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COURSE NAME:
Anthropology

Assignment Title:

Medical Anthropology: The biocultural, politico-ecological, socio-structural, institutional, and syndemic determinants of cardiovascular diseases in Black Populations.

A systematic literature review & conceptual framework

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Abstract

Black populations across the world are disproportionately affected by hypertension and cardiovascular diseases. In Africa alone, cardiovascular diseases account for approximately 38.3% of global deaths from noncommunicable diseases (NCDs) and 13% of all-cause mortalities on the continent. In 2019, cardiovascular diseases were responsible for over 1 million deaths in Sub-Saharan Africa. Over the past three decades numerous theories have been put forward to explain the observed increase in cases of cardiomyopathy, hypertension, and atherosclerotic disorders in Africa. Salt sensitivity and insulin resistant genes in Black populations are just a few of these theories. Other theories include westernization of African nations and the rise in overweight and obesity rates. However, clinical experience and historical data suggest a far more complex and syndemic relationship between cardiovascular diseases, well known risk factors and numerous unidentified social determinants. The key objective of this systematic review was to evaluate the existing anthropological evidence to support a hypothesis that less well known biocultural, political-ecology and structural violence factors, can also influence the emergence and life cycle of cardiovascular diseases in Africa. The review covered 29 articles published between 2016 and 2023, highlighting cardiovascular risk factors in Black or African populations. Over 75% of the hypothesized determinants were associated with cardiovascular diseases in Black population studies, and a few were found to be significant in at least one African nation. However, the overall effects of some biocultural determinants (shift work, physical activity, gender, age, housing and alcohol consumption) differed in Black compared to White populations. The literature also uncovered 3 distinct anthropological models or pathways to cardiovascular diseases, self-classified as the Village Pathway, Urban Pathway and Structural Violence or SV Pathway. Undoubtedly, more research is critically required in African settings to empower African leaders to achieve the 2030 SDG goal of reducing premature deaths from cardiovascular diseases by 33%.

Keywords cardiovascular diseases, Africa, biocultural, political ecology, structural violence, anthropological models, cardiovascular risk factors

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Anthropology, Relevance to Healthcare and Non-communicable Disease [NCD] Studies

The remarkable concept of anthropology emerged between 1900 and 1949, with medical anthropology becoming an academic subdiscipline two decades later (introduced initially by Professor Benjamin David Paul at Stanford University USA).

Disciplines of anthropology

According to Britannica online, anthropology is the 'science of humanity' (Britannica, 2023) a discipline designed to promote the study of human behaviour and the influence of biological, socio-cultural, ecological, linguistic and economic factors on man's present, future and historical adaptational responses and survival as a species. Sub-disciplines of anthropology typically include *biological or physical anthropology* (which is the study of primatology, concepts of human evolution, genetics and forensic anthropology*), linguistics*, *socio-cultural anthropology*, and *archaeological anthropology* (Miller, 2012). Hence, anthropology is a dynamic, diverse, multidisciplinary field that evolves as more research data becomes available. This is undoubtedly the case in *medical anthropology* (a key sub-discipline of socio-cultural anthropology), which also integrates several sub-sciences. (figure 1)

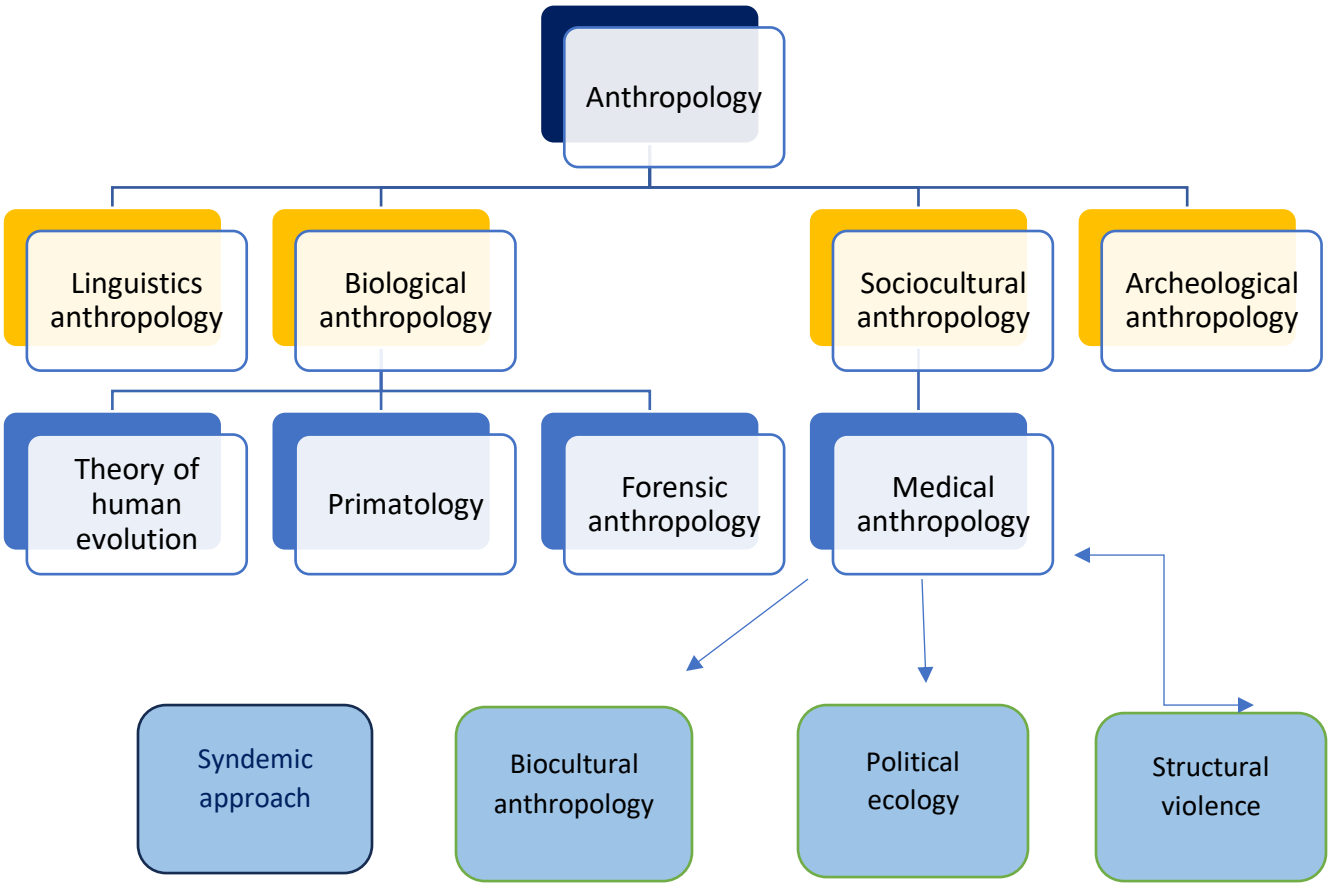
Medical Anthropology Concepts

For instance, medical anthropology focuses on the interconnections between healthcare, health systems, disease outcomes, health-seeking behaviour, lifestyles and external influences, including political, cultural, socioeconomic, and environmental factors. A typical scenario that could have benefited from anthropological studies was the mass rejection of COVID-19 vaccinations in many African countries in 2021 despite free MRNA vaccine supplies. Medical anthropologists usually examine the effects of various determinants on health and disease by studying biocultural anthropology, political ecology, structural violence, and the syndemic approach (McMahan & Nichter, 2019).

Biocultural anthropology explores the influence of individual and societal factors, including genetics, culture, community values, income, perceptions, occupation, geography, education, tradition, and lifestyle practices on wellness and disease.

Biocultural anthropological studies can also support research efforts to ascertain how access to resources is impacted by migration, conflicts, food insecurity, rural development, urbanisation, industrialisation, and population changes, which in turn can affect lifestyles, mortality risk, child survival, essential medicine supply chains, and disease progression over time. In contrast, political ecology studies highlight the effects of public policies governing environmental health, climate change, deforestation, air quality, slum settlements, water supply and other ecological issues on health and disease. For example, in a recent research study on 22 Ebola epidemics by the author, there were linear correlations between multilocation Ebola outbreaks and deforestation levels in areas where index cases were found. In this case, a political ecology study could seek to understand how national policies and rural communities contribute to deforestation and illegal logging and how these factors promote zoonotic epidemics in high-risk regions.

Figure 1: Multidisciplinary nature of anthropology



Structural violence is quite distinct from the other subsciences in medical anthropology, considering that anthropologists in this discipline often seek to identify the effects of oppressive social (rather than physical environments) on health and disease. In essence, structural violence studies may focus on how racial and gender discrimination, inequitable social policies, post-colonialism, or unfavourable health insurance policies affect the vulnerable and poorest income segments. Therefore, a structural violence study, for instance, may examine the extent to which government policies promoting child marriages or limiting access to secondary or tertiary education for girls have contributed to a rise in maternal and infant mortality rates.

Lastly, the term syndemic approach refers to an anthropological study designed to focus on populations with multiple adverse disease states or "social vulnerability and disease combinations" co-existing and interacting negatively to hinder the effective management of the disease. For instance, a well-recognized syndemic syndrome amongst migrant and highly mobile male populations in South Africa is the 4-factor model of *substance abuse-sexually transmitted diseases-tuberculosis and AIDS.* An anthropologist may be interested in identifying the link between sociocultural or economic determinants of risky sexual practices and substance abuse in these migrant populations.

Anthropology and Cardiovascular Diseases

In the same vein, rising rates of chronic cardiovascular diseases in Africa appear to be multifactorial and syndemic in nature. Research evidence frequently highlights the numerous risk factors associated with cardiovascular diseases in low-income and low-middle-income African nations, of which hypertension, hypertensive heart disease, heart failure, and cardiomyopathies are the leading causes of morbidity and mortality from non-communicable diseases (NCDs) (Keates, Mocumbi, & Ntsekhe, 2017).

