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Cardiovascular Risk Factor Knowledge and Behaviors Among Low-Income Urban Women in Mysore, India

Karl Krupp, PhD [Postdoctoral Fellow],

Department of Health Promotion Sciences, Mel & Enid Zuckerman College of Public Health,
University of Arizona, 1295 N. Martin Avenue, P.O. Box 245209, Tucson, AZ 85724, USA;

Public Health Research Institute of India, 89/B, 2nd Cross, 2nd Main, Yadavgi, Mysuru 560070,
Karnataka, India

Meredith L. Wilcox, MPH,

Midwest Biomedical Research/Center for Metabolic and Cardiovascular Health, Addison, IL, USA;

MB Clinical Research, Boca Raton, FL, USA

Arun Srinivas, MD,

Department of Cardiology, Apollo Hospital, Adichunchanagiri Road, Kuvempu Nagara, Mysuru,
Karnataka 570023, India

Vijaya Srinivas, DGO,

Public Health Research Institute of India, 89/B, 2nd Cross, 2nd Main, Yadavgi, Mysuru 560070,
Karnataka, India

Purnima Madhivanan, PhD [Associate Professor],

Department of Health Promotion Sciences, Mel & Enid Zuckerman College of Public Health,
University of Arizona, 1295 N. Martin Avenue, P.O. Box 245209, Tucson, AZ 85724, USA;

Public Health Research Institute of India, 89/B, 2nd Cross, 2nd Main, Yadavgi, Mysuru 560070,
Karnataka, India

Elena Bastida, PhD [Professor & Chair]

Department of Health Promotion and Disease Prevention, Stempel College of Public Health,
Florida International University, 11200, SW 8th Street, Miami, FL 33199, USA

Abstract

Background: Cardiovascular diseases (CVD) are the leading causes of death among women globally. CVD-related events are more common in older women compared to men, and more likely to result in death. While research in high income countries suggests women have unique sociobiological CVD risk factors, only a few studies have examined risk factor knowledge among women from low- and middle-income countries.

Objective: Assess CVD risk factor knowledge among low-income urban Indian women.

CORRESPONDING AUTHOR: Karl Krupp, M.Sc., Ph.D., Department of Health Promotion Sciences, Mel & Enid Zuckerman College of Public Health, University of Arizona, 1295 N. Martin Avenue | P.O. Box 245209 | Tucson, AZ 85724-5209, kkrupp@email.arizona.edu.

Conflicting Interest: None

Methods: A cross-sectional study was conducted among a nonprobability sample of 607 slum-dwelling women, 40 – 64 years of age, living in Mysore, India, between October 2017 and May 2018. Participants underwent an interviewer-administered questionnaire measuring demographics, CVD risk factor knowledge, and medical history.

Results: CVD risk factor knowledge was low in this population and was associated with age, education, income and caste. About half (47%) of participants answered less than 50% of questions correctly, and a third had knowledge scores above 70%, which we defined as ‘good knowledge’. Only four of seven traditional CVD risk factors (physical activity, smoking, overweight, and high cholesterol) were recognized by greater than half of participants. The lowest knowledge levels were among older single women with no education and monthly household incomes below 3000 INR (approximately \$42 USD).

Conclusions: Previous research among slum dwellers in India reported a high prevalence of modifiable CVD risk factors compared to more affluent urban peers. Interventions aimed at CVD risk factor knowledge may be an important first step in controlling heart disease in this vulnerable population.

Keywords

Women; Cardiovascular Diseases; India; Knowledge; risk factors

INTRODUCTION

Worldwide, about 17.9 million people die each year from cardiovascular disease (CVD); this represents roughly a third (31%) of all mortality¹. Three-quarters of these deaths occur in lower- and middle-income countries (LMIC) where CVDs are now the leading causes of death¹. While the age-standardized mortality rates for CVD remain higher among men, actual lifetime risk for CVD is similar in both genders^{2, 3}. Women develop heart diseases about seven to 10 years after men, and experience the steepest increases in CVD mortality following menopause^{4, 5}.

Low- and Middle-Income Countries (LMIC) are experiencing a CVD epidemic that closely parallels the rapid urbanization of emerging nations across the world^{6, 7}. Growing evidence suggests that living in cities is associated with increases in unhealthy lifestyles, tobacco and alcohol, sedentarism, and adoption of diets high in salt, sugar and fat⁸. Slums, or densely populated urban areas characterized by inadequate housing and a lack of essential services, tend to amplify these effects⁹. In India, there are currently as many as 98 million people living in urban slums with some of the highest rates of chronic disease among India’s urban communities^{10–15}.

The World Health Organization (WHO) estimates that 80% of premature heart disease is preventable¹⁶. Population-based studies suggest that lifestyle changes and management of seven modifiable cardiovascular risk factors (blood pressure, cholesterol, serum glucose, physical activity, diet, weight, and smoking) could reduce CVD risk by as much as two-thirds^{17–19}. In high-income countries, prevention efforts have focused on improving CVD risk factor knowledge since this knowledge has been shown a prerequisite to the lifestyle

changes required for reducing CVD morbidity and mortality^{20, 21}. While data about CVD risk factors and their relationship to premature heart disease are limited for many LMIC²², existing studies suggest generally low population knowledge about the causes of heart disease and stroke, particularly among populations at highest risk^{23–25}.

