Background—Respondents in the US Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes (SHIELD) reported whether they had a diagnosis of dyslipidemia, were taking prescription dyslipidemia medication, and knew their heart disease risk (low, moderate, high, or do not know). We assessed whether respondents who reported a diagnosis of dyslipidemia with or without lipid-modifying treatment knew their heart disease risk and whether it correlated with National Cholesterol Education Program Adult Treatment Panel (ATP) III risk.

Methods and Results—Based on self-report of risk factors, ATP III high risk was defined as diagnosis of heart disease/heart attack, narrow/blocked arteries, stroke, or diabetes; moderate risk included ≥ 2 risk factors (ie, men aged ≥ 45 years, women aged ≥ 55 years, hypertension, low high-density lipoprotein cholesterol, current smoking, and family history of CHD); and low risk included < 2 risk factors. Of 7629 respondents with dyslipidemia, 35% reported not taking cholesterol medication, and 29% reported not knowing their heart disease risk. For respondents treated for dyslipidemia, 27% reported not knowing their risk, and of the 73% who reported knowing, 24% to 35% reported the same risk level as ATP III risk. For respondents with untreated dyslipidemia, 33% reported not knowing their risk, and of the 67% who reported knowing, 20% to 37% reported the same risk as ATP III risk.

Conclusions—A large proportion of respondents with dyslipidemia did not know their heart disease risk. Among those who reported knowing their risk level, > 60% of respondents did not classify themselves at the same ATP III-defined risk level. There is a gap in understanding and awareness of heart disease risk among respondents with dyslipidemia regardless of treatment status. (Circ Cardiovasc Qual Outcomes. 2009;2:207-212.)

Key Words: cardiovascular diseases ■ dyslipemias ■ heart diseases

Coronary heart disease (CHD) is the leading cause of death in the United States, accounting for more than 450,000 deaths in 2004,1 largely attributable to myocardial infarction and sudden cardiac death.2 Approximately 15.8 million Americans aged 20 years and older have CHD.3 Extensive clinical trial evidence has shown that modifying risk factors can prevent the development of cardiovascular disease (CVD) events and delay or prevent events in those with clinical evidence of CVD.4-5 For every 2-mg/dL decrement in low-density lipoprotein cholesterol (LDL-C), there is a 1% reduction in CVD events.6

Being aware of the risk of heart disease is important as the first step in taking action to lower risk. A national study conducted by the American Heart Association (AHA) in 2003 showed that fewer than 50% of American women know that heart disease is their leading cause of death.7 Only 38% of women reported that their doctors had ever discussed heart disease with them, and 31% reported that high cholesterol is a cause of heart disease.7 A similar telephone questionnaire study in 2005 found that the rate of awareness in women of CVD as the leading cause of death nearly doubled since 1997 (55% versus 30%).8 Yet, fewer than 50% of respondents were aware of healthy levels of risk factors for CVD.8 Being aware of personal risk level and intervention options can empower individuals to live a long and healthy life. The AHA developed evidence-based guidelines to help individuals achieve heart-healthy lifestyles and reduce their chances of having a heart attack or stroke.9-12 However, if they are unaware of their risk of heart disease, they may not take the appropriate steps toward prevention.

The purpose of the present study was to assess whether respondents who reported a diagnosis of dyslipidemia, an at-risk population, identified awareness of their heart disease risk, and whether the reported risk level was correlated with the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III guidelines risk level.10

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WHAT IS KNOWN

- It is well documented that coronary heart disease is the leading cause of death in the US.
- Extensive clinical trial evidence has shown that management of risk factors can prevent the development of cardiovascular disease events.

WHAT THE STUDY ADDS

- This study shows that there is a gap in knowledge of one’s heart disease risk among individuals with dyslipidemia; one-third of respondents did not know their risk.
- Among respondents reporting a heart disease risk level, only 21%–36% reported the same risk level as their calculated NCEP ATP III risk.
- Patients need to be aware of their heart disease risk to empower them to achieve a heart-healthy life.

Methods

A cross-sectional analysis of survey data from the Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes (SHIELD) was conducted to determine whether respondents with dyslipidemia knew their heart disease risk.

