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Cardiovascular health knowledge, attitude, and practice/behavior in an urbanizing community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site

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ARTICLE SUMMARY

Article focus

- We aimed to gain a deeper understanding of knowledge, attitude, and behavior/practice regarding cardiovascular health in a semi-urban community of Nepal, a low-income South Asian country.

Key messages

- The study site has a high burden of cardiovascular risk factors. In particular, low physical activity and overweight/obesity exceed the national average.
- Unprompted responses to cardiovascular health questions revealed a poor level of knowledge, and respondents' attitude toward cardiovascular health showed low risk perception.
- Poor correlation between knowledge, attitude, and behavior scores imply that commonly applied health promotion strategies that merely increase knowledge of cardiovascular health may be insufficient, thus emphasizing the need for a more holistic approach to disease prevention.

Strengths and limitations of the study

- This study is the first to extensively explore knowledge, attitude, and behavior/practice regarding cardiovascular health in Nepal.
- Random sampling derived from a sampling frame generated from a health demographic surveillance site provides the logistic advantage of further follow-up and intervention.
- Using both prompted and unprompted questions in the same study illustrates the variation that may be obtained by these approaches.
- Except for the WHO STEPS questionnaire on behavioral risk factors, we used questions from many unvalidated sources.
- Unintentional oversampling of women respondents yielded unsegregated gender-wise results that are more likely to represent knowledge, attitude, and practice/behavior in women.

Abstract:

Objectives: This study aimed to determine the knowledge, attitude, and practice/behavior of cardiovascular health in residents of a semi-urban community of Nepal.

Design: To increase understanding of knowledge, attitude, and practice/behavior toward cardiovascular health, we conducted in-home interviews using a questionnaire based on WHO STEPS and other resources, scoring all responses. We also recorded blood pressure and took anthropometric measurements.

Setting: Our study was conducted as part of the HARDIC project at the Jhaukhel-Duwakot Health Demographic Surveillance Site in two urbanizing villages near Kathmandu. Our results present baseline data from the project that aims to improve cardiovascular health literacy through health promotion.

Participants: The study population included 777 respondents from six randomly selected clusters in both villages.

Primary outcome measure: Proportion of the study population with correct knowledge about the causes, manifestation, immediate management, and preventability of cardiovascular diseases. Our data reveals participants' attitude toward cardiovascular health and its preventability as well as cardiovascular health behavior, as reflected in the risk factor status and positive actions taken toward achieving them.

Secondary outcome measure: Our data calculated and correlated participants' scores regarding knowledge, attitude, and practice/behavior.

Results: Participants showed only poor knowledge of heart disease causes, heart attack symptoms, and appropriate action. In general, the participants' attitude toward heart health was inappropriate. The burden of cardiovascular risk factors among participants was high. Median percent scores for knowledge, attitude, and practice/behavior were 79.25, 74.29, and 48.00, respectively. We observed poor correlations between the Pearson coefficient for knowledge and

attitude; attitude and behavior/practice; and knowledge and behavior/practice (0.025, 0.126, and 0.121, respectively).

Conclusions: Our study demonstrates poor level of cardiovascular health knowledge, attitude, and practice/behavior in a semi-urban community in a low-income nation. Tailoring health promotion activities to our findings might improve public health literacy for cardiovascular disease.

INTRODUCTION

Noncommunicable diseases (NCDs) pose increasingly important public health problems in low- and middle- income countries (LMICs). In 2008, 80% of global NCD deaths occurred in LMICs,[1] and NCDs recently accounted for 7.9 million of 14.5 million deaths (54%) in Southeast Asia.[2] Poverty, illiteracy, poor health infrastructure, and demographic transition, including increasing life expectancy, are major contributors to rising burden of NCDs in the region. Other postulated causes include poor fetal and childhood nutrition.[3, 4] A similar pattern is evident in South Asian countries like Nepal, where NCDs currently occur more frequently than communicable diseases and behavioral risk factors such as tobacco smoking are high.[5]

Globally, cardiovascular diseases (CVDs) comprise 39% of all NCD deaths.[6] Eighty percent of CVDs result from tobacco smoking, unhealthy diet, physical inactivity, and harmful use of alcohol.[7] The risk of all-cause mortality among individuals who score poorly in behavioral factors is four fold higher than those who score best.[8] In high-income countries, declining CVD mortality is largely attributed to the reduction of behavioral risk factors.[9] Underlying socioeconomic parameters and societal influences affect exposure and vulnerability to CVD risk factors. Therefore, surveillance of NCD risk factors should include social determinants of

cardiovascular health.[1, 10] Currently, understanding the individual and social determinants of cardiovascular health behaviors is among the top 20 priority areas for NCD research in LMICs.[11]

As a precursor of favorable health behavior, experts have advocated health literacy since community-based interventions (e.g., Finland's North Karelia Project) began exploring the potential impact of behavioral changes on CVD.[1, 12] The World Health Organization (WHO) promotes public awareness of diet and physical activity as a "best buy" to improve cardiovascular behavior.[9] Similarly, the American Heart Association emphasizes the importance of improving community awareness of cardiovascular health issues.[13, 14] However, achieving desired health behavior requires deeper understanding of the underlying social context of disease.[15] Hence, studies on knowledge, attitude, and practice (KAP) increase our understanding of cardiovascular health literacy and community behavior.[16] Currently, such studies have been limited in South Asia.

In Pakistan, inability to recognize the symptoms of heart attack associates independently with delayed hospitalization.[17]An earlier study reported a low level of knowledge about heart attack[18] and diabetes symptoms in Nepal.[19] Nepal's high prevalence of underlying behavioral risk factors, particularly tobacco and alcohol consumption, and poor cardiovascular health knowledge is a matter of concern.[20]

Currently, attempts to improve cardiovascular health knowledge and behavior in Nepal focus mainly on campaigns that transmit information but pay little attention to the population's actual health literacy To gain greater insight into this important issue, we undertook a community-based KAP study in the Jhaukhel-Duwakot Health-Demographic Surveillance Site (JD-HDSS) outside Kathmandu.[21] The baseline census in these villages suggested that NCDs, particularly CVDs, are the predominant cause of morbidity and mortality.[21] Additionally, our pilot study in the Duwakot population demonstrated poor cardiovascular health knowledge.[22]

Heart-Health Associated Research and Dissemination in the Community (HARDIC) is the cardiovascular health component of JD-HDSS. In Nepalese, hardic means "heartily" or "from the heart". Using community-level interventions, HARDIC aims to improve cardiovascular health literacy and practice/behavior and this paper reports the baseline results from HARDIC. Our

study is the first to conduct a detailed analysis of KAP/health literacy in relation to cardiovascular health.

METHODS

Study site and population

We conducted our descriptive, community-based, cross-sectional study between September and November 2011 in the JD-HDSS of Bhaktapur district in the Kathmandu Valley, 13 kilometers from Kathmandu. An earlier report described the establishment of the surveillance site.[21] Duwakot and Jhaukhel each contain nine administrative wards. We randomly selected three wards from each village. Based on the JD-HDSS 2010 baseline census,[21] we compiled a complete list of households containing adults aged 25-59 years in the selected wards. Next, we selected one adult, of either sex, from all interview households. If a household contained more than one adult, we used the Kish technique to select the respondent.[23]

Study tools

Interviews based on the WHO-NCD STEPS questionnaire

We structured the basic questionnaire using the WHO-NCD STEPS[24] and other sources.[17, 25-39] Questions were related to respondents' knowledge of cardiovascular health (e.g., causes and risk factors, warning signs, and action for suspected heart attack); heart-healthy diet; and disease prevention. The first two areas included unprompted (spontaneous, open-ended) and prompted (clues provided, closed-ended) responses, and the latter two areas included only prompted responses. We asked respondents about their attitude toward different aspects of cardiovascular health: did they perceive themselves at risk for CVD? Did they think behavior change would reduce their risk of developing CVD?

Behavior-related questions were based on Step 1 of the WHO STEPwise approach to surveillance (STEPS), which uses a questionnaire to collect data on risk factors.[24] Our questions probed current and past smoking behavior; smokeless tobacco; alcohol consumption in the past 30 days (current drinker), and drinking frequency among current drinkers. The physical activity section asked respondents to report the number of days and amount of time they participated in vigorous and moderate activities at work, leisure, and travel. After calculating the Metabolic

Equivalent of Task (MET) minutes/week, we grouped participants as highly active, moderately active, or inactive (low physical activity) in accord with the STEPS manual. Additional practice and behavioral questions explored whether participants had engaged in any heart-friendly behavior in the previous year and for what reason.

Cronbach's alpha, which measures question reliability, for the overall knowledge and attitude was 0.941 (range: 0.775–0.913) and 0.824 (range: 0.791–0.822), respectively. Cronbach's alpha for practice and behavior ranged from low (0.257) for physical activity questions to high (0.929) for blood pressure measurement.

Twelve local female enumerators (two per ward) conducted the interviews. All enumerators had completed at least grade 10 in school. Supervisors included two public health graduates; a field coordinator who holds both master's and PhD degrees in public health; two PhD students including one author (AV).

Scoring knowledge, attitude, and practice/behavior questions

To compare and correlate the three components, we scored responses regarding KAP/behavior for cardiovascular health. The maximum possible score for KAP/behavior was 53, 70, and 25 respectively. See Supplement for further detail.

Physical measurements

Enumerators recorded anthropometric measurements (i.e., weight, height, and waist and hip circumferences) according to STEPs guidelines.[24] Weight was measured to one decimal place using a Microlife BR-9201 Weighing Scale (Microlife AG Swiss Corporation, Widnau, Switzerland). Height and waist and hip circumferences were measured using non-stretchable tapes (Jonson Tapes Ltd, New Delhi, India). Blood pressure was determined digitally by Microlife BP 3AP1-3E (Microlife AG Swiss Corporation, Widnau, Switzerland). Enumerators recorded three readings for each respondent, taken at 5-minute intervals. We averaged the readings to attain the final blood pressure measurements. Respondents with known history of hypertension (diagnosed cases) and those diagnosed during the study according to Joint National Committee -VII[41] were termed as having "hypertension."

Data management and analysis

Supervisors checked all completed questionnaires and, if necessary, asked enumerators to revisit households. We outsourced data entry to a team of data entry operators, public health graduates by qualification. Data was coded and entered in Epidata version 2.1 and analyzed with SPSS version 17.0 (IBM, Armonk, New York, USA) and STATA version 10.0 (StataCorp, Texas, USA). Demographic variables were taken as independent variables; other variables, including KAP components, were analyzed as dependent variables. Categorical data is presented as percentages, and continuous data is presented as mean (standard deviation). KAP scores are presented as median score percents. We used the Chi-square test to compare proportions and the Kruskal–Wallis test to compare medians. $P<0.05$ was considered statistically significant.

Ethical considerations

The Nepal Health Research Council and the Institutional Review Board of Kathmandu Medical College approved this study. Following a pattern established at the outset of JD-HDSS, we consulted local leaders and sought their informal permission for HDSS activities. In addition, we periodically consulted with health and administrative authorities in both villages. All participants gave informed consent, and privacy was maintained during the interview process. To maintain confidentiality, all data were secured in the HDSS office. Computer data were accessible only to the research team. Although respondents received no monetary incentives, we provided a referral that included discounted consultation fees at Kathmandu Medical College or Nepal Medical College for self-reported illness and newly diagnosed hypertension.

RESULTS

We surveyed 789 of 840 households in randomly selected six wards of Duwakot and Jhaukhel (non-response rate = 6.07%). After omitting incomplete questionnaires, we included 777 individuals in the analysis. Except for missing recordings for height, weight, or blood pressure, the data reported here cover all 777 respondents.

Demographic variables

Table 1 describes the respondents. Seventy percent of all participants were female, and 25% lacked formal education.

Table 1: Demographic characteristics and risk factor status of the study population (n=777)

Demographic variables (n=777)	Male (%)	Female (%)	Total (%)
Age (years)			
25–34	30.1	34.3	33.1
35–44	34.1	36.9	36.0
45–59	35.8	28.8	30.9
Ethnic group			
Brahmin	37.1	38.1	37.8
Chhetri	24.0	25.4	25.0
Newar	29.3	23.2	25.0
Minorities	9.6	13.3	12.2
Education*			
No formal schooling	11.8	33.2	26.9
Primary school	32.3	31.4	31.7
Secondary school	32.3	22.6	25.5
High school or more	23.6	12.8	16.0
Occupation†			
Employee	30.6	8.4	14.9
Self-employed	32.4	6.6	13.9
Housewife		67.3	47.5
Agriculture	21.0	14.2	16.3
Other	17.0	3.5	17.5
Cardiovascular risk factors§			
Smoking (current) (n=777)	33.5	14.7	20.1
Smokeless tobacco (current) (n=777)	20.2	3.3	8.3
Alcohol drinkers (ever) (n=777)	36.7	14.1	20.7
Alcohol drinkers (current) (n=777)	34.5	12.6	19.0
Low physical activity (n=777)	38.3	45.2	43.3
Hypertension (known and new) (n=670)	20.6	22.1	21.6

Self-reported high blood sugar (n=777)	4.8	3.5	3.9
Overweight/obese (n=762)	25.0/5.4	31.6/11.2	29.7/9.4
Increased waist circumference (cm) (n=773)	21.6	56.6	46.3
Increased waist/hip ration (n=750)	57.9	55.6	56.3

Note: Classification of ethnic groups is based on the National Central Bureau of Statistics.[41]

*Primary and secondary schooling indicate education up to grade 4 and 10, respectively.

†Employee describe individuals working for governmental or nongovernmental organizations. "Other" occupations include students, unemployed individuals (able or unable to work), retired, and non-paid workers.

§Risk factor categories are based on the WHO-NCD Risk Factor STEPS Survey manual.[24] Current smokers included those who responded "yes" to "Do you smoke?" Past smokers included those who replied "yes" to "Did you ever smoke in the past?" "Ever drinkers" included respondents who had "consumed a drink that contained alcohol ever in lifetime," and current drinkers included respondents who had "consumed alcohol within the previous month." Percentage of drinking frequency represents current drinkers who consumed at least one standard drink per occasion. Blood pressure data exclude respondents who did not submit to all three readings. Likewise, data for body mass index, waist circumference, and waist-hip ratio exclude respondents whose weight, height, and waist and/or hip measurements were not taken. Increased waist circumference includes waist measurements of ≥ 80 cm (females) and ≥ 90 cm (males); increased waist-hip ratio is ≥ 0.85 (females) and ≥ 0.90 (males).

High burden of risk factors related to cardiovascular health

Table 1 also shows the prevalence of cardiovascular risk factors in the study population. One in four respondents was a past or current smoker. One in five respondents had consumed at least one alcoholic beverage in the previous month. Both males and females consumed fruit 2.6±1.98 and 3.3±2.17 days/week, respectively. Likewise, males and females consumed vegetables 5.33±1.69 and 5.64±1.55 days/week, respectively. More than 40% of the respondents reported low physical activity. Prevalence of known and newly diagnosed hypertension was 21.6%. As measured by BMI, the prevalence of overweight and obesity was 29.7% and 9.4 %, respectively. Abdominal obesity (i.e., increased waist circumference and waist-hip ratio) was 46.3% and 56.3%, respectively (Table 1).

Poor knowledge of cardiovascular health

Cause of heart disease

When seeking unprompted responses, enumerators asked participants to spontaneously name the causes of CVD (Table 2). Respondents showed low overall knowledge of the factors that cause CVDs, ranging from 1.0% (high blood sugar) to 29.2% (smoking). Generally, males knew more

than females; younger respondents knew more than older ones; ethnic minorities knew less; and better-educated individuals and governmental or nongovernmental employees were better informed than those with less education and in other employment situations.

Table 2: Percentage of respondents citing various causes of heart disease (n=777)

	Hypertension	High blood sugar	High cholesterol	Physical inactivity	Overweight	Smoking	Smokeless tobacco	Excessive alcohol	Excess stress
Sex									
Male	18.8*	1.3	20.5*	7.0	5.7	34.9*	8.3	31.4*	16.2
Female	10.9*	0.9	13.5*	4.0	5.3	26.8*	4.7	23.9*	13.5
Age (years)									
25–34	14.8	1.6	17.5	5.4	6.2	31.1	6.2	28.4	16.0*
35–44	13.2	0.4	17.1	5.7	6.1	26.8	5.0	25.0	17.1*
45–59	11.7	1.3	11.7	3.3	3.8	30.0	6.3	25.0	9.2*
Ethnicity									
Brahmin	14.3*	1.0	21.1#	7.5*	5.8	29.3	8.2	25.2	12.9
Chhetri	19.1*	1.0	16.5#	4.6*	6.7	32.5	3.6	25.8	20.1
Newar	10.8*	.5	9.8#	3.6*	5.7	27.8	6.2	28.4	10.8
Minorities	3.2*	2.1	8.4#	0.0*	1.1	25.3	2.1	25.3	13.7
Education									
Primary school	13.0*	0.8	14.2#	5.3#	4.5*	30.5	8.1	27.6	15.0*
Secondary school	15.7*	1.5	18.7#	8.6#	8.6*	29.8	3.0	27.8	16.7*
High school or more	21.0*	1.6	27.4#	4.8#	8.9*	33.9	8.1	26.6	18.5*
No formal schooling	6.7*	0.5	7.2#	1.0#	1.4*	24.4	4.3	22.5	8.6*
Occupation									
Employee	26.7#	0.9	32.8#	10.3	8.6	30.2	8.6	31.9	23.3*
Self-employed	17.6#	2.8	14.8#	1.9	7.4	29.6	2.8	25.9	15.7*
Housewife	10.6#	1.1	11.7#	3.3	5.4	25.7	3.5	23.8	13.0*
Agriculture	7.1#	0.0	14.3#	7.1	1.6	37.3	8.7	26.2	11.1*

Others	8.6#	0.0	10.3#	5.2	3.4	31.0	13.8	29.3	8.6*
Overall	13.3	1.0	15.6	4.9	5.4	29.2	5.8	26.1	14.3

Note: Figures are based on spontaneous participant responses. The table includes only established CVD risk factors and excludes responses that cited other non-established causes (e.g., food hygiene, air pollution, etc.). Calculated with Chi-square test, p-values compare all categories in the variables.

*P-value <0.05; # p-value <0.01]

Knowledge of heart attack symptoms

Around 60% of respondents did not know any heart attack symptoms compared with 20% who knew 2–4 symptoms. This ratio was uniform across all the demographic variables (Table 3). Importantly, less than 25% of respondents identified chest pain—the most prominent and important indicator of heart attack—as a symptom (data not shown). This knowledge decreased with age (p=0.013) and level of education (p=0.055). Brahmin respondents (p<0.001) and governmental or nongovernmental employees (p=0.021) had slightly better knowledge about chest pain.

Table 3: Correctly reported warning signs of heart attack (n=777)

	Signs reported (number)			
	0 (%)	**1 (%)**	**2–4 (%)**	**P-value**
Sex				
Male	59.4	18.3	22.3	0.605
Female	59.5	20.8	19.7	
Age (years)				
25–34	63.4	16.7	19.8	
35–44	57.1	21.4	21.4	0.494
45–59	57.9	22.1	20.0	
Ethnicity				
Brahmin	56.8	22.1	21.1	0.395

Chhetri	62.9	18.0	19.1	
Newar	59.3	17.0	23.7	
Others	61.1	24.2	14.7	
Highest education				
No formal schooling	60.3	22.0	17.7	
Up to primary school	58.1	18.7	23.2	0.493
Up to secondary school	60.1	22.2	17.7	
High school or more	59.7	16.1	24.2	
Main job				
Employee	55.2	19.0	25.9	
Self-employed (self)	57.4	20.4	22.2	
Housewife	59.1	21.4	19.5	0.687
Agriculture	65.1	15.9	19.0	
Others	62.1	22.4	15.5	
Overall	**59.5**	**20.1**	**20.5**	

Note: Warning signs were based on a list provided by American Heart Association.[42]

P-values were calculated using the Chi-square test and compare all categories in the variables.

