

# Analyzing Coronary Heart Disease Risk Factors and Proper Clinical Prescription of Statins

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## Abstract

A sample of adults participating in the first 7 months of visit 5 of the Atherosclerosis Risk in Communities (ARIC) study were analyzed to determine if they were receiving statin treatment, when indicated, based on their risk factors for coronary heart disease. This sample consisted of male and female adults ages 67 through 89. Data collected from the ARIC study along with the Framingham risk score were used to calculate participants ten year risk. Next, the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults report was used to determine if the 10 year risk was great enough to warrant statin use. It was found that 163 of 831 males and 213 of 1145 females were not on statins even though their risk factors suggested they should be.

## Introduction

Coronary heart disease is a major health concern in the United States. The ARIC study is a long standing prospective epidemiologic study examining the factors associated with developing coronary heart disease. The cohort component of the ARIC study has been following participants since 1987 and has collected a large amount of data related to participants' risk factors for developing CHD. Traditional risk factors include total cholesterol, HDL-cholesterol, LDL-cholesterol, current smoker status, diabetes status, and blood pressure (Chambless et al 2003). The ARIC study has gathered information on these factors and a number of others as participants undergo a number of tests during ARIC clinical visits. For instance, ultrasounds are taken in order to visualize the vessels of the heart and analyze arterial wall thickening. Fasting blood analysis allows for the determination of blood glucose, HDL, LDL, and total cholesterol. Blood pressure measurements are taken. Data regarding previous coronary heart disease, stroke, or diabetes are also collected. In addition, medication use such as statin drugs and diabetes medication are taken.

The Framingham risk score is an empirically determined way to calculate a person's ten year risk of developing coronary heart disease (Lloyd-Jones et al, 2004). This score gives point values to risk factors for CHD. The Framingham risk score also shows how different risk factors affect males and females differently, assigning different point values for different risk factors. The total number of points determines the ten year risk of developing coronary heart disease.

To further use the data collected by the ARIC study in visit 5 (in 2011), the ATP III was used to compare the necessity of statin use based on ten year risk of developing CHD. Statin drugs reduce cholesterol by inhibiting the enzyme HMG CoA-reductase. The goal of this project was to determine whether participants who needed to be on statins according to their ten year risk were being prescribed statin drugs. The proper use of these risk factors in diagnosing patients and prescribing preventive treatments has major implications on patient outcomes. This emphasizes the importance of following guidelines that outline when a person should be on medication to counteract some of the risk factors listed above.

Whether physicians are using these guidelines when deciding how they treat their patients is an important part of battling coronary heart disease.

## Results

The sample analyzed was split into male and female participants. The first step taken to determine which participants should be on statin drugs or not was determining the prevalence of diabetes, previous CHD, and stroke. Any participant with one or more of these diseases was considered to be in need of statin drugs. The results of these findings for males can be found in figure 1 and females in figure 2.

### Prevalence of Select Diseases in Male Participants

Condition	Number of Participants	Percentage of Participants
Total Participants	831	-
Coronary Heart Disease Only	107	12.9%
Stroke Only	3	.4%
Diabetes Only	196	23.6%
Diabetes and CHD	62	7.5%
Diabetes and Stroke	2	.4%
CHD and Stroke	2	.4%
Diabetes, CHD, and Stroke	0	0

Figure 1. Participants were asked to disclose if they had any previous history of the three conditions listed above and if they were on medications for any of these conditions. The most prevalent disease among the male participants of this study was diabetes. 23.6% of the population either had a fasting blood glucose level over 126 mg/dL or were on medication to treat diabetes.

### Prevalence of Select Disease in Female Participants

Condition	Number of Participants	Percentage of Participants
Total Participants	1145	-
Coronary Heart Disease Only	71	6.2%
Stroke Only	6	.5%
Diabetes Only	225	19.7%
Diabetes and CHD	16	1.45%
Diabetes and Stroke	1	.09
CHD and Stroke	2	.2%
Diabetes, CHD, and Stroke	1	.09%

Figure 2. Prevalence of select diseases was also determined in the women participants. Diabetes was the most prevalent disease among women participants at 19.7% of the population.

Next, the information from the ARIC study was used to calculate each participants 10 year risk percentage of developing coronary heart disease. This was determined from the Framingham risk equation by counting up the total point score for the various risk factors. The results for the male population can be viewed in figure 3 while the female population results can be viewed in figure 4.