SHIELD Surveys

SHIELD included an initial screening phase to identify cases of interest in the general population, a baseline survey to follow up identified cases with a questionnaire about health status, health knowledge and attitudes, and current behaviors and treatments, and annual follow-up surveys. A detailed description of the SHIELD methodology has been published previously.13,14

In brief, the screening survey was mailed on April 1, 2004, to a stratified random sample of 200,000 U.S. households, representative of the U.S. population for geographic residence, household size and income, and age of head of household,15 identified by the Taylor Nelson Sofres National Family Opinion (TNS NFO) panel (Greenwich, Conn). The head of household provided responses to the screening survey for up to 4 adult (aged ≥18 years) household members. All TNS NFO surveys are voluntary, and no special incentives were provided. A response rate of 63.7% was obtained from 127,420 households (containing 211,097 adults).

The baseline survey was mailed in September and October 2004 to a representative sample of individuals (n = 22,001) who were identified in the screening survey as having type 1 diabetes mellitus (T1DM) or type 2 diabetes mellitus (T2DM) (healthcare professional told them they have diabetes) or being at risk for diabetes. Each respondent group was balanced to be representative of that population for age, gender, geographic region, household size, and income for the U.S. population, and then a random sample from each group was selected and sent the baseline survey. A response rate of 71.8% was obtained.

In August 2005, the first annual follow-up survey was mailed to all individuals selected for the baseline survey who were still enrolled in the TNS NFO panel (n = 19,613). The second annual follow-up survey was mailed in July 2006 to individuals who had returned either or both the baseline and first annual questionnaires (n = 18,445). A 75% response rate was obtained for the 2006 follow-up survey (n = 13,877). This study used the 2006 survey responses. The study sample includes respondents with diabetes or at risk for diabetes, thus the prevalence of diabetes in this cohort is high.

Study Measures

Respondents reported whether a physician, nurse, or other healthcare professional had ever told them they had “cholesterol problems” (ie, diagnosis of dyslipidemia). Respondents also reported the name of each prescription medication currently prescribed to them and were instructed to refer to their medication labels for accurate reporting. Respondents with a diagnosis of dyslipidemia were stratified by whether they were currently taking lipid-lowering treatment or not.

Knowledge of heart disease risk was assessed by the question “Do you know your level of heart disease risk?” with response categories of low, moderate, high, “don’t know.” Knowledge of LDL-C levels was assessed by the question “Do you know the recommended target level of your LDL-Cholesterol (bad cholesterol)?,” and respondents wrote in their LDL-C level or indicated “don’t know.”

Respondents’ NCEP ATP III risk level was estimated using risk factor information from the survey. High CHD risk was defined by self-reporting a diagnosis of heart disease/heart attack, narrowed or blocked arteries, stroke, or diabetes. Moderate CHD risk included ≥2 risk factors: men aged >45 years, women aged >55 years, diagnosis of hypertension, low high-density lipoprotein cholesterol (HDL-C), current smoking, and family history of CHD without high risk features. Low CHD risk included ≤1 of the risk factors.

Statistical Analysis

Descriptive statistics for categorical variables were provided as proportions, and continuous variables were presented as mean and standard deviation. Comparisons between respondents who did and did not know their heart disease risk were made using χ² tests for proportions and t tests for comparison of means. Multivariable logistic regression was used to identify predictors of heart disease knowledge. The dependent variable in the regression model was knowledge of heart disease risk (yes versus don’t know), and the independent variables were age (continuous), race, gender, household income, education, comorbid conditions, and CHD risk level. Odds ratios and 95% CIs were computed for the dyslipidemia population. Probability values less than 0.05 were considered statistically significant.

The authors had full access to the data and take responsibility for its integrity. All authors have read and agree to the manuscript as written.

Results

In the SHIELD population, 7629 respondents reported a diagnosis of dyslipidemia and 65% (n = 4938) were taking lipid-lowering therapy at the time of the survey. The dyslipidemia group was composed of 59% women, 88% whites, 41% with low household income, and 28% with a high school or less education (Table 1). The majority (62%) of the dyslipidemia respondents were classified as high CHD risk, and 25% were moderate risk according to the NCEP ATP III guidelines.10 The treated dyslipidemia group was older, comprised more men and whites, and had a greater proportion with low education level, hypertension, diabetes, and high CHD risk compared with the untreated dyslipidemia respondents (P < 0.001).

