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Modifiable Risk Factors for Non-Communicable Diseases among Undergraduate Students in Dar es Salaam, Tanzania: A Cross-Sectional Study

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Abstract

Background

Non-Communicable Diseases (NCDs) are among the global health problems accounting for more than 70% of deaths. Yet, healthcare, workers, university and college students who are key educators to the public about health matters are ironically at high risk for NCDs. We aimed to assess modifiable risk factors for NCDs among undergraduates in Dar es Salaam, Tanzania.

Methods

This was a cross-sectional study among respondents from six universities. The sample was split equally between universities with medical and those without medical courses. Respondents were randomly selected from each of the two clusters of universities. We administered a modified World Health Organization (WHO) STEP-1 questionnaire to collect data on modifiable risk factors for NCDs.

Results

Of the 574 undergraduates studied, 275 (47.9%) were in medical programmes. Among medical students, 262 (95.3%), as compared to 291 (97.3%) of the non-medical undergraduates had at least one NCD modifiable risk factor. While 15 (4.8%) of undergraduates in medical cluster reported consuming heavy alcohol, non-medical undergraduates reporting similar behaviour were 6 (2.3%). The proportion of non-medical undergraduates reporting to lead a sedentary lifestyle was significantly higher, 97 (37.5%), as compared to 82 (31.2%) of their counterparts ($p<0.01$). Independent of age, marital status and year of study, male undergraduates in non-medical programmes had 16% increased prevalence ratio of modifiable risk factors compared to females, (aPR=1.16, 95%CI: 1.03–1.30).

Conclusions

On one hand, use of tobacco, heavy alcohol consumption and excessive salt intake among undergraduates are low. On the other, the proportions of undergraduates having inadequate fruits and vegetables and physical inactivity are extremely high.

Keywords: *Non-Communicable Diseases, Modifiable Risk Factors, STEPS Survey, Undergraduates, Tanzania.*

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Introduction

Non-communicable diseases (NCDs) refer mainly to chronic conditions (1). They include, for example, diabetes, cancers, cardiovascular diseases, obesity, chronic respiratory diseases, musculoskeletal diseases, mental disorders and others and are not transmitted from one person to the other (2, 3). They result from a combination of genetic, physiological, environmental and behavioral factors (4). Currently, in some countries of sub-Saharan Africa like Tanzania, the leading cause of hospital admissions and ultimately mortality include infectious diseases such as malaria, respiratory infections, HIV/AIDS and anaemia (5). However, due to the rising scourge of NCDs, by 2030 they will be the leading causes of mortality followed by infectious diseases in the region (6).

Although NCDs are complex and having multifactorial aetiology, the World Health Organization (WHO) underscores behavioral and biological risk factors (7, 8). Of the two categories, most of the factors in the former category are associated with the lifestyle of the individual (9). These risk factors are modifiable or controllable. Examples of common lifestyle-related NCDs risk factors include tobacco use, harmful alcohol consumption, unhealthy diet and physical inactivity (10, 11). In spite of the scanty literature on NCDs in many developing countries, one of the most recent WHO-guided surveys in Tanzania was about physical activity and associated socio-economic factors in rural and urban Tanzania. In this survey, more than 95% of the study participants attained the WHO-recommended level (12). However, one of the studies found more than 7% in Zanzibar and 16% in Tanzania Mainland being smokers (13).

Statistically, the behaviour and general practices of healthcare workers (HCWs) on NCDs do not deviate significantly from those of the general population (14). Although on one hand healthcare workers are perceived by the majority to be the frontline in education and providing healthcare services, but on the other hand the society would consider them to be a mirror of their practices (15). Studies have demonstrated patients receiving appropriate counselling on healthy behaviours were dependent on health workers attitudes and behaviour (16). The universities and other higher academic learning institutions have the responsibilities of not only to impart knowledge and skills to students but also to groom them so that the education they get has meaningful impact in the society (17). In these institutions, medical students are trained to gain an understanding of both the aetiology of diseases and the factors involved. They also get experiences from direct contact and consultation with

patients suffering from different morbidities including NCDs. In this process, a positive behaviour change is expected. It is therefore important to address how theoretical and clinical knowledge and practice affect student's habits to the control of NCDs. Mishra et al. suggest that a larger proportion of these students have greater risk factors of NCDs when compared to the general population (18). This is important because unhealthy habits in universities and colleges may persist to adult life (19).

