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Research Brief

PRIMARY CARE Research Institute

The North Texas Healthy Heart Study

Identifying the Causes of Racial/Ethnic Disparities in Cardiovascular Disease

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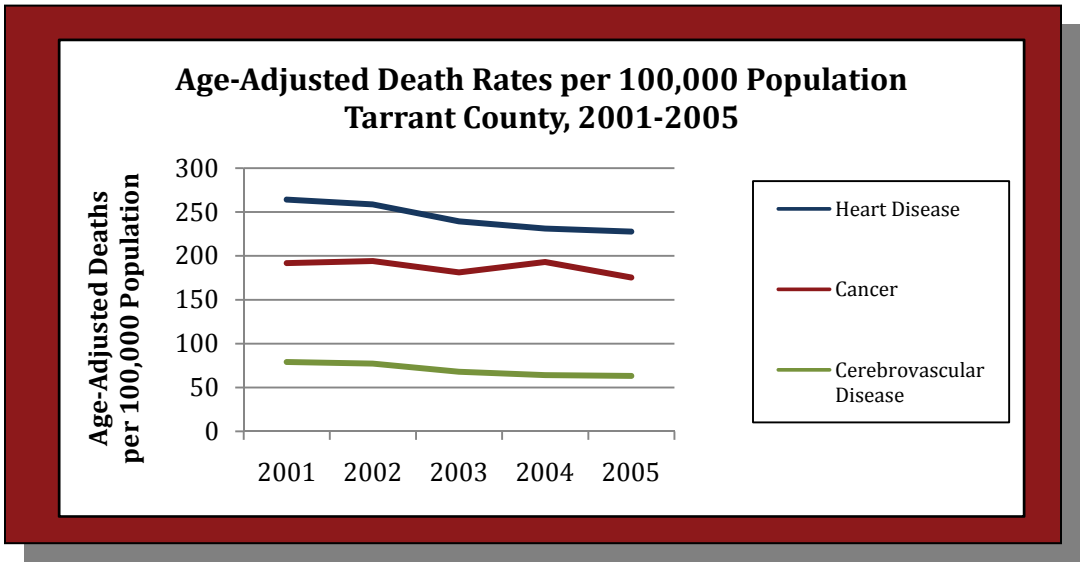
INTRODUCTION

Burden of Cardiovascular Disease

Cardiovascular disease (CVD), which encompasses all diseases affecting the heart or blood vessels, is a major cause of sickness and death in the United States. In fact, CVD has been the leading cause of death for both men and women in the United States for the last 80 years.[1] Heart disease is the most prevalent type of cardiovascular disease, causing nearly one in every three deaths in the United States.[2] It is estimated that about $403 billion were spent on heart disease in 2006, including costs for healthcare professionals, hospital and nursing home services, medications, other medical expenses, and lost productivity. In comparison, only $190 billion were spent on cancer in 2004.[3]

Residents of North Texas experience a similar burden from CVD. As in the United States, heart disease is the leading cause of death in Tarrant County, with a death rate of 228 heart disease deaths/100,000 population (see Figure 1). In fact, the DFW Hospital Council suggests that heart disease education, prevention, and treatment programs are needed in every major service area in Tarrant County.[4]

Figure 1. Leading Causes of Death in Tarrant County[4]



Extent of Cardiovascular Disease Disparities

Although CVD impacts the entire population, there are significant disparities in cardiovascular disease morbidity and mortality based on race/ethnicity in the United States. As shown in Figures 2 and 3, although death rates from CVD have dropped significantly in the last 50 years, the disparities in CVD death rates between Whites and Blacks have not improved. In fact, among males, CVD death rates were actually higher in Whites than in Blacks until the 1970s. But improvements in CVD prevention and treatment impacted White males much better than Black males, causing White CVD death rates to drop significantly faster. This created a Black/White CVD death disparity, which has not reduced significantly for the past 20 years.[5]

Figure 2. Cardiovascular Disease Deaths among Females by Race/Ethnicity[5]

