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ORIGINAL RESEARCH

Non-Communicable Disease Risk Factors Among Caregivers of Patients Attending a Tertiary Cardiovascular Hospital in Tanzania

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Background: Notwithstanding the ever-present burden of infectious diseases, the sub-Saharan Africa (SSA) region has experienced a 67% rise in the non-communicable disease (NCD) burden in less than three decades. Furthermore, regardless of the increased recognition of NCDs threat in the region, reliable local estimates and associated drivers are generally lacking. We therefore conducted this cross-sectional study to establish the pattern and correlates of the modifiable NCD risk factors among caregivers of patients attending a tertiary cardiovascular centre in Tanzania.

Methods: A cross-sectional survey was conducted at Jakaya Kikwete Cardiac Institute, Dar es Salaam, Tanzania. We used a structured questionnaire bearing a modified WHO STEPwise Approach to NCD Risk Factor Surveillance (STEPS) tool to explore the modifiable behavioral and modifiable biological NCD risk factors.

Results: A total of 1063 caregivers were enrolled in this study. The mean age was 40.5 years, and 55.7% were female. Nearly 80% of participants had a good knowledge regarding NCDs and 85.4% had a positive family history of NCDs. Overall, 1027 (96.6%) participants had at least one modifiable NCD risk factor while 510 (48.0%) had three or more (i.e., clustering). With respect to modifiable behavioral NCD risk factors, 34 (3.2%) were tobacco users, 56 (5.3%) had harmful alcohol consumption, 691 (65%) had unhealthy eating behavior, and 820 (77.1%) were physically inactive. Pertaining to modifiable biological NCD risk factors, 710 (66.8%) had excess body weight, 420 (39.5%) had hypertension and 62 (5.8%) were diabetic.

Conclusion: A vast majority of caregivers of NCD patients in this tertiary setting were found to have modifiable NCD risk factors with a strong tendency of clustering. These findings call for intensification of both population strategies and targeted group interventions for better control of the NCD threat and its correlates.

Keywords: STEPS survey, modifiable NCD risk factors, behavioral risks, biological risks, clustering

Background

Linked to virtually three-quarters of global deaths, non-communicable diseases (NCDs) pose a major health and development challenge to humankind.[1] With an estimated cumulative lost economic output of over US$7 trillion (2011–2025) and every three of four NCD deaths transpiring in low- and middle-income countries, the developing world is disproportionately affected.[2] Notwithstanding the unending burden of infectious diseases, and with an increase of total disability-adjusted life years (DALYs) due to NCDs (90.6 million in 1990 to 151.3 million in 2017), the sub-Saharan Africa (SSA) region has experienced an alarming 67% rise in the NCD burden.[3] Unlike in high-income countries where NCD deaths occur later in life, NCDs in low- and middle-income countries often affect the economically and socially working-age, leading to poverty perpetuation and burdened fragile health systems.[4,5] Considering the current trajectory, NCDs are projected to overtake communicable, maternal, neonatal, and nutritional diseases combined as the leading cause of mortality in the SSA region by 2030.[4]

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The burgeoning epidemic of NCDs in SSA has several driving forces including demographic transition, urbanization, economic development, aging population, and increased risk behaviors such as harmful use of alcohol, physical inactivity, tobacco use, and unhealthy diet.[6–8] It is a well-known fact that most risk behaviors for NCDs are modifiable and the related morbimortality is preventable; however, compared with resource-endowed regions, sufficient evidence-based surveillance systems in SSA and similar resource-constrained settings are lacking.[9] In view of this, concerted efforts to curb the rapid rising NCD burden in the region starting with the provision of reliable local estimates and associated drivers is pivotal to devise effective and sustainable prevention strategies. In an attempt to understand NCDs in resource-limited settings, we conducted this cross-sectional study to establish the pattern and correlates of NCD risk factors among caregivers of patients attending a tertiary cardiovascular centre in Tanzania.

Methods

Recruitment Process and Definition of Terms

A cross-sectional study was conducted at Jakaya Kikwete Cardiac Institute (a tertiary care public teaching hospital) in Dar es Salaam, Tanzania between December 2019 and February 2020. A consecutive sampling method was utilized to recruit consented caregivers of patients with cardiovascular disease (CVD). During a patient's scheduled clinic visit, accompanying caregivers were explained the objectives of this study and were requested to take part in it. We enrolled the caregivers consecutively in all clinic days during the study period. As per the 2019 statistics, Jakaya Kikwete Cardiac Institute was attended by about 40,000 hypertensive patients in a year. For the purpose of this screening, we aimed to recruit at least 2.5% of the caregivers equivalent to the annual hypertensive population, i.e. ≥1000 caregivers.