Traditional Western views of cardiovascular risk factors tend to emphasize the harmful effects of 4 key factors: physical inactivity, high-cholesterol diets, tobacco use and alcohol use. However, risk factors vary from region to region, and aside from genetics, lifestyle variables such as obesity, physical inactivity and smoking rates may

be relatively insignificant in some African populations. Traditional assumptions posit that at-risk populations are more likely to be middle -to high-income urban residents with sedentary jobs and highly processed food diets (Tulu, Salmi, & Jones, 2021). For instance, in Kenya, cardiovascular diseases are more prevalent among the urban wealthy. On the other hand, rural farming populations in some African states are just as likely as urban populations to present with high rates of hypertension and cardiovascular complications. Furthermore, unlike the Western world, the prevalence of coronary heart disease is lower in Sub-Saharan Africa, and cardiovascular diseases may affect lower-income, younger female groups (Keates, Mocumbi, & Ntsekhe, 2017).

In Table 1, cardiovascular risk factors (smoking, alcohol, obesity, and wealth status) of 4 African countries and the United Kingdom, collated from global databases (World Obesity Federation, 2023), the World Population Review WPR (World Population Review, 2023) reveal some striking trends.

Table 1: Status of cardiovascular risk factors and deaths from cardiovascular diseases

Country	Smoking rates WPR	Alcohol rates Liters per person/year	Obesity rates	Poverty rates WPR	Deaths from Cardiovascular disease
South Africa	31.4%	9.4	15.98%	55.5%	17.3%
Egypt	21.4%	0.14	23.5%	32.5%	46.2%
Mozambique	14.4%	2.69	3.42%	46.1%	9.45%
Nigeria	4.8%	6.19	4.82%	40.1%	8.0%
United Kingdom UK	19.2%	12	27.88%	18.6%	25.0%

Interestingly, while three risk factors can explain the low rates of cardiovascular deaths in both Mozambique and Nigeria, cardiovascular deaths in Egypt (compared to UK values) appear to be excessive relative to reported risk factors. Similarly, despite having the worst risk factors for smoking and alcohol consumption within the group, South Africa's cardiovascular death rates are just a third of Egypt's death rates.

Anthropological Data Gaps

Therefore, the possibility exists that cardiovascular diseases in Africa have numerous unidentified, social, biocultural, institutional, syndemic and ecological risk factors that may be contributing to differences in disease progression, incidence and prevalence, disease severity, cardiovascular mortality rates, response to treatment, and the clinical outcomes of the disease. In 2017, a meta-analysis involving 16 studies and over 15 million participants revealed a significant correlation between delicate particulate matter in the air (PM2.5) and cardiovascular mortalities (Zhiguang, et al., 2018). Furthermore, in the USA, cardiovascular outcomes have been linked to occupational types (Professional Safety, 2017). According to (Noubiaq, et al., 2023), cardiovascular disease research is not widely available in African countries. Hence, more data is urgently required to bridge knowledge gaps in almost all African regions.

Rationale for a Medical Anthropology Approach

Therefore, virtually all medical anthropological study approaches are relevant to understanding the mechanisms and pathways of cardiovascular diseases in Africa. For instance, a biocultural method could explore possible relationships between approximately 20 socio-demographic factors and cardiovascular diseases in African countries. Little is known, for instance, about how cultural norms, religious fasts, beliefs, financial stressors, family size, polygamy, early marriage, ethnicity, traditional African diets, cooking styles, childbirth, traditional medicine use, poor housing, nomadic occupations, migration, community structures, universal health coverage, sleep patterns, education, literacy, working hours, rural lifestyles, or manual labour, modifies the life cycle of cardiovascular diseases or promotes the emergence and progression of the disease in African nations..

Similarly, political ecology studies that focus on the impact of environmental variables on cardiovascular diseases could unearth correlations between 12 key determinants, e.g. industrialization, air pollution, oil drilling, urban noise levels, carbon emissions, wind farms, coal plants, deforestation, climate change effects (droughts, floods), pesticide use, water contaminants, mining activities, and other cardiovascular risk factors.

In an anthropological setting, structural violence studies could test several hypotheses related to the effects (on the prevalence and progression of cardiovascular diseases) of roughly 12 indicators of social injustice, e.g. extreme capitalism, segregation, oppressive racial, ethnic and gender discrimination, forced labour, and even prohibitive food taxes. Anthropologists may also be interested in determining if the lifecycle of the disease is influenced by reduced access to educational opportunities, social welfare, gainful employment, essential medications, or healthcare services,

Lastly, considering the difficulty in establishing specific preventive or curative algorithms for hypertension and other related cardiovascular diseases, including cerebrovascular accidents and chronic kidney disease, a syndemic anthropological approach would seem relatively logical. The assumption here is that cardiovascular diseases often have comorbid conditions or integrated social issues that confound the effective management of the principal disease. Therefore, it may be simplistic to expect persons with cardiovascular diseases to remain well-controlled on medications alone. A more holistic strategy could mean preventing the emergence of the disease irrespective of genetic predisposition or reducing the risk of complications by controlling and managing all interrelated biocultural, ecological, institutional and social determinants.

Hypothesis and Research Questions

In this paper, I hypothesize that numerous less-known biocultural, ecological, co-morbid, and societal structures are directly or indirectly linked to the emergence, progression, and life cycle of cardiovascular diseases in Africa (Figure 2).

Therefore, my tentative pre-review research questions are:

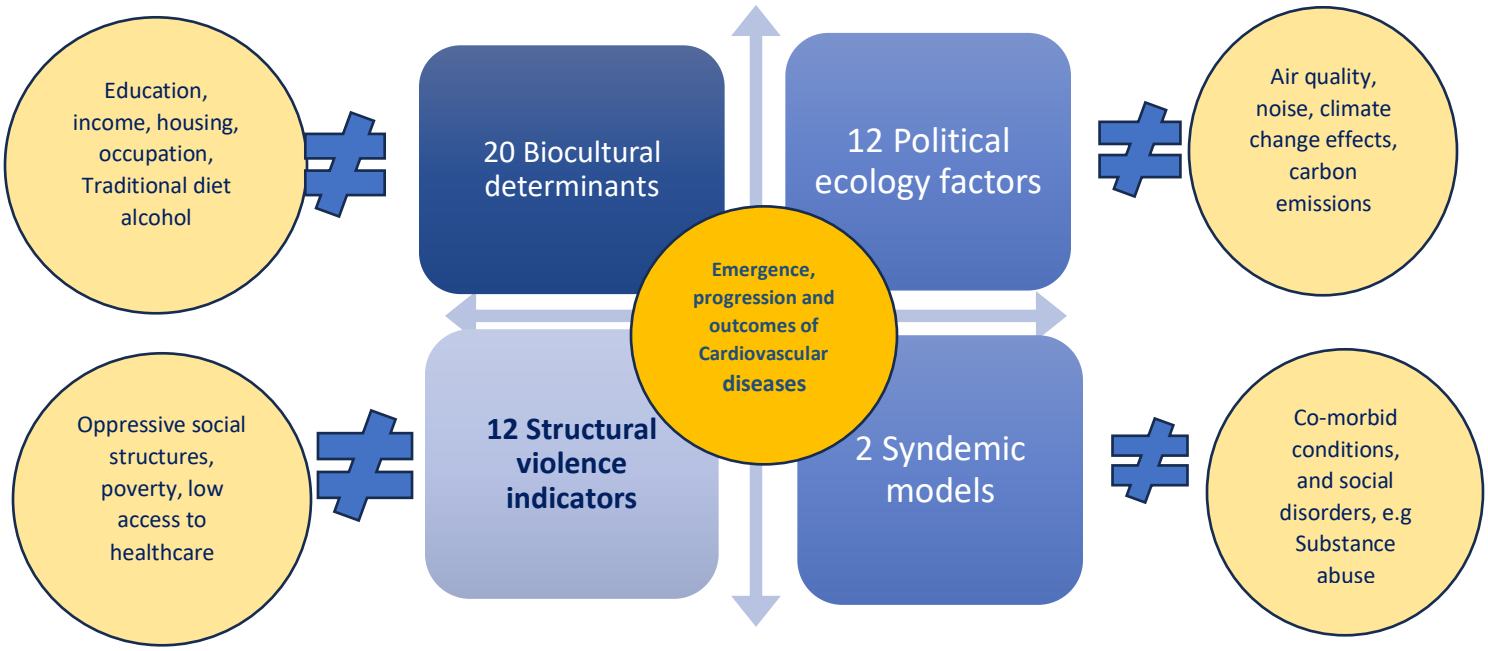
1. How do *biocultural factors* (cultural norms, education, literacy, religious fasting, financial stressors, family size, marriage/ polygamy, early pregnancy, ethnicity, traditional African diets, cooking styles, childbirth, traditional medicine use, poor housing, occupations, alcohol consumption, physical activity, sleep patterns, working hours, or manual work), affect the emergence, progression or complication rates of cardiovascular diseases in Africa?.

2. What is the relationship between *policy-driven ecological determinants* of environmental health and the emergence, progression or outcomes of cardiovascular diseases in Africa?

3. How does *structural violence* (including but not limited to oppressive government policies that promote multidimensional poverty, ethnic, gender or racial discrimination, restricted access to education, healthcare, or medications, and other forms of social injustice) influence the emergence, progression or outcomes of cardiovascular diseases in Africa?

4. What syndemic combinations are associated with cardiovascular diseases in Africa?

Figure 2 represents the tentative conceptual framework for the multi-faceted anthropological study.



The next chapter describes the systematic literature review of studies that uncover the possible associations between the four medical anthropological elements and the emergence, progression or outcomes of cardiovascular diseases in Black populations. Therefore, the findings of this review formed the basis of my final research questions and informed the design of a future anthropological study on cardiovascular diseases in African nations.

Systematic Literature Review

This chapter will include a comprehensive review of 34 publications (Journal articles and international health reports) selected from an assessment of 76 articles gathered from online databases (PubMed, Research Gate, Elsevier, National Institute of Health, and the AIU library) dated 2016 to 2023, on cardiovascular disease studies in Black populations (African Americans or Africans). The review has been restricted to publications no older than six years in peer-reviewed journals that include any of the 20 biocultural determinants, 12 ecological factors, or 12 indicators of structural violence (and any related co-morbid conditions) represented by the conceptual framework and identified in the research questions. The review's objective is to confirm further the content range of the existing body of knowledge and the research gaps in this area of study.