While the public assumes that HCWs are too knowledgeable on NCDs, medical students, physicians, and other HCWs have similar or even increased modifiable risk factors for NCDs as the non-healthcare workers (18). This contradiction indicates a variance between knowledge and practices towards preventative practices among physicians, which have led to obesity, risky and harmful alcohol use, low level of physical activity and poor intake of healthy diets (fruits and vegetables) (19–22).

All undergraduates in Tanzania are either enrolled in medical or non-medical streams (23). While the medical undergraduate degrees include Doctor of Medicine (MD/MBBS) and Doctor of Dental Surgery (DDS), all other undergraduate courses are non-medical degrees. However, whether in medical or non-medical stream, undergraduates are trained and also are expected to be future leaders in their various professions. Furthermore, upon graduation these students, especially those in medical stream, have a great role to play in the provision health and well-being of community members (24, 25). Because of having more exposure in health-related issues, this expectation may be higher towards undergraduates undertaking medical courses than their counterparts.

Like in many other sub-Saharan countries and in low- and middle-income countries, Tanzania has limited literature on the burden and distribution of modifiable risk factors of NCDs among adolescents, university students and in adults (26–28). Furthermore, few studies have compared modifiable risk factors of NCDs among medical and non-medical university students. Lack of literature and baseline data are some of the impediments against corrective measures to reverse the tide. Therefore, this study compared undergraduates in medical and those in non-medical universities in Dar es salaam, Tanzania to determine the prevalence of modified risk factors for NCDs and the associated individual-level predictors.

Methods

Study design setting

A cross-sectional study was conducted among clusters of undergraduates in Dar es Salaam, Tanzania. There are 13 public and private universities and colleges in Dar es Salaam, five of them having medical training programmes. Countrywide, the population of undergraduates with medical programmes is about 5,000 while that of non-medical programmes is about 23,000.

Sample size and sampling

We used a sample size formula for estimating two proportions as suggested by Fleiss (29). Since we aimed to compare between medical and non-medical undergraduate students, the sample size and sampling process reflected the two clusters. Although there are limited data about risk factors for NCDs among undergraduates in Tanzania, using results from the general population (30), we assumed that about 30% of non-medical and 20% of medical undergraduate students are current smokers. Using a 95% confidence level and aiming to have 80% power of detecting the difference, with equal allocation between the two clusters, the sample size for each cluster was 313 undergraduates.

We applied a two-stage sampling strategy to get the study population in each cluster. In the first stage the primary sampling units were universities. From a list of four medical and eight non-medical universities in Dar es Salaam, we randomly selected three universities in each cluster. The secondary sampling units included students from the selected universities. In Tanzania, all undergraduate medical programmes last for five years. Since we were focusing on knowledge and behaviours towards NCD risk factors as a result of medical training, we excluded students in the first and second year of medical programmes because they have less exposure to medical training. Therefore, all students in third, fourth and fifth years were eligible for selection. We requested a list of these undergraduates from the dean of students in each university. Using a simple random sampling procedure, we selected 350 medical undergraduates, over and above the calculated sample size, to allow for non-participation. For non-medical universities/colleges, most of their programmes last for up to four years. Since we did not expect much exposure health-related matters as compared to undergraduates in the other group, all undergraduates in this cluster were eligible for the study. Nevertheless, we excluded universities offering programmes based on online and distance learning modes due to logistics of accessing students in these universities and also

undergraduates from abroad because of the possibility for them having previous training on NCDs.

Data collection instruments

We used a self-administered WHO STEPS (STEP-wise approach to Surveillance) data collection tool on NCDs risk factors (31). We pre-tested the tool in one university different from those earmarked for the study. After the pre-testing, the tool was slightly modified to suit local situation. For example, some of the demographic information (level of education, occupation, etc.), type of tobacco products were revised to meet out study population. For instance, betel nut, leaf, etc. were not included in the tool. The questionnaire included structured questions organized into two main sections: (a) the background (social and demographic) information and (b) exposure to the five risky behaviours related to NCDs (tobacco use, alcohol consumption, unhealthy diet, salt intake and physical inactivity). The tool was prepared in English and organized with full instructions for self-administration. Consenting participants were left with the tool to fill-in for about one week after which we collected filled-in questionnaires for processing and analysis.

