Application of the Screening for Heart Attack Prevention and Education Task Force Recommendations to an Urban Population

Observations From the Dallas Heart Study

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Background: The Screening for Heart Attack Prevention and Education (SHAPE) Task Force recommends noninvasive atherosclerosis imaging of all asymptomatic men (aged 45-75 years) and women (aged 55-75 years), except those at very low risk, to augment conventional cardiovascular risk assessment algorithms.

Methods: Among 2611 participants in the Dallas Heart Study aged 30 to 65 years who underwent computed tomography to measure coronary artery calcification, low-density lipoprotein cholesterol (LDL-C) therapeutic targets were calculated using both National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) and SHAPE algorithms. The proportion of subjects reclassified as being “at goal” for LDL-C vs “not at goal” after implementation of the SHAPE recommendations was determined.

Results: More subjects were identified with LDL-C levels greater than or equal to goal based on SHAPE than NCEP-ATP III (27.4% vs 21.6%), with 7.0% of individuals reclassified as having unmet LDL-C goals and 1.1% of individuals reclassified as at goal. When more aggressive optional LDL-C goals were implemented, 31.7% had LDL-C levels greater than or equal to goal using SHAPE recommendations vs 28.1% using NCEP-ATP III recommendations, with 6.3% of subjects reclassified as being not at goal and 2.7% as being at goal.

Conclusions: The SHAPE recommendations resulted in bidirectional reclassification of eligibility for lipid-lowering therapy in subjects aged 30 to 65 years. While broad implementation of these recommendations would modestly increase cholesterol-lowering drug use in this age range, the magnitude of the increase depends on whether standard or optional LDL-C goals are targeted.

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To estimate how implementation of the SHAPE recommendations would influence the proportion of subjects identified as failing to reach their respective LDL-C goals and therefore deserving consideration for cholesterol-lowering therapy, the NCEP-ATP III and SHAPE risk assessment algorithms were applied to a representative sample of Dallas County, Texas, residents using data from the Dallas Heart Study (DHS).

METHODS

STUDY POPULATION

The DHS is a multiethnic, probability-based, population sample consisting of 6101 adult Dallas County subjects between the ages of 18 and 65 years who were enrolled between July 2000 and January 2002. The initial cohort underwent a detailed in-home health survey (visit 1), after which 3398 subjects aged 30 to 65 years returned for blood and urine collection (visit 2). Subsequently, 2971 subjects returned for visit 3, which included a detailed clinical examination and electron beam computed tomography (EBCT) scans for all assessments.

Statin-dominated lipid lowering was encouraged in all participants. Subjects with angina, diabetes mellitus, or history of myocardial infarction (MI) or stroke were assigned a priori to the highest risk status with an LDL-C goal of less than 100 mg/dL (to convert cholesterol to millimoles per liter, multiply by 0.0259) and an optional goal of less than 70 mg/dL.

The subjects were classified into respective CHD risk categories and assigned corresponding LDL-C goals based on the modification of the NCEP-ATP III criteria published in 2004 (Figure 1). Subjects with angina, diabetes mellitus, or history of myocardial infarction (MI) or stroke were assigned a priori to the highest risk status with an LDL-C goal of less than 100 mg/dL (to convert cholesterol to millimoles per liter, multiply by 0.0259) and an optional goal of less than 70 mg/dL. Subjects with 2 or more traditional risk factors (smoking, hypertension, high-density lipoprotein cholesterol <40 mg/dL, family history of premature MI, and age ≥45 years for men and ≥55 years for women) underwent calculation of the Framingham Risk Score, with LDL-C treatment goals assigned based on 10-year estimates of the risk for fatal or nonfatal CHD: an LDL-C level of less than 130 mg/dL for all subjects at moderate risk (≥2 risk factors and estimated 10-year CHD event risk <10%), an LDL-C level of less than 130 mg/dL with an optional goal of less than 100 mg/dL for subjects at moderately high risk (10-year risk, 10%-20%); and an LDL-C level of less than 100 mg/dL with an optional goal of less than 70 mg/dL for subjects at high risk (10-year risk, >20%). Individuals with less than 2 risk factors were considered to be at lower risk (10-year risk, <10%) and were assigned an LDL-C goal of less than 160 mg/dL. Subjects taking statins (n = 166), statin-naive lipid values were estimated assuming a uniform 40% reduction in LDL-C and a 30% reduction in total cholesterol and were used for all assessments.