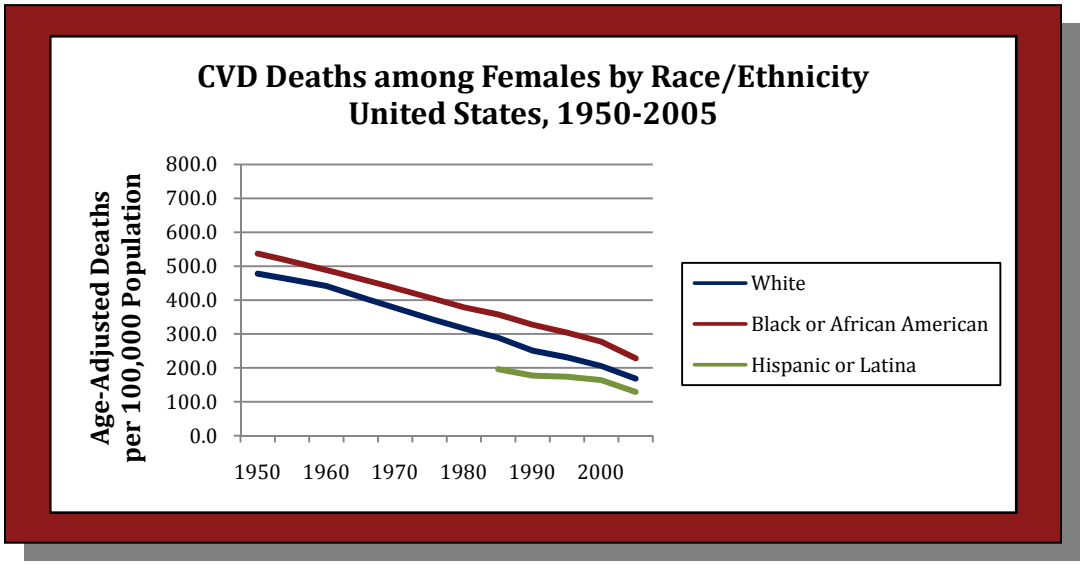
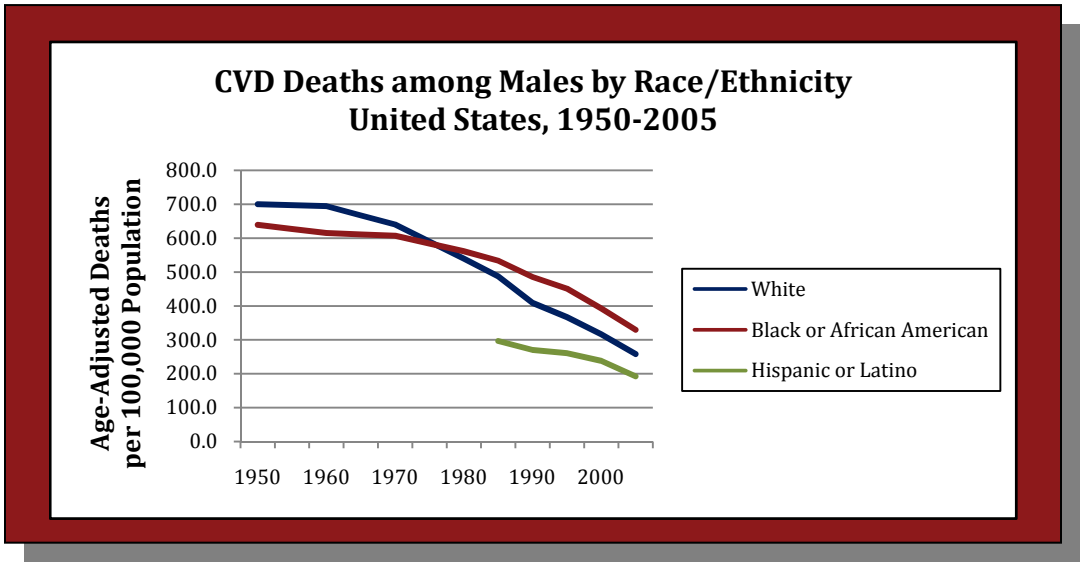


Figure 3. Cardiovascular Disease Deaths among Males by Race/Ethnicity[5]



These racial/ethnic disparities in cardiovascular disease are evident within the North Texas region, as well. Compared to non-Hispanic Whites, African Americans suffer a 30% higher death rate for cardiovascular disease.[6]

