Effectiveness of a Volunteer-Delivered Lifestyle Modification Program for Reducing Cardiovascular Disease Risk Factors

Paul Rankin, MPHa, Darren P. Morton, PhD*a,*, Hans Diehl, DrHScb, John Gobble, DrPHc, Peter Morey, EdDd, and Esther Chang, Phdd

Lifestyle modification has been demonstrated to effectively reduce the risk factors associated with cardiovascular disease, but there is a perception that it is costly to administer and resource. The present study examined the results achieved by a 30-day lifestyle modification program (Coronary Health Improvement Project) delivered by volunteers in a community setting. Changes in selected biometric measures of 5,070 participants in the Coronary Health Improvement Project programs delivered throughout North America (January 2006 to October 2009), were assessed. Overall, significant reductions (p < 0.001) were recorded in body mass (−3.2%), systolic and diastolic blood pressure (−4.9% and −5.3%, respectively), total cholesterol (−11.0%), low-density lipoprotein cholesterol (−13.0%), triglycerides (−7.7%), and fasting plasma glucose (−6.1%). Stratification of the data revealed more dramatic responses in those presenting with the greatest risk factor levels. Those presenting with cholesterol levels >280 mg/dl recorded an average reduction of 19.8%. A mean decrease of 16.1% in low-density lipoprotein levels was observed among those who entered the program with a low-density lipoprotein level >190 mg/dl. Individuals who presented with triglycerides >500 mg/dl recorded a mean reduction of 44.1%. The Framingham assessment forecast that approximately 70 cardiac events would be averted during the subsequent decade in the cohort because of the program. In conclusion, significant reductions in cardiovascular disease risk factors can be achieved in a 30-day lifestyle intervention delivered by volunteers, providing a cost-effective mode of administering lifestyle medicine. © 2011 Elsevier Inc. All rights reserved. (Am J Cardiol 2011;xx:xxx)
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lifestyle questionnaire. The questionnaire included demo-

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height, weight, and blood pressure were taken and fasting

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16 sessions and completed the pre- and postassessments

use because of the intervention.

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cian throughout the program, because previous experience

The program encouraged participants to move toward a

whole-food, plant-based diet ad libitum, with emphasis on

nutrition workshops. The participants paid a fee of $250 to
cover the costs of the biomedical assessments, food samples
distributed throughout the program, and resources, includ-

ing a textbook and supplementary reading.

The program encouraged participants to move toward a

food, plant-based diet ad libitum, with emphasis on the

consumption of grains, legumes, fresh fruits, and vege-
tables. Specifically, the program recommended <15% of

calories be derived from fat, with <10 teaspoons of added
sugar, <5,000 mg of salt (2,000 mg sodium), and <50 mg
of cholesterol per day. The participants were also encour-
ged to consume 2 to 2.5 L (eight 10-oz glasses) of water
daily.5 At least 30 minutes of daily aerobic exercise (or
10,000 steps) was prescribed, and stress reduction tech-
niques were advocated.

The intent of the CHIP program was to nurture intelli-

gent self-care through enhanced understanding of the epi-

demiology, etiology, and risk factors associated with CVD.
The CHIP curriculum included the following topics: mod-

ern medicine’s accomplishments and limitations, athero-
sclerosis, cardiovascular risk factors, smoking, exercise, di-
etary fiber, cholesterol, plant-based nutrition, obesity,
diabetes, hypertension, dyslipidemia, lifestyle and health,
behavioral change, and self-worth.5

The participants were encouraged to consult their physi-
cian throughout the program, because previous experience
has demonstrated that it is necessary to modify medication
use because of the intervention.

The participants who attended a minimum of 13 of the
16 sessions and completed the pre- and postassessments
“graduated” from the program and were encouraged to
join a CHIP alumni group, which met monthly to provide
ongoing support for the lifestyle changes initiated during
the intervention.

Before participating in the CHIP program (baseline) and
again at its conclusion (postintervention), the participants’
height, weight, and blood pressure were taken and fasting
(12-hour) blood samples were collected. The blood samples
were collected by trained phlebotomists and analyzed by
local pathology laboratories for determination of the total
cholesterol, low-density lipoprotein, high-density lipopro-
tein, triglycerides, and fasting plasma glucose levels. In
addition, the participants completed a self-reported medical/
lifestyle questionnaire. The questionnaire included demo-

graphic data, a brief medical and family history, details of
medication use, and various measures of lifestyle habits
such as dietary behavior, activity level, rest, and the use of
alcohol, caffeine, and tobacco.