Study variables and measures

In 2002, WHO developed a surveillance tool for monitoring the main NCD risk factors. The entire surveillance process is referred to as Stepwise approach to non-communicable disease (NCD) Surveillance (STEPS). It contains three main steps: STEP-1, used to collect background characteristics and behavioral measurements, STEP-2 for physical measurements and STEP-3 for biochemical samples. STEP-1 contains self-report information on demographic and socio-economic data, exposure to tobacco and alcohol, physical inactivity, fruits and vegetable intake. For our objectives, we extracted key questions from STEP-1 module. Furthermore, assessing the burden of modifiable risk factors for NCDs using a WHO standard tool may have some limitations.

Tobacco use

Tobacco use was assessed using self-reporting. It was defined as smoking cigarettes, *shisha*, smokeless tobacco, cigars, nicotine e-cigarette or “vaporizer pens” or hand-rolled cigarettes. Smokers were either current (within 12 months) or previous (life-time).

Alcohol consumption

Study participants self-reported alcohol consumption. Although classification of alcohol consumption varies considerably, in this study we defined heavy drinkers as those drinking more than five and four standard drinks for men and women respectively per day while light drinkers were those drinking less than this amount or not drinking at all. One standard alcoholic drink was regarded as consuming a 300ml bottle of regular beer or local brew, 30 ml of spirits or 120 ml glass of wine.

Salt intake

Participants self-reported types (ordinary table salt, unrefined salt, iodized salt, salty stock cubes and powders and salty sauces) and quantity and frequency of dietary salt intake. Valid responses ranged from always (1) to never (5). “Always” was translated to mean poor intake while “never” was translated to mean low salt intake. We ended up having a composite variable on dietary salt with the excessive salt intake (4-12 points) and recommended salt intake (13-20).

Physical activity

Participants self-reported time duration spent on different types of physical activity in a typical week. Physical inactivity also here referred to as sedentary lifestyle was computed as the sum of the total activity-minutes for work and recreational activities per week. Participants reporting physical activity less than 75 minutes of vigorous or less than 150 minutes of moderate physical activity per week were categorized as being physically inactive, while those having more were considered physically active.

Fruits and vegetable intake

Although assessing dietary intake is complex, one of the components to gauge a healthy diet is the amount and frequency of consuming fruits and vegetables (32). To assess fruits and vegetable intake, participants self-reported consumption of vegetables and fruits in a week. One serving of vegetables was considered similar to a handful of leafy vegetables or three tablespoons of kidney beans or peas or boiled maize. One serving of fruit was considered similar to one mid-sized banana or an orange or mango or a handful of grapes or similar fruits. The weighted number for servings of vegetable and fruit consumption per day was computed as follows:

*1/7 ((vegetables consumed per day*vegetable servings) + (fruits consumed per day*fruit servings))*

Based on WHO definition and recommendation (33), adequate fruit and vegetables per day should be five or more servings; equivalent to 400 grams of fruits and vegetables per day, while less than this amount should be considered as inadequate.

Overall modifiable high risk for NCDs

An undergraduate scoring at least two of the five risky NCDs factors was considered as having the overall modifiable high risk for NCDs.

Data processing and analysis

Collected data were entered into statistical software (Statistical Package for Social Sciences). The first step was to run frequencies for all variables to detect possible out-of-range values. The second step was to check for inconsistencies of responses. We summarized data by running frequencies for categorical variables and calculated the means with standard deviations for quantitative variables. We assessed the association between the outcome variables and selected independent variables using Pearson's Chi-Square test. Since the proportion of undergraduates with high-risk behaviours for NCDs was higher than 10%, we used Poisson regression to predict the risk for NCDs between the medical and non-medical university undergraduates. We calculated 95% confidence intervals as a measure of the strength of the association: using robust adjustment for clustering of the outcome within one institute. The level of significance was set at 5%.

Results

Background characteristics of study participants

From the medical group, 299 (95.5% of the estimated sample) as compared to 275 (87.9% of the estimated sample) from the non-medical undergraduates filled-in and returned the questionnaires. Table 1 summarizes the background information between the two groups. Despite the two groups being almost equally distributed by age, most of the undergraduates were young (19 to 24 years). The majority (almost 90%) were never married.