Among all respondents with dyslipidemia, 29% reported not knowing their heart disease risk level (Figure 1). Respondents who were not taking lipid-lowering therapy (untreated) were less likely to report knowing their heart disease risk (don’t know, 33%) than respondents who were treated for dyslipidemia (27%; P < 0.001). For respondents with dyslipidemia, increasing age, race, gender, household income, higher education, and higher CHD risk level were independently associated with self-reported knowing their heart disease risk level (P < 0.05; Table 2). Minorities and women were less likely to report knowing their risk and respondents with household incomes above $20,000 or at least some college education were more likely to report knowing their
risk, after adjusting for all other covariates. Respondents at moderate CHD risk were 41% more likely to report knowing their heart disease risk and respondents at high CHD risk were 69% more likely to report knowing their risk compared with respondents with low CHD risk ($P<0.01$). The same characteristics (age, race, income, education, and CHD risk) were significantly predictive of self-reported heart disease risk knowledge among respondents who were taking lipid-lowering therapy as were observed in the total dyslipidemia population.

When respondents with dyslipidemia were stratified by their calculated NCEP ATP III CHD risk level, approximately one third of respondents self-reported the same risk level as their ATP III risk level (Figure 2). Among high CHD risk respondents, 30% self-reported that their heart disease risk was high, 45% reported a lower risk level (34% moderate, 11% low), and 25% reported not knowing their heart disease risk. For ATP III calculated moderate CHD risk respondents, 36% self-reported that their heart disease risk was moderate, 17% reported low risk, and 34% reported not knowing their risk. A similar pattern was observed for the ATP III calculated low CHD risk group, with 38% self-reporting that they did not know their risk (Figure 2). Significantly more respondents with ATP III calculated low CHD risk reported not knowing their heart disease risk compared with ATP III calculated high CHD risk respondents ($P<0.001$). Overall, 21% to 36% of respondents self-reported the same risk level as their NCEP ATP III level. The proportion of respondents self-reporting the same risk level among those treated versus those not treated was 24% versus 20% ATP III low risk, 35% versus 37% ATP III moderate risk, and 30% versus 25% ATP III high risk, respectively.

### Table 1. Characteristics of SHIELD Respondents With Dyslipidemia

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total Dyslipidemia Sample (n=7629)</th>
<th>Treated Dyslipidemia Respondents (n=4938)</th>
<th>Untreated Dyslipidemia Respondents (n=2691)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, mean (SD)</td>
<td>60.6 (13.3)</td>
<td>62.7 (12.2)*</td>
<td>56.8 (14.5)</td>
</tr>
<tr>
<td>Women, %</td>
<td>58.9</td>
<td>55.9*</td>
<td>64.3</td>
</tr>
<tr>
<td>White, %</td>
<td>90.6</td>
<td>91.8*</td>
<td>88.5</td>
</tr>
<tr>
<td>Income, % with &lt;$35 000</td>
<td>41.2</td>
<td>40.3</td>
<td>42.8</td>
</tr>
<tr>
<td>Education, % with no more than a high school degree</td>
<td>32.6</td>
<td>33.6*</td>
<td>30.9</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>67.3</td>
<td>72.6*</td>
<td>57.6</td>
</tr>
<tr>
<td>Diabetes, %</td>
<td>43.2</td>
<td>47.3*</td>
<td>35.7</td>
</tr>
<tr>
<td>NCEP ATP III risk level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High CHD risk, %</td>
<td>62.1</td>
<td>69.4*</td>
<td>48.9</td>
</tr>
<tr>
<td>Moderate CHD risk, %</td>
<td>24.6</td>
<td>22.8</td>
<td>27.9</td>
</tr>
<tr>
<td>Low CHD risk, %</td>
<td>13.2</td>
<td>7.8*</td>
<td>23.2</td>
</tr>
</tbody>
</table>

* $P<0.001$ for treated versus untreated.

