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RESEARCH

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Public knowledge of risk factors and warning signs of heart attack and stroke

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Abstract

Background Knowledge of the predisposing risk factors and prompt recognition of the warning signs for heart attack and stroke is fundamental in modification of lifestyle behaviors and an imperative precursor to health-seeking behavior. In view of an existing knowledge gap amidst increasing incidence of heart attack and stroke in Tanzania, we conducted this community-based cross-sectional study among residents of Dar es Salaam city.

Results A total of 1759 respondents were enrolled in this study. The mean age was 45.4 years, females constituted over a half of participants and over two-thirds had attained at least secondary school education. Regarding risk factors, just over 2% of participants displayed satisfactory awareness and only stress was recognized by at least half of participants. With regard to warning signs, barely 1% of participants had satisfactory knowledge for either of the conditions while nearly three-quarters of participants failed to mention even a single warning sign for heart attack. Recognized by about two-thirds of respondents, sudden numbness or weakness in face, arm or leg was the most acknowledged stroke symptom; however, other symptoms were familiar to less than a third of participants. Although over a half of respondents acknowledged going to a hospital as their first resort, over one-tenth of respondents expressed inappropriate reactions towards heart attack and stroke victims. Old age, higher level of education, positive history of heart attack or stroke, high blood pressure and history of dyslipidemia showed association with both risk factors and warning signs knowledge during bivariate analyses.

Conclusions Public knowledge of common risk factors and typical warning signs for heart attack and stroke was critically suboptimal. These findings herald an utmost need for public health efforts to increase community awareness of risk factors and typical signs of the two conditions to curb the rising prevalence and associated morbimortality.

Keywords Heart attack, Stroke, Public knowledge, Risk factors, Warning signs

Background

As the epidemiologic transition continues to transform the disease landscape in low- and middle-income countries, an upsurge of acute coronary syndromes (ACS) and stroke is increasingly realized as an epidemic of public health importance particularly in the sub-Saharan Africa (SSA) region [1–6]. Globally, over 200 million people are diagnosed with ischemic heart disease (~3 million succumb to heart attack) while nearly 90 million persons are affected by stroke every year [7, 8]. Apart from being the leading contributors to the global burden of disease, heart

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attack and stroke top the global mortality list (8.8 million and 7.1 million deaths, respectively) and are projected to remain so coming 2030 [8–10]. Despite of mounting evidence for the burgeoning incidence of ischemic heart disease (IHD), Tanzania lacks the respective national representative estimates but a recently published article from the northern part of the country revealed a 59.9% acute myocardial infarction (MI) mortality at 1 year [11, 12]. Moreover, with an annual incidence of up to 316 strokes per 100,000 individuals and a 50% 90-day mortality rate, Tanzania is among the most affected nations [13]. Furthermore, with the estimated global management cost amounting to US$~1 trillion/year, ACS and stroke have considerable economic ramifications among residents of Dar es Salaam city [14, 15].

Heart attack and stroke are medical emergencies that necessitate immediate symptom recognition, rapid emergency transport and prompt management decisions. However, despite remarkable advances in revascularization techniques and stroke therapy, the general public largely remains uninformed about the two conditions and a substantial fraction of heart attack and stroke victims die before accessing medical care [16, 17]. Clinical outcomes of heart attack and stroke are principally time-dependent, however temporal trends suggests that despite improved emergency services and health education programs, prehospital delay constitutes the majority (> two-thirds) of delays to treatment [18–21]. For instance, despite significant reduction in door-to-balloon time in acute MI management, majority of patients seek medical attention way beyond the optimal time for reperfusion albeit experiencing prodromal symptoms for several hours [22]. While a key public health strategy to curb heart attack and stroke morbimortality is to increase the symptomology knowledge, the awareness of such at the community level is seldom given attention. In view of an existing epidemiological gap regarding the knowledge of heart attack and stroke risk factors and warning signs, we conducted this community-based cross-sectional study.

