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FULL RESEARCH PAPER
Global cardiovascular health

Association of health knowledge with adoption of heart healthy behaviours: a cross-sectional analysis using data from the PURE study

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Aims This study aims to assess aspects of health knowledge: (i) awareness of health effect of tobacco smoking and (ii) awareness of preventive actions for heart disease and stroke, and their relationships with adoption of heart healthy behaviours (smoking cessation and utilization of anti-hypertensive treatment).

Methods and results In this study, data from adults aged 35–70 years from 21 countries were included. Data on health effects of tobacco smoking (10 questions) and health actions to prevent heart disease or stroke (11 questions) were collected at baseline. Logistic regression analyses were used to examine the relationship with the outcomes of smoking cessation and use of anti-hypertensive treatment adjusting for adjusting for possible confounders. Of the 12 962 included in the descriptive analysis,

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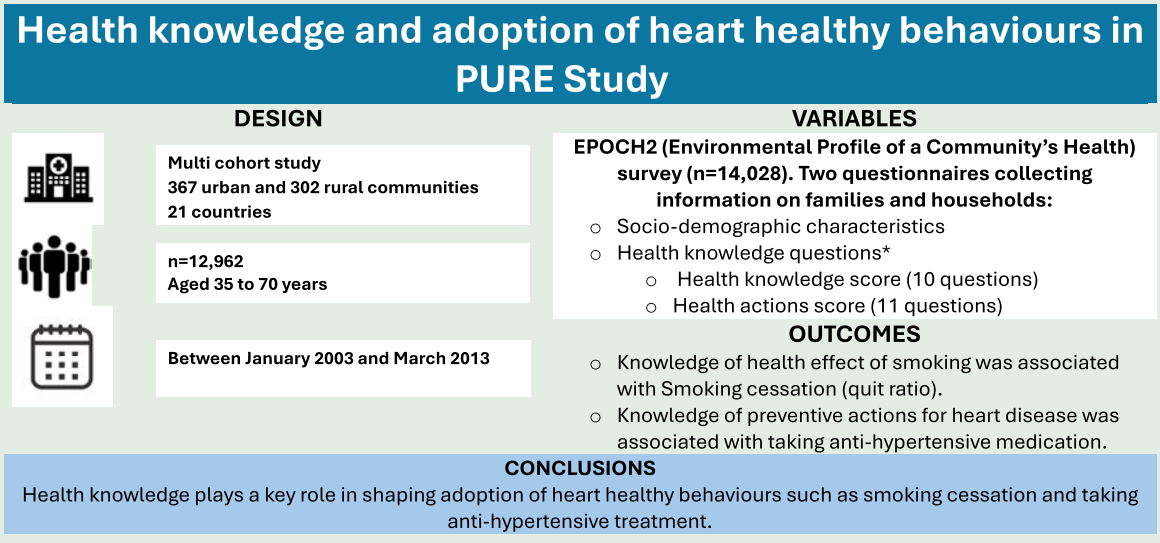
50.0% were female, 42.9% had no or primary education, and 53.3% were residing in low or lower middle-income country. Among current and former smokers, having knowledge of health effect of tobacco smoking on heart disease [adjusted odds ratio (aOR): 1.70, 95% CI: 1.19,2.43], stroke (1.41, 1.08,1.86), and on heart disease in non-smokers exposed to others smoking (1.40, 1.06,1.86) was significantly and positively associated with smoking cessation compared to those who were not aware of health effects. Knowledge of the importance of reducing dietary salt aOR 1.62 (1.23,2.13), dietary fat aOR 1.56 (1.17,2.08), and exercising more aOR 1.48 (1.22,1.80) to prevent heart disease or stroke was positively associated with taking anti-hypertensive medication compared to those who were not aware of preventative actions.

Conclusion This study reinforces that better health knowledge shapes adoption of heart healthy behaviours such as smoking cessation and taking anti-hypertensive treatment even after accounting for baseline education and wealth.

Lay summary Health knowledge is an important determinant of heart healthy behaviours across diverse educational or socio-economic backgrounds.

- Knowledge of health effect of smoking on heart disease, stroke, and on heart disease among second-hand smokers was associated with smoking cessation in PURE study.
- Knowledge of the importance of reducing dietary salt, dietary fat, and exercising more to prevent heart disease or stroke was associated with taking hypertensive medication in PURE study.

