

# EDUCATING AND MOBILIZING YOUTH TO DETECT UNDIAGNOSED ELEVATED BLOOD PRESSURE: SEARCHING FOR THE SILENT KILLER

**Background:** Hispanic individuals with high blood pressure are less likely than other ethnic groups to be aware of their high blood pressure or to be on medication for the condition. We investigated the feasibility of using high school students in predominantly Hispanic neighborhoods to conduct a large-scale blood pressure screening and education outreach in their communities.

**Methods:** In 2005, 960 students from Los Angeles high schools in predominantly Hispanic communities were trained to conduct blood pressure screening and provide educational materials and referrals. A multivariable analysis using logistic regression was conducted to analyze the association between self-reported cardiovascular risk factors and elevated blood pressure.

**Results:** Students presented educational materials to 5395 persons and screened 5165 persons in their communities. Of 5395 individuals screened, 299 (6%) were found to have elevated blood pressure, of which only 77 (26%) were taking antihypertensive medication. Of those with elevated blood pressure on screening, 46% indicated they had a history of hypertension, and 3% of the entire screened community were identified as having elevated blood pressure for the first time. Older age, male sex, heavy alcohol consumption, and history of hypertension were all independently associated with elevated blood pressure.

**Conclusions:** Training high school students to identify persons with elevated blood pressure is feasible and could reach large numbers of ethnic minorities unaware of their blood pressure status. (*Ethn Dis.* 2008;18:84–88)

**Key Words:** Hypertension, Screening, Outreach, Community, High School Students

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## INTRODUCTION

Hypertension is a primary risk factor for heart disease, stroke, and renal disease and as such represents a substantial public health burden in the United States.<sup>1</sup> In 2004, hypertension killed >54,000 people in the United States and was a “primary or contributing cause of death” in ≈277,000 individuals.<sup>2</sup> Although morbidity and mortality from hypertension have declined since the 1970s, current levels of hypertension control remain unacceptably low. For instance, 28% of hypertensive adults are unaware of their condition, and nearly 39% of those with hypertension are not receiving treatment.<sup>3</sup> While hypertension affects all populations, racial and ethnic disparities exist in its prevalence and treatment. African Americans are more likely to suffer from hypertension, and Mexican Americans with hypertension are significantly less likely to be aware of their condition, to be on medication, or to have their hypertension under control compared to their non-Hispanic White counterparts.<sup>1</sup>

Traditionally a disease of older adults, hypertension now affects children and young adults in increasing numbers. A 2002 study of individuals aged 10–19 years in Houston found a 4.5% prevalence of hypertension overall, with significantly higher prevalence in Hispanic children.<sup>4</sup> Compounding this issue, emerging data indicate that even persons with blood pressure values previously considered to be in the high-normal range are also at risk for cardiovascular disease (CVD). Data from the Framingham Heart Study

revealed hazard ratios for CVD of 1.6 in men with pre-hypertension (ie, blood pressure of 120/80–129/89 mm Hg) and 2.5 in women with pre-hypertension when compared with men and women with normal blood pressure.<sup>5</sup>

Given the pervasiveness of hypertension in the United States, a population-based approach to combating the problem may be warranted.<sup>6</sup> Accordingly, Healthy People 2010 objective 12–12 seeks to “Increase the proportion of adults who have had their blood pressure measured within the preceding two years and could state whether their blood pressure was normal or high.”<sup>7</sup>

The American Heart Association Minority Health Summit recommends using community members as health educators to raise hypertension awareness in their communities.<sup>8</sup>

Indeed, numerous public health interventions have employed lay health educators and community members to conduct blood pressure screening.<sup>9–13</sup> One such study published >20 years ago used high school students to conduct blood pressure screening on a modest scale.<sup>9</sup> We, however, are unaware of any large-scale studies that have

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evaluated the use of high school students to screen blood pressure. Using an existing workforce to reach a large number of individuals could be indispensable to significantly decreasing elevated blood pressure in high-risk communities. In this study, we investigated the feasibility of a large-scale intervention using Los Angeles high school students to screen members of their communities for elevated blood pressure.