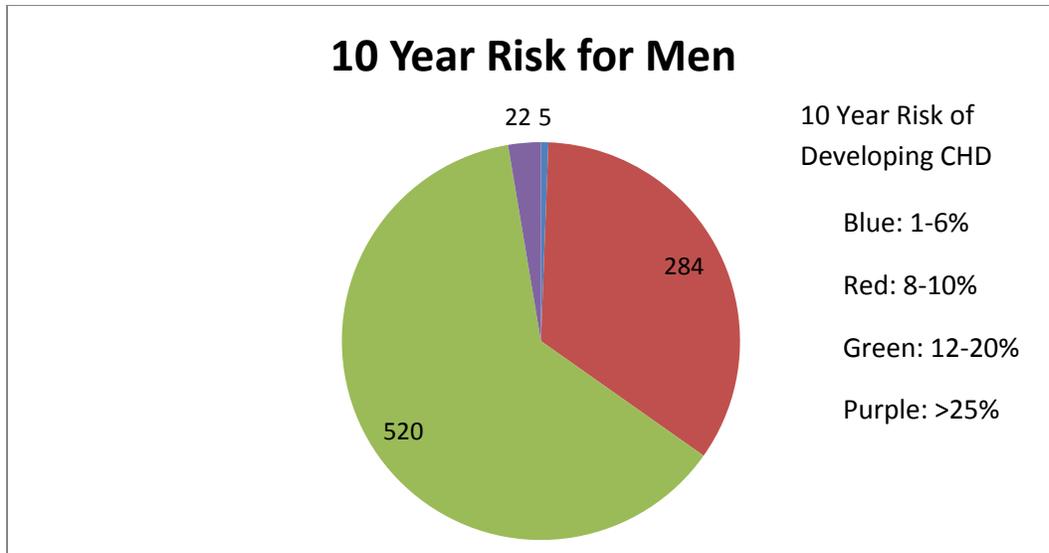


Figure 3. This figure shows the number of male participants (n=831) that had various levels of 10 year risk of developing CHD. Risk levels are calculated based on the Framingham risk equation. These values do not include the prevalence of CHD, diabetes, or stroke.

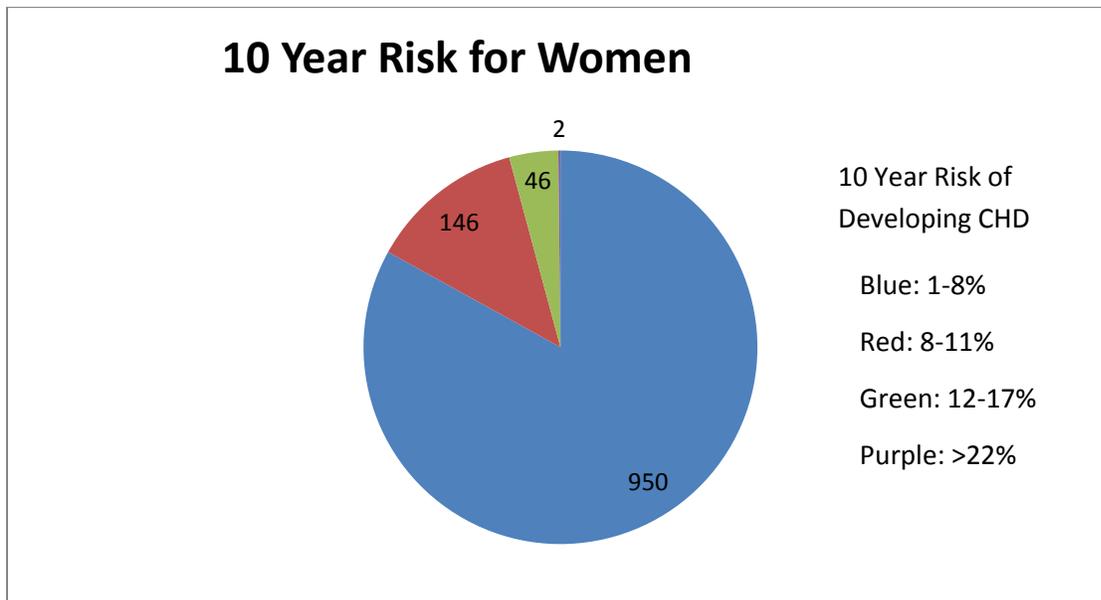


Figure 4. This figure shows the number of female participants (n=1145) that had a certain 10 year risk of developing CHD. The colors correspond to the level of risk as determined by a participants score using the Framingham risk equation. Each participants score relates to a certain level of risk. These risk calculations do not include the prevalence of CHD, stroke, or diabetes.

