Journal of
COMMUNITY SAFETY & WELL-BEING

An analysis of patterns and predictors of self-reported common mental disorders in Ibadan Metropolis, Nigeria

Adeniyi Sunday Gbadegesin* and Godwin O. Ikwuyatum*

ABSTRACT

Common mental disorders (CMDs) have been on the rise in developing countries. This study set out to unravel the pattern of CMD prevalence in a traditional African city, Ibadan. The study, in addition to socio-economic and demographic variables, takes into cognisance the effect of some peculiar environmental variables. The Self-Reporting Questionnaire-20 was used for CMD screening, and the questionnaire was administered to 1,200 respondents in a cross-sectional survey approach. The results showed that the overall pattern of CMD prevalence is random (Global Moran's I ($P = 0.78$, $I = 0.00$ and $Z = 0.29$)). Respondents without education reported the highest cases of CMD (48.6%). When combined together, migrants reported 52.5% of the CMDs. The significant variables are food security ($\beta = -0.198$), green space ($\beta = -0.057$), migration status ($\beta = -0.054$), flood-prone residence ($\beta = 0.453$), low-quality housing ($\beta = -0.061$), frequent recreation participation ($\beta = -0.071$), experience of spousal violence ($\beta = 0.199$), positive self-rated health ($\beta = -0.134$) and positive quality of life ($\beta = -0.205$). The predictors of CMD explained about 35.8% of the variation (R^2) and an R value of 59.9%. The study showed that CMDs occur among most of the urban population. Adequate media sensitization will have significant ameliorating effects on urban residents.

Key Words   Urban; self-rated; mental disorders; predictors.

INTRODUCTION

Common mental disorders (CMDs), also called minor or non-psychotic psychiatric morbidity, present as anxiety and depression and are frequently reported in the general population (Kuruvilla & Jacob, 2007). The expression "common mental disorders" was created by Goldberg and Huxley in 1992 due to the high frequency in the community, thereby creating a public health challenge.

The concept of "health" comprises not only the physical component but also the social and mental components according to the World Health Organization's (WHO) definition of health. However, the Nigerian medical geography literature is well concentrated with studies based on the physical component of health; examples include measles, malaria, pneumonia, tetanus, dysentery, tuberculosis, to mention a few, but the geographic studies of CMD are very scanty. CMDs are classified according to the International Classification

of Disease (ICD-10) as neurotic, stress-related somatoform disorders and mood disorders (Patel & Kleinman, 2003).

City residents are predisposed to mental health risk (Gruebner et al., 2017), and urbanization is one of the predisposing risk factors of mental health problems in Nigeria, with a prevalence rate up to 20–30% (Suleiman, 2016). In low-income countries, depression, which is a type of CMDs, has become almost as prevalent as malaria, with 3.2% as against 4% of the disease burden, and this has been projected to increase to approximately 5% in 2030 (Mathers & Loncar, 2006).

Despite the burden of CMDs, it has not been extensively researched in developing countries. Approximately 90% of all mental health problems can be classified as CMDs (Blue et al., 1996; Goldberg & Huxley, 1992). In Nigeria, it is estimated that between 20% and 30% of the population experience mental health disorders (MHLAP, 2012; Onyemelukwe, 2016; Suleiman, 2016; WHO, 2006). This study in its exact context

becomes very necessary as the health of urban residents is gaining increasing attention in the literature without a corresponding attention in the Nigerian context. The living and working conditions in most cities often have adverse effects on residents' health. Thus, this present study examined the spatial pattern of CMDs with a view to describing the distribution and identifying the significant correlates like socio-economic, demographic, lifestyle or behavioural and environmental factors.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

In the city of Ouagadougou, Burkina Faso, Duthé et al. (2016) conducted a study in the urban area. The prevalence of major depressive disorder was 4.3%; the study observed that the disorder is highly prevalent among urban residents in Burkina Faso and the case is likely the same in other urban centres in sub-Saharan Africa. This study did not take into cognisance the rural areas and the need to understand the prevalence of other types of mental health problems apart from depression. The study by Zhang et al. (2019) found that stigmatizing attitudes towards mental illness are highly prevalent in central Mozambique. The results showed that males; urban residents; divorced or widowed individuals; respondents aged between 18 and 24 years and individuals with low literacy levels, with no religion and in lower socio-economic strata have high levels of stigmatizing attitudes towards mental illness. This study, however, failed to consider the various types of mental illness and if stigma applies to all categories of mental health problems.

The spatial distribution of depression was examined in South Africa by Cuadros et al. (2019); the study identified a spatial structuring of depression at a national scale and clearly mapped out the geographical hotspots of concentration of individuals with depressive symptoms. The study did not consider the political ecology of diseases which is applicable to most African countries. The study also did not explore the advantages inherent in small-area studies, as they often provide deeper insights into the patterns of disease prevalence. According to Patel and Kleinman (2003), earlier studies found strong associations between correlates of poverty and mental disorders, with low levels of education being the most consistent. Other predictors are income levels, insecurity, hopelessness, social change, violence and physical ill-health. Of all the explanatory models of CMDs, poverty and socio-economic disadvantage have been the most cited and the most important.

The study by Charlson et al. (2014) showcased the need to increase the mental health workforce in sub-Saharan Africa by 2050 and up to about 45 million YLDs (years lived with disability). The study identified the huge gap in the mental healthcare workforce in African countries and calls for huge investment in mental healthcare. There is need for a periodic review of the mental health workforce across various countries and to also unravel the patterns of migration of mental health workers across sub-Saharan African countries.