In LMIC, women are heavily overrepresented in older age groups most affected by CVD²⁶. Evidence suggests they face widespread discrimination in healthcare and this is reflected in lower use of preventative services, poorer health literacy, and a higher prevalence of chronic disease in later life²⁷. A study of more than 2 million outpatient visits in India, for instance, showed an overall 1.69 male to female ratio; this ratio increased to 1.75 among people aged 60 years and older²⁸. Since most health-related data in India are obtained from public hospitals and public health-care service units²⁹, the health needs of these elderly women are likely to be largely unrepresented in Indian public health research and programming³⁰.

While there have been a number of studies that examined the prevalence of CVD risk factors in India, little is known about levels of CVD risk factor knowledge among urban slum dwellers^{31–35}. The majority of existing studies were carried out in tertiary care hospitals^{36–38} or rural settings^{39–41}, and these reported relatively low knowledge about underlying risks for heart disease. The only study examining CVD risk knowledge in urban adults was carried out in Bangalore among a young (82% were under age 50) and well-educated (64% of participants who had completed secondary school or higher education) sample⁴². This study is one of the first to examine CVD risk factor knowledge among urban middle-age slum-dwelling women in India.

METHODS

Overview

This analysis is the first paper to describe data from *Mera Dil* study which examined coronary heart disease among a nonprobability sample of urban women, 40 – 64 years of age, living in registered slums in Mysore city, India, between October 2017 and May 2018. Along with CVD risk factor knowledge, data were collected on biological and reported measures of anemia, blood pressure, lipids, serum glucose, physical activity, diet, weight, smoking, anthropometry, medical and family history of chronic disease, diet, sleep, and reproductive history.

Study Sites and Population

The study was carried out in six urban slums in Mysore, India, (*Kesere, Kudaremalu, Ekalavya Nagara, Amrutha badavane, K N Pura and Ganeshnagar*) randomly selected from a sampling frame of 63 communities officially designated as ‘notified’ slums by the Karnataka Slum Development Board⁴³. According to the 2011 census, Mysore as a whole had a population of 920,550, of which 459,508 were women⁴⁴. Approximately 73.6% of the city’s residents are Hindus, 21.9% Muslims, 2.8% Christians, and the remainder, other religions. The literacy rate for the entire city is 87.7%, and *Kannada* is the most widely spoken regional language. Approximately one in five residents lived below the poverty line, and about 39,029 residents lived in slums (as defined by the Karnataka Slum Act). While

individual-level census data is unavailable for slum residents, the reported size of slum communities is estimated to be from several hundred to several thousand people⁴⁵. Most slum dwellers in South India migrated from rural areas as the result of droughts, erratic rainfall, or accumulated debts^{31, 46}. While there is considerable heterogeneity in conditions, a large percentage lack potable water, regular electricity, sanitation, and access to healthcare, and live in substandard housing with high-overcrowding^{45, 46}. The study population included consenting women, aged 40–64 years, who had lived in study slums for the prior six months.

Theoretical Framework

The Precaution Adoption Process Model (PAPM) by Weinstein and Sandman was used as a theoretical framework in the *Mera Dil* study to help understand the relationship between knowledge and readiness to adopt heart healthy behaviors⁴⁷. PAPM posits that adoption and maintenance of health behaviors is associated with a series of stages. According to the theory, people may be: (1) unaware of an issue; (2) aware of an issue but not personally engaged by it; (3) engaged and deciding what to do next; (4) planning to act, but not yet acting; (5) deciding not to act; (6) taking-action; and (7) maintaining the results of an action. Each stage has specific patterns of beliefs, behaviors, and experience. PAPM suggests that specific factors are associated with advancement across the continuum, and others are necessary for stage transitions. In this study, PAPM stage will be identified with seven stage descriptions adapted from a study by Patricia Weinstein, which assessed awareness of cardiovascular risk in women with Systemic Lupus Erythematosus⁴⁸: 1) I don't think I'm at greater risk of getting heart disease than any other person; 2) I know I am at risk for heart disease but I haven't thought much about it; 3) I am thinking about changing my behaviors to decrease my chances for getting heart disease, but I haven't made up my mind it's something I want to do; 4) I have thought about changing some of my behaviors to decrease my chances for getting heart disease but I have decided against it; 5) I have decided to change some of my behaviors to decrease my chances for getting heart disease, but I have not started doing them yet; 6) I have recently changed some of my behaviors within the last month to decrease my chances for getting heart disease; and 7) I have made changes in my behavior to decrease my chances for getting heart disease for at least six months. The questionnaire sought to identify: 1) knowledge and beliefs about CHD risk factors and personal risk; 2) thought patterns associated with intentions to maintain health behaviors or adopt new ones; 3) weight loss and attempted weight loss; 4) smoking cessation and attempted smoking cessation; 5) discontinuation or lowered alcohol use; 6) health-seeking and lifestyle changes to lower serum cholesterol, blood pressure, and serum glucose; and 7) adoption or non-adoption of physical activity and other healthier behaviors. PAPM was operationalized using the Adoption of Risk Reducing Behaviors Instrument (ARRBI) adapted from a measure developed and validated by Weinstein *et al*⁴⁸.