## METHODS

The American Heart Association and District Nursing Services at the Los Angeles Unified School District (LAUSD) partnered to educate and mobilize high school students for a community outreach program geared at screening blood pressure, as well as providing education and physician referral opportunities for persons found to have elevated blood pressure. Between November 2005 and May 2005, 960 students were recruited from 17 high schools in LAUSD. Students were recruited from high schools in predominantly Hispanic communities in Los Angeles to reach this at-risk ethnic group.

Students from health education, biology, and economics classes were trained by LAUSD nurses during two 45-minute class sessions. Students were presented with information on CVD, associated risk factors, and the proper method to take blood pressure readings with digital blood pressure monitors. The second session consisted of a lab wherein students practiced using the blood pressure monitors on one another. The 11th grade economics students also discussed the financial effect of hypertension on the community. In addition, students were trained on the completion of a short CVD risk assessment questionnaire and how to identify high-risk individuals for referral to volunteer physicians.

Each client was asked a short series of CVD risk factor questions about alcohol consumption, sodium intake, physical activity, smoking, current high blood pressure, history of high blood pressure in the family, perceived weight, and medication usage for high blood pressure. Risk factor questions were worded with simple phrasing to facilitate CVD education from the student to the community members. For instance, participants were asked to indicate on a scale how frequently they used salt in their food or how much alcohol they drank per day. Demographic information, including age, sex, ethnicity, and zip code of residence, were collected on the risk assessment form, as well. Students were also provided with English and Spanish CVD educational materials and referral information to distribute to community persons.

## Outreach

Three hundred digital blood pressure monitors and cuffs were distributed and rotated among the 960 students. Students were assigned to engage a minimum of 10 family members, friends, or acquaintances to take their blood pressure and provide them with educational materials, including a medical resource book and medical referrals for individuals with systolic blood pressure readings  $\geq 140$  mm Hg. Students were given two weeks to complete the assignment. Each student approached a community member and explained the program. The student took a blood pressure reading from that person and recorded the results on a risk assessment form. Then the student asked the person a short series of questions to complete the risk assessment form.

High blood pressure or hypertension is defined as systolic pressure  $\geq 140$  mm Hg or diastolic pressure  $\geq 90$  mm Hg.<sup>3</sup> In this study, to meet the criterion of having elevated blood pressure, both systolic and diastolic blood pressure values had to be above 140/90 mm Hg.

We also evaluated a pre-hypertensive blood pressure category, defined as systolic pressure 120–139 mm Hg and diastolic pressure 80–89 mm Hg.<sup>3</sup> To meet the criterion of having pre-hypertension, both systolic and diastolic blood pressure values had to be met. Since blood pressure was only assessed once during this survey and not multiple times per national guidelines to meet the precise diagnosis of hypertension and pre-hypertension,<sup>3</sup> we will be referring to these categories of individuals as having “elevated blood pressure” or “pre-elevated blood pressure,” respectively throughout the rest of this article. In this study we used only current biomarker status (ie, elevated blood pressure at the time of evaluation) as our outcome. We did not consider persons taking antihypertensive medication as having met the criterion of elevated blood pressure because students could not verify the indication and actual use of the medication. Similarly, persons who reported a history of hypertension were also not considered as having met the criterion of elevated blood pressure since confirmation that this medical diagnosis had actually been made by a healthcare professional could not be verified.

All persons were provided with cholesterol and stroke education materials. Those persons with elevated blood pressure readings were referred to a volunteer physician to receive guidance on further management. Volunteer physicians who spoke both English and Spanish were available and could be consulted by telephone.

The LAUSD has an institutional review board as part of its Program Evaluation and Research Division, which reviewed and approved the study protocol. In addition, all students had to provide a signed authorization form to participate in the intervention.

