*European Journal of Medical and Health Sciences*
*www.ejmed.org*

# Do People Screen for Non-Communicable Diseases? A Cross-Sectional Survey in a Peri-Urban Community in Ghana

Patrick Kwame Akwaboah and Michael Owusu

**ABSTRACT**

***Objectives*: Screening has become a key component in the fight against the rising burden of Non-Communicable Diseases (NCDs). This study assessed the rate of screening for NCD risk factors among residents in a per-urban community.**

***Setting*: The study was carried out in the Upper Denkyira East Municipality of Ghana.**

***Methods*: A descriptive cross-sectional survey was carried out among adults aged 18 to 60 years using a convenience sampling technique. Information on socio-demographic characteristics and screening for NCD risk factors were obtained using a pretested questionnaire. The Statistical Package for Social Sciences (SPSS) version 25 was used to analyze the results. Data analysis was done by descriptive statistics.**

***Results*: A total of 136 respondents participated in the study. The mean age of respondents was 31.18±6.47, with most respondents being female (63.2%). Of the 136 respondents, 16.9% had a history of raised blood pressure, and 5.9% had a history of raised blood glucose levels. The analysis indicates that there was high screening for blood pressure (70.6%), blood glucose (64.0%), and body mass index (51.5%). There was however low screening for kidney function (27.9%) and blood cholesterol/lipids (35.3%).**

***Conclusion*: There is high screening for blood glucose, blood pressure, and body mass index, but low screening for kidney function and blood cholesterol/lipids. This can significantly affect Ghana's healthcare system due to the growing burden of NCDs. Efforts aimed at encouraging and improving access to screening for NCD metabolic risk factors are key to achieving SGD 3.4.**

**Keywords:** Adults, Non-Communicable Diseases, Risk Factors, Screening.

**Submitted :** May 25, 2023

**Published :** July 12, 2023

**ISSN**: 2593-8339

**DOI**: 10.24018/ejmed.2023.5.4.1826

**P. K. Akwaboah ***
School of Public Service and Governance, Ghana Institute of Management and Public Administration, Accra, Ghana.
(e-mail: akwaboahpatrick@gmail.com)
**M. Owusu**
Ghana Health Service, Ghana.

**Corresponding Author*

## I. Introduction

Non-communicable Diseases (NCDs) have led the mortality chart worldwide for the past decade, accounting for an estimated premature 15 million yearly deaths [1]. NCDs share many common modifiable and metabolic risk factors, which include high blood pressure, high blood glucose levels, high blood cholesterol/lipids, and obesity [2]. In 2017, NCDs had the highest risk-attributable burden with 26.6 million deaths. The risk factor that led the chart was high blood pressure, with 10.4 million deaths). Also, 10.4 million deaths were attributed to smoking, with 6.53 million deaths and 4.72 million deaths attributed to high fasting plasma glucose and high body mass index respectively. High blood cholesterol and impaired kidney functions were the 8$^{th}$ and 15$^{th}$ leading risk factors with attributable deaths respectively [3]. Efforts targeted at reducing the modifiable and metabolic risk factors for NCDs are important in controlling these diseases [4].

Health screening has been a key component of the response to NCDs. Screening helps to identify early evidence of modifiable and metabolic risk factors, to improve health trajectories [5], [6]. Screening has been defined by the WHO as the presumptive identification of unrecognized disease in a healthy asymptomatic population using tests, examinations, or other procedures that can be applied rapidly and easily to the target population [7]. The WHO Best Buy, a recommended intervention for the prevention and control of NCDs globally, has "screening" as a core intervention [8]. In other jurisdictions, screening has been among the best buys in the control of NCDs [9].

While screening programs have helped to create some public health awareness, the uptake of screening services has not been encouraging [10], [11]. In working towards the Sustainable Development Goal (SDG) 3.4, which aims that by 2030, there will be a one-third reduction in premature mortality from NCDs through prevention and treatment and promotion of mental health well-being [12], improving access to and increasing knowledge on NCD metabolic risk factor screening is vital.

