A study published Jan. 26, 2016 in the Journal of the American Heart Association concludes that consumption of caffeinated beverages did not cause a detrimental disturbance of cardiac rhythm (extra heartbeats called ectopy) that is associated with increased disease and death.

It was reported Jan. 26, 2016 in U.S. News & World Report.

What is a heartbeat?

Electrical impulses in the heart cause its two chambers to contract one at a time and pump blood throughout the body.

What are extra heartbeats? How common are they?

Extra heartbeats are collectively termed ectopy. When they originate through premature contractions in one of the chambers of the heart called the atrium, we call it atrial ectopy. When they originate in one of the chambers of the heart called the ventricle, we call it ventricular ectopy.

Atrial and ventricular ectopy are very common. During a 24-hour period, 99 percent of people will have at least one extra atrial heartbeat. Extra ventricular heartbeats are nearly as frequent, with 80 percent of people having one every 24 hours. Generally speaking, the number will grow over time so that young people have very little ectopy and older patients will have more.

People who have heart disease will have more atrial and ventricular extra heartbeats.

Are extra heartbeats dangerous? How?

The largest studies looking at the risk of extra atrial heartbeats have been completed in Southeast Asia. Those studies conclude that extra atrial heartbeats double the risk of dying from heart disease and risk of hospitalization compared to individuals who do not have extra atrial heartbeats. However, the most convincing evidence is related to the association of atrial fibrillation (a potentially dangerous type of irregular heart rhythm) and extra atrial heartbeats. Several studies have demonstrated an increased risk of developing atrial fibrillation in individuals who have atrial ectopy compared to individuals who do not. However, there is no evidence to suggest that atrial ectopy alone increases the risk of stroke or sudden cardiac death.

Ventricular ectopy is much more complex. There is evidence that ventricular ectopy increases risk of dying from heart disease as well as increases rates of sudden death in roughly the same proportion as extra atrial heartbeats. Patients with coronary artery disease and frequent extra ventricular beats have an increased risk of dying from heart disease. Patients with heart failure often also have frequent extra ventricular beats and are likely at no greater disadvantage than those patients who have heart failure and no extra ventricular beats.
Premature ventricular contractions can, on their own, cause heart failure as well. This is largely determined by the nature and total number of premature ventricular contractions. Overall, premature ventricular contractions need to be scrutinized on the basis of what if any evidence there is for having structural heart disease as well as the origin and number of all ectopic beats.

What have clinicians thought about the cause of these premature cardiac contractions? Why have they instructed patients to avoid caffeine?

All cardiac tissue is capable of spontaneous contraction, called automaticity. Typically, an area of the heart called the sinus node sets the heart rate, and all the other cardiac cells fall in line. When a cell or group of cells starts early, an extra heartbeat is initiated. Another way to think about this is that the sinus node serves as the heart's master clock. When the internal clock of another group of cells runs fast, an extra heartbeat arises. This is called enhanced automaticity.

Another mechanism by which premature beats are initiated is through triggered activity. Certain drugs, electrolyte imbalance, or injury can result in early spontaneous contractions of a group of cells which occur so early in the cardiac cycle that some of the heart is still recovering from the preceding heartbeat. In these situations, that very early contraction creates waves of chaotic electrical activation in the cells of the heart.

Caffeine has been demonstrated to decrease a chemical called phosphodiesterase that usually breaks down another substance known as cyclic AMP. More circulating cyclic AMP makes heartbeats more forceful. Caffeine also promotes the release of noradrenaline (adrenalin) which can increase heart rate. So it makes intuitive sense that increases in caffeine will place more workload on the heart by creating more total heartbeats and more forceful heartbeats, making it possible to have premature atrial contractions and premature ventricular contractions.

Are there beneficial cardiovascular effects of any caffeinated products? What are they?

Cocoa-derived products such as chocolate have high amounts of flavonoids, a family of plant compounds which have demonstrated a positive cardiovascular effect through their antioxidant properties (which can prevent or delay some types of cell damage), and through increases in a substance called nitric oxide. Nitric oxide is a chemical which works directly on the lining of blood vessels, known as endothelium, to relax blood vessels and thereby lower local and system blood pressures. Through these effects coffee and chocolate consumption has been shown in some studies to reduce cardiovascular mortality from coronary artery disease. Although tea is not cocoa-derived, it has also demonstrated similar reductions in incidence and prevalence of coronary artery disease.

