respected scientists and cardiologists. Furthermore, this paper unravel how acute stress can and will build up over an individual's lifetime and lead to cardiovascular issues. In addition, this article will explain the difference between eustress and distress and their effects on the cardiovascular system. This paper will also include an explanation of how modern healthcare affects the heart and surrounding organs. In the same way, this paper will illustrate the effects and links between physiological stressors (acute and chronic) on the heart and heart disease, while bringing awareness to the topic of stress and suggest ways to cope with and prevent stress.

*Keywords:* [acute, short-term, chronic, long-term, stress, heart, cardiovascular]

### Stressed Out: How Physiological Stress Affects the Heart

The heart, one of the most important organs in the human body. Various situations can affect the heart both beneficially and adversely. Stress is infamously known for having an adverse effect on the heart, whether acute or chronic. There are two different kinds of stress, eustress and distress. Eustress is also known as “good stress,” which motivates people to take on intimidating tasks in day to day life. In contrast, distress is known as “bad stress” that can and will take a toll on one's life. Furthermore, psychological distress whether acute or chronic can and will eventually pose a disadvantageous effect on the cardiovascular system and surrounding systems.

Acute stressors can display the same damage as chronic stressors, however in smaller intervals. An example of acute stress is a natural disaster, because these instances occur instantaneously without warning. In James Dimsdale's 2014 article Psychological Stress and Cardiovascular Disease, during the 1999 Taiwan earthquake, over a dozen patients were being studied by Holter monitoring (Dimsdale, 2014). Dimsdale found that the patient's heart rate increased exponentially, up to 160 beats per minute. Dimsdale's team also noticed an increase in low frequency/high-frequency ratio proving that a withdrawal of parasympathetic nervous activity, was occurring while there was an increase in activity within the sympathetic nervous system.

Many diseases can occur due to stress levels in the heart. The heart is constantly under stress and, studies have shown that coronary heart disease may be a result of too much stress. Coronary heart disease occurs when plaque builds up in the coronary arteries. A significant increase in stress can lead to health problems and at the end of these studies it was proven that stress can lead to coronary heart disease and it affected more women than men. Coronary heart

disease occurs mostly because of poor health habits, blood and fats can build up and become plaque, which slowly starts collecting in the arteries and it can cause blockage. The plaque can lead to blockage or the rupture of the arteries. The reason that coronary heart disease is caused by stress is because stress causes displeasure and over time people start eating more unhealthy food because it causes pleasure and eventually the patient is left with fat build up.

There was another study on veterans and the effects stress can have on their health. Since veterans are constantly under stress and while performing vigorous exercise the results could be more controlled. The results were that veterans were under a great risk for new-onset coronary heart disease. The heart is made up of muscle and through time it becomes less efficient and most people come along with heart disease as they grow older but it does not mean that heart diseases occur in a certain age range. When the results were categorized in more detail it was shown that age had more contribution to the disease and the individuals' history specifically their lifestyle. Specifically, these veterans were under chronic psychological stress because if they were under combat they were constantly seeing horrible situations where it involved people to fight for a cause and the heartbeat became very irregular or tachycardia because their hearts were pounding half the time from constant exercise, fear, anxiety, and much more through that a person can attain a heart rate that is constantly changing rates and making the heart rate irregular and it puts more stress on the muscle. With an irregular heartbeat the heart can slowly start to skip heartbeats and this disease is called arrhythmias. Arrhythmias have symptoms that include shortness of breath, chest pain, dizziness along with other symptoms. If this occurs the diagnosed person may need to start taking medications or get a pacemaker to stabilize the heart rate. Veterans are constantly under stress which has great impact on the heart. Diseases come from many areas and different factors can lead to other diseases or health related problems.