Action in case of a heart attack

When asked what action they would take for a suspected heart attack, 75% of respondents said they would immediately take the person to a hospital. About 3% said they would try home therapy, consult a traditional healer, or stay home and wait for the symptoms to go away. More than 20% gave no response.

Heart-healthy foods

When asked to identify a particular heart-healthy food , most respondents identified green leafy vegetables (94.6%) and fruit (92.1%). Around 7% thought fried food or saturated fat (e.g., ghee) are healthy foods. Nearly 22% thought salty food (e.g., chips) is heart-healthy.

Heart disease prevention

After reading aloud a list of specific actions that help prevent CVD, enumerators asked respondents to comment if they thought a particular action would help. Actions included quitting smoking; getting physical exercise; losing weight; reducing intake of dietary fat, animal products, and salt; reducing stress; and maintaining healthy blood pressure. A majority of respondents thought these actions are helpful, ranging from 86.1% for weight reduction to 92.5% for smoking cessation.

Attitude toward heart health in an urbanizing community

Enumerators asked respondents about their attitude toward different issues of heart health (Table 4). Regarding lifestyle and preventive measures, 72.9% of males and 68.0%females did not perceive themselves at risk of CVD and more than half did not want to change their current lifestyle (males = 63.3%; females = 53.1%). Seventy-five percent said they did not eat more than they need; 80% did consider themselves overweight; and three fifths did not think that changing their behavior would lower their cardiovascular risk. Further, 52.4% of males and 60.8% of females thought that God or a higher power determines their health.

Table 4: Response to attitude-related questions on heart health

Attitude	Strongly disagree		Somewhat disagree		Somewhat agree		Strongly agree		Don't know/ Can't say	
	M	F	M	F	M	F	M	F	M	F
I don't perceive myself to be at risk for heart disease	31.4	30.8	41.5	37.2	15.7	21.9	9.6	8.6	1.7	1.5
I don't want to change my lifestyle (activity, smoking, alcohol)	17.5	20.3	17.9	25.4	30.1	20.8	33.2	32.3	1.3	1.3
I feel the amount of food I eat is too much, and I would like to cut down	33.6	28.5	49.3	45.1	10.0	15.3	5.2	10.2	1.7	0.9

I feel my present weight is too high for my health	36.2	34.9	47.6	41.4	7.9	11.9	7.0	10.4	1.3	1.5
I don't think changing my behavior will reduce my risk of developing heart disease	13.1	15.0	21.8	23.4	38.4	32.5	24.9	24.5	1.7	4.7
I don't have time to take care of myself	44.1	39.4	22.3	29.9	13.5	14.4	18.3	14.6	1.7	1.6
God or some higher power ultimately determines my health	25.8	23.7	20.1	13.5	25.3	22.3	27.1	38.5	1.7	2.0
Opinions on various preventive aspect of heart health	**Very helpful**		**Somewhat helpful**		**Not very helpful**		**Not helpful**		**Don't know**	
Access to more fruits, vegetables, and other healthy foods	93.4	93.2	5.2	3.8	0.4	0.2	0.4	0.7	0.4	2.0
Greater access to indoor and outdoor public recreational facilities	56.3	67.3	31.0	22.4	7.0	3.6	0.9	0.5	4.8	6.0
Smoking bans	92.1	92.0	3.9	4.2	0.9	0.9	1.7	0.7	1.3	2.2
More awareness programs for healthy heart	85.2	87.0	9.6	8.6	3.1	0.9	0.9	0.4	13	31
Availability of health facilities to detect and treat heart diseases	89.1	87.6	7.0	7.7	1.7	0.7	0.9	0.7	1.3	3.3

Local volunteers that shall try to change any adverse health behavior	65.1	64.6	17.0	20.6	3.1	2.9	1.7	0.4	13.1	11.5

Note: Figures indicate percentage of respondents among males (M) and females (F).

Next, enumerators asked for respondent opinions on various preventive aspects of heart health (e.g., improved access to fruits, vegetables, and other healthy foods) (Table 4). Most thought that smoking bans or increased access to fruits, vegetables, and other healthy foods would be very helpful. About two thirds of all respondents thought that greater access to indoor and outdoor public recreational facilities would be very helpful and one quarter thought it would be somewhat helpful. Around 10% of females seemed unsure whether local health volunteers trying to change the community's health practice/behavior would be useful.

Practice/behavior in relation to heart disease

Enumerators elicited practice- and behavior-related responses in two ways. First, they asked WHO STEPs-based questions about four major behavior-related risk factors (i.e., tobacco smoking, alcohol consumption, physical activity, and fruit and vegetables) (Table 1). Second, they asked respondents if they had participated in any heart-friendly practice/behavior in the previous year (e.g., blood pressure, blood sugar, or other diagnostic tests; tobacco cessation; increased physical activity; weight loss). Half of all respondents had their blood pressure measured and 10% reported getting a diagnostic test for CVD. About 60% attempted to reduce their consumption of unhealthy foods and 25% tried to lose weight or increase physical activity. Half of the smokers said they had attempted to quit smoking.

When enumerators asked why responders who reported one or more positive health behaviors tried to change their lifestyle or practice/behavior, participants responded that they wanted to feel better (70%); had seen, read, or heard information (65.4%); did it for their family (45.9%); or were encouraged to do so by a healthcare professional (41.3%), family member (39.0%), or friend (31.8%). Other reasons for changing lifestyle or practice/behavior included wanting avoid taking medications (20.6%); a family member, relative, or friend who developed CVD, became ill, or died (16.5%); and developing possible cardiovascular symptoms (14.8%).

KAP scores and demographic variables

Median percent scores were similar across the various demographic variables (Table 5). Males, younger people, or better-educated respondents scored 2%–8% higher than females, older respondents, and the less educated. Similarly, median percent scores for attitude tended to decrease about 2% in older respondents, Newars, and those without formal schooling. Behavioral median percent scores were 4%–8% higher among younger and more-educated respondents, Brahmins, Chhetris, and government employees or housewives (Table 5).

Table 5: Median percent score of knowledge, attitude, and practice/behavior according to demographic variables

	Knowledge median percent score	P-value	Attitude median percent score	P-value	Behavior median percent score	P-value
Sex						
Male	79.2	<0.001	74.29	0.139	48.00	0.660
Female	77.4		74.29		48.00	
Age (years)						
25–34	79.79		74.29		48.00	
35–44	79.24	0.005	74.29	0.074	44.00	0.018
45–59	75.47		72.86		44.00	

Ethnic group						
Brahmin	75.47		74.29		48.00	
Chhetri	79.24	<0.001	74.29	<0.001	48.00	0.030
Newar	79.24		72.14		44.00	
Other	79.24		74.29		44.00	
Education						
No formal schooling	75.47		72.86		44.00	
Primary school	77.35		74.29		44.00	
Secondary school	79.24	<0.001	74.29	0.001	48.00	<0.001
High school or more	83.02		75.71		52.00	
Occupation						
Employed	79.24		74.29		48.00	
Self-employed	79.24		74.29		44.00	
Housewife	79.24	<0.001	74.29	0.940	48.00	0.156
Agriculture	75.47		74.29		44.00	
Other	79.24		74.29		48.00	
Overall	79.24		74.29		48.00	

Note: Knowledge scores were based on prompted responses.

Calculated with the Kruskal-Wallis test, p-values compared all categories in the variables.

Correlation between knowledge, attitude, and practice/behavior scores

Scatter-plots (Figure 1a–1c) show the correlations between the three components. We observed a poor positive correlation between knowledge and attitude median scores (Pearson correlation: 0.025, p=0.480) [Figure 1a]) and a negative correlation between attitude and behavior (Pearson correlation: -0.126, p <0.001) [Figure 1b]). However, we observed a positive correlation between knowledge and behaviour (Pearson correlation: 0.121, (p=0.001) [Figure 1c]).

DISCUSSION

The present study is the first to conduct a detailed analysis of the relationship between KAP/health literacy and cardiovascular health in a semi-urban setting near Kathmandu.

Cardiovascular risk factors are abundant in the study population

Our respondents showed a high burden of behavioral and biological risk factors. The prevalence of tobacco smoking and vegetable and fruit consumption were similar to national averages and alcohol consumption was lower.[43] In accord with our earlier review on obesity in Nepal, the effect of urbanization is evident in low physical activity and overweight/obesity that exceeds the national average.[22, 43] The prevalence of hypertension in our study population is similar to the national average (22%) but less by about one third than a study in Bhadrabas, a similar semi-urban Kathmandu community,[44] most probably due to different age groups. Self-reported prevalence of diabetes mellitus (3.9%) confirms the HDSS baseline figure reported earlier.[21]

Poor knowledge of cardiovascular health

Our study population showed low overall knowledge of the causes of CVD. Unprompted responses suggested that respondents identified behavioral factors (e.g., smoking) more frequently than physiological causes (e.g., hypertension). Other studies have reported similar findings for unprompted[38] and prompted responses.[34] Conversely, unhealthy diet, obesity, and family history were common responses in Taiwan,[32] and American women frequently identified obesity.[35] Many of our respondents also attributed CVD to environmental factors such as food hygiene and air pollution. Indeed, acute inflammatory reactions to air pollutants accelerate coronary atherosclerosis and trigger arrhythmia or myocardial infarction.[45] Unlike the Strong Heart Study[39] in American populations, our results did not exhibit a higher probability of knowledge of a risk factor in persons who have that risk factor, demonstrating poor cardiovascular health literacy even among those already affected.

Similar to Pakistan,[17] a large majority (60%) of our respondents could not identify even one heart attack symptom. However, similar to an earlier study in Nepal,[18] 6%–22% of individuals in our demographic subsets recognized chest pain as a symptom, which is less compared to 60% of Vietnamese Americans who spontaneously mentioned chest pain.[47] Importantly, two thirds of heart attack patients delayed their arrival at a Karachi hospital because they did not recognize heart attack symptoms.[17] Similar to a previous study,[18] three quarters of our respondents believed they would immediately take a suspected heart attack patient to a hospital but one fifth did not answer the question or opted instead for home therapy or traditional healing. Combined with our earlier finding of not knowing heart attack symptoms, this lack of knowledge about appropriate action underscores the need to educate the Nepalese population about this issue. In contrast, 85%

of Vietnamese Americans knew that they should immediately call 911 if they suspect a heart attack.[46] Despite inadequate knowledge about the causes of CVD, our respondents were much better informed about prevention measures. This finding concurs with the perception level of American women,[35] probably because enumerators asked prompted questions in this section of the questionnaire. In Taiwan, only 25% of respondents thought that CVD is preventable and 50% were "not sure."[32]

Inappropriate attitude toward cardiovascular health

In contrast to their opinion that behavioral modifications can prevent CVD, most of our respondents did not consider themselves at risk and did not want to alter their lifestyle. This may be explained by the Health Belief Model[47] (i.e., a person may be knowledgeable about disease prevention but is more likely to undertake prevention when s/he perceives herself/himself to be at risk of developing the disease). Others have described a similarly optimistic bias.[48] Risk indicators (e.g., number of cigarettes smoked; death of a parent due to CVD; and self-assessment of blood pressure, weight, and cholesterol levels) account for a 24% variance in perceived risk.[48] The likelihood of perceiving oneself at higher risk increases when the presence of a risk factor is known.[32] However, respondents often underestimate their cardiovascular risk.[48]

Attempts toward better cardiovascular health practice/behavior

Compared to Nepal's national average (69%), only half of our respondents underwent blood pressure measurement in the previous year.[44] Ninety percent of the known hypertensive population had their blood pressure under control, exceeding the 6% and 9.5% control rate reported in two other suburban Kathmandu studies[44,49] and an urban study in Eastern Nepal (58.5%).[50] Half of the smokers reported here that they had tried to quit smoking. Our questionnaire did not explore whether they had actually quit and did not identify the barriers against quitting, information that might be important for public health. The theory of reasoned action[47] argues that intention is a critical component of healthy behavior. Although confirming the genuineness of intention is difficult, such intention may provide an opportunity for public health intervention. Importantly, we identified our respondents' reasons for attempting positive health behavior. Many constructs of the Health Belief Model,[47] such as perceived benefit ("wanted to feel better"), cues to action ("encouraged by a health professional, etc."), fear ("death of a family member, etc."), appear to affect behavioral decisions.

Gender

Seventy percent of our respondents were women. We reported earlier a male: female ratio (1.15) in the population.[21] Enumerators used the Kish technique to select respondents at the household level, expecting a proportionate sampling.[23] However, enumerators might have interviewed more women than men because women were more likely to be available in the households when enumerators visited. Nevertheless, our analysis includes a gender-wise stratification, and we present data separately whenever we observed marked gender differences. In our study, more men than women smoked tobacco or drank alcohol. The prevalence of hypertension and self-reported diabetes was similar in both groups. On the other hand, low physical activity and obesity were higher in the women. Although men had better knowledge of heart disease, their attitude was similar to those reported by women. However, more women than men strongly agreed that their health was ultimately determined by God or a higher power. A Canadian study[36] observed a similar knowledge level among women and men. One major factor for the gender discrepancy in our study is that more women (33.2%) than men (11.8%) lacked formal education.

Effect of other socio-demographic variables on KAP

Age-wise, KAP/behavior scores decreased around 4% from the youngest to the oldest age group. An earlier study reported a higher level of knowledge among young respondents.[36] Interestingly, a study in adolescents reported a very poor level of cardiovascular knowledge.[51] Otherwise, knowledge levels rise linearly from childhood until middle age, when the level starts to plateau.[52] In our study, better-educated respondents ate more fruit and consumed less tobacco and alcohol, but they also reported less physical activity and more hypertension. The highest education category (high school or more) scored higher than the lowest category (no formal schooling) but only by 3%–8%. Other studies observed a consistent link between better KAP scores and higher education.[32, 36, 53] Occupation-wise, employed respondents knew more about biological causes (e.g., high blood pressure, diabetes, and high cholesterol), possibly due to more education, wider exposure to information, and better access to screening and treatment. A Canadian study reported similar findings.[36]

Prompted vs. unprompted responses

Although we used unprompted responses to evaluate general knowledge, we used prompted responses to calculate scores, thus providing a denominator ("full marks") to calculate median score percent. In other settings, KAP studies have variably used prompted[34, 39, 46, 54] or unprompted questions;[18, 32, 38] some studies used both.[35] Other studies did not identify their chosen method.[33] Although the accuracy of prompted vs. unprompted questions in knowledge assessment has been a topic of debate, prompted questions confer a higher level of knowledge.[55] When we analyzed knowledge responses based on prompted responses, the percent of correct answers increased drastically. The psychological explanation is that respondents must simply "recognize" answers to prompted questions, but they must engage in the more difficult mental process of "recalling" answers to unprompted questions.[56] We believe that unprompted responses more accurately reflect knowledge level because they emerge from a thought process that involves respondents' knowledge, experience, and perception regarding a specific issue.

Poor correlation between KAP scores

Poor correlation between KAP scores was unsurprising because a linear relationship between variables may not exist in cardiovascular health. Valente argued that each of six possible behavior change models contains a varying order of KAP/practice and that a population can be described in terms of the percentage that fits into each model.[57] This implies that no universal intervention can improve the cardiovascular health KAP of every individual in a community. The challenge lies in identifying individuals who fit into different linear models. Furthermore, health behavior theories (e.g., social cognitive theory and the theory of reasoned action[47]) suggest that knowledge and attitude are only two components of the pathways that lead to behavior. Constructs (e.g., self-efficacy) and other personal and environmental factors (in social cognitive theory) and perceived behavioral control, subjective norms, and ultimately intention (in the theory of reasoned action) play crucial roles in shaping one's health behavior.[47]

CONCLUSION

Our community-based cross-sectional HARDIC study demonstrated poor knowledge, inappropriate attitude, and highly adverse behavior regarding cardiovascular health in a semi-urban community of Nepal. We aimed to determine a baseline KAP in the community to aid the planning of health promotion activities. Our results show the potential and possibility that community health promotion can improve cardiovascular health literacy.

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Contributors

AV designed the study, performed statistical analysis, and drafted the manuscript. AK helped design the study and provided critical revision of the manuscript. Both authors have read and approved the final manuscript.

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Competing interests

None declared.

Data sharing

No additional data available.

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Figure legends:

Figure 1: Scattergrams showing correlation between median score percents for (a) knowledge and attitude, (b) attitude and behavior, and (c) knowledge and behavior (n=777).

Scores were obtained from the prompted knowledge questions, attitudinal questions, and practice/behavior responses. Median score percents were calculated and plotted. See Supplement for greater detail about score derivation.

Figure 1 (a)

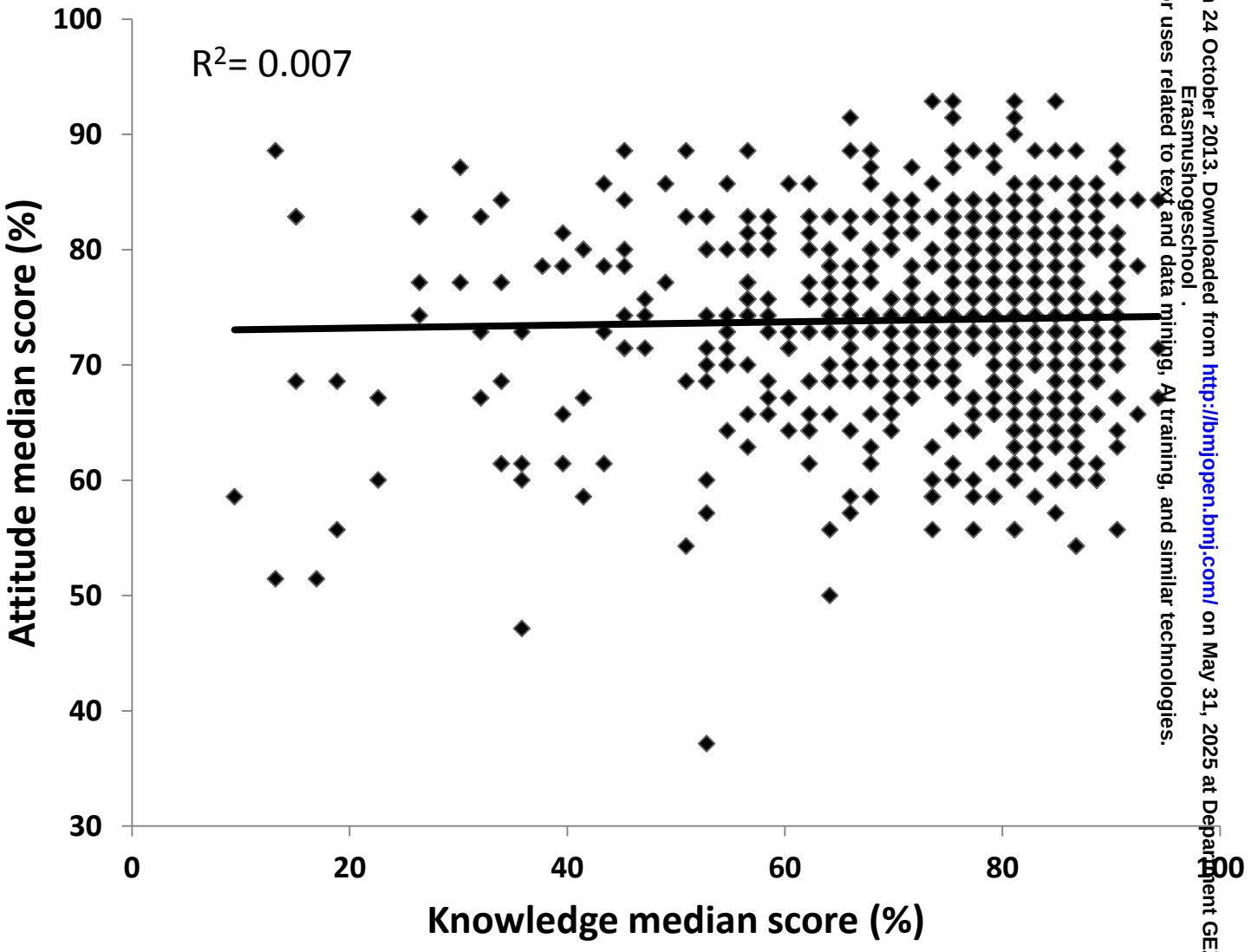


Figure 1 (b)