Graphical Abstract



Keywords Health knowledge • Hypertension • Medication • Prevention

Introduction

Health inequalities are driven largely by the conditions in which people live but knowledge about health and disease also plays a role. This includes health knowledge in general, or the ability to find, understand, and use information and services to inform health-related decisions (health literacy), and specific knowledge about one or more conditions. The association between these two types of knowledge is inconsistent, perhaps reflecting differences in the impact of the particular condition on one's life[1,2] but there is some evidence that disease-specific knowledge is a mediator between health literacy and health outcomes.[3]

Most research has focused on health literacy that, when low, is associated with greater cardiovascular disease mortality,[4] with higher body mass index (BMI), physical inactivity, smoking, and increased anxiety and depression,[5] and with higher prevalence of ultrasound-detected carotid artery plaques, similar to that for smoking.[6] Evidence on the association with medication adherence is, however, inconsistent,[7,8] although patients at emergency departments with low levels of health literacy were three times as likely to return within 90 days.[9] Other research finds an association between lower health literacy and greater utilization and costs.[10–13] There is some evidence on the mechanisms involved. Patients with low health literacy were more likely to misinterpret warning levels on prescription medications, increasing sub-optimal compliance and adverse events.[14] They were less responsive to prevention messages, less able to manage their health conditions,[10] and follow advice on medication use.[12,13]

Research on disease-specific knowledge has largely focused on chronic conditions. There is an incentive for those affected to invest in obtaining information, although they are not always better informed than those without the condition, as seen with cardiovascular disease in one German study.[15] However, greater knowledge has been linked to better outcomes for several conditions, including chronic airways disease,[16] irritable bowel disease,[16,17] and rheumatoid arthritis.[18]

This research is, however, almost exclusively from high-income countries, as are many of the initiatives to enhance disease knowledge, such as those from the American Heart Association[19] and American Medical Association.[20] Yet, nearly three-quarters of the 17 million cardiovascular disease (CVD) deaths worldwide occur in low- and middle-income countries.[21,22] Health knowledge is also closely linked with other determinants of health such as socio-economic position[23,24]; such that individuals from lower socio-economic background are less likely to acquire health knowledge, and develop health literacy.[19,23,25] Thus, if measures are to be adopted that improve knowledge of health and disease, then it will be important to have information on how this varies with markers of socio-economic status such as education or household wealth in different settings, and how it correlates with cardiovascular health behaviours.

The primary research question of this study is to examine the association between two aspects of health knowledge: (i) awareness of health of effect of tobacco smoking among current and former smokers and (ii) awareness of preventive actions for heart disease and stroke among those diagnosed with hypertension and their relationship with adoption of heart healthy behaviours such as smoking cessation and utilization of anti-hypertensive treatment using a large cross-cohort study that has collected consistent data from low- and middle-income countries.

Methods

Study design and participants

We analysed data on individuals included in the PURE study, which recruited adults aged between 35 years and 70 years from 367 urban and 302 rural communities in 21 countries. We combined these individual data with information on the communities in which each lived, derived from the EPOCH2 (Environmental Profile of a Community's Health) survey ($n = 14\,028$) from PURE study, which captures knowledge and perception about cardiovascular health and their surrounding from a sample of PURE participants living in that community. The design, methods, and participant characteristics have been published elsewhere.[25–28] We categorized countries according to the 2006 World Bank income classification. Men and women within the target age range, expected to remain in their community for at least 4 years, were eligible for recruitment, with a 72% response rate. Differences between characteristics of the PURE household population and national data have been shown to be unlikely to impact significantly exposure-disease associations derived from the study, with demographics and mortality rates generally comparable to national statistics.[29] The protocol was approved by ethics committees at each centre and all participants provided written informed consent.

Procedures

Individual PURE data

We administered two questionnaires on families and households. The first collected sociodemographic characteristics of all household members and the second information about household structure and amenities. Cardiovascular risk factors, such as tobacco use, hypertension history, diabetes, and physical measurements, were assessed with standardized questions in a third questionnaire. The physical examination included blood pressure, anthropometric measurements, and an electrocardiogram. Participants who consented also provided a fasting blood sample. We standardized protocols, with centralized training, and rigorous quality control.

We measured socio-economic status by education and a household wealth index. We categorized education levels as: no or primary school education only (lowest), secondary school education (intermediate), or higher education, including completion of trade school, college, or university (highest). The household wealth index was based on asset ownership and housing characteristics. We designed this to cover countries at all levels of development and validated it in the study countries. Taking anti-hypertensive medication is defined as those who responded taking anti-hypertensive medication in baseline.

