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The Significance of the Biopsychopolitical Model of Mental Health and Illnesses: Exploring Trends, Predictors and Statistical Challenges

Evariste erwin sebahutu

Department of Public Health, Ballsbridge University, Common Wealth of Dominica

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***Corresponding author:**
Email: erwin.ndaruhutse@gmail.com

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Abstract

The current concerns regarding the ever-increasing global burden of non-communicable diseases where mental disorders and related somatic diseases make a significant contribution triggered my interest in the review of social determinants of mental health. Sufficient evidence led to the link of political systems to mental ill-health of citizens and taking into account the drawbacks of the biopsychosocial model based interventions led me to the formulation of the biopsychopolitical model that may guide the curative and preventive interventions for mental and related somatic diseases that I collectively call Social Distress Coping Disorders (SDCDs). The present paper aimed to find the predictor that may guide epidemiological studies. While ironically the Human Development Index (HDI) and Social Development Index (SDI) positively correlate with the global prevalence of disorders like depression and anxiety; an attempt was made to find a predictor that may negatively correlate with the prevalence of SDCDs on a global scale with no success due to reasons elucidated. On a local scale, the income inequality measures weakly negatively correlated with hypertension at 95% CI ($R= -0.307$, $\beta = -0.449$, $p= 0.030$) while no correlation was found for depression ($R= -0.106$, $\beta = -0.014$, $p= 0.47$) in 50 African countries with available data, and possible reasons for this were mentioned. The link between political systems and social determinants of mental health is certain, while waiting for a suitable model and predictor due to biased data as shown, the validity of the biopsychopolitical model is assured.

Introduction

Like other types of conditions, humans have lived with mental ailments since time immemorial. Different models were developed to explain their etiology and most importantly, guide the formulation of interventional approaches. Among them the most common models include the psychological, biomedical, and biopsychosocial models. Their usefulness in understanding and treating mental disorders until now cannot be underestimated however, the ever-increasing global burden of non-communicable diseases of which mental disorders and mental health related somatic disorders make a large percentage imply a weakness in their provisions. In order to account for the increasing prevalence of mental disorders such as anxiety disorders and depressive disorders and mental health related somatic diseases such as hypertension and

related complications, especially in developing countries, and in the light of evidence linking political systems to social determinants of mental health; the biopsychopolitical (BPP) model was formulated to explain their etiology and guide curative and preventive interventions. This model is built upon five concepts: sociosomatics, neuroplasticity, network model of mental disorders, multiple mental disorder, and socio-politics. With sociosomatics or simply sociomatics, daily experiences mainly unpleasant ones also called social distress activate complex biochemical processes that in turn lead to mental and somatic diseases while neuroplasticity also called psychosocial genomics recognizes that contrary to old belief in the immutable brain fabric, neuronal networks are constantly formed due to daily experiences hence socio-cultural experience affect the human somatic side and this is the well-known as gene-environment interaction. The network model recognizes symptoms of mental illnesses as nodes that activated by external factors (external to the psychopathology network that may also be of inside the body origin) and once activated they interact and activate and sustain each other hence mental disorders arise when groups of tightly coupled symptoms actively maintain each other. Due to overlap in symptoms due to many psychopathological nodes activation, most of the time more than one mental disorder occurs simultaneously and this complex disorder is called Multiple Mental Disorder (MMD) and finally socio-politics which takes into account the increase in human rights violations and hegemonic style practiced by a large number of political systems especially in developing countries. The biopsychopolitical model of mental health and associated illnesses generally considers that social determinants of mental health are strongly affected if not determined by politics that determine everyday life and these politics create stressors that will induce distresses that require coping strategies by the body that in the case of failure lead to mental and related somatic diseases. For preventive and curative interventions, the biopsychopolitical model stresses the importance of interventions in reducing and eventually removing these chronic stressors that are embedded in everyday life that call for the requirement for the same political elites to recognize the effects of their own doings and intervene upon the upstream and where deemed necessary on downstream social determinants of mental health while health systems intervene on downstream social determinants of mental health, mental ill-health, and carry out advocacy for the government to intervene in cases out of their reach. Accordingly, factors that affect mental health include income inequality; various forms of discrimination and denied political participation and or representation; freedom in its diverse forms such as economic freedom, freedom of expression, and press freedom freedom of the press among others. Any model that would explain the trend in current global prevalence of mental diseases is required to draw on one or more of these social factors of mental health.