Methods

This cross-sectional community-based survey was conducted in Dar es Salaam city between August 2022 and April 2023. Located in the east coast of the country and covering an area of 1393 km^2, Dar es Salaam region is the largest city and financial hub of Tanzania. The metro area population of Dar es Salaam as per the 2022 census is 5,383,728 and it encompass 1,550,066 households. A random pre-selection of specific blocks was utilized to select a random sample of 1759 households based on the 2022 Demographic and Health Survey and Malaria Indicator Survey census frame. Within each household, the person aged at least 18 years whose birthday was the earliest in the calendar year was eligible to participate in the study. As a mitigation to minimize potential bias, persons with medical-related occupations were not eligible. Face-to-face questionnaire-based interviews were administered to the participants. This study utilized a validated standardized questionnaire that was developed by Ahmed and colleagues which has been used in numerous scholarly works [23]. The aforementioned data collection tool consists of three domains including sociodemographic and clinical characteristics, awareness of risk factors and knowledge of heart attack and stroke warning signs. Closed-ended questions were used for all knowledge assessments. Each respondent was asked to mention as many (as they can) risk factors and warning symptoms for heart attack and stroke, respectively. Respondents' verbatim responses were recorded in the respective questionnaire space (using appropriate medical terms) until the respondent declared to know no more. Height and weight measurements were taken using Digital Phoenix Pbmi-200p BMI Machine (India) to calculate body mass index (BMI).

We defined a priori eleven risk factors (aging, smoking, alcoholism, stress, physical inactivity, overweight, unhealthy diet, genetics, hypertension, diabetes, and hypercholesterolemia) for heart attack/stroke; eight heart attack warning signs (chest pain, arms/shoulder pain, neck/jaw/back pain, diaphoresis, shortness of breath, lightheadedness/fainting, epigastric pain, and nausea/vomiting), and six typical symptoms (sudden unilateral numbness/weakness of the face, arm or leg; sudden trouble with walking/loss of balance; sudden trouble with speaking/understanding; sudden severe headache; sudden difficulty in seeing, and nausea/vomiting) of stroke. A respondent could therefore score between 0 and 11, 0 and 8, and 0 and 6, respectively, depending on the correctly identified parameters. As emergency services (like 911, 112, and others), are not readily available in this setting, we regarded "taking the patient to the hospital" as the appropriate response for the action to be taken in case of stroke or heart attack. Owing to the fact that heart attack and stroke are vascular events that necessitate rapid symptom recognition and prompt seeking of medical care, the questions for heart attack and stroke symptoms were grouped on a composite basis for analysis. Nonetheless, respective scores for heart attack and stroke were examined separately by descriptive statistics. A cut off of > 50% was used to denote satisfactory knowledge as well as in comparison of knowledge level among different strata [24].

All statistical analyses utilized STATA v15.0 software. Categorical data are expressed as frequency (percentage), whereas continuous data are displayed as means (standard deviation). Pearson Chi-square and Student's

t-test were employed in comparison categorical and continuous variables, respectively. Factors associated with respective knowledge were assessed by bivariate analyses. We report mean scores and *p*-values where appropriate. All tests were 2-sided and $p < 0.05$ was used to signify statistical significance.

Results

A total of 1759 respondents were enrolled in this study. Table 1 displays the social and demographic characteristics of participants. The mean age was 45.4 years and just less than three-quarters of participants were aged less than 55 years. Females constituted over a half (55.3%) of participants and over two-thirds (70%) had attained at least secondary school education. Over three-quarters (80.8%) of respondents had a regular income generating activity and over 84% resided in urban area. About 3% were current smokers, nearly a quarter (24.6%) were alcohol drinkers and 71.7% had excess body weight. With regard to disease history, about a third (31.1%) of participants were hypertensive, 6.9% had history of diabetes, and 11.5% had positive history of hypercholesterolemia.

A total of 118 (6.7%) and 49 (2.8%) respondents had personal history of heart attack and stroke, respectively, while 216 (12.3%) and 518 (29.5%) participants had positive family history of such. Overall, 664 (37.8%) respondents had a perception of being at risk of heart attack or stroke. Although smokers displayed similar risk perception compared to non-smokers (47.3% versus 37.5%, $p = 0.14$); participants with age ≥ 55 (45.8% versus 34.7%, $p < 0.001$), positive family history of heart attack (52.8% versus 35.6%, $p < 0.001$), positive family history of stroke (46.7% versus 34.0%, $p < 0.001$), history of hypercholesterolemia (58.1% versus 35.1%, $p < 0.001$), BMI ≥ 25 (40.1% versus 31.7%, $p < 0.001$), diabetes (53.3% versus 36.6%, $p < 0.001$) and hypertension (51.0% versus 31.8%, $p < 0.001$) displayed superior risk perception compared to their respective counterparts.