Health knowledge questions in EPOCH2

We took knowledge of health effect of smoking (10 questions) and health actions to prevent heart attack or stroke (11 questions) from the Environmental Profile of a Community's Health survey. These were used to calculate the (i) health knowledge of smoking and (ii) health action scores.[30] Participants were asked to respond 'yes', 'no', or 'unsure' as to whether smoking is responsible for 10 diseases (lung disease, heart disease, diabetes, stroke, arthritis, lung cancer, mouth/throat cancer, environmental tobacco exposure, premature birth, low birth weight). Likewise, participants were asked to respond whether changes in these behaviours (exercise, eat more fruit, green vegetables intake, less meat, less caffeine, dairy products, eat more fish, quit smoking, reduce fat intake, reduce salt intake, lose weight) that could prevent heart attack or stroke.

Statistical analyses

Regression analysis

We undertook two sets of analyses limited to those with hypertension or CVD at baseline, where smoking cessation and blood pressure management is crucial for overall disease management and prevention of complications; first, examined smoking cessation among current and former smokers; and the second, examined adherence to anti-hypertensive medicines among those with hypertension or CVD at baseline. The flow diagram for analysis is shown in Supplementary material online, *Figure S1*.

For both analyses, we developed three sets of regression models. First, we performed unadjusted logistic regression analysis for each of the knowledge variables accounting for clustering at country level. Second, we ran a multivariable adjusted model that included possible confounders in *Table 1*. Third, we fitted three sequential regression models. The fitted model 1 includes health knowledge scores (three categories) adjusting for possible confounders in *Table 1*. Subsequently, model 2 includes variables in model 1 plus education. Similarly, model 3 includes variables in model 2 plus wealth index. For these models (e.g. models 1 or 2 compared with model 3), (log-)likelihood values were used to calculate the deviance (e.g. −2 log likelihood) in model fit. To calculate the quitting ratios (comparing former smoker with current smokers), we used a multilevel regression framework accounting for clustering at the community. For all analysis, we used the worst-off group (e.g. wealth index) as a reference category to ensure consistency. Depending on the clustering of individuals (e.g. community and country), random effects were specified for analysis involving taking anti-hypertensive medication and smoking cessation.

Construction of knowledge scores and the association with health behaviours

We calculated two scores: first using health effect of smoking (10 questions), which we termed 'health knowledge score; and second, we collated knowledge of captured health actions to prevent heart disease or stroke (11 questions) which we termed 'health actions score'.

The scoring method has been defined and used previously.[30–32] Such methods are widely used for assessing the association of cumulative knowledge scores of knowledge questions or risk factors.[30–32] Following previous practices, each question in our analysis contributed equally to the overall score. For each individual, we created a categorical knowledge score variable (three categories: high, medium, low health knowledge) based on tertiles of scores; each tertile contributing to a third of the population. We presented the percentages of correct responses for each questions capturing health effect of smoking and health actions by country and income regions (*Figure 1*).

Table 1 Baseline characteristics of the sample

Variables	Total population	$n = 12\,962$ Hypertension treatment (row, %)	*P* value (χ^2)	$n = 1608$ Former smoker (row, %)	*P* value (χ^2)
Age					
Mean (SD)	50.5 (9.8) years	57.2 (8.3)	<0.0001	57.4 (8.4)	<0.0001
Median (IQR)	50.0 (42–58) years	58.0 (52–54)		59.0 (51.0–64.0)	
Gender					
Female	6473 (50.0)	840 (13.0)	0.608	212 (56.1)	0.0001
Male	6485 (50.1)	822 (12.7)		522 (42.4)	
Education level					
None, primary, or unknown	5550 (42.9)	692 (12.5)	0.0001	240 (39.4)	0.0001
Secondary/higher secondary	4478 (34.6)	509 (11.4)		220 (39.5)	
Trade or college/ university	2902 (22.4)	459 (15.8)		274 (62.3)	
Urban and rural setting					
Urban	6662 (51.4)	974 (12.1)	0.0001	477 (51.1)	0.0001
Rural	6296 (48.6)	1022 (15.3)		257 (38.1)	
Country classification					
HIC	2400 (18.5)	535 (22.3)	0.0001	342 (70.7)	0.0001
UMIC	3531 (27.3)	595 (16.9)		263 (45.7)	
LMIC	4398 (33.9)	431 (9.80)		102 (24.9)	
LIC	2629 (20.3)	101 (3.84)		27 (19.3)	
Previous coronary heart disease					
No	12 380 (95.7)	1404 (11.3)	0.0001	649 (44.2)	0.0001
Yes	555 (4.3)	257 (46.3)		84 (61.8)	
Previous stroke					
No	12 732 (98.5)	1575 (12.4)	0.0001	711 (45.5)	0.376
Yes	197 (1.2)	84 (42.6)		22 (52.4)	
Hypertension					
No	7587 (60.7)	154 (2.03)	0.0001	57 (27.7)	0.0001
Yes	4916 (39.3)	1480 (30.1)		665 (49.4)	
Diabetes					
No	11 908 (92.1)	1313 (11.0)	0.0001	620 (43.8)	0.0001
Yes	1027 (7.9)	348 (33.9)		114 (60.0)	
BMI					
Mean (SD) kg/m^2	26.1 (5.4)	29.5 (5.8)	<0.0001	29.4 (5.4)	<0.0001
Median (IQR) kg/m^2	25.6 (22.5–29.0)	28.5 (25.6–32.3)		28.6 (26.0–32.0)	
Obesity					
<30 kg/m^2	10 021 (80.1)	996 (9.94)	0.0001	453 (41.6)	0.0001
≥30 kg/m^2	2489 (19.9)	636 (25.6)		268 (57.5)	