Biocultural Determinants

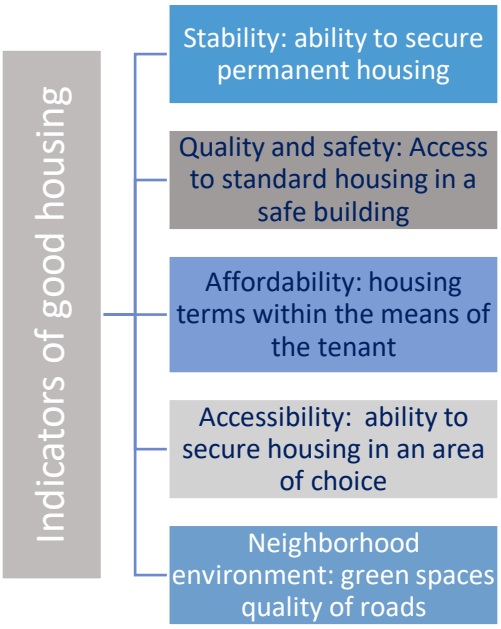
An evaluation of biocultural associations reveals that African researchers examined just a fraction of all possible biocultural determinants over the past six years. In contrast, more research evidence is available for African Americans in the USA, but sociodemographic and cultural factors may differ from populations residing on the African continent.

Effects of education. Limited research evidence linking biocultural risk factors to cardiovascular diseases is available for African populations. However, some studies have highlighted statistical correlations between cardiovascular diseases and education. In one global study with 578 patients and 789 controls, Silwa et al. (2016) report an increase in cardiovascular events (specifically myocardial infarction) in persons with less than eight years of education (Silwa, L, Gersh, & Mocumbi, 2016). Researchers consider that low levels of education often lead to a lack of understanding regarding cardiovascular risk factors and lifestyle changes that may help prevent or modify the disease's life cycle. (Mwita & Godman, 2021). However, other education-related socio-demographic factors not outlined in the study may also compound genetic dispositions in Africans, including low access to healthcare by uneducated populations who reside in

rural areas. Educational deficiencies also hinder access to highly paid jobs, and low-income communities may be more exposed to risk factors associated with poor-quality housing. Hence, in a future anthropological study on education and cardiovascular disease, it would be essential to examine how education determines the emergence or progression of the disease or how education influences health-seeking behavior and access to specialist care.

Housing and cardiovascular disease. American researchers studying the effects of housing indicators (stability, quality, safety, affordability, accessibility and neighborhood environment) examined the effects of these indicators on cardiovascular health and disease in Black populations (Figure 3). The study aimed to identify housing indicators with the most significant impact on cardiovascular health and disease progression (Sims, et al., 2020).

Figure 3: Sims et al. (2020) research study indicators for housing



Regarding *housing stability*, the housing study findings suggest that housing insecurity and unstable housing may increase the risk of cardiovascular diseases. However, in reality, numerous confounders may erroneously link housing to adverse

cardiovascular events. For instance, persons with housing instability are also more likely to have income deficiencies, become unemployed or underemployed, report low access to health services, and have a history of alcohol and tobacco abuse. Alcohol and tobacco consumption are direct risk factors for cardiovascular diseases. To genuinely link housing to cardiovascular disease, all confounders must be minimised. Using a control group with similar alcohol and tobacco usage rates to make comparisons can also help. In this case, researchers recruited native Americans, Asians and White Americans with similar housing instability problems as target populations. They found that unstable housing and cardiovascular disease were also statistically linked in native Americans but did not have the same effect on Whites and Asians (Sims, et al., 2020).

Housing Quality indicators may refer to the building quality (including maintenance status and the status of air vents, walls, flooring, roofing, ceilings, infestations, and support structures). Researchers find that poor-quality housing with mouldy walls, harmful indoor air and sub-standard heating systems frequently contribute to hypertension in exposed persons. Other housing concerns include affordability and the neighbourhood environment.

Housing affordability issues often lead to 'residential segregation' otherwise known as 'Black neighbourhood syndrome' according to Sims et al. (2020). This is commonly seen in overcrowded cities where the middle and upper classes live in neighbourhoods that are financially inaccessible to poor minority populations. Study findings indicate that residential segregation may cause hypertension in Black people. This effect disappears when segregation is eliminated. Furthermore, in unaffordable neighbourhoods, Black people at risk of foreclosure also report more incidents of hypertension.

Mental/psychological stress variables may nonetheless confound these results. Mental stressors include insufficient income and financial difficulties, and this may mean that housing affordability may not be directly linked to cardiovascular health. Therefore, Africa-based studies must address this confounder by identifying indicators for measuring psychological stress.

Lastly, Sims et al. (2020) identified links between cardiovascular disease and neighbourhoods with limited *green recreational spaces*. They conclude that green areas can reduce the risk of heart attacks in communities with access to public parks.

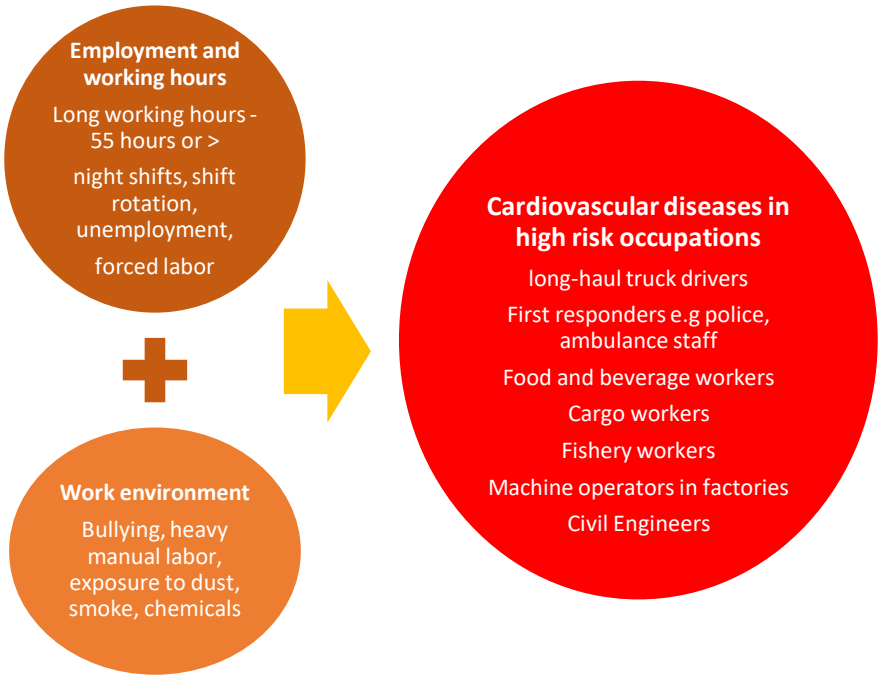
Although the multi-article review above was not a quantitative study, and the sample populations needed to be better defined concerning size and inclusion or exclusion criteria, reported findings on housing effects suggest that a more detailed study on African populations may be warranted. Indeed, personal experience has shown that a significant proportion of people (young and old) who live in poor-quality housing, e.g. slum settlements, often develop cardiovascular diseases.

Cardiovascular disease, occupation and hours of work. The evidence linking long working hours (55 hours or more per week) and cardiovascular disease is compelling. The International Labour Organization confirms that in 2016 alone, 745000 persons died of stroke and ischemic heart disease globally as a result of long working hours (International Labour Organization, 2021). However, not all studies support associations between working hours, at-risk occupations and cardiovascular diseases.

For instance, studies on the effect of shift work on cardiovascular diseases were recently conducted in South Africa. In 2022, researchers examined a group of 607 long-distance truck drivers in two provinces who operated day and night shifts or day shifts alone (Draaijer, et al., 2022). The truck drivers were screened for cardiovascular risk factors and had electrocardiograms, body mass index measurements, lipid tests, and blood pressure measurements. *Nothing significant was found*. 33% of truck drivers had hypertension, and 37% had hyperlipidemia, but night shift workers did not report more cardiovascular incidents. The results may have appeared normal because the hours covered by shifts were not excessive. According to the study, night shifts covered 11 pm to 6 am once a week. In addition, the study did not utilise a control group, and the study design should have been more appropriate. In this case, a cohort of truck drivers with no existing hypertension or cardiovascular diseases could have been followed up over time to see if the hours of work led to cardiovascular disorders or not.

An Africa-based study could further investigate the effects of various other occupations that run daily shift systems compared to jobs that don't run shifts. This could be a worthwhile exercise since the U.S. National Institute for Occupational Safety and Health (NIOSH) has circulated a report describing various work determinants of cardiovascular events (Centers for Disease Control and Prevention : NIOSH, 2023) and high-risk occupations (figure 4)

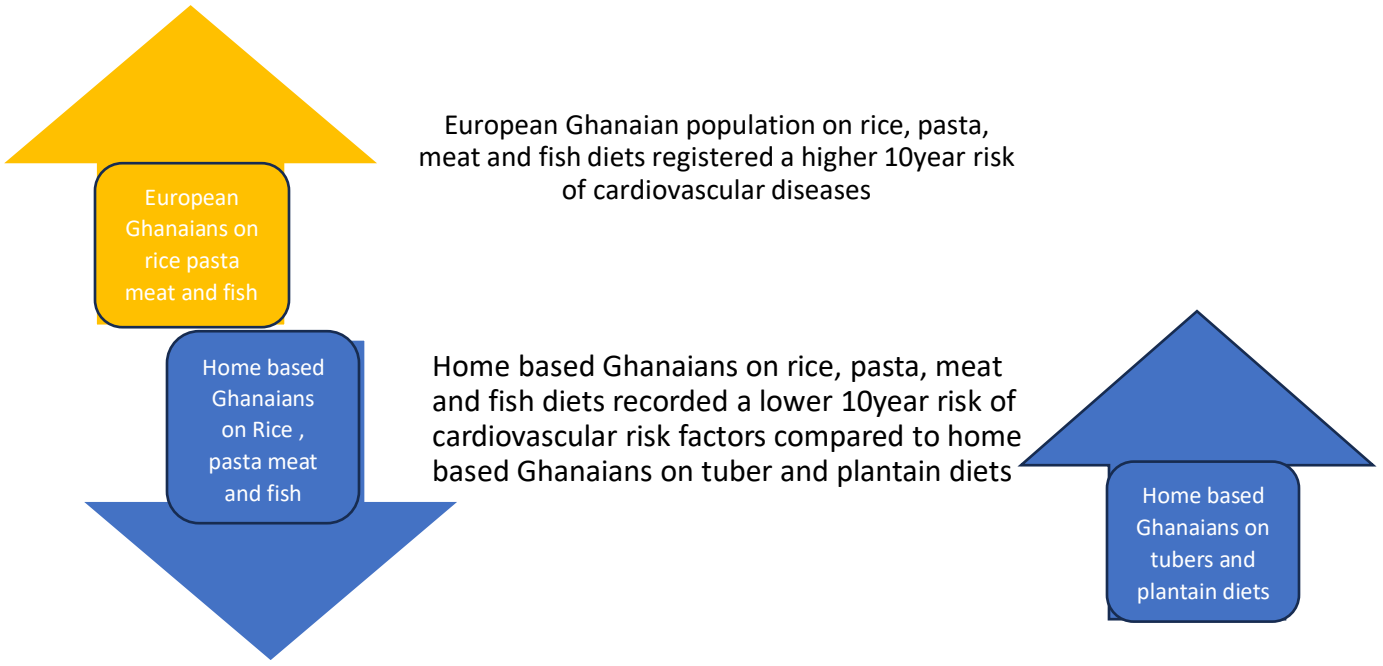
Figure 4: NIOSH at-risk occupations and work hours that may promote cardiovascular diseases



It may be essential to add medical professionals to this list of high-risk occupations provided by NIOSH, considering that medical personnel shortages are rampant in African countries and overtime rates exceeding 55 hours may be the norm rather than the exception. In many urban hospitals in Nigeria, doctors may be on continuous day and night shifts for 72 hours or more. In one hospital where I worked as a senior manager, our cardiologist experienced an acute cardiovascular event after a heavy workload. A convincing study could improve the opportunity to advocate for better working conditions in African countries.