What was this study seeking to determine?

This was an observational study looking to determine the number of premature atrial contractions and premature ventricular contractions per hour based upon the number of caffeinated beverages or foods individuals consumed. The subjects wore a 24-hour Holter monitor, a portable battery-powered device that provides a continuous recording of the heart's electrical activity and the timing of how each chamber contracts to pump blood through the heart.

Who did they study? How many subjects? From where? What ages, genders, ethnicities? How were they tested and their diet assessed? How long were they followed?

The study was conducted through four academic centers (Johns Hopkins University, Wake Forest University, University of Pittsburgh, and University of California, Davis). A total of 1,388 individuals were included in the study from Medicare beneficiaries at these four centers. The group included 50

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percent men, and about 95 percent were white, 4 percent were black, and 1 percent classified themselves as “other.”

At the beginning of the study, individuals were asked to complete a picture-sort exercise based upon 99 food items. They were asked to quantify their consumption into five categories on an average annual basis: never, five to 10 times per year, one to three times per month, one to four times per week, and almost every day. Caffeinated coffee, tea, and chocolate were the three items in the questionnaire which contained caffeine.

What did the researchers find?
There were no statistically significant differences between the number of premature atrial contractions per hour, premature ventricular contractions per hour, runs of supraventricular tachycardia or ventricular tachycardia (abnormally high heart rates) between levels of coffee, tea, and chocolate ingestion.

Focusing on coffee consumption, it made no difference whether the subjects drank no coffee or drank coffee every day. Individuals all had between two and four premature atrial contractions every hour, one premature ventricular contraction every hour, no or one episode of supraventricular tachycardia, and no episodes of ventricular tachycardia.

What is the significance of these results? How does this study fit with previous research findings?
This research reaffirms existing data that suggests while exceedingly high levels of caffeine ingestion have resulted in abnormal heart rhythms, moderate caffeine consumption has no impact on the frequency of premature atrial and ventricular contractions or sustained abnormal rhythms.

Did the researchers analyze their results by gender? Did they find any differences between racial or ethnic groups?
This study was not powered to draw conclusions related to differences in gender for coffee, tea, and chocolate consumption’s relationship to cardiac ectopy. Similarly, the study population was overwhelmingly Caucasian, and therefore no analysis can be completed on ethnic or racial disparities.

How will these results affect your recommendations to patients when it comes to caffeine consumption?
We have always adhered to a recommendation to limit known triggers for individuals with abnormal heart rhythms. So for patients with a clear association between caffeine consumption and symptoms of cardiac ectopy, we have recommended avoidance if possible. For other individuals who have not demonstrated a clear personal relationship between consumption and symptoms, we recommend moderate and/or consistent consumption of caffeinated products. The results of this study supports our practice pattern.

Are there any shortcomings to this study? What would be a good follow-up to learn more?
Generally speaking, studies like these that utilize dietary recall to determine consumption can be prone to recall bias — people don’t always remember accurately what and how much they consume. Additionally, in this scenario there hasn’t been a clear determination of the total dose of caffeine consumed. Coffee from different manufacturers and roasts contains different amounts of caffeine, so a better study design would have tried to determine the total ingested caffeine dose rather than the amount of total products consumed.

All studies on human health should include female subjects and analyze results by gender. Lumping male and female data together obscures any potential sex or gender differences. Any future research should make sure to fully consider sex and gender as an experimental variable.

In addition, studying essentially only a white population limits the role that race and ethnicity may play.

And nearly 35 percent of the individuals were on some sort of drug therapy to limit ectopy (antiarrhythmic drugs). It can make it difficult to see small differences in arrhythmia (an abnormal heart rhythm) burden when patients are on drug therapy. Including a broader demographic not on drug therapy to limit arrhythmias and obtaining caffeine doses would provide more robust data and potentially reveal more disparities between consumption profiles.