Study Recruitment

Study staff visited selected slums one day prior to study recruitment and distributed study brochures in *Kannada* which described the study purpose and activities. Potential participants interested in participating were instructed to come to a specified meeting point having fasted from 8.00 PM the previous evening. They were asked to bring any of their

medical reports or medications that concerned diabetes, heart disease, or stroke, as well as reports that detailed physical examinations and blood tests, particularly those that had measures of anemia, high blood pressure, cholesterol, or serum glucose. On recruitment day, participants were transported by van to a medical clinic, where all study activities were carried out. Prior to the beginning of data collection, participants underwent a group informed consent process that consisted of study staff explaining the study purpose, reading the informed consent document out loud verbatim, and describing all study procedures. Because this was a vulnerable population, we explained that while there were potential benefits for participation—enrolled participants received a free medical examination, a resting electrocardiogram to assess the electrical activity of their heart at rest, blood tests for anemia and lipid profile, and a referral for a free visit to the cardiology department at a local tertiary care hospital (Apollo Hospital) if we detected any issues—there also were risks including discomfort in answering some health questions, and the possibility of minor physical discomfort and infection at the site of the blood draw. Questions from participants were answered until participants indicated they had no further questions. Those who wished to enroll in the study were taken to private space and study staff met with them on a one-on-one basis to read the consent document out loud a second time and clarify any doubts. If potential participants decided to participate, they were required to give informed consent prior to data collection. A brief anonymous survey was then read aloud verbatim to potential participants who declined to enroll to determine if there were any systematic biases in participant recruitment. Participants received INR 200 (USD 3.33), an amount traditional for studies of this type, to compensate them for their time and transportation expenses. A protocol for the study was reviewed and approved by Institutional Review Boards at Florida International University in Miami, USA, and the Public Health Research Institute of India in Mysore, India.

Translation and Cross-cultural Adaptation of Instruments

Kannada language versions of study measures were translated and tested prior to data collection with the goal of producing culturally relevant instruments that were conceptually equivalent to English versions. This was accomplished in a four-step process: 1) Forward translation from English to *Kannada*, the local regional language; 2) Expert panel back-translation from *Kannada* to English; 3) Pre-testing (PT) and cognitive interviewing among a sample of study participants to establish equivalency; and 4) development of a final version based on input from Pre-testing and cognitive interviewing⁴⁹. Detailed information on the methods used for translation and cross-cultural adaptation can be found elsewhere⁴⁹. Study instruments included:

1. Study Questionnaire: A standardized interviewer-administered questionnaire adapted from the CARRS (Centre for cArdiometabolic Risk Reduction in South-Asia) Surveillance Study⁵⁰. A trained interviewer read survey questions to participants and data were collected on demographics, socio-economic status, current employment, and residence. Information on tobacco and alcohol consumption, dietary habits, physical activity, sleep, and quality of life were also collected along with personal and family history of diagnosed cardio-metabolic disorders and their risk factors; diabetes; heart disease, stroke, chronic

obstructive pulmonary disease, angina, peripheral vascular disease, kidney disease, and respiratory disease. Sleep duration and quality were measured with scales adapted from the National Heart Lung Blood Institute (NHLBI) Sleep Habits Questionnaire which covered sleep characteristics, patterns, and snoring⁵¹. Daytime sleepiness was measured using an adapted Epworth Sleepiness Scale (ESS)⁵². Medical history and medication adherence were collected in five disease-specific sections on Hypertension, Diabetes, Hyperlipidemia, Heart Disease, Stroke, and Chronic Kidney Disease. Adherence was quantified with the question: “How regular are you in taking your physician-prescribed medicines for [the condition]?”. There were five possible responses: 1. Taking regularly; 2. Forget to take occasionally; 3. Take medications only when I feel [the condition] is high; 4. Discontinued for more than a month at a time; and 5. Never taken any medications.

2. **Heart Disease Risk Factor Knowledge:** A 17-item instrument measuring participant knowledge of heart disease risk factors was adapted from Wagner *et al*'s Heart Disease Fact Questionnaire (HDFQ)⁵³. HDFQ measures 10 cardiovascular risk domains: family history of heart disease, age, sex, smoking, physical activity, glycemic control, lipids, blood pressure, weight, and whether a person would know if heart disease was present. Seventeen items were included in the HDFQ after extensive pretesting, cognitive interviewing and adaptation for cultural relevance, understandability, and ease of administration and scoring. Response options on the HDFQ were ‘yes’, ‘no’, and ‘I don’t know’.
3. **Adoption of Risk Reducing Behaviors Instrument (ARRBI):** The AARBI, a measure operationalizing the PAPM theoretical framework, was adapted from a measure developed and validated by Weinstein *et al*⁴⁷. Participants were asked to “Select one answer that best describes your feelings about your behavior and changes of getting heart disease”. Responses could be classified into one of the seven PAPM stages: 1. Unaware of the Issue, 2. Unengaged by the Issue, 3. Undecided about Acting, 4. Decided not to Act, 5. Decided to Act, 6. Acting, 7. Maintenance.