Cardiovascular disease and traditional African diet. When research publications announce findings on cardiovascular disease dietary risk factors, they usually refer to Western diets. Hence, more should be known about the possible effects of traditional African diets on cardiovascular health. In 2019, a team of researchers in Sub-Saharan Africa examined the effects of two dietary styles on the 10-year risk of cardiovascular disease: (rice, pasta, meat and fish) and tuber foods (yams and cassava) plantain (Boateng, et al., 2019). In a cohort study of 2976 Ghanaian adults 40-70 years who lived in Ghana and Europe, researchers collected self-administered questionnaires. Interestingly, the rice, pasta, meat and fish diet group living in Ghana had a lower 10-year risk of cardiovascular disease than the tubers and plantain group (Boateng, et al., 2019). In comparison, the Ghana-European group on the rice pasta, meat and fish diet had a higher 10-year risk of cardiovascular disease. (figure 5)

Figure 5: Dietary effects and 10-year risk of cardiovascular disease amongst Ghanaians in Ghana and the Diaspora



These differences between European and home-based Ghanaians could be due to the more extensive calorie content and portion size of food consumed in Europe.

Considering such differences, the findings suggest that dietary risks are not entirely similar worldwide. Key reasons are that food preparation, genetic engineering and farming practices often determine the calorie content of food. Additionally, 50-70% of African populations may be disadvantaged and have access only to low-quality frozen or dry fish and lean meat options. Furthermore, affordability may be a barrier to high-calorie diets since Western meals may cost the equivalent of a week's wages. Nonetheless, the study design may have introduced some bias. None of the cohorts were screened for possible confounders or existing disorders such as obesity and diabetes, and the primary data collection tool was a questionnaire. Therefore, a recall bias may be present. Similarly, assessments of alcohol consumption effects on African populations may be less than accurate.

Cardiovascular disease and alcohol consumption. To date**,** alcohol consumption studies have yielded conflicting results. In a few studies, a low rate of wine consumption was found to be beneficial to the heart, but in most publications, drinking is considered a cardiovascular risk factor. A study team examining five female cohorts of African ancestry who lived in five geographical locations: Ghana, Seychelles, Jamaica, USA and South Africa in 2021, reported the effects of light drinking (1-3 drinks a day) and heavy drinking (3-4 drinks a day) compared to non-drinking women in addition to exercise effects (Baghadan, et al., 2021). Participants self-reported their drinking habits. All participants had body mass index measurements, exercise monitors, fasting blood sugar tests, blood pressure measurements and blood triglyceride profiles. According to findings, heavy drinkers had a higher odds of developing hypertension and raised triglyceride levels compared to light drinkers. However, researchers opined that heavy drinkers did not have more cardiovascular risk factors than light drinkers.

The study suggests that even in Black populations, alcohol consumption may lead to hypertension and dysfunctional fat metabolism. Still, in contrast to non-Black people, the risk of cardiovascular disease may not rise with increased alcohol consumption. This aligns with the modest cardiovascular disease trends observed in South Africa despite a significant alcohol consumption rate, and the implications of this could, therefore, be an interesting future research in Africa. Nonetheless, since this was

a cohort study, insufficient information was provided about co-morbid conditions. Participants may have had other co-morbid disorders or social determinants that increase triglyceride and blood pressure levels besides diabetes. Age and gender adjustments were made, however. The length of time during which participants maintained a light or heavy drinking routine was also not reported, including a previous history of drinking in non-drinkers. Furthermore, alcohol is not the only stimulant consumed by African populations.

Cardiovascular disease, and kola nut consumption. In many West African countries, a high caffeine intake is relatively standard. However, coffee is only sometimes the source of caffeine. Kola nuts are harvested seeds of the Kola tree and are traditionally consumed as a stimulant by urban, rural and mobile populations. Nigeria, Ghana, Cameroon and Ivory Coast export 90% of the global volume of kola nuts, primarily to animal feed, beverage and soap manufacturing companies abroad (Oduro, Doe, Asani, Nyadanu, & Konlan, 2021) Two kola nut species dominate the export market, C. nitida and C. acuminate. Bitter Kola or Garcinia Kola is also a well-known kola nut species.

Kola nuts are often shared as traditional gifts or as peace and friendship offerings at weddings, baby ceremonies, funerals, and community gatherings or consumed by night shift workers, farmers, students studying for exams and long-distance drivers to improve alertness. The lifetime consumption rate of Kolanuts in Southern Nigeria in a 2011 study was estimated at 74.8% (Erinfolami, et al., 2011). Under-age users were likely to be from polygamous homes in which mothers were less educated than fathers.

Limited studies contain information about the caffeine content of kola nuts, but a team of Nigerian researchers reported a value of 1.15 mg/L for C. nitida in 2020 (Akpomie, Augustine, Anwani, & Lorbee, 2020). This is more than double the caffeine content (0.41mg/L) of a single cup of Nescafe coffee. C.nitida also had more caffeine than Garcinia Kola (0.18 mg/L). Despite the relatively higher caffeine content in Cnitida, this species has an unexpected cardioprotective effect on humans. Garcinia Kola has

also exhibited some beneficial characteristics in persons with hypertension and bacterial or viral infections.

For instance, an extract of Garcinia Kola (Kolaviron) can decrease systolic and diastolic blood pressure by 22-27%. The evidence may suggest that consumers of kola nuts could experience cardio-protective and anti-hypertensive benefits (F.J, Akindele, Balogun, Awodele, & Adejare, 2023). Future anthropological research could further uncover the additional effects of kola nuts on the incidence or prevalence of cardiovascular diseases in Africa and determine the extent to which kola nut consumption can reduce the risk factors for cardiovascular disease.

Physical activity (PA) effects on cardiovascular disease. Globally, exercise is also thought to improve the outlook of cardiovascular diseases. In African populations, little is known about how exercise frequency or intensity reduces the risk factors for cardiovascular disease from one region to another. Most studies merely describe exercise in general rather than quantitative terms. In a South African study by Kganakga et al. (2022), physical activity reduced the risk of a non-fatal cardiovascular episode by 38% (Kganakga, et al., 2022). No definitions were provided for physical activity frequency, timing or type of exercise.

A second and more detailed study reported the impact of physical activity on the blood pressure values of 310 Afro-Caribbean males aged 50-89. An unsatisfactory blood pressure was classified as any value above 140/90 mmHg (Cvejkus, et al., 2021). Exercise was categorised as *no exercise, light PA*, and *moderate to intense PA* and measured with a wearable PA sensor. Statistical adjustments were made for several co-morbid factors and social determinants of health, including alcohol consumption, age, use of antihypertensive medication, smoking, a family history of cardiovascular diseases, and body fat and salt intake. Both systolic and diastolic blood pressures declined by about 0.5-1 mmHg when men in the non-exercise group were assigned to light PA (Cvejkus, et al., 2021). Blood pressure decline in persons on anti-hypertensive medication was not as marked.

Nevertheless, not all studies report a risk-free effect of rigorous PA, and one such study suggests that a more significant increase in systolic blood pressure occurs during exercise in Black males compared to White males (Drew, Charkoudian, & Park, 2020). In my personal experience as a medical doctor, I have also discovered an unexplainable spate of cardiac arrests in young, ‘’apparently healthy ’African males who collapsed at a gym, squash club, football pitch or on a jog. Just recently, two Black players, Bronny James and Damar Hamlin, both collapsed on a football field. Several news media covered Damar’s cardiac incident and highlighted similar football incidents. At the same time, some reports also pointed to emerging evidence describing how Black players were virtually “five times more likely” to suffer cardiac arrest during a sports event compared to their White counterparts (Snipe, 2023). This may not be strictly accurate, but the evidence does support some peculiar racial vulnerabilities to cardiovascular disorders in young Black males.

A Case-control study may help to determine the PA type, time range and intensity at which cardiac arrest occurs in cases (young Black sports persons) versus controls. Hence, subsequent studies focusing on the apparent PA differences between Black populations and non-Black populations could offer a better understanding of the cardiovascular risk factors for Africans. Africans may also exhibit a different response to medications prescribed for cardiovascular conditions.