This paper aimed to assess Ghanaians' health screening rate in a peri-urban community for NCDs. We sought to find out if the respondents have undergone screening regarding blood pressure, blood glucose, blood cholesterol/lipids, kidney function, and body mass index (BMI).

## II. Materials and Methods

### A. Study Design

The study used a descriptive cross-sectional design. People aged 18 to 60 years in the Dunkwa Post Office Community of the Upper Denkyira East Municipality were contacted to respond to the structured questionnaire, with no follow-ups required.

### B. Setting

The study was conducted in the Upper Denkyira East Municipal. The Municipality covers 501.9sq kilometers of land, approximately 17% of land areas in the Central Region. The 2010 data from the Municipal Assembly estimates a population of 70,762 of which 34,796 are males and 35,966 are females [13].

### C. Study Population

The target population for the study was adults aged 18 to 60 in the Dunkwa Post Office Community of the Dunkwa-on-Offin Municipality. Respondents who were available in their homes or workplace at the time of the visit were recruited into the study.

### D. Sample and Sampling Technique

In a sample of 241 residents in the Dunkwa Post Office Community (13), the sample size was calculated using the Yamane Formula:

$$n = N \div (1 + Ne^2)$$

where $n$ is the sample size, N is the population size, which is 241, and **e** is the margin of error set at 0.05 (5%). A sample size ($n$=150) was obtained.

The respondents were sampled using the convenience sampling technique. Respondents who qualified to participate in the study were those aged 18 to 60. The study was conducted in January 2023.

### E. Data Collection and Analysis

Data was collected using a pretested questionnaire. The study tool was pretested in the Mfuom Market Community, which has the same demographic characteristics as the Dunkwa Post Office Community. The questionnaire comprised demographic data, history of raised blood pressure and raised blood glucose levels, and risk factors screening history. Out of the 150 respondents, 14 (9.3%) declined to participate in the study. The valid data of 136 respondents were therefore used for the study. The data were entered into the Statistical Package for Social Sciences (SPSS) version 25.0 for analysis. Data were analyzed using descriptive statistics.

### F. Ethical Consideration

The study received approval from the Research and Ethics Committee of the Ghana Institute of Management and Public Administration (GIMPA), with protocol ID number GM/IRB/71/22. A consent form was presented and approved by all respondents before the administration of the questionnaires. The study's goal was explained to the understanding of each respondent. The privacy and confidentiality of each respondent were ensured throughout the data collection, processing, and analysis.

## III. Results

A total of 136 respondents participated in this study, of which the majority (63.2%) were females, and 36.8% were males as shown in Table I. The mean age with standard deviation was 31.18±6.47, with the modal age (69.9%) between 26 to 35 years. The majority (36.8%) of the respondents had attained a high school/o level certificate, 35.3% had their bachelor's degree, 21.3% had a diploma, 7% had a master's qualification, and 2 respondents representing 1.5% had a doctorate. The proportion of respondents employed was 77.2%, while 19.9% were students and 2.9% had no employment.

TABLE I: Sociodemographic Characteristics

| Variable | Female N (%) | Male N (%) | Total N (%) |
|---|---|---|---|
| *Age* (31.18±6.47) | | | |
| 18-25 | 11 (8.1) | 7 (5.1) | 18 (13.2) |
| 26-35 | 63 (46.3) | 32 (23.5) | 95 (69.9) |
| 36-45 | 9 (6.6) | 9 (6.6) | 18 (13.2) |
| 46-60 | 3 (2.2) | 2 (1.5) | 5 (3.7) |
| Total | 86 (63.2) | 66 (36.8) | 136 (100) |
| *Educational level* | | | |
| High School/O Level | 28 (20.6) | 22 (16.2) | 50 (36.8) |
| Diploma | 21 (15.4) | 8 (5.9) | 29 (21.3) |
| Bachelors | 30 (22.1) | 18 (13.2) | 48 (35.3) |
| Masters | 5 (3.7) | 2 (1.5) | 7 (5.1) |
| Doctorate | 2 (1.5) | 0 (0.0) | 2 (1.50 |
| Total | 86 (63.2) | 50 (36.8) | 136 (100) |
| *Employment Status* | | | |
| Employed | 64 (47.1) | 41 (30.1) | 105 (77.2) |
| Student | 20 (14.7) | 7 (5.1) | 27 (19.9) |
| Not Employed | 2 (1.5) | 2 (1.5) | 4 (2.9) |
| Total | 86 (63.2) | 50 (36.8) | 136 (100) |

Source: Author's Compilation, (2023).