Figure 1 displays the respondents' knowledge of heart attack and stroke risk factors. Overall the mean score was 17.6% and 38 (2.2%) scored above 50%. Stress (57.5%), unhealthy diet (35.5%) and hypertension (26.6%) were the most recognized risk factors. Other factors including overweight (16.8%), physical inactivity (15.4%), alcoholism (11%), hypercholesterolemia (8.9%), diabetes (8.7%), smoking (5.6%), aging (4.1%) and positive family history (3.1%) were recognized at lesser frequencies. Eight (0.5%) participants mentioned witchcraft as a risk factor for heart attack and stroke while a total of 322 (18.3%)

Table 1 Sociodemographic characteristics of study participants ($N = 1759$)

Characteristics	Frequency (%)
Age (mean, SD)	45.4 (14.2)
Age group	
< 55 years	1281 (72.8%)
≥ 55 years	478 (27.2%)
Sex	
Male	786 (44.7%)
Female	973 (55.3%)
Marital status	
Single	386 (22.0%)
Married	1105 (62.8%)
Divorced	109 (06.2%)
Widowed	159 (09.0%)
Education	
No formal	40 (02.3%)
Primary	488 (27.7%)
Secondary	518 (29.5%)
University	713 (40.5%)
Occupation	
Jobless	199 (11.3%)
Self-employed	829 (47.1%)
Employed	592 (33.7%)
Retired	139 (07.9%)
Residence	
Urban	1661 (84.4%)
Semi urban	98 (05.6%)
Smoking	
Never	1543 (87.7%)
Ex-smoker	161 (09.2%)
Current	55 (03.1%)
Alcohol	
Drinker	433 (24.6%)
Non-drinker	1326 (75.4%)
Body mass index (BMI)	
Underweight	29 (01.7%)
Normal weight	467 (26.6%)
Overweight	603 (34.2%)
Obese	660 (37.5%)
Disease history	
Hypertension	547 (31.1%)
Diabetes	122 (06.9%)
Hypercholesterolemia	203 (11.5%)
Heart attack and stroke history	
Personal history of heart attack	118 (06.7%)
Family history of heart attack	216 (12.3%)
Personal history of stroke	49 (02.8%)
Family history of stroke	518 (29.5%)
At risk of heart attack or stroke (self-perception)	664 (37.8%)