Cardiovascular medication effects on Black populations. Compared to non-Black populations, Black persons are genetically prone to more resistant hypertension types and may experience lower levels of control on the same medications prescribed to non-Blacks. According to the Cleveland Clinic, resistant hypertension refers to blood pressure disorders that require multiple medications (3-4) to maintain a reading below 140/90 (Cleveland Clinic, 2023). Using a five-year National Database for Health and Nutrition (2013-2018), researchers examined blood pressure control levels in 4,739 treated Black and non-Black populations (Hayes, et al., 2022). Blood pressure control rates for Black adults were just 34.9% compared to 45% of White adults, and Black patients were prescribed more diuretics and calcium channel blockers. Research evidence also emphasizes the lower response in Black populations to angiotensin

inhibitors (ACE Inhibitors) and beta blockers and the improved blood pressure controls when diuretics and calcium channel blockers were prescribed (Flack & Buhnerkempe, 2022)

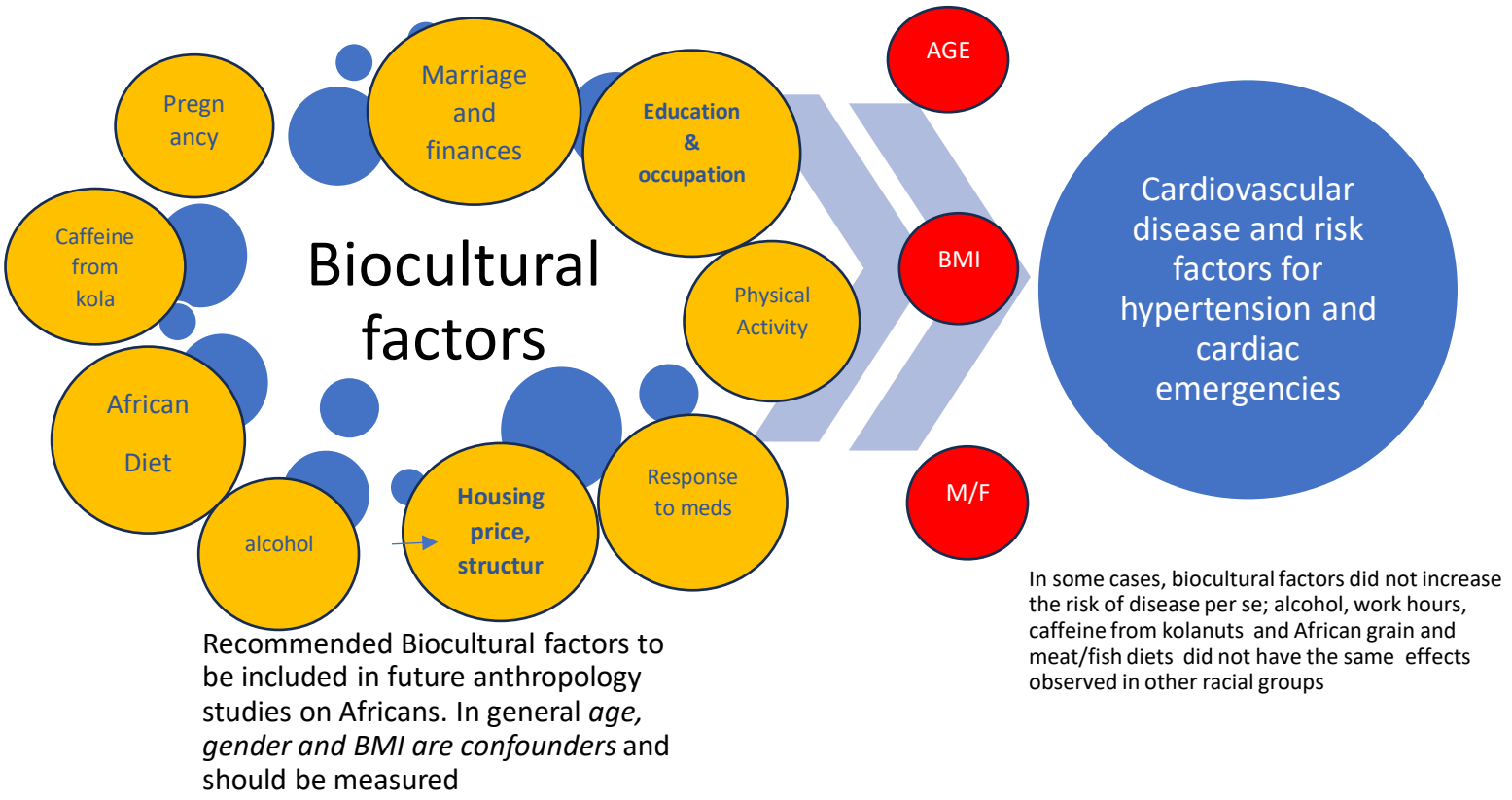
Nonetheless, clinical experience has shown that some Black population sub-groups respond well to ACE inhibitors and beta blockers despite recent evidence that Blacks have salt sensitivity genes. An important next step would be to determine and understand why such subgroups respond better than other groups. Anthropological studies offer an opportunity to identify biocultural factors, such as ethnicity, age, or diet, that may account for these differences.

Other biocultural determinants worth examining (but with limited research evidence in Africans) include marriage styles: polygamy, pregnancy, financial stressors and their impact on cardiovascular disease. For instance, polygamous unions have been linked to cardiovascular incidents in some Asian publications in which males with more than one wife had an increased risk of a cardiac emergency (European Society of Cardiology, 2015). One suggested root cause includes the added physical burden borne by males in polygamous unions when they require multiple jobs to maintain their large families. Other possible causes personally observed in rural Nigeria include obesity and diabetes (often promoted by excessive meals from numerous wives) and the use of herbal aphrodisiacs. Additionally, Black women who are pregnant have been found to have a higher risk of pre-eclampsia but a lower risk of pregnancy-related cardiovascular complications compared to pregnant Asian women (Minhas, et al., 2021). In a few African-American studies, researchers also examined the effect of financial stressors on cardiovascular health. A 12year cohort study involving 2256 persons in Jackson, USA, who did not have cardiovascular disease at the beginning of the study, reported three times the rate of cardiovascular disorders as a result of financial difficulties (Peter, 2019)

In summary, the evidence has highlighted numerous possible associations between biocultural factors in Black populations and the emergence and progression of cardiovascular diseases (figure 6). However, most studies evaluated had quality

deficiencies. Some studies needed help with study design and research methodology. Confounding and bias could invalidate the findings of such studies. Lastly, more studies involved African- Americans rather than Africans.

Figure 6: Evidence-supported biocultural risk factors for cardiovascular diseases



Therefore, the evidence summarized in Figure 6 underscores the need to investigate the most compelling biocultural factors. This could allow observed variations in risk factors to be identified afresh in African populations, but more must be done. Political ecology factors are also foundational to understanding cardiovascular diseases in Africa.

Political Ecology Determinants

Environmental policies in Africa may need to be more robust and effective. Policies addressing deforestation rates, urban green spaces, carbon emissions, air quality, sewage contamination of rivers and estuaries, indoor pollution, and using clean

energy may need to be upgraded. Subsequently, monitoring activities are low, and sanctions need to be meted out to violators. For instance, the public health issue of noise pollution has only recently gained traction in a few African countries like Nigeria. Not surprisingly, little or no attention has been paid to the possible health effects of these environmental determinants of health. However, most of these ecological factors may be associated with cardiovascular diseases in Black populations.

Carbon emissions, indoor air quality and cardiovascular diseases in Africa. Poor-quality air may contain suspended particles of varying sizes. PM10 are large coarse particles (industrial dust, wood smoke, bacteria, mould), PM2.5 are finer particles (vehicular and power generator plants), and PM0.1 are ultra fine particles (carbon emissions) (Smith, 2020). In Africa, approximately 1.1 million people died as a result of air pollution in 2019 (Fisher, et al., 2021), and air pollution is now considered the second most important cause of preventable mortalities in Africa. These deaths occur from ischemic heart disease, stroke, chronic obstructive airway disease, and neonatal conditions (Fisher, et al., 2021). Additionally, exposure to PM2.5 particulate matter appears to be the root cause of 20-25% of cardiovascular disorders in Africa.

Biomass cooking systems, bush burning and rising road traffic from rapid urbanisation in Africa are just a few sources of dangerous particulate matter. A research team estimates that fewer than 18% of African populations use clean cooking devices (Khavari, Ramirez, Jeuland, & Nerini, 2023). The Global Health Institute also opines that 463000 persons could be saved annually through the widespread adoption of clean cooking methods (Global Health Institute, 2023). Furthermore, an African-American heart health study carried out by Weaver et al. (2021) confirms that delicate particulate matter and ozone concentrations in the air may lead to raised systolic and diastolic blood pressures in Black populations (Weaver, et al., 2021)

Therefore, there is strong evidence that poor-quality air is probably responsible for roughly ¼ of cardiovascular deaths in Africa. Further ecological studies could help to determine the extent of the problem in rural versus urban areas in Africa in terms of population density, indoor and outdoor pollution sources, and disease prevalence.

However, air pollution is not Africa's only pressing environmental health issue. The absence of green space planning in most African cities is an ongoing public health concern.

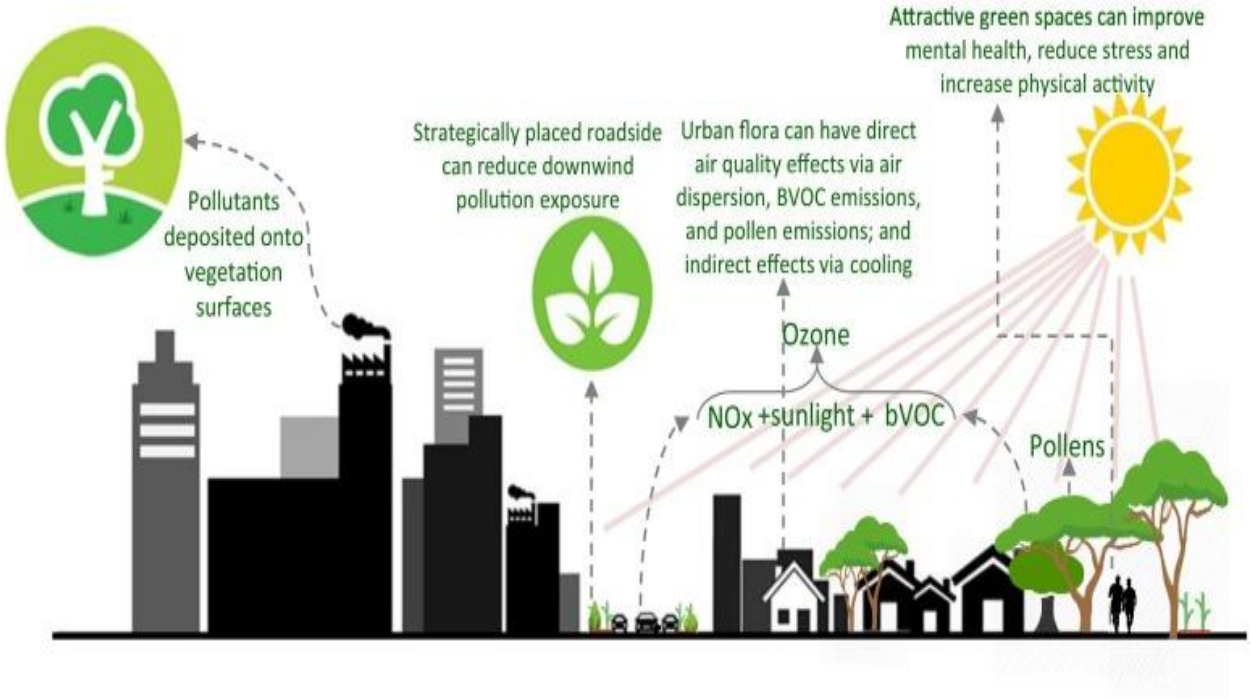
Green spaces and cardiovascular disease risks. Green spaces are typically spaces where parks, playgrounds and sports fields are usually found in well-planned urban areas. Tree conservation practices further provide shade and air cleaning benefits (oxygen production and carbon dioxide absorption), thereby helping to control greenhouse gases and minimise soil erosion. One study reports a mere 3% -21% allocation to green spaces in three East African cities (Dar es Salaam, Accra and Luanda), a situation that also restricts sufficient physical activity in at-risk persons (Appiah-Opoku, Manu, Asibey, & Amponsah, 2023). Unfortunately, this is a recurring theme in almost every city in East and West Africa.