Stratified and sensitivity analysis

Previous evidence showed that higher knowledge of cardiovascular risk factors is associated with education and socio-economic background[33,34] so we stratified each sample by education and household wealth. Further, following previous practices we conducted two sets of sensitivity analysis using regression weighted knowledge scores to confirm the robustness of main findings.[33,34] All analysis were conducted from March 2023 to January 2024 using the PURE EPOCH datasets in SAS 9.4 and visualization was done in Python version 3.9.5 (Delaware, USA). All statistical tests were two-tailed, and $P < 0.05$ was considered statistically significant.

Results

Descriptive characteristics

Of the 12 962 individuals included in the analysis, nearly half were female, 42.9% had no or primary education, and 53.3% were residing in low or lower middle-income country (see Supplementary material online, *Figure S1*). Overall, most participants had knowledge of three health effects of smoking, namely: chronic lung disease (95.1%), lung cancer (93.7%), and mouth and throat cancer (88.2%). There is a

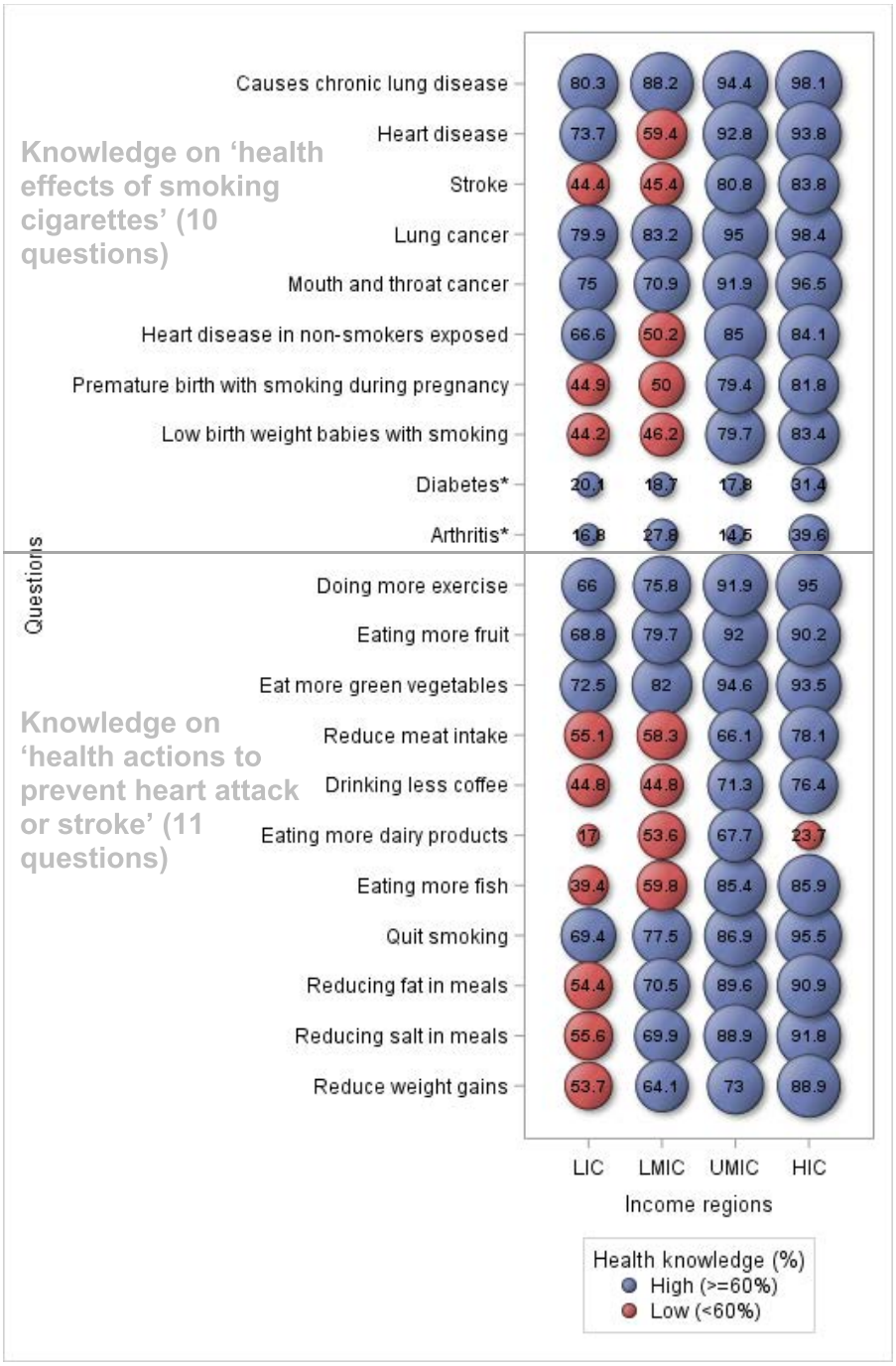


Figure 1 Distribution of health knowledge variables shown by bubble plot by countries in PURE study. The number inside the bubble is percentages (%). We used an arbitrary cut-off 60% for visualization of regions with high (≥60%) vs. low health knowledge (<60%). *Diabetes and arthritis are not considered as health effects of smoking; therefore, not highlighted in red colour. LIC, low-income country; LMIC, lower middle-income country; UMIC, upper middle-income country; HIC, high-income country.

wide difference in knowledge among income regions. Only 80.3% of those in low-income countries (LICs) gave correct answers about the effects of smoking against 98.1% in high-income countries (HICs). Differences were even wider for specific questions on lung cancer (79.9% vs. 98.4%) and mouth–throat cancer (75% vs. 98.5%) between LIC and HIC (*Figure 1*, Supplementary material online, *Figure S2*).

On knowledge of health actions to prevent CVD, the top three responses were quitting smoking (95.3%), eating more green vegetables (92.0%), and eating more fruit (90%). Again, this differed widely by income region. For example, in LIC only 69.4% gave correct responses on knowledge of smoking cessation to prevent CVD compared to 95.5% in HIC. Again, differences were wider for some specific questions,