Risk Factors

There are a number of conditions and behaviors that are known to be risk factors for CVD. For example, people with high levels of cholesterol, specifically low-density lipoprotein cholesterol (LDL), high blood pressure, and/or diabetes mellitus are at increased risk for developing CVD.[7] These conditions are highly prevalent throughout the North Texas region. In 2006, over 33% of the Tarrant County population had high cholesterol, more than 36% of the population had high blood pressure, and about 15% of the population had diabetes.[4] Similarly, in Dallas County, about 30% of the population had high cholesterol, nearly 40% had high blood pressure, and 18% of the population had diabetes.[8]

Not surprisingly, the behavioral risk factors for CVD are, in many cases, the same as the risk factors for high

cholesterol, high blood pressure, and diabetes. These include tobacco use, a diet high in saturated fats and cholesterol, physical inactivity, excessive alcohol consumption, and obesity.[7] Compared to the nation as a whole, Tarrant County residents are less likely to exercise, more likely to smoke, and more likely to be overweight or obese. However, they are more likely to eat a diet high in fruits and vegetables and less likely to drink excessively.[9] Dallas County residents, compared to the U.S. population, are also less likely to exercise. But they are more likely to eat a diet high in fruits and vegetables, less likely to be overweight/obese, less likely to smoke, and less likely to drink heavily.[9]

These known risk factors for CVD, however, cannot completely explain the prevalence of CVD. Many risk factors are as yet unknown, and additional research is needed to identify and address them.

North Texas Healthy Heart Study

Primary Care Research Institute

Housed at the University of North Texas Health Science Center, the Primary Care Research Institute was established to improve the lives of Texas citizens through interdisciplinary primary care and public health service, research, and education. The Institute is dedicated to working with interdisciplinary partners and translating research into primary care and public health practice. The Primary Care Research Institute is revolutionizing the approach to primary care research by developing collaborative partnerships to improve the health and lives of the people of Texas through interdisciplinary and translational research and education.

With funding from the National Institutes of Health through the Texas Center for Health Disparities (1-P20-MD001633-010003), the Primary Care Research Institute initiated the North Texas Healthy Heart Study in 2006. The study seeks to identify biological mechanisms that could contribute to racial/ethnic differences in cardiovascular disease (CVD) risk. The study's specific aims and hypotheses are described in more detail below.

Race/Ethnicity, Psychosocial Factors, and Cardiovascular Disease Risk

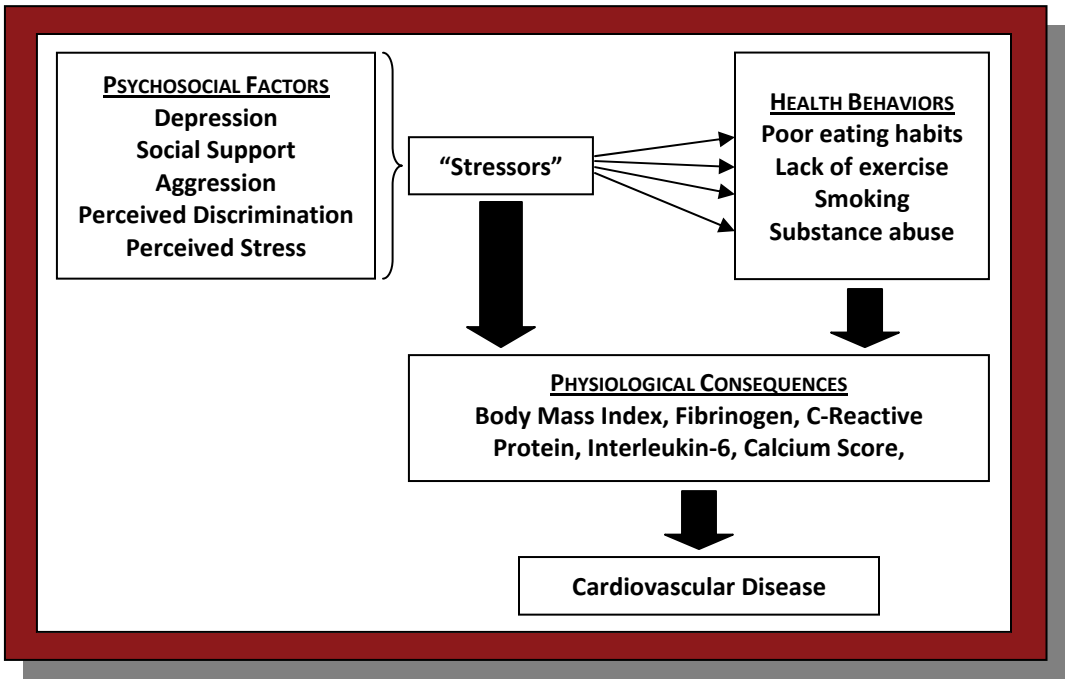
Although a growing body of scientific evidence supports the hypothesis that psychosocial factors are related to CVD mortality and morbidity,[10-13] few studies have investigated the biologic mechanisms through which these psychosocial factors may impact CVD risk. In an effort to fill this gap, the first aim of the North Texas Healthy Heart Study was to assess racial/ethnic differences in the relationship between psychosocial factors and biologic markers of CVD risk, including cardiovascular serum markers and coronary calcium scores. When these markers are present at higher levels, however, they are indicative of elevated risk of cardiovascular disease. Coronary calcium scores quantify the amount of coronary calcium deposits along the arterial walls. The presence of any calcium in the coronary arteries is predictive of coronary artery disease, and the magnitude of the coronary calcium is directly related to the risk of having a cardiac event.