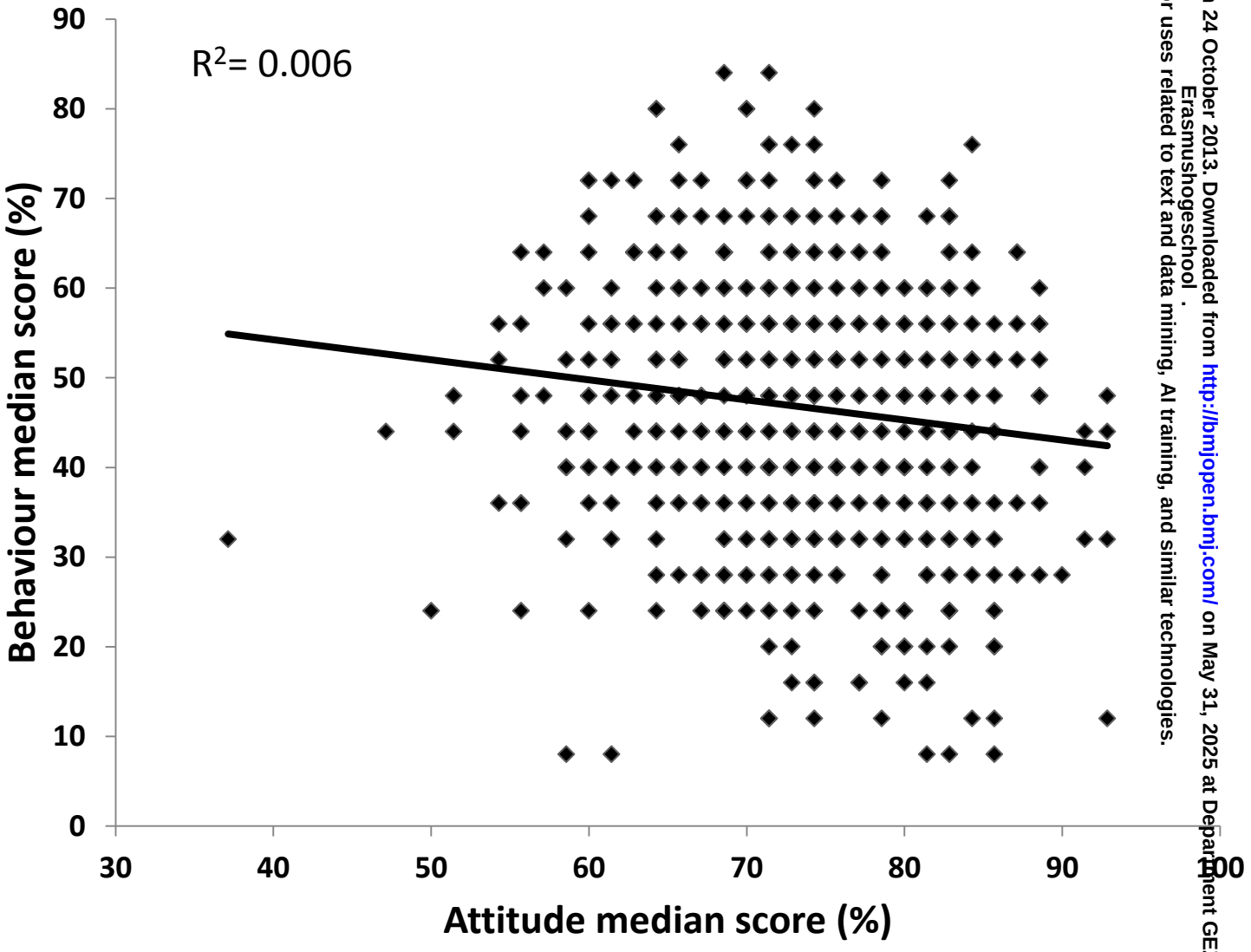
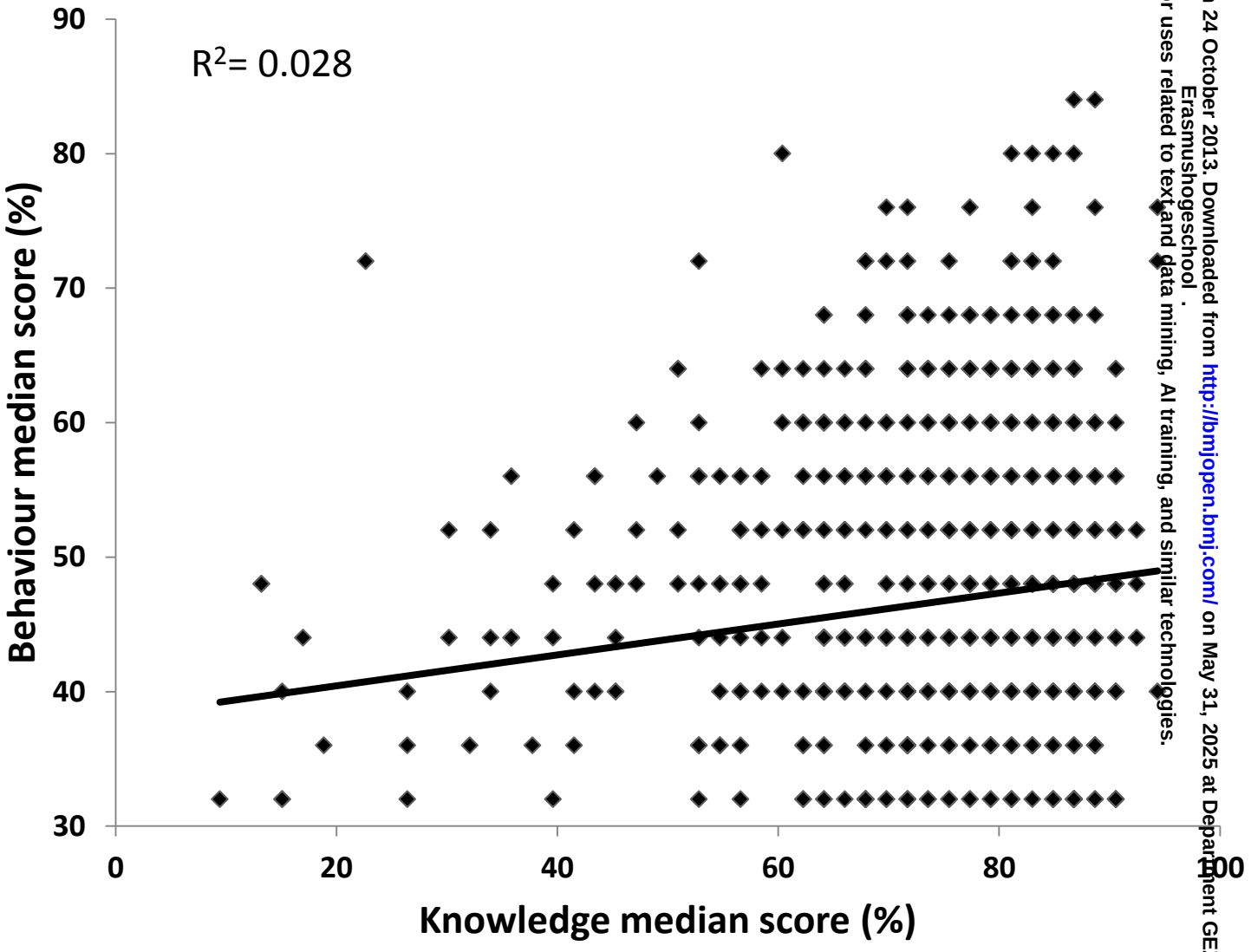


Figure 1 (c)



Supplement

Methods

Scoring system

Knowledge score

To calculate the knowledge score, we considered prompted responses to the five sections that explored that topic. The total score on knowledge combines the scores for cause of heart diseases, warning signs of heart attack, action in case of a heart attack, knowledge regarding heart-healthy foods, and knowledge regarding prevention of heart diseases. Maximum possible score was 11+15+7+10+10= 53.

Cause of heart diseases

Enumerators read aloud a list of conventional causes of heart disease. Score 1 was given if the respondent answered "yes." No negative marking was given for "no" or "don't know" responses.

Warning signs of heart attack

Nine common symptoms that are considered warning signs of a heart attack by the American Heart Association[43] and two incorrect signs (abdominal pain and leg pain) were mingled together. Respondents were asked if the symptoms were correct. If they answered "yes", we allocated the scores as follows: 3 points for chest pain; 2 points each for breathlessness, sweating, and vomiting; 1 point each for arm, tooth, or jaw pain;1 point for light-headedness and unconsciousness; 0 points for abdominal or leg pain. Additionally, we scored 1 point if respondents answered "no" for abdominal or leg pain.

Action in case of a heart attack

We asked respondents what actions they would take or not take in case of a heart attack. If the responses were "yes", we allocated scores as follows: treat at home (0), immediately take the person to a hospital (2), take to a pharmacy/medicine shop (0), give home-made therapy (0), wait for appointment with a heart specialist (0), take the person to a traditional healer (0).

Heart-healthy foods

We asked each respondent if they considered a particular food item from a pre-selected list to be heart-healthy. Responses were recorded as "yes,""no," or "don't know."We scored 1 point for each correct answer, depending on whether or not the particular food is actually heart-healthy(e.g., fruits) or not (e.g., fat).

Prevention of heart diseases

We asked each respondent about the various preventive actions that are considered good for improving heart health. Possible answers were "yes," "no," or "don't know."We scored 1 point for each "yes" answer.

Attitude

Each respondent completed a 14-item questionnaire related to her/his attitude towards heart health. Responses were recorded as strongly agree/disagree, somewhat agree/disagree, or don't know/can't say. Depending on whether the attitude was proper or not, we allotted scores ranging between 1 and 5 points. Similarly, participants were also asked for their opinions on various preventive aspects of heart. We recorded those responses on a scale from "very helpful" to "not at all helpful" as the extremes. Maximum possible score for the attitude section was 14×5=70.

Practice and behavior score

We asked each respondent if s/he undertook any particular action in the previous year that would increase her/his heart health and scored the answers accordingly. We also scored participants according to their risk factor status. Maximum score possible was 25.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Comment [AV1]: Yes
Comment [AV2]: Yes
Comment [AV3]: Yes
Comment [AV4]: Yes
Comment [AV5]: Yes
Comment [AV6]: Yes
Comment [AV7]: Yes
Comment [AV8]: Yes
Comment [AV9]: Yes
Comment [AV10]: Yes
Comment [AV11]: Purposive
Comment [AV12]: Yes
Comment [AV13]: Yes
Comment [AV14]: Yes
Comment [AV15]: Not applicable
Comment [AV16]: Done, mentioned in the tables, etc as well
Comment [AV17]: Yes
Comment [AV18]: Not relevant
Comment [AV19]: Yes
Comment [AV20]: Yes
Comment [AV21]: Yes
Comment [AV22]: Yes
Comment [AV23]: Yes

Discussion			
Key results	18	Summarise key results with reference to study objectives	**Comment [AV24]:** Yes
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	**Comment [AV25]:** Yes
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	**Comment [AV26]:** Yes
Generalisability	21	Discuss the generalisability (external validity) of the study results	**Comment [AV27]:** Yes
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	**Comment [AV28]:** Yes

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Cardiovascular health knowledge, attitude, and practice/behavior in an urbanizing community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site

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Cardiovascular health knowledge, attitude, and practice/behavior in an urbanizing community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site

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ABSTRACT

Objectives: This study determined the knowledge, attitude, and practice/behavior of cardiovascular health in residents of a semi-urban community of Nepal.

Design: To increase understanding of knowledge, attitude, and practice/behavior toward cardiovascular health, we conducted in-home interviews using a questionnaire based on WHO STEPS and other resources, scoring all responses. We also recorded blood pressure and took anthropometric measurements.

Setting: Our study was conducted as part of the HARDIC project in the Jhaukhel-Duwakot Health Demographic Surveillance Site in two urbanizing villages near Kathmandu.

Participants: The study population included 777 respondents from six randomly selected clusters in both villages.

Results: Seventy percent of all participants were female and 26.9 % lacked formal education. The burden of cardiovascular risk factors was high; 20.1 % were current smokers, 43.3 % exhibited low physical activity, and 21.6 % were hypertensive. Participants showed only poor knowledge of heart disease causes; 29.7 % identified hypertension and 11% overweight and physical acitivity as causes, wheras only 2.2 % identified high blood sugar as causative. Around 60 % of respondents did not know any heart attack symptoms compared with 20% who knew 2–4 symptoms. Median % scores for knowledge, attitude, and practice/behavior were 79.3, 74.3, and 48.0, respectively. Nearly 44% respondents had insufficient knowledge and less than 20% had highly satisfactory knowledge. Among those with highly satisfactory knowledge, only 14.7% had highly satisfactory attitude and 19.5% and 13.9% had satisfactory and highly satisfactory practices, respectively.

Conclusions: Our study demonstrates a gap between cardiovascular health knowledge, attitude, and practice/behavior in a semi-urban community in a low-income nation, even among those already affected by CVD.

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ARTICLE SUMMARY

Article focus

- We aimed to gain a deeper understanding of knowledge, attitude, and behavior/practice regarding cardiovascular health in a semi-urban community of Nepal, a low-income South Asian country.

Key messages

- We found a high burden of low physical activity and overweight/obesity; cardiovascular risk factors in our study site exceeded the national average.
- Low level of knowledge and attitude towards risk perception combined with poor relation between knowledge, attitude, and behavior scores imply that health promotion strategies that merely increase knowledge of cardiovascular health may be insufficient, thus emphasizing the need for a more holistic approach to disease prevention.

Strengths and limitations of the study

- This study is the first to extensively explore knowledge, attitude, and behavior/practice regarding cardiovascular health in Nepal and was conducted in a health demographic surveillance site which provides the logistic advantage of further follow-up and intervention.
- Using both prompted and unprompted questions in the same study illustrates the variation that may be obtained by these approaches.
- Unintentional oversampling of women respondents yielded unsegregated gender-wise results that are more likely to represent knowledge, attitude, and practice/behavior in women.

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INTRODUCTION

Noncommunicable diseases (NCDs) pose increasingly important public health problems in low- and middle-income countries (LMICs). In 2008, 80% of global NCD deaths occurred in LMICs,[1] and NCDs recently accounted for 7.9 million of 14.5 million deaths (54%) in Southeast Asia[2] and were responsible for two of every three deaths (34.5 million) worldwide in 2010.[3] Poverty, illiteracy, poor health infrastructure, and demographic transition, including increasing life expectancy, are major contributors to rising burden of NCDs in LMICs. Other postulated causes include poor fetal and childhood nutrition.[4,5] A similar pattern is evident in South Asian countries like Nepal, where NCDs currently occur more frequently than communicable diseases and behavioral risk factors such as tobacco smoking are high.[6]

Globally, cardiovascular diseases (CVDs) are responsible for one in four deaths (12.9 million).[3] Eighty percent of CVDs result from tobacco smoking, unhealthy diet, physical inactivity, and harmful use of alcohol.[7] The risk of all-cause mortality among individuals who score poorly in behavioral factors is four fold higher than those who score best.[8] In high-income countries, declining CVD mortality is largely attributed to the reduction of behavioral risk factors.[9] Underlying socioeconomic parameters and societal influences affect exposure and vulnerability to CVD risk factors. Therefore, surveillance of NCD risk factors should include social determinants of cardiovascular health.[1,10] Currently, understanding the individual and social determinants of cardiovascular health behaviors is among the top 20 priority areas for NCD research in LMICs.[11]

As a precursor of favorable health behavior, experts have advocated health literacy since community-based interventions began exploring the potential impact of behavioral changes on CVD.[1,12] The World Health Organization (WHO) promotes public awareness of diet and physical activity as a “best buy” to improve cardiovascular behavior.[9] However, achieving desired health behavior requires deeper understanding of the underlying social context of disease.[13,14] Hence, studies on knowledge, attitude, and practice (KAP) increase our understanding of cardiovascular health literacy and community behavior.[15] Currently, such studies have been limited in South Asia.

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Earlier studies report low level of knowledge about heart attack[16] and diabetes symptoms in Nepal.[17] Nepal's high prevalence of underlying behavioral risk factors, particularly tobacco and alcohol consumption, and poor cardiovascular health knowledge is a matter of concern.[18] Nationwide in Nepal, the age group 25+ exhibits fasting blood glucose of 5.5 mmol/L for males and 5.4 mmol/L for females, systolic blood pressure of 125.9 mmHg and 126.6 mmHg for males and females respectively, and total cholesterol of 4.1 mmol/L (males) and 4.3 mmol/L (females).[19]

Currently, attempts to improve cardiovascular health knowledge and behavior in Nepal focus mainly on campaigns that transmit information but pay little attention to the population's actual health literacy. We therefore undertook a community-based KAP study in the Jhaukhel-Duwakot Health-Demographic Surveillance Site (JD-HDSS) outside Kathmandu where NCDs, particularly CVDs, are the predominant cause of morbidity and mortality.[20] Additionally, our pilot study in the Duwakot population demonstrated poor cardiovascular health knowledge.[21] Our study is part of the Heart-Health Associated Research and Dissemination in the Community (HARDIC) project, which is the cardiovascular health component of JD-HDSS. In Nepalese, hardic means "heartily" or "from the heart". This paper reports the baseline results from HARDIC and is the first to conduct a detailed analysis of cardiovascular health knowledge, attitude, and practice/behavior in an urbanizing community of Nepal.

METHODS

Ethical considerations

The Nepal Health Research Council and the Institutional Review Board of Kathmandu Medical College approved this study. Following a pattern established at the outset of JD-HDSS, we consulted local leaders and sought their informal permission for HDSS activities. In addition, we periodically consulted with health and administrative authorities in both villages. All participants gave informed consent, and privacy was maintained during the interview process. To maintain confidentiality, all data were secured in the HDSS office. Computer data were accessible only to the research team. Although respondents received no monetary incentives, we provided a referral

that included discounted consultation fees at Kathmandu Medical College or Nepal Medical College for self-reported illness and newly diagnosed hypertension.

Study site

We conducted our descriptive, community-based, cross-sectional study between September and November 2011 in the JD-HDSS of Bhaktapur district in the Kathmandu Valley, 13 kilometers from Kathmandu. An earlier report described the establishment of the surveillance site.[20]

Study population and sample size

This study is the first step in the larger HARDIC project that will be conducted in the whole JD-HDSS. Duwakot and Jhaukhel each contain nine administrative wards and we randomly selected three wards from each village. Based on the JD-HDSS 2010 baseline census,[20] we compiled a complete list of households containing adults aged 25-59 years in the selected wards. Next, we selected one adult, of either sex, from all interview households and surveyed 789 of 840 households (non-response rate = 6.07%). We applied the Kish technique to select the respondent.[22]

Study tools

We structured the basic questionnaire and tailored it for site specific responses in Nepal using the WHO-NCD STEPS (STEP 1 and 2 questionnaires) for demographic information, behavioral and physical measurements [23] and other sources for addressing knowledge, attitude and practice/behavior issues. [15, 24-39] Responses to questions on cardiovascular health knowledge, attitude and practice/behavior were given scores in order to compare and correlate the components. A detailed description of the scoring system is given as an appendix to this article.

Interviewers

Twelve local female enumerators (two per ward) conducted the interviews. All enumerators had completed at least grade 10 in school. Supervisors included four public health graduates; a field coordinator with Master and PhD degrees in public health; and two PhD students/authors (AV and URA).