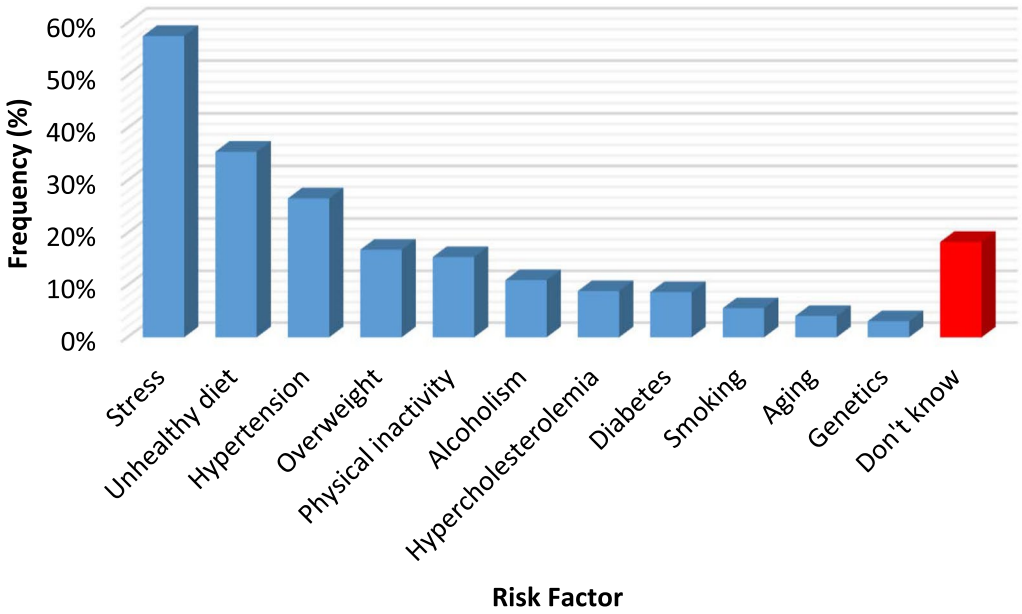

Fig. 1 Respondents' knowledge of heart attack and stroke risk factors

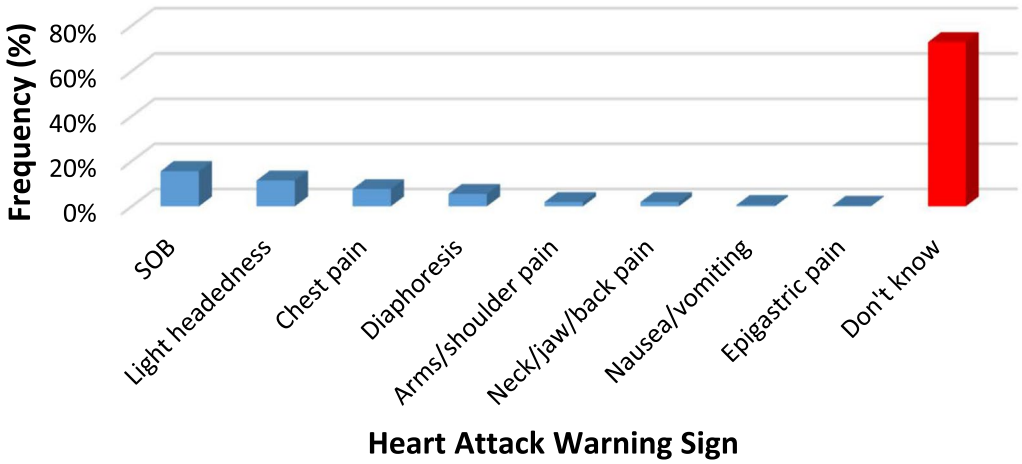

Fig. 2 Respondents' knowledge of heart attack warning signs

participants failed to correctly mention even a single risk factor.

Figures 2 and 3 display the respondents' knowledge of heart attack and stroke, respectively. The mean score for knowledge of heart attack warning signs was 4.7% and 12 (0.7%) respondents scored more than 50%. Regarding heart attack, nearly three-quarters (72.7%) of participants failed to mention even a single warning sign. Nevertheless, shortness of breath (15.6%), lightheadedness (11.5%) and chest pain (7.7%) were the most recognized signs followed by diaphoresis (5.5%), arms/shoulder pain (1.9%), neck/jaw/back pain (1.9%), nausea/vomiting (0.6%) and epigastric pain 0.3%. With regard to stroke, over 29% of respondents could not mention a single warning sign. The mean score for knowledge of stroke warning signs was 19.8% and 17 (1.0%) respondents scored more than 50%. Sudden numbness or weakness in face, arm or leg was the most (62.7%) mentioned risk followed by sudden trouble walking or loss of balance (28.8%), sudden trouble speaking or understanding (20%), sudden severe headache (4.7%), sudden trouble seeing (2.2%) and nausea/vomiting (0.2%).

Regarding respondent's planned response when oneself or closed one succumb to heart attack or stroke,