In Spain, researchers found an association between low green space density and hypertension in women but not in men (Plans, Gullon, Cebrecos, & Fontan, 2019). However, in developed countries like Spain or the USA, Black populations may not have better access to green spaces. Due to racism, neighbourhood segregation and discrimination, Black minorities abroad may live in poorer ‘nature-deprived’ communities without adequate green spaces, according to a recent National Geographic report (Borunda, 2020). In Africa, virtually no research studies focus on the effects of green spaces on cardiovascular health. However, private housing developers are now more likely to include large green spaces within luxury housing estates (green estates) in some countries, including Nigeria and Ghana. Hence, there is a dearth of data in this area.

In summary, political ecology studies are also highly relevant to studying cardiovascular diseases in Africans. Priority areas for further research include indoor and ambient air pollution effects in high-density African capitals compared to rural areas. Green space studies in African cities may also help ascertain how the newer, greener estates impact cardiovascular health. Figure 7 summarises the mechanisms through which green spaces mitigate air pollution. For instance, trees bordering roads

can absorb the excess carbon dioxide and promote a cooling effect in ozone-blanketed districts (Kumar, et al., 2019)

Figure 7: Mechanisms of air pollution and green spaces



(Kumar, et al., 2019)

Nonetheless, as desirable as green spaces and clean air may sound, African countries may have drought and desert encroachment concerns or landmass constraints, and poverty tends to promote low access to clean energy, standard town planning practices, good roads, and healthy transportation systems. In numerous LICs (Low-income nations) and Low-Middle-Income countries (LMICs), poverty headcounts may range from 3% (Cape Verde) to over 70% in South Sudan and Madagascar. Thus, poverty can severely limit African governments from initiating the required environmental health changes. Factors related to structural violence may further hamper and obstruct a clear, logical pathway to achieving equitable healthcare for persons with cardiovascular diseases.

Structural Violence and Cardiovascular Diseases

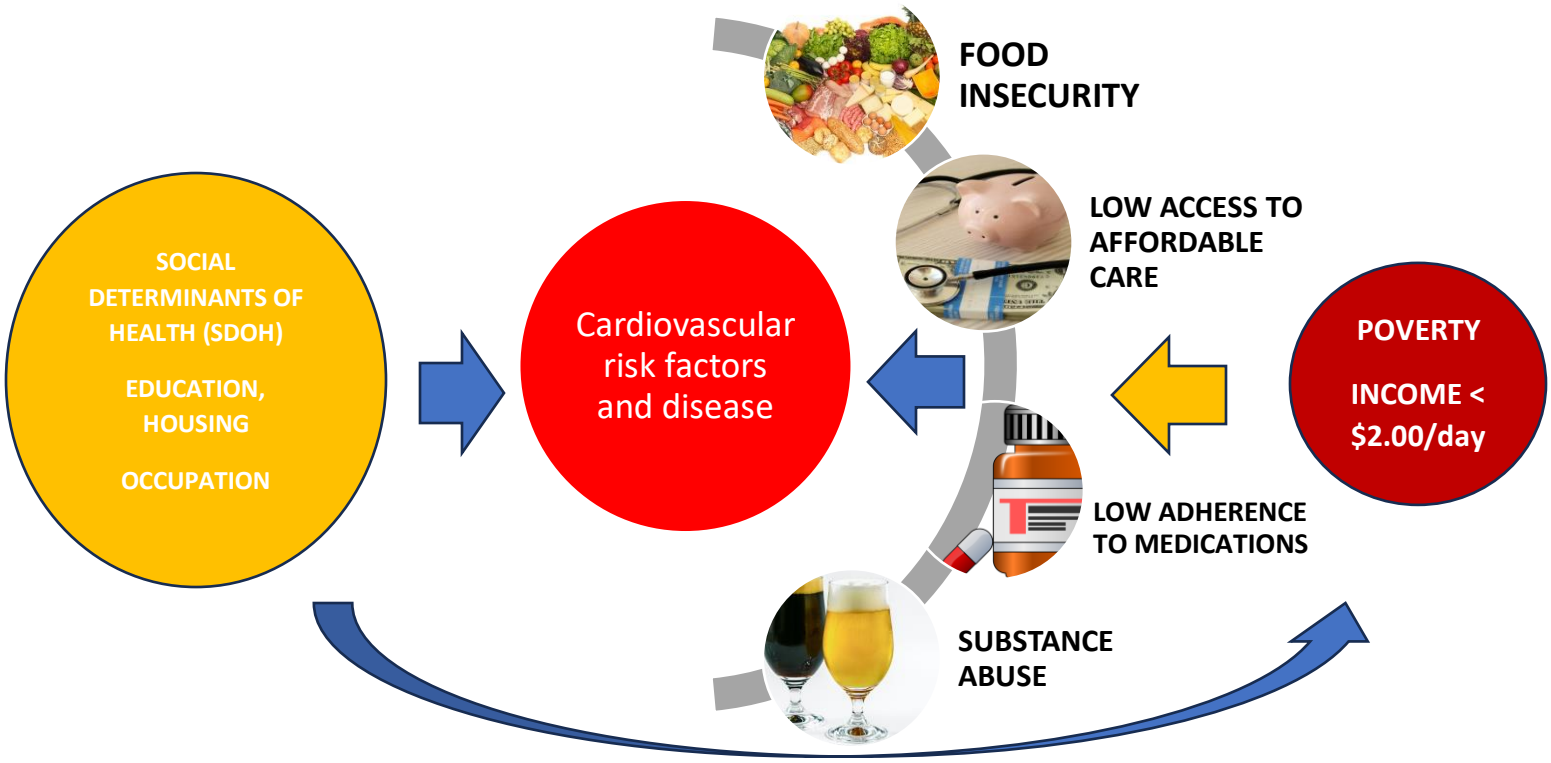
African nations with a history of insurgencies, ethnic wars, genocides, extreme colonialism, harsh military regimes or apartheid-driven racial policies may all have social connections to structural violence and marginalisation. Structural violence is an umbrella name for social or religious systems that enforce and normalise gender discrimination, child marriages, low access to education for girls, and caste systems that relegate minority ethnic groups to 'slave farms" and segregated neighbourhoods; similarly, marginalised communities find it challenging to improve family income and social status. Thus, with low literacy, marginalised groups may have generational livelihoods, e.g. subsistence farming, camel rearing, basket making, well digging or goat rearing, entomb generations after them in the same cycle of multidimensional poverty.

Entrenched p**overty and cardiovascular diseases**. In some impoverished Northern Nigerian communities, young boys are taken away from their families, denied an education, and forced to become Almajiris. Little provision is often made for their upkeep and feeding. Most grow up in special religious schools where they are left on the streets to beg for up to 6 hours a day to cover their school expenses. According to the United States Children's Emergency Fund (UNICEF), there could be as many as 10 million children in Nigeria's Almajiri school system who are forced to beg on the streets or scavenge in landfills for 5-7 years or more. A few studies report high rates of infectious diseases amongst Almajiris, who could be as old as 28 years (Muhammad, et al., 2023).In addition, a Northern Nigerian research team confirms the possible link between food insecurity in Almajiris and hypertension (Sarkingobir, Sahabi, Saadu, Bello, & Bakwai, 2019). Still, none have examined the residual effects of the Almajiri system on cardiovascular health, more so when chronic vitamin B1 deficiency and malnutrition-driven infectious diseases are well-known risk factors for Beri-Beri and Rheumatic heart disease, respectively.

Beyond nutritional deficiencies, poverty appears to have a rather multi-faceted relationship with cardiovascular health in that multiple inter-woven social factors may increase the risk of cardiovascular diseases. These include insufficient access to preventive healthcare or risk screening, the presence of psychological stressors, poor

quality housing, manual labour in some cases, and low adherence to prescribed medications on account of cost. (figure 8). The United Nations has also described the association between poverty and substance abuse, confirming in a 2022 report that marginalisation and poverty are both risk factors for substance abuse (including alcohol and tobacco use), which, in turn, are both recognised determinants of cardiovascular diseases (United Nations, 2022). Figure 8 summarises poverty and marginalisation's multiple direct and indirect links to cardiovascular diseases.

Figure 8 Effects of poverty and marginalisation on cardiovascular risk factors and disease



Hence, an anthropological study on structural violence must examine all possible relationships between interconnected variables and determinants. Considering the scale of this problem in Africa, it would be helpful to investigate structural violence effects in different regions. For example, in South Africa, post-apartheid policies have continued to enable social and financial inequities within the nation.

Post-apartheid policy effects and cardiovascular diseases. In post-apartheid South Africa, systemic racism continues to strengthen social injustice in numerous dimensions. Government policies support significant differences in how benefits are utilised by the rich and the poor, thus sustaining the cycle of poverty described in Figure 8. For instance, Silwa and Ntusi (2019) represent a distressing range of policies that leave 70% of medical doctors in private practice, while public hospitals that serve people experiencing poverty in South Africa are underfunded and under-resourced (Silwa & Ntusi, Battling cardiovascular diseases in a perfect storm: South Africa 25 years after apartheid, 2019). Other cardiovascular health and wellbeing barriers include inequitable educational opportunities, unemployment, a chronic shortage of cardiologists at public facilities, and segregated neighbourhood structures. Hence, a combination of biocultural and structural violence determinants is probably responsible for significant health disparities in South Africa.