Among the respondents, 16.9% had a history of raised blood pressure. There was a significant relationship between gender and history of raised blood glucose levels, $\chi^2$ (1, N=136) =5.3456, p=0.021, where 5.9% (1.5% females and 4.4% males) had a previous history (Table II).

TABLE II: History of Raised Blood Pressure and Raised Blood Glucose

| Variable | Yes (%) | No (%) | Total N (%) | Significant Value |
|---|---|---|---|---|
| *History of raised blood pressure* | | | | |
| Female | 12 (8.8) | 74 (54.4) | 86 (63.2) | $\chi^2$=1.457 |
| Male | 11 (8.1) | 39 (28.7) | 50 (36.8) | p=0.227 |
| Total | 23 (16.9) | 113 (83.1) | 136 (100) | |
| *History of raised blood sugar* | | | | |
| Female | 2 (1.5) | 84 (61.8) | 86 (63.3) | $\chi^2$=5.3456 |
| Male | 6 (4.4) | 44 (32.4) | 50 (36.8) | p=0.021 |
| Total | 8 (5.9) | 128 (94.1) | 136 (100) | |

Source: Author's Compilation, (2023).

The study sought to assess the metabolic risk factor screening rate among respondents. As shown in Table III, the percentage of respondents who had screened for blood pressure (70.6%), and blood glucose (64.0%) in the past 1 year, as well as BMI in the past 2 years (51.5%) were relatively high. However, screening for kidney function (27.9%) and blood cholesterol/lipid (35.3) in the past 3 years was low. Interestingly, females screened more than males for all risk factors assessed in the study.

TABLE III: HISTORY OF RISK FACTOR SCREENING

| Variable | Yes (%) | No (%) | Total N (%) | Significant Value |
|---|---|---|---|---|
| Checked blood pressure | | | | |
| Female | 60 (44.1) | 26 (19.1) | 86 (63.2) | $\chi^2$=0.78 p=0.783 |
| Male | 36 (26.5) | 14 (10.3) | 50 (36.8) | |
| Total | 96 (70.6) | 40 (29.4) | 136 (100) | |
| *Checked blood sugar* | | | | |
| Female | 53 (39.0) | 33 (24.3) | 86 (63.3) | $\chi^2$=0.557 |
| Male | 34 (25.0) | 16 (11.7) | 50 (36.8) | p=0.455 |
| Total | 87 (64.0) | 49 (36.0) | 136 (100) | |
| *Done kidney function test* | | | | |
| Female | 23 (16.9) | 63 (46.4) | 86 (63.3) | $\chi^2$=0.166 |
| Male | 15 (11.0) | 35 (25.7) | 50 (36.7) | p=0.683 |
| Total | 38 (27.9) | 98 (72.1) | 136 (100) | |
| *Done lipid profile test* | | | | |
| Female | 28 (20.6) | 58 (42.6) | 86 (63.2) | $\chi^2$=0.767 |
| Male | 20 (14.7) | 30 (22.1) | 50 (36.8) | p=0.381 |
| Total | 48 (35.3) | 88 (64.7) | 136 (100) | |
| *Checked body mass index (BMI)* | | | | |
| Female | 46 (33.8) | 40 (29.4) | 86 (62.8) | $\chi^2$=0.381 |
| Male | 24 (17.7) | 26 (19.1) | 50 (38.2) | p=0.537 |
| Total | 70 (51.5) | 66 (48.5) | 136 (100) | |

Source: Author's Compilation, (2023).