The data were entered into a specially developed Mi-

crosoft Access program, exported into Microsoft Excel (Mi-
crosoft, Redmond, Washington) and then imported into
PASW Statistics, version 18 (SAS Institute, Cary, North
Carolina), for analysis. The data are expressed as the
mean ± SD. The extent of the changes (from baseline to
postintervention) in the biometric measures and risk factors,
for both the overall and the stratified data, were assessed
using paired t tests. The McNemar chi-square test was used
to determine the changes from before to after the interven-
tion in the distribution of participants across the various risk
factor categories. The participants were classified as having
the metabolic syndrome at baseline and after intervention,
according to the “harmonized definition,”6 and a Mantel-
Haenszel chi-square test was used to test the assumption
that there was no significant difference between the number
of participants with the metabolic syndrome from baseline
to after the intervention.

Results

The 5,070 participants (mean age 57.2 ± 12.9 years)
included 1,694 men (57.8 ± 13.0 years) and 3,372 women
(56.9 ± 12.9 years). Of these participants, 210 (4.1%) self-
reported a history of myocardial infarction, 111 (2.1%)
had undergone bypass surgery, 101 (2.0%) had experienced
a stroke, and 439 (8.7%) had a history of cancer.

The mean changes from baseline to after the intervention
for all participants combined are presented in Table 1. Signifi-
cant reductions were recorded in all the risk factors,
with the most notable being in total cholesterol (−11%).
High-density lipoprotein cholesterol also decreased after the
intervention but not to the same magnitude as total choles-
terol, reducing the total cholesterol/high-density lipoprotein
to 4.02:1 to 3.89:1 (p < 0.001)

A significant reduction (p < 0.001) was found in the
number of participants requiring medication because of the
program, with 1,085 participants (21.4%) reporting medi-
cation use at the start of the intervention and 879 (17.4%) at
its conclusion. The most common medications taken by the

<table>
<thead>
<tr>
<th>Factor</th>
<th>Participants (n)</th>
<th>Baseline</th>
<th>After Intervention</th>
<th>Mean Change</th>
<th>% Change</th>
<th>t Statistic</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lb)</td>
<td>4,607</td>
<td>192.3 ± 50.4</td>
<td>186.2 ± 48.2</td>
<td>−6.1</td>
<td>−3.2%</td>
<td>69.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>4,536</td>
<td>31.0 ± 7.3</td>
<td>30.0 ± 7.0</td>
<td>−1.0</td>
<td>−3.2%</td>
<td>72.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>4,579</td>
<td>133.2 ± 19.3</td>
<td>126.7 ± 25.5</td>
<td>−6.5</td>
<td>−4.9%</td>
<td>17.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>4,577</td>
<td>79.9 ± 11.3</td>
<td>75.7 ± 10.0</td>
<td>−4.2</td>
<td>−5.3%</td>
<td>27.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>4,674</td>
<td>193.6 ± 41.7</td>
<td>172.3 ± 39.9</td>
<td>−21.3</td>
<td>−11.0%</td>
<td>54.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Low-density lipoprotein (mg/dl)</td>
<td>4,568</td>
<td>131.0 ± 62.0</td>
<td>114.0 ± 54.8</td>
<td>−17.0</td>
<td>−13.0%</td>
<td>41.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>High-density lipoprotein (mg/dl)</td>
<td>4,673</td>
<td>54.8 ± 25.7</td>
<td>50.1 ± 23.1</td>
<td>−4.7</td>
<td>−8.6%</td>
<td>36.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>4,669</td>
<td>143.5 ± 90.0</td>
<td>132.5 ± 74.7</td>
<td>−11.0</td>
<td>−7.7%</td>
<td>12.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fasting plasma glucose (mg/dl)</td>
<td>4,631</td>
<td>101.1 ± 28.9</td>
<td>94.9 ± 31.1</td>
<td>−6.2</td>
<td>−6.1%</td>
<td>23.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Framingham score</td>
<td>3,689</td>
<td>12.2 ± 9.3</td>
<td>10.4 ± 7.8</td>
<td>−1.8</td>
<td>−14.7%</td>
<td>17.4</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD, unless noted otherwise.
Body mass index (kg/m²) was analyzed further, with the results listed in Table 2; the sure. Of the 102 smokers at baseline, only 64 were still