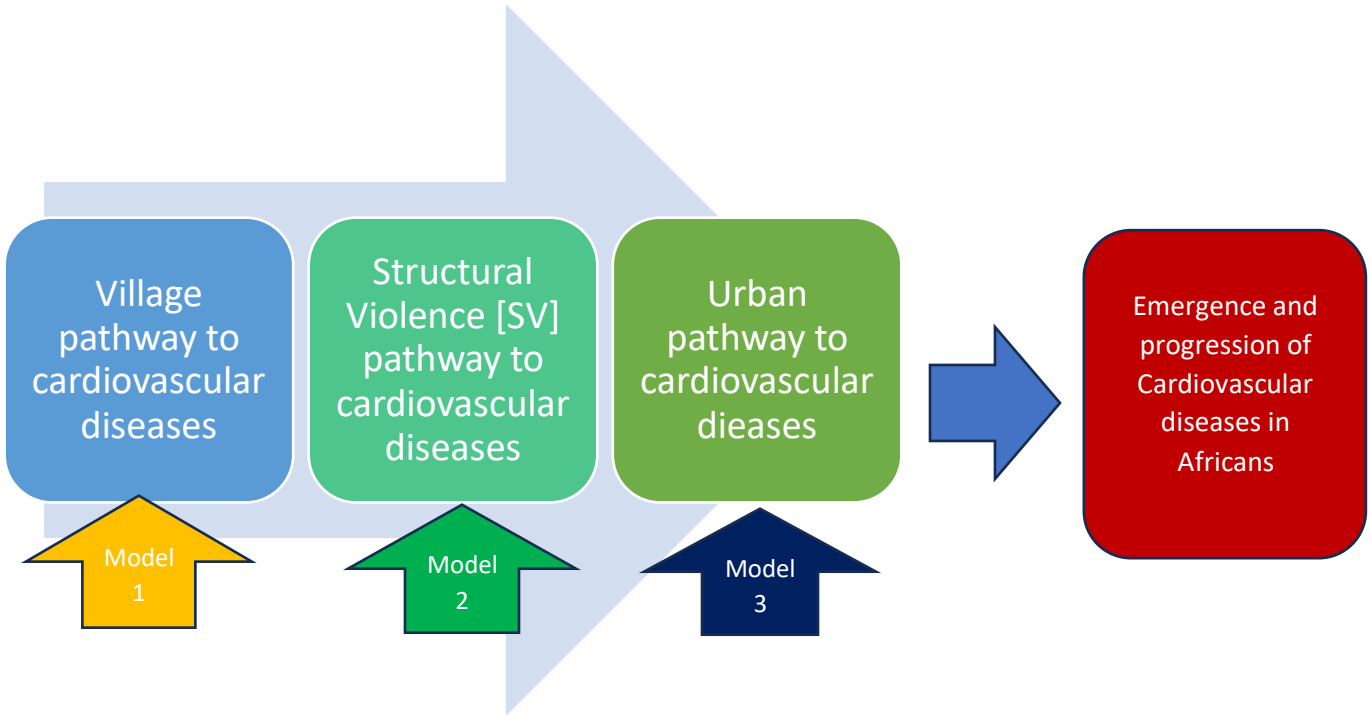
The Syndemics of Cardiovascular Diseases

Therefore, the evidence makes it relatively easy to understand why medications alone cannot prevent or control the emergence and progression of cardiovascular diseases in Africa. It also highlights the key reasons why genetics, salt sensitivity and insulin-resistant theories are not sufficient to explain the incidence and life cycle of cardiovascular diseases in Black populations (Samuelson, 2022) For example; Northwestern University announced in 2022 that the higher risk of cardiovascular diseases in Black adults compared to White adults could be better explained by *anthropological* determinants (including but not limited to poverty, neighbourhood factors, lifestyle, education and diet), rather than race alone (Samuelson, 2022). This supports my initial pre-review hypothesis. Nevertheless, the Northwestern study team did not attempt to create syndemic models.

Hence, when considering the syndemic mechanisms of cardiovascular diseases, findings from the existing literature have been synthesised to recreate the most likely interlocking components of cardiovascular diseases in African settings. It is possible to extract **three** distinct syndemic pathways from the available evidence. Three major

syndemics ‘’pathways” are summarised in figures 9-12 under a revised theoretical concept.

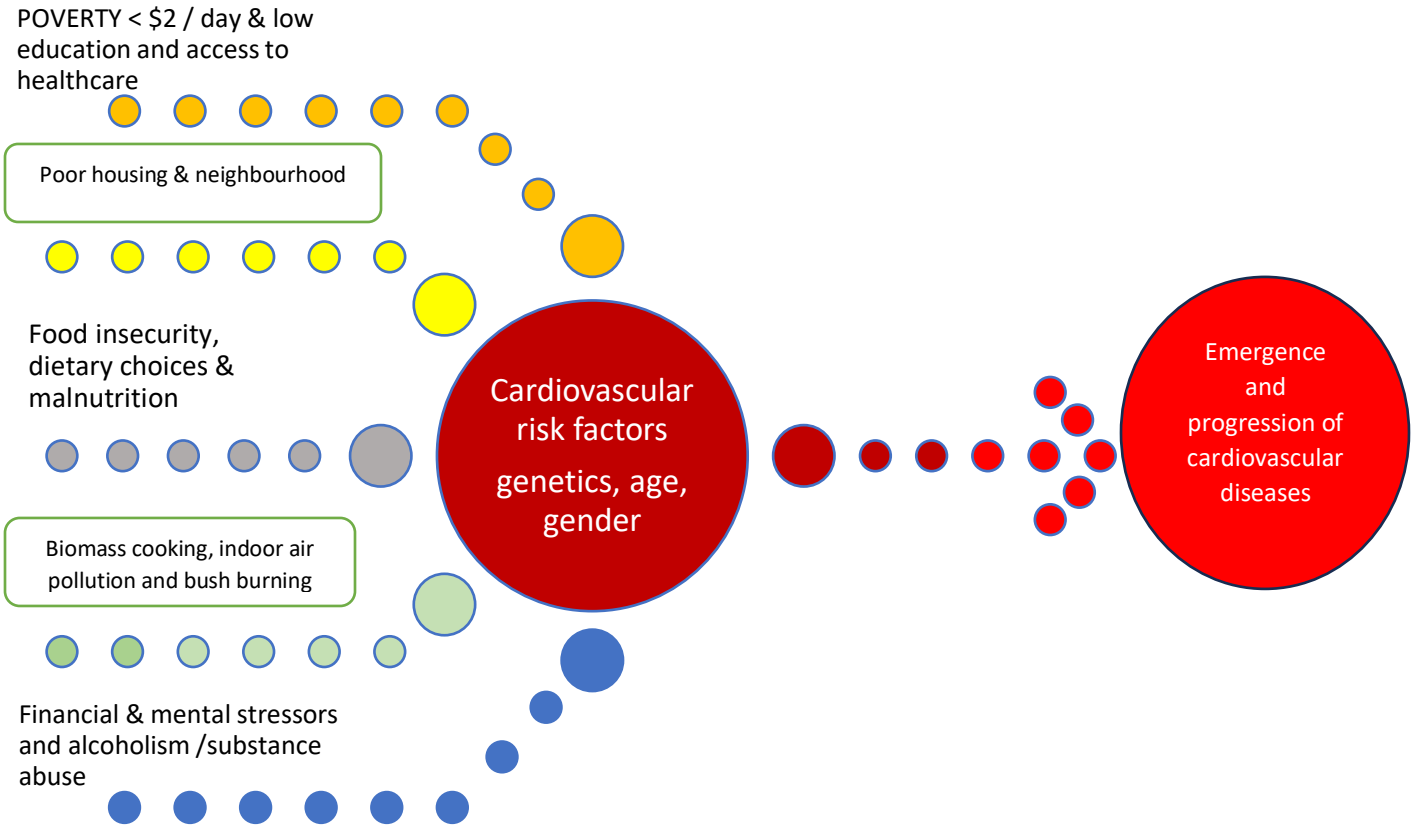
Figure 9: Conceptual illustration of 3 distinct syndemic pathways to cardiovascular diseases in persons of African ancestry



My revised hypothesis: The above conceptual framework for syndemic pathways describes the three main anthropological avenues by which Africans and Black populations may develop risk factors for cardiovascular diseases. These risk factors may eventually metamorphosize into a variety of cardiovascular diseases (Both communicable and non-communicable) in the absence of strategic public health interventions. This model better represents the key reasons why rural populations who do not have Western lifestyles are also at significant risk of disease. The components of the **‘village pathway”** are explained further in Figure 10. In each syndemic model, components are a mix of inter-related biocultural determinants, ecological factors and, (in model two), SV factors. I further hypothesise that syndemic models are not fixed or static. A rural dweller with a village risk model who migrates to the city to live with a

wealthy family as a driver can quickly move from a village model into an urban risk model. In African nations, a military coup or civil war may move entire populations of vulnerable minorities from a village model into an SV syndemic model of risk.

Figure 10: The proposed village pathway syndemic model 1



The village pathway to cardiovascular diseases considers a mix of biocultural and ecological factors interacting with traditional risk factors (age, gender and genetics) to trigger the emergence of cardiovascular diseases. In African villages, alcohol consumption may be significant, although locally brewed gin or beer may be more popular than expensive factory-manufactured products. In Nigeria, this is undoubtedly the case. Locals in rural Nigeria distil their gin or spirits and tap palm wine from trees.

Figure 11 demonstrates that the **SV pathway** is a variant of the village pathway. Usually, the vulnerable poor are more susceptible to systemic and political oppression compared to the wealthy elite (many of whom may be dual citizens who can emigrate to other countries at short notice).