Study Variables

CVD Risk Factor Knowledge was measured using the HDFQ. ‘Don’t Know’ responses were scored as incorrect answers. Heart disease risk factor knowledge was classified as poor (<50% correct answers), moderate (50–69% correct answers) or good knowledge (70% correct answers). Readiness to adopt heart healthy behaviors was assessed from participant responses that could be categorized into: Unaware of the Issue, Unengaged by the Issue, Undecided about Acting, Decided not to Act, Decided to Act, Acting, and Maintenance. Participant response was classified as reporting durable behavior change if they selected the response option: “I have changed my behavior to reduce my risk for heart disease and have maintained that change for six or more months.”

Statistical Analysis

Data were presented as frequencies and percentages of total for categorical variables, and as means and standard deviations (SD) or medians for continuous variables. Multinomial logistic regression models were used to identify significant factors of CVD knowledge. Factors that were conservatively associated with CVD knowledge ($p < 0.200$ for appropriate tests) were selected *a priori* as covariates. Variables were excluded from the model if there was little variation in response (if 90% of the sample fell into a single response category) or if variables were highly correlated. Correlation and multicollinearity were assessed using Pearson's correlation coefficients and variance inflation factors (VIFs), respectively. All analyses used a two-tailed level of significance of $\alpha = 0.05$ and were carried out using SPSS 22 or higher (SPSS statistics IBM Corp. Armonk, NY, USA). Odds ratios and corresponding confidence intervals and p-values were generated using GENLINMIXED with the covariate(s) as fixed effect(s) and slum as a random effect.

RESULTS

Sample Characteristics

Participants averaged 50 years of age, and a large majority reported their religion as Hindu (84.2%) (Table 1). Nearly two out of three participants had no formal schooling (62.8%) and six in ten were employed (61.4%). Half were married (51.4%), slightly less than half (47.1%) belonged to a scheduled caste or tribe, and a majority (53.0%) lived in a household with a monthly household income ranging from 3,000 to 10,000 Indian Rupees (1 USD=66.78 INR).

CVD Risk Factor Knowledge among Slum-dwelling Indian Women

Responses to the CVD risk factor knowledge measures are included in Table 2. In general, knowledge about CVD risk factors was extremely poor in this population. Scores on the HDFQ ranged from 0.0 to 94.1 with a mean score of 49.7 (standard deviation: ± 29.9). Nearly half of the participants were categorized as having poor knowledge about CVD risk factors (47.3%), while only one-third had good knowledge (33.9%). Among participants, the most frequently recognized CVD risk factors were lack of physical activity (66.9%), smoking (66.7%), being overweight (64.1%), and having high cholesterol (61.6%). Only 46%, 45%, 43.5%, and 27.3% of women respectively knew that age, having hypertension, having family history of heart disease, or having diabetes increased risk for CVD. While a majority of women (60.6%) said that quitting cigarettes would reduce their risk for heart disease, only 43.2% believed that managing their serum glucose levels would alter their CVD risk.

CVD risk factor knowledge was significantly associated with age, education, monthly household income, marital status, and caste (Table 3). Lower age was significantly associated with greater CVD knowledge. The average age ($\pm$ SD) of women with low knowledge was 51.4 years (± 7.3); moderate knowledge 48.5 years (± 7.3); and good knowledge 49 years (± 7.1). Greater educational achievement was also associated with higher CVD knowledge scores: 71% of the respondents in the poor CVD knowledge category had no schooling, compared to 55.3% in both the moderate or good knowledge category.

Similarly, only 3.8% of women in the poor knowledge category reported having a secondary school education or higher, while 10.5% and 12.1% of the participants with moderate and good knowledge respectively, had completed high school or a higher level of education. The mean number of “don’t know” responses for each item on the risk factor assessment was significantly lower among women with secondary education vs. no schooling (4.7 vs. 8.3, $p<0.001$); and significantly lower among women with high school education vs. no schooling (5.7 vs. 8.3, $p<0.001$). CVD knowledge was low across all income categories with the lowermost knowledge scores found among people with lower incomes; 54.3% among the <3000 INR group (<\$42 USD); 42.7% in the 3000–10000 (\$42 - \$139) INR group; and 51.3% of participants with family incomes >10,000 INR (>\$139) had poor knowledge about CVD risk factor knowledge. Having marital status as being single (71.4%) was associated with poor risk factor knowledge as was being a member of a general caste as compared to scheduled castes or tribes (SC/ST) or Other Backward Castes; 50.3% of SC/ST, 40.6% of Other Backward Castes, and 52.9% of General Caste women, had poor CVD risk factor knowledge scores. CVD risk factor knowledge was not associated with hypertension, diabetes, hyperlipidemia, or CVD medication adherence (data not shown).