Gruebner et al. (2012) observed that mental health problems are a serious issue in developing countries and have not been adequately addressed in the rapidly urbanizing megacities. The study found that mental well-being was significantly associated with factors such as the natural environment, flood risk, sanitation, housing quality, sufficiency and durability. Thus, it was concluded that the factors determining mental well-being were related to the socio-physical environment and individual-level characteristics. The findings of this study are in agreement with those by Melis et al. (2015).

In the study by Weich et al. (2003), a multi-level approach was used to determine CMD prevalence. Adults aged 16–74 years living in private households within the 642 electoral wards in England, Wales and Scotland were recruited into the study. The findings showed that individual-level risk factors explained 19.8% of the prevalence. Similarly, Delaney et al. (2007) used an Irish population to examine the distribution and determinants of mental well-being. The findings showed that the distribution of well-being is mostly explained by education and social capital variables. Generally, the review of extant studies showed a major gap in the studies of pattern and predictors or correlates as well as methods of screening CMDs in the context of the sub-Saharan cities. Largely, more studies are conducted in the Global North than in the South, thus implying that there is need to understand the pattern of mental health problems in the developing countries.

The human ecology of disease model (Figure S1) guided the study. Here, ecology refers to the interactions that exist among the living organisms within the environment. The interaction and relationship between human beings (as living organisms) and the surrounding ecosystem is the major concern here especially as it relates to mental health outcomes. This model has three vertices, namely the habitat, population and behaviour, all of which determine the state of human health (mental health inclusive). Habitat refers to where people live (environment). The habitat is made up of three sub-sections or types (the social, built and natural habitat). Built habitat refers to the man-made parts of the environment, e.g., road network, buildings, transport amenities, etc. The natural habitat refers to the nature-made components of the environment such as climate, air and landscape forms. Green areas like gardens and parks have been established to positively influence mental health. The social habitat refers to how the society is organized in terms of relationship between people, among groups or entire communities/neighbourhood and the society at large. The availability of trusted persons and membership of social groups can either affect mental health tremendously. Population is made up of genes, age and gender, refers to human beings as biological organisms who are the potential hosts for diseases, in this case mental ill-health. The extent to which a population can cope with different types of stressors depends on a lot of factors like genetic make-up, nutritional status, immunity level, immediate physiological status and biological components (Meade & Earickson, 2000). Also, certain disorders like substance-abuse disorders are related to young people than other cohorts of the population. Women of different ages are affected by premenstrual disorder, pre-natal and post-partum depression and depression at menopause. Behaviour represents the most observable aspect of human culture. It includes mobility, practices in various cultures and technological interventions. Behaviours like alcohol consumption/substance use, recreation, domestic violence, exercise or physical activity can also be linked to mental

health and consequences of disease production. The disease triangle seeks to explain human health as a function of three variables, namely population, habitat and behaviour.

The three variables of the disease triangle can be jointly applied in different forms to explain the state of health at any point in time (Meade & Earickson, 2000). This model is useful in understanding the pattern of interaction between human beings and social and physical environments. The subject is more interesting especially when developing countries with high inequality, many people living under abject poverty, deteriorating living environmental conditions and high levels of infrastructure decay are considered. Prevalence of CMDs can also be explained by considering the relationships between these variables as mental health can vary widely in different dimensions due to the habitat, population of interest and behaviour. The relevance of this concept is to identify and provide explanations on the different social, demographic, behavioural/lifestyle and environmental factors and how these can impact the mental health outcome of different categories of individuals.

METHODOLOGY

Description of the Study Area

This study was carried out in the ancient metropolitan area of Ibadan (Figure S2) which lies between latitudes 7° 15' and 7° 30' north of the equator and longitudes 3° 45' and 4° 00' east of the Greenwich meridian. Ibadan, which is acclaimed to be the largest metropolis in sub-Saharan Africa, has expanded significantly to include adjacent towns and villages. Based on the percentage of the urban area covered, five local government areas (LGAs) that constitute the Ibadan city covering an area of 128 km² were selected and are as follows: Ibadan North, Ibadan North-east, Ibadan North-west, Ibadan South-east and Ibadan South-west. A total of 104 localities were selected from the 5 LGAs using the state valuation map. The study adopted the classification of residential localities in the city of Ibadan, which was classified mainly into three areas based on residential density, namely high-, medium- and low-density areas (Ayeni, 1982). The localities selected for this study cut across the three types earlier identified, and the localities and their residential density characteristics are further provided in the Results and Discussion section.

The Source of Research Data

Primary data were collected using a cross-sectional survey approach. The research design for the study is the survey method which entails a one-time collection of information from samples of population elements, in this case household. Questionnaire was administered to individuals in the households selected for the survey to collect data on the socio-economic and demographic characteristics of the respondents, lifestyle of respondents, environmental characteristics, quality of life (WHO-5) and symptoms of CMDs (Self-Reporting Questionnaire-20 (SRQ-20)). The data obtained were from a one-time survey of respondents, and the entire data were collected over a period of 2 months. Health data can either be obtained by patient records or by self-reported diagnosis. Due to the nature of CMDs, which are usually under-reported and not easily detected, the self-rated approach is adopted in this study.

Data Collection and Procedures

A sample size of 1,200 respondents was selected from the study area using the Neumann's probability sampling formula. This sample size was selected at the confidence level of 95% and 3% margin of error/confidence interval. Thereafter, the 1,200 respondents were selected proportionally to the population of the communities. Ibadan is purposively selected for this study. This is because of the prevalence rate reported in the earlier studies of mental illness (21.9%) in this traditional city as carried out by Amoran et al. (2005). To collect the data for this present study, the multi-stage sample method was adopted. The first stage entails the selection of the 11 LGAs in Ibadan, followed by the selection of 104 communities within the 11 LGAs and a classification of these communities according to residential densities and a random systematic selection of households per community. The focus is on adult population above 18 years who are heads or members of households for questionnaire administration. The questionnaire was administered according to the samples selected from the projected population in each of the communities within the metropolis. The street layout of each of the locality was adopted in selecting the respondents from the households. The data were collected over a period of 2 months with the help of university students as field officers. The questionnaire was translated for the sake of those without adequate knowledge of formal English. The translation was done by the researcher with special consultation with a psychiatrist to ascertain accuracy of translations.