A structured questionnaire bearing questions pertaining to sociodemographic and clinical characteristics was used to gather respective participant's information. Weight in kilograms (kg) and height in centimeters (cm) were measured using Health-o-Meter 500KL professional scale. We defined underweight as BMI<18.5 kg/m^2, normal: BMI 18.5–24.9 kg/m^2, overweight: BMI 25.0–29.9 kg/m^2 and obese: BMI ≥30.0 kg/m^2.[10] Moreover, waist circumference was measured (to the nearest 0.1cm) in the horizontal plane at the midpoint between the lower margin of the rib cage and the upper border of the iliac crest using a non-stretchable plastic tape. Measurements of >94 cm for men and >80 cm for women were used to denote increased waist circumference.[11] Blood pressure was measured using OMRON HEM-7156 digital automated sphygmomanometer. OneTouch Select Plus glucometer was utilized in blood glucose concentration measurements. Furthermore, an adopted questionnaire consisting of 22 statements assessing various NCD risk behaviors was utilized for assessment of knowledge.[12] A percentage score for each participant was computed by dividing the sum of correct responses by the total number of questions (i.e. 22) multiplied by 100. A cut-off score of ≥70% was used to signify adequate knowledge and a score <70 was regarded as poor knowledge.[13,14]

A modified WHO STEPwise Approach to NCD Risk Factor Surveillance (STEPS) tool was utilized in the assessment of four modifiable behavioral (i.e. tobacco use, harmful alcohol consumption, unhealthy diet, and low physical activity) and three biological (i.e. excess body weight, raised blood pressure, and impaired fasting glycemia) NCD risk factors. Coexistence of ≥3 risk factors in the same individual was regarded as clustering of NCD risk factors.[14] For the purpose of this study, we defined the modifiable NCD risk factors as follows:

(i) Tobacco use: use of any tobacco product in any form within one month prior to recruitment in this present study.[15]
(ii) Harmful alcohol intake: consumption of ≥5 drinks/day or ≥4 drinks/day on at least one occasion by a male or female participant, respectively within one month prior to recruitment in this study.[16]
(iii) Unhealthy diet: intake of <5 servings/week of fruits and vegetables.[17]
(iv) Low physical activity: achieving <600 metabolic equivalent (MET)-minutes/week in accordance with WHO guidelines.[18]
(v) Excess body weight (overweight): a body mass index (BMI) of ≥25 kg/m^2.[10]
(vi) Raised blood pressure (hypertension): a systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg, or use of blood pressure lowering agents.[19]

(vii) Impaired fasting glucose (diabetes): fasting blood glucose (FBG) ≥7 mmol/L or use of glucose-lowering agents.[20]

Statistical Analysis

All statistical analyses were performed by a Statistical Package for the Social Sciences (SPSS) v20 software. Summaries of continuous variables are presented as means (± SD) and categorical variables are presented as frequencies (percentages). Categorical and continuous variables were compared using the Pearson Chi square test and Student's *t*-test respectively. Logistic regression analyses were used to assess for factors associated with modifiable NCD risks. Stepwise and forward selection procedures were used to add and assess the statistically significant variables in the multivariate regression model. Wald Chi square test was used to assess for the interaction terms, with a p <0.1 cut-off used as criteria for inclusion in multivariate analysis. Odds ratios (OR) with 95% confidence intervals (CI) and p-values are reported. All tests were 2-sided and p<0.05 was used to denote a statistical significance.

Results

Table 1 displays the sociodemographic characteristics of the 1063 enrolled participants by their NCD risk status. The mean age was 40.5 years and nearly half (49.3%) of the participants fell in the age-group 35–54 years. Female sex constituted 55.7% of participants and 59.9% had attained at least secondary level education. Over two-thirds (66.9%) and more than three-quarters (79.4%) of participants were married and had a regular income-generating activity, respectively. Just over a third (33.7%) of participants had health insurance and 54.9% had never had a health check-up before. Nearly 80% of participants had a good NCD knowledge and 85.4% had a positive family history of NCDs.

Overall, 1027 (96.6%) participants had at least one modifiable NCD risk factor. Among participants with risk factors; 219 (21.3%) had behavioral risks alone, 76 (7.4%) had biological risk factors alone, and 732 (71.3%) had both behavioral and biological risks. Whereas there was no difference in the rates of 'biological risks alone' between the two sexes (i.e.