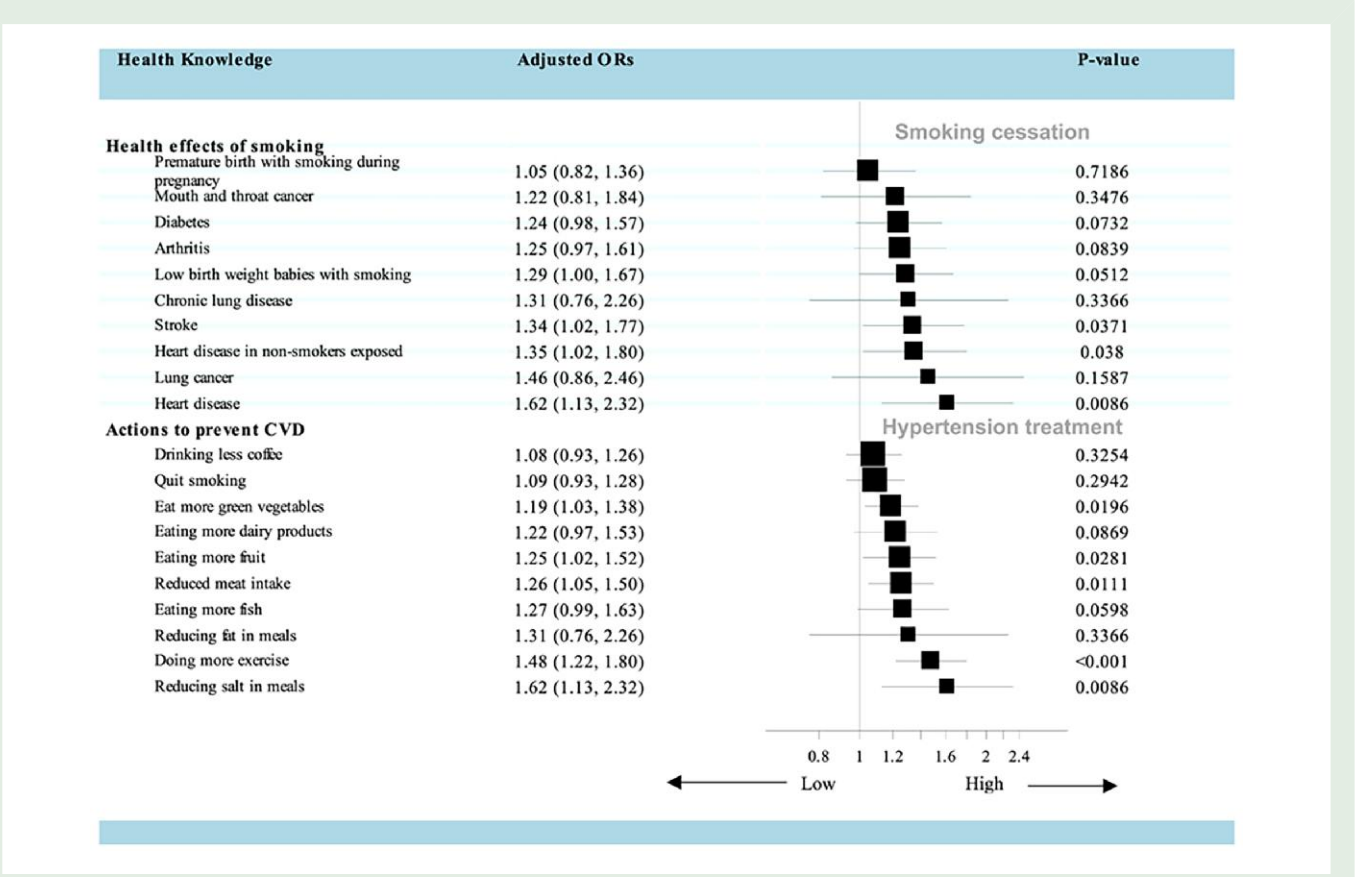


Figure 2 Relative ranking health effects of smoking (10 questions) and *health actions to prevent CVD* (11 questions) associated with *smoking cessation* ($N = 1608$) and hypertension treatment (yes, no) ($N = 4032$) from mutually adjusted model in PURE study, odds ratio (ORs) and 95% confidence interval. The analysis is adjusted for a basic set of covariates in *Table 1*.

eating more green vegetables (72.5% vs. 93.5%) and eating more fruit (68.8% vs. 90.2%) (*Figure 1*, Supplementary material online, *Figure S2*).

Regression analysis

As described above, *Figure 2* shows the association of two sets of health knowledge questions and two health behaviours (smoking cessation and taking anti-hypertensive medication) in appropriate sub-samples. Using the first set of questions, we found that knowledge of the health effect of tobacco smoking on heart disease adjusted odds ratio (aOR) 1.70 (95% CI: 1.19,2.43), stroke 1.41 (1.08,1.86), and heart disease in non-smokers exposed to others smoking aOR 1.40 (1.06,1.86) was significantly and positively associated with smoking cessation among current and former smokers.

Second, the knowledge of health actions questions like reducing salt in meals aOR 1.62 (1.23,2.13), reducing fat in meals aOR 1.56 (1.17,2.08), and doing more exercise aOR 1.48 (1.22,1.80) for prevention of heart disease or stroke was positively associated with higher likelihood of taking anti-hypertensive treatment among those who had been diagnosed with hypertension or CVD at baseline (see Supplementary material online, *Table S1*, *Figure 2*).

Construction of knowledge scores and the association with health behaviours

We present the relationship between health knowledge tertiles and health behaviour variables in the two groups in *Tables 2* and *3*. As the health knowledge score increased, there was increase in percentage of former smokers (from 38.6% to 50.7%) as well as taking anti-hypertensive medication (from 10.4% to 19.4%). For example, among current and former smokers, those with high health knowledge of tobacco smoking were significantly and positively associated with odds of smoking cessation (quit ratios: 1.30, 95% CI: 1.01,1.68) in model 1, although this did not reach statistical significance after accounting for education and household wealth in model 3 (see Supplementary material online, *Table S1*). Similarly, in those with hypertension or CVD, high health knowledge of actions to prevent CVD was significantly and positively associated with taking anti-hypertensive medication (aOR 2.58, 95% CI: 1.57,4.22) in model 1; the effect size only decreased marginally after adjusting for education and household wealth in model 3 (*Table 3*). −2 log likelihood showed the fit of models with health knowledge, education, and household wealth adjusting for all possible confounders in the multivariable analysis.