ASSIGNMENT OF LDL-C GOALS

Variable definitions have previously been described. Hypertension was defined as a systolic blood pressure of 140 mm Hg or higher, a diastolic blood pressure of 90 mm Hg or higher, or the use of an antihypertensive medication. Diabetes mellitus was defined by either self-report accompanied by the use of antihyperglycemic medication, a fasting glucose level of 126 mg/dL or higher (to convert glucose to millimoles per liter, multiply by 0.0555), or a nonfasting glucose level of 200 mg/dL or higher. Smoking status was categorized as current smoker or former smoker/never smoker. Angina was defined using the Rose angina questionnaire. Two consecutive coronary EBCT scans were performed (GE Imatron C-150XP; Imatron Inc, San Bruno, California), with mean CAC results expressed in Agatston units.

STUDY DEFINITIONS

Figure 1. National Cholesterol Education Program Adult Treatment Panel III algorithm for determining cardiovascular risk with corresponding low-density lipoprotein cholesterol (LDL-C) therapeutic targets. Numbers other than risk factors (RFs), cholesterol values (to convert to millimoles per liter, multiply by 0.0259), and Framingham 10-year risk scores (%) represent the number of individuals at each division of the algorithm. CVA indicates cerebrovascular accident; DM, diabetes mellitus; HDL-C, high density lipoprotein cholesterol; MI, myocardial infarction.
The study comprised 2611 individuals with a mean (SD) age of 44 (16) years, including 1451 women (55.5%) and 1266 (48.5%) nonwhite participants. Baseline characteristics stratified by sex are presented in Table 1. Age- and sex-specific percentile cut points of CAC scores within the overall DHS cohort are summarized in Table 2. Application of the SHAPE recommendations identified 685 participants (26.2%) who were eligible for noninvasive atherosclerosis imaging.

LDL-C GOAL ASSIGNMENT

When standard (nonoptional) LDL-C goals were applied, no patients had an LDL-C goal of less than 70 mg/dL using the NCEP-ATP III guidelines, compared with 12.4% using the SHAPE strategy. When the optional LDL-C goals were used, application of the SHAPE algorithm resulted in increases in the proportions of the 3 lowest LDL-C goal categories (15%-17% for LDL-C <70 mg/dL; 6%-10% for LDL-C <100 mg/dL; and 15%-18% for LDL-C <130 mg/dL) and a concomitant decrease in the proportion of subjects assigned to an LDL-C goal of less than 160 mg/dL (63%-56%) (Figure 3).

BIDIRECTIONAL RECLASSIFICATION OF LDL-C GOALS AND ELIGIBILITY FOR LIPID-LOWERING THERAPY

Using standard LDL-C goals, 198 participants (7.0%) were reclassified as “not at goal” and 47 (1.1%) were reclassified as “at goal” after implementation of the SHAPE algorithm, resulting in an overall discordance of 8.1 be-
the proportion of subjects not at goal when using optional LDL-C targets (Table 3).

When sensitivity analyses excluding subjects taking statins at study entry (n=166) were performed, all results were qualitatively similar (data not shown). Moreover, the results were similar in race-stratified analyses (Table 3). Finally, sensitivity analyses were performed substituting age-, sex-, and race-specific CAC percentile cut points reported from the Multi-Ethnic Study of Atherosclerosis. Using Multi-Ethnic Study of Atherosclerosis cut points, 1.1% of the participants were reclassified to at goal and 8.5% to not at goal with standard LDL-C goals, and 2.7% to at goal and 6.7% to not at goal with optional LDL-C goals.

**INFLUENCE OF AGE AND DIABETES STATUS**

When individuals below the recommended age cut points for atherosclerosis imaging (<45 years for women and <55 years for men) in SHAPE were excluded, the SHAPE algorithm had a greater impact on reclassification and eligibility for lipid lowering. The overall discordance in this subgroup between NCEP-ATP III and SHAPE was 19.0% using nonoptional LDL-C goals (18.3% reclassified as not at goal and 0.6% reclassified as at goal; P<.001 by McNemar test); the overall discordance using optional goals was 22.3% (20.0% reclassified as not at goal and 2.3% reclassified as at goal; P<.001 by McNemar test) (Table 3).