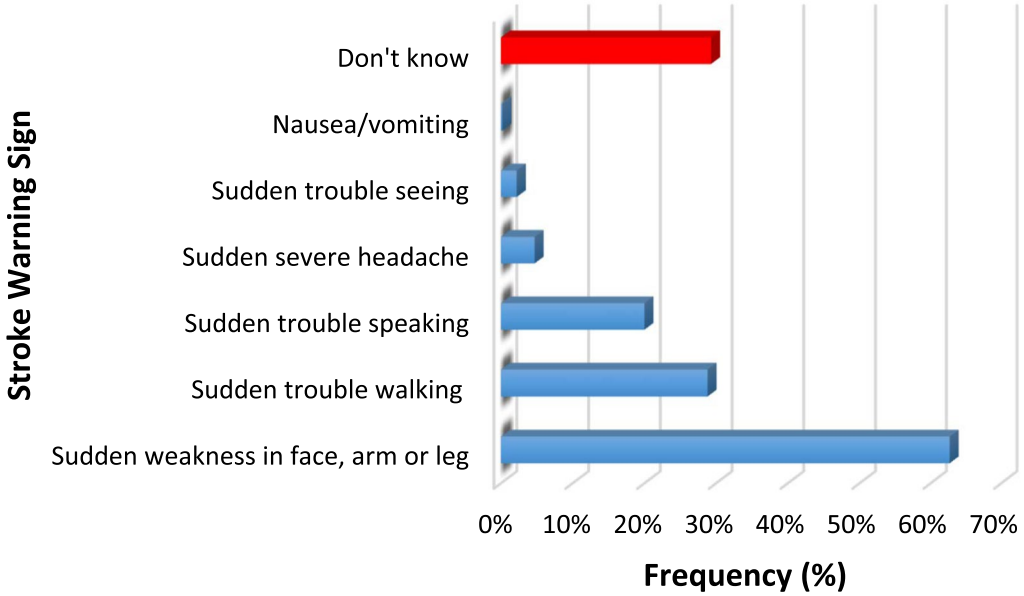

Fig. 3 Respondents' knowledge of stroke warning signs

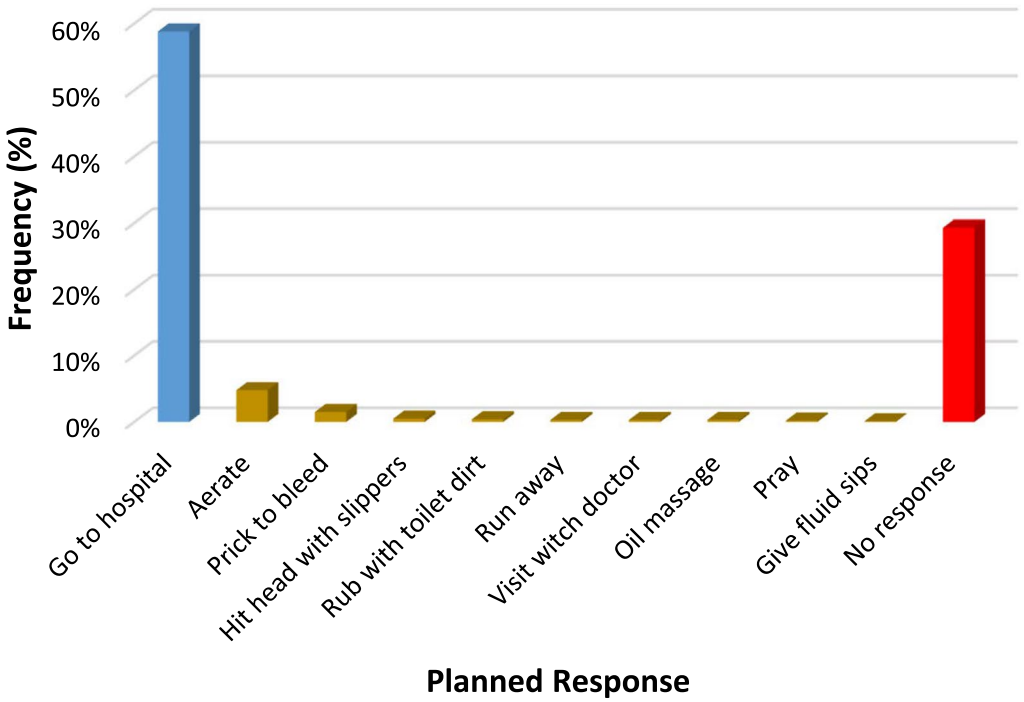

Fig. 4 Respondents' reactions to heart attack/stroke

1035 (58.8%) said they would go immediately to the hospital (Fig. 4). Furthermore, 209 (11.9%) respondents' expressed inappropriate reactions towards heart attack and stroke victims including; keep victim in open air 84(4.8%), prick the toes to bleed 26(1.5%), hit the victim's head with slippers 9(0.5%), rub the patient with toilet dirt 7(0.4%), run away 5(0.3%), visit a witch doctor 5(0.3%), oil massage 5(0.3%), pray 4(0.2%) and giving fluid sips 2(0.1%). A total of 515(29.3%) respondents did not know how to respond.

Table 2 Comparative analysis of risk factors and warning signs knowledge of heart attack and stroke across various subgroups