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Table 1: Background characteristics of the study participants

Characteristics	Medical (n=299) Number (%)	Non-medical (n=275) Number (%)	Total (n=574) Number (%)
Sex			
Male	209 (69.9)	167 (60.7)	376 (65.5)
Female	90 (30.1)	108 (39.3)	198 (34.5)
Mean age in years (SD)	23.6 (2.3)	24.1 (2.4)	23.8 (2.3)
Age group (years)			
19 – 24	224 (74.9)	203 (73.8)	427 (74.4)
25 – 49	75 (25.1)	72 (26.2)	147 (25.6)
Marital status			
Never married	275 (92.0)	236 (85.8)	511 (89.0)
Ever in union	24 (8.0)	39 (14.2)	63 (11.0)
Year of study			
First and second	0 (0.0)	28 (10.2)	111 (19.3)
Third	246 (82.3)	67 (24.4)	230 (40.1)
Fourth and fifth	53 (17.7)	180 (65.5)	233 (40.6)

Modifiable risk factors associated with NCDs

In Figure 1, we present the proportion of undergraduates in medical and non-medical programmes for each of the five categories of modifiable risk factors for NCDs.

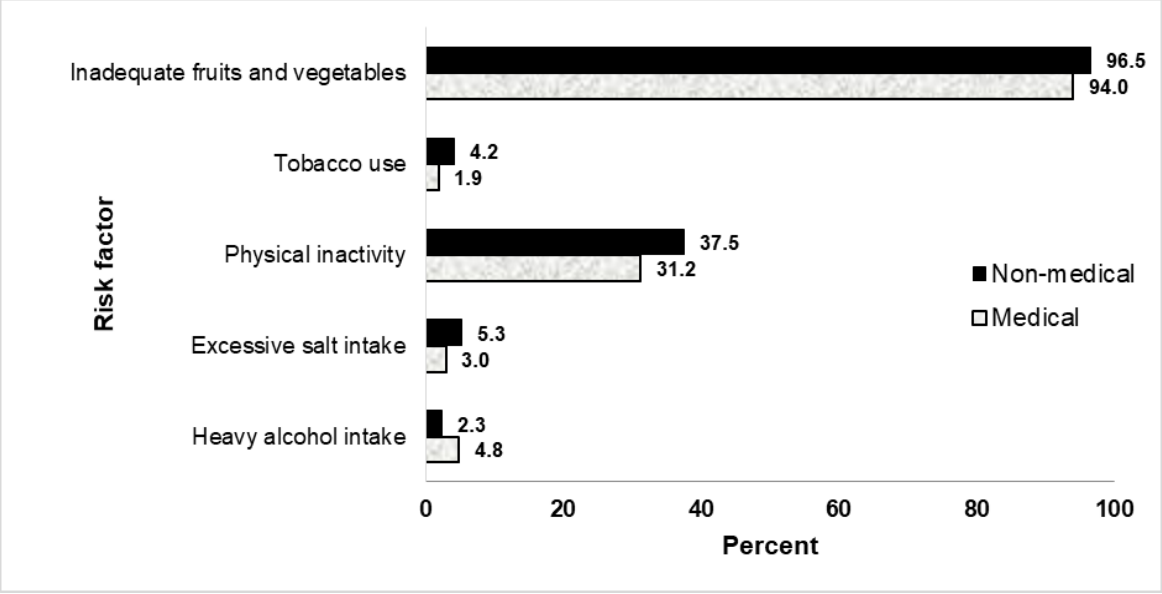

Figure 1: The proportion of undergraduates reporting modifiable risk factors for NCDs

Tobacco use

Current tobacco use was 17 (3.0%) among all undergraduates and 11 (4.2%) among undergraduates in non-medical programmes as compared to 6 (1.9%) students in non-medical programmes.

Alcohol consumption

Among all undergraduates, 21 (3.7%) reported heavy alcohol consumption. Although proportionately more than twice, 15 (4.8%), medical undergraduates reported heavy alcohol consumption compared to 6 (2.3%) among non-medical undergraduate students, the difference was not statistically significant.