Data Preparation and Analysis

The study analyzed the data from the field using SPSS 2017 (version 25.0, IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Armonk, NY, USA) together with geographic information system methods that evaluate the existence of clusters in the spatial arrangement of a given variable. Here we have Global and Local Moran's statistics. To determine the pattern of CMD, the Moran's I statistic was employed. The multiple regression method was used to predict the observed values of the dependent variable using a linear function of the observed values of two or more independent variables. The study posited that CMD is determined by income, educational, age, gender, employment status, household size, alcohol consumption, recreational pattern, perception of housing satisfaction, persons per room ratio, migration status, social capital, perceived neighbourhood crime rate, household food security, domestic violence, flood-prone residence, housing quality, exposure to mobility stress, access to green space and personal health. Among the many tools that can be used for CMD screening, this study adopted the main tool which has been validated for use among general populations in developing countries, SRQ-20. The SRQ-20 has earlier been validated in Nigeria in the studies by Adebowale and James (2018), Ola et al. (2011) and Osasona and Koleoso (2015). The tool has also been used in other countries like Ethiopia, South Africa, Brazil and Mexico (Parreira et al., 2017). The Cronbach's alpha, which is an indicator of scale reliability and internal consistency for SRQ, in this study is 0.77. The respondents were classified based on the cut-off or threshold into dichotomous outcomes "case" (7 and above) and "non-case" (below 7). The reported CMD cases were treated as continuous outcome. The total number of CMD

cases for the locations was aggregated to explain the spatial distribution.

Ethical Consideration

The study obtained ethical clearance from the Social Sciences and Humanities Ethics Review Committee of the University of Ibadan with the assigned number UI/SSHEC/2017/0012. During the survey, the respondents were assured of the confidentiality of the information gathered and that the information collected would be for research purposes only and would not be shared with a third party. The data were collected with all sense of professionalism and ethical conduct. The respondents were given adequate knowledge of the purpose of the research and also informed of their right to withdraw from the study at any stage or decline providing any information considered to be discreet, which was strictly adhered to.

RESULTS AND DISCUSSION

Socio-economic Characteristics

Here is the summary of the demographic and socio-economic characteristics of the respondents, as depicted in Tables S1 and S2. The sample is predominantly male (52.3%), Yoruba (84.6%) and married (94%). Seventy-four percent of the respondents earn between ₦18,000 and ₦59,999, 38.8% of the respondents had a secondary education and 62.7% were self-employed. With respect to the environmental and behavioural characteristics of the respondents, to a large extent, most respondents reside in flats (43.6%), followed by face-me and face you (33.4); 53.1% have experienced crime cases more than once in their locality; 65.2% feel their housing infrastructure is satisfactory; 67.8% have no green space around their housing and 73.2% do not visit green spaces like park and gardens.

The Distribution of CMDs

The SRQ-20 adopted the cut-off score of 7; positive responses to seven items on the SRQ scale represent a "case" and a score below 7 is "non-case". The total number of cases reported was sorted and aggregated by 104 communities in Ibadan metropolis on a continuous scale. From the communities, a total sample of 1,200 respondents was drawn in line with residential densities in this order: low-density communities, 93; medium-density communities, 812; high-density communities, 295. The Global Moran's I statistic of ArcGIS was employed to describe the spatial distribution of CMD. Global Moran's I is a spatial statistic which provides insight into the spatial distribution of different phenomena, in this case CMD. The Global Moran's I statistic is used to probe the nature of relationships that exists between a spatial dataset. Further analyses of the spatial pattern were carried out using the Local Moran's I statistic and the hotspot analysis.

The Pattern of Overall Cases of CMDs

The overall pattern of cases of CMDs across the study area is shown in Figure S3a, b and Table S3. Here, the total number of cases reported for males and females in all the communities in Ibadan was aggregated and mapped according to communities. This is followed by a selection of classification quantities. For the overall and gender pattern, the datasets were classified into five categories with different shades of colours. The highest number of CMD cases, between 11 and 16 cases, was reported at Molete, with 16 cases; Adamasingba had 14 cases (medium-density area); Oje, a high-density residential area in the traditional core areas, had 12 cases and Oremeji had 12 cases (medium-density area). Molete is a medium-density residential area dotted with commercial land use. Other locations in the second category are locations with CMD cases in the range of 7 to 10. These are as follows: Eleyele (8 cases), Ijokodo (9 cases), Oniyanrin (8 cases), Odo Ona (7 cases), Yemetu (9 cases), Ring Road (7 cases), Liberty (7 cases), Odinjo (10 cases), Aperin (9 cases), Oja'ba (9 cases), Eleta (9 cases), Aremo (8 cases), Inalende (10 cases) and Mokola (8 cases).

The third category where most localities fall is locations with about three to six cases of CMDs. These include Apata (6), Alesinloye (3), Okebola (3), Agugu (4), Adekile (4), Abayomi (4), Oluyoro (5), Ashi (5), New Bodija (3), Old Bodija (3), Samonda (6), Sango (5), UI (4), Ojoo by Orogun (4), Agbowo-Orogun Express (5), Olopomewa (5), UCH (3), Adeoyo State Hospital (3), Anfani Layout (3), Odo Oba (4), Academy (6), Oniyere (5), Elekuro (4), UMC (3), Ilupeju (4) and Yambule (4).