Parameter	Comparative groups	n	Knowledge (mean, SD)			*p*-value
			Risk factors	Heart attack signs	Stroke signs	
Age	< 55 years	1281	17.2 (13.9)	4.4 (9.1)	18.8 (16.6)	0.06
	≥ 55 years	478	18.6 (13.7)	5.4 (9.9)	22.4 (17.5)	< 0.05
						< 0.001
Sex	Male	786	17.8 (13.9)	4.1 (8.7)	19.2 (16.6)	0.5
	Female	973	17.4 (13.9)	5.2 (9.8)	20.3 (17.1)	0.01
						0.2
Education	≤ Primary education	528	13.6 (13.5)	4.1 (8.5)	17.7 (16.9)	< 0.001
	≥ Secondary education	1231	19.3 (13.7)	5.0 (9.7)	20.7 (16.8)	0.06
						< 0.001
Smoking	Non-smoker	1704	17.7 (13.9)	4.7 (9.3)	20.0 (16.9)	< 0.01
	Current smoker	55	12.9 (13.2)	4.6 (9.5)	12.7 (14.7)	0.9
						< 0.01
Alcohol	Non-drinker	1326	17.5 (14.0)	4.8 (9.5)	19.5 (16.6)	0.8
	Drinker	433	17.7 (13.5)	4.4 (9.0)	19.9 (17.0)	0.5
						0.7
Body mass index	BMI < 25	496	15.1 (12.9)	4.3 (9.6)	17.9 (16.5)	< 0.001
	BMI ≥ 25	1263	18.6 (14.1)	4.9 (9.3)	20.5 (17.0)	0.2
						< 0.01
Hypertension	Hypertensive	547	19.7 (14.4)	6.8 (11.4)	22.8 (17.0)	< 0.001
	Normotensive	1212	16.6 (13.5)	3.8 (8.1)	18.4 (16.7)	< 0.001
						< 0.001
Diabetes	Diabetic	122	19.6 (12.5)	6.9 (13.1)	20.8 (17.2)	0.1
	Diabetes-free	1637	17.4 (14.0)	4.6 (9.0)	19.7 (16.9)	< 0.01
						0.5
Dyslipidemia	Positive history	203	21.5 (12.6)	7.5 (11.7)	24.6 (16.9)	< 0.001
	Negative history	1556	17.1 (13.9)	4.3 (8.9)	19.2 (16.8)	< 0.001
						< 0.001
Personal history of heart attack	Positive	118	21.4 (14.8)	11.8 (14.6)	25.7 (18.7)	< 0.01
	Negative	1641	17.3 (13.8)	4.2 (8.6)	19.3 (16.7)	< 0.001
						< 0.001
Family history of heart attack	Positive	216	20.3 (14.3)	6.0 (8.8)	24.3 (16.2)	< 0.01
	Negative	1543	17.2 (13.8)	4.5 (9.4)	19.2 (16.9)	0.03
						< 0.001
Personal history of stroke	Positive	49	19.3 (18.1)	7.9 (14.5)	23.5 (18.6)	0.4
	Negative	1710	17.5 (13.7)	4.6 (9.2)	19.7 (16.8)	< 0.001
						0.06
Family history of stroke	Positive	518	19.3 (13.8)	5.6 (9.6)	22.9 (17.0)	< 0.001
	Negative	1241	16.9 (13.8)	4.4 (9.2)	18.5 (16.7)	0.01
						< 0.001
Risk of heart attack/stroke (self-perception)	At risk	664	18.9 (13.9)	5.3 (10.2)	21.1 (16.6)	< 0.01
	Not at risk	1095	16.8 (13.8)	4.4 (8.8)	19.0 (17.0)	< 0.05
						0.01

The 1st, 2nd and 3rd *p*-values correspond to the associations in the risk factors, heart attack signs and stroke signs columns respectively

Table 2 displays comparative analysis of risk factors and warning signs knowledge of heart attack and stroke across various subgroups. Although age differences displayed similar knowledge regarding risk factors, those aged 55 year or more displayed superior mean knowledge scores for both heart attack (5.4 versus 4.4, $p < 0.05$) and stroke (22.4 versus 18.8, $p < 0.001$) warning signs compared to those aged less than 55 years. Sex differences displayed similar risk factors and stroke signs knowledge, however, females displayed more knowledge of heart attack signs compared to males (5.2 versus 4.1, $p = 0.01$). With regard to education, respondents with secondary education or higher displayed superior mean knowledge scores in risk factors (5.0 versus 4.1, $p < 0.001$) and stroke signs (20.7 versus 17.7, $p < 0.001$) compared to their counterparts with at most primary education. Similarly, non-smokers displayed superior means in risk factors (17.7 versus 12.9, $p < 0.01$) and stroke signs (20.0 versus 12.7, $p < 0.01$) knowledge compared to current smokers. Participants with excess body weight had better knowledge mean for risk factors (18.6 versus 15.1, $p < 0.001$) and stroke signs (20.5 versus 17.9, $p < 0.01$)