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Participants (n)</th>
<th>McNemar Chi-square Test (p Value)</th>
<th>Baseline</th>
<th>After</th>
<th>Mean Change</th>
<th>% Mean Change</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index (kg/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;18.5</td>
<td>27</td>
<td>33</td>
<td>449 (&lt;0.001)</td>
<td>17.6 ± 0.9</td>
<td>17.5 ± 0.8</td>
<td>−0.1</td>
<td>−0.8%</td>
</tr>
<tr>
<td>18.5–24.9</td>
<td>884</td>
<td>1,086</td>
<td></td>
<td>22.7 ± 1.6</td>
<td>22.3 ± 1.7</td>
<td>−0.5</td>
<td>−2.1%</td>
</tr>
<tr>
<td>25–30</td>
<td>1,470</td>
<td>1,539</td>
<td></td>
<td>27.5 ± 1.4</td>
<td>26.6 ± 1.5</td>
<td>−0.9</td>
<td>−3.1%</td>
</tr>
<tr>
<td>&gt;30</td>
<td>2,242</td>
<td>1,965</td>
<td></td>
<td>36.6 ± 6.1</td>
<td>35.4 ± 6.0</td>
<td>−1.3</td>
<td>−3.4%</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;120</td>
<td>1,279</td>
<td>1,866</td>
<td>662 (&lt;0.001)</td>
<td>111.8 ± 9.0</td>
<td>114.5 ± 27.0</td>
<td>2.7</td>
<td>2.4%</td>
</tr>
<tr>
<td>120–139</td>
<td>1,719</td>
<td>1,788</td>
<td></td>
<td>129.9 ± 5.1</td>
<td>125.2 ± 27.0</td>
<td>−4.7</td>
<td>−3.6%</td>
</tr>
<tr>
<td>140–160</td>
<td>1,127</td>
<td>743</td>
<td></td>
<td>147.2 ± 5.8</td>
<td>134.3 ± 13.1</td>
<td>−12.9</td>
<td>−8.7%</td>
</tr>
<tr>
<td>&gt;160</td>
<td>454</td>
<td>182</td>
<td></td>
<td>170.7 ± 11.9</td>
<td>147.3 ± 17.6</td>
<td>−23.3</td>
<td>−13.7%</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;80</td>
<td>2,619</td>
<td>3,364</td>
<td>560 (&lt;0.001)</td>
<td>72.4 ± 6.9</td>
<td>71.8 ± 8.9</td>
<td>−0.7</td>
<td>−0.9%</td>
</tr>
<tr>
<td>80–89</td>
<td>1,060</td>
<td>822</td>
<td></td>
<td>84.8 ± 2.3</td>
<td>78.3 ± 7.7</td>
<td>−6.4</td>
<td>−7.6%</td>
</tr>
<tr>
<td>90–100</td>
<td>688</td>
<td>322</td>
<td></td>
<td>92.9 ± 3.0</td>
<td>82.7 ± 8.4</td>
<td>−10.2</td>
<td>−10.9%</td>
</tr>
<tr>
<td>&gt;100</td>
<td>210</td>
<td>69</td>
<td></td>
<td>106.2 ± 13.0</td>
<td>87.7 ± 10.3</td>
<td>−18.5</td>
<td>−17.4%</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;160</td>
<td>631</td>
<td>1,862</td>
<td>1,950 (&lt;0.001)</td>
<td>141.0 ± 18.7</td>
<td>133.2 ± 24.8</td>
<td>−7.8</td>
<td>−5.6%</td>
</tr>
<tr>
<td>160–199</td>
<td>2,116</td>
<td>1,781</td>
<td></td>
<td>182.5 ± 15.7</td>
<td>165.5 ± 24.4</td>
<td>−17.0</td>
<td>−9.3%</td>
</tr>
<tr>
<td>200–239</td>
<td>1,261</td>
<td>756</td>
<td></td>
<td>215.6 ± 10.5</td>
<td>188.5 ± 25.5</td>
<td>−27.1</td>
<td>−12.6%</td>
</tr>
<tr>
<td>240–280</td>
<td>478</td>
<td>183</td>
<td></td>
<td>254.7 ± 10.7</td>
<td>215.2 ± 30.7</td>
<td>−39.5</td>