To further examine the effect of age on reclassification of LDL-C goal status, the analyses were stratified by 10-year age groups. The proportion of individuals not meeting LDL-C goals increased in the 55- to 65-year-old stratum with the SHAPE algorithm, while it decreased or remained qualitatively unchanged in the younger strata whether or not optional LDL-C goals were applied (Table 3). These age-stratified analyses were similar when further stratified by sex (data not shown).
Table 3. Age-Stratified Proportions With 95% Confidence Intervals (CIs) of the Cohort Classified as Being “at Goal” and “Not at Goal” for Low-Density Lipoprotein Cholesterol (LDL-C) by the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) and Screening for Heart Attack Prevention and Education (SHAPE) Recommendations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Failure to Meet NCEP-ATP III LDL-C Goal</th>
<th>Failure to Meet SHAPE LDL-C Goal</th>
<th>Changed to “at Goal” With SHAPE</th>
<th>Changed to “Not at Goal” With SHAPE</th>
<th>Net Change in Subjects Not Meeting LDL-C Goal</th>
<th>Net Change in Subjects Not Meeting SHAPE LDL-C Goal</th>
<th>Relative Change in Subjects Not Meeting LDL-C Goal With SHAPE</th>
<th>Relative Change in Subjects Not Meeting SHAPE LDL-C Goal With SHAPE</th>
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<tbody>
<tr>
<td>Overall (N=2611)</td>
<td>21.6 (19.2-23.9)</td>
<td>27.4 (24.9-30.0)</td>
<td>1.1 (0.7-1.5)</td>
<td>7.0 (5.5-8.4)</td>
<td>+5.9</td>
<td>+27.2</td>
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<td>Age, y</td>
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<td>&lt;45 (n=1319)</td>
<td>12.8 (10.4-15.1)</td>
<td>13.6 (11.2-16.1)</td>
<td>1.0 (0.4-1.5)</td>
<td>1.8 (0.8-2.9)</td>
<td>+0.8</td>
<td>+6.3</td>
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<tr>
<td>45-55 (n=816)</td>
<td>25.8 (21.6-29.9)</td>
<td>33.4 (28.7-38.1)</td>
<td>1.8 (0.8-2.8)</td>
<td>9.4 (6.3-12.5)</td>
<td>+7.6</td>
<td>+29.5</td>
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<tr>
<td>55-65 (n=476)</td>
<td>42.6 (34.9-50.2)</td>
<td>61.5 (54.2-68.8)</td>
<td>0.3 (0.0-0.5)</td>
<td>19.2 (12.3-25.1)</td>
<td>+18.9</td>
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<td>Men ≥45, women ≥55 (n=864)</td>
<td>37.0 (31.8-42.1)</td>
<td>54.7 (49.6-59.9)</td>
<td>0.6 (0.1-1.1)</td>
<td>18.5 (14.3-22.4)</td>
<td>+17.7</td>
<td>+48.0</td>
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<td>Diabetic subjects (n=277)</td>
<td>60.7 (51.1-70.2)</td>
<td>64.2 (55.4-72.9)</td>
<td>12.0 (7.0-16.9)</td>
<td>15.5 (8.6-22.4)</td>
<td>+3.5</td>
<td>+5.8</td>
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<tr>
<td>Black subjects (n=1262)</td>
<td>90.5 (86.1-94.9)</td>
<td>64.4 (55.7-73.1)</td>
<td>26.1 (18.0-34.2)</td>
<td>0.0 (0-0)</td>
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<td>−28.8</td>
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<td>White subjects (n=833)</td>
<td>21.1 (17.7-24.4)</td>
<td>27.4 (23.7-31.1)</td>
<td>0.9 (0.3-1.6)</td>
<td>7.2 (5.1-9.4)</td>
<td>+6.3</td>
<td>29.9</td>
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<td>Optional LDL-C goals</td>
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<tr>
<td>Overall (N=2611)</td>
<td>28.1 (25.6-30.6)</td>
<td>31.7 (29.0-34.4)</td>
<td>2.7 (1.8-3.5)</td>
<td>6.3 (4.9-7.6)</td>
<td>+3.6</td>
<td>+12.8</td>
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<td>Age, y</td>
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<td>&lt;45 (n=1319)</td>
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<td>42.0 (37.2-46.9)</td>
<td>3.9 (2.0-5.8)</td>
<td>11.2 (6.1-14.3)</td>
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<tr>
<td>55-65 (n=476)</td>
<td>53.0 (45.5-60.4)</td>
<td>70.5 (63.9-77.0)</td>
<td>0.5 (0.1-0.9)</td>
<td>18.0 (12.4-23.7)</td>
<td>+17.5</td>
<td>+33.1</td>
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<tr>
<td>Men ≥45, women ≥55 (n=864)</td>
<td>49.6 (44.4-54.8)</td>
<td>67.3 (62.6-72.0)</td>
<td>2.3 (0.8-3.9)</td>
<td>20.0 (16.0-24.1)</td>
<td>+17.7</td>
<td>+35.7</td>
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<td>+2.0</td>
<td>+6.3</td>
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<td>26.6 (23.0-30.2)</td>
<td>33.0 (29.0-36.9)</td>
<td>2.3 (1.2-3.4)</td>
<td>8.6 (6.2-11.0)</td>
<td>+6.4</td>
<td>+23.8</td>
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</table>