Table 1 Sociodemographic Characteristics of Study Participants by Modifiable NCD Risk Status (N = 1063)

Characteristic	All (N = 1063)	Modifiable Biological NCD Risks			Modifiable Behavioral NCD Risks		
		None (n = 255)	≥ 1 Factor (n =808)	p-value	None (n = 112)	≥ 1 Factor (n =951)	p-value
Age (Mean, SD)	40.5 (13.0)	32.6 (12.3)	43.0 (12.2)	<0.001	41.8 (14.7)	40.3 (12.8)	0.2
Age group							
18–34	379 (35.7%)	169 (66.3%)	210 (26.0%)	<0.001	41 (36.6%)	338 (35.5%)	0.8
35–54	525 (49.3%)	70 (27.5%)	455 (56.3%)	<0.001	49 (43.8%)	476 (50.1%)	0.2
≥55	159 (15.0%)	16 (6.2%)	143 (17.7%)	<0.001	22 (19.6%)	137 (14.4%)	0.1
Sex							
Male	471 (44.3%)	159 (33.8%)	312 (66.2%)		55 (11.7%)	416 (88.3%)	
Female	592 (55.7%)	96 (16.2%)	496 (83.8%)	<0.001	57 (09.6%)	535 (90.4%)	0.3
Education							
No Formal	22 (02.1%)	5 (02.0%)	17 (02.1%)	0.9	3 (02.7%)	19 (02.0%)	0.6
Primary	404 (38.0%)	88 (34.5%)	316 (39.1%)	0.2	44 (39.3%)	360 (37.9%)	0.8
Secondary	385 (36.2%)	90 (35.3%)	295 (36.5%)	0.7	42 (37.5%)	343 (36.0%)	0.8
University	252 (23.7%)	72 (28.2%)	180 (22.3%)	0.05	23 (20.5%)	229 (24.1%)	0.4
Marital status							
Single	279 (26.2%)	126 (49.4%)	153 (19.0%)	<0.001	34 (30.4%)	245 (25.8%)	0.3
Married	711 (66.9%)	121 (47.4%)	590 (73.0%)	<0.001	60 (53.6%)	651 (68.4%)	<0.01
Divorced	26 (02.5%)	4 (01.6%)	22 (02.7%)	0.3	7 (06.2%)	19 (02.0%)	<0.01
Widowed	47 (04.4%)	4 (01.6%)	43 (05.3%)	0.01	11 (09.8%)	36 (03.8%)	<0.01

(*Continued*)

Table 1 (Continued).