North Texas Healthy Heart Study researchers are testing the following hypotheses:

- Experiences of perceived discrimination or unfair treatment are associated with elevated levels of cardiovascular serum markers and an elevated calcium score.
- A low level of social support is associated with elevated levels of cardiovascular serum markers and an elevated calcium score.
- A weak sense of control is associated with elevated levels of cardiovascular serum markers and an elevated calcium score.

Figure 4 shows the conceptual framework behind these hypotheses.

Figure 4. Conceptual Framework Linking Psychosocial Factors and CVD



Race/Ethnicity, Physical Activity, Body Composition, and Cardiovascular Disease Risk

Excess fat is strongly associated with cardiovascular risk factors, including hypertension, high cholesterol, and type 2 diabetes. The pattern of fat distribution is thought to be important, with certain types of fat conferring higher risk than others. Visceral adipose tissue (VAT), the deep layer of fat packed between internal organs, has been linked with the development of insulin resistance, hypertension, diabetes, and other cardiovascular diseases.[14-17] VAT has also been linked with the production of proteins which initiate the inflammation process and which may initiate or exacerbate cardiovascular risk factors.

Since VAT is time-consuming and expensive to measure, body measurements such as waist circumference or body mass index (BMI) are used as surrogates for VAT measurements. Several studies, however, have demonstrated that there may be race-specific differences in the relationship between body measurements and underlying VAT[18-21] and that there may be race-specific differences in the relationship between VAT and markers of inflammation.[22, 23] This suggests that other factors may modulate the relationship between VAT and cardiovascular risk. One such factor that has been largely unaccounted for in minority groups is that of habitual physical activity. Physical fitness/activity has been demonstrated to reduce morbidity and mortality from cardiovascular and other metabolic diseases independent of body fat. While it has been shown that minorities are less physically active compared with Whites,[24-26] associations among fitness/activity, body composition, and inflammatory biomarkers have not been extensively documented in minority populations. Therefore, a study of relationships among physical activity, body measures of body composition, VAT, and inflammatory and other risk factors is needed.

To address this need, the North Texas Healthy Heart Study aims to determine the impact of physical activity on the racial/ethnic differences in the relationship between body composition, as measured with both body and VAT measurements, and cardiovascular risk factors. The specific hypotheses are described below:

- There are racial/ethnic differences in the relationship between visceral adipose tissue (VAT), as measured using computed tomography (CT) scanning, and anthropometric measures of body

composition, including BMI and waist circumference.

- There are racial/ethnic differences in the relationships between VAT, markers of inflammation, and other cardiovascular risk factors.

- Racial/ethnic differences in physical activity account for altered relationships among body composition and both markers of inflammation and other cardiovascular/metabolic risk factors.