Data Collection

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Interview process

The interviews were conducted at the participants' homes. The initial part of the interview consisted of questions related to demographic profile. Questions then followed relating to knowledge of cardiovascular health (e.g., causes and risk factors, warning signs, and action for suspected heart attack); heart-healthy diet; and disease prevention. The first two areas included unprompted (spontaneous, open-ended) and prompted (clues provided, closed-ended) responses, and the latter two areas included only prompted responses. We asked respondents about their attitude toward different aspects of cardiovascular health: did they perceive themselves at risk for CVD? Did they think behavior change would reduce their risk of developing CVD? The responses were recorded in Likert-scale (strongly agree, somewhat agree, don't know, somewhat disagree, strongly agree).

Behavioral factors

Behavior-related questions were based on Step 1 of the WHO STEPwise approach to surveillance (STEPS), which uses a questionnaire to collect data on risk factors.[23] Our questions probed current and past smoking behavior; smokeless tobacco; alcohol consumption in the past 30 days (current drinker), and drinking frequency among current drinkers. The physical activity section asked respondents to report the number of days and amount of time they participated in vigorous and moderate activities at work, leisure, and travel. Additional practice and behavioral questions explored whether participants had engaged in any heart-friendly behavior in the previous year and for what reason.

Physical measurements

Enumerators recorded anthropometric measurements (i.e., weight, height, and waist and hip circumferences) according to STEPs guidelines.[23] Weight was measured to one decimal place using a Microlife BR-9201 Weighing Scale (Microlife AG Swiss Corporation, Widnau, Switzerland). Height and waist and hip circumferences were measured using non-stretchable tapes (Jonson Tapes Ltd, New Delhi, India). Blood pressure was determined digitally by Microlife BP 3AP1-3E (Microlife AG Swiss Corporation, Widnau, Switzerland). Enumerators recorded three readings for each respondent, taken at 5-minute intervals. We averaged the readings to attain the final blood pressure measurements.

Diagnostic criteria for sub-classification

Respondents with known history of hypertension (diagnosed cases) and those diagnosed during the study according to Joint National Committee -VII[40] were termed as having "hypertension".

Data management

Supervisors checked all completed questionnaires and, if necessary, asked enumerators to revisit households. After omitting incomplete questionnaires, we included 777 individuals in the analysis. Except for missing recordings for height, weight, or blood pressure, data reported in our KAP-study covers all 777 respondents. We outsourced data entry to a team of data entry operators, public health graduates by qualification. Data was coded and entered in Epidata version 2.1.

Statistical analyses

Data was analyzed with SPSS version 17.0 (IBM, Armonk, New York, USA) and STATA version 10.0 (StataCorp, Texas, USA). After calculating the Metabolic Equivalent of Task (MET) minutes/week, we grouped participants as highly active, moderately active, or inactive (low physical activity) in accord with the STEPS manual.

For scoring knowledge, attitude, and practice/behavior questions and to compare and correlate the three components, we scored responses regarding KAP/behavior for cardiovascular health. The maximum possible score for KAP/behavior was 53, 56 and 25, respectively. Further, total knowledge score was classified into the following five categories based on the quintile scores: ≤20 % 'highly insufficient'; 21–40 % 'insufficient'; 41–60 % 'sufficient'; 61–80 % 'satisfactory'; >80 % 'highly satisfactory'.[41]

Categorical data is presented as number, percentages, and continuous data as median and inter-quartile range (IQR). KAP percentage scores are presented as median. We used Chi-square test to compare proportions among demographic variables and Mann-Whitney U test to compare scores from males and females. $P<0.05$ was considered statistically significant.

Cronbach's alpha, which measures question reliability, for the overall knowledge and attitude was 0.941 (range: 0.775–0.913) and 0.824 (range: 0.791–0.822), respectively. Cronbach's alpha

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for practice and behavior ranged from low (0.257) for physical activity questions to high (0.929) for blood pressure measurements.

RESULTS

Demographic characteristics and cardiovascular risk factors

Table 1 describes the sex-wise demographic characteristics of the respondents. Seventy percent of all participants were female, and 25% lacked formal education. The median age (IQR) for male and female respondents was 40 (33-49) years and 38 (32-46) years, respectively. Two third of the female respondents were housewives and 3 out of 5 male were either serviceholders or self-employed. We have shown previously that 59.2% belonged to the upper-lower class.[20]

Table 1: Demographic characteristics of the study population.

Demographic variables	Male (n=229) Number (%)	Female (n=548) Number (%)	Total (n=777) Number (%)
Age (years)			
25–34	69 (26.8)	188 (73.2)	257 (100)
35–44	78 (27.9)	202 (72.1)	280 (100)
45–59	82 (34.2)	158 (65.8)	240 (100)
Caste/Ethnicity			
Brahmin	85 (28.9)	209 (71.1)	294 (100)
Chhetri	55 (28.4)	139 (71.6)	194 (100)
Newar	67 (34.5)	127 (65.5)	194 (100)
Others*	22 (23.2)	73 (76.8)	95 (100)
Education			
No formal schooling	27 (12.9)	182 (87.1)	209 (100)
Primary school (Grade:1-5)	74 (30.1)	172 (69.9)	246 (100)
Secondary school (Grades: 6-10)	74 (37.4)	124 (62.6)	198 (100)
High secondary and above (Grade:11 and above)	54 (43.5)	70 (56.5)	124 (100)

Major Occupation[§]			
Service (government and private)	70 (60.3)	46 (39.7)	116 (100)
Self-employed	72 (66.7)	36 (33.3)	108 (100)
Agriculture	48 (38.1)	78 (61.9)	126 (100)
Housewife[**]	N/A	369 (100)	369 (100)
Others[†]	39 (67.2)	19 (32.8)	58 (100)

[*]Other caste/ethnicity includes Rai, Magar, Tamang, Dalit, Gurung, Mandal, Chaudary, Pariayar, Purkutti. [§]The definition of occupation was adopted from the Nepal Non-Communicable Disease Survey, 2007 and modified to the local context.[42] [**]A woman involved in her own household activities like cooking, washing , cleaning etc but does not earn money. [†]Other occupation includes unemployed individuals, able or unable to work, retired, and non-paid workers.

Figure 1 shows the sex-wise prevalence of cardiovascular risk factors in the study population. Overall, three in ten respondents was a past or current smoker and one in five respondents had consumed at least one alcoholic beverage in the previous month. More than 40% of the respondents reported low physical activity. Prevalence of known and newly diagnosed hypertension was 21.6%. As measured by BMI, the prevalence of overweight and obesity was 29.7% and 9.4 %, respectively. Abdominal obesity (i.e., increased waist circumference and waist-hip ratio) was 46.3% and 56.3%, respectively. There was statistically significant difference in the prevalence rate among males and females in smoking, smokeless tobacco use, alcohol intake, overweight/obesity and increased waist circumference.

m=number of male, f=number of female, # p<0.001, ## p<0.01 (chi-square tests). Risk factor categories based on the WHO-NCD Risk Factor STEPS Survey manual.[23] Current smokers included those who responded "yes" to "Do you smoke?" Past smokers included those who replied "yes" to "Did you ever smoke in the past?". "Ever drinkers" included respondents who had "consumed a drink that contained alcohol ever in lifetime," and current drinkers included respondents who had "consumed alcohol within the previous month." Percentage of drinking frequency represents current drinkers who consumed at least one standard drink per occasion. Blood pressure data exclude respondents who did not submit to all three readings. Likewise, data for body mass index, waist circumference, and waist-hip ratio exclude respondents whose weight, height, and waist and/or hip measurements were not taken. Increased waist circumference includes waist measurements of ≥80 cm (females) and ≥90 cm (males); increased waist-hip ratio is ≥0.85 (females) and ≥0.90 (males).

Knowledge towards cardiovascular disease

Knowledge regarding causes and warning signs of heart disease

Table 2 shows unprompted responses for the perceived causes of heart diseases. The responses ranged from 1.0% for high blood sugar to 29.1% for smoking. The median percentage scores for males and females were 13.8 and 10.4 %, respectively (p<0.001, Mann-Whitney U test).

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Younger respondents (<35 years) knew more than older participants (median 13.7% vs. 10.3%, p=0.01). Respondents belonging to Brahmin, Newer and Chhetri ethnicities had less knowledge than those in the other caste/ethnicity group (median 13.8% vs. 6.9%, p=0.001) (Table 1). The respondents with high school or more education and working in government or non-government offices knew more than those with less education and in other employment situations (median 17.2% vs. 10.34%, p=0.001).

Table 2: Percentage of respondents citing various causes of cardiovascular disease and warning signs of heart attack.

Causes of Heart Attack	Male (n=229) Number (%)	Female (n=548) Number (%)	Total (n=777) Number (%)	P-value*
Hypertension	43 (18.8)	60 (10.9)	103 (13.3)	<0.01
High blood sugar	3 (1.3)	5 (0.9)	8 (1.0)	0.06
High cholesterol	47 (20.5)	74 (13.5)	121 (15.6)	0.01
Physical inactivity	16 (7.0)	22 (4.0)	38 (4.9)	0.08
Overweight	13 (5.7)	29 (5.3)	42 (5.4)	0.82
Cigarette/Bidi Smoking	80 (34.9)	147 (26.8)	227 (29.1)	0.02
Smokeless tobacco	19 (8.3)	26 (4.7)	45 (5.8)	0.06
Excessive alcohol	72 (31.4)	131(23.9)	203 (26.1)	0.03
Excess stress	37 (16.2)	74 (13.5)	111 (14.3)	0.34
Warning signs	**Male (n=93)§ Number (%)**	**Female (n=222)§ Number (%)**	**Total (n=315)§ Number (%)**	**P value***
Difficulty in breathing	17 (11.1)	41 (15.1)	58 (13.6)	0.25
Pain in the chest	30 (19.6)	57 (21.0)	87 (20.5)	0.74
Pain or numbness in the arms	0 (0)	3 (1.1)	3 (0.7)	-
Pain in the teeth or jaw	0 (0)	1 (0.4)	1 (0.2)	-
Excessive sweating	15 (9.8)	30 (11.0)	45 (10.6)	0.69
Vomiting tendency	1 (0.7)	6 (2.2)	7 (1.6)	0.65
Dizziness or light headedness	24 (15.7)	40 (14.7)	64 (15.1)	0.78
Loss of consciousness	55 (35.9)	86 (31.6)	141 (33.2)	0.36

Numbers based on participants' unprompted responses. Only established CVD risk factors included and responses citing other non-established causes (e.g., food hygiene, air pollution, etc.) excluded. *Obtained from chi square test.
§Respondents who did not know any warning sign were excluded from analysis.

Table 2 also describes the warning signs of heart attack as perceived by the respondents. Around 60% of respondents did not know any of the heart attack signs. Among those who were familiar with those signs, nearly 50% of respondents knew only one sign, 37% knew any two signs, 11.42% knew any three signs and 2.53% knew four signs. The proportions of each warning sign told by the male and female respondents were not statistically different ($p>0.05$). The proportions of knowledge about warming signs were not statistically different in terms of age ($\chi2=3.39$, $p=0.49$), caste/ethnicity ($\chi2=6.25$, $p=0.4$), and education ($\chi2=5.50$, $p=0.53$). Importantly, only 20% of respondents identified chest pain—the most prominent and important indicator of heart attack—as a symptom of heart attack.

Knowledge on action in case of a heart attack

When asked about what action the respondents would take for a suspected heart attack, more than 20% gave no response and 75% (81.2% male and 73% female, $\chi2=4.05$, $p= 0.04$) said they would immediately take the affected person to hospital. About 3% said they would try home therapy, consult a traditional healer, or stay home and wait for the symptoms to go away.

Knowledge on healthy foods for heart diseases

When asked to identify a particular heart-healthy food, most respondents identified green leafy vegetables (94.6%) and fruit (92.1%). Furthermore, 22% thought salty food like chips and around 7% thought fried food or saturated fat (e.g., ghee) are healthy foods.

Attitudes and practice towards cardiovascular disease

Attitude toward heart health in an urbanizing community

Table 3 describes opinions reflecting attitudes towards various aspects on heart diseases. Regarding lifestyle and preventive measures, 25% of males and 30.0% females perceived themselves to be at risk of CVD. More than half of the respondents did not want to change their current lifestyle (64.6% males vs. 55.4% females, $p< 0.01$). Nearly 23% said they eat more and would like to cut down; approximately 82% considered themselves to be overweight - the perceived proportion being significantly higher among males ($p<0.05$); nearly 32% believe that they do not have time to take care themselves; and three fifths did not think that changing their

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behavior would lower their cardiovascular risk. Further, 25.3% of males and 27.2% of females thought that God or a higher power determines their health.

Table 3: Responses to attitude-related questions on cardiovascular disease.

SN	Items	Male	Female	Total	P-value*
		Number (%)	Number (%)	Number (%)	
Attitude items on heart health					
1	I don't perceive myself to be at risk for heart disease (m=225/f=540) §	58 (25.8)	167 (30.9)	225 (29.0)	0.15
2	I don't want to change my lifestyle (activity, smoking, alcohol) (m=229/f=548)	148 (64.6)	298 (54.4)	446 (57.4)	p<0.01
3	I feel the amount of food I eat is too much, and I would like to cut down (m=229/f=543) §	35 (15.2)	140 (25.5)	175 (22.5)	p<0.01
4	I feel my present weight is too high for my health (m=229/f=548)	37 (14.9)	130 (23.7)	167 (21.5)	0.02
5	I don't think changing my behavior will reduce my risk of developing heart disease (m=229/f=522) §	145 (63.3)	312 (56.9)	457 (58.8)	0.23
6	I don't have time to take care of myself (m=229/f=548)	77 (33.6)	168 (30.7)	245 (31.5)	0.42
7	God or a higher power ultimately determines my health (m=229/f=548)	58 (25.3)	149 (27.2)	207 (26.6)	0.59
Opinions on various preventive aspects of heart health that are helpful					
8	Access to more fruits, vegetables, and other healthy foods (m=229/f=548)	226 (98.6)	533 (99.1)	759 (99.1)	-†
9	Greater access to indoor and outdoor public recreational facilities (m=229/f=548)	200 (87.3)	492 (89.7)	692 (89.1)	0.31
10	Smoking bans (m=218/f=535) §	209 (96.1)	515 (96.2)	724 (96.1)	0.89
11	More awareness programs for healthy heart (m=226/f=536) §	214 (96.1)	483 (90.1)	697 (98.0)	0.38
12	Availability of health facilities to detect and treat heart diseases (m=226/f=531) §	217 (96.1)	524 (98.6)	741 (97.9)	0.02

13	Local volunteers that shall try to change any adverse health behavior (m=226/f=530) [§]	186 (82.1)	522 (98.5)	708 (93.6)	p<0.01

m=number of males, f=number of females. Questions based on 5-scale Likert questions (strongly disagree, somewhat disagree, I do not know, somewhat agree and strongly agree (question 1-7)/very helpful; somewhat helpful; I do not know; not very helpful; not at all helpful (question 8-13). We classified five options into three categories as 'agree/helpful', 'disagree/not helpful' and 'I do not know'. Only 'strongly agree' or 'very helpful' and 'agreed/somewhat helpful' answers were merged and presented in the table and 'I do not know/cannot say' were excluded from analysis. *Obtained from chi square test . [§]'I do not know/cannot say' answers were excluded from analysis. [†]Cannot be computed due to expected frequency less than 5.

Table 3 also describes the respondents' opinions on various preventive aspects of heart health that would be helpful. Almost all respondents believed that increased access to fruits, vegetables, and other healthy foods would be helpful. Nearly 9 in 10 respondents thought that greater access to indoor and outdoor public recreational facilities would be helpful. Four percent of respondents did not believe smoking bans would be helpful to reduce heart diseases. Eight in 10 male respondents believed that local volunteers should try to change any adverse health behaviors while nearly 9 in 10 females believed the same (p<0.01).

Practice towards heart diseases

Half of all the respondents had their blood pressure measured and 10% reported getting a diagnostic test for CVD in the previous year. About 60% attempted to reduce their consumption of unhealthy foods and 25% tried to lose weight or increase physical activity. Half of the smokers said they had attempted to quit smoking.

When enumerators asked the respondents who reported one or more positive health behaviors the main reason for trying to change their lifestyle or practice/behavior, the reasons given were: they wanted to feel better (70%); had seen, read, or heard information (65.4%); did it for their family (45.9%); or were encouraged to do so by a healthcare professional (41.3%), family member (39.0%), or friend (31.8%). Other reasons for changing lifestyle or practice/behavior included wanting to avoid taking medications (20.6%); a family member, relative, or friend who developed CVD, became ill, or died (16.5%); and developing possible cardiovascular symptoms (14.8%).

Comparison between level of knowledge, attitude and behavior/practice

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Overall, the average prompted knowledge of heart diseases (median 79.3%) was 11.5% lower than average attitudes (median 67.8%) and nearly 31.1% higher than average practices (median 48.2%). Next, average level of attitudes score was nearly 19.6% higher than practices. Similarly, average spontaneous knowledge of heart diseases (median 10.3%) was 57.5% lower than average attitudes (median 67.8%) and nearly 40% lower than average practice (median 48.18%).

Table 4 describes level of KAP based on quintile scores. Regarding knowledge, 20.4 % of the respondents had highly insufficient knowledge, 23.2% had insufficient knowledge, 22.6% had sufficient knowledge, 16.5% had satisfactory knowledge and 17.2% had highly satisfactory knowledge. Similarly, attitude levels were as follows: highly insufficient 20.6%, insufficient 26.9%; sufficient 15.4%; satisfactory 11.2% and highly satisfactory 19.8%. Regarding the behaviour/practices, it was highly insufficient in 12.1% of the respondents, insufficient in 24.3%; sufficient in 22.7%; satisfactory in 27.5% and highly satisfactory in 13.4%. Among those with highly insufficient knowledge, 20.3% of them had highly satisfactory attitudes and 6.9% had highly satisfactory practice. Conversely, among the respondents with highly satisfactory knowledge, 14.7% had highly satisfactory attitude and 19.5% and 13.9% had satisfactory and highly satisfactory practices respectively. Likewise, one in ten respondents with satisfactory knowledge had satisfactory attitude while two in ten had highly satisfactory attitude. Nearly four out of ten had satisfactory/highly satisfactory behavior. As the level of knowledge increased, the highly satisfactory practice also increased from 6.9% to 13.4%. However, when the level of knowledge increased, the highly satisfactory attitude decreased from 20.3% to 14.7%.

Table 4: Percentage distribution of level of knowledge, attitude and behavior/practice regarding cardiovascular health.

Knowledge (n=777)	Attitude (n=777)				
	HI (n = 160)	I (n = 209)	Suff (n=120)	Sat (n=134)	HS (n=154)
HI (n = 159)	26.0	27.6	13.8	12.5	20.3
I (n=180)	17.9	28.4	19.1	12.5	22.2
Suff (n=176)	17.9	29.8	17.2	11.9	26.2
Sat (n=128)	20.8	33.7	15.8	6.9	23.8
HS	33.7	24.2	12.6	12.6	14.7

(n=134)					
Knowledge (n=777)	**Behavior (n=777)**				
	HI (n = 94)	I (n=189)	Suff (n=176)	Sat (n=214)	HS (n=104)
HI (n = 159)	16.4	29.6	21.4	25.8	6.9
I (n=180)	10.4	26.1	19.4	30.6	13.3
Suff (n=176)	11.4	20.5	20.5	31.2	16.5
Sat (n=128)	10.9	18.8	33.6	19.5	17.2
HS (n=134)	11.2	26.1	20.9	28.5	13.4
Attitude (n=777)	**Behavior (n=777)**				
	HI	I	Suff	Sat	HS
HI (n = 132)	15.0	23.8	20.0	28.1	13.1
I (n=101)	12.0	22.0	18.7	30.1	17.2
Suff (n=256)	10.0	24.2	25.0	28.3	12.5
Sat (n=134)	13.8	33.3	17.2	29.9	5.7
HS (n=154)	10.4	20.8	33.8	24.0	11.0

HI: Highly insufficient; I: Insufficient; Suff: Sufficient; Sat: Satisfactory; HS: Highly Satisfactory. The total score was 53, 64 and 25 for KAP, respectively. Then, the quintile scores were obtained. The quintile score (1st-4th) was for prompted knowledge: 34, 40, 43, 45; for attitudes: 33, 37, 39, 42; for behavior: 9, 11, 13, 15. Next, the levels of survey respondents on KAP were classified into the following five subdivisions based on quintile score: ≤20 % 'highly insufficient'; 21–40 % 'insufficient'; 41–60 % 'sufficient'; 61–80 % 'satisfactory'; >80 % 'highly satisfactory'.[41] Median percentage scores for knowledge, attitude and practice were 79.3, 74.2 and 48 for all respondents.