The last category is for locations with reported CMD cases of two and below. Most of the low-density residential communities like Moor Plantations, Imalefalafia (2), IAR&T (0), Ago Taylor (0), D-Rovans (0), Alalubosa (2), Idi Ishin (1), NIHORT qtrs (0), Askar Paints (1), Coca-Cola (1), Secretariat (0), Lieutmack Barrack (2), Onireke GRA (2), Iyaganku (2), Osungbade (0), Felele (2), Polytechnic-Emmanuel College (2), Sanyo (1), Holy Trinity (0), Links Reservation (1), Agodi GRA (2), Ikolaba (2), Basorun (2) and Oluwo Nla (2), apart from those listed above, fall into this category.

Most parts of Ibadan are also occupied by mostly migrants who are either Yoruba non-indigenes or people from different parts of the country. Studies have proven that migrants are vulnerable to diseases and mental health problems (Naieni et al., 2018). The results of the Global Moran's I analysis showed that from the datasets, cases of CMD and non-cases of CMD had a random pattern. The above findings are largely in conformity with those of the studies by Tizón et al. (2009) conducted in Barcelona, which found a significantly higher prevalence in the lower socio-economic status (SES) area, and Termorshuizen et al. (2014), who also observed an influence of ethnic density on non-affective psychotic disorder (NAPD) prevalence. The main findings of the analyses of Pignon et al. (2016) in urban France showed that the distribution of cases of NAPDs was associated with economic deprivation. Figure S3a depicts the summary of the results of the Global Moran's I statistic ($P = 0.779$, $I = 0.003$ and $Z = 0.294$). The pattern of CMD is a random pattern. The graphical illustration of the results is as shown below.

The Pattern of Female Prevalence of CMDs

Figure S3b depicts the pattern of CMDs among females in Ibadan metropolis. Here, the gender of the respondents was cross-tabulated along with the cases of CMDs reported in the communities. The scale of classification here is reduced into two categories, with the highest cases of CMD between six and nine cases. The communities include Ring Road, Molete, Inalende, Gbagi, Adamasingba, Yemetu and Oje; of particular concern is Yemetu and Oje, which are communities

in the inner core and occupied by largely indigenous people and mostly of low SES. This tells about the association of CMD with SES. Also, traffic noise, pollution and crowding can be presumed as likely factors responsible for Ring Road and Molete.

Communities with four to five reported cases of CMD include Eleyele, Olopowema, Ijokodo, Oremeji, Sango, Samonda, Aperin, Agugu, Oniyere, Elewura, Liberty, and Odinjo. Two to three CMD cases were reported at Apata, Odo Ona, Adeoyo State Hospital, Anfani Layout, Ilupeju, Kudeti, UMC, Imalefalafia, Idi Arere, Agbokojo, Onireke GRA, Mokola, Old Bodija, New Bodija, Ashi, Ojoo by Oro-gun, Basorun, Oluyoro, Aremo, Adekile, Eleta and Ilupeju. The last category is communities with CMD cases of one and below. Largely, most other communities which do not fall into any of the above two categories fall here; also a greater proportion of the communities in Ibadan fall here, namely UI, Polytechnic-Emmanuel College, Agbowo-Orogun Express, Oluwo Nla, Yambule, Mokola, Secretariat, Ikolaba, Abayomi, UCH, Lieutmack Barracks, Links Reservation, Askar Paints, NIHORT Qtrs, Jericho GRA, Idi Ishin, Aleshinloye, Alalubosa, Moor Plantations, IAR&T, Ago Taylor, Iyaganku, Oke-Ado, Felele, Osungbade, Sanyo, Academy, Ile tuntun, Academy, Elekuro, Oke Are, Bode and Oke Oluokun.

Figure S3c depicts the summary of the results of the Global Moran's I statistic ($P = 0.481$, $I = 0.021$ and $Z = 0.481$); the pattern of CMD is a random pattern. Also, Figure S3d depicts the cases of CMDs among the females.

The Pattern of Male Prevalence of CMDs

Figure S3e depicts the pattern of CMD among males. Oremeji and Molete stand out with seven to eight CMD cases. Next are locations with reported cases between four and six, namely Elewura, Odo Ona, Eleyele, Ijokodo, Academy, Odinjo, Oje, Aremo, Aperin, Kobomoje, Oja Oba, Oniyanrin, Inalende and Adamasingba. The following locations reported two to three cases of CMD: Alesinloye, Eleyele, Apata, Liberty, Ososami, Felele, Odo Oba, Elekuro, Oluyoro, Abayomi, Ikolaba, UCH, Yemetu, Okebola, Foko, Yambule, Ashi, UI, Agbowo-Orogun Express and Adekile. Most of the other locations had barely one case of CMD. This result further stresses the fact that CMDs are more common among the low-income or socio-economic class of the population.

Figure S3e depicts the summary of the results of the Global Moran's I statistic ($P = 0.79$, $I = −0.02$ and $Z = −0.27$); the pattern of CMD is a random pattern. Figure S3f shows the prevalence of CMDs across the communities.