Characteristic	All (N = 1063)	Modifiable Biological NCD Risks			Modifiable Behavioral NCD Risks		
		None (n = 255)	≥ 1 Factor (n =808)	p-value	None (n = 112)	≥ 1 Factor (n =951)	p-value
Occupation							
Jobless	166 (15.6%)	64 (25.0%)	102 (12.6%)	<0.001	31 (27.7%)	135 (14.2%)	<0.001
Self-employed	640 (60.2%)	131 (51.4%)	509 (63.0%)	0.001	62 (55.4%)	578 (60.8%)	0.3
Employed	204 (19.2%)	55 (21.6%)	149 (18.4%)	0.3	13 (11.6%)	191 (20.1%)	0.03
Retired	53 (05.0%)	5 (02.0%)	48 (06.0%)	0.01	6 (5.3%)	47 (04.9%)	0.9
Residence							
Urban	907 (85.3%)	209 (23.0%)	698 (77.0%)		93 (10.2%)	814 (89.8%)	
Rural	156 (14.7%)	46 (29.5%)	110 (70.5%)	0.08	19 (12.2%)	137 (87.8%)	0.5
Relationship to Patient							
Spouse	142 (13.4%)	24 (09.4%)	118 (14.6%)	0.03	19 (17.0%)	123 (12.9%)	0.2
Child	661 (62.2%)	176 (69.0%)	485 (60.0%)	<0.01	63 (56.2%)	598 (62.9%)	0.2
Sibling	162 (15.2%)	37 (14.5%)	125 (15.5%)	0.7	19 (17.0%)	143 (15.0%)	0.6
Parent	38 (03.6%)	5 (02.0%)	33 (04.1%)	0.06	8 (07.1%)	30 (03.2%)	0.01
Other	60 (05.6%)	13 (05.1%)	47 (05.8%)	0.7	3 (02.7%)	57 (06.0%)	0.2
Health insured							
Yes	358 (33.7%)	66 (18.4%)	292 (81.6%)		39 (10.9%)	319 (89.1%)	
No	705 (66.3%)	189 (26.8%)	516 (73.2%)	<0.01	73 (10.4%)	632 (89.7%)	0.8
When last check-up							
Never	583 (54.9%)	151 (59.2%)	432 (53.4%)	0.1	58 (51.8%)	525 (55.2%)	0.5
Within a Year	399 (37.5%)	84 (33.0%)	315 (39.0%)	0.08	46 (41.1%)	353 (37.1%)	0.4
Over a Year	81 (07.6%)	20 (07.8%)	61 (07.6%)	0.9	8 (07.1%)	73 (07.7%)	0.8
Family history of NCDs							
Yes	908 (85.4%)	224 (24.7%)	684 (75.3%)		99 (10.9%)	809 (89.1%)	
No	155 (14.6%)	31 (20.0%)	124 (80.0%)	0.2	13 (08.4%)	142 (91.6%)	0.3
NCD death (family)							
Yes	218 (20.5%)	41 (16.1%)	177 (21.9%)	<0.05	24 (21.4%)	194 (20.4%)	0.8
No	799 (75.2%)	199 (78.0%)	600 (74.3%)	0.2	83 (74.1%)	716 (75.3%)	0.8
Do not know	46 (04.3%)	15 (05.9%)	31 (03.8%)	0.1	5 (04.5%)	41 (04.3%)	0.9
NCD Knowledge							
Adequate	847 (79.7%)	192 (22.7%)	655 (77.3%)		93 (11.0%)	754 (89.0%)	
Poor	216 (20.3%)	63 (29.2%)	153 (70.8%)	<0.05	19 (08.8%)	197 (91.2%)	0.4
Weight Perception							
Correct	660 (62.1%)	180 (27.3%)	480 (72.7%)		61 (09.2%)	599 (90.8%)	
Incorrect	403 (37.9%)	75 (18.6%)	328 (81.4%)	0.001	51 (12.7%)	352 (87.3%)	0.08

5.7% vs 8.3%, p = 0.1), males had a higher likelihood of having 'behavioral risks alone' (i.e. 27.8% vs 14.9%, p <0.001), while females had higher chances of having both risks (i.e. 75.5% vs 60.5%, p <0.001). In the context of age, age group 18–34 displayed higher rates (38.3%) of 'behavioral risks alone' compared with age groups 35–54 (11.8%) and ≥55 (7.5%), both p <0.001. In contrast age groups 35–54 and ≥55 exhibited higher frequencies of 'biological risks alone' (7.8%, p <0.05 and 11.3%, p <0.01) and 'both risks' (78.6% and 78.9%, both p <0.001) respectively compared with age group 18–34 (4.5% and 50.9%).

With respect to modifiable behavioral risk factors, 34 (3.2%) were tobacco users, 56 (5.3%) had harmful alcohol consumption, 691 (65.0%) had unhealthy eating behavior, and 820 (77.1%) were physically inactive (Figure 1).

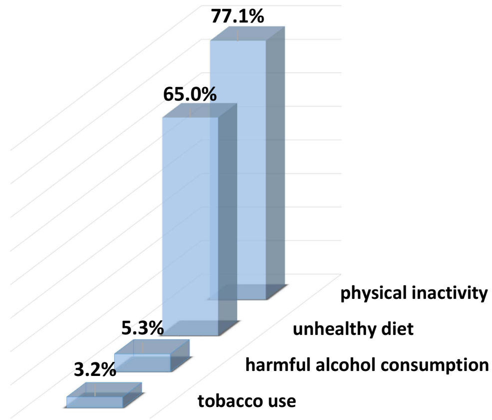

Figure 1 Bar graph displaying the frequency and pattern of modifiable behavioral NCD risk factors.

Pertaining to modifiable biological risk factors, 710 (66.8%) had excess body weight [overweight 358 (33.7%) and obese 352 (33.1%)], 420 (39.5%) had hypertension [219 (52.1%) of whom were newly diagnosed] and 62 (5.8%) were diabetic [19 (30.6%) of whom were newly diagnosed] (Figure 2). In general, 181 (17.0%) participants had one risk factor, 336 (31.6%) had two, 317 (29.8%) had three, 155 (14.6%) had four, 37 (3.5%) had five, 1 (0.1%) had six, and none had seven of the assessed modifiable NCD risks (Figure 3). Cumulatively, 510 (48.0%) participants had three or more (i.e. clustering) modifiable NCD risk factors in different permutations.