For BMI screening, it was observed that respondents aged 26-35 had the highest frequency (39.0%), followed by 36-45-year-olds (6.6%). Respondents aged 18-25 (3.7) and 46-60 (2.2) had the lowest BMI screening rates, as shown in Table IV.

TABLE IV: AGE AND BMI

| Variable | Yes (%) | No (%) | Significant Value |
|---|---|---|---|
| *Age* | | | |
| 18-25 | 5 (3.7) | 13 (9.6) | $\chi^2$=4.916 |
| 26-35 | 53 (39.0) | 42 (30.9) | p=0.178 |
| 36-45 | 9 (6.6) | 9 (6.6) | |
| 46-60 | 3 (2.2) | 2 (1.5) | |
| Total | 70 (51.5) | 66 (48.5) | |

Source: Author's Compilation, (2023).

## IV. DISCUSSION

The study assessed the metabolic risk factors screening for NCDs among residents aged 18-60 years in the Dunkwa Post Office community of the Upper Denkyira East Municipality. The study identified 16.9% of the respondents as having a history of raised blood pressure. This was generally lower than the reported prevalence in other studies by Osei *et al*. [14] at 33.5%, and Bosu and Bosu [15] at 27%.

The screening for two metabolic risk factors was poor among respondents (kidney test=27.9%, lipid test=35.3%). High blood cholesterol/lipids are a risk factor for CVDs [16]. In 2015, CVD was the leading cause of NCD deaths globally, with an estimated 17.9 million deaths [17]. In Ghana, it accounted for 19% of all deaths in 2016 [18]. The global burden of disease risk assessment shows that high cholesterol was the 8th leading risk factor for all-cause mortality in 2017 [3]. The prevalence of high cholesterol has been recorded in other countries: 12% in the United States of America [19], 26.6% in Tunisia [20], and 44% in Saudi Arabia [21]. In Ghana, a prevalence of 11.6% and 12.8% have been recorded in rural and urban areas respectively [22].

The National Cholesterol Education Program (NCEP) in the United States recommends that adults should check their cholesterol levels every 5 years [23]. The 2012 National Policy for the Prevention and Control of Chronic Non-Communicable Diseases in Ghana (NPPCCNCDs) had as one of its strategic areas that all persons with CVD or Diabetes will be screened to assess their cholesterol levels. Also, opportunistic screening was to cover some cancers, cholesterol, and diabetes [24]. Also, the 2022 National Policy for Non-Communicable Diseases in Ghana (NPNCD) has screening and early detection as one of its key areas of focus [25].

The study revealed that the screening for cholesterol among participants was low. Several factors could account for the low screening rate. It could be due to poor knowledge of CVD and lipid abnormalities as found by Sanuade *et al*. [26], and Micah and Nkum [27]. Other factors that could also account for the low cholesterol screening rate are access and cost. Although the NPPCCNCDs aimed at having screening for cholesterol added to routine opportunistic screenings, some hospitals and health centers (where primary health care is mainly practiced, and much of the populace resides) do not have the capacity/laboratory equipment to run cholesterol tests. Clients are therefore left with no option but to do the test in private laboratories, which sometimes becomes a financial burden.

The study also revealed a low screening rate for kidney function. Chronic Kidney Disease (CKD) has been a growing challenge, especially in LMICs. CKD caused an estimated 1.2 million deaths in 2015 [17]. In Nigeria, the prevalence of CKD was reported to be 12% by Olanrewaju *et al*. [28]. A study by Tannor *et al*. [29] in Ghana revealed a CKD prevalence of 28.5%, while Bawah *et al*. [30] also found a prevalence of 13.2%. These studies reveal a high prevalence of CKD in Ghana. In 2017, impaired kidney function was the 15th leading risk factor for all-cause mortality globally [17]. There is a need therefore for affirmative steps to be taken to screen for risk factors of CKD in Ghana. The low screening rate for kidney function among the respondents could be due to cost, access, or lack of kidney disease awareness. Tannor *et al*. [31] showed in their study that lack of kidney disease awareness, and inadequate services to accurately diagnose kidney disease [32] are factors affecting the screening and diagnoses of CKD in Ghana.