***Fruits and vegetables intake*:**

The proportion of undergraduates consuming less fruits and vegetables was 546 (95.1%). Out of 315 undergraduates in medical programmes, 296 (94.0%) reported consuming less fruits and vegetables as compared to 250 (96.5%) of the 259 students in non-medical universities.

Salt intake

Out of 528 undergraduates, 21 (4.0%) reported excessive salt intake. More undergraduates 12 (5.3%), in non-medical programmes reported excessive intake as compared to 9 (3.0%) among undergraduates in medical programmes.

Physical activity

Overall, 179 (31.2%) university students in Dar es Salaam reported having inactive physical activities, thus, leading a sedentary lifestyle. Significantly, ($p < 0.01$), more students in non-medical universities reported leading a sedentary life as compared to students in medical universities, 97 (37.5%) against 82 (31.2%), respectively.

Overall high risk for NCDs among undergraduates

In total, 528 undergraduates had complete data on modifiable risk factors for NCDs. The proportion of undergraduates having the overall high risky behaviours was 168 (31.8%). Significantly, ($p=0.025$), more undergraduates in non-medical universities reported having high risk behaviours for NCDs as compared to medical undergraduates, 72 (27.3%) and 96 (36.4%) respectively. Significantly more females reported having high risk for NCDs than

males, 69 (37.3%) and 99 (28.9%) respectively (p=0.047). In addition, when comparing the proportion of the overall high risk for NCDs between medical and non-medical undergraduates, the proportion of undergraduates with high risk for NCDs is significantly higher among males in medical undergraduates as compared to their counterparts in non-medical group. In addition, the proportion of young undergraduates (between 19 and 24 years) having high risk for NCDs in medical group is significantly higher than those in a non-medical group (Table 2).

Table 2: Number and proportion of undergraduates at high risk for NCDs by selected characteristics

Characteristic	Cluster of enrolment		p-value
	Medical Number at risk (%)	Non-medical Number at risk (%)	
Sex			
Male	64 (35.8)	35 (21.3)	0.003
Female	32 (37.6)	37 (37.0)	0.928
Age (mean and SD)	23.5 (SD=2.5)	23.7 (SD=1.9)	0.857
Age group (years)			
19 – 24	76 (38.0)	57 (22.4)	0.020
25 – 49	20 (31.3)	15 (20.8)	0.252
Current marital status			
Never in union	86 (35.2)	57 (25.1)	0.017
Ever in union	10 (50.0)	15 (40.5)	0.492
Year of study			
First and second	0	9 (32.1)	NA
Third	54 (22.0)	21 (31.8)	0.099
Fourth and fifth	42 (28.0)	42 (24.7)	0.504

In Table 3 we present predictors of the overall modifiable high risk for NCDs among undergraduates in medical and non-medical groups. We used sex, age, marital status and year of study as possible predictors of high risk for NCDs. While males in non-medical programmes had 16% significantly higher prevalence of higher risk for NCDs as compared to females, (aPR=1.16, 95%CI: 1.03–1.30), never married in the same programme had 18% significantly higher prevalence of higher risk for NCDs as compared to their counterparts, (aPR=1.18; 95%CI: 1.00-1.40).

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Table 3: Factors associated with modifiable high risk factors for NCDs

	Cluster of enrolment			
	Medical PR (95%CI)*		Non-medical PR (95%CI)*	
Factor	**Unadjusted**	**Adjusted**	**Unadjusted**	**Adjusted**
Sex				
Male	1.17 (1.04, 1.31)	0.99 (0.87, 1.12)	1.02 (0.90, 1.15)	1.16 (1.03, 1.30)
Female	Reference	Reference	Reference	Reference
Age (years)				
19 – 24	Reference	Reference	Reference	Reference
25 – 49	1.07 (0.95, 1.20	1.09 (0.95, 1.25)	0.94 (0.82, 1.07)	1.05 (0.94, 1.18)
Ever married				
Never	1.17 (0.99, 1.38)	1.23 (0.96, 1.58)	1.16 (0.92, 1.46)	1.18 (1.00, 1.40)
Ever	Reference	Reference	Reference	Reference
Year of study				
First and 2nd	Reference	Reference	Reference	Reference
Third	1.07 (0.90, 1.30)	1.10 (0.94, 1.30)	1.10 (0.93, 1.30)	1.09 (0.92, 1.30)
Fourth and 5th	1.00 (0.82, 1.23)	0.99 (0.86, 1.13)	0.99 (0.86, 1.13)	1.03 (0.85, 1.26)