Compared with their risk-free counterparts, participants with modifiable biological risk factors were older (43.0 vs 32.6, p<0.001) and the age group ≥55 displayed the highest risk frequency (i.e. 89.9%) compared with the age groups 18–34 (55.4%) and 35–54 (86.7%). Furthermore, females displayed a higher rate of modifiable biological risk factors compared with males (i.e. 83.8% vs 66.2%, p<0.001) (Table 1). On the contrary, participants displayed similar rates of modifiable behavioral risk factors across age (18–34: 89.2%; 35–54: 90.7%; ≥55: 86.2%; p>0.05) and sex (90.4% vs 88.3%, p = 0.3). However, married (68.4% vs 53.6%, p<0.01) and employed (20.1% vs 11.6%, p = 0.03) individuals displayed a higher rate of behavioral risks compared with their unmarried and unemployed counterparts (Table 1). With respect to the distribution of modifiable risk factors by age, tobacco use was similar across the three age groups (18–34: 4.0%; 35–54: 2.7%; ≥55: 3.1%; p>0.05). Likewise, harmful alcohol consumption was similar across age (18–34: 4.2%; 35–54: 6.1%; ≥55: 5.0%; p >0.05). Age group ≥55 displayed the lowest rates of physical inactivity (18–34: 77.0%; 35–54: 81.9%; ≥55: 61.6%). With age group 18–34 as the reference, age groups 35–54 and ≥55 had higher rates of overweight (46.7% vs 78.7%, p <0.001 and 46.7% vs

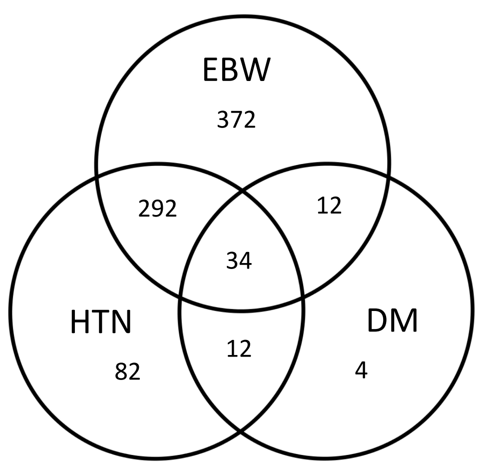

Figure 2 Venn diagram displaying the frequency, pattern and interactions of modifiable biological NCD risk factors.
Abbreviations: EBW, excess body weight; HTN, hypertension; DM, diabetes mellitus.

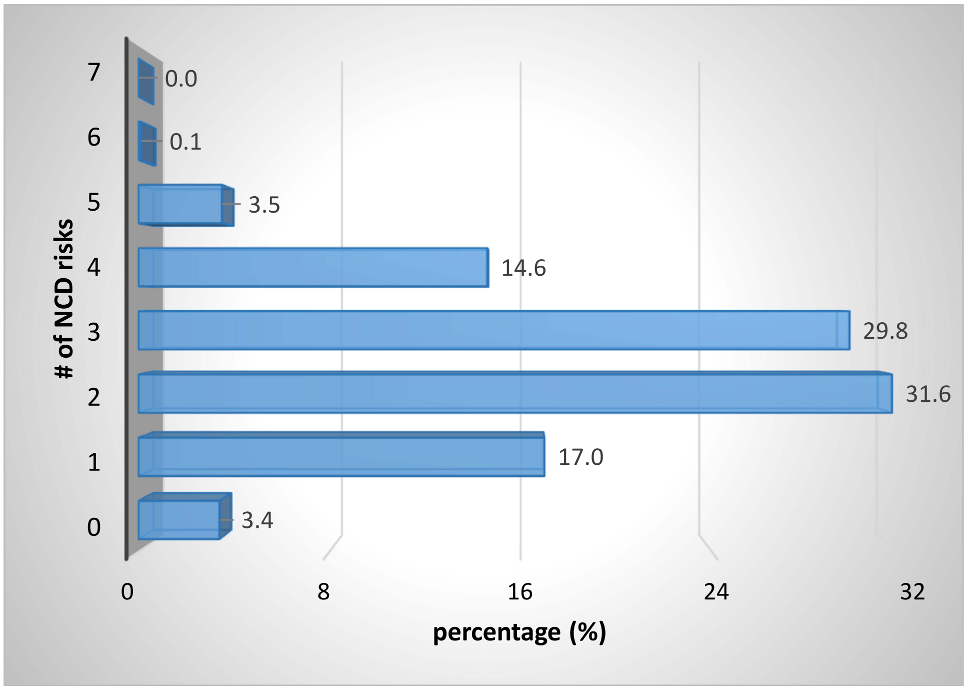

Figure 3 Bar graph displaying the proportion of participants by number of modifiable NCD risks.