*All proportions adjusted for sample weights.*

Table 4. The Impact of Differing Thresholds for Defining Coronary Artery Calcium (CAC) Elevation on Low-Density Lipoprotein Cholesterol (LDL-C) Goal Reclassification Using Screening for Heart Attack Prevention and Education (SHAPE) Recommendations in the Overall Population

<table>
<thead>
<tr>
<th>CAC Threshold, Agatston Units</th>
<th>Failure to Meet NCEP-ATP III LDL-C Goal</th>
<th>Failure to Meet SHAPE LDL-C Goal</th>
<th>Changed to “at Goal” With SHAPE</th>
<th>Changed to “Not at Goal” With SHAPE</th>
<th>Net Change in Subjects Not Meeting LDL-C Goal</th>
<th>Net Change in Subjects Not Meeting SHAPE LDL-C Goal</th>
<th>Relative Change in Subjects Not Meeting LDL-C Goal With SHAPE</th>
<th>Relative Change in Subjects Not Meeting SHAPE LDL-C Goal With SHAPE</th>
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</thead>
<tbody>
<tr>
<td>≥1</td>
<td>21.6 (19.2-23.9)</td>
<td>27.4 (24.9-30.0)</td>
<td>1.1 (0.7-1.5)</td>
<td>7.0 (5.5-8.4)</td>
<td>+5.9</td>
<td>+27.2</td>
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<tr>
<td>≥10</td>
<td>21.6 (19.2-23.9)</td>
<td>26.9 (24.9-29.5)</td>
<td>1.2 (0.8-1.7)</td>
<td>6.6 (5.2-8.1)</td>
<td>+5.4</td>
<td>+25.0</td>
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<tr>
<td>≥100</td>
<td>21.6 (19.2-23.9)</td>
<td>25.8 (23.2-28.3)</td>
<td>1.5 (1.0-2.0)</td>
<td>5.7 (4.4-7.1)</td>
<td>+4.3</td>
<td>+19.8</td>
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</table>

*Abbreviation: NCEP-ATP III, National Cholesterol Education Program Adult Treatment Panel III.*

Compared with the overall cohort, the participants with diabetes were much more likely to be downgraded to at goal status with SHAPE (Table 3). Diabetic subjects (n=277) accounted for 87% (41 of 47) of the individuals who were downgraded to at goal status by SHAPE when standard LDL-C goals were used and for 83% (73 of 88) when optional LDL-C goals were used.

**CAC THRESHOLDS AND THE EFFICIENCY OF CAC SCANNING**

To examine the effect of altering the threshold to define a “positive EBCT scan,” CAC scores of 1 or more, 10 or more, and 100 or more Agatston units were evaluated (Table 4). While the use of higher CAC thresholds led to fewer subjects identified by SHAPE as not meeting their LDL-C goal, the difference between a threshold of 10 or higher and a threshold of 1 or higher was modest (25.0% [n=763] vs 27.2% [n=778]).

Finally, the efficiency of CAC scanning according to the SHAPE recommendations was assessed by determining the number needed to scan (NNS) to reclassify 1 participant as meeting or not meeting his or her individual LDL-C goal. These analyses were restricted to subjects who were specifically recommended for imaging by SHAPE (n=685). The NNS ranged from 4.1 to 7.8 and varied modestly depending on age, sex, and threshold used to define a positive scan (Table 5).