The heart is an organ that never stops working while a person is still alive so one of our main purposes is to keep it as healthy as possible. Stress is a part of everyone's life, but with some experiences stress becomes something that is not as beneficial. Stress is often considered to be a negative reaction. However, stress can be good and everyone has experienced some form of eustress which can have positive effects on the heart as well. An example of good stress is competition, it makes individuals strive to do their best and it makes the body work constantly. Through stress the body sends out signals, giving more importance to the task. Eustress has positive effects on the heart by keeping a person active and part of keeping the heart healthy is daily exercise. The heart is part of the human body and all the systems work together. Some have bigger impacts on the patient's health condition. The heart is connected to the lungs since the blood it pumps needs to be oxygenated. If the heart is under a small amount of stress while exercising it puts the organs to work and it also keeps the capillaries of the heart more free from clots as it is constantly working, there is less risk of failure.

Stress often causes people to eat poorly, it is one of the most common side effects of stress and poor eating habits have a direct correlation to heart disease. Unhealthy eating habits can result in plaque, clots, hypertension, tachycardia, heart failure, and many other diseases. Stress can also become too much for some people, most people classify stress as a situation that is becoming too much for them to handle. When stress starts to get to this point it frustrates people and their health slowly starts to become less important. This is another way that stress can directly affect the heart. During stressful situations people start ignoring symptoms caused by stress, because they want to get the assignment done and their priorities start to change and people slowly begin to be affected by this. They ignore the fact that they have to do things to maintain their health.

Although there are healthcare providers and methods to treat stress, it is also a major cause of stress. Many patients stress about their health and access to health care because of how expensive health care is in the 21<sup>st</sup> century. Since stress is a factor that is there all the time there should be some new methods that the healthcare system could practice making doctor to patient interaction more practical. Most clinics have limited staff and although they have nurses working, the patient must wait for a longer period of time for the doctor or physician to treat them. When the patients go to their checkups there should be better time management that way the patient gets the care they need while still getting through as many people as possible.

The reason why stress can affect the heart is because stress changes the hearts behavior. A stressful situation sets off a chain of events, signals are sent to the rest of the body. The signals sent can cause the body to release adrenaline which temporarily causes the heart rate and breathing to speed up which also causes blood pressure to increase. Although these are temporary responses, if the body remains under stress for a long period of time, chronic stress will cause your blood pressure to remain high which will damage the arterial wall and lining of the blood vessels. Studies show that acute stress reduces blood flow to the heart, it then makes the heart beat irregular which could cause blood clots. All of these reactions can trigger the development of cardiovascular disease.

Although stress is not the most common heart disease risk factor their research shows there is a connection. Other than just poor habits that people resort to when under stress, there are other ways distress can harm the heart. People must find a way to stress less, to eustress! Because as it increases it causes more damage. Being distressed itself can alter the way the body behaves and it can bring about changes to the blood and nervous system, which will have a negative effect on your heart's health.

Appendix A

Participation Agreement

Date: 2/6/17

Names: Ola Olaleye, Jessica Arroyo, Jarely Mejia and Jessica Daniels

Classes participating in the URHSS project include students from the Central Park Campus (CPC) Human Anatomy and Physiology II Classes taught by Professors R. Brown & R. Cravo along with students from the Health Sciences Academy (HSA) classes taught by Professors K. Newby & T. Sanchez

Human Biological Organ interested in:

Heart

Interest in medicine or research:

Physiological stress affecting the

Additional information:

None

Style of communication/presentation preferred:

Communication: Email

Presentation: Essay, Powerpoint presentation, Tri-fold poster

Agreement to participate with assigned partner in the Premier Workshop: Undergraduate Research Health Sciences Symposium. I attest I will meet all requirement of the assignment and present on March 31, 2017.

]



Appendix B

Intellectual Property Consent Form



Don't stress about the heart!!

Intellectual Property Consent Form

I, Ola Olaleye, give my permission for Jessica Arroyo and Jarely Mejia and our student mentor, Jessica Daniel, to utilize the information and research from our Undergraduate Research Health Sciences Symposium (URHSS) workshop project for educational purposes only. Each of the four named individuals have permission to utilize this intellectual material insofar as they each provide proper attribution to all parties involved.