## Analysis

Descriptive statistics, including cross-tabulations, were conducted to assess the

general demographics of community members and determine the number of persons with elevated blood pressure detected by the students. A multivariable analysis using logistic regression was conducted to analyze the association between self-reported cardiovascular risk factors and elevated blood pressure. SPSS 11.0 was used for all statistics. The following sociodemographic variables were included a priori in the multivariable model: age, race, ethnicity, sex, medical history of hypertension, use of antihypertensive medication, history of regular exercise, current smoking, alcohol consumption status, salt consumption status, and family history of hypertension. Data analysis was based on the number of respondents for each question; missing values were excluded. To help ensure the validity of the data, LAUSD nurses conducted periodic quality assurance checks on finished questionnaires. The final data were also examined to determine whether a student might have screened the same person more than once and whether more than one student might have screened the same individual.

## RESULTS

### Demographics

Students provided CVD education to 5395 persons in the community. A plurality (46%) of these persons were Hispanic, 7% were African American, 5% were Asian, 4% were White, and 3% were another ethnicity; 35% did not indicate a race or ethnicity. Most persons were female (55%). A plurality (38%) were aged 18–33 years, 18% were <18 years, 29% were 34–49 years, and 14% were ≥50 years. The risk assessment was conducted in Spanish for 22% of the participants.

### Detection of Elevated Blood Pressure

Blood pressure readings were collected for 5165 persons. The students

**Table 1. Multivariable predictors of elevated blood pressure among Los Angeles community members intercepted by high school students (n=3113)**

Variable		OR (95% CI)
Male sex (vs female)*		2.69 (1.90–3.80)
Race/ethnicity	White	Referent
	African American/Black	.78 (.38–1.58)
	Armenian	.65 (.17–2.48)
	Asian/Pacific Islander/Filipino	.75 (.34–1.65)
	Hispanic/Latino	.76 (.42–1.38)
	Middle Eastern/Persian	1.10 (.10–11.20)
Age (years)	<18	Referent
	18–33	1.80 (.80–4.05)
	34–49*	6.75 (3.14–14.54)
	≥50 *	6.28 (2.79–14.13)
Regular exercise		.80 (.58–1.12)
Current smoking		1.14 (.74–1.74)
Family history of high blood pressure		1.25 (.87–1.78)
Alcohol consumption	Never	Referent
	<1 per day	1.01 (.68–1.50)
	1 or 2 per day	1.43 (.76–2.68)
	>2 per day*	3.46 (1.71–7.01)
Salt consumption	Never	Referent
	Sometimes	.97 (.56–1.67)
	Always	.76 (.43–1.36)
History of high blood pressure*		4.19 (2.77–6.34)
Taking medication for high blood pressure		.85 (.51–1.42)

\*  $P < .01$ .

OR= odds ratio; CI= confidence interval.

identified 299 (6%) persons with elevated blood pressure. However, only 77 (26%) of those with elevated blood pressure reported taking medication for hypertension. Of those with elevated blood pressure on screening, 134 (46%) indicated they had a history of hypertension; 145 persons (3% of the sample) were newly identified as having elevated blood pressure.

Using our criteria, the LAUSD high school students identified an additional 1114 (22%) persons taking medication for hypertension; and 241 (22%) of pre-elevated blood pressure persons reported having a history of hypertension. Of the total community sample ( $n=5165$ ), 16% were newly identified with pre-elevated blood pressure.

### Associated Risk Factors

In multivariable analysis, four factors were significantly associated with elevated blood pressure in this sample. Men were 2.7 times more likely than women to have elevated blood pressure,

while adults aged ≥34 were more than 6 times more likely than those ≤18 to have elevated blood pressure. Persons who reported drinking >2 drinks per day were 3.5 times more likely to have elevated blood pressure than those who reported no alcohol consumption, and those who indicated a history of hypertension were 4.2 times more likely to have elevated blood pressure than those who reported no history of hypertension (Table 1).