**COMMENT**

In a probability-based population sample of subjects aged 30 to 65 years, implementation of the SHAPE Task Force recommendations led to greater numbers of participants being classified as being at goal and fewer being classified as not meeting goal, reducing the percentage of people requiring lifestyle or drug intervention by 29% (7.9% vs 11.2%).
recommendations compared with the updated NCEP-ATP III guidelines resulted in the reclassification of LDL-C goals in 8.1% to 9.0% of subjects. Because subjects were reclassified into both higher- and lower-risk categories, the proportion of participants identified as not meeting their individual LDL-C goal and thus potentially eligible for lipid-lowering intervention increased more modestly than previously predicted.9

The SHAPE Task Force recommends the relatively liberal use of noninvasive atherosclerosis imaging for asymptomatic individuals, excluding only those at the very lowest and very highest of risk categories. The SHAPE authors project that application of this strategy in the entire population would result in as much as a 50% to 65% relative increase in the use of cholesterol-lowering drugs in the United States.9 In contrast, in our probability-based urban US population sample of 30- to 65-year-old adults, application of the SHAPE recommendations compared with the NCEP-ATP-III guidelines would result in a 27.2% relative (5.9% absolute) increase in the proportion of subjects with indications for the initiation of lipid-lowering therapy. If optional LDL-C goals are used for both SHAPE and NCEP-ATP III, the differences would be more modest, with a 12.8% relative (3.6% absolute) increase in subjects eligible for lipid-lowering therapy. Given recent clinical trial evidence to support the optional NCEP-ATP-III goals,18,19 we believe that estimates based on optional LDL-C goals better reflect the future implications of implementation of the SHAPE recommendations.

There are several possible explanations for the discrepancies between the predictions of the SHAPE Task Force and the findings of the present study. First, the present study used a relatively young population, with a mean age of 44 years, near the earliest age at which men would be considered for imaging by SHAPE guidelines and well below the age threshold for imaging in women. When the analyses were restricted to the subset of individuals meeting the age criteria specified by the SHAPE guidelines (≥45 years in men and ≥55 years in women), a 35.7% to 48.0% relative increase in the proportion of individuals potentially eligible for lipid-lowering drug therapy was noted, nearer to the increase projected by the SHAPE authors.9 Analyses stratified by age showed the greatest net increase in potential candidates for drug therapy among individuals 55 to 65 years of age. Inclusion of persons older than 75 years, who are universally classified as very high risk in the SHAPE recommendations, would substantially increase the number of potential candidates for lipid-lowering therapy. This aspect of the SHAPE recommendations is not addressed by the present analyses.

Another factor contributing to the observed discordance between the projected and the observed influence of the SHAPE strategy is the different manner in which diabetes is handled in the NCEP-ATP III and the SHAPE algorithms. While all individuals with diabetes are classified in high-risk categories by the modified NCEP-ATP III guidelines, the SHAPE Task Force does not consider diabetes to be a high-risk state unless detectable atherosclerosis is documented by imaging. Subjects with diabetes who are either younger than 45 years or 45 years or older but with no detectable CAC are reclassified into a less stringent LDL-C goal category by the SHAPE algorithm. The presence of diabetes accounts for most of the downward reclassification to at-goal status observed in the present study. Indeed, we observed that 83% to 87% of the individuals who were downgraded to at-goal status by SHAPE were diabetic subjects.

The downgrading of risk in individuals on the basis of atherosclerosis imaging in the present study is of interest as it reflects a possibly unanticipated effect of applying the SHAPE recommendations, potentially reducing the intensity of CHD risk modification in younger individuals and in individuals with negative atherosclerosis imaging results (including diabetic subjects). Because CAC is a highly specific indicator of coronary atherosclerosis and is associated with increased CHD risk,3,20 it is reasonable to speculate that subjects reclassified as eligible for drug therapy on the basis of detectable CAC are appropriately reclassified into a higher-risk category. In contrast, fewer data are available regarding the interpretation and therapeutic ramifications of negative atherosclerosis imaging results in subjects who are otherwise perceived to be at an increased CHD risk based on the presence of multiple traditional risk factors or diabetes. Before the full implications of the SHAPE algorithm can be predicted, it will be necessary to determine rates of adverse CHD events during long-term follow-up among such individuals.