Signatures Below:

Ola Olaleye \_\_\_\_\_ 2/6/17  
Date

Jarely Mejia \_\_\_\_\_ 2/6/17  
Date

Jessica Arroyo \_\_\_\_\_ 2/6/17  
Date

Jessica Daniel \_\_\_\_\_ 2/6/2017  
Date

Appendix C

Email to Mentor

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Undergraduate Research Health Science Symposium Inbox x



Ola.Olu Olaleye <oolaleye2@cougarmail.collin.edu>

Feb 6



to jdanieH, RCravo, Tanya, Knewby, bcc: me

Hello! I'm Ola Olaleye, your mentee for the Undergraduate Research Health Science Symposium. My partner's, Jarely Mejia, Jessica Arroyo, and I look forward to working with you! Attached is a consent form, it would be great if you could sign it and send it back.

Thanks,  
Ola Olaleye



## Appendix D

## Annotated Bibliography

Boyde, M., & Peters, R. (2014). Education material for heart failure patients: what works and what does not?. *Current heart failure reports, 11*(3), 314-320.

This article covers heart failure and ways to keep the heart healthy. It talks about why those methods work and the functions of the heart. It also describes the other end of the spectrum which explains why certain methods in caring for your heart do not work.

Crum-Cianflone, N. F., Bagnell, M. E., Schaller, E., Boyko, E. J., Smith, B., Maynard, C., ... & Smith, T. C. (2014). Impact of combat deployment and posttraumatic stress disorder on newly reported coronary heart disease among US active duty and reserve forces. *Circulation, CIRCULATIONAHA-113*.

In this article they did a study on service members in the military, since they are constantly under a great amount of stress. This study covers what diseases could come from stress factors. They specially focused on coronary heart diseases and how their heart adjusted under stressful situations. Overall, the results came out that in a short period of time many young veterans are found to be at risk of coronary heart disease.

Dimsdale, J.E. (2008) Psychological Stress and Cardiovascular Disease. *Journal of the American College of Cardiology, 51*, 1237-1246. -References - Scientific Research Publish. (n.d.).

Dimsdale shares the effects of long-term and acute stress on the heart, as well as the connection between stressors and cardiovascular disease. Dimsdale investigates what

long-term stressors like jobs, marital burdens, caregiving, and acute stressors such as terms of disasters are linked to the deterioration of the heart and cardiovascular disease.

Matkovich, S. J. (2014). MicroRNAs in the stressed heart: sorting the signal from the noise. *Cells*, 3(3), 778-801.

RNAs, known as microRNAs, are of importance in cellular signaling during differentiation and development. They also play a role in as adaptive and maladaptive responses of adult tissues, including those that compromise the heart. A large part being explored is microRNA responses in both physiological and pathological. Cardiac microRNAs are regulated by hemodynamic in result of exercise and hypertension. There is still a large part of mRNAs and signaling pathways to explore.

Nabi, H., Kivimäki, M., Batty, G. D., Shipley, M. J., Britton, A., Brunner, E. J., ... & Singh Manoux, A. (2013). Increased risk of coronary heart disease among individuals reporting adverse impact of stress on their health: the Whitehall II prospective cohort study. *European Heart Journal*, eht216.

Stress affects many aspects of health but how does it impact the heart. Is it related to myocardial infarction, a heart attack, or what point of the heart will it take action on. This article covers stress, impact it can have on the heart and what part of it is most affected.

Parswani, M. J., Sharma, M. P., & Iyengar, S. S. (2013). Mindfulness-based stress reduction program in coronary heart disease: A randomized control trial. *International journal of yoga*, 6(2), 111.

This article explains the effects of Psychological risk factors such as anxiety and depression on the cardiovascular system. Additionally, the article divulges into the links between psychological risk factors and coronary heart disease (CHD), hypertension, and obesity.