<td>−15.5%</td>
</tr>
<tr>
<td>&gt;280</td>
<td>126</td>
<td>30</td>
<td></td>
<td>306.6 ± 27.2</td>
<td>245.9 ± 43.4</td>
<td>−60.7</td>
<td>−19.8%</td>
</tr>
<tr>
<td>Low-density lipoprotein (mg/dl)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;100</td>
<td>1,453</td>
<td>2,115</td>
<td>1,008 (&lt;0.001)</td>
<td>80.6 ± 15.1</td>
<td>75.3 ± 209.1</td>
<td>−5.3</td>
<td>−6.6%</td>
</tr>
<tr>
<td>100–129</td>
<td>1,345</td>
<td>1,326</td>
<td></td>
<td>114.6 ± 8.3</td>
<td>102.1 ± 20.2</td>
<td>−12.5</td>
<td>−10.9%</td>
</tr>
<tr>
<td>130–159</td>
<td>905</td>
<td>588</td>
<td></td>
<td>142.4 ± 8.5</td>
<td>120.1 ± 21.8</td>
<td>−22.3</td>
<td>−15.7%</td>
</tr>
<tr>
<td>160–190</td>
<td>377</td>
<td>197</td>
<td></td>
<td>172.0 ± 8.2</td>
<td>141.6 ± 27.1</td>
<td>−30.4</td>
<td>−17.7%</td>
</tr>
<tr>
<td>&gt;190</td>
<td>488</td>
<td>342</td>
<td></td>
<td>273.9 ± 67.9</td>
<td>229.8 ± 73.1</td>
<td>−44.1</td>
<td>−16.1%</td>
</tr>
<tr>
<td>High-density lipoprotein (mg/dl)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;40</td>
<td>1,316</td>
<td>1,814</td>
<td>539 (&lt;0.001)</td>
<td>34.2 ± 4.8</td>
<td>33.2 ± 7.0</td>
<td>−1.0</td>
<td>−3.0%</td>
</tr>
<tr>
<td>40–60</td>
<td>2,097</td>
<td>1,912</td>
<td></td>
<td>48.9 ± 5.3</td>
<td>45.0 ± 7.8</td>
<td>−3.8</td>
<td>−7.8%</td>
</tr>
<tr>
<td>≥60</td>
<td>1,261</td>
<td>948</td>
<td></td>
<td>86.3 ± 29.8</td>
<td>76.2 ± 28.5</td>
<td>−10.1</td>
<td>−11.8%</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;100</td>
<td>3,053</td>
<td>3,232</td>
<td>109 (&lt;0.001)</td>
<td>95.5 ± 29.7</td>
<td>99.7 ± 41.8</td>
<td>4.2</td>
<td>4.4%</td>
</tr>
<tr>
<td>100–199</td>
<td>753</td>
<td>765</td>
<td></td>
<td>171.9 ± 13.9</td>
<td>158.1 ± 53.0</td>
<td>−13.8</td>
<td>−8.1%</td>
</tr>
<tr>
<td>200–500</td>
<td>820</td>
<td>663</td>
<td></td>
<td>270.5 ± 62.4</td>
<td>220.1 ± 81.8</td>
<td>−50.3</td>
<td>−18.6%</td>
</tr>
<tr>
<td>≥500</td>
<td>45</td>
<td>11</td>
<td></td>
<td>634.7 ± 114.2</td>
<td>354.8 ± 158.5</td>
<td>−279.9</td>
<td>−44.1%</td>
</tr>
<tr>
<td>Fasting plasma glucose (mg/dl)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;110</td>
<td>3,716</td>
<td>4,026</td>
<td>265 (&lt;0.001)</td>
<td>90.7 ± 9.9</td>
<td>88.6 ± 10.9</td>
<td>−2.1</td>
<td>−2.3%</td>
</tr>
<tr>
<td>110–125</td>
<td>390</td>
<td>304</td>
<td></td>
<td>116.1 ± 15.5</td>
<td>106.0 ± 15.5</td>
<td>−10.1</td>
<td>−8.7%</td>
</tr>
<tr>
<td>≥125</td>
<td>525</td>
<td>301</td>
<td></td>
<td>164.0 ± 42.2</td>
<td>131.4 ± 34.5</td>
<td>−32.6</td>
<td>−19.9%</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD, unless noted otherwise.