From the foregoing results, it can be found that the spatial pattern, male, female and overall, is random. The study attempted to examine if no form of clustering exists in the study area. The hotspot analysis and the Local Moran's I statistic were carried out. Figure S4a depicts the results of the Local Moran's I statistic; generally, the pattern of CMD is not significant in most communities except for the high-high cluster observed in Mokola, Adamasingba, Inalende and Oniyanrin. Both Mokola and Adamasingba lie along the modern CBD (Dugbe). Land use is intense there, and the competition for space often leaves migrants in this location, where they can be close to work and business locations. Inalende and Oniyanrin also share the same characteristics – proximity to traditional core areas like Yemetu, Oje and the

like. This finding conforms to the fact that cases of CMD can be found around the city centres. Molete is the only community with high-low clusters of CMD. Figure S4b depicts the results of the hotspot analysis. The CMD pattern in most of the communities is not significant. The hotspot locations at the 99% confidence level are Mokola and Oniyanrin, lying very close to both the modern and traditional CBDs. At the 90% confidence interval, Ososami also featured as a hotspot location in Ibadan metropolis. Only Ago Taylor and Oke Bola featured as cold spots of CMD (95% confidence interval).

Figure S4c–f shows the results of the Local Moran's I statistic and the hotspot analysis for the females. Three high-high clusters were noticed; these are Ijokodo, Adamasingba and Inalende. Ring Road and Molete were also seen as the high-low outlier. The pockets of concentration are all scattered around the metropolis. Largely, the pattern of CMD is not significant in most communities. The result of the hotspot analysis is also related to that of the Local Moran's I statistic. Oniyanrin is the only hotspot location identified at the 99% confidence interval. Ijokodo, Mokola and Inalende are also significant hotspots at 95% confidence intervals. Ososami is also a significant hotspot at the 90% confidence interval. Ago Taylor is the only cold spot at the 99% confidence interval. Odo Ona, Idi Ishin and Alalubosa are significant cold spots at the 90% confidence interval. The results of the Local Moran's I statistic for the males showed that Mokola and Oniyanrin are also a high-high cluster of CMD, while Oremeji and Odo Ona are high-low outliers. Only Mokola is a hotspot community going by the hotspot analysis. Elekuro, Aperin and Labiran are all significant hotspots at 90% confidence intervals. Oke Bola is the only cold spot at the 90% confidence interval.

It can thus be asserted that non-psychotic disorders or CMDs are randomly distributed in most populations. The results of the study by Pignon et al. (2016), however, showed a non-random distribution of psychotic disorders in an urban area in France. In the study by Dean and James (1984), the results showed random distribution of people with manic depression. Generally, the literature has established that high concentration of cases of CMDs can be correlated with socio-economic disadvantage, and by implication, individuals with lower SES have higher frequencies of CMDs. Mental healthcare resources can thus be recommended to be randomly distributed over space. In line with the models of urban spatial structures, the inner cities or core areas often present frequent cases of ill-health and in this case CMD (Phillimore, 1993).

Analysis of Correlates of CMDs

Multiple regression analysis revealed that out of the 18 variables considered in the model, only 9 significantly contributed to CMD. The significant variables include food security ($\beta = −0.198$), green space ($\beta = −0.057$), migration status ($\beta = −0.054$), flood-prone residence ($\beta = 0.453$), low-quality housing ($\beta = −0.061$), recreation participation ($\beta = −0.071$), spousal violence ($\beta = 0.199$), self-rated health (SRH) ($\beta = −0.134$) and quality of life ($\beta = −0.205$). Table S3 reveals that the contribution of the independent variables to CMD explains about 35.8% of the variation (R^2) and an R value of 59.9%.

Considering the significant variables in the light of the literature, the following review is presented. In most developing countries, food insecurity has been proven to be strongly

related to CMDs (Weaver & Hadley, 2009). Jebena et al. (2016) examined the effect of food insecurity on mental health and how this can be related with CMDs. The present study found negative and significant relationship between food security and CMD, suggesting that households that are food insecure are more prone to CMDs ($\beta = -0.198$). Epidemiological studies noted that food insecurity can trigger CMD onset directly. There is, thus, the need for the government to address food provision as this is a major predictor of metal health outcome.

Also, housing is a major problem in most Nigerian cities with issues such as low-quality housing, overcrowding, slum residence, to mention a few at the forefront. The study showed that there is relationship between low-quality housing and CMD ($\beta = -0.061$). Furthermore, the descriptive statistics showed that only 1.3% of respondents who live in high-quality housing reported CMDs. A study observed that there are connections between housing and the mental health of residents. Crowding has detrimental effects on human health in all dimensions of health (Aliyu & Amadu, 2017; Evans et al., 2001). Also, Bankole and Oke (2016) found that overcrowding affects psychological well-being and increases the anxiety level of residents. This study buttresses the fact that a major relationship exists between housing quality and mental health outcome. There is need for the government to target provision of satisfactory housing, and the identified areas of low-quality housing should also be the focus of health intervention.

Ahern et al. (2005) observed that there is need for more studies on how flooding can lead to CMDs like anxiety, depression, post-traumatic stress disorder and suicide in low-income countries as only few studies exist pertaining to these countries. This study found a positive significant relationship between flood-prone residence ($\beta = 0.453$) and CMDs, meaning that individuals who reside in areas liable to flooding have higher tendencies of reporting CMDs (Alderman et al., 2012; Eguaroje et al., 2015; Fernandez et al., 2015; Stanke et al., 2012). The residents of flood-prone areas of Ibadan are mainly found along areas around floodplains like areas liable to floods, especially Ogunpa, Orogun, Sapati, Mokola hills, to mention a few (Makinde, 2012). There is need to address the residents of areas liable to flooding and also rehabilitate (through counselling) those affected by flooding.

Furthermore, the negative relationship between recreational participation and CMD is an indication that the higher the time spent on recreational activities ($\beta = -0.071$), the lower the likelihood of CMD onset. Also, 80% of individuals who do not participate in recreation reported CMDs. Similar to the study by Harvey et al. (2010) in Norway, regular leisure time activity of any intensity can reduce the likelihood of developing depressive symptoms. There is a need for deliberate public policies to drive in recreational activities in cities. There are very few recreational sites in Ibadan, which includes Agodi Park and Gardens and the Zoological Garden, UI. Largely, there is a restorative role that recreation plays on health. Urban residents are encouraged to be more involved in recreational activities as these have the capacity to reduce mental health problems.