Stratified and sensitivity analysis

We conducted two sets of sensitivity analysis as follows: knowledge of health effects of smoking and smoking cessation (tertiles), and the relationship of health actions to prevent CVD or stroke (tertiles) and taking anti-hypertensive medication, using regression weighted knowledge scores (see Supplementary material online, *Tables S2* and *S3*). Additionally, we showed the cross stratified relationship of health knowledge tertiles with smoking cessation and taking hypertensive

Table 2 Association between knowledge of health effects of smoking and *smoking cessation* (*N* = 1608)

Variable	Total population	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Health effects (of smoking) score				
Low health knowledge	512 (37.9)	Reference	Reference	Reference
Moderate health knowledge	530 (33.0)	1.21 (0.94,1.58)	1.20 (0.92,1.56)	1.16 (0.89,1.52)
High health knowledge	566 (35.2)	**1.30 (1.01,1.68)**	**1.33 (1.03,1.73)**	1.28 (0.99,1.67)
Education				
None or primary only	609 (37.9)	Reference	Reference	Reference
Secondary	557 (34.7)	1.06 (0.84,1.34)	1.08 (0.86,1.37)	1.05 (0.82,1.33)
Trade, college, or university	440 (27.4)	**1.65 (1.26,2.16)**	**1.67 (1.27,2.19)**	**1.57 (1.19,2.08)**
Wealth				
Poorest third	529 (33.4)	Reference	—	Reference
Middle third	519 (32.8)	1.26 (0.99,1.59)	—	1.21 (0.95,1.54)
Richest third	536 (33.8)	**1.39 (1.08,1.79)**	—	1.28 (0.99,1.66)
−2 Res log pseudo-likelihood (smaller is better)		9457	9453	9291

Model 1s are individual models of association between knowledge of health effects of smoking score, education, and wealth—adjusted for a basic set of covariates in *Table 1*. Model 2 is adjusted for model 1 plus education. Model 3 is adjusted for model 2 plus wealth. Likelihood ratio test defined as l (bigger model) − l (smaller model) ~ c 2p, where, l is the maximum log likelihood, and p is the number of extra parameters in the bigger model. c 2p is χ^2 value with p degrees of freedom. Statistically significant *p*-values are shown in bold.

Table 3 Association between health knowledge of actions to prevent cardiovascular disease and taking anti-hypertensive medication (*N* = 4032)

Variable	Total population	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Knowledge on health actions to prevent CVD score				
Low health knowledge	1344 (33.3)	Reference	Reference	Reference
Moderate health knowledge	1329 (33.0)	**1.74 (1.36,2.21)**	**1.72 (1.34,2.22)**	**1.69 (1.30,2.20)**
High health knowledge	1359 (33.7)	**2.58 (1.57,4.22)**	**2.54 (1.52,4.23)**	**2.46 (1.46,4.15)**
Education				
None or primary only	1265 (31.8)	Reference	Reference	Reference
Secondary	1300 (32.7)	1.18 (0.85,1.64)	1.14 (0.87,1.48)	1.05 (0.82,1.36)
Trade, college, or university	1410 (35.5)	1.32 (0.95,1.84)	1.18 (0.86,1.61)	1.07 (0.82,1.39)
Wealth				
Poorest third	1673 (41.6)	Reference	—	Reference
Middle third	1343 (33.4)	1.18 (0.90,1.55)	—	1.13 (0.89,1.45)
Richest third	1007 (25.0)	**1.49 (1.03,2.16)**	—	**1.39 (1.02,1.90)**
−2 log likelihood (smaller is better)		3525	3520	3477

Model 1s are individual models of association between knowledge of health effects of smoking score, education, and wealth—adjusted for a basic set of covariates in *Table 1*. Model 2 is adjusted for model 1 plus education. Model 3 is adjusted for model 2 plus wealth. Likelihood ratio test defined as l (bigger model) − l (smaller model) ~ c 2p, where, l is the maximum log likelihood, and p is the number of extra parameters in the bigger model. c ^{2}p is χ^2-squared value with p degrees of freedom. Statistically significant *p*-values are shown in bold.

medication, using both household wealth and education. Our main findings remained robust even after accounting for regression-based weights for each individual knowledge questions in *Table 1*. We found a notable effect of increasing health knowledge on odds of smoking cessation by educational attainment and wealth (see Supplementary material online, *S4* and *S5* & distribution of these variables in Supplementary material online, *Figure S3* and *Table S6*). Among people in trade, college, or university education, the odds of smoking cessation were nearly 2.3 times higher if they had higher knowledge of the health effect of tobacco smoking. Similarly, a statistically significant, and positive effect of increasing knowledge of both health effects of smoking and health actions to prevent CVD was present among people regardless of educational attainment and wealth status (see Supplementary material online, *Tables S2–S4*).