Lastly the risk factors measured by the ARIC study along with the disease data were used to determine whether or not participants should be on statin drugs. Using the ATP III report guidelines it was found that 163 out of 831 male participants were not on statin drugs and either had prevalent cardiovascular disease or ten year risk that determined they should be on statins (see figure 5). It was also found that

213 of 1145 female participants were not on statin drugs when they needed to be (see figure 6). Also of note, many participants in both the male and female populations were found to be on statin drugs even though they did not have disease or risk factors that warranted statin use. One factor in determining the ten year risk that wasn't taken into account when using the Framingham risk equation was the pre existing use of statins and the change to lipid levels that this would have. To investigate this, a sensitivity calculation was performed to find a range of those participants who were not on statins but should have been. The assumption was made that any participant that was on statin drugs had the risk factors that deemed they should be taking statins. When taking this into account two percentages were determined for the number of participants not on statin drugs that needed to be. This range was determined to be 26-35% in males and 26-39% in females. This range still suggests a large number of participants are not receiving statin treatment that need it.

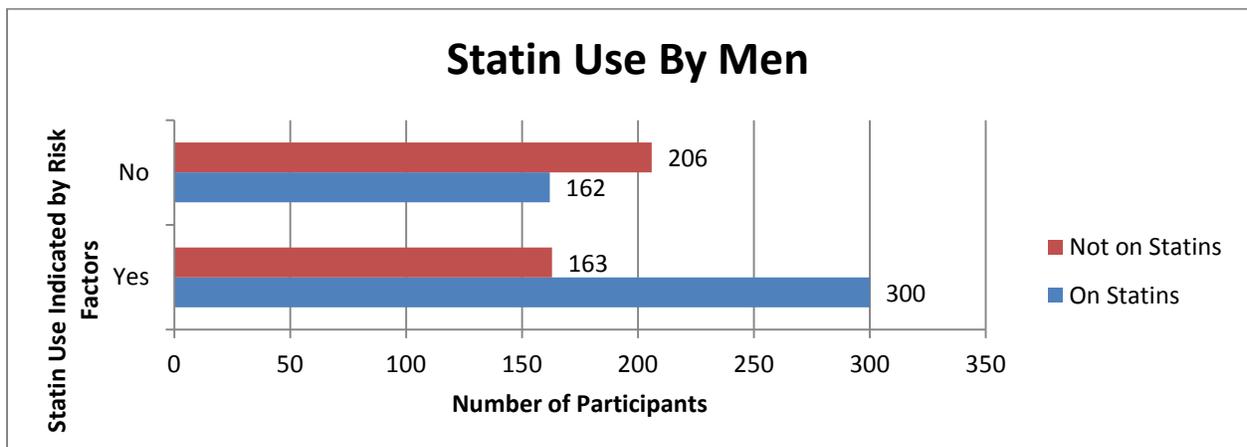


Figure 5. In this population 55.6% of male participants were using statin drugs. 65% of those on statins had risk factors or disease that indicated they should be on statin drugs. 35% did not have risk factors that indicated they should be on statins. 35% of those indicated for statin use were not on statin drugs. The sensitivity measurements argue that 26% of those indicated for statin use are not on statins. The actual value of participants will fall within the range of 26%-35% range.