The global prevalence of overweight and obesity has increased over the years. People with obesity increased from 921 million in 1980 to 1.2 billion in 2012 [33]. In Ofori-Asenso *et al*. [34] systematic review and meta-analysis, a national prevalence of 25.4% for overweight and 17.1% for obesity among Ghanaian adults was seen. Obesity is associated with an increased risk of CVDs, diabetes, hypertension, musculoskeletal disorders, and some cancers [35]. In 2017, high BMI (an indicator of obesity/overweight) was the 4th leading risk factor for all-cause mortality globally

[3]. It is therefore imperative that BMI screening be encouraged and intensified.

The study revealed that although BMI screening was high, the screening rate for age groups 18-25 years was low. Because BMI screening is free at all healthcare facilities, intensifying education on free BMI screening at all public health facilities, and the health and economic implications of BMI will be a good step in consolidating Ghana's gains toward achieving SDG 3.4 targets by 2030. Also, this age group is of particular interest as screening to identify the risk of obesity can help prevent increased morbidity and mortality associated with obesity-related diseases.

The burden of hypertension and diabetes has been increasing over the years globally. They were found to be among the leading cause of all deaths globally [17]. A high prevalence of hypertension and diabetes has been reported globally [36] and in Sub-Saharan Africa [37], [38]. In Ghana, studies have shown a prevalence of 27% [15] and 13% [39] for hypertension. Also, a 6.46% [40], and 13.1% [14] prevalence rate for diabetes has been reported. High blood pressure and high fasting plasma glucose were among the leading risk factors for all-cause mortality in 2017 [3]. This study revealed a high screening rate for blood pressure and blood glucose. Notwithstanding, efforts can be improved to encourage a higher screening for blood glucose and blood pressure among Ghanaians.

NCDs share the most common risk factors, namely high blood glucose levels, high blood pressure, high cholesterol, high body mass index, and impaired kidney function. Working towards achieving the goal of SDG 3.4 means increasing efforts to screen many Ghanaians for these risk factors that contribute significantly to the disease burden.

## V. Conclusion

While the screening rate for blood pressure, blood glucose, and BMI was high among respondents, kidney function and blood cholesterol/lipids screening were low.

The Ghana Non-Communicable Disease Landscaping revealed key barriers in the country's response to NCDs. There was inadequate NCD screening in many health facilities, no organized screening programs among 20% of assessed facilities, and no community-based screening programs among over 60% of assessed facilities [41].

These barriers, coupled with the findings from this study make it imperative for strengthening and increasing access to screening for NCD risk factors. With a key focus on increasing access to screening services and training staff in NCD screening and counseling, the NPNCD [25] will be of great benefit in the fight against NCDs if implemented successfully. Also, increased health education on NCD risk factors among the various communities in Ghana will contribute greatly to increased knowledge levels.

There should be increased dialogue between the Ministry of Health, Ghana Health Service, Teaching Hospitals, Christian Health, Private Facilities, the National Health Insurance Scheme, and key stakeholders on making screening for blood glucose, cholesterol, and kidney function free at no extra cost to each Ghanaian, at least once in every 5 years, and equipping all district hospitals and most health centers to run these tests.

There should also be further studies to identify socioeconomic, psychological, and personal factors that influence the low screening rate for cholesterol and kidney function while intensifying educational and outreach programs that target BMI screening among the youth.

## VI. Limitation

A self-reported questionnaire was used in this study, where respondents answered the questions themselves with supervision from the researchers. As such, there is a possibility that the results were influenced by a respondent/recall bias.

## Funding

The work was funded by the authors with no external funding.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

## References

[1] United Nations General Assembly. Progress on the prevention and control of non-communicable diseases. 2017; A/72/662.

[2] PAHO. Non-communicable diseases [Internet]. 2022 [cited 2022 Jun 5]. Available from: http://www.paho.org/en/topics/noncommunicable-diseases

[3] GBD 2017 Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet. 2018:* 1923-94.