Regarding attitude, among those with the level of attitudes of highly insufficient, 41.2% had satisfactory/highly satisfactory behaviour/practice. When the level of attitude was highly satisfactory, 35% had satisfactory/highly satisfactory practice. Similarly, when the attitude was sufficient, 25% had insufficient practice and nearly 41% had satisfactory practice. When the level of attitude increased, the proportion of those with highly satisfactory practice remained unchanged.

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A comparison of male and female respondents showed no difference in level of knowledge ($\chi2=4.4$, p=0.4) attitudes ($\chi2=3.6$, p=0.5) and practice ($\chi2=2.1$, p=0.7). However, there were significant differences in the level of knowledge according to age ($\chi2=18.1$, p=0.02), caste/ethnicity ($\chi2=43.8$, p<0.001) and education level ($\chi2=48.7$, p<0.001). In contrast, the level of attitude was not statistically significant for these variables (p>0.05). On the other hand, the level of practice was also statistically different according to age ($\chi2=18.7$, p=0.01), caste/ethnicity ($\chi2= 21.1$; p=0.004) and education status ($\chi2=45.7$, p<0.001).

Respondents <35 years of age were more likely to have highly satisfactory knowledge (37.3% vs. 29.2%) and practice (38.5% vs. 19.2%) than those >45 years. Brahmins (30.5%) were more likely to have highly satisfactory knowledge than Newars (27.6%), Chhetris (20.4%), and others (21.5%). Regarding highly satisfactory practice, the proportion was highest among Brahmins (41.3%), followed by Chhetris (30.8%), Newars (17.3%) and others (10.6%). Those who had no formal schooling exhibited higher proportion of highly satisfactory knowledge than those who had high school or more education (28.3% vs. 24.6%, but highly satisfactory practice is low among them (12.5% vs. 28.8%, data not shown).

DISCUSSION

The present study is the first to conduct a detailed analysis of the relationship between KAP/health literacy and cardiovascular health in a semi-urban setting near Kathmandu.

Cardiovascular risk factors are abundant in the study population

Our respondents showed a high burden of behavioral and biological risk factors. While the prevalence of tobacco smoking was similar to the national average, the alcohol consumption was lower.[42] National figures on tobacco smoking and alcohol consumption for Bangladesh, Nepal, India and Pakistan show that current smoking of any tobacco product (age-standardized rate, both sexes) is 24%, 32%, 15% and 20%, respectively.[19] The total adult (recorded and unrecorded) per capita consumption of pure alcohol according to WHO-available projected estimates for 2008 indicates that consumption in Bangladesh, Nepal, India and Pakistan is 0.17,

2.42, 2.69, 0.05 litres of pure alcohol, respectively, over a calendar year.[19] Numbers have been increasing in these countries over the last years.[19]

In accord with our earlier review on obesity in Nepal, the effect of urbanization is evident in low physical activity and overweight/obesity that exceeds the national average.[21, 42] The prevalence of hypertension in our study population is similar to the national average (22%) but less by about one third than a study in Bhadrabas, a similar semi-urban Kathmandu community,[43] most probably due to different age groups. The 2008 national reported age-standardized level of hypertension in Nepal is similar to levels in Bangladesh but lower than in Pakistan (38.6% and 39.5%, respectively) and higher than in India (35.2%).[44] Self-reported prevalence of diabetes mellitus (3.9%) confirms the HDSS baseline figure reported earlier.[20]

Knowledge of cardiovascular health is limited

Our study population showed low overall knowledge of the causes of CVD. Unprompted responses suggested that respondents identified behavioral factors (e.g., smoking) more frequently than physiological causes (e.g., hypertension). Other studies have reported similar findings for unprompted[38] and prompted responses.[33] Conversely, unhealthy diet, obesity, and family history were common responses in Taiwan.[31] In Vietnam, knowledge on the negative influence of tobacco smoking on stroke and heart attack is lower than general knowledge regarding health risks of active smoking and exposure to second hand smoke.[45]

Many of our respondents also attributed CVD to environmental factors such as food hygiene and air pollution. Indeed, acute inflammatory reactions to air pollutants accelerate coronary atherosclerosis and trigger arrhythmia or myocardial infarction.[46] Unlike the Strong Heart Study[39] in American populations, our results did not exhibit a higher probability of knowledge of a risk factor in persons who have that risk factor, demonstrating poor cardiovascular health literacy even among those already affected.

Similar to Pakistan,[15] a large majority (60%) of our respondents could not identify even one heart attack symptom. However, similar to an earlier study in Nepal,[16] 6%–22% of individuals in our demographic subsets recognized chest pain as a symptom, which is less compared to 60% of Vietnamese Americans who spontaneously mentioned chest pain.[47] Importantly, two thirds of

heart attack patients delayed their arrival at a Karachi hospital because they did not recognize heart attack symptoms.[15] Similar to a previous study,[18] three quarters of our respondents believed they would immediately take a suspected heart attack patient to a hospital but one fifth did not answer the question or opted instead for home therapy or traditional healing. Combined with our earlier finding of not knowing heart attack symptoms, this lack of knowledge about appropriate action underscores the need to educate the Nepalese population about this issue. In contrast, 85% of Vietnamese Americans knew that they should immediately call 911 if they suspect a heart attack.[45] Despite inadequate knowledge about the causes of CVD, our respondents were much better informed about prevention measures. This finding concurs with the perception level of American women,[35] probably because enumerators asked prompted questions in this section of the questionnaire. In Taiwan, only 25% of respondents thought that CVD is preventable and 50% were "not sure."[31]

Inappropriate attitude toward cardiovascular health

In contrast to their opinion that behavioral modifications can prevent CVD, most of our respondents did not consider themselves at risk and did not want to alter their lifestyle. This may be explained by the Health Belief Model.[48] Others have described a similarly optimistic bias.[49] Risk indicators (e.g., number of cigarettes smoked; death of a parent due to CVD; and self-assessment of blood pressure, weight, and cholesterol levels) account for a 24% variance in perceived risk.[49] The likelihood of perceiving oneself at higher risk increases when the presence of a risk factor is known.[31] However, respondents often underestimate their cardiovascular risk.[49]

Attempts for better cardiovascular health practice/behavior

Compared to Nepal's national average (69%), only half of our respondents underwent blood pressure measurement in the previous year.[42] Ninety percent of the known hypertensive population had their blood pressure under control, exceeding the 6% and 9.5% control rate reported in two other suburban Kathmandu studies[43,50] and an urban study in Eastern Nepal (58.5%).[51] Half of the smokers reported here that they had tried to quit smoking. Our questionnaire did not explore whether they had actually quit and did not identify the barriers against quitting, information that might be important for public health. The theory of reasoned action[48] argues that intention is a critical component of healthy behavior. Although confirming

the genuineness of intention is difficult, such intention may provide an opportunity for public health intervention. Importantly, we identified our respondents' reasons for attempting positive health behavior. Many constructs of the Health Belief Model,[48] such as perceived benefit ("wanted to feel better"), cues to action ("encouraged by a health professional, etc."), fear ("death of a family member, etc."), appear to affect behavioral decisions.

Influence of gender

Although females were unintentionally oversampled, our analysis includes a gender-wise stratification and we present data separately whenever we observed marked gender differences. In our study, more men than women smoked tobacco or drank alcohol. The prevalence of hypertension and self-reported diabetes was similar in both groups. On the other hand, low physical activity and obesity were higher in the women. Although men had better knowledge of heart disease, their attitude was similar to those reported by women. However, more women than men strongly agreed that their health was ultimately determined by God or a higher power. Female gender is usually significantly related to good knowledge of cardiovascular disease.[52] One major factor for the gender discrepancy in our study is that more women (33.2%) than men (11.8%) lacked formal education, which in itself is alarming. In fact, illiteracy is one of the main risk factors along with behavioral factors in rural/urban Asian Indian women.[53]

Effect of other socio-demographic variables on KAP

Age-wise, KAP/behavior scores decreased around 4% from the youngest to the oldest age group. An earlier study reported a higher level of knowledge among young respondents.[36] Interestingly, a study in adolescents reported a very poor level of cardiovascular knowledge.[54] Otherwise, knowledge levels rise linearly from childhood until middle age, when the level starts to plateau.[55] In our study, better-educated respondents ate more fruit and consumed less tobacco and alcohol, but they also reported less physical activity and more hypertension. The highest education category (high school or more) scored higher than the lowest category (no formal schooling) but only by 3%–8%. Other studies observed a consistent link between better KAP scores and higher education.[31,36,52,56] Occupation-wise, employed respondents knew more about biological causes (e.g., high blood pressure, diabetes, and high cholesterol), possibly due to more

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education, wider exposure to information, and better access to screening and treatment. A Canadian study reported similar findings.[36]

Prompted vs. unprompted responses

Although we used unprompted responses to evaluate general knowledge, we used prompted responses to calculate scores, thus providing a denominator ("full marks") to calculate median score %. In other settings, KAP studies have variably used prompted[33,39,47,57] or unprompted questions;[16, 31, 38] while some studies used both.[35] Other studies did not identify their chosen method.[32] Although the accuracy of prompted vs. unprompted questions in knowledge assessment has been a topic of debate, prompted questions confer a higher level of knowledge.[58] When we analyzed knowledge responses based on prompted responses, the percent of correct answers increased drastically. The psychological explanation is that respondents must simply "recognize" answers to prompted questions, but they must engage in the more difficult mental process of "recalling" answers to unprompted questions.[59] We believe that unprompted responses more accurately reflect knowledge level because they emerge from a thought process that in

Comparison between levels of knowledge, attitude, and practice towards cardiovascular disease

The findings of the study indicate that there is gap in knowledge attitude and practices. Poor relation between KAP scores was unsurprising because a linear relationship between variables may not exist in cardiovascular health (e.g. highly satisfactory knowledge=high satisfactory attitude and behavior). Valente argued that each of six possible behavior change models contains a varying order of KAP/behaviour and that a population can be described in terms of the percentage that fits into each model.[60] This implies that no universal intervention can improve the cardiovascular health KAP of every individual in a community. The challenge lies in identifying individuals who fit into different linear models. Furthermore, health behavior theories (e.g., social cognitive theory and the theory of reasoned action)[48] suggest that knowledge and attitude are only two components of the pathways that lead to behavior. Constructs (e.g., self-efficacy) and other personal and environmental factors (in social cognitive theory) and perceived behavioral control, subjective norms, and ultimately intention (in the theory of reasoned action) play crucial roles in shaping one's health behavior.[48]

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Study limitations

Females were unintentionally oversampled (72.7%) although the male:female ratio of the study population is 1:1.15.[20] Women were more likely to be available in the households when enumerators visited as most of the females in our study were housewives. The age-range is limited to 25-59 years as the age groups 60-64 and 70-74 years only constitute 1-2% of the total JD-HDSS population. Most of the respondents belonged to the caste/ethnic groups Brahmin, Chhetri, and Newar which are not representative of all caste/ethnic groups in Nepal. Further, respondents' and interviewers' mood as well as place and time of interview may influence the study and a recall bias may occur when questions are asked about history of CVD risk factors.

CONCLUSION

Our community-based cross-sectional HARDIC study demonstrated poor knowledge, inappropriate attitude, and highly adverse behavior regarding cardiovascular health in a semi-urban community of Nepal even among those already affected by CVD. We aimed to determine a baseline KAP in the community to aid the planning of health promotion activities. Our results show the potential and possibility that community health promotion can improve cardiovascular health literacy.

Figure legend

Figure 1: Sex-wise distribution of cardiovascular risk factor status in the study population.

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CONTRIBUTORS

AV designed the study, performed statistical analysis, and drafted the manuscript. URA performed statistical analysis and revised the manuscript. AK helped design the study and provided critical revision of the manuscript. All authors have read and approved the final manuscript.

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COMPETING INTERESTS

None declared.

DATA SHARING

No additional data available.

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SCORE SYSTEM FOR KNOWLEDGE, ATTITUDE & PRACTICE/BEHAVIOUR

Responses to questions on cardiovascular health knowledge, attitude and practice/behaviour were given scores, in order to compare and correlate the three components.

Knowledge score

Prompted responses of the five sections on knowledge were considered for calculating knowledge score. The total score on knowledge was calculated by combining scores of the below-mentioned five sections of knowledge: cause of heart diseases, warning signs of heart attack, action in case of a heart attack, knowledge regarding foods that are good for heart and knowledge regarding prevention of heart diseases. Maximum possible score for the Knowledge part was thus 11+15+7+10+10= 53.

Cause of heart diseases: Eleven conventional causes were read out to the respondent one by one. Score 1 was given if the answer was 'yes'. No negative marking was given for 'no' or 'don't know' responses. Maximum score possible for the section was 11.

Warning signs of heart attack: Nine common symptoms which are considered as warning signs of a heart attack by the American Heart Association (ref) and two incorrect signs (pain in the abdomen and pain in the leg) were mingled up and read to the respondent who were asked if the symptoms are correct. If answered 'yes', scores were allocated as follows: 3 for chest pain; 2 each for breathlessness, sweating and vomiting; 1 each for pain in the arm, teeth or jaw, light-headedness and unconsciousness; 0 for pain in the abdomen and pain in the leg. Additionally, if 'no' response came for pain in the abdomen and pain in the leg, 1 mark was given. No marks were given if the response was 'don't know'. Maximum score possible was 15 for the section.

Action in case of a heart attack: Respondents were asked about actions that they would do or would not do in case of a heart attack. If the responses were 'yes', then scores were given as follows: treat at home (0), immediately take the person to a hospital (2), take to a pharmacy/medicine shop (0), give home-made therapy (0), wait for appointment with a heart specialist (0), take the person to a traditional healer (0). No mark was given if the answer was 'no' or 'don't know'. Maximum score possible for the section was 7.

Foods that are good for heart: Each respondent was asked if they considered a particular food item from a pre-selected list to be good for the heart. The response was recorded as 'yes', 'no' or 'don't know'. Depending on whether the particular food is actually good (e.g. fruits) for heart or not (e.g. fat), 1 mark was given for each correct answer. No mark was given if the response was 'don't know'. Maximum score possible for the section was 10.

Prevention of heart diseases: Each respondent was asked about the various preventive actions that are considered good for improving heart-health. The response was recorded as 'yes', 'no' or 'don't know'. One mark was given if the response was 'yes'. Maximum score possible for the section is 10 for the ten questions.

Attitude score

Each respondent was asked a 14-item questions related to his/her attitude towards heart-health. Responses were recorded as strongly agree or disagree, or somewhat agree or disagree, or don't know/can't say. Depending on whether it was a proper attitude or not, scores from 1 to 4 were allotted. A score of '0' was given for don't know/can't say. Similarly, participants were also asked about their opinions on various preventive aspects of heart health and the responses were recorded with 'very helpful' and 'not at all helpful' as the extremes. Maximum possible score for the attitude section was 14x4=56.

Practice and behaviour score

Each respondent was asked if s/he undertook any particular action in the previous year that would help towards having a better heart health. Scores were given accordingly. Additionally, participants were also given scores according to their risk factor status. No negative marking was given. Maximum score possible was 25.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

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Comment [AV17]: Yes
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Comment [AV19]: Yes
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Comment [AV23]: Yes

Discussion			
Key results	18	Summarise key results with reference to study objectives	**Comment [AV24]:** Yes
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	**Comment [AV25]:** Yes
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	**Comment [AV26]:** Yes
Generalisability	21	Discuss the generalisability (external validity) of the study results	**Comment [AV27]:** Yes
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	**Comment [AV28]:** Yes

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Cardiovascular health knowledge, attitude, and practice/behavior in an urbanizing community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site

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Keywords: knowledge, attitude, and practice/behavior; Nepal; cardiovascular health; health literacy

Word count: 4,~~894~~ 337 (excludes title page, abstract, references, tables, and figures, per author guidelines)

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ABSTRACT

Objectives: This study determined the knowledge, attitude, and practice/behavior of cardiovascular health in residents of a semi-urban community of Nepal.

Design: To increase understanding of knowledge, attitude, and practice/behavior toward cardiovascular health, we conducted in-home interviews using a questionnaire based on WHO STEPS and other resources, scoring all responses.

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We also recorded blood pressure and took anthropometric measurements.

Setting: Our study was conducted as part of the HARDIC project in the Jhaukhel-Duwakot Health Demographic Surveillance Site in two urbanizing villages near Kathmandu.

Participants: The study population included 777 respondents from six randomly selected clusters in both villages.

Results: Seventy percent of all participants were female and 26.9 % lacked formal education. The burden of cardiovascular risk factors was high; 20.1 % were current smokers, 43.3 % exhibited low physical activity, and 21.6 % were hypertensive. Participants showed only poor knowledge of heart disease causes; 29.7 % identified hypertension and 11% overweight and physical acitivity as causes, wheras only 2.2 % identified high blood sugar as causative. Around 60 % of respondents did not know any heart attack symptoms compared with 20% who knew 2-4 symptoms. Median % scores for knowledge, attitude, and practice/behavior were 79.3, 74.3, and 48.0, respectively. Nearly 44% respondents had insufficient knowledge and less than 20% had highly satisfactory knowledge. Among those with highly satisfactory knowledge, only 14.7% had highly satisfactory attitude and 19.5% and 13.9% had satisfactory and highly satisfactory practices, respectively.

Conclusions: Our study demonstrates a gap between cardiovascular health knowledge, attitude, and practice/behavior in a semi-urban community in a low-income nation, even among those already affected by CVD.

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ARTICLE SUMMARY

Article focus

- We aimed to gain a deeper understanding of knowledge, attitude, and behavior/practice regarding cardiovascular health in a semi-urban community of Nepal, a low-income South Asian country.

Key messages

- ~~We found~~The study site has a high burden of cardiovascular risk factors. In particular, low physical activity and overweight/obesity~~; cardiovascular risk factors in our study site exceeded~~ exceed the national average.
- ~~Low~~ Unprompted responses to cardiovascular health questions revealed a poor level of knowledge, and respondents' attitude ~~towards~~toward cardiovascular health showed low risk perception ~~combined with poor relation~~.
- Poor correlation between knowledge, attitude, and behavior scores imply that commonly applied health promotion strategies that merely increase knowledge of cardiovascular health may be insufficient, thus emphasizing the need for a more holistic approach to disease prevention.

Strengths and limitations of the study

- This study is the first to extensively explore knowledge, attitude, and behavior/practice regarding cardiovascular health in Nepal ~~and was conducted in~~.
- Random sampling derived from a sampling frame generated from a health demographic surveillance site ~~which~~ provides the logistic advantage of further follow-up and intervention.
- Using both prompted and unprompted questions in the same study illustrates the variation that may be obtained by these approaches.
- Except for the WHO STEPS questionnaire on behavioral risk factors, we used questions from many unvalidated sources.

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- Unintentional oversampling of women respondents yielded unsegregated gender-wise results that are more likely to represent knowledge, attitude, and practice/behavior in women.

Abstract:

Objectives: This study aimed to determine the knowledge, attitude, and practice/behavior of cardiovascular health in residents of a semi-urban community of Nepal.

Design: To increase understanding of knowledge, attitude, and practice/behavior toward cardiovascular health, we conducted in-home interviews using a questionnaire based on WHO STEPS and other resources, scoring all responses. We also recorded blood pressure and took anthropometric measurements.