compared to respondents with BMI < 25. Participants with hypertension had better means across all knowledge categories [risk factors (19.7 versus 16.6, $p < 0.001$), heart attack signs (6.8 versus 3.8, $p < 0.001$) and stroke signs (22.8 versus 18.4, $p < 0.001$)] compared to normotensive individuals. Although they displayed similar risk factors and stroke signs knowledge, participants with diabetes exhibited better knowledge of heart attack symptoms (6.9 versus 4.6, $p < 0.01$) compared to diabetes-free individuals. Participants with history of hypercholesterolemia displayed superior knowledge means across all categories [risk factors (13.9 versus 12.6, $p < 0.001$), heart attack signs (11.7 versus 8.9, $p < 0.001$), and stroke signs (24.6 versus 19.2, $p < 0.001$)] compared to their counterparts with negative history. Lastly, participants with positive personal and family history of heart attack, positive family history of stroke and those with self-perception of being at risk for heart attack or stroke displayed superior knowledge means across all groups compared to their respective counterparts.

Discussion

The growing burden of heart attack and stroke are increasingly exposing the unprepared state of most health-care systems in the developing world, more so the SSA region. It is evident that the improved clinical outcomes and survival prospects conferred by percutaneous coronary intervention (PCI) and thrombolysis are time-dependent. Owing to this, knowledge of the predisposing risk factors and prompt recognition of the warning signs for heart attack and stroke is fundamental in modification of lifestyle behaviors and an imperative precursor to health-seeking behavior. Likewise, lack of the aforementioned knowledge inevitably leads to delay in summoning medical attention which potentially leads to ineligibility for prompt intervention ultimately resulting in increased morbidity and premature mortality.

Just like any other non-communicable disease (NCD), the likelihood of occurrence of heart attack or stroke has been linked to the coexistence of modifiable risk factors. Parallel to recent studies [25–29] conducted in this setting, nearly three-quarters of the respondents in this present study had at least one of the three biological risk factors including excess body weight, hypertension or diabetes. However, despite these high rates of biological risk factors, about one-fifth of participants could not mention even a single risk factor for heart attack or stroke. Variable rates (9.4–91.4%) of complete unawareness of risk factors has been reported by previous studies [30–37] and our observed rates are within this wide range which could potentially be explained by the differences in knowledge assessment methods and population characteristics across studies. Nonetheless, in contrast to our expectations, this present study revealed significantly lower knowledge level compared to an earlier study [26] conducted in the same setting. Moreover, similar to the cited earlier local study, a disconnection between knowledge and practice was also observed in this present study. This observation raises serious concerns and warrants concerted public health efforts to increase not only awareness but knowledge retention and practice as well.

As the only risk factor to be mentioned by over a half of participants, stress was the most recognized risk factor in this study. In consonance to our findings, stress (57.3%) was the most familiar risk factor in an Ethiopian study by Workina and colleagues [33]. Although different studies [24, 30–42] have displayed diverse frequency pattern of acknowledged risks, the documented public knowledge of heart attack and stroke across the globe is largely unsatisfactory. Furthermore, the absence of an obvious pattern of recognized risks among studies implies that educational strategies across different populations ought to be tailored to address respective knowledge deficiencies. Surprisingly, even in this era, witchcraft was among the risk factors mentioned by respondents from a major economic city in the SSA region. Although in none of the reviewed studies from the western world was witchcraft mentioned, it was reported by numerous earlier studies from the African continent including Nigeria, Malawi and Uganda [35, 37, 40, 43]. Such superstitious beliefs particularly in the developing world play a notable role in causing delays in access to care and deter the attainment of Sustainable Development Goals (SDGs) at large.

Following heart attack or stroke, victims' ability to recognize symptoms and to take appropriate action is central if desirable outcomes are to be achieved. With less than one percent of participants displaying satisfactory knowledge of either heart attack or stroke warning signs, respondents from this study exhibited critically low awareness of typical symptomatology particularly of heart attack (about three-quarters of respondents failed to mention a single sign). Whereas chest pain was the most identified heart attack symptom in literally all previous studies [24, 39–41, 44–51], participants of this study recognized shortness of breath and lightheadedness ahead of chest pain an observation which is quite similar to a Hertz and colleagues study [52] from the Northern part of the country. Furthermore, contrary to heart attack where the most recognized warning sign was identified by less than one-fifth of participants; in stroke's case, sudden numbness or weakness in face, arm or leg was impressively acknowledged by almost two-thirds of the respondents. The observation of unilateral weakness/paralysis as the most familiar stroke sign from this present study echoes findings from numerous preceding studies [32, 33, 38, 44, 45, 47, 48, 50, 51]. Nevertheless,