Background on the search for models to explaining the ever-increasing global burden of mental health-related disorders

The global increase in mental illness prevalence continues to be problematic. Different models have been developed to guide curative and preventive interventions but still none is proving itself to be promising that one day the world will be free of these health threatening diseases despite global efforts. Billions of dollars are lost each year due to Years Lived with Disability (YLDs), Years of Life Lost (YLLs), and treatment costs. In the wake of COVID-19, through the systematic review and meta-analysis, Nochaiwong et al. (2021) found the global prevalence estimate of major mental disorders to be: 28.0% for depression; 26.9% for anxiety; 24.1% for post-traumatic stress symptoms; 36.5% for stress; 50.0% for psychological distress; and 27.6% for sleep problems.

A study by Zuberi et al. (2021) on the prevalence of mental diseases in the Eastern Mediterranean Region (EMR) of the World Health Organization showed that depression comes first with a prevalence of 14.8%; followed by generalized anxiety disorder (GAD) prevalence of 10.4%; next is post-traumatic stress disorder with a prevalence of 7.2%; substance use with a prevalence of 4.0%; and obsessive-compulsive disorder with a prevalence of 2.8% among others. The global and regional prevalence and disparities studies on 204 countries

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and regions were done by Ferrari et al. (2022) and Zhu et al. (2022) through a systematic review meta-analysis of available data from 1990 to 2019. Ferrari et al. (2022) found that the number of disability-adjusted life-years (DALYs) due to mental disorders increased from 80.8 million in 1990 to 125.3 million in 2019. They found also the proportion of global DALYs attributed to mental disorders increased from 3.1% in 1990 to 4.9% in 2019. Zhu, H. (2022) argue the global mental health issues to show a gradual upward trend. They also argue that there is a significant positive and moderate correlation between national development and the burden of mental disorder and concluded that in developed countries, the burden of mental disorders is relatively high but with a downward trend while in developing countries, the burden of mental disorders is not large but with a growth rate that is relatively fast.

It is common knowledge that determinants of mental health go hand in hand with countries' development indicators and persons' socio-economic position. It is in this context that many academics tried and are still trying to link the global trend in mental illnesses with the standards of living of people in different countries but without success. The most used indicators are the United Nations Development Program (UNDP)'s Human Development Index (HDI) that takes into account elements like life expectancy at birth, education or literacy rate, and real GDP per capita; and the Social Demography Index (SDI) that is based on the comprehensive average of the per capita income, average education level and fertility rate. In their study on the association between socioeconomic inequality and the global prevalence of anxiety and depressive disorders using HDI and its components using linear regression, Shahbazi et al. (2022) found that the prevalence of anxiety and depressive disorders significantly increased as life expectancy at birth, mean years of education, gross national income and HDI level increased. With respect to the indicators presented and with a 95% confidence interval, their model showed positive β coefficients for anxiety and depression prevalence. They concluded that the prevalence of anxiety and depressive disorders is higher in developed countries and that this increase goes hand in hand with countries development pathways.