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Setting: Our study was conducted as part of the HARDIC project at the Jhaukhel-Duwakot Health Demographic Surveillance Site in two urbanizing villages near Kathmandu. Our results present baseline data from the project that aims to improve cardiovascular health literacy through health promotion.

Participants: The study population included 777 respondents from six randomly selected clusters in both villages.

Primary outcome measure: Proportion of the study population with correct knowledge about the causes, manifestation, immediate management, and preventability of cardiovascular diseases. Our data reveals participants' attitude toward cardiovascular health and its preventability as well as cardiovascular health behavior, as reflected in the risk factor status and positive actions taken toward achieving them.

Secondary outcome measure: Our data calculated and correlated participants' scores regarding knowledge, attitude, and practice/behavior.

Results: Participants showed only poor knowledge of heart disease causes, heart attack symptoms, and appropriate action. In general, the participants' attitude toward heart health was inappropriate. The burden of cardiovascular risk factors among participants was high. Median percent scores for knowledge, attitude, and practice/behavior were 79.25, 74.29, and 48.00, respectively. We observed poor correlations between the Pearson coefficient for knowledge and attitude; attitude and behavior/practice; and knowledge and behavior/practice (0.025, 0.126, and 0.121, respectively).

Conclusions: Our study demonstrates poor level of cardiovascular health knowledge, attitude, and practice/behavior in a semi-urban community in a low-income nation. Tailoring health promotion activities to our findings might improve public health literacy for cardiovascular disease.

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INTRODUCTION

Noncommunicable diseases (NCDs) pose increasingly important public health problems in low- and middle- income countries (LMICs). In 2008, 80% of global NCD deaths occurred in LMICs,[1] and NCDs recently accounted for 7.9 million of 14.5 million deaths (54%) in Southeast Asia,[2] ~~and were responsible for two of every three deaths (34.5 million) worldwide in 2010.[3]~~ Poverty, illiteracy, poor health infrastructure, and demographic transition, including increasing life expectancy, are major contributors to rising burden of NCDs in ~~LMICs~~the region. Other postulated causes include poor fetal and childhood nutrition.[~~4, 5~~3, 4] A similar pattern is evident in South Asian countries like Nepal, where NCDs currently occur more frequently than communicable diseases and behavioral risk factors such as tobacco smoking are high.[~~6~~5]

Globally, cardiovascular diseases (CVDs) ~~are responsible for one in four~~comprise 39% of all NCD deaths ~~(12.9 million).[3]~~[6] Eighty percent of CVDs result from tobacco smoking, unhealthy diet, physical inactivity, and harmful use of alcohol.[7] The risk of all-cause mortality among individuals who score poorly in behavioral factors is four fold higher than those who score best.[8] In high-income countries, declining CVD mortality is largely attributed to the reduction of behavioral risk factors.[9] Underlying socioeconomic parameters and societal influences affect exposure and vulnerability to CVD risk factors. Therefore, surveillance of NCD risk factors should include social determinants of cardiovascular health.[1, 10] Currently, understanding the individual and social determinants of cardiovascular health behaviors is among the top 20 priority areas for NCD research in LMICs.[11]

As a precursor of favorable health behavior, experts have advocated health literacy since community-based interventions (e.g., Finland's North Karelia Project) began exploring the potential impact of behavioral changes on CVD.[1, 12] The World Health Organization (WHO) promotes public awareness of diet and physical activity as a "best buy" to improve

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cardiovascular behavior.[9] Similarly, the American Heart Association emphasizes the importance of improving community awareness of cardiovascular health issues.[13, 14] However, achieving desired health behavior requires deeper understanding of the underlying social context of disease.[~~13, 14~~15] Hence, studies on knowledge, attitude, and practice (KAP) increase our understanding of cardiovascular health literacy and community behavior.[~~15~~16] Currently, such studies have been limited in South Asia.

~~Earlier studies report~~In Pakistan, inability to recognize the symptoms of heart attack associates independently with delayed hospitalization.[17] An earlier study reported a low level of knowledge about heart attack[~~16~~18] and diabetes symptoms in Nepal.[~~17~~19] Nepal's high prevalence of underlying behavioral risk factors, particularly tobacco and alcohol consumption, and poor cardiovascular health knowledge is a matter of concern.[~~18~~20] ~~Nationwide in Nepal, the age group 25+ exhibits fasting blood glucose of 5.5 mmol/L for males and 5.4 mmol/L for females, systolic blood pressure of 125.9 mmHg and 126.6 mmHg for males and females respectively, and total cholesterol of 4.1 mmol/L (males) and 4.3 mmol/L (females).~~[~~19~~]

Currently, attempts to improve cardiovascular health knowledge and behavior in Nepal focus mainly on campaigns that transmit information but pay little attention to the population's actual health literacy~~. We therefore~~ To gain greater insight into this important issue, we undertook a community-based KAP study in the Jhaukhel-Duwakot Health-Demographic Surveillance Site (JD-HDSS) outside Kathmandu ~~where~~.[21] The baseline census in these villages suggested that NCDs, particularly CVDs, are the predominant cause of morbidity and mortality.[~~20~~21] Additionally, our pilot study in the Duwakot population demonstrated poor cardiovascular health knowledge.[~~21~~22] ~~Our study is part of the~~

Heart-Health Associated Research and Dissemination in the Community (HARDIC) ~~project, which~~ is the cardiovascular health component of JD-HDSS. In Nepalese, hardic means "heartily" or "from the heart". ~~This~~Using community-level interventions, HARDIC aims to improve cardiovascular health literacy and practice/behavior and this paper reports the baseline results from HARDIC ~~and~~. Our study is the first to conduct a detailed analysis of ~~cardiovascular health knowledge, attitude, and practice/behavior~~ KAP/health literacy in ~~an urbanizing community of Nepal.~~ relation to cardiovascular health.

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METHODS

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~~Ethical considerations~~

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~~The Nepal Health Research Council and the Institutional Review Board of Kathmandu Medical College approved this study. Following a pattern established at the outset of JD-HDSS, we consulted local leaders and sought their informal permission for HDSS activities. In addition, we periodically consulted with health and administrative authorities in both villages. All participants gave informed consent, and privacy was maintained during the interview process. To maintain confidentiality, all data were secured in the HDSS office. Computer data were accessible only to the research team. Although respondents received no monetary incentives, we provided a referral that included discounted consultation fees at Kathmandu Medical College or Nepal Medical College for self-reported illness and newly diagnosed hypertension.~~

Study site and population

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We conducted our descriptive, community-based, cross-sectional study between September and November 2011 in the JD-HDSS of Bhaktapur district in the Kathmandu Valley, 13 kilometers from Kathmandu. An earlier report described the establishment of the surveillance site.[~~20~~21]

~~Study population and sample size~~

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~~This study is the first step in the larger HARDIC project that will be conducted in the whole JD-HDSS.~~ Duwakot and Jhaukhel each contain nine administrative wards ~~and we~~. We randomly selected three wards from each village. Based on the JD-HDSS 2010 baseline census,[~~20~~21] we compiled a complete list of households containing adults aged 25-59 years in the selected wards. Next, we selected one adult, of either sex, from all interview households ~~and surveyed 789 of 840 households (non-response rate = 6.07%). We applied~~. If a household contained more than one adult, we used the Kish technique to select the respondent.[~~22~~23]

Study tools

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Interviews based on the WHO-NCD STEPS questionnaire

We structured the basic questionnaire ~~and tailored it for site specific responses in Nepal~~ using the WHO-NCD STEPS ~~(STEP 1 and 2 questionnaires) for demographic information, behavioral and physical measurements~~ [~~23~~24] and other sources ~~for addressing knowledge, attitude and~~

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practice/behavior issues. [15,24][17, 25-39] Responses to questions on cardiovascular health knowledge, attitude and practice/behavior were given scores in order to compare and correlate the components. A detailed description of the scoring system is given as an appendix to this article.

Interviewers

Questions were related to respondents' Twelve local female enumerators (two per ward) conducted the interviews. All enumerators had completed at least grade 10 in school. Supervisors included four public health graduates; a field coordinator with Master and PhD degrees in public health; and two PhD students/authors (AV and URA).

Data Collection

Interview process

The interviews were conducted at the participants' homes. The initial part of the interview consisted of questions related to demographic profile. Questions then followed relating to knowledge of cardiovascular health (e.g., causes and risk factors, warning signs, and action for suspected heart attack); heart-healthy diet; and disease prevention. The first two areas included unprompted (spontaneous, open-ended) and prompted (clues provided, closed-ended) responses, and the latter two areas included only prompted responses. We asked respondents about their attitude toward different aspects of cardiovascular health: did they perceive themselves at risk for CVD? Did they think behavior change would reduce their risk of developing CVD? The responses were recorded in Likert-scale (strongly agree, somewhat agree, don't know, somewhat disagree, strongly agree).

Behavioral factors

Behavior-related questions were based on Step 1 of the WHO STEPwise approach to surveillance (STEPS), which uses a questionnaire to collect data on risk factors.[23][24] Our questions probed current and past smoking behavior; smokeless tobacco; alcohol consumption in the past 30 days (current drinker), and drinking frequency among current drinkers. The physical activity section asked respondents to report the number of days and amount of time they participated in vigorous and moderate activities at work, leisure, and travel. Additional practice

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and behavioral questions explored whether participants had engaged in any heart-friendly behavior in the previous year and for what reason.

Physical measurements

Enumerators recorded anthropometric measurements (i.e., weight, height, and waist and hip circumferences) according to STEPs guidelines.[23] Weight was measured to one decimal place using a Microlife BR-9201 Weighing Scale (Microlife AG Swiss Corporation, Widnau, Switzerland). Height and waist and hip circumferences were measured using non-stretchable tapes (Jonson Tapes Ltd, New Delhi, India). Blood pressure was determined digitally by Microlife BP 3AP1-3E (Microlife AG Swiss Corporation, Widnau, Switzerland). Enumerators recorded three readings for each respondent, taken at 5 minute intervals. We averaged the readings to attain the final blood pressure measurements.

Diagnostic criteria for sub-classification

Respondents with known history of hypertension (diagnosed cases) and those diagnosed during the study according to Joint National Committee - VII[40] were termed as having "hypertension".

Data management

Supervisors checked all completed questionnaires and, if necessary, asked enumerators to revisit households. After omitting incomplete questionnaires, we included 777 individuals in the analysis. Except for missing recordings for height, weight, or blood pressure, data reported in our KAP study covers all 777 respondents. We outsourced data entry to a team of data entry operators, public health graduates by qualification. Data was coded and entered in Epidata version 2.1.

Statistical analyses

Data was analyzed with SPSS version 17.0 (IBM, Armonk, New York, USA) and STATA version 10.0 (StataCorp, Texas, USA). After calculating the Metabolic Equivalent of Task (MET) minutes/week, we grouped participants as highly active, moderately active, or inactive (low physical activity) in accord with the STEPS manual. Additional practice and behavioral questions explored whether participants had engaged in any heart-friendly behavior in the previous year and for what reason.

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~~For scoring knowledge, attitude, and practice/behavior questions and to compare and correlate the three components, we scored responses regarding KAP/behavior for cardiovascular health. The maximum possible score for KAP/behavior was 53, 56 and 25, respectively. Further, total knowledge score was classified into the following five categories based on the quintile scores: ≤20 % 'highly insufficient'; 21–40 % 'insufficient'; 41–60 % 'sufficient'; 61–80 % 'satisfactory'; >80 % 'highly satisfactory'.[41]~~

~~Categorical data is presented as number, percentages, and continuous data as median and inter-quartile range (IQR). KAP percentage scores are presented as median. We used Chi-square test to compare proportions among demographic variables and Mann–Whitney U test to compare scores from males and females. P<0.05 was considered statistically significant.~~

Cronbach's alpha, which measures question reliability, for the overall knowledge and attitude was 0.941 (range: 0.775–0.913) and 0.824 (range: 0.791–0.822), respectively. Cronbach's alpha for practice and behavior ranged from low (0.257) for physical activity questions to high (0.929) for blood pressure ~~measurements~~measurement.

Twelve local female enumerators (two per ward) conducted the interviews. All enumerators had completed at least grade 10 in school. Supervisors included two public health graduates; a field coordinator who holds both master's and PhD degrees in public health; two PhD students including one author (AV).

Scoring knowledge, attitude, and practice/behavior questions

To compare and correlate the three components, we scored responses regarding KAP/behavior for cardiovascular health. The maximum possible score for KAP/behavior was 53, 70, and 25 respectively. See Supplement for further detail.

Physical measurements

Enumerators recorded anthropometric measurements (i.e., weight, height, and waist and hip circumferences) according to STEPs guidelines.[24] Weight was measured to one decimal place using a Microlife BR-9201 Weighing Scale (Microlife AG Swiss Corporation, Widnau, Switzerland). Height and waist and hip circumferences were measured using non-stretchable tapes (Jonson Tapes Ltd, New Delhi, India). Blood pressure was determined digitally by Microlife BP 3AP1-3E (Microlife AG Swiss Corporation, Widnau, Switzerland). Enumerators

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recorded three readings for each respondent, taken at 5-minute intervals. We averaged the readings to attain the final blood pressure measurements. Respondents with known history of hypertension (diagnosed cases) and those diagnosed during the study according to Joint National Committee -VII[41] were termed as having "hypertension."

Data management and analysis

Supervisors checked all completed questionnaires and, if necessary, asked enumerators to revisit households. We outsourced data entry to a team of data entry operators, public health graduates by qualification. Data was coded and entered in Epidata version 2.1 and analyzed with SPSS version 17.0 (IBM, Armonk, New York, USA) and STATA version 10.0 (StataCorp, Texas, USA). Demographic variables were taken as independent variables; other variables, including KAP components, were analyzed as dependent variables. Categorical data is presented as percentages, and continuous data is presented as mean (standard deviation). KAP scores are presented as median score percents. We used the Chi-square test to compare proportions and the Kruskal–Wallis test to compare medians. $P<0.05$ was considered statistically significant.

Ethical considerations

The Nepal Health Research Council and the Institutional Review Board of Kathmandu Medical College approved this study. Following a pattern established at the outset of JD-HDSS, we consulted local leaders and sought their informal permission for HDSS activities. In addition, we periodically consulted with health and administrative authorities in both villages. All participants gave informed consent, and privacy was maintained during the interview process. To maintain confidentiality, all data were secured in the HDSS office. Computer data were accessible only to the research team. Although respondents received no monetary incentives, we provided a referral that included discounted consultation fees at Kathmandu Medical College or Nepal Medical College for self-reported illness and newly diagnosed hypertension.

RESULTS

We surveyed 789 of 840 households in randomly selected six wards of Duwakot and Jhaukhel (non-response rate = 6.07%). After omitting incomplete questionnaires, we included 777 individuals in the analysis. Except for missing recordings for height, weight, or blood pressure, the data reported here cover all 777 respondents.

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Demographic characteristics and cardiovascular risk factors variables

Table 1 describes the sex wise demographic characteristics of the respondents. Seventy percent of all participants were female, and 25% lacked formal education. The median age (IQR) for male and female respondents was 40 (33-49) years and 38 (32-46) years, respectively. Two third of the female respondents were housewives and 3 out of 5 male were either serviceholders or self employed. We have shown previously that 59.2% belonged to the upper lower class.[20]

Table 1: Demographic characteristics and risk factor status of the study population. (n=777)

Demographic variables (n=777)	Male (n=229) Number (%)	Female (n=548) Number (%)	Total (n=777) Number (%)
Age (years)			
25–34	30.178 (27.9)	34.3 36.9	33.1 36.0
35–44	34.1 35.8	28.8	30.9
45–59			
Caste/Ethnicity			
Ethnic group	85 (28. 37.1	209 (71 38.1)	294 (100) 37.8
Brahmin	24.0	25.4	25.0
Chhetri	29.3	23.2	25.0
Newar	9).6	13.3	12.2
Minorities			

25–34	69 (26.8)	188 (73.2)	257 (100)
45–59	82 (34.2)	158 (65.8)	240 (100)
Chhetri	55 (28.4)	139 (71.6)	194 (100)
Newar	67 (34.5)	127 (65.5)	194 (100)
Others*	22 (23.2)	73 (76.8)	95 (100)

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~~**Education**~~			
~~No formal schooling~~	~~27 (12.9)~~	~~182 (87.1)~~	~~209 (100)~~
~~Primary school (Grade:1-5)~~	~~74 (30.1)~~	~~172 (69.9)~~	~~246 (100)~~
Education*	~~74 (37.4)~~	~~124 (62~~	
No formal schooling	11.8	33.2	26.9~~198~~
Primary school	32.3	31.4	~~(100)~~
Secondary school ~~(Grades: 6-10)~~	32.3	22.6~~)~~	31.7
High school or more	23.6	12.8	25.5
			16.0
~~High secondary and above (Grade:11 and~~	~~54 (43.5)~~	~~70 (56~~	~~124 (100)~~
~~above)~~**Occupation**†	30.6	8.4	14.9
Employee	32.4	6.6	13.9
Self-employed		67.3	47.5
Housewife	21.0	14.2	16.3
Agriculture	17.0	3.5~~)~~	17.5
Other			
~~**Major Occupation**~~§			
~~Service (government and private)~~	~~70 (60.3)~~	~~46 (39.7)~~	~~116 (100)~~
~~Self-employed~~**Cardiovascular risk factors**§	~~72 (66~~		
Smoking (current) (n=777)	33.5	14.7~~36~~	20.1
Smokeless tobacco (current) (n=777)	20.2	~~(33.~~	8.3
Alcohol drinkers (ever) (n=777)	36.7	3~~).~~3	20.7
Alcohol drinkers (current) (n=777)	34.5~~)~~	14.1	19.0
Low physical activity (n=777)	38.3	12.6	43.3~~108~~
Hypertension (known and new) (n=670)	20.6	45.2	~~(100)~~
Self-reported high blood sugar (n=777)	4.8	22.1	21.6
Overweight/obese (n=762)	25.0/5.4	3.5	3.9
Increased waist circumference (cm) (n=773)	21.6	31.6/11.2	29.7/9.4
Increased waist/hip ration (n=750)	57.9	56.6	46.3
		55.6	56.3
~~Agriculture~~	~~48 (38.1)~~	~~78 (61.9)~~	~~126 (100)~~

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Housewife**	N/A	369 (100)	369 (100)
Others‡	39 (67.2)	19 (32.8)	58 (100)

‡Other caste/ethnicity includes Rai, Magar, Tamang, Dalit, Gurung, Mandal, Chaudary, Pariayar, Purkutti. §The definitionNote: Classification of occupation was adopted fromethnic groups is based on the Nepal Non-Communicable Disease Survey, 2007National Central Bureau of Statistics.[41]

*Primary and modifiedsecondary schooling indicate education up to the local context.[42] **A woman involved in her own household activities like cooking, washing , cleaning etc but does not earn money. †Other occupation includesgrade 4 and 10, respectively.

†Employee describe individuals working for governmental or nongovernmental organizations. "Other" occupations include students, unemployed individuals, (able or unable to work,), retired, and non-paid workers.

Figure 1 shows the sex-wise prevalence of cardiovascular risk factors in the study population. Overall, three in ten respondents was a past or current smoker and one in five respondents had consumed at least one alcoholic beverage in the previous month. More than 40% of the respondents reported low physical activity. Prevalence of known and newly diagnosed hypertension was 21.6%. As measured by BMI, the prevalence of overweight and obesity was 29.7% and 9.4 %, respectively. Abdominal obesity (i.e., increased waist circumference and waist-hip ratio) was 46.3% and 56.3%, respectively. There was statistically significant difference in the prevalence rate among males and females in smoking, smokeless tobacco use, alcohol intake, overweight/obesity and increased waist circumference.