[4] WHO. Non-communicable diseases [Internet]. 2022 [cited 2022 Jun 6]. Available from: http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

[5] Fragala MS, Shiffman D, Birse CE. Population Health Screenings for the Prevention of Chronic Disease Progression. *Am J Manag Care*. 2019; 25(November): 548–53.

[6] Wild CP, Espina C, Bauld L, Bonanni B, Brenner H, Brown K, *et al*. Cancer Prevention Europe. *FEBS Press*. 2019; 13: 528–34.

[7] Sagan A, Mcdaid D, Rajan S, Farrington J, Mckee M. Screening When is it appropriate and how can we get it right? Policy brief 35 health systems and policy analysis. 2020; Available from: http://www.euro.who.int/en/about-us/partners/.

[8] WHO. Best buys and other recommended interventions for the prevention and control of noncommunicable diseases. World Health Organization. 2017.

[9] Teerawattananon Y, Kingkaew P, Koopitakkajorn T, Youngkong S, Tritasavit N, Srisuwan P, *et al*. Development of a Health Screening Package under the Universal Health Coverage: The Role of Health Technology Assessment. *Health Economics* (United Kingdom). 2016; 25: 162–78.

[10] Ebu NI, Mupepi SC, Sampselle CM. Knowledge, practice, and barriers toward cervical cancer screening in Elmina, Southern Ghana Knowledge, practice, and barriers toward cervical cancer screening in Elmina, Southern Ghana. 2014.

[11] Lussiez A, Dualeh SHA, Dally CK, Opoku BK. Colorectal Cancer Screening in Ghana: Physicians' Practices and Perceived Barriers. *World J Surg*. 2021; 45(2): 390403.

[12] United Nations. Transforming our world: the 2030 agenda for sustainable development. 2015; A/RES/70/1.

[13] Ministry of Local Government and Rural Development. Upper Denkyira East Municipal Assembly: 2011 District Annual Progress Report (APR). 2012.

[14] Osei E, Amu H, Appiah-kubi P, Konlan KD, Mumuni H, Orish VN, *et al*. Prevalence and predictors of selected risk factors of non-communicable diseases in Ghana: evidence from a sub-national survey. *J Glob Health Sci*. 2021; 3(2): e13.