## DISCUSSION

This study demonstrates the feasibility of using high school students to implement a large-scale blood pressure screening and education intervention in their communities. Student outreach workers discovered a 3% incidence of newly identified individuals with elevated blood pressure and provided them with relevant educational resources and referrals. Because students were unable

to verify that participants had been previously given a diagnosis of hypertension from a physician or that they were actually taking antihypertensive medication, the number of individuals with undiagnosed or poorly controlled hypertension in this study is very likely underestimated. Furthermore, students also identified 16% of participants who met our criterion for pre-elevated blood pressure. This finding is particularly important in light of recent evidence regarding the detrimental health effects of even high-normal blood pressure.<sup>5</sup> Importantly, students reached a substantial number of Hispanics (46%). This number is most likely an underestimate since 35% of participants failed to answer the question regarding ethnicity. Targeting Hispanics is critical since hypertensive Hispanics have been shown to be less aware of their condition. Overall, the study found that only 46% of the sample were aware of their elevated blood pressure status. Clearly, broader blood pressure screening is needed in the study population.

Results of the multivariate analysis found an independent association between elevated blood pressure and older age, alcohol consumption, and male gender. There was also a very strong association between elevated blood pressure in this study and self-report of hypertension. While limitations to the study design preclude any estimate of prevalence in the community as a whole, the results of the multivariate analysis lend validity to the study since they reflect established risk factors for hypertension.<sup>3</sup>

Using students as community outreach workers has several distinct advantages. For one, because the students conducted these activities in their own communities, the outreach should be linguistically and culturally appropriate. Public high school students may also offer access to hard-to-reach populations. In Los Angeles, for example, public high school students may have access to community members of lower

socioeconomic status that might be less likely to use regular preventative health care. In addition, this method is likely to be very cost-effective, since workers are volunteers who get a certificate of community service instead of paid employees. While this screening intervention benefited from a strong school nursing department, it would not be difficult to adapt the program in other districts. Including planning and training time for students and nurses, the entire program required about nine months to complete.

This study adds to the extremely limited literature on using high school students for blood pressure outreach. A future study could screen participants over at least two consecutive intervals, as this is considered the gold standard for blood pressure measurement.<sup>3</sup> Such a study could also employ a pre-post assessment to measure changes in blood pressure knowledge, attitudes, and behaviors in the student workers themselves. Further investigation into the outcome of this intervention could lead to applications in other diseases and conditions.

This study had several limitations. First of all, with the exception of the blood pressure reading, the questionnaire items rely on self-report of data. Because of this, recall bias may have affected some answers. Second, only one blood pressure reading was taken for each participant. To more accurately gauge a participant's blood pressure, at least two readings should be taken on different occasions. Furthermore, no followup was conducted with participants with elevated blood pressure to see if the screening and healthcare professional referral led to prompt and optimal management. Cooke and Meyers found that a follow-up letter and phone call doubled the number of hypertensive participants who sought medical attention after receiving a referral.<sup>13</sup> In the future, student workers could conduct this type of followup with participants after the intervention.

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*This study demonstrates that a community blood pressure screening intervention conducted by high school students is feasible.*

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Data could also be gathered from the volunteer physicians regarding any participants who sought care. Another limitation is that the number of persons screened by the students was lower than the number initially projected. Students were able to screen slightly more than five individuals each, on average, instead of the 10 called for in their assignment. However, students did screen >5,000 community members, which is much more than most community hypertension interventions that use volunteers. Finally, no information was collected from individuals who refused to be screened, so we cannot know if those who consented to screening were significantly different from those who refused. Despite these limitations, this preliminary study does suggest that using high school students to conduct community blood pressure screening is a worthwhile intervention strategy.

Research suggests that reducing the blood pressure level in the US population by as little as 2 mm Hg would result in a 15% reduction in risk for stroke and a 6% reduction in risk for CVD.<sup>14</sup> Therefore, it is imperative that hypertension screening occurs on a population level. Innovative community interventions such as ours can reach many thousands of individuals both efficiently and cost-effectively. This study demonstrates that a community blood pressure screening intervention conducted by high school students is feasible. Further study, however, is needed to improve intervention methods and to ensure that both participants and students optimally benefit from the intervention.



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