75.5%, p<0.001, respectively), hypertension (19.0% vs 44.8%, p <0.001 and 19.0% vs 71.1%, p <0.001, respectively) and diabetes (1.6% vs 6.5%, p <0.001 and 1.6% vs 13.8%, p <0.001, respectively).

Regarding NCD risk pattern by sex, males had higher frequency of tobacco use (6.8% vs 0.3%, p <0.001) and harmful alcohol consumption (7.2% vs 3.7%, p = 0.01) compared with females. In contrast, females displayed higher rates of excess body weight (75.8% vs 55.4%, p <0.001) and hypertension (42.2% vs 36.1%, p = 0.04) compared with males. Other risk factors i.e. unhealthy diet (32.3% vs 37.2%, p = 0.1), physical inactivity (75.2% vs 78.7%, p = 0.2), and diabetes (5.9% vs 5.7%, p = 0.9) were similar between the two sexes. Concerning NCD knowledge, similar rates of adequate knowledge were observed across all but three modifiable risk behaviors, i.e. tobacco use (58.8% vs 80.4%, p <0.01), unhealthy diet (77.7% vs 83.3%, p = 0.03), and overweight (82.0% vs 75.1%, p <0.01) in which those with risk behaviors displayed lesser knowledge.

A logistic regression analysis was performed to elucidate on the factors associated with modifiable NCD risk factors (Table 2). In a logistic model of 12 characteristics, 3 characteristics i.e. female sex, regular income-generating activity and married status displayed a significant association with the outcome during bivariate analysis. However, after adjusting for plausible confounders during multivariate analyses, female sex (OR 4.6, 95% CI 2.1–10.4, p <0.001) and married status (OR 3.5, 95% CI 1.6–7.7, p <0.01) proved to be the independent associated factors.

Discussion

The burden of NCDs is escalating worldwide and the ramifications (i.e. morbidity and mortality) are resonating across the globe. Owing to rapid globalization and urbanization, a resource-constrained SSA region is experiencing a devastating impact of the dual burden of NCDs and infectious diseases. This double burden not only poses an enormous challenge to health-care providers and policymakers but halts the progress towards achieving the developmental goals.[3,21] Moreover, the lack of reliable data regarding NCD risk factors and associated morbimortality is SSA is a well-known obstacle.[22] As public health interventions are data driven, data paucity in the region affects the understanding of disease trends and impairs planning of population-tailored interventions amidst the rapidly rising NCD burden.

Table 2 Factors Associated with Modifiable NCDs Risk Factors

Characteristic	Comparative	OR	95% CI	p-value	Adj.OR	95% CI	p-value
Age >40	Age≤40	2.4	1.1–5.0	0.02	1.3	0.5–2.9	0.6
Female	Male	4.6	2.1–10.2	<0.001	4.6	2.1–10.4	<0.001
≤ Primary Education	≥ Secondary Education	2.4	1.1–5.3	0.03	1.7	0.7–3.8	0.2
Regular income-generating activity	Unemployed/Retired	2.0	1.0–4.0	0.06	-	-	-
Married	Single/Divorced/Widowed	3.8	1.9–7.5	<0.001	3.5	1.6–7.7	<0.01
Urban residence	Rural	1.9	0.6–6.4	0.3	-	-	-
Possess health insurance	Uninsured	1.3	0.6–2.5	0.5	-	-	-
Never had a health check-up	Ever had a check-up	1.2	0.6–2.4	0.6	-	-	-
Positive family history of NCDs	Negative history	1.9	0.6–6.3	0.3	-	-	-
Positive family history of NCDs death	Negative history	1.0	0.4–2.3	1.0	-	-	-
Incorrect weight perception	Correct perception	1.9	0.9–4.0	0.1	-	-	-
Poor knowledge of NCD risks	Adequate knowledge	1.6	0.6–4.2	0.3	-	-	-