[15] Bosu WK, Bosu DK. Prevalence, awareness and control of hypertension in Ghana: A systematic review and meta-analysis. 2021.
[16] Navar-boggan AM, Peterson ED, Agostino RBD, Neely B, Sniderman AD, Pencina MJ. Epidemiology and Prevention. Hyperlipidemia in Early Adulthood Increases Long-Term Risk of Coronary Heart Disease. *Circulation*. 2015; 451–8.
[17] GBD 2015 Mortality and Causes of Death Collaborators D. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980 – 2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016; 388: 1459-522
[18] Profiles C. *Noncommunicable diseases*. 2018.
[19] Carroll MD, Kit BK, Lacher DA, Ed M, Sug S, Yoon S, *et al*. Total and High-density Lipoprotein Cholesterol in Adults: National Health and Nutrition Examination Survey, 2011–2012. *NCHS data brief, no 132*. Hyattsville, MD: National Center for Health Statistics. 2013.
[20] Cherifa F Ben, Ati J El, Doggui R, Ati-hellal M El. Prevalence of High HDL Cholesterol and Its Associated Factors Among Tunisian Women of Childbearing Age: A Cross-Sectional Study. 2021.
[21] Al-kaabba AF, Al-hamdan NA, Tahir A El, Abdalla AM, Saeed AA, Hamza MA. Prevalence and Correlates of Dyslipidemia among Adults in Saudi Arabia: Results from a National Survey. *OJEMD*. 2012; 2: 89–97.
[22] Linden E van Der, Meeks K, Beune E, Aikins A, Addo J, Owusu-dabo E, *et al*. Dyslipidaemia among Ghanaian migrants in three European countries and their compatriots in rural and urban Ghana: The RODAM study. *Atherosclerosis*. 2020; 284(March 2019): 83–91.
[23] National Cholesterol Education Program. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adults Treatment Panel III). 2001.
[24] Health MOF. REPUBLIC OF GHANA National Policy for the Prevention and Control of Chronic Non-Communicable Diseases in Ghana. 2012;(August).
[25] MoH Ghana. National Policy: Non-communicable Diseases. Ministry of Health, Ghana. 2022. 45 p.
[26] Sanuade OA, Kushitor MK, Awuah RB, *et al*. Lay knowledge of cardiovascular disease and risk factors in three communities in Accra, Ghana: a cross-sectional survey. *BMJ Open*. 2021; 11: e049451.
[27] Micah FB, Nkum BC. LIPID DISORDERS IN HOSPITAL ATTENDANTS IN KUMASI, GHANA. 2012;46(1):14–21.
[28] Olanrewaju TO, Aderibigbe A, Popoola AA, Braimoh KT, Buhari MO, Adedoyin OT, *et al*. Prevalence of chronic kidney disease and risk factors in North-Central Nigeria: a population-based survey. *BMJ Nephrology*. 2020; 21: 467.
[29] Tannor EK, Stephen F, Mobula LM, Sarfo O, Rexford K, Gyamfi A, *et al*. Prevalence and predictors of chronic kidney disease among Ghanaian patients with hypertension and diabetes mellitus: A multicenter cross-sectional study. *J Clin Hypertens*. 2019; 21: 1542–1550.
[30] Bawah AT, Edufia F, Yussif FN, Adu A, Yakubu YA. Chronic kidney diseases among homeless and slum dwellers in Accra, Ghana. 2021.
[31] Tannor EK, Norman BR, Adusei KK, Sarfo FS, Davids MR, Bedu-addo G. Quality of life among patients with moderate to advanced chronic kidney disease in Ghana - a single centre study. *BMJ Nephrology*. 2019; 20: 122.
[32] Tannor EK, Hussein KK, Agyei M, Boima V. Early detection of kidney disease in Ghana - A situational survey of secondary hospitals in the Ashanti Region of Ghana. *AJOL*. 2021; 2–7.
[33] Manuscript A. Europe PMC Funders Group Global, regional and national prevalence of overweight and obesity in children and adults 1980-2013: A systematic analysis. *Lancet*. 2014; 384(9945): 766–81.
[34] Ofori-asenso R, Agyeman AA, Laar A, Boateng D. Overweight and obesity epidemic in Ghana - a systematic review and meta-analysis. BMC Public Health. 2016.
[35] WHO. Obesity and overweight [Internet]. 2022 [cited 2022 Jun 15]. Available from: http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
[36] Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, *et al*. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract.* 2019; 157: 107843.
[37] George JA, Brandenburg J tristan, Fabian J, Crowther NJ, Agongo G, Alberts M, *et al*. Articles Kidney damage and associated risk factors in rural and urban sub-Saharan Africa (AWI-Gen): a cross-sectional population study. *Lancet Glob Health*. 2019; 7: e1632–43.
[38] Gebreyes YF, Goshu DY, Geletew TK, Argefa TG, Zemedu TG, Lemu KA, *et al*. Prevalence of high blood pressure, hyperglycemia, dyslipidemia, metabolic syndrome and their determinants in Ethiopia: Evidences from the National NCDs STEPS Survey 2015. *PLoS ONE.* 13 (5): e0194819.
[39] Sanuade OA, Boatemaa S, Kushitor MK (2018). Hypertension prevalence, awareness, treatment and control in Ghanaian population: Evidence from the Ghana demographic and health survey. *PLoS ONE*. 13 (11): e0205985.
[40] Asamoah-Boaheng M, Sarfo-Kantanka O, Tuffour AB, Eghan B, Mbanya JC. Prevalence and risk factors for diabetes mellitus among adults in Ghana: a systematic review and meta-analysis. *Int Health*. 2019; 11:83–92.
[41] PATH. Ghana Noncommunicable Disease Landscaping: 2020.