### Table 2. Logistic Regression Comparing All Dyslipidemia Respondents Who Reported Knowing or Not Knowing Their Heart Disease Risk (n=6363)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Reported Knowing Heart Disease Risk vs Did Not Know, OR (95% CI)</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, per year</td>
<td>0.994 (0.980–0.999)</td>
<td>0.019</td>
</tr>
<tr>
<td>Black or other race (white is reference)</td>
<td>0.60 (0.43–0.72)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Women (men is reference)</td>
<td>0.87 (0.80–0.98)</td>
<td>0.024</td>
</tr>
<tr>
<td>Income (&lt;$20 000 is reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$20 000 to $34 999</td>
<td>1.29 (1.10–1.53)</td>
<td>0.003</td>
</tr>
<tr>
<td>$35 000 to $54 999</td>
<td>1.50 (1.23–1.78)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>$55 000 to $84 999</td>
<td>1.74 (1.27–2.11)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>$85 000</td>
<td>2.20 (1.51–2.71)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Education (≤8th grade is reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some high school</td>
<td>0.95 (0.40–1.54)</td>
<td>0.84</td>
</tr>
<tr>
<td>High school graduate</td>
<td>1.19 (0.51–1.85)</td>
<td>0.45</td>
</tr>
<tr>
<td>Some college</td>
<td>1.64 (0.72–2.56)</td>
<td>0.028</td>
</tr>
<tr>
<td>College graduate</td>
<td>1.76 (0.82–2.78)</td>
<td>0.015</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>2.35 (1.03–3.76)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.88 (0.69–1.01)</td>
<td>0.063</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.10 (0.85–1.39)</td>
<td>0.44</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.03 (0.90–1.25)</td>
<td>0.75</td>
</tr>
<tr>
<td>CHD risk (low risk is reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.41 (1.10–1.72)</td>
<td>0.001</td>
</tr>
<tr>
<td>High</td>
<td>1.69 (1.05–2.19)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Sample for logistic regression is less than total sample because of missing values for some variables included in the model.
Among all respondents with dyslipidemia, 26% of respondents who reported knowing their heart disease risk \( (n=5263) \) also reported knowing their recommended LDL-C level, and 11% of respondents who reported not knowing their heart disease risk \( (n=2145) \) reported knowing their recommended LDL-C level (Figure 3). Respondents who were not treated for dyslipidemia were less likely to report knowing their recommended LDL-C level regardless of their self-reported knowledge of heart disease risk compared with respondents who were treated \( (P<0.01; \text{Figure 3}) \). Significantly more respondents who were treated for dyslipidemia and reported knowing their heart disease risk also reported knowing their recommended LDL-C level compared with untreated respondents who reported knowing their heart disease risk.

**Discussion**

Based on the study findings, there is much room for improvement in an individual's knowledge of heart disease risk. Approximately one third of respondents reported not knowing their heart disease risk even though they had been diagnosed with dyslipidemia. Even among respondents who reported knowing their risk level, only 21% to 36% of respondents reported the same risk level as their NCEP ATP III risk. This was especially true for high CHD risk respondents, 45% of whom reported a lower risk level than high risk and 25% of whom reported not knowing their risk level. This gap in knowledge is important because the prevalence of dyslipidemia is high in the U.S. population; approximately 29% in the MESA study.\(^{16}\) The MESA study also found that dyslipidemia treatment and control was suboptimal.\(^{16}\) Combined with the limited knowledge of heart disease risk as shown in this SHIELD study, the high prevalence and poor control make it a vulnerable population. This SHIELD study also found that there was little difference in the proportion of respondents reporting the same risk level as the calculated ATP III risk between treated and untreated dyslipidemia respondents. Accurate knowledge of risk level was low for both groups. This may indicate that treatment does not equate to knowledge and awareness of heart disease risk. Individuals may not know why they are taking a drug or understand that the medication correlates to high or moderate heart disease risk.