PAPM and CVD Risk Behavior

Of the 607 women completing the ARRBI, 60% ($n=364$) reported that they had not been thinking about changing their behavior to reduce their risk for heart disease and did not intend to do so in the next 6 months; 7.6% ($n=46$) reported they were not changing their behavior to reduce risk for heart disease but intended to do so in the next six months; 3.8% ($n=23$) reported having decided what behavior (weight loss, quitting smoking, etc.) they needed to change; 4.4% ($n=27$) reported having changed behavior within the last six months; and 24.2% ($n=147$) reported having changed behavior for six or more months. Among participants who reported not having thought about changing their CVD risk behavior; 55.2% had poor, 17.6% moderate, and 27.2% good knowledge about CVD risk factors, respectively.

Among participants who reported an intention to change their behavior in the next six months, 28.3% had poor, 30.4% moderate, and 41.3% good CVD risk factor knowledge; those that had made behavior changes but not yet maintained that change for more than six months, 40.7%, 18.4%, and 40.7% had poor, moderate, and good knowledge respectively; and among those who had maintained CVD risk factors for more than six months, 37.4%, 18.4% and 44.5% had poor, moderate, and good knowledge, respectively. There was a significant association between CVD risk factor knowledge and risk behavior ($p<0.001$).

Factors Associated with CVD Knowledge

The results of the multinomial logistic regression models are presented in Tables 4a and 4b. Age, education, religion, and CVD risk behaviors were significant correlates of poor (compared to good) CVD knowledge. For every one-year increase in age, the odds of poor (compared to good) CVD knowledge significantly increases by 4% ($p=0.007$). As compared to no schooling, the odds of having poor (compared to good) CVD knowledge was 50% and 69% lower among participants with a high school diploma and those educated beyond high school, respectively ($p=0.011$ and $p=0.004$, respectively). Women belonging to Muslim

religion and those that reported they had not been thinking about changing their behavior to reduce their risk for CVD had over two times the odds of poor (compared to good) CVD knowledge as women belonging to Hindu religion and those who said they had changed their behavior and maintained it for more than six months, respectively ($p=0.031$ and $p<0.001$, respectively).

The only significant factor of moderate (compared to good) CVD knowledge was caste. The odds of moderate (compared to good) CVD knowledge was 53% lower among women who were members of a scheduled caste or tribe compared to those who were members of a general caste ($p=0.034$).

DISCUSSION

This research was part of a larger study assessing the burden of coronary heart disease in slum-dwelling women in Mysore, India. Considering that more than 104 million people live in Indian urban slums, surprisingly little is known about the prevalence and correlates of CHD in this population. As Riley *et al* had observed, we know almost nothing about the “magnitude, distribution, and risk factors for these illnesses before they manifest as stroke, [AND] myocardial infarction...”⁵⁴. To our knowledge, this is one of the first studies to assess knowledge levels about modifiable CVD risk factors among India’s slum-dwelling population. This study correlated knowledge levels with health-related behavior change assessed using a PAPM model.

In this study, we found that slum-dwelling women had low knowledge about modifiable CVD risk factors; a finding consistent with studies of low-income urban populations in other parts of India and the world^{23, 37, 55}. Muslim women had over two times the odds of poor (compared to good) CVD knowledge as women belonging to Hindu religion. This is consistent with other Indian studies suggesting that Indian Muslims appear to have disparities in overall access to medical care and healthcare spending compared to Hindus and other Indian minorities⁵⁶. About half (47%) of the participants answered less than 50% of questions correctly, and only a third had knowledge scores above 70%, which we defined as ‘good knowledge’. Only four of seven traditional CVD risk factors; physical activity, smoking, overweight, and high cholesterol were recognized by greater than half of participants. On the other hand, only 46%, 43.5%, and 27.3% of women respectively knew about some of the most important risk factors including hypertension, family history of heart disease, or diabetes increased risk for CVD. Consistent with studies in other disadvantaged populations, we found that CVD risk factor knowledge was significantly associated with age, education, monthly household income, and marital status^{57–59}. The lowest knowledge levels were found among older single women with no education and monthly household incomes of less than 3000 INR (approximately \$42 USD). Furthermore, women with no schooling had more ‘Don’t know’ responses as compared to women with secondary education or more. Interestingly, women in lower castes had more knowledge about CVD risk factors than those in general or higher castes. We speculate that this increased knowledge is due to greater healthcare access provided by the Government of India’s National Urban Health Mission, which provides low- and no-cost medical treatment to the lowest income families in India’s urban slums.