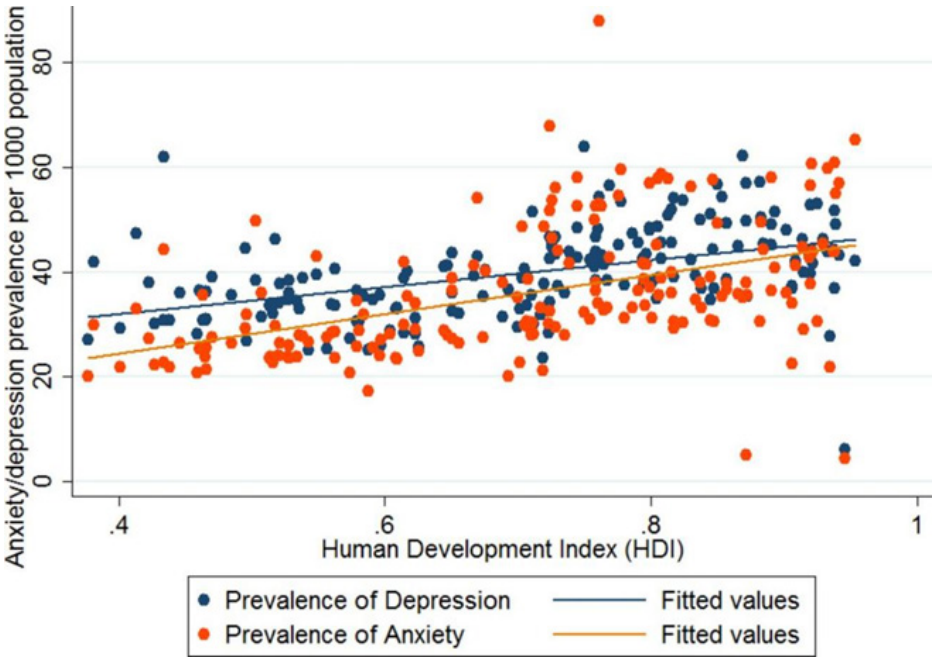


Figure 1. Scatter plots for the relationship between the Human Development Index (HDI) and anxiety/depressive disorder prevalence (0=lowest HDI; 1=highest HDI). Source: Shahbazi et al. (2022) reproduced under the CC BY-NC license.

Zhu, H. (2022) adopted a new approach. This is the use of DALYs (Disability Adjusted Life Years) a compound indicator of years lived with disability (YLDs) and years of life lost (YLLs), Human Development Index (HDI) and the social demography index (SDI) to calculate and present the trend and hence global disparity in the burden of mental disorder. They found the global burden of mental disorders to show an upward trend from 1990 to 2019; based on the HDI, the higher it is the higher the YLDs; based on the SDI, countries or regions with medium and high SDI levels have a relatively high burden of mental disorders but with a downward trend in the proportion of the burden of mental disorders and the growth rate of the number; they found also the burden of mental illnesses in low-income countries not to be high but with an obvious increase in growth rate.

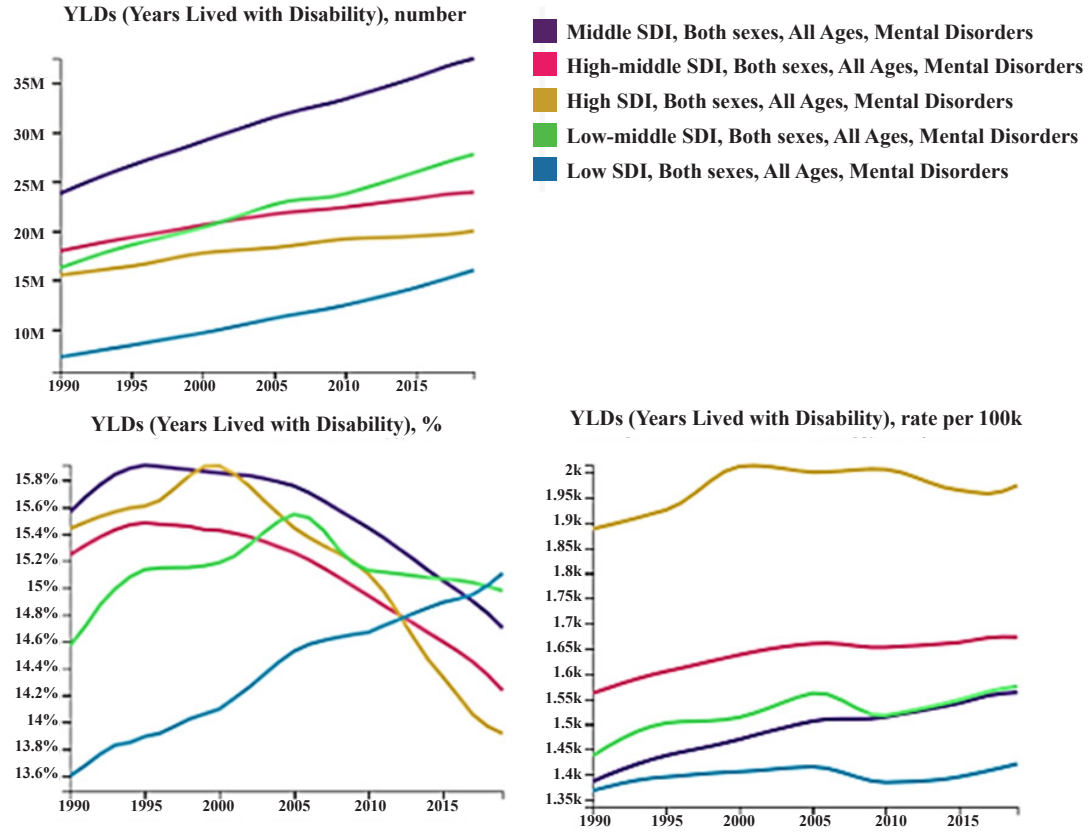


Figure 1. YLDs of mental disease burden of different countries (1990-2019). Source: Zhu et al. (2022). Reproduced under Creative Commons Attribution 4.0 International License.