The SHIELD results are similar to the AHA 2003 national study of women's awareness of heart disease.\(^{7}\) Also, this SHIELD study provides current information on men's awareness of heart disease, adding to the evidence on awareness of heart disease in both genders. The AHA 2003 study found that only 46% of respondents identified heart disease as the leading cause of death in women and only 38% of women reported that their doctors had ever discussed heart disease with them.\(^{7}\) In the AHA survey, 40% of women considered themselves to be either very well or well informed about heart disease, and only a minority of respondents were able to name the major risk factors, including high cholesterol.\(^{7}\) The 2005 national survey of women found that 55% correctly answered that heart disease/heart attack is the leading cause of death.\(^{8}\) Awareness of heart disease as the leading cause of death was significantly greater among women who perceived themselves to be at high or moderate risk of heart disease.\(^{8}\) With the results of the present SHIELD study and the AHA study, it is clear that both men and women were not knowledgeable regarding their heart disease risk. Additionally, the SHIELD study found that women were less likely to know their risk than men. Both SHIELD and AHA studies found that minorities and younger respondents were less likely to know their risk or have lower awareness of heart disease.

Knowledge of recommended LDL-C levels was poor both among SHIELD respondents who reported knowing their heart disease risk and those who reported not knowing their risk. Only 26% of respondents with dyslipidemia who reported knowing their risk also reported knowing their recommended LDL-C level. The percentage of respondents who reported knowing their heart disease risk and recommended LDL-C levels was not greater even among those who were being treated for dyslipidemia (27%) compared with the total sample. These results are similar to the AHA 2005 survey that found \( \approx 21\% \) of all women were aware of the healthy level for LDL-C.\(^{8}\) Also, 80% of women stated that their cholesterol levels had been checked within 5 years; 84% said their doctor told them their numbers but only 46% remembered them.\(^{8}\) Thus, many individuals diagnosed with dyslipidemia, regardless of treatment status, were not aware of their risk or knowledgeable about recommended LDL-C levels to be able to take action to lower their risk and manage their cholesterol.

So how do we increase the knowledge and awareness of heart disease risk to affect action in managing the risk? Several studies have demonstrated that patient education through a physician or other healthcare provider improves the likelihood of initiation and compliance with healthy lifestyle changes and drug therapy. A review of patient education studies and epidemiological models estimated that effective physician interaction with a patient's teaching could reduce drug errors, facilitate adherence, enhance patients' understanding of their disease and its treatment, and improve clinical outcomes by 40%.\(^{17\text{-}19}\) The AHA 2005 study showed that women who had seen, heard, or read information about heart disease in the last 12 months were significantly more likely to increase their physical activity, decrease their intake of unhealthy food, and lose weight.\(^{8}\) Also, women who were aware that heart disease is the leading cause of death for women were more likely to increase physical activity and...
lose weight. Sustained improvement in blood pressure control and >50% fewer deaths have been observed in those receiving patient education than in controls in clinical trials using health education for hypertension. In a systematic assessment of 102 controlled studies of patient education related to prescription drugs, individual attention, relevance, and feedback provided in face-to-face communication predicted improved change in patient knowledge and beliefs. More recently, video education in conjunction with in-person education has been shown to prompt self-care behavior adherence. Other studies have shown that educational materials, access to help lines, and regular telephone contact with qualified healthcare workers improved adherence to lipid-lowering therapy for at-risk patients.

Limitations of this study include the possible bias introduced by having self-selected volunteers (5% to 8% of those solicited) as the basis for the TNS NFO household panel study population. Under-representation of the very wealthy and very poor sectors of society, as well as exclusion of military and institutionalized individuals, are potential shortcomings associated with household panels. The SHIELD survey relied on self-reporting of clinical data, including the diagnosis of dyslipidemia and prescription medications, without independent confirmation by the physician or examination of medical records. Recall of this type of information by the respondent could potentially differ for recently diagnosed respondents compared with respondents given the diagnosis several years before.

Conclusion

Because CVD events can often be prevented, the study findings are an important call to action. The AHA and other leading health organizations have disseminated comprehensive guidelines for heart disease prevention. If they are not done so already, physicians need to incorporate these guidelines into routine clinical practice and educate their patients on their heart disease risk. Incorporation of risk stratification educational materials and guidelines into other venues such as pharmacies, grocery stores, health clubs, or even nonmedical areas may help to improve awareness. The guidelines call for awareness, knowledge, and action to make patients aware of their personal risk and empower them to achieve a heart-healthy life. Physicians should be certain that patients are aware of their risk, particularly those who have one or more risk factors and those who require lifestyle changes or drug therapy.

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Disclosures

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Knowledge of Heart Disease Risk Among SHIELD Respondents With Dyslipidemia
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