In this study, we found that knowledge of CVD risk factors was significantly associated with reported change and maintenance of health behavior. This finding is consistent with other studies reporting that adequate knowledge about health risk is an important prerequisite for making appropriate health decisions^{60, 61}, but the present study design was inadequate for assessing whether knowledge alone was sufficient to facilitate change or maintenance of health behavior. A large body of theory suggests that health behaviors are complicated and multi-factorial, and behavior change is dependent on a large number of internal factors including attitudes, beliefs, motivation, self-efficacy, social norms, and sociocultural contexts^{62, 63}. Evidence from research using social-ecological frameworks also suggests that low-income urban environments like slums present substantial barriers to health and behavior change⁶⁴. Food deserts and poor transportation make accessing adequate nutrition difficult or even impossible; the need for personal safety may preclude walking beyond a person's immediate neighborhood; and the most basic services including healthcare, electricity, and potable water are often unavailable or inaccessible to slum populations^{65, 66}.

There is a clear and significant association between low health knowledge, adverse health outcomes, and poor use of health-care services⁶⁷. Studies also suggest that higher levels of health knowledge influences attitudes toward behavior change, improves self-regulation skills and abilities, and enhance health outcomes⁶⁸. The finding that 60% of participants in this study reported they were not thinking about changing their heart health behavior and a majority (55.2%) of those had poor knowledge about heart disease risk factors, points to a serious public health problem. While India currently does not have an integrated health education curriculum in its schools that includes information on CVD and its risk factors, there have been recent calls for comprehensive health promotion in schools, social marketing, and mass media campaigns to increase population knowledge about the need for heart healthy lifestyles^{69, 70}. Data from this study reinforces the need for greater awareness and control of CVD risk factors particularly in vulnerable populations with low access to healthcare.

This study has several limitations. Our sample of 607 slum-dwelling women was small and limited to a nonprobability sample of women who agreed to participate, limiting the generalizability of the findings. The participants self-reported smoking; alcohol use; diet; and sleep duration and quality; and the accuracy of this data is likely limited by social desirability and recall biases. Despite these limitations, the study also had strengths including being one of the first studies to examine knowledge about CVD risk factors in an Indian slum population with the study being informed by the Precaution Adoption Process Model that has been widely used to study lifestyle change to prevent cancer and chronic diseases^{71–74}.

CONCLUSIONS

Previous studies among slum-dwellers in India report a high prevalence of modifiable CVD risk factors compared to their more affluent urban peers. Our results suggest that that interventions aimed at educating slum-dwellers about CVD risk factors may be an important first step to controlling the burden of cardiovascular disease among some of India's most vulnerable populations.

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What is new:

- Slum-dwelling women had low knowledge about modifiable CVD risk factors.
- One of the first studies to assess knowledge levels about modifiable CVD risk factors among India's slum-dwelling population.
- This study correlated knowledge levels with health-related behavior change assessed using a PAPM model.

Table 1.

Sociodemographic characteristics of sample of slum dwelling women in Mysore, India (N=607)

	N	%
Age (in years)		
Mean (SD)	50.035	(7.318)
Median (Q1, Q3)	50	(44, 55)
Education		
No schooling	381	62.8
Primary school	61	10.0
High school	117	19.3
Secondary and above	48	7.9
Religion		
Hindu	510	84.2
Muslim	76	12.5
Christian	20	3.3
Caste		
SC/ST	286	47.1
Other backward caste	217	35.7
General caste	104	17.1
Marital Status		
Single	7	1.2
Married	312	51.4
Other	288	47.4
Work Status		
Employed	373	61.4
Housewife	234	38.6
Monthly Household Income (INR)		
<3000	129	21.3
3000–10,000	321	53.0
>10,000	156	25.7
BMI		
Underweight/normal	270	45.8
Overweight	91	15.4
Obese I	171	29.0
Obese II	57	9.7

Abbreviations: SD= standard deviation; Q1= first quartile; Q3= third quartile; SC/ST= scheduled caste/scheduled tribe; INR= Indian Rupees; BMI= body mass index

Education: Defined as: No Schooling, Primary School (1–7 years), High School (8–12 years), and Secondary School or above (12+ years)

Marital Status: "Other" includes separated, divorced, and widow/widower.

BMI: Underweight < 18.5 kg/m²; Normal weight 18.5–22.9 kg/m²; Overweight= 23–24.9 kg/m²; Obese I= 25–29.9 kg/m²; Obese II = 30 kg/m² and above

Table 2.

Responses to the Heart disease risk factor knowledge measures among a sample of slum dwelling women in Mysore, India (N=607)