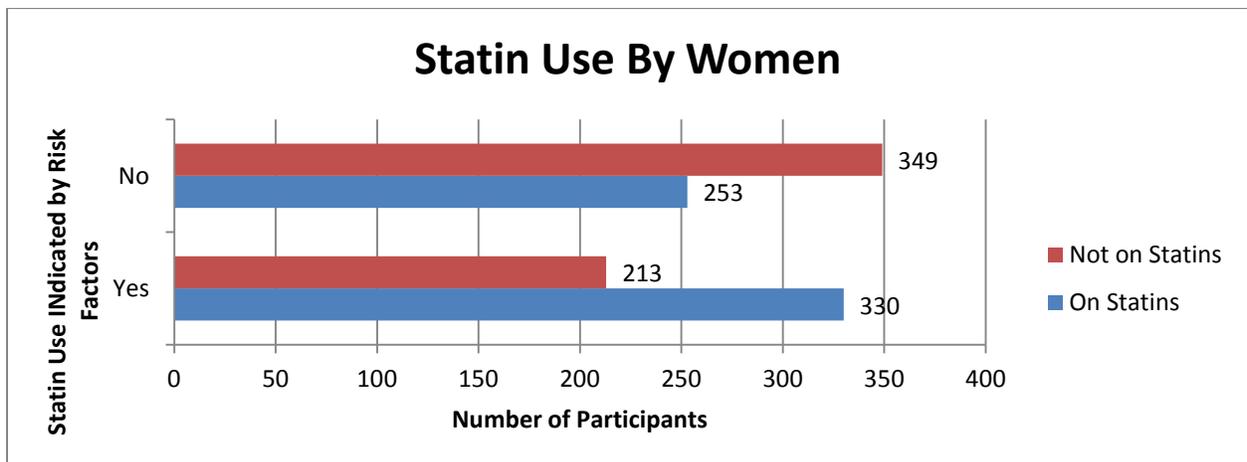


Figure 6. In this population 50.9% of the female participants were on statin drugs. 56.6% of those on statins had risk factors or disease that indicated they should be on statin drugs. 43.4% did not have risk factors that indicated they should be on statins. Of those indicated for statin use 39.2% were not on statin drugs. The sensitivity measurements argue that 26.8% of those indicated for statin use are not on statins. The actual value will fall within the range of 26.8%-39.2%.

## Discussion

The findings of this analysis took into account many factors that determine the ten year risk of participants developing coronary heart disease. Disease was a major contributor to the need for statin use. Disease was not directly counted as a point total in the Framingham risk equation, but was considered as a “yes” or “no” determinant of needing statin drugs because of the affects of diabetes, previous CHD event, or stroke on the future risk of developing CHD. The next factor taken into account were the guidelines from the ATP III looking at overall risk of developing coronary heart disease in the next ten years and LDL levels when determining what patients should be on statin drugs (Grundy et al. 2002). It was found that a number of participants were not on statin drugs that had the risk factors or disease that suggested they should be. These findings could indicate that physicians are not using patients ten year risk of developing coronary heart disease when prescribing statin drugs.

It is important to consider factors outside of the information obtained from the ARIC study for why patients wouldn't be on statin drugs even if their risk factors suggest they should be when analyzing these findings. This could include patient refusal to take statin drugs even though their physician suggested it, or the prevalence of other medications that prevented them from using statin drugs from drug interactions for instance.

Next steps that could be taken with this research would be to analyze how risk factors differed by race or where participants are from. This analysis did not differentiate between the four ARIC field centers where data was obtained. Looking more closely at what areas and genders and races were not receiving medication based on their risk factors would be an interesting extension of this research.

## References:

- Scott M. Grundy, Diane Becker, Luther T. Clark, Richard S. Cooper, Margo A. Denke, Wm. James Howard, Donald B. Hunninghake, D. Roger Illingworth, Russell V. Luepker, Patrick McBride, James M. McKenney, Richard C. Pasternak, Neil J. Stone, Linda Van Horn. 2002. “Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Final Report.” *Circulation* 106 (25) (December 17): 3143–3421.
- Lloyd-Jones, Donald M, Peter W.F Wilson, Martin G Larson, Alexa Beiser, Eric P Leip, Ralph B D’Agostino, and Daniel Levy. 2004. “Framingham Risk Score and Prediction of Lifetime Risk for Coronary Heart Disease.” *The American Journal of Cardiology* 94 (1) (July 1): 20–24. doi:10.1016/j.amjcard.2004.03.023.
- Chambless Lloyd, Folsom Aaron, Sharrett A., Sorlie Paul, Couper David, Szklo Moyses, Nieto F. 2003. Coronary Heart Disease Risk in the Atherosclerosis Risk in Communities Study. *Journal of Clinical Epidemiology*. 56: 880-890.