With the knowledge and definition of determinants of mental health, it is expected even for lay people that poor countries (lower HDI and SDI) will have higher burden or rate of mental disorders. It may seem contradictory since both Shahbazi et al. (2022) and Zhu, H. (2022) found a positive correlation between mental disorders and HDI and SDI even though Zhu, H. (2022) argue that their burden in poor countries has an increase growth rate. By retaining the observations by Shahbazi et al. (2022) that data and hence prevalence of mental illnesses in poor or developing countries are affected by under-reporting due to poor health education, difficulties in seeking healthcare, delayed identification of mental illness and misdiagnosis; I agree with them by adding that the disadvantaged socio-economic living style makes a large fraction of the population in developing countries live and cope with social stressors that make some mental illnesses a normal part of their living. Results that rely

on data of reported mental illnesses from developing countries will be highly biased hence the need for another indicator that is easily recorded and that may reflect the mental health.

In this article I will use, besides depression, hypertension as a mental disturbance related illness that is also considered to be a member of the Social Distress Coping Disorders (SDCDs). Social Distress Coping Disorders (SDCDs) comprise a category of psychiatric conditions characterized by persistent and maladaptive coping strategies that individuals employ in response to social stressors and challenges, particularly those arising from prevailing authoritative and dictatorial political systems. Diagnosing and treating SDCDs necessitates a holistic comprehension of an individual's coping mechanisms and the underlying socio-political factors contributing to their distress. Effective interventions for SDCDs aim to address and reshape these maladaptive coping patterns, fostering healthier social interactions and emotional regulation, all while considering the impact of the prevailing socio-political environment. It is now a common knowledge that social environment especially harsh and stressing gets under the skin and cause psychological and somatic diseases. Sociomatics, neuroplasticity and social psychogenetics help to understand this mechanism (Hatala, 2012). According to McEwen (2012), hormones associated with chronic stress may either benefit the body by creating adaptation or allostasis or produce diseases in the long run due to allostatic overload. It is in this context that chronic stress affects the human circulatory system and causes cardiovascular diseases (CVD) including high blood pressure or hypertension. Hypertension or raised blood pressure is defined as the systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg (Zhou et al., 2021). In 2008 Doctor Dimsdale from the University of California, San Diego carried out a systematic literature review to gather evidence on the psychological stressors' effect on the heart and found substantive studies confirmed the raised blood pressure after acute stressors such as earthquakes and continued and increased blood pressure after chronic stressors such as warfare, however, he concluded the data to be not unanimous about the effects of stress on cardiovascular disease (Dimsdale, 2008).In 2016 Amy Ronaldson, from the University College London in his doctoral dissertation destined to the establishment of the role of the hypotha lamic-pituitary-adrenal axis in linking cardiovas cular diseases and psychosocial stress, made a comprehensive literature review on the psychological stress' effect on cardiovascular diseases. According to the literature reproduced, chronic stress burden was associated with a higher prevalence of known CVD risk factors such as type 2 diabetes and hypertension in those free from CVD (Ronaldson, 2016). He reproduced also the work of Bomhof-Roordink et al. (2015) where they argue that life stress including childhood trauma, negative life events, daily hassles, and job strain to be associated with increased arterial stiffness. He retains the idea from evidence, that psychosocial stress is a significant risk factor for CVD incidence and mortality and argues that those studies that did not find association may be a consequence of how stress was conceptualized.

McMahon et al. (2021) also argue on the substantive studies and evidence that support the cardiovascular reactivity (CVR) which is a physiological change in heart rate (HR), blood pressure (BP) or other measures of cardiovascular function between a resting period, and during the presence of an external stressor. The cardiovascular reactivity hypothesis stipulates that exaggerated cardiovascular responses to psychological stress contribute to the development of cardiovascular disease (CVD), an increased risk of hypertension, and poorer cardiovascular risk status. They reproduce the works of many researchers including Matthews indicating that reactivity to acute psychological stressors within the laboratory is predictive of future blood pressure status and disease outcomes. I argue that hypertension or raised blood pressure is directly related to mental health in such a way that its prevalence goes hand in hand with mental ill-nesses resulting from chronic social stress. Even though both Shahbazi et al. (2022) and Zhu et al. (2022) failed to link lower HDI and lower SDI to increased prevalence of mental illnesses, especially depression and anxiety, it is still valid to argue that lower socio-economic statuses are linked with increased prevalence of mental illnesses. It is high-

ly unlikely that any attempt to statistically link the increased prevalence of mental illnesses and the decreased socio-economic statuses using HDI and SDI indices will succeed any time soon. This is due to the fact that data used are highly biased especially in poor countries where even these mental conditions are not considered diseases that seek medico-psycho logical care.