Item	Question	Correct answers	
		n	(%)
1	A person always knows when they have heart disease	FALSE 376	(61.9)
2	If you have a family history of heart disease, you are at risk for developing heart disease.	TRUE 166	(27.3)
3	The older a person is, the greater their risk of having heart disease.	TRUE 279	(46.0)
4	Smoking is a risk factor for heart disease	TRUE 405	(66.7)
5	A person who stops smoking will lower their risk of developing heart disease	TRUE 368	(60.6)
6	High blood pressure is a risk factor for developing heart disease	TRUE 273	(45.0)
7	Keeping blood pressure under control will reduce a person's risk for developing heart diseases.	TRUE 267	(44.0)
8	High cholesterol is a risk factor for developing heart disease.	TRUE 374	(61.6)
9	Eating fatty foods does not affect blood cholesterol levels	FALSE 21	(3.5)
10	Being overweight increases a person's risk for heart disease.	TRUE 389	(64.1)
11	Regular physical activity will lower a person's chance of getting heart disease	TRUE 406	(66.9)
12	Diabetes is a risk factor for developing heart disease	TRUE 264	(43.5)
13	High blood sugar makes the heart work harder	TRUE 234	(38.6)
14	A person who has diabetes can reduce their risk of developing heart disease if they keep their blood sugar levels under control	TRUE 262	(43.2)
15	Abdominal obesity (fat belly) is a risk factor for developing heart diseases	TRUE 329	(54.2)
16	Stress may cause an increase in blood sugar, blood pressure, and cholesterol levels	TRUE 434	(71.5)
17	Slow deep breaths, counting to 10 before speaking, going for a walk, are examples of stress stoppers	TRUE 283	(46.6)
Total Score		49.7%	

Heart disease risk factor knowledge by social economic status among a sample of slum dwelling women in Mysore, India (N=607)

Table 3.

SES Factor	Heart Disease Risk Factor Knowledge*						P-value	
	Poor		Moderate		Good			
	n	(Col %)	n	(Col %)	n	(Col %)		
Age (in years)	Mean (SD)	51.4	(7.3)	48.5	(7.3)	49.0	(7.1)	<0.001
	Median (min, max)	50.0	(40.0, 64.0)	48.0	(40.0, 64.0)	47.0	(40.0, 64.0)	
	Secondary or above	11	(3.8%)	12	(10.5%)	25	(12.1%)	0.001
	High school	43	(15.0%)	28	(24.6%)	46	(22.3%)	
	Primary school	29	(10.1%)	11	(9.7%)	21	(10.2%)	
Educational Status	No schooling	204	(71.1%)	63	(55.3%)	114	(55.3%)	
	<3,000	70	(24.4%)	16	(14.0%)	43	(21.0%)	0.037
	3,000–10,000	137	(47.7%)	74	(64.9%)	110	(53.7%)	
	>10,000	80	(27.9%)	24	(21.1%)	52	(25.4%)	
	Employed	168	(58.5%)	74	(64.9%)	131	(63.6%)	0.367
Employment Status	Housewife	119	(41.5%)	40	(35.1%)	75	(36.4%)	
	Single	5	(1.7%)	0	(0.0%)	2	(1.0%)	0.021
Marital Status	Married	134	(46.7%)	73	(64.0%)	105	(51.0%)	
	Other	148	(51.6%)	41	(36.0%)	99	(48.1%)	
Religion	Hindu	244	(85.3%)	91	(79.8%)	175	(85.0%)	0.582
	Muslim	35	(12.2%)	18	(15.8%)	23	(11.2%)	
	Sikh	0	(0.0%)	0	(0.0%)	0	(0.0%)	
	Christian	7	(2.5%)	5	(4.4%)	8	(3.9%)	
	SC/ST	144	(50.2%)	39	(34.2%)	103	(50.0%)	0.008
Caste	Other backward caste	88	(30.7%)	54	(47.4%)	75	(36.4%)	
	General caste	55	(19.2%)	21	(18.4%)	28	(13.6%)	

Notes: Heart disease risk factor knowledge is defined as poor (<50% correct answers), moderate (50–69% correct answers) or good knowledge (>70% correct answers).

Education: Defined as: No Schooling, Primary School (1–7 years), High School (8–12 years), and Secondary School or above (12+ years)

Marital Status: "Other" includes separated, divorced, and widow/widower.

Table 4a.

Logistic regression analysis of the association of demographic characteristics with knowledge (Poor vs. Good) about heart health among slum dwelling women in Mysore, India.