Figure 11: The conceptual SV pathway (model 2) to cardiovascular diseases in Black populations

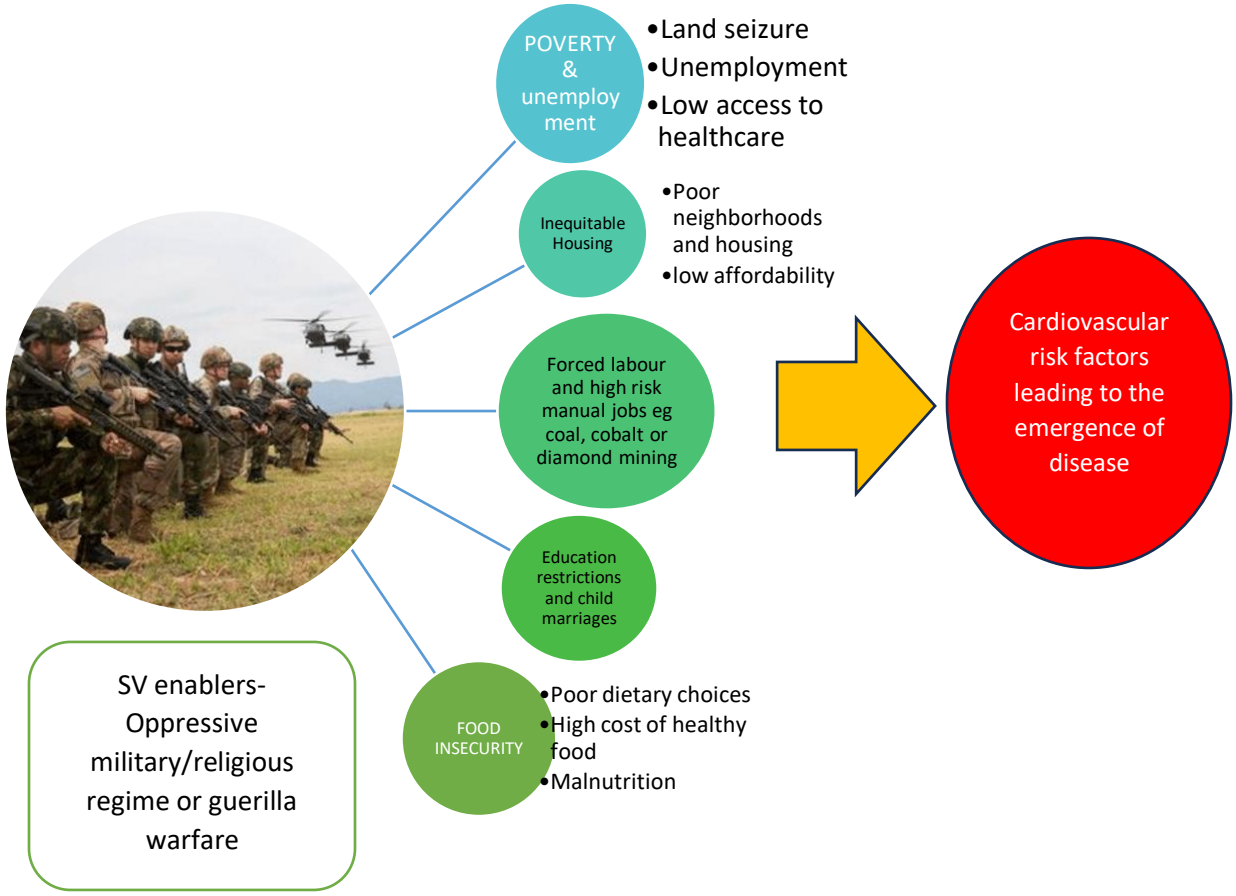
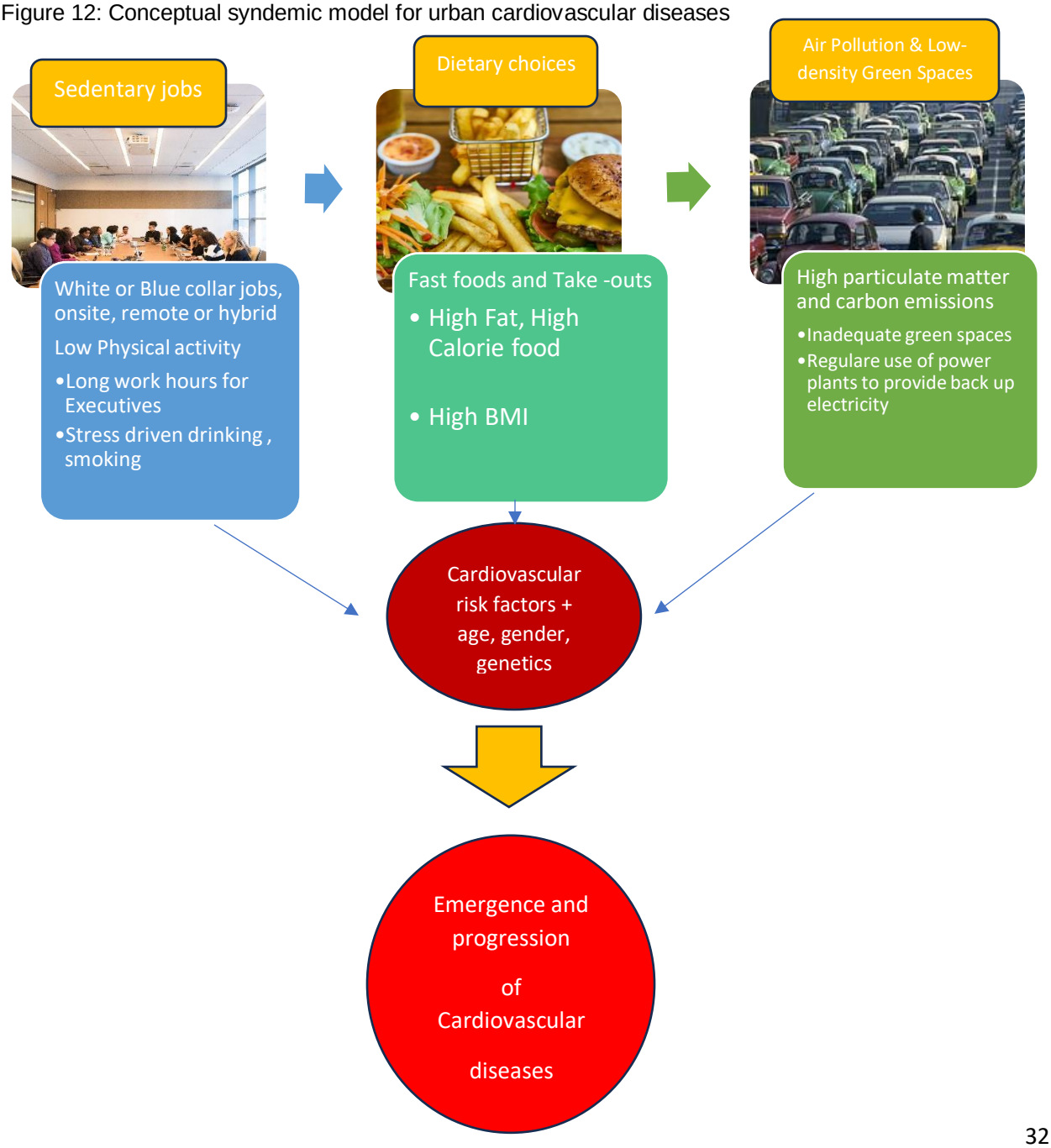


Figure 11 represents a scenario that has played out in numerous African nations where political instability, military coups, guerilla warfare and insurgencies are rife. Farmlands may be destroyed and seized by militia, and people with low incomes may be driven off their ancestral lands. Vulnerable populations and minorities may be forced to live in poor-quality accommodations or make-shift camps, with no hope of regular employment or access to Western education. Child labour and forced labour are rampant, and many will find themselves working in mines for very little or no pay. This was the plight of the

vulnerable in Liberia, Somalia, Congo and Sierra Leone in the 1990s, but remains a public health and human rights concern in numerous African nations today, including North Eastern Nigeria, the Democratic Republic of Congo, and South Sudan. Then, there is the issue of rapid urbanisation in Africa.

Therefore, the **urban pathway** to cardiovascular diseases in Figure 12 illustrates the typical urban risks to the disease model.

Figure 12: Conceptual syndemic model for urban cardiovascular diseases



Hence, one or more syndemic models can be integrated into a study design on anthropological determinants of cardiovascular diseases in Africa. Possible study designs may involve (from best to least effective);

a. **Prospective Cohort study** – a design in which a cohort of persons with biocultural and ecological determinants described in models 1-3 (but with no cardiovascular diseases) are followed up for several years to see how many develop cardiovascular diseases
b. **Case Control study**- a study design that uses patient records to identify established cases with cardiovascular diseases in either urban or rural areas or both, who are then matched with persons without the disease, and investigated to understand exposure patterns to determinants in the syndemic models 1-3
c. **Retrospective cohort study** – a study design that uses secondary or historical data to determine if a cohort of persons with cardiovascular diseases had any related exposure to biocultural or ecological determinants of disease. Since this method does not use controls, it is less accurate than a case-control study when attempting to ascertain cause and effect.

However, the final study design selection may depend on the availability of funding and access to patient records.

Conclusion

Despite limitations in the existing literature, regarding quality, and Africa related content, the systematic anthropological review of cardiovascular disease determinants in Black populations has provided numerous invaluable insights. The three conceptual syndemic models for instance, represent the possible mechanisms by which African populations may be disproportionally affected by cardiovascular illnesses. The models also summarize the information required to adjust my research questions as follows:

1. How do *biocultural factors* (age, gender, education, poverty and financial difficulties, marriage style, pregnancy, traditional African diets, occupation, poor housing, disadvantaged neighborhoods, food insecurity, substance abuse and *ecological factors* (indoor pollution, and use of biomass fuels), influence the emergence, or progression of cardiovascular diseases in the **Village pathway** risk model in Africa?.
2. How do *biocultural factors* (age, gender, BMI, sedentary jobs, work hours, dietary choices, substance abuse, work stress, response to medication and *ecological factors* (air pollution from vehicular traffic & power plants and low green space density) influence the emergence, or progression of cardiovascular diseases in the **Urban pathway** risk model in Africa?.
3. How do structural violence factors interact with SDOH (social determinants of health) to promote cardiovascular risk factors and diseases states in Africa?

One or more of these research questions could become part of my anthropological research in the near future. Hopefully, my findings could then provide a more effective road map to public health leaders planning interventions and preventive health programs in African nations.

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