Materials and methods

An attempt was made to link social distress coping disorders: hypertension and depressive disorders with another socio-economic status indicator which is income inequality on a global scale by including countries in which all data were available. The world inequality data and report 2022 edition by World Inequality Lab were used and the bottom 50 % of the nation's population income share was used as a measure of inequality by country. The WHO's World Health Statistics 2022 edition was used also to retrieve the age standardized prevalence of hypertension expressed in percentage among adults aged 30 -79 years. Finally, the latest data on depressive disorders were obtained from the Global Burden of Disease Study 2019 (GBD 2019) by Institute for Health Metrics and Evaluation (IHME) and the inequality data of the same year used. Statistical treatment of data was done using SOFA-Statistics Version 1.5.4 and pvalue.io, a Graphic User Interface to the R statistical analysis software for scientific medical publications available at https://www.pvalue.io. A 95% CI, a p value <0.05 is considered statistically significant.

Table 1: For 50 African countries: inequality, hypertension and depression data.

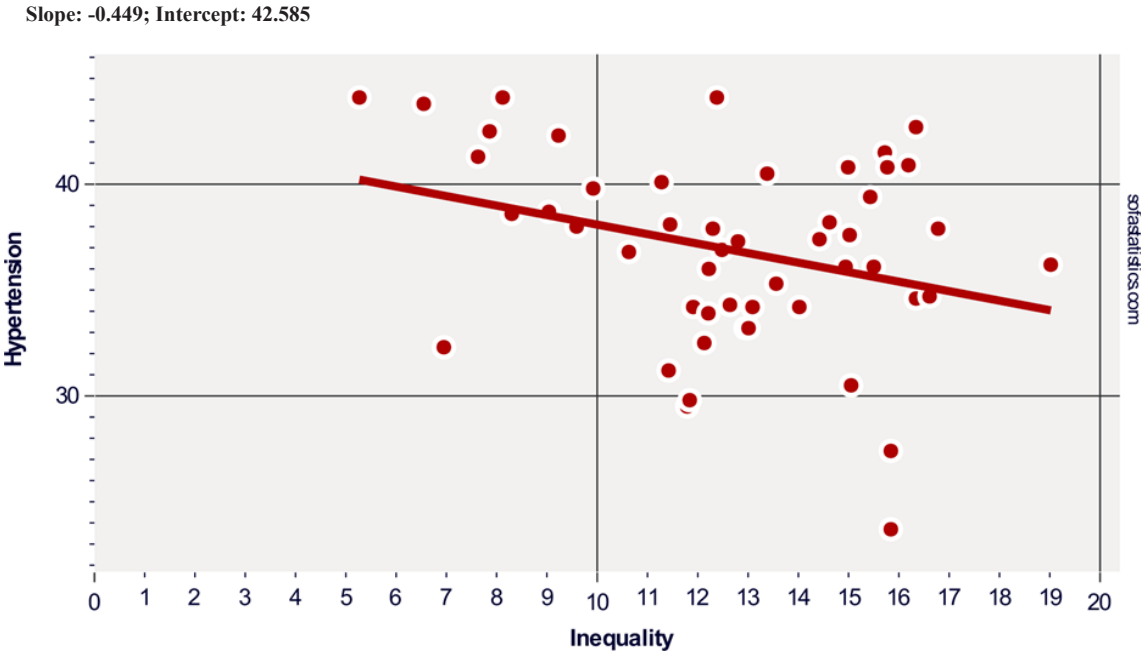
Country	Hypertension (2022)	Inequality (2022)	Depression (2019)	Inequality (2019)
Algeria	36.2	19.02	4.5	19.02
Angola	38.7	9.04	3.6	9.04
Benin	31.2	11.42	3.9	14.22
Botswana	44.1	8.12	4.7	8.12
Burkina Faso	30.5	15.05	3.6	10.36
Burundi	34.2	14.02	4.2	14.02
Cabo Verde	44.1	12.38	4.9	12.38
Cameroon	36.8	10.63	3.9	10.63
Central African Republic	41.3	7.63	4.2	7.63
Chad	37.9	12.3	3.5	14.33
Congo	39.8	9.92	3.9	9.92
Côte d'Ivoire	37.3	12.8	3.8	12.8
Democratic Republic of the Congo	34.3	12.64	3.8	12.64
Djibouti	34.2	13.09	5.1	13.09
Egypt	38.2	14.62	3.5	15.25
Equatorial Guinea	38.1	11.45	4.2	11.63
Eritrea	23.7	15.84	4.3	15.84
Eswatini	42.5	7.86	4.2	7.86
Ethiopia	27.4	15.84	4.7	15.84
Gabon	37.4	14.42	4.3	14.42