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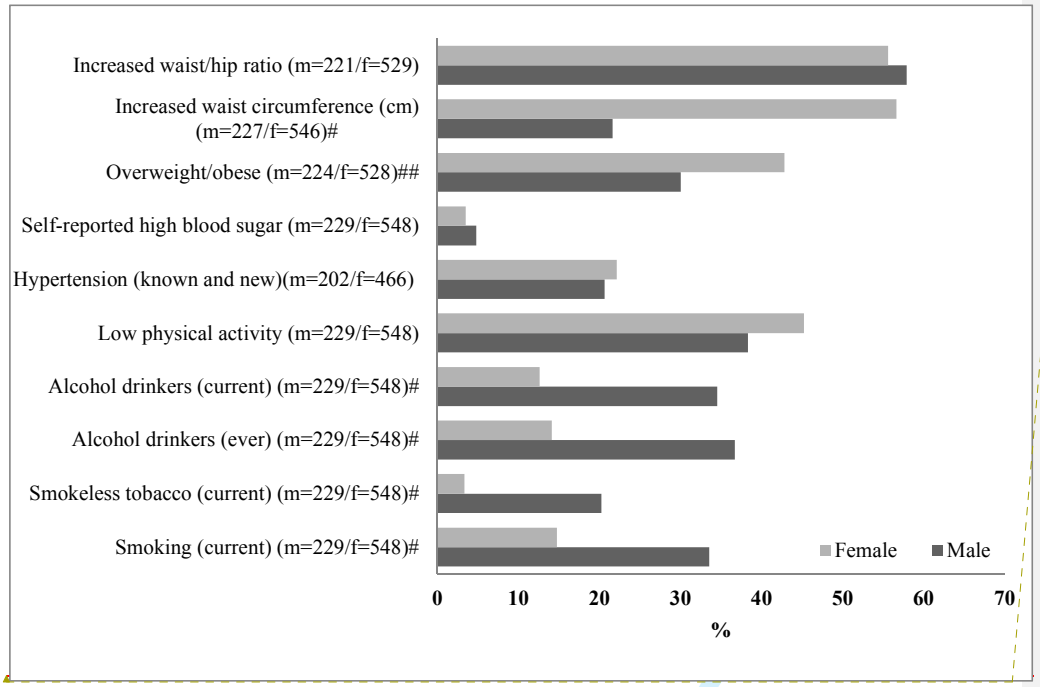
Figure 1: Sex-wise distribution of cardiovascular risk factor status in the study population.



m=number of male, f=number of female, # p<0.001, ## p<0.01 (chi-square tests). [§]Risk factor categories are based on the WHO-NCD Risk Factor STEPS Survey manual.[23,24] Current smokers included those who responded "yes" to "Do you smoke?" Past smokers included those who replied "yes" to "Did you ever smoke in the past?" "Ever drinkers" included respondents who had "consumed a drink that contained alcohol ever in lifetime," and current drinkers included respondents who had "consumed alcohol within the previous month." Percentage of drinking frequency represents current drinkers who consumed at least one standard drink per occasion. Blood pressure data exclude respondents who did not submit to all three readings. Likewise, data for body mass index, waist circumference, and waist-hip ratio exclude respondents whose weight, height, and waist and/or hip measurements were not taken. Increased waist circumference includes waist measurements of ≥ 80 cm (females) and ≥ 90 cm (males); increased waist-hip ratio is ≥ 0.85 (females) and ≥ 0.90 (males).

Knowledge towards

High burden of risk factors related to cardiovascular disease health

Table 1 also shows the prevalence of cardiovascular risk factors in the study population. One in four respondents was a past or current smoker. One in five respondents had consumed at least one alcoholic beverage in the previous month. Both males and females consumed fruit 2.6±1.98 and 3.3±2.17 days/week, respectively. Likewise, males and females consumed vegetables

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5.33±1.69 and 5.64±1.55 days/week, respectively. More than 40% of the respondents reported low physical activity. Prevalence of known and newly diagnosed hypertension was 21.6%. As measured by BMI, the prevalence of overweight and obesity was 29.7% and 9.4 %, respectively. Abdominal obesity (i.e., increased waist circumference and waist-hip ratio) was 46.3% and 56.3%, respectively Knowledge regarding causes and warning signs (Table 1).

Poor knowledge of cardiovascular health

Cause of heart disease

Table 2 shows When seeking unprompted responses for the perceived causes of heart diseases. The responses ranged, enumerators asked participants to spontaneously name the causes of CVD (Table 2). Respondents showed low overall knowledge of the factors that cause CVDs, ranging from 1.0% for (high blood sugar) to 29.1% for 2% (smoking. The median percentage scores for). Generally, males andknew more than females were 13.8 and 10.4 %, respectively (p; younger≤0.001, Mann-Whitney U test). Younger respondents (<35 years) knew more than older participants (median 13.7% vs. 10.3%, p=0.01). Respondents belonging to Brahmin, Newer and Chhetri ethnicities had less knowledge than those in the other caste/ethnicity group (median 13.8% vs. 6.9%, p=0.001) (Table 1). The respondents with high school or more education and working in government or non-government offices knew moreones; ethnic minorities knew less; and better-educated individuals and governmental or nongovernmental employees were better informed than those with less education and in other employment situations (median 17.2% vs. 10.34%, p=0.001). .

Table 2: Percentage of respondents citing various causes of cardiovascular heart disease and warning signs of heart attack. (n=777)

Causes of Heart Attack	Male (n=229) Number (%)	Female (n=548) Number (%)	Total (n=777) Number (%)	P-value*
Hypertension	43 (18.8)	60 (10.9)	103 (13.3)	<0.01
High blood sugar	3 (1.3)	5 (0.9)	8 (1.0)	0.06
High cholesterol	47 (20.5)	74 (13.5)	121 (15.6)	0.01
Physical inactivity	16 (7.0)	22 (4.0)	38 (4.9)	0.08
Overweight	13 (5.7)	29 (5.3)	42 (5.4)	0.82
Cigarette/Bidi Smoking	80 (34.9)	147 (26.8)	227 (29.1)	0.02

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Smokeless tobacco	19 (8.3)	26 (4.7)	45 (5.8)	0.06
Excessive alcohol	72 (31.4)	131(23.9)	203 (26.1)	0.03
Excess stress	37 (16.2)	74 (13.5)	111 (14.3)	0.34
Warning signs	**Male (n=93)[$] Number (%)**	**Female (n=222)[$] Number (%)**	**Total (n=315)[$] Number (%)**	**P value[*]**
Difficulty in breathing	17 (11.1)	41 (15.1)	58 (13.6)	0.25
Pain in the chest	30 (19.6)	57 (21.0)	87 (20.5)	0.74
Pain or numbness in the arms	0 (0)	3 (1.1)	3 (0.7)	-
Pain in the teeth or jaw	0 (0)	1 (0.4)	1 (0.2)	-
Excessive sweating	15 (9.8)	30 (11.0)	45 (10.6)	0.69
Vomiting tendency	1 (0.7)	6 (2.2)	7 (1.6)	0.65
Dizziness or light headedness	24 (15.7)	40 (14.7)	64 (15.1)	0.78
Loss of consciousness	55 (35.9)	86 (31.6)	141 (33.2)	0.36

Numbers

	Hypertension	High blood sugar	High cholesterol	Physical inactivity	Overweight	Smoking	Smokeless tobacco	Excessive alcohol	Excess stress
Sex									
Male	18.8*	1.3	20.5*	7.0	5.7	34.9*	8.3	31.4*	16.2
Female	10.9*	0.9	13.5*	4.0	5.3	26.8*	4.7	23.9*	13.5
Age (years)									
25–34	14.8	1.6	17.5	5.4	6.2	31.1	6.2	28.4	16.0*
35–44	13.2	0.4	17.1	5.7	6.1	26.8	5.0	25.0	17.1*
45–59	11.7	1.3	11.7	3.3	3.8	30.0	6.3	25.0	9.2*
Ethnicity									
Brahmin	14.3*	1.0	21.1[#]	7.5*	5.8	29.3	8.2	25.2	12.9
Chhetri	19.1*	1.0	16.5[#]	4.6*	6.7	32.5	3.6	25.8	20.1
Newar	10.8*	.5	9.8[#]	3.6*	5.7	27.8	6.2	28.4	10.8
Minorities	3.2*	2.1	8.4[#]	0.0*	1.1	25.3	2.1	25.3	13.7
Education									
Primary school	13.0*	0.8	14.2[#]	5.3[#]	4.5*	30.5	8.1	27.6	15.0*

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Secondary school	15.7*	1.5	18.7#	8.6#	8.6*	29.8	3.0	27.8	16.7*
High school or more	21.0*	1.6	27.4#	4.8#	8.9*	33.9	8.1	26.6	18.5*
No formal schooling	6.7*	0.5	7.2#	1.0#	1.4*	24.4	4.3	22.5	8.6*
Occupation									
Employee	26.7#	0.9	32.8#	10.3	8.6	30.2	8.6	31.9	23.3*
Self-employed	17.6#	2.8	14.8#	1.9	7.4	29.6	2.8	25.9	15.7*
Housewife	10.6#	1.1	11.7#	3.3	5.4	25.7	3.5	23.8	13.0*
Agriculture	7.1#	0.0	14.3#	7.1	1.6	37.3	8.7	26.2	11.1*
Others	8.6#	0.0	10.3#	5.2	3.4	31.0	13.8	29.3	8.6*
Overall	13.3	1.0	15.6	4.9	5.4	29.2	5.8	26.1	14.3

Note: Figures are based on ~~participants' unpromptedspontaneous participant~~ responses. ~~Only~~The table includes only established CVD risk factors ~~included~~ and excludes responses ~~eitingthat cited~~ other non-established causes (e.g., food hygiene, air pollution, etc~~.) excluded. *Obtained from chi square test. $Respondents who did not know any warning sign were excluded from analysis,~~). Calculated with Chi-square test, p-values compare all categories in the variables.

~~Table 2 also describes the warning signs~~*P-value <0.05; #p-value <0.01]

Knowledge of heart attack ~~as perceived by the respondents.~~ symptoms

Around 60% of respondents did not know any ~~of the~~ heart attack ~~signs. Among those who were familiar~~symptoms compared with ~~those signs, nearly 50% of respondents knew only one sign, 37%~~ 20% who knew ~~any two signs, 11.42% knew any three signs and 2.53% knew four signs. The proportions of each warning sign told by~~ 2–4 symptoms. This ratio was uniform across all the ~~male and female respondents were not statistically different (p>0.05). The proportions of knowledge about warming signs were not statistically different in terms of age (χ2=3.39, p=0.49), caste/ethnicity (χ2=6.25, p=0.4), and education (χ2=5.50, p=0.53).~~demographic variables (Table 3). Importantly, ~~only 20~~less than 25% of respondents identified chest pain—the most prominent and important indicator of heart attack—as a symptom ~~of heart attack~~(data not shown). This knowledge decreased with age (p=0.013) and level of education (p=0.055). Brahmin respondents (p<0.001) and governmental or nongovernmental employees (p=0.021) had slightly better knowledge about chest pain.

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~~Knowledge on action~~**Table 3: Correctly reported warning signs of heart attack (n=777)**

	Signs reported (number)			
	0 (%)	1 (%)	2–4 (%)	P-value
Sex				
Male	59.4	18.3	22.3	0.605
Female	59.5	20.8	19.7	
Age (years)				
25–34	63.4	16.7	19.8	
35–44	57.1	21.4	21.4	0.494
45–59	57.9	22.1	20.0	
Ethnicity				
Brahmin	56.8	22.1	21.1	
Chhetri	62.9	18.0	19.1	0.395
Newar	59.3	17.0	23.7	
Others	61.1	24.2	14.7	
Highest education				
No formal schooling	60.3	22.0	17.7	
Up to primary school	58.1	18.7	23.2	0.493
Up to secondary school	60.1	22.2	17.7	
High school or more	59.7	16.1	24.2	
Main job				
Employee	55.2	19.0	25.9	
Self-employed (self)	57.4	20.4	22.2	
Housewife	59.1	21.4	19.5	0.687
Agriculture	65.1	15.9	19.0	
Others	62.1	22.4	15.5	

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Overall	**59.5**	**20.1**	**20.5**

Note: Warning signs were based on a list provided by American Heart Association.[42]

P-values were calculated using the Chi-square test and compare all categories in the variables.

Action in case of a heart attack

When asked ~~about~~ what action ~~the respondents~~they would take for a suspected heart attack, ~~more than 20% gave no response and 75% (81.2% male and 73% female, $\chi 2=4.05$, p= 0.04)~~ 75% of respondents said they would immediately take the ~~affected~~ person to a hospital. About 3% said they would try home therapy, consult a traditional healer, or stay home and wait for the symptoms to go away. More than 20% gave no response.

~~Knowledge on~~

Heart-healthy foods ~~for heart diseases~~

When asked to identify a particular heart-healthy food, most respondents identified green leafy vegetables (94.6%) and fruit (92.1%). ~~Furthermore, 22% thought salty food like chips and around~~Around 7% thought fried food or saturated fat (e.g., ghee) are healthy foods. ~~-~~Nearly 22% thought salty food (e.g., chips) is heart-healthy.

~~**Attitudes and practice towards cardiovascular**~~Heart disease prevention

After reading aloud a list of specific actions that help prevent CVD, enumerators asked respondents to comment if they thought a particular action would help. Actions included quitting smoking; getting physical exercise; losing weight; reducing intake of dietary fat, animal products, and salt; reducing stress; and maintaining healthy blood pressure. A majority of respondents thought these actions are helpful, ranging from 86.1% for weight reduction to 92.5% for smoking cessation.

Attitude toward heart health in an urbanizing community

Enumerators asked respondents about their attitude toward different issues of heart health (Table ~~3 describes opinions reflecting attitudes towards various aspects on heart diseases.~~4). Regarding lifestyle and preventive measures, ~~25~~72.9% of males and ~~30~~68.0%-females ~~perceived~~did not perceive themselves ~~to be~~ at risk of CVD. ~~More~~ and more than half ~~of the respondents~~ did not want to change their current lifestyle (~~64.6%~~ males ~~vs. 55.4%~~= 63.3%; females, ~~p< 0.01). Nearly~~

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23% = 53.1%). Seventy-five percent said they did not eat more and would like to cut down; approximately 82% consideredthan they need; 80% did consider themselves to be overweight– the perceived proportion being significantly higher among males (p<0.05); nearly 32% believe that they do not have time to take care themselves; and three fifths did not think that changing their behavior would lower their cardiovascular risk. Further, 25.352.4% of males and 27.260.8% of females thought that God or a higher power determines their health.

Table 3: Responses4: Response to attitude-related questions on cardiovascular disease.heart health

SN	Items	Male Number (%)		Female Number (%)		Total Number (%)		P-value*			
Attitude items on heart health		Strongly disagree		Somewhat disagree		Somewhat agree		Strongly agree		Don't know/ Can't say	
		M	F	M	F	M	F	M	F	M	F
1	I don't perceive myself to be at risk for heart disease (m=225/f=540)$	58 (25.8)31.4	167 (30.98	225 (29.0) 41.5	37.2	0.15.7	21.9	9 6	8.6	1.7	1.5
2	I don't want to change my lifestyl	148 (64.6)17.5	20.3298 (54.4)	17.9	446 (57254.4)	30.1p <0.01	20.8	33 2	32.3	1.3	1.3

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	e (activity, smoking, alcohol) (m=229/f=548)										
3	I feel the amount of food I eat is too much, and I would like to cut down (m=229/f=543)[3]	33.6	28.5	49.3	45.1	10.0	35 (15.2) 3	14 0 (25.5) 2	175 (22.5) 10.2	1.7	p<0.019
4	I feel my present weight is too high	36.2	37 (14349)	47.6	41.4	130 (23.7) 9	167 (21.5) 11.9	7.0 02	10.4	1.3	1.5

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	for my health (m=229/f=548)											
5	I don't think changing my behavior will reduce my risk of developing heart disease (m=229/f=522)[5]	145 (63.3)	312 (56.9)	457 (58)	0.23	38.4	32.5	24	24.5	1.7	4.7	
		131	150	218	4			9				
6	I don't have time to take care of myself (m=229/f=548)	44.1	39.4	22.3	29.9	13.5	14.4	18	77	168	245	0.4
								3	(3314)	(301)	(31.5)	2
7	God or	25.8	23.7	20.1	13.5	58	22.3	14	207	1.7	2.0	59

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	asome higher power ultimately determines my health (m=229/f=548)					(25.3)		9 (27.2)	(26.6) 38.5		
	Opinions on various preventive aspectsaspect of heart health that are helpful	**Very helpful**		**Somewhat helpful**		**Not very helpful**		**Not helpful**		**Don't know**	
8	Access to more fruits, vegetables, and other healthy foods (m=229/f=54	226 (98.6)	533 (99.1)	759 (99.1)	-‡3.8	0.4	0.2	0.4	0.7	0.4	2.0
		93.4	93.2	5.2							

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	8)										
9	Greater access to indoor and outdoor public recreational facilities (m=229/f=548)	200 (875 6.3)	67.3	31.0	22.4	492 (89.7) 0	692 (89.1) 3.6	0.319	0.5	4.8	6.0
10	Smoking bans (m=218/f=535)[5]	209 (969 2.1)	92.0	3.9	515 (964. 2)	0.9	0.9	724 (96.1) 7	0.897	1.3	2.2
11	More awareness programs for healthy heart (m=226/f=536)[5]	214 (96.1)85.2	87.0	9.6	8.6	483 (903.1)	697 (98.0) .9	0.389	0.4	13	31
1	Availa	217	524	7.0	7.7	1.7	0.7	741	0.027	1.3	3.3

2	bility of health facilities to detect and treat heart disease s (m=226/f=531)[$]	(9689.1)	(9887.6)					(970.9)			
13	Local volunteers that shall try to change any adverse health behavior (m=226/f=530)[$]	186 (826 5.1)	64.65 22 (98.5)	17.0	708 (932 0.6)	p<0.0 13.1	2.9	1.7	0.4	13.1	11.5

m=number of males, f=number of females. Questions based on 5-scale Likert questions (strongly disagree, somewhat disagree, I do not know, somewhat agree and strongly agree (question 1-7)/very helpful; somewhat helpful; I do not know; not very helpful; not at all helpful (question 8-13). We classified five options into three categories as 'agree/helpful', 'disagree/not helpful' and 'I do not know'. Only 'strongly agree' or 'very helpful'

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and 'agreed/somewhat helpful' answers were merged and presented in the table and 'I do not know/cannot say' were excluded from analysis. *Obtained from chi square test . $'I do not know/cannot say' answers were excluded from analysis. ‡Cannot be computed due to expected frequency less than 5.

Table 3 also describes the respondents'Note: Figures indicate percentage of respondents among males (M) and females (F).

Next, enumerators asked for respondent opinions on various preventive aspects of heart health (e.g., improved access to fruits, vegetables, and other healthy foods) (Table 4). Most thought that would be helpful. Almost all respondents believed thatsmoking bans or increased access to fruits, vegetables, and other healthy foods would be very helpful. Nearly 9 in 10About two thirds of all respondents thought that greater access to indoor and outdoor public recreational facilities would be very helpful. Four percent of respondents did not believe smoking bans and one quarter thought it would be somewhat helpful to reduce heart diseases. Eight in 10 male respondents believed that. Around 10% of females seemed unsure whether local health volunteers should trytrying to change any adverse health behaviors while nearly 9 in 10 females believed the same (p<0.01). community's health practice/behavior would be useful.

Practice towards/behavior in relation to heart diseasesdisease

Half of all theEnumerators elicited practice- and behavior-related responses in two ways. First, they asked WHO STEPs-based questions about four major behavior-related risk factors (i.e., tobacco smoking, alcohol consumption, physical activity, and fruit and vegetables) (Table 1). Second, they asked respondents if they had participated in any heart-friendly practice/behavior in the previous year (e.g., blood pressure, blood sugar, or other diagnostic tests; tobacco cessation; increased physical activity; weight loss). Half of all respondents had their blood pressure measured and 10% reported getting a diagnostic test for CVD in the previous year. About 60% attempted to reduce their consumption of unhealthy foods and 25% tried to lose weight or increase physical activity. Half of the smokers said they had attempted to quit smoking.

