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Lessons from the trials

The Dallas Heart Study using the probability sample technique for ethnicity and cardiovascular health differences

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ABSTRACT

The decrease in cardiovascular death rates in the United States has been slower in blacks than whites, especially in patients <65 years of age. The Dallas Heart Study was designed as a single-site, multiethnic, population-based probability sample to produce unbiased comparison of cardiovascular health among multiple ethnicities.

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INTRODUCTION

In the United States, the decrease in cardiovascular death rates has been slower in blacks than in whites or other ethnic groups, resulting in widening disparity, especially in patients < 65 years of age. The Dallas Heart Study was designed to study this disparity by having equal representation of black and non-black adults who were not self-selected and were surveyed with an extensive household interview.¹

THE STUDY

The Dallas Heart study was conducted in Dallas County, Texas with estimated 1.43 million, non-institutionalized adults aged 18 to 65 years who maintained their primary residency in the County. The study was conducted from July 2000 to January 2002. The primary basis for the sampling frame was the US Postal Service delivery sequence file which included 841,943 housing unit addressed in the county. Selection probabilities were greater in strata with larger concentrations of blacks to achieve the desired 50:50 split in ethnicity. From 10 geographic strata of different ethnic composition, random samples totaling were selected and finally 7,586 eligible individuals selected, including at most 1 subject from each address. The primary reasons for this sampling process is (1) to obtain a probability sample of residents in the target population from which to determine the prevalence of cardiovascular diseases and the risk factors predisposing to these diseases in the target population, and (2) to supply enough subjects to be recruited later for a growing list of mechanistic sub studies. On the basis of power calculations, the aim was to recruit completing all phases of initial data collection, with equal numbers of blacks and non-blacks, women and men, and age groups 30 to 45 and 46 to 65 years.

Epidemiologic and biologic data were collected in 3 separate and sequential visits.

Visit 1 (home visit); the household interview, consisted of 60 minute, computer-assisted health interviews of 6,101 subjects (54% blacks) with measurements of blood pressure (BP), heart rate, and weight in adults 18 to 65 years of age. The ethnic category of each participant was self-assigned from the same structured list of categories used in the Third National Health and Nutrition Examination Survey. In future analyses, race-specific sequence variations in the genome will be used to establish the amount of racial admixture in the population.

Visit 2 (home visit, the “phlebotomy visit”); consisted of the in-home collection of fasting venous blood (66 ml) and first-morning urine samples from 3,398 interview participants (52% black) 30 to 65 years of age. BP was measured as in visit 1.

Visit 3 (clinic Visit); consisted of extensive clinic examinations of 2,971 phlebotomy visit participants (50% black) by trained medical personnel at Texas Southwestern Medical Center. The examination included several imaging modalities; (1) a thoracic magnetic resonance imaging study to measure left ventricular mass and function and aortic dispensability; (2) an electron beam computed tomographic scan of the heart to quantify the amount of calcium in the coronary arteries as marker of coronary atherosclerosis; (3) abdominal magnetic resonance imaging to measure subcutaneous and visceral adipose tissue directly; (4) proton magnetic resonance spectroscopy to measure the fat content of the liver; and (5) dual-energy x-ray absorptiometry scans to measure regional adiposity, total lean body mass, and bone density. BP was measured as in visit 1 and 12-lead electrocardiography was also performed. To test the effectiveness of the sampling weights in correcting for nonparticipation bias at the interview step, the design of the study permitted a sampling weight to be calculated for each subject in the interview, phlebotomy and clinic samples to ensure adequate representation of the community.¹

RESULTS

The investigators reported that through the above design they were able to enroll much larger percentage of black patients than any other prior cardiovascular study that collected a probability sample, moreover, the participation rates compared favorably with those of other health surveys in American adults. The Dallas Heart Study estimates for the stratification variables (ethnicity, gender, and age) were identical to those of the 2000 United States census. The estimated population distribution of educational attainment was also very similar to the 2000 census estimate. In the non-black population, the distribution of Hispanic and white or other ethnic groups was similar in the 2 population estimates.

For most demographic, social, medical, and biologic variables, no meaningful differences in weighted population estimates were found among interview, phlebotomy, and clinic samples,

indicating that weighting process eliminated most of the nonparticipating bias from progressive sample attrition. Weighted estimation for the population means of biologic characteristics measured during the household interviews was virtually identical when calculated from the interview, phlebotomy, and clinic samples. Weighted estimates of mean fasting blood glucose, plasma lipids, and serum creatinine (measured at the phlebotomy visit) were identical when calculated from the phlebotomy and clinic samples.

DISCUSSION

The Dallas Heart Study provided a unique format to study cardiovascular health in a community by using a sample of subjects at the same time ensuring adequate representation of various ethnicities and genders are adequately represented. Furthermore, these samples of subjects are extensively studied both in the community and at the clinic and having undergone extensive survey, blood and urine collection for immediate and future studies as well as extensive imaging evaluations. To date more than 80 important observations were published from this study.²⁻⁵

The investigators outlined the advantages of a probability-based sample for the multidisciplinary study of ethnicity and cardiovascular diseases including; the ability to (1) make inferences at the population level, (2) track secular changes over time, and (3) avoid the biases associated with convenience samples of self-selected and health care-seeking volunteers often used for association studies.

Recently increased emphasis in research in cardiovascular health according to ethnicities was emphasized, we and others^{6,7} have observed significant differences in clinical characteristics, management and outcome in acute cardiac conditions including acute coronary syndrome (ACS), heart failure and atrial fibrillation according to ethnicities (Asians versus Arabs), however in contrary to data from Western countries, Asians with ACS living in the Middle East are younger with lower cardiovascular risk profile and better outcomes when compared with native patients, this is primarily because the Asian population in the Middle east are mainly younger, more likely to be male healthy manual workers when compared to Asians living in their native countries and in the Western world.

WHAT WE HAVE LEARNED?

The methodology of the Dallas Heart Study provides an opportunity for researchers who are interested to study populations using the sampling technique used in this study instead of whole population study and hence reducing the cost of the study while at the same time maintaining the quality of the study. This format of the study might be ideal for conducting population-based studies in the Middle East and around various geographic locations around the world.

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