All over the world, domestic violence is a significant threat to public health. The significant effect ($\beta = 0.199$) of spousal violence and CMD is an indication that experience of spousal violence can trigger CMDs. About 95.8% of respondents who responded no to the question "Do you fight with your husband/wife and get physical injury?" did not report CMDs. Globally, and in Nigeria, violence against women is largely under-reported. The prevalence of domestic violence in Nigeria was put at between 11% and 79% (Aimakhu et al., 2004; Fawole et al., 2005; Onoh et al., 2013). For domestic violence, personal experience of domestic violence is more likely to develop CMDs. As shown by Ola et al. (2011), experience of physical violence was the strongest predictor of antenatal mental disorder case anddomestic violence triggers other mental health issues like depressive symptoms, anxiety and so on. Married people should avoid spousal violence as this has been shown in previous studies, and this particular one was found to be capable of leading to the onset of CMDs and related problems.

The study found a significant relationship ($\beta = -0.134$, $p = 0.000$) between SRH and CMD, indicating that people with a high self-rated score are less prone to CMD. It is also referred to as self-assessed/perceived health. SRH is strongly correlated with diseases, illnesses and disability (Goldberg & Huxley, 1992; Kaplan et al., 1996). There is a relationship between SRH and CMDs. The need to ensure that individuals are well holistically cannot be overemphasized. The focus of healthcare should not only be to cure a particular disease or infection but should address all facets of health: social, physical and mental. Quality of life (measured by WHO-5) was found to be positively significant to CMD ($\beta = -0.205$). Individuals with high quality of life are less prone to CMDs. The result is similar to that of the study by Amoran et al. (2005) in Oyo state. The study called for provision of essential services for the populace as this can be of great impact in improving quality of life and thereby bringing down the rates of psychiatric morbidity in individuals.

The quest for opportunities remains a major driver of migration stream between localities, states and regions (Ikwuyatum, 2016). The process of migration itself entails a lot of risks, stress, threats, discomfort and fear at most times. Migrants are vulnerable to CMDs owing to uncertainties in the process of movement from the source to destination. Migration status ($\beta = -0.054$) was significantly related. Mental disorders in migrants caused by stress, prolonged separation from family, financial strain, lack of accommodation and hostility are one of the major problems faced by them (Naieni et al., 2018). Also, 50.3% of the rural-urban migrants reported CMDs. In Ibadan, residents of inner city areas are descendants of migrants who are residents in the central areas because of jobs and business opportunities but poor housing. Makinde (2012) observed that certain areas of Ibadan like Molete, Oke-Ado, Mokola, Eleyele, Agbowo and other recently developed localities are often occupied by people from other Yoruba towns and ethnic groups. The vulnerability of migrants to mental health problems has been established by this study. There is a fundamental need to support the urban migrants and help them settle down.

Studies across the globe have proven that green space areas have mental health benefit for individuals. In fact, exercise and other related physical activities done in green spaces can lead to decreased cases of anxiety and depression. This study found a negative and significant relationship between CMDs and green spaces ($\beta = -0.057$). This implies that the more an individual accesses green spaces, the lesser

the likelihood of CMD onset. Respondents were asked the question "Do you have green spaces (garden, parks, trees) around your house?", and 71.8% of those who responded "No" reported CMD cases. Similarly, 76.2% of those who responded "No" to the question "Do you visit green space (garden/parks)?" reported cases of CMD. In fact, between walking in nature and walking in a shopping centre, walking in nature has been proven to be significantly beneficial to health, with reduced risk of depressive symptoms (Barton et al., 2009). The research of Kjellgren and Buhrkall (2010) further demonstrated that natural environments produce greater altered state of consciousness than other types of environments. The rehabilitative and restorative effects of green spaces have been established. There is need to further plan and maintain the green spaces in urban areas and encourage positive attitudinal change to their use in most developing countries.

CONCLUSIONS

The disease triangle presents a ready framework in understanding the explanations for cases or non-cases of CMD. It sees disease production or health outcome as a consequence of human interaction with the environment. The concept provides explanations for the variation in space of human disease and health using three dimensions: habitat (environment), population and culture/behaviour. The likelihood of people's predisposition towards mental disorders consists of different factors like genetics, demographic factors, socio-economic factors, traumatic events, lifestyle and the environment (built, natural and social), which serve as a background factor that can trigger, reduce or amplify the risk of suffering from a mental disorder. The governments of developing countries need to ensure and enhance food security among the populace. There is need to maintain, cultivate and plan green spaces while individuals are encouraged to visit green spaces. Strong legislation has to be put in place to discourage individuals from residing in flood-prone areas, while those already in such settlements should be resettled. Recreation improves mental health, and participation is encouraged for urban residents as it is a buffer against the vagaries of the harsh urban environment. The study identified some limitations, e.g., a few of the variables found to be insignificant in the multiple regression model might be largely due to issues of measurement and calibration. Also, the study did not adopt secondary data (notwithstanding its limitation); this might have some sort of impact on the results as it could have provided more robust data for analyses. Finally, the human ecology of disease model speaks of the combined effect of population characteristics, habitat and behaviour as the major determining factor of the health. These factors are also found to be relevant to explaining the prevalence of CMD as a combination of socio-economic, demographic, behavioural and environmental factors are found to be the correlates of CMD.

CONFLICT OF INTEREST DISCLOSURES
The authors have no conflicts of interest to declare.