Country	Hypertension (2022)	Inequality (2022)	Depression (2019)	Inequality (2019)
Gambia	37.6	15.02	3.9	15.02
Ghana	33.9	12.21	4.2	12.21
Guinea	40.9	16.19	3.9	18.2
Guinea-Bissau	38	9.59	4	15.43
Kenya	33.2	13.01	4.4	13.01
Lesotho	40.1	11.28	4.8	11.28
Liberia	39.4	15.43	3.5	15.43
Libya	42.7	16.34	4.5	16.37
Madagascar	36.9	12.48	4.4	12.48
Malawi	29.5	11.79	4.1	13.93
Mali	34.6	16.34	3.6	14.75
Mauritania	37.9	16.78	4.1	16.78
Morocco	35.3	13.56	4.5	13.56
Mozambique	38.6	8.3	4.1	8.3
Namibia	43.8	6.55	4.4	6.55
Niger	41.5	15.72	3.4	14.38
Nigeria	36.1	15.5	3.9	15.5
Rwanda	29.8	11.84	3.8	11.84
Senegal	40.5	13.38	3.9	13.96
Sierra Leone	40.8	14.99	3.9	14.99
Somalia	36.1	14.94	4	14.94
South Africa	44.1	5.27	4.6	5.82
South Sudan	34.2	11.91	4.4	11.91
Sudan	40.8	15.77	3.6	15.77
Togo	36	12.22	3.9	12.42
Tunisia	34.7	16.61	4.9	16.61
Uganda	32.5	12.13	4.6	12.25
United Republic of Tanzania	33.2	12.95	4.1	12.95
Zambia	32.3	6.95	4	6.95
Zimbabwe	42.3	9.23	4	9.23

Results

An attempt to statistically link income inequality index to available data on mental illnesses such as depression and anxiety and hypertension on a global scale using linear regression analysis like other studies before did not yield any statistically significant relationship. I argue that the failure has roots in underreported and misdiagnosed cases especially in poor countries and the fact that people in different geographical areas and cultures, different statuses such as gender exhibit different c

oping strategies and coping resources hence the same social distress may lead to different outcomes. For example, the same social distress may produce anxiety and depression in females while leading males to alcoholism and hypertension.The prevalence of an easily diagnosable and mental health related illness should be used. Hypertension is a good candidate here. I argue that for data to make sense and reduce bias there is a need for regional consideration instead of global coverage since countries belonging to the same region such as Africa have many things in common in their socio-cultural behaviors and beliefs, approximately equal technological and physical infrastructures used in diagnosis and reporting illnesses.The scatter plot of the relationship between hypertension and income inequality expressed as the share of the bottom 50% of the adult population by country in 50 African countries is given below:



The inequality as expressed by the income share of the bottom 50% of the country's adult population ranges from 0% to 100%. This means that with the income share of 0% the bottom 50% of the population earns nothing while the share of 100% means that the bottom 50% earns 100% of the total income of the country.