**Prevalence ratio (95% Confidence Interval)*

Discussion

In this study, the proportion of undergraduates reporting exposure to high risk behaviours for NCDs is more than 30%; higher among medical than non-medical undergraduates. Although data on modifiable risk factors for NCDs among undergraduates are rare, the overall prevalence in this study is similar to the findings from Nepal's general population (34), which is also a developing country. However, although more undergraduate males in medical programmes are at higher risk for NCDs as compared to their counterparts, it is contrary in the other general populations and also in a sub-group of university staff in the West Indies (32). Although sex, marital status and age differences in relation to risk factors for NCDs is complex, considerations of lifestyle are not ruled out (35).

The overall proportion of undergraduates using tobacco was less than 5% and almost similar among undergraduates in each of the sub-samples. Around the same decade, the proportion of smoking in the general population of adolescents in Dar es Salaam was about 4% (36). Nevertheless, despite of difficulties to explain low proportion of tobacco use in this study, concealment of tobacco use is also possible.

Adequate intake of fruits and vegetables is vital for the individual health specifically for the protection against major NCDs (37). In this study, many undergraduates, regardless of whether enrolled in medical or non-medical degree programmes, reported taking inadequate fruits and vegetables. In addition, Mayige and Kagaruki (30), reported similar pattern among the Tanzania general population. One of the speculations for inadequate fruits and vegetables intake is low purchasing power and cultural barriers (38).

Limitation of the study

Although the tool has been previously validated (39), we were not able to assess the validity and reliability of the extracted questions. Nevertheless, use of self-administered questionnaires improved consistent environments of our study participants, the pre-tested explanation that was included together with the tool and enough questions to measure each of the NCDs' risk factors must have improved the validity and reliability of the tool. In addition, according to WHO STEP-1 is complimented by the other two steps. In this study, due to limited resources, we were not able to include the other modules of the entire surveillance tool. Lack of two modules may have hampered the WHO STEPS methodology in assessing the modifiable risk factors for NCDs. However, in spite of the World Health Organization (WHO) STEPwise approach to non-communicable disease (NCD) surveillance (STEPS) mainly developing this tool for monitoring the national, regional or global populations (40), we feel that we were able to use part (STEP-1) of the entire tool for assessing NCD modifiable risk factors among undergraduates in Dar es Salaam, Tanzania. The current study has a significant contribution in literature of modifiable risk factors of NCDs among undergraduates in Dar es Salaam, Tanzania.

There are other several potential limitations associated with this study. The primary limitation is the possibility of under-reporting of modifiable risk factors due to self-reporting. We were not able to maximize the response rate as a result of using a self-administered questionnaire. Despite of our efforts in emphasizing the return of the tools, the overall response rate was almost 90%. Although we used a self-administered questionnaire, there is a possibility of concealment to disclose smoking and alcohol consumption habits among undergraduates leading to information bias, resulting in an underestimate of the indicators. In addition, although it is possible to conclude associations in cross-sectional studies, inference on causality is difficult. Furthermore, factors associated with NCDs are diverse.

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Modifiable factors included in this study may have not been exhaustive; rather, we remained guided by part of the WHO methodology.

Conclusion

Specific modifiable risk factors for NCDs such as tobacco use, heavy alcohol consumption and excessive salt intake were low regardless of the enrolled programmes. However, the proportion of students having inadequate fruits and vegetables and physical inactivity was high especially among undergraduates in medical programmes. We recommend universities to minimize sedentary lifestyle by setting aside mandatory time for physical exercises and to sensitize students about healthy diet that includes fruits and vegetables within the brackets of their financial capabilities.

Authors' contributions

SA conceptualization, SA and MK designed the study, SA supervision of data collection, SA and MK wrote, edited, and made final approval of the manuscript.

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Ethics approval

Although no human or animal samples were included in the research presented in this article, Muhimbili University of Health and Allied Sciences' Institutional Review Board granted the ethical clearance number DA.282/298/01.c/. We also requested for informed consent from each of the study participants; all study participants were required to sign an informed consent form.

Competing interests

Authors declare that they have no competing interests in the study.

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