AUTHOR AFFILIATION
*Department of Geography, University of Ibadan, Ibadan, Nigeria.

SUPPLEMENTAL MATERIAL
Supplemental material linked to the online version of the paper at journalcswb.ca/index.php/cswb/article/view/308/supp_material
- Figure S1: The Human Ecology of Disease Triangle
- Table S1: Socio-economic/Demographic Characteristics
- Table S2: Spatial autocorrelation (Global Moran's I) of Common Mental Disorder Cases in Ibadan Metropolis
- Figure S2: The Study Area
- Figure S3a: Global Moran's I of Overall Cases of Common Mental Disorders in Ibadan Metropolis
- Figure S3b: Cases of Common Mental Disorders in Ibadan Metropolis
- Figure S3c: Global Moran's I of Female Cases of Common Mental Disorders in Ibadan Metropolis
- Figure S3d: Females Cases of Common Mental Disorders in Ibadan Metropolis
- Figure S3e: Global Moran's I of Male Cases of Common Mental Disorders in Ibadan Metropolis
- Figure S3f: Males Cases of Common Mental Disorders in Ibadan Metropolis
- Figure S4a: Local Moran's I Analysis of Overall Cases of CMD
- Figure S4b: Hotspot Analysis of Overall Cases of CMD
- Figure S4c: Local Moran's I Analysis of Female CMD Cases
- Figure S4d: Hotspot Analysis of Female CMD Cases
- Figure S4e: Local Moran's I Analysis of Male CMD Cases
- Figure S4f: Hotspot Analysis of Male CMD Cases
- Table S3: Variables of Multiple Regression Analysis

REFERENCES

Adebowale, O. O., & James, B. O. (2018). Psychoactive substance use and psychiatric morbidity among pregnant women attending an ante-natal clinic in Benin City, Nigeria. *Nigerian Postgraduate Medical Journal, 25*(1), 8–12. https://doi.org/10.4103/npmj.npmj_189_17

Ahern, M., Kovats, R. S., Wilkinson, P., Few, R., & Matthies, F. (2005). Global health impacts of floods: Epidemiologic evidence. *Epidemiologic Reviews, 27*, 36–46. https://doi.org/10.1093/epirev/mxi004

Aimakhu, C. O., Olayemi, O., Iwe, C. A. B., Oluyemi, F. A., Ojoko, I. E., Shoretire, K. A., Adeniji, R. A., & Aimakhu, V. E. (2004). Current causes and management of violence against women in Nigeria. *Journal of Obstetrics and Gynaecology, 21*, 58–63. https://doi.org/10.1080/01443610310001620314

Alderman, K., Turner, L. R., & Tong, S. (2012). Floods and human health: A systematic review. *Environment International, 47*, 37–47. https://doi.org/10.1016/j.envint.2012.06.003

Aliyu, A. A., & Amadu, L. (2017). Urbanization, cities and health: The challenges to Nigeria – A review. *Annals of African Medicine, 16*(4), 149–158. https://doi.org/10.4103/aam.aam_1_17

Amoran, O. E., Lawoyin, T. O., & Oni, O. O. (2005). Risk factors associated with mental illness in Oyo State, Nigeria: A community based study. *Annals of General Psychiatry, 4*, 19. https://doi.org/10.1186/1744-859X-4-19

Ayeni, B. (1982). Map of land-use patterns in Ibadan. In M. O. Filani, F. O. Akintola & C. O. Ikporukpo (Eds.), *Unpublished cited in Abumere S. I. (1994) Residential differentiation in Ibadan: Some sketches of an explanation* (pp. 72–84). Ibadan Region Rex Charles Publication Ibadan.

Bankole, E. T., & Oke, O. M. (2016). Effects of housing quality and overcrowding on psychological wellbeing of residents in Lagos State, Nigeria. *IOSR Journal of Humanities and Social Science, 21*(11), 14–22.

Barton, J., Hine, R., & Pretty, J. (2009). The health benefits of walking in greenspaces of high natural and heritage value. *Journal of Integrative Environmental Sciences, 6*(4), 261–278. https://doi.org/10.1080/19438150903378425

Blue, I., Ducci, M., Jaswal, J., Ludermir, A., & Harpham, T. (1996). The mental health of low-income urban women: Case studies from Bombay, India; Olinda, Brazil; and Santiago, Chile. In T. Harpham & I. Blue (Eds.), *Urbanization and mental health in developing countries* (pp. 75–102). Brookfield, VT: Ashgate.

Charlson, F. J., Diminic, S., Lund, C., Degenhardt, L., & Whiteford, H. A. (2014). Mental and substance use disorders in Sub-Saharan Africa: Predictions of epidemiological changes and mental health workforce requirements for the next 40 years. *PLoS One, 9*(10), e110208. https://doi.org/10.1371/journal.pone.0110208

Cuadros, D. F., Tomita, A., Vandormael, A., Slotow, R., Burns, J. K., & Tanser, F. (2019). Spatial structure of depression in South Africa: A longitudinal panel survey of a nationally representative sample of households. *Science Report, 9*, 979. https://doi.org/10.1038/s41598-018-37791-1

Dean, K. G., & James, H. D. (1984). Depression and schizophrenia in an English city. In H. L. Freeman (Ed.), *Mental health and the environment.* Churchill Livingstone: Edinburgh.