Pereira, V. H., Cerqueira, J. J., Palha, J. A., & Sousa, N. (2013). Stressed brain, diseased heart: a review on the pathophysiologic mechanisms of neurocardiology. *International Journal of Cardiology*, 166(1), 30-37.

Cardiovascular diseases are normally related to risk factors such as smoking, diabetes and hypertension. Recently, anxiety and depression have been proposed as risk factors for cardiovascular diseases such as heart failure, ischemic disease, hypertension and arrhythmias

Schubert, C., Lambertz, M., Nelesen, R. A., Bardwell, W., Choi, J. B., & Dimsdale, J. E. (2009). Effects of stress on heart rate complexity—a comparison between short-term and chronic stress. *Biological Psychology*, 80(3), 325-332.

This article discusses the effects of chronic and short-term stress among fifty adults. The experimenters altered time, frequency, and phase domain (complexity) to measure the effects they possess over heart rate variability (HRV). Over all, the experimenters observed that chronic and short-term stressors pose various effects of the heart.

Steinberg, J. S., Arshad, A., Kowalski, M., Kukar, A., Suma, V., Vloka, M., ... & Reed, G.

(2004). Increased incidence of life-threatening ventricular arrhythmias in implantable defibrillator patients after the World Trade Center attack. *Journal of the American College of Cardiology*, 44(6), 1261-1264.

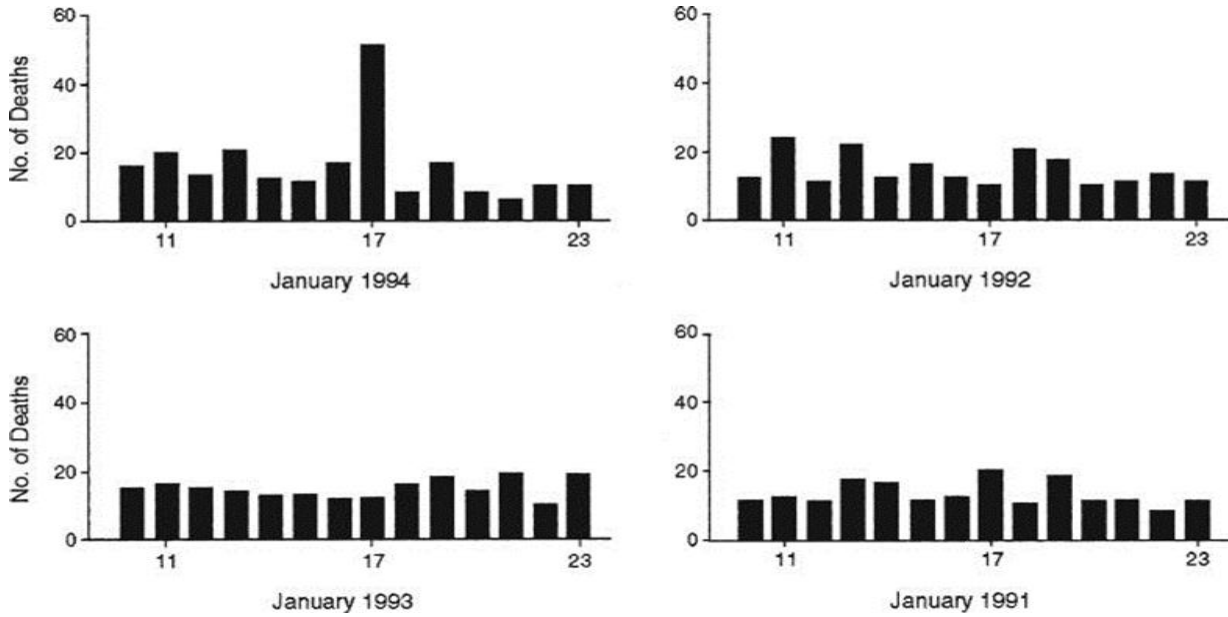
This article discusses the effects of acute stress. The acute stressor in this article is the World Trade Center attack. Steinberg and Kowalski explain how the stress of experiencing the World Trade Center attack affected the patients.

van Dijk, E. T., Westerink, J. H., Beute, F., & IJsselsteijn, W. A. (2015). In sync: the effect of physiology feedback on the match between heart rate and self-reported stress. *BioMed Research International*, 2015.