	Knowledge Factor	Unadjusted Model			Adjusted Model		
		OR	(95% CI)	P-value	AOR	(95% CI)	P-value
Poor (vs. Good)		1.05	(1.02, 1.07)	0.001	1.04	(1.01, 1.07)	0.007
Educational Status	Age (in years)						
	Secondary or above	0.25	(0.12, 0.52)	<0.001	0.31	(0.14, 0.68)	0.004
	High school	0.52	(0.32, 0.84)	0.008	0.50	(0.30, 0.85)	0.011
	Primary school	0.77	(0.42, 1.42)	0.404	0.83	(0.43, 1.62)	0.588
Monthly H. Income (INR)	No schooling	Ref.			Ref.		
	<3,000	1.06	(0.63, 1.78)	0.830	0.72	(0.40, 1.29)	0.265
	3,000–10,000	0.81	(0.53, 1.225)	0.337	0.70	(0.43, 1.12)	0.137
	>10,000	Ref.			Ref.		
Employment Status	Employed	0.81	(0.56, 1.17)	0.258	0.88	(0.58, 1.32)	0.526
	Housewife	Ref.			Ref.		
Religion	Hindu	Ref.			Ref.		
	Muslim	1.09	(0.62, 1.92)	0.760	2.20	(1.07, 4.51)	0.031
	Christian	0.63	(0.22, 1.77)	0.378	0.86	(0.28, 2.62)	0.794
Caste	SC/ST	0.71	(0.42, 1.20)	0.202	0.76	(0.44, 1.33)	0.336
	Other backward caste	0.60	(0.34, 1.04)	0.067	0.54	(0.28, 1.02)	0.058
	General caste	Ref.			Ref.		
Intent to Change Behavior							
	I have not been thinking about changing my behavior to reduce my risk...I do not intend to do so in the next 6 months.	2.40	(1.56, 3.71)	<0.001	2.61	(1.65, 4.12)	<0.001
	I am currently not changing my behavior to reduce my risk for heart disease but I intend to do so in the next 6 months.	0.81	(0.37, 1.79)	0.600	0.98	(0.43, 2.25)	0.961
	I have decided what behavior (wt loss, quitting smoking, etc.) I need to change to reduce my risk for heart disease.	0.69	(0.25, 1.88)	0.467	0.68	(0.24, 1.98)	0.482

Knowledge Factor	Unadjusted Model			Adjusted Model		
	OR	(95% CI)	P-value	AOR	(95% CI)	P-value
I have changed my behavior to reduce my risk for heart disease but it is <6 months since I started.	1.18	(0.47, 2.95)	0.720	1.18	(0.45, 3.13)	0.736
I have changed my behavior to reduce my risk for heart disease and I have maintained that change for 6 months.	Ref.		Ref.	Ref.		

Table 4b.

Logistic regression analysis of the association of demographic characteristics with knowledge (Moderate vs. Good) about heart health among slum dwelling women in Mysore, India.

	Knowledge Factors	Unadjusted Model			Adjusted, Full Model		
		OR	(95% CI)	P-value	AOR	(95% CI)	P-value
Age (in years)		0.99	(0.96, 1.02)	0.507	1.00	(0.96, 1.03)	0.830
Educational Status	Secondary or above	0.87	(0.41, 1.85)	0.715	0.75	(0.33, 1.70)	0.494
	High school	1.10	(0.63, 1.94)	0.737	0.96	(0.52, 1.77)	0.884
	Primary school	0.95	(0.43, 2.10)	0.895	1.01	(0.43, 2.40)	0.980
	No schooling	Ref.			Ref.		
Monthly Income (INR)							
	<3,000	0.81	(0.38, 1.71)	0.574	0.79	(0.35, 1.75)	0.553
	3,000–10,000	1.46	(0.83, 2.57)	0.193	1.49	(0.82, 2.71)	0.196
	>10,000	Ref.			Ref.		
Employment Status							
	Employed	1.06	(0.66, 1.71)	0.814	0.95	(0.57, 1.60)	0.853
	Housewife	Ref.			Ref.		
Religion							
	Hindu	Ref.			Ref.		
	Muslim	1.51	(0.77, 2.94)	0.231	1.20	(0.54, 2.66)	0.663
	Christian	1.20	(0.38, 3.80)	0.754	1.05	(0.30, 3.62)	0.945
Caste							
	SC/ST	0.51	(0.26, 0.99)	0.048	0.47	(0.23, 0.95)	0.034
	Other backward caste	0.96	(0.49, 1.87)	0.904	0.86	(0.41, 1.81)	0.693
	General caste	Ref.			Ref.		
Intent to Change Behavior							
	I have not been thinking about changing my behavior to reduce my risk...I do not intend to do so in the next 6 months.	1.56	(0.90, 2.70)	0.115	1.53	(0.86, 2.72)	0.145
	I am currently not changing my behavior to reduce my risk for heart disease, but I intend to do so in the next 6 months.	1.77	(0.78, 4.06)	0.175	1.72	(0.72, 4.09)	0.222

Knowledge Factors	Unadjusted Model			Adjusted, Full Model		
	OR	(95% CI)	P-value	AOR	(95% CI)	P-value
I have decided what behavior (wt loss, quitting smoking, etc.) I need to change to reduce my risk for heart disease.	0.80	(0.24, 2.73)	0.724	0.85	(0.24, 3.02)	0.795
I have changed my behavior to reduce my risk for heart disease, but it is <6 months since I started.	1.09	(0.35, 3.47)	0.878	1.16	(0.35, 3.82)	0.803
I have changed my behavior to reduce my risk for heart disease and I have maintained that change for 6 months.	Ref.		Ref.			

OR= odds ratio; CI= confidence interval; AOR= adjusted odds ratio; SC/ST= scheduled caste/scheduled tribe; INR= Indian Rupees Heart disease risk factor knowledge is defined as poor (<50% correct answers), moderate (50–69% correct answers) or good knowledge (70% correct answers).

Education: Defined as: No Schooling, Primary School (1–7 years), High School (8–12 years), and Secondary School or above (12+ years)

Marital Status: “Other” includes separated, divorced, and widow/widower