Descriptive Analysis

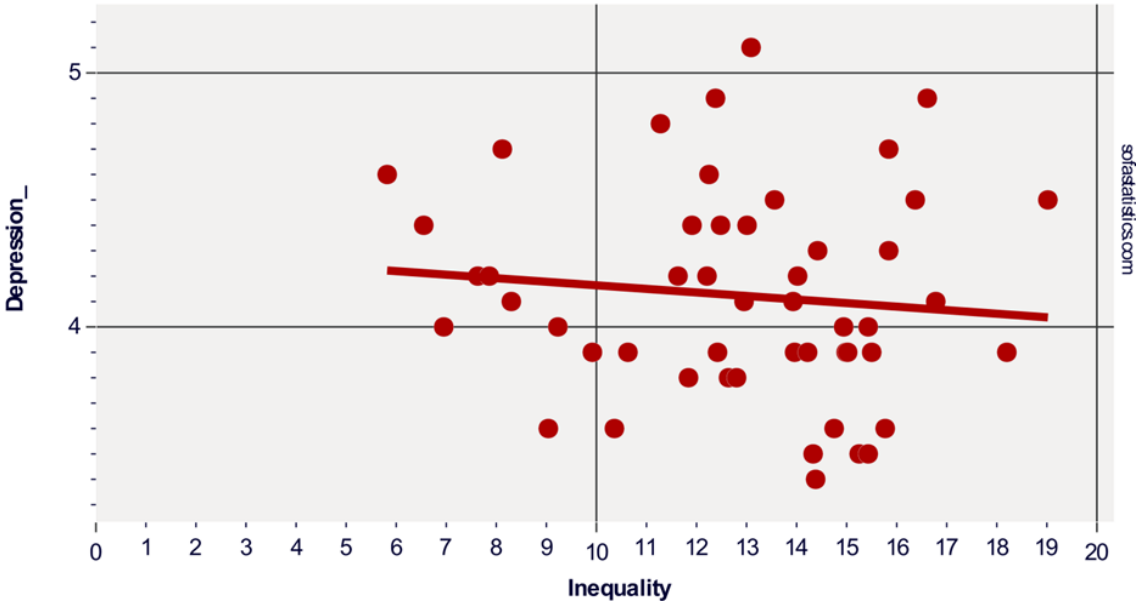
Quantitative variables	mean (sd)	median [Q25-75]	min	max	n
Hypertension	36.9 (4.52)	37.3 [34.2; 40.4]	23.7	44.1	50
Inequality	12.6 (3.08)	12.7 [11.3; 15.0]	5.27	19.0	50

A simple linear regression analysis was performed to test if the decrease in income inequality significantly predicts the decrease in hypertension prevalence among African countries. The results of the regression analysis indicated that the prevalence of hypertension decreased with increased income share or decreases income inequality (R= -0.307, β = -0.449, p= 0.030). When the income share of the bottom 50% increases by 1 unit (for instance from 23 to 24), hypertension decreases on average by -0.449; p = 0.03.

	correlation coefficient, R (95% CI)	β (95% CI)	n	p	test
Inequality	-0.307 (-0.539; -0.0311)	-0.449 [-0.864; -0.0345]	50	0.03	Pearson

The scatter plot of the relationship between depressive disorders and income inequality expressed as the share of the bottom 50% of the adult population over 20 years old by country in 50 African countries is given:

Slope: -0.014; Intercept: 4.303



Descriptive Analysis

Quantitative variables	mean (sd)	median [Q25-75]	min	max	N
Depression	4.12 (0.408)	4.10 [3.90; 4.40]	3.40	5.10	50
Inequality	12.8 (3.08)	13.1 [11.4; 15.0]	5.82	19.0	50

A simple linear regression analysis was performed to test if the decrease in income inequality significantly predicts the decrease in depressive disorders prevalence among African countries.

	correlation coefficient, R (95% CI)	β (95% CI)	N	p	test
Inequality	-0.106 (-0.373; 0.178)	-0.0140 [-0.0522; 0.0243]	50	0.47	Pearson

The results of the regression analysis indicated that the prevalence of depressive disorders decreased with increased income share but may be statistically not significant due to the large value of p hence with a 5% risk, we have not been able to show any statistically significant relationship between depression and inequality.

Discussion

In the contemporary world, we only change the course and act when the modern science including mathematical sciences prove the status quo wrong beyond reasonable doubt. For example, it is commonly acknowledged that we will not ban a chemical substance on the market until there are sufficient data to support its carcinogenic or teratogenic nature i.e. enough people harmed and sufficient data collected and statistically significant regardless of the fact that we have sufficient evidence that support the ad-

verse effects of such a substance. It is in this context that policy implication of modern toxicology deals with the dilemma of the lowest acceptable levels of exposure or the highest dose known to produce no effect and the acceptable higher levels with acceptable risks or the lowest dose known to produce an adverse effect. Social distress coping requires resources including knowledge, experience, social support, and sometimes government interventions depending on the nature and extent of the distressing situations. When sufficient resources are available and mobilized the stressors become less threatening and end up being suppressed. However, when stressors cannot be eradicated like in the case of politically driven socio-economic chronic stressors the failure in coping may result in distress illnesses since limited resources are invested for coping and in the case of exhaustion, maladaptive diseases are initiated. According to Carr and Umberson (2013), the effects of stress and stressors on health depend on social factors including race, socioeconomic status, gender, age, and psychological attributes including coping style.