The SHAPE algorithm defines the threshold for a positive EBCT scan as a CAC score of 1 or more Agatston units. However, controversy exists over what CAC threshold should be used to define atherosclerosis. At CAC scores of less than 10 Agatston units, high interscan variability is observed and reduced concordance is seen between multiple scans in the same individual. These problems are magnified in obese subjects.21 Therefore, the lower threshold recommended by the SHAPE Task Force may be more likely to result in false-positive assignments of atherosclerosis, resulting in misclassification of individuals as not achieving their LDL-C goal. When we compared a more conservative CAC threshold of 10 or more Agatston units with a threshold of 1 or more...
Agatston units to define atherosclerosis, the relative increase in individuals potentially eligible for lipid-lowering therapy changed only from 27.2% to 25.0%. However, when the CAC threshold was raised to 100 or more Agatston units, the relative increase fell to 19.8%. These findings indicate that the implications of the SHAPE recommendations are sensitive not only to age but also to the CAC thresholds used to define atherosclerosis. Between CAC thresholds of 1 and 10, however, the influence of the CAC threshold is modest.

While cost analyses of SHAPE as public policy have recently been reported, the cost data were modeled from predicted increases in the proportion of individuals exceeding their LDL-C goal22 rather than from actual patient data. To the best of our knowledge, the present results represent the first application of the SHAPE screening strategy to a population cohort. Although we did not perform cost analyses in the DHS, we did evaluate the "efficiency" of CAC scanning as recommended by SHAPE. The NNS to reclassify 1 individual as newly eligible (or no longer eligible) for lipid-lowering therapy averaged 5.2. Of interest, efficiency was only modestly sensitive to age, sex, and CAC threshold: the NNS ranged from 4.1 to 7.8 as these parameters were varied. The relative efficiency of CAC scanning in SHAPE suggests that costs of lipid-lowering therapies may be more important than costs of imaging in determining the overall cost implications of the SHAPE recommendations.

Several limitations to the present study should be noted. First, the relatively young age of the study population may be a potential source of bias, as younger populations are less likely to have a high atherosclerosis burden. Therefore, the present findings cannot be generalized to older subjects, and estimates of reclassification apply only to subjects aged 30 to 65 years. In the SHAPE algorithm, individuals older than 75 years are assigned, regardless of risk factor status, to the very-high-risk category with an LDL-C goal of less than 70 mg/dL; therefore, inclusion of subjects older than 75 years would result in more individuals requiring lipid-lowering therapy. Also, we did not systematically assess peripheral vascular disease, a CHD disease equivalent in both NCEP-ATP III and SHAPE. Similarly, while the SHAPE recommendations also consider left ventricular hypertrophy as a high-risk disease state, this was not considered in our analyses. Cardiovascular outcomes were not collected in our cross-sectional study; therefore, no inferences can be made regarding prognostic utility or cost-effectiveness. However, this analysis provides a novel and unbiased evaluation of the magnitude of LDL-C goal reassignment in a specific age range and the potential resource use associated with such reclassification. These data should be useful to researchers and policy makers interested in fully understanding the potential impact of the SHAPE Task Force recommendations.

Finally, the goals for cholesterol-lowering therapy set in this study and in SHAPE are arbitrary for the purposes of comparison. The NCEP-ATP III guidelines specifically allow clinical judgment to be used both for goal setting and for initiation of drug therapy. Application of SHAPE recommendations in practice presumably would make the same allowances.

In conclusion, in a population-based cohort consisting of subjects aged 30 to 65 years who underwent cardiovascular risk assessment using the NCEP-ATP III guidelines, application of the SHAPE Task Force recommendations modestly increased the proportion of the population who were not meeting LDL-C goals and who were thus potentially eligible for lipid-lowering therapy. The implications of SHAPE were magnified in older subjects, particularly in those who met the criteria for noninvasive imaging, and lessened when optional (more aggressive) LDL-C goals were used. The inclusion of older individuals (>65 years) would result in a substantially larger increase in the proportion of individuals eligible to receive lipid-lowering therapy and should be evaluated in other population-based cohorts. Further investigation of the public health and economic impact of these findings is warranted.

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