participants were to lower cholesterol and/or blood pressure. Of the 102 smokers at baseline, only 64 were still smoking at the end of the 30-day program.

The effect of the intervention on the various risk factors was analyzed further, with the results listed in Table 2; the data were stratified by conventional risk factor categories. The National Cholesterol Education Program Adult Treatment Panel III classification system was used to categorize the participants for all risk factors, except total cholesterol, for which the Framingham risk classification was used. The Framingham classification was used for stratification of the cholesterol data, because it includes 5 categories compared to only 3 in the National Cholesterol Education Program Adult Treatment Panel III classification system and thus allowing a more detailed analysis of the effect of the intervention on the highest risk participants.

The chi-square analyses were highly significant for all risk factors, indicating substantive changes in the distribution of participants across the various categories. Of the participants presenting with the highest category total cholesterol levels of >280 mg/dl at baseline, 77% no longer belonged in this classification by the end of the intervention. Similarly, 224 (43%) of those with fasting plasma glucose levels >125 mg/dl at baseline had reduced their risk factor categorization after the intervention. There was a significant (p < 0.001) 10.4% reduction in the number of participants classified as having the metabolic syndrome from baseline (n = 2,111) to after the intervention (n = 1,891).

To show the clinical significance of the results, Table 3 presents the stratified results using the Framingham 10-year heart risk score assessment, which has been shown to be an indicator of the potential risk of a coronary event in the next
10 years.7,9,10 As with the risk factors listed in Table 2, the greatest improvements were observed among participants ranked in the greatest risk categories at baseline. The mean 1.8% reduction in the predicted likelihood of experiencing a cardiac event during the 10 years after the CHIP program suggests that the intervention would save approximately 70 coronary episodes for this cohort.

**Discussion**

Although the study results represent observational data in that the participants were self-selected and no control group was included, the results are nonetheless noteworthy. Clearly, significant reductions in body weight and CVD risk factors can be achieved through a lifestyle intervention program delivered in a community setting by volunteers. Furthermore, those with the greatest risk benefited the most. Harnessing the energy of volunteer directors, who need not be health professionals, presents a potentially powerful and cost-effective mode for administering lifestyle medicine. Sourcing volunteers might be best achieved through community-oriented groups such as faith-based organizations and other community interest groups.

The mean changes in body mass and CVD risk factors observed in the study were substantive when considering the period during which they were achieved. The 6.1-lb reduction in body mass, equating to a 3% decrease, might in itself be clinically significant. Although in the combat of the metabolic syndrome and associated CVD, a 10% reduction in body mass is the goal during the first year, 5% can be helpful,11 and the participant in the present study made good progress toward this goal within the 30 days. Also, the observed changes in the blood lipid profile compared favorably to those achieved with statin medication.12

The merits of volunteer-directed, community-based lifestyle interventions, such as CHIP, are evident, given that they are inexpensive to administer while potentially yielding substantive reductions in the fiscal burden associated with lifestyle diseases. Importantly, these outcomes are achieved without adverse side effects. The potential savings from reducing total cholesterol alone in the present study are noteworthy. The results of a meta-analysis conducted by Gould et al12 indicate that the mean decrease of 21.3 mg/dl in total cholesterol observed among the participants in the present study would translate to a 20% reduction in relative risk for all-cause mortality. The Framingham assessment, which predicted the avoidance of almost 70 cardiac events during the following decade for the cohort, further adds to the economic rationale for the program. The cost of diabetes care and medications would also have been reduced, given that almost ½ of the participants who entered the program with “diabetic” fasting glucose levels reduced their classification within the 30 days. Although the extent of economic savings arising from the program is difficult to estimate, it is likely to be substantial.

Two important factors might have confounded the results observed in the present study. First, compliance was not assessed; therefore, the extent to which the participants adhered to the lifestyle changes advocated by the program is not known. Additional studies will gather valid measures of the various lifestyle changes made by participants during the CHIP program to elucidate the contributions of these behavioral changes to the results achieved. Undoubtedly, not all participants completely embraced the behavioral changes recommended in the program; however, this would have only diluted the overall effectiveness of the results.

A second confounding factor was that many participants decreased or even ceased their medication use, in consultation with their personal physician, throughout the 30-day CHIP program. Although this is a desirable outcome, it too would have had the effect of diminishing the observed effectiveness of the program as reflected in the mean changes from baseline to after intervention.

The results observed in the present study using volunteer directors are comparable with those achieved by CHIP programs delivered by health professionals.3,13 Although this might be surprising, the volunteer directors were resourced with professionally generated materials. For example, a cardiovascular epidemiologist presented the prerecorded lectures viewed by the participants at each session. Furthermore, it has been documented that passionate volunteers can possess strong motivational properties and have the ability to incite their peers to action.14 Many of the volunteer
The directors of the CHIP programs in the present study were CHIP alumni and therefore had a strong investment and bond with the program. Conceivably, the volunteer director with experiential and emotional ties to a program might even be able to establish better rapport and be more inspirational to participants than certain health professionals.

The results of the present study have demonstrated that volunteers can be valuable social capital in the combat of CVD. Resourced with appropriate, well-developed materials and programs, volunteers can act as powerful agents of change for health promotion within their community.