This present study revealed a substantially high (>96%) existence of NCD risks among caregivers of patients with NCDs. Our findings however are consistent with numerous previous studies from Nepal, Nigeria, Saudi Arabia, and South Africa which revealed rates between 96.7% and 97.2%.[23–26] With such alarming prevalence of modifiable NCD risks in different communities across the globe, almost the entire adult population comprises impending NCD patients. Furthermore, half of participants in this study exhibited clustering of NCD risk factors. Similarly, roughly one in two participants in studies conducted in Bhutan (52.5%),[15] India (52.9% and 56.3%),[27,28] Nepal (46.1%),[29] Nigeria (56.3%),[24] Saudi Arabia (57.6%),[25] and South Africa (55.5%)[26] demonstrated clustering. Owing to the understanding that NCD risk factors are not randomly distributed, clustering of modifiable risk factors has gained much attention in recent times. Moreover, as clustering confers higher risk of NCDs, understanding it and its permutations across different sociodemographic strata is pivotal in understanding NCDs and in designing effective and targeted multi-sectoral interventions to curb the risk behaviors.[30,31]

Policymakers worldwide are facing a challenge in developing strategies aimed at reducing behavioral risk factors. This challenge is largely compounded by the fact that it requires action regarding the social determinants of health. Reported by about 3% of participants in this study, tobacco use was the least prevalent risk factor in this setting. Similar tobacco use rates have been reported in Dar es Salaam city by a couple of previous community-based studies,[32,33] however, as per the WHO statistics of 2017 at least 14% of Tanzanian adults were current tobacco users.[34] Variable rates of tobacco use ranging from 2.9% in Nigeria to 49.9% in Bangladesh are reported by studies conducted in different communities.[12,15,23–27,29,35–51] Similarly, with regards to harmful alcohol use, a wide prevalence range (0.8–34.7%) is found in the body of literature.[12,15,23,24,27,29,36–44,46–49] A 5% rate in harmful alcohol consumption observed in this present study echoes findings of an earlier study conducted just over a decade ago in Dar es Salaam city.[52] Nonetheless, a more recent study in a similar setting that involved motorcycle taxi riders revealed a striking rate (61.5%) of hazardous alcohol consumption.[53] Such discrepancy in the risk rates underscores the importance of studying different socio-demographic groups because although the risk factors are uniform, the burdens of particular risks are not necessarily similar. Some risk factors were seemingly gendered. For instance, tobacco use and harmful alcohol consumption were significantly higher among males. Nonetheless, previous studies have unanimously demonstrated a similar sex pattern regarding the two behavioral risks.[12,15,23–27,29,35–51]

Observed in about two-thirds and over three-quarters of participants, unhealthy eating and physical inactivity, respectively were amongst the top modifiable risks in this setting. Both diet and activity level are known to play essential roles in the etiology and pathophysiology of various NCDs. Findings from this present study are significantly higher compared with findings of the 2012 national STEPS survey which revealed 9.2% and 3% rates of unhealthy diet and physical inactivity, respectively.[54] With the rapidly rising rates of overweight, hypertension and diabetes in Tanzania, it is increasingly becoming evident that the soaring rates of consumption of highly processed foods together with low levels of physical activity are playing a dominant role in the NCD epidemic.[33,55,56] Nonetheless, despite the wide variability in the rates of unhealthy eating (41.9–99.7%) and low physical activity (14.5–86.4%) from studies worldwide, the message is clear that both risks are increasing at a staggering rate.[12,15,23–28,35–46,49–51,57,58]

To successfully stifle the emergence of NCDs in Tanzania, effective measures to address the biological risk factors are imperative. Over two-thirds of participants were overweight or obese. Studies from all over Tanzania have produced distressing rates of overweight and obesity in recent years. Our findings echo the results of a community-based study that involved nearly 7000 Dar es Salaam residents that revealed rates of overweight/obesity of 67.2%.[33] Another recent study conducted in Arusha region, northern Tanzania revealed similar rates of excess body weight (68.9%) among participants.[59] Looking back at the 2012 national STEPS survey which revealed 26% rate of excess body weight, the current trend (i.e. ≥two-thirds of participants being overweight) raises serious public health concerns.[54] Furthermore, studies in other countries have revealed overweight rates ranging between 33% and 75.9%.[12,15,23–27,29,35–38,40,41,45,48–50] As it's linked to literally every chronic condition and increased all-cause mortality, overweight is potentially the strongest modifiable risk factor for NCDs.[60,61]