When enumerators asked the respondentswhy responders who reported one or more positive health behaviors the main reason for tryingtried to change their lifestyle or practice/behavior, the reasons given were:participants responded that they wanted to feel better (70%); had seen, read, or heard information (65.4%); did it for their family (45.9%); or were encouraged to do so by a healthcare professional (41.3%), family member (39.0%), or friend (31.8%). Other reasons for

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changing lifestyle or practice/behavior included wanting to avoid taking medications (20.6%); a family member, relative, or friend who developed CVD, became ill, or died (16.5%); and developing possible cardiovascular symptoms (14.8%).

Comparison between level of knowledge, attitude and behavior/practice

Overall, the average prompted knowledge of heart diseases (median 79.3%) was 11.5% lower than average attitudes (median 67.8%) and nearly 31.1% higher than average practices (median 48.2%). Next, average level of attitudes score was nearly 19.6% higher than practices. Similarly, average spontaneous knowledge of heart diseases (median 10.3%) was 57.5% lower than average attitudes (median 67.8%) and nearly 40% lower than average practice (median 48.18%).

Table 4 describes level of KAP based on quintile scores. Regarding knowledge, 20.4 % of the respondents had highly insufficient knowledge, 23.2% had insufficient knowledge, 22.6% had sufficient knowledge, 16.5% had satisfactory knowledge and 17.2% had highly satisfactory knowledge. Similarly, attitude levels were as follows: highly insufficient 20.6%, insufficient 26.9%; sufficient 15.4%; satisfactory 11.2% and highly satisfactory 19.8%. Regarding the behaviour/practices, it was highly insufficient in 12.1% of the respondents, insufficient in 24.3%; sufficient in 22.7%; satisfactory in 27.5% and highly satisfactory in 13.4%. Among those with highly insufficient knowledge,

KAP scores and demographic variables

Median percent scores were similar across the various demographic variables (Table 5). Males, younger people, or better-educated respondents scored 2%–8% higher than females, older respondents, and the less educated. Similarly, median percent scores for attitude tended to decrease about 2% in older respondents, Newars, and those without formal schooling. Behavioral median percent scores were 4%–8% higher among younger and more-educated respondents, Brahmins, Chhetris, and government employees or housewives (Table 5).

Table 5: Median percent score of knowledge, attitude, and practice/behavior according to demographic variables

20.3% of them had highly satisfactory attitudes and 6.9% had highly satisfactory practice. Conversely, among the respondents with highly satisfactory knowledge, 14.7% had highly satisfactory attitude and 19.5% and 13.9% had satisfactory and highly satisfactory practices respectively. Likewise, one in ten respondents with satisfactory knowledge had satisfactory

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attitude while two in ten had highly satisfactory attitude. Nearly four out of ten had satisfactory/highly satisfactory behavior. As the level of knowledge increased, the highly satisfactory practice also increased from 6.9% to 13.4%. However, when the level of knowledge increased, the highly satisfactory attitude decreased from 20.3% to 14.7%.

Table 4: Percentage distribution of level of knowledge, attitude and behavior/practice regarding cardiovascular health.

	Knowledge (n=777) median percent score	P-value	Attitude (n=777) median percent score	P-value	Behavior median percent score	P-value
Sex						
Male	79.2	<0.001	74.29	0.139	48.00	0.660
Female	77.4		74.29		48.00	
Age (years)						
25–34	79.79	0.005	74.29	0.074	48.00	0.018
35–44	79.24		74.29		44.00	
45–59	75.47		72.86		44.00	

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Suff (n=176)	11.4	20.5	20.5	31.2	16.5
Sat (n=128)	10.9	18.8	33.6	19.5	17.2
HS (n=134)	11.2	26.1	20.9	28.5	13.4

Attitude (n=777)	Behavior (n=777)				
	HI	I	Suff	Sat	HS
HI (n = 132)	15.0	23.8	20.0	28.1	13.1
I (n=101)	12.0	22.0	18.7	30.1	17.2

Suff (n=256) **Ethnic group**	10.0		25.		28.3	12.5	
Brahmin		75.47			74.29		48.0
Chhetri		79.24	<0.001		74.29	<0.001	0
Newar		79.24			72.14		48.0
Other		79.24			74.29		0
							44.0
							0
							44.0
							0
Sat (n=134) **Education**		13.8		17.2	72.86		44.0
No formal schooling		75.47			74.29		0
Primary school		77.35			74.29		44.0
Secondary school		79.24	<0.00133		74.29	0.0015	0
High school or more		83.02			75.71		48.0
							0
							52.0
							0
HS (n=154) **Occupation**	10.4	20.8	33.8	11.			
Employed		79.24			74.29		48.0
Self-employed		79.24	<0.001		74.29	0.940	0
Housewife		79.24			74.29		44.0
Agriculture		75.47			74.29		0
Other		79.24					48.0
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							44.0
							0
							48.0
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Overall	79.24		74.29		48.00	

HI: Highly insufficient; I: Insufficient; Suff: Sufficient; Sat: Satisfactory; HS: Highly Satisfactory. The total score was 53, 64 and 25 for KAP, respectively. Then, the quintile scores were obtained. The quintile score (1st-4th) was for prompted knowledge: 34, 40, 43, 45; for attitudes: 33, 37, 39, 42; for behavior: 9, 11, 13, 15. Next, the levels of survey respondents on KAP were classified into the following five subdivisions based on quintile score: ≤20 % 'highly insufficient'; 21–40 % 'insufficient'; 41–60 % 'sufficient'; 61–80 % 'satisfactory'; >80 % 'highly satisfactory'.[41] Median percentage scores for knowledge, attitude and practice were 79.3, 74.2 and 48 for all respondents.

Regarding attitude, among those with the level of attitudes of highly insufficient, 41.2% had satisfactory/highly satisfactory behaviour/practice. When the level of attitude was highly satisfactory, 35% had satisfactory/highly satisfactory practice. Similarly, when the attitude was sufficient, 25% had insufficient practice and nearly 41% had satisfactory practice. When the level of attitude increased, the proportion of those with highly satisfactory practice remained unchanged.

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~~A comparison of male and female respondents showed no difference in level of knowledge ($\chi2$=4.4, p=0.4) attitudes ($\chi2$=3.6, p=0.5) and practice ($\chi2$=2.1, p=0.7). However, there were significant differences in the level of knowledge according to age ($\chi2$=18.1, p=0.02), caste/ethnicity ($\chi2$=43.8, p~~Note: Knowledge scores were based on prompted responses. Calculated with the Kruskal-Wallis test, p-values compared all categories in the variables.

Correlation between knowledge, attitude, and practice/behavior scores

Scatter-plots (Figure 1a–1c) show the correlations between the three components. We observed a poor positive correlation between knowledge and attitude median scores (Pearson correlation: 0.025, p=0.480) [Figure 1a]) and a negative correlation between attitude and behavior (Pearson correlation: -0.126, p <0.001) [Figure 1b]). However, we observed a positive correlation between knowledge and behaviour (Pearson correlation: 0.121, (p=0.001) [Figure 1c]).

~~<0.001) and education level ($\chi2$=48.7, p<0.001). In contrast, the level of attitude was not statistically significant for these variables (p>0.05). On the other hand, the level of practice was also statistically different according to age ($\chi2$=18.7, p=0.01), caste/ethnicity ($\chi2$= 21.1; p=0.004) and education status ($\chi2$=45.7, p<0.001).~~

~~Respondents <35 years of age were more likely to have highly satisfactory knowledge (37.3% vs. 29.2%) and practice (38.5% vs. 19.2%) than those >45 years. Brahmins (30.5%) were more likely to have highly satisfactory knowledge than Newars (27.6%), Chhetris (20.4%), and others (21.5%). Regarding highly satisfactory practice, the proportion was highest among Brahmins (41.3%), followed by Chhetris (30.8%), Newars (17.3%) and others (10.6%). Those who had no formal schooling exhibited higher proportion of highly satisfactory knowledge than those who had high school or more education (28.3% vs. 24.6%, but highly satisfactory practice is low among them (12.5% vs. 28.8%, data not shown).~~

DISCUSSION

The present study is the first to conduct a detailed analysis of the relationship between KAP/health literacy and cardiovascular health in a semi-urban setting near Kathmandu.

Cardiovascular risk factors are abundant in the study population

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Our respondents showed a high burden of behavioral and biological risk factors. ~~While the~~The prevalence of tobacco smoking ~~was~~and vegetable and fruit consumption were similar to ~~the~~ national ~~average, the~~averages and alcohol consumption was lower.[~~42~~43] ~~National figures on tobacco smoking and alcohol consumption for Bangladesh, Nepal, India and Pakistan show that current smoking of any tobacco product (age-standardized rate, both sexes) is 24%, 32%, 15% and 20%, respectively.[19] The total adult (recorded and unrecorded) per capita consumption of pure alcohol according to WHO-available projected estimates for 2008 indicates that consumption in Bangladesh, Nepal, India and Pakistan is 0.17, 2.42, 2.69, 0.05 litres of pure alcohol, respectively, over a calendar year.[19] Numbers have been increasing in these countries over the last years.[19]~~

In accord with our earlier review on obesity in Nepal, the effect of urbanization is evident in low physical activity and overweight/obesity that exceeds the national average.[~~21, 42~~22, 43] The prevalence of hypertension in our study population is similar to the national average (22%) but less by about one third than a study in Bhadrabas, a similar semi-urban Kathmandu community,[~~43~~44] most probably due to different age groups. ~~The 2008 national reported age-standardized level of hypertension in Nepal is similar to levels in Bangladesh but lower than in Pakistan (38.6% and 39.5%, respectively) and higher than in India (35.2%).[44]~~ Self-reported prevalence of diabetes mellitus (3.9%) confirms the HDSS baseline figure reported earlier.[~~20~~21]

~~Knowledge~~Poor knowledge of cardiovascular health ~~is limited~~

Our study population showed low overall knowledge of the causes of CVD. Unprompted responses suggested that respondents identified behavioral factors (e.g., smoking) more frequently than physiological causes (e.g., hypertension). Other studies have reported similar findings for unprompted[38] and prompted responses.[~~33~~34] Conversely, unhealthy diet, obesity, and family history were common responses in Taiwan.[~~31~~32] ~~In Vietnam, knowledge on the negative influence of tobacco smoking on stroke and heart attack is lower than general knowledge regarding health risks of active smoking and exposure to second hand smoke.[45]~~

American women frequently identified obesity.[35] Many of our respondents also attributed CVD to environmental factors such as food hygiene and air pollution. Indeed, acute inflammatory reactions to air pollutants accelerate coronary atherosclerosis and trigger arrhythmia or

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myocardial infarction.[46 45] Unlike the Strong Heart Study[39] in American populations, our results did not exhibit a higher probability of knowledge of a risk factor in persons who have that risk factor, demonstrating poor cardiovascular health literacy even among those already affected.

Similar to Pakistan,[15 17] a large majority (60%) of our respondents could not identify even one heart attack symptom. However, similar to an earlier study in Nepal,[16 18] 6%–22% of individuals in our demographic subsets recognized chest pain as a symptom, which is less compared to 60% of Vietnamese Americans who spontaneously mentioned chest pain.[47 47] Importantly, two thirds of heart attack patients delayed their arrival at a Karachi hospital because they did not recognize heart attack symptoms.[15 17] Similar to a previous study,[18] three quarters of our respondents believed they would immediately take a suspected heart attack patient to a hospital but one fifth did not answer the question or opted instead for home therapy or traditional healing. Combined with our earlier finding of not knowing heart attack symptoms, this lack of knowledge about appropriate action underscores the need to educate the Nepalese population about this issue. In contrast, 85% of Vietnamese Americans knew that they should immediately call 911 if they suspect a heart attack.[45 46] Despite inadequate knowledge about the causes of CVD, our respondents were much better informed about prevention measures. This finding concurs with the perception level of American women,[35] probably because enumerators asked prompted questions in this section of the questionnaire. In Taiwan, only 25% of respondents thought that CVD is preventable and 50% were "not sure."[31 32]

Inappropriate attitude toward cardiovascular health

In contrast to their opinion that behavioral modifications can prevent CVD, most of our respondents did not consider themselves at risk and did not want to alter their lifestyle. This may be explained by the Health Belief Model[48 47] (i.e., a person may be knowledgeable about disease prevention but is more likely to undertake prevention when s/he perceives herself/himself to be at risk of developing the disease). Others have described a similarly optimistic bias.[49 48] Risk indicators (e.g., number of cigarettes smoked; death of a parent due to CVD; and self-assessment of blood pressure, weight, and cholesterol levels) account for a 24% variance in perceived risk.[49 48] The likelihood of perceiving oneself at higher risk increases when the presence of a risk factor is known.[31 32] However, respondents often underestimate their cardiovascular risk.[49 48]

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Attempts ~~for~~toward better cardiovascular health practice/behavior

Compared to Nepal's national average (69%), only half of our respondents underwent blood pressure measurement in the previous year.[~~42~~44] Ninety percent of the known hypertensive population had their blood pressure under control, exceeding the 6% and 9.5% control rate reported in two other suburban Kathmandu studies[~~42,50~~44,49] and an urban study in Eastern Nepal (58.5%).[~~51~~50] Half of the smokers reported here that they had tried to quit smoking. Our questionnaire did not explore whether they had actually quit and did not identify the barriers against quitting, information that might be important for public health. The theory of reasoned action[~~48~~47] argues that intention is a critical component of healthy behavior. Although confirming the genuineness of intention is difficult, such intention may provide an opportunity for public health intervention. Importantly, we identified our respondents' reasons for attempting positive health behavior. Many constructs of the Health Belief Model,[~~48~~47] such as perceived benefit ("wanted to feel better"), cues to action ("encouraged by a health professional, etc."), fear ("death of a family member, etc."), appear to affect behavioral decisions.

~~**Influence of gender**~~

~~Although females were unintentionally oversampled, our analysis includes a gender-wise stratification~~**Gender**

Seventy percent of our respondents were women. We reported earlier a male: female ratio (1.15) in the population.[21] Enumerators used the Kish technique to select respondents at the household level, expecting a proportionate sampling.[23] However, enumerators might have interviewed more women than men because women were more likely to be available in the households when enumerators visited. Nevertheless, our analysis includes a gender-wise stratification, and we present data separately whenever we observed marked gender differences. In our study, more men than women smoked tobacco or drank alcohol. The prevalence of hypertension and self-reported diabetes was similar in both groups. On the other hand, low physical activity and obesity were higher in the women. Although men had better knowledge of heart disease, their attitude was similar to those reported by women. However, more women than men strongly agreed that their health was ultimately determined by God or a higher power. ~~Female gender is usually significantly related to good knowledge of cardiovascular disease.[52]~~A Canadian study[36] observed a similar knowledge level among women and men. One major factor for the gender

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discrepancy in our study is that more women (33.2%) than men (11.8%) lacked formal education~~, which in itself is alarming. In fact, illiteracy is one of the main risk factors along with behavioral factors in rural/urban Asian Indian women.[53]~~.

Effect of other socio-demographic variables on KAP

Age-wise, KAP/behavior scores decreased around 4% from the youngest to the oldest age group. An earlier study reported a higher level of knowledge among young respondents.[36] Interestingly, a study in adolescents reported a very poor level of cardiovascular knowledge.[54,51] Otherwise, knowledge levels rise linearly from childhood until middle age, when the level starts to plateau~~[55]~~.[52] In our study, better-educated respondents ate more fruit and consumed less tobacco and alcohol, but they also reported less physical activity and more hypertension. The highest education category (high school or more) scored higher than the lowest category (no formal schooling) but only by 3%–8%. Other studies observed a consistent link between better KAP scores and higher education.[~~31,36,52,56~~32, 36, 53] Occupation-wise, employed respondents knew more about biological causes (e.g., high blood pressure, diabetes, and high cholesterol), possibly due to more education, wider exposure to information, and better access to screening and treatment. A Canadian study reported similar findings.[~~36~~36]

Prompted vs. unprompted responses

Although we used unprompted responses to evaluate general knowledge, we used prompted responses to calculate scores, thus providing a denominator ("full marks") to calculate median score ~~%~~ percent. In other settings, KAP studies have variably used prompted[~~33,39,47,57~~34, 39, 46, 54] or unprompted questions;[~~16, 31~~18, 32, 38] ~~while~~ some studies used both.[~~35~~35] Other studies did not identify their chosen method.[~~32~~33] Although the accuracy of prompted vs. unprompted questions in knowledge assessment has been a topic of debate, prompted questions confer a higher level of knowledge.[~~58~~,55] When we analyzed knowledge responses based on prompted responses, the percent of correct answers increased drastically. The psychological explanation is that respondents must simply "recognize" answers to prompted questions, but they must engage in the more difficult mental process of "recalling" answers to unprompted questions.[~~59~~,56] We believe that unprompted responses more accurately reflect knowledge level because they emerge from a thought process that ~~in~~ involves respondents' knowledge, experience, and perception regarding a specific issue.

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~~**Comparison between levels of knowledge, attitude, and practice towards cardiovascular disease**~~

~~The findings of the study indicate that there is gap in knowledge attitude and practices. Poor relation~~**Poor correlation between KAP scores**

Poor correlation between KAP scores was unsurprising because a linear relationship between variables may not exist in cardiovascular health ~~(e.g. highly satisfactory knowledge=high satisfactory attitude and behavior).~~ Valente argued that each of six possible behavior change models contains a varying order of KAP/~~behaviour~~practice and that a population can be described in terms of the percentage that fits into each model.[60 57] This implies that no universal intervention can improve the cardiovascular health KAP of every individual in a community. The challenge lies in identifying individuals who fit into different linear models. Furthermore, health behavior theories (e.g., social cognitive theory and the theory of reasoned action~~)~~[48 47]) suggest that knowledge and attitude are only two components of the pathways that lead to behavior. Constructs (e.g., self-efficacy) and other personal and environmental factors (in social cognitive theory) and perceived behavioral control, subjective norms, and ultimately intention (in the theory of reasoned action) play crucial roles in shaping one's health behavior.[48 47]

~~**Study limitations**~~

~~Females were unintentionally oversampled (72.7%) although the male:female ratio of the study population is 1:1.15.[20] Women were more likely to be available in the households when enumerators visited as most of the females in our study were housewives. The age range is limited to 25–59 years as the age groups 60–64 and 70–74 years only constitute 1–2% of the total JD-HDSS population. Most of the respondents belonged to the caste/ethnic groups Brahmin, Chhetri, and Newar which are not representative of all caste/ethnic groups in Nepal. Further, respondents' and interviewers' mood as well as place and time of interview may influence the study and a recall bias may occur when questions are asked about history of CVD risk factors.~~

CONCLUSION

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Our community-based cross-sectional HARDIC study demonstrated poor knowledge, inappropriate attitude, and highly adverse behavior regarding cardiovascular health in a semi-urban community of Nepal ~~even among those already affected by CVD.~~ We aimed to determine a baseline KAP in the community to aid the planning of health promotion activities. Our results show the potential and possibility that community health promotion can improve cardiovascular health literacy.

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~~CONTRIBUTORS~~

Contributors

AV designed the study, performed statistical analysis, and drafted the manuscript. ~~URA performed statistical analysis and revised the manuscript.~~ AK helped design the study and provided critical revision of the manuscript. ~~All~~Both authors have read and approved the final manuscript.

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~~COMPETING INTERESTS~~

Competing interests

None declared.

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Data sharing

No additional data available.

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Figure legends:

Figure 1: Scattergrams showing correlation between median score percents for (a) knowledge and attitude, (b) attitude and behavior, and (c) knowledge and behavior (n=777).

Scores were obtained from the prompted knowledge questions, attitudinal questions, and practice/behavior responses. Median score percents were calculated and plotted. See Supplement for greater detail about score derivation.

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