METHODS

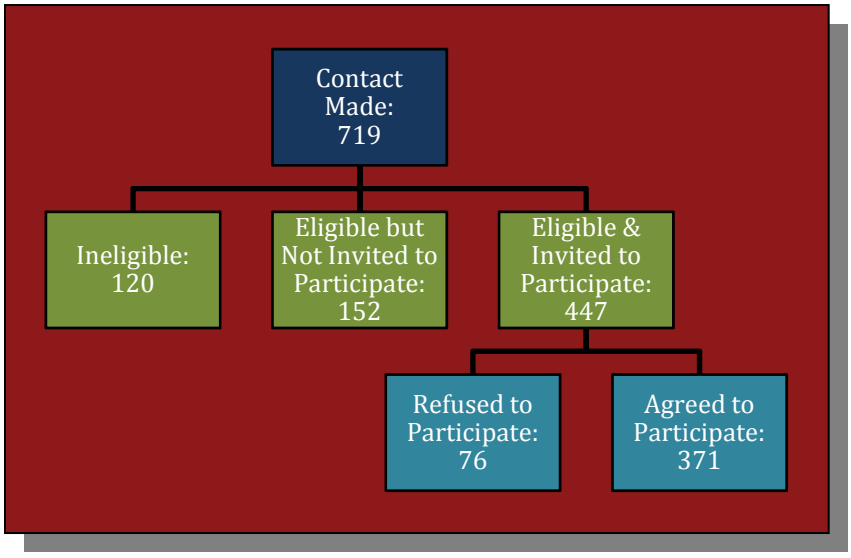
Participant Selection

The North Texas Healthy Heart Study is a cross-sectional study involving a sample of 371 non-Hispanic Whites, non-Hispanic Blacks, and Hispanics/Latinos recruited from participating sites of the North Texas Primary Care Practice-Based Research Network (NorTex) and within Tarrant County. NorTex is a collaborative network of primary care clinics serving low-income, underrepresented populations of the Dallas/Fort Worth, Texas metropolitan area. The family medicine/internal medicine clinic sites that participated in the North Texas Healthy Heart Study included four academic community-based clinics, three county health centers, four solo-practitioner private practices, and one federally-qualified health center.

Participants were eligible for the study if they were over the age of 44, identified themselves as non-Hispanic White, non-Hispanic Black, or Hispanic/Latino, and had no self-reported history of cardiovascular disease (coronary artery disease, peripheral arterial disease, history of myocardial infarction or stroke, or congestive heart failure), renal failure, or cirrhosis.

Recruitment of potential subjects occurred by receiving referrals from clinicians, posting flyers in each clinic, participating in health fairs, and having research assistants recruit within each clinic. All participants were screened for eligibility either on-site or over the phone. All willing and eligible subjects were given a morning appointment to come to the NorTex research office. Initial contact was made with 718 individuals, with 599 meeting eligibility criteria. Of those who were eligible, 447 were invited to participant in the study. 371 agreed to participate, representing an 83% recruitment rate (Figure 1). All study procedures were approved by the University of North Texas Health Science Center and JPS Health Network Institutional Review Boards.

Figure 5. North Texas Healthy Heart Study Recruitment



Study Procedures

As study recruits arrived at the clinic for their scheduled appointment, a research assistant reviewed the study protocol, risks, and benefits and asked the recruit to sign an informed consent form. Once participants were consented, they began the study. The procedures are briefly explained below. Details of the interview instrument and the biological markers measurements are described in more detail below.

1) ***Interview.***
All participants who consented to take part in the study underwent a one-hour face-to-face interview. The interview instrument measured demographic information, medical histories, and several psychosocial domains.

2) ***Pregnancy Test.***
Women, except for those who had a hysterectomy, underwent a urine pregnancy test since computed tomography (CT) scanning may pose a risk to the fetus. There were no positive urine pregnancy tests among the study participants.

3) ***Body Measurements.***
Participants were brought into a clinical exam room, changed into a gown, and had weight, height, waist/hip circumferences, blood pressure, and percent body fat measurements taken. All measurements were completed by trained research assistants.

4) ***Blood Draw.***
Subjects re-dressed and had 25 milliliters of blood drawn by a phlebotomist for the studies discussed in detail below.

5) ***CT Scan.***
Each subject was scheduled for a 16-slice computed tomography (CT) scan of the heart and abdomen within 2 weeks to measure coronary calcium and visceral fat.

6) ***Follow-up.***
Each participant will be contacted yearly for the next 3 consecutive years for follow-up phone interviews assessing medical and social events that have occurred during the previous year.