About two-fifths of participants in this study were hypertensive, half of these being newly diagnosed. Rates of hypertension continue to rise in the country, and more worryingly are the unsatisfactory low awareness, treatment and control rates.[62–66] As with other risk factors, variable rates of hypertension (21–76%) are documented across the world, all displaying an upward trend.[15,23–27,29,35–40,42,43,45,47,49] Diagnosed in less than 6% of participants with nearly a third being newly diagnosed, diabetes was the least prevalent biological risk factor in this study. The rates of diabetes in this present study are lower than those of the 2012 national STEPS survey which revealed rates of >9%,[54] however, a more recent study conducted in a northern region of Tanzania (Kilimanjaro) revealed similar rates (5.7%) of diabetes.[67] Similar to hypertension, diabetes is under-recognized and poorly controlled with reported prevalence ranging between 3.9% and 22.8%.[15,23–25,27,29,35–37,39–41,43,45,46,48,49] A sizeable deviation regarding the prevalence of overweight and hypertension was observed between the two sexes, with females displaying a higher burden. Such observation echoes findings of multiple previous studies[15,25,27,33,35–38,40,41] and together with the aforementioned sex differences in tobacco use and harmful alcohol consumption it underscores that some risk factors might require a sex-specific approach.

Knowledge about NCD risk factors is an essential step towards modifying lifestyle risks.[68–71] Impressively, over three-quarters of caregivers in this present study had adequate NCD knowledge. A wide variability of NCD knowledge has been documented from different parts of the world, some as modest[12,72,73] as ours but some quite as low.[12,23,48,74–77] Participants with some risk behaviors i.e. tobacco use, unhealthy diet and overweight displayed poorer knowledge compared with their risk-free counterparts. This observation calls for implementation and intensification of awareness raising programs particularly for the abovementioned risk factors. Nonetheless, the observation that the majority of study participants were knowledgeable yet having a high burden of risk factors is worrying and warrants further exploration. However, in consonance with our findings, numerous previous studies from different regions around the globe have observed a nonsignificant correlation between an individual's NCD risks and NCD knowledge.[12,23,73,75–77,] Such disconnection between an individual's knowledge and lifestyle raises serious public health concerns and calls for potential revision and/or intensification of the educational initiatives for NCDs.

Strengths and Limitations

Several strengths can be drawn from this study: (i) a sufficiently large sample to estimate the prevalence and describe the pattern of NCD risk factors as well as conducting analyses stratified according to potential effect modifiers, (ii) the use of rigorous and standardized tools for data collection and utilization of the WHO STEPS tool for assessment of NCD risks. Conversely, this study is not short of limitations. Owing to the cross-sectional nature and convenience sampling method technique utilized, we cannot preclude bias, explore causality or generalize these findings. Nonetheless, findings obtained from this study can contribute in formulation of larger and more representative community-based studies for a more robust NCD risks estimation. Furthermore, as study participants were caregivers of individuals with established NCDs, it is conceivable that they are more likely to be enlightened than the general population regarding NCD risks and their prevention, thus their responses could be somewhat different to those of the general public. Lastly, as our assessment of some risk behaviors (i.e. tobacco use, alcohol consumption, physical inactivity and dietary habits) relied on self-reports, we cannot rule out possibility of response bias and/or recall bias with consequential over- or under-estimation.

Conclusions

A vast majority of caregivers of NCD patients in this tertiary setting were found to have modifiable NCD risk factors with a strong tendency of clustering. These findings call for intensification of both population strategies and targeted group interventions for better control of the NCD menace and its correlates. Lifestyle modifications at the population level are urgently required as several risk factors such as unhealthy diet, excessive body weight, high blood pressure and physical inactivity were alarmingly high and frequently clustered. Moreover, primary prevention strategies to increase awareness, strengthen legislative measures and promote behavior change coupled with strengthening of the current health-care surveillance system for continuous monitoring and evaluation of NCD programs is paramount in the NCD battle.

Abbreviations

BMI, body mass index; cm, centimeter; CI, confidence interval; CVDs, cardiovascular diseases; DALYs, disability-adjusted life years; DBP, diastolic blood pressure; FBG, fasting blood glucose; kg, kilogram; MET, Metabolic equivalent of task; NCDs, non-communicable diseases; OR, odd ratio; SBP, systolic blood pressure; SPSS, Statistical Package for the Social Sciences; SSA, sub-Saharan Africa; STEPS, STEPwise Approach to NCD Risk Factor Surveillance; US$, United States Dollars; WHO, World Health Organization.

Data Sharing Statement

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

Ethics Approval and Consent to Participate

Participants gave written informed consent to participate in the study. The study protocol was approved by the local ethics committees (Jakaya Kikwete Cardiac Institute) and was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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