other stroke symptoms in this study were familiar to less than a third of participants. Moreover, corroborating the findings of several previous studies, we found significant differences in knowledge across groups defined by age [30, 31, 34], level of education [30, 31, 33, 35, 36, 38, 39], history of heart attack or stroke [30, 31, 34, 39], hypertension [30] and history of dyslipidemia [30, 34]. In general, these observations indicate the urgent desirability of improving the level of public awareness of heart attack and stroke typical presentations. Furthermore, as the constellation of symptoms differ among patients, it is pivotal that educational messages recognize and address the diversity and variability of the typical signs.

Regarding the suitable actions for someone suffering from heart attack or stroke, nearly three-fifths of the respondents appropriately said they would go immediately to the hospital. Such observation resonates with numerous other studies where over a half of respondents' first resort was the hospital [30, 32, 37, 40, 44, 45, 48, 51, 53, 54]. However, given the aforementioned critically low knowledge of risk factors and warning signs, this present study underscore a vivid gap between taking suitable action and ability to spot the typical signs in the first place. Furthermore, these findings raise serious concerns on the methods used by the health-care providers to ensure effective transmission and retention of heart attack and stroke basic knowledge. Perhaps, the most surprising finding of this study was that over one-tenth of the respondents' expressed inappropriate planned reactions some of which are quite precarious (including prick the toes to bleed, hit the victim's head with slippers, rub the patient with toilet dirt and run away). The aforementioned reactions have not been reported by any of the previous studies; however, other odd responses including giving fluid sips [45], faith healing [32, 43, 53, 55], oil massage [53, 55] and visiting a witch doctor [55, 56] have been documented. Such myths, particularly in the SSA region remain a stumbling block towards the battle against NCDs and calls for deliberate efforts to debunk cognate health-related misinformation.

The strengths of our study include a sufficiently large sample to estimate the awareness of stroke and heart attack warning signs with adequate precision. Furthermore, we used door-to-door population-based sampling and standardized tools for knowledge assessment to reduce selection and information bias. However, the likelihood of some healthy participation bias and imprecision in the estimates resulting from both open and closed questions cannot be precluded.

Conclusions

Despite portraying an averagely acceptable planned response to heart attack or stroke, public knowledge of common risk factors and typical warning signs was critically suboptimal. These findings have crucial implications for both health policy and further research particularly in this era where heart attack and stroke incidence is rapidly rising in Tanzania and elsewhere. Furthermore, these observations somewhat divulge the incompetency of the health-care system to recognize and educate high risk individuals and general public at large. These findings herald an utmost need for public health efforts to increase community awareness of risk factors and typical signs of the two conditions to curb the rising prevalence and associated morbimortality. A comprehensive mass media campaign, targeted education of high risk groups (including their families), and tailored eHealth interventions will be rewarding in a setting like this one. Moreover, educational endeavors should also target health-care professionals, particularly the primary care providers.

Abbreviations

ACS	Acute coronary syndrome
BMI	Body mass index
ECG	Electrocardiogram
ECHO	Echocardiography
IHD	Ischemic heart disease
MI	Myocardial infarction
NCDs	Non-communicable disease
PCI	Percutaneous coronary intervention
SD	Standard deviation
SDGs	Sustainable development goals
SSA	Sub-Saharan Africa

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Author contributions

PP and PRK conceived the study. ZSM, MK, LM, SK, GM, and AN conducted all the interviews, as well as anthropometric and blood pressure measurements. SVB, HAM and EK performed the necessary investigations (i.e., ECHOs and ECGs). HYF conducted nutritional counselling and education. JM, PRK, PP, and SVB participated in patient management. ZSM entered all the data while PP performed all the data cleaning and analysis. The corresponding author (PP) wrote the first draft of the manuscript, and other authors contributed to and approved it. All authors made the decision to submit the manuscript for publication. All authors undertake responsibility for the accuracy and integrity of the analysis.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was submitted to, and approved by the Ethical Committee, of the Jakaya Kikwete Cardiac Institute (JKCI) on May 28th, 2022. Written informed consent was obtained from all study participants. This research was conducted in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors have no conflict of interest to declare.

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