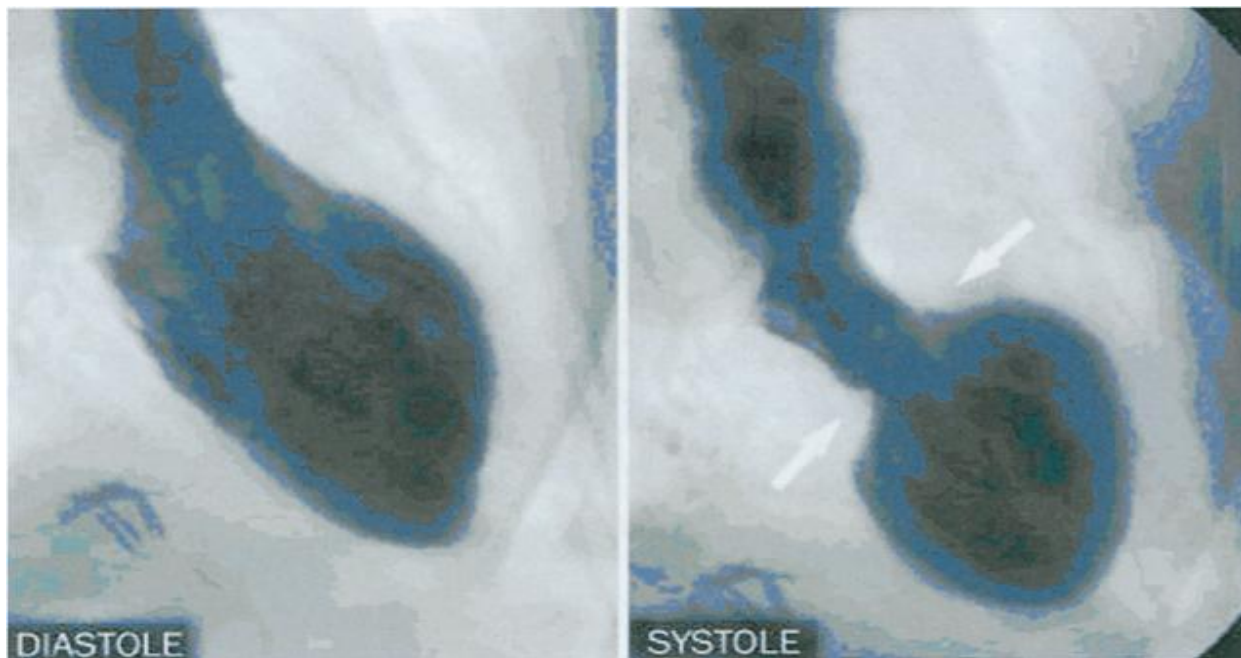
This article discusses the links to various heart rates and amounts of self-reported physiological stress. Furthermore, this article explains how stress affects other cardiovascular organs and passageways.