Discussion

This cross-sectional study examined the relationship between two aspects of health knowledge: awareness of health effects of tobacco smoking and of actions to prevent heart disease and stroke *on* adoption of heart healthy behaviours across over 600 communities in low- and

middle-income countries. We found a positive relationship between health knowledge and adoption of heart healthy behaviours such as smoking cessation and taking anti-hypertensive treatment in the relevant subgroups even after accounting for individual's baseline education or wealth. However, given the cross-sectional design, we cannot claim to have established causality.

Our findings are consistent with previous studies that showed effect of health knowledge on health behaviours on both short (high blood pressure, hyperglycaemia) and long-term health outcomes (hospitalization, mortality)[35–38] and health-related quality of life.[39] For example, Isa *et al.*[38] suggested that health literacy has a notable effect on blood pressure outcomes, with consistently poorer control among people with lower health literacy. Nevertheless, Du *et al.*[40] suggested that the evidence regarding the influence of health literacy on clinical and behavioural outcomes, such as self-care and self-efficacy, is insufficient, underscoring need for future studies. Aligning with this idea, we quantified the association as well as the shape of the relationship with two aspects of heart health behaviours: smoking cessation and taking anti-hypertensive treatment in appropriate subgroups. We also quantified whether health knowledge is independently associated with these outcomes after considering education and wealth. Our analysis further confirmed that those with lower health knowledge, lower educational attainment and lower household wealth were less unlikely to stop smoking and/or take anti-hypertensive medication. Our findings support the statement of the American Heart Association that highlights lack of knowledge as a barrier to improving cardiovascular health.[19] This is consistent with other social determinants of health; those with lower educational attainment and wealth status were least likely to adopt healthy behaviours.[41] Further studies are needed to assess the broader effect of health knowledge and literacy on both short- and long-term health outcomes and health system costs for diseases including, and not limited to, cardiovascular diseases.

Our study has several strengths. First, we have incorporated a unique and geographically diverse sample from countries at different levels of economic development. Second, we employed a standardized and systematic approach to collect data. Lastly, we utilized both wealth and education as indicators of socio-economic status, both of which serve as proxies for the ability of individuals to make choices. However, there are certain limitations to our study. We grouped countries based on their economic status (low-income or high-income), but each is culturally, socially, and economically diverse. Unfortunately, our study, like many others of its kind, did not gather data on quality of education and attainment. Therefore, grouping education into a single variable based on time spent lacks granularity. Although the participants in our study generally resemble the populations of the respective countries, it is possible that the impact of education and wealth on health could vary depending on each country's welfare policies or ethnic or religious diversity, which may be linked to belief systems, social networks, or marginalization that we could not identify. Further, there are limitations on use of health knowledge questions that were self-reported and might not represent the diversity of health knowledge that is captured typically by a health literacy instrument. Despite having 10 questions that assessed the health knowledge and 11 questions that assessed the knowledge-actions, they may not encompass those specifically indicative of self-care or self-efficacy, which are the crucial pillars in the development of health literacy.[19] For these various reasons, the estimated ORs could be overestimated compared to any typical analysis involving much nuanced health literacy instruments. Lastly, the baseline may not fully reflect current health awareness and behaviours, and is not updated to the recent years.

Despite the limitations, we provide a comprehensive evaluation of two aspects of health knowledge and their associated effects on two health behaviours namely smoking cessation and taking anti-hypertensive medication. Further studies are needed to quantify the effect on both short- and long-term health outcomes and the extent to which are findings are influenced by the structural constraints that people face.

Conclusion

Our findings reinforce and extend prior evidence that better health knowledge contributes to the adoption of heart healthy behaviours. These results underscore the importance of community-based initiatives to improve cardiovascular health awareness, thereby supporting healthier behaviours and ultimately better cardiovascular outcomes.

Supplementary material

Supplementary material is available at *European Journal of Preventive Cardiology*.

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Author contribution

CK, SRM contributed to the conception or design of the study. SM performed data cleaning and statistical analysis of the dataset for the study with feedback from Simone Marschner. SM drafted the manuscript. CK provided supervision. All authors critically reviewed and provided feedback on the final manuscript. All authors contributed to the final article and approved the submitted version. CK is the guarantor of this work.

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Data availability

Data are available from the PURE collaborative group upon reasonable request. The data analysis was done from March 2023 to January 2024 using the PURE EPOCH dataset in SAS 9.4, and visualization was done in Python.

Appendix

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