Contrary to the most expected findings from any study by many that socio-economic status affects mental health in such a way that a negative correlation is most likely to be found between and socio-economic index and the prevalence of mental illnesses such as anxiety disorders and depression, epidemiological studies conducted on the global scale using HDI and SDI as measures of SES find a positive correlation instead. I argue that finding a predictor that may negatively correlate the global prevalence of mental illnesses especially social distress coping disorders to the socio-economic status will not be achieved any time soon. This is due to the well documented differences in reporting, diagnosis and infrastructures among countries that put developed countries in the first ranks of the global burden listing; and the still puzzling diversity in the coping mechanisms that lead to different outcomes. Depending on human diversity based on factors such as ethnicity, race, socio-economic status, gender, age, psychological status, and neuroendocrine integrity; the same causes will not produce the same effects hence making it difficult to find the common denominator while studying the global prevalence of social distress coping illnesses. Depending on the gender, social distress in females may highly likely lead to depression and anxiety while in males lead to alcoholism and drug abuse. Gambling may be common in males than females as a result of poverty due to income loss and poverty. Social distress may lead a majority of young people into social media addiction than adult people. Social inequality and related consequences are mainly found in marginalized minorities and races and poor neighbourhoods that trigger alcoholism and compulsive sexual behaviors that may lead to increased prevalence of HIV and STIs. Due to the complementarity of the sociosomatic model of mental illnesses, psychosocial genomics and the network theory that considers mental symptoms to be interconnected networks where the activation of one symptom will necessarily activate the next, social distress disorders will manifest as comorbid conditions with their peers or other mental illnesses. Confounding symptoms will affect the diagnosis hence the biased reported prevalence among countries and besides this unintentional biased prevalence; among malpractices in corrupt, repressive, or authoritative political systems; is the politicization of numbers where false statistics are intentionally published in the context of denying or camouflaging the results of their own doings. The global epidemiologic study of social distress coping disorders is and will continue to be affected many years in the future in twofold. First is the problematic suitable and universal indicator or predictor for the trend in these disorders and second is the fact that the same causes do not necessarily produce the same effect due to some external factors such as social support or peer pressure and internal factors such as genetic makeup; and this will continue to be problematic since it will not be easy to find any disease that may reflect the global common response to social distress. While waiting for that day when the icebreaking discovery will find a social indicator or a suitable biological marker that explains the global prevalence in terms of lower socio -economic status, the biopsychopolitical model of mental illnesses may be applied to individual countries.

Conclusions

It is common knowledge that the burden of non -communicable diseases including mental illnesses, the diseases that I call Social Distress Coping Disorders (SDCDs) is increasing on a global scale irrespective of age or gender. Studies of their risk factors include smoking, alcohol and drug use, and poor diet. The inefficiency of laws and policies for preventing NCD-related risk factors has been observed for example in Akseer et al. (2020) and recommendations on the need for multi-sectoral efforts made. However, due to the perceived gap in exploring why people engage in self-harming behaviors, I studied the link between social determinants of mental health and politics and found evidence of a significant contribution of political systems such as dictatorships and authoritarianism to the determinants of mental ill-health and a biopsychopolitical model was developed. The mathematical verification of the significance of the model on a global scale is still suffering from biased data especially in poor countries either due to underreporting, misdiagnosis, and people not seeking medical interventions, and probably the politicization of statistical data by governments. The other important source of bias is through the coping styles and resources where people in different areas and cultures exhibit different outcomes of the same social processes. Previous attempts and my attempts at finding a model or predictor of Social Distress Coping Disorders seems not succeeded. Besides the widely accepted strong relationship between social processes and mental ill-health, regarding the question of whether we will ever have a model or predictor to guide the global epidemiological research on social distress coping disorders, my answer will be not any time soon. This is due to the complexity of the matter but while waiting that time when one of us finds a suitable model and predictor, the biopsychopolitical model is well placed to guide curative and preventive endeavors regarding mental health related disorders.

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