Appendix E

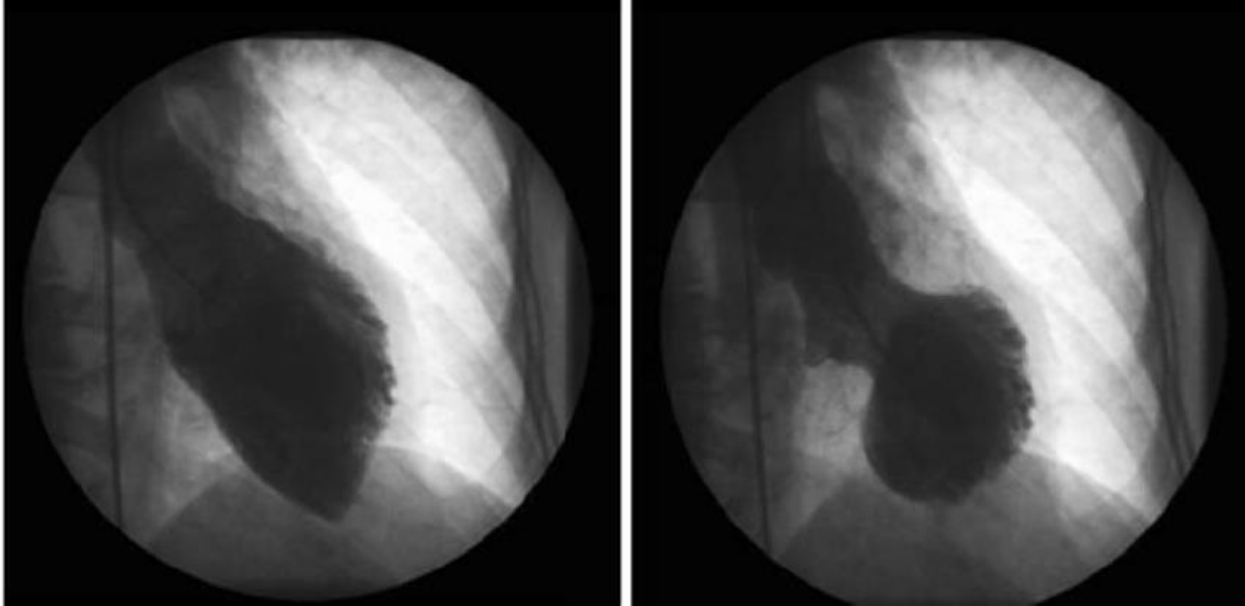
Diagrams



Daily Cardiac Deaths in Los Angeles Associated With Earthquake (Dimsdale, 2104)



Angiogram in Stress Cardiomyopathy (Dimsdale, 2014)



Normal Angiogram (Sealove, Tiyyagura, Fuster, 2015)



## Appendix F

## References

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- Hermann Nabi, Mika Kivimäki, G. David Batty, Martin J. Shipley, Annie Britton, Eric J. Brunner, Jussi Vahtera, Cédric Lemogne, Alexis Elbaz, Archana Singh-Manoux; Increased risk of coronary heart disease among individuals reporting adverse impact of stress on their health: the Whitehall II prospective cohort study.
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program in coronary heart disease: A randomized control trial.

Matkovich, S. J. (2014). MicroRNAs in the stressed heart: sorting the signal from the noise.

*Cells*, 3(3), 778-801.

Pereira, V. H., Cerqueira, J. J., Palha, J. A., & Sousa, N. (2013). Stressed brain, diseased

heart: a review on the pathophysiologic mechanisms of neurocardiology. *International*

*Journal of Cardiology*, 166(1), 30-37.

Schubert, C., Lambertz, M., Nelesen, R. A., Bardwell, W., Choi, J.-B., & Dimsdale, J. E. (2009).

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stress. *Biological Psychology*, 80(3), 325–332.

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Stress. (n.d.). Retrieved February 24, 2017

Appendix G

Change Log

DATE	Location/Who?	Date of response	Changes Made	Were changes made?
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02/20/2017	Professor Newby	02/21/2017	Formatting, and Grammar	Yes
03/14/2017	Writing Center	03/14/2017	Changes according to the writing center	Yes
03/03/2017	Mentor (Jessica Daniel)	03/18/2017	Changes were suggested, in some cases kept writing lab suggestions.	Yes

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[jarroyo4@cougarmail.collin.edu](mailto:jarroyo4@cougarmail.collin.edu)