Next Steps

North Texas Healthy Heart Study (NTHHS) researchers are currently following up with participants to collect a second wave of biomarker data. These data will be used to assess the impact of psychosocial factors on CVD markers over time. By collecting the psychosocial and CVD measures at the same time, as was done in the first round of the NTHHS, researchers cannot determine whether the psychosocial factors led to changes in CVD biomarkers or whether the CVD biomarkers led to certain psychosocial outcomes (depression, stress, etc.). Thus, regardless of the results, causality cannot be known. But, after the second wave of biomarker data is collected, researchers can compare psychosocial measures at baseline to CVD biomarkers to assess the impact over time.

Preliminary Results

Initial analyses of the data collected from the North Texas Healthy Heart Study have identified some interesting variations in risk factors for coronary artery calcification (CAC) by race/ethnicity. Among non-Hispanic Whites, male gender and history of hyperlipidemia were risk factors for elevated CAC, but these were not risk factors for African Americans or Hispanics. Among African Americans, diabetics were more likely than non-diabetics to have elevated CAC, but this was not a risk factor for Hispanics or non-Hispanic Whites. Furthermore, the impact of social support on CAC risk differed by race/ethnicity. Although social support was

not associated with CAC risk for any racial/ethnic group, emotional support was protective against CAC in Whites. However, among Hispanics and African Americans, having high amounts of emotional support was a risk factor for CAC.

Risk factors for elevated CAC levels differed by psychosocial factors, such as how participants responded to unfair treatment, as well. Among those who indicated that if they were treated unfairly, they tried to do something about it, male gender, older age, and increased BMI were risk factors for CAC. Among those who responded passively to unfair treatment (i.e. if they were treated unfairly, they accepted it as a fact of life), older age, smoking, and history of hyperlipidemia were risk factors for CAC. Also of note, passive responders who reported experiences of racial discrimination were more than nine times more likely than passive responder who had not experienced racial discrimination to have elevated CAC levels.

DISCUSSION

The results of the North Texas Healthy Heart Study have the potential to impact public health knowledge, clinical practice, and public policy. Public health researchers have been investigating the role of psychosocial factors and physical activity in CVD and other chronic diseases for decades. However, there is not yet a consensus as to the importance of these factors on health, partly due to differences in the magnitude of the effects observed in different studies. This study could help to clarify these differences by showing that psychosocial factors and physical activity impact people from various racial/ethnic groups differently. Furthermore, identifying differences in fat distribution based on racial/ethnic group could help to explain the pathophysiologic pathways that lead from psychosocial factors and physical inactivity to CVD.

From a clinical standpoint, the results of the NTHHS could help physicians be more sensitive to their patients, based on their psychological and social features. This study may also help to understand the predictive value of certain biomarkers for CVD. As clinicians become better able to assess the full spectrum of CVD-related risk factors, they can provide better advice to their patients to address those issues and better manage their patient's CVD.

This study could also lead policy makers within communities and healthcare systems to support policies that could reduce the prevalence and impact of psychosocial risk factors for CVD. For example, according to the United Way of Metropolitan Tarrant County's 2005 Needs Assessment, more than 5% of residents reported experiencing discrimination while seeking medical care.[4] Such experiences could discourage people from seeking medical care in the future, and, according to preliminary NTHHS results, could increase their odds of having cardiovascular disease, depending on how they respond to their experience. Healthcare systems policy makers could respond to such information by enacting policies and/or providing cultural competency training to ensure equal treatment of all patients, regardless of race/ethnicity.

CONCLUSIONS

Cardiovascular disease is a major cause of morbidity and mortality in the United States and, despite successful efforts to reduce this burden over the past few decades, significant racial/ethnic disparities persist. Many of these efforts have worked to reduce the impact of known CVD risk factors, but many of the risk factors for CVD are still unknown, so targeted interventions cannot be created to address them all. The North Texas Healthy Heart Study aims to improve our understanding of the psychosocial and physiological risk factors for CVD and to identify differences in the way these risk factors affect people of different races/ethnicities. The results of this study could help clinicians to better understand and address their patients' personal risk factors and could motivate policy makers to implement community-wide policies that could reduce the burden of CVD, especially on racial/ethnic minority populations.

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