Delaney, L., Doyle, O., McKenzie, K., & Wall, P. G. (2007). *The distribution of well-being in Ireland. UCD Geary Institute Discussion Paper Series.* Dublin: University College Dublin, Geary Institute. https://www.academia.edu/1100131/The_Distribution_of_Well_Being_in_Ireland

Duthé, G., Rossier, C., Bonnet, D., Soura, A. B., & Corker, J. (2016). Mental health and urban living in sub-Saharan Africa: Major depressive episodes among the urban poor in Ouagadougou, Burkina Faso. *Population Health Metrics, 14*, 18. https://doi.org/10.1186/s12963-016-0084-2

Eguaroje, O. E., Alaga, T. A., Ogbole, J. O., Omolere, S., Alwadood, J., Kolawole, I. S., Muibi, K. H., Nnaemeka, D., Popoola, D. S., Samson, S. A., Adewoyin, J. E., Jesuleye, I., Badru, R. A., Atijosan, A., & Ajileye, O. O. (2015). Flood vulnerability assessment of Ibadan City, Oyo State, Nigeria. *World Environment, 5*, 149–159. http://article.sapub.org/10.5923.j.env.20150504.03.html

Evans, J., Heron, J., Francomb, H., Oke, S., & Golding, J. (2001). Cohort study of depressed mood during pregnancy and after childbirth. *BMJ (Clinical research ed.), 323*(7307), 257–260. https://doi.org/10.1136/bmj.323.7307.257

Fawole, O. I., Aderonmu, A. L., & Fawole, A. O. (2005). Intimate partner abuse: Wife beating among civil servants in Ibadan, Nigeria. *African Journal of Reproductive Health, 9*, 54–64. https://doi.org/10.2307/3583462

Fernandez, A., Black, J., Jones, M., Wilson, L., Salvador-Carulla, L., Astell-Burt, T., & Black, D. (2015). Flooding and mental health: A systematic mapping review. *PLoS One, 10*(4), e0119929. https://doi.org/10.1371/journal.pone.0119929

Goldberg, D., & Huxley, P. (1992). *Common mental disorders: A bio-social model.* Oxfordshire: Routledge.

Gruebner, O., Khan, M. H., Lautenbach, S., Muller, D., Kramer, A., Lakes, T., & Hostert, P. (2012). Mental health in the slums of Dhaka – A geoepidemiological study. *BMC Public Health, 12*, 177. https://doi.org/10.1186/1471-2458-12-177

Gruebner, O., Rapp, M. A., Adli, M., Kluge, U., Galea, S., & Heinz, A. (2017). Cities and mental health. *Deutsches Ärzteblatt International, 114*(8), 121–127. https://doi.org/10.3238/arztebl.2017.0121

Harvey, S. B., Hotopf, M., Overland, S., & Mykletun, A. (2010). Physical activity and common mental disorders. *The British Journal of Psychiatry, 197*, 357–364. https://doi.org/10.1192/bjp.bp.109.075176

Ikwuyatum, G. O. (2016). Migration and urbanization: Exploring the factors of the Nexus in Nigeria. *International Journal of Humanities and Social Science, 6*(8), 161–175.

Jebena, M. G., Lindstrom, D., Lema, T. B., Hadley, C., Lachat, C., Verstraeten, R., De Cock, N., & Kolsteren, P. (2016). Food insecurity and common mental disorders among Ethiopian youth: Structural equation modelling. *PLoS One, 11*(11), e0165931. https://doi.org/10.1371/journal.pone.0165931

Kaplan, G. A., Pamuk, E. R., Lynch, J. W., Cohen, R. D., & Balfour, J. L. (1996). Inequality in income and mortality in the United States: Analysis of mortality and potential pathways. *BMJ (Clinical research ed.), 312*(7037), 999–1003. https://doi.org/10.1136/bmj.312.7037.999. Erratum in: *BMJ* 1996;312(7041):1253.

Kjellgren, A., & Buhrkall, H. (2010). A comparison of the restorative effect of a natural environment with that of a simulated natural environment. *Journal of Environmental Psychology, 30*, 464–472. https://doi.org/10.1016/j.jenvp.2010.01.011

Kuruvilla, A., & Jacob, K. S. (2007). Poverty, social stress & mental health. *Indian Journal of Medical Research, 126*, 273–278.

Makinde, O. O. (2012). Housing: Central City Slums, a case study of Ibadan. *Journal of Environment and Earth Science, 2*(9), 21–31.

Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine, 3*(11), e442.

Meade, M. S. & Earickson, R. J. (2000). *Medical geography.* New York: Guilford Press.

Melis, G., Gelormino, E., Marra, G., Ferracin, E., & Costa, G. (2015). The effects of the urban built environment on mental health: A cohort study in a Large Northern Italian City. *International Journal of Environmental Research and Public Health, 12*(11), 14898–14915. https://doi.org/10.3390/ijerph121114898

Mental Health Leadership and Advocacy Programme – MHLAP. (2012). *Mental health situation analysis in Nigeria.* Ibadan: College of Medicine, University of Ibadan.

Naieni, K. H., Faghihi, M. M., Barati, H., Salehiniya, H., & Khani, Y. (2018). An evaluation of migrants' mental health status and affecting factors in Bastam. *Biomedical Research, 29*(7), 1366–1369.

Ola, B., Crabb, J., Tayo, A., Ware, S. H. G., Dhar, A., & Krishnadas, R. (2011). Factors associated with antenatal mental disorder in West Africa: A cross-sectional survey. *BMC Pregnancy and Childbirth, 11*, 90. https://doi.org/10.1186/1471-2393-11-90

Onoh, R. C., Umeora, O. U. J., Ezeonu, P. O., Onyebuchi, A. K., Lawani, O. L., & Agwu, U. M. (2013). Prevalence, pattern and consequences of intimate partner violence during pregnancy at Abakaliki Southeast Nigeria. *Annals of Medical and Health Science Research, 3*(4), 484–491. https://doi.org/10.4103/2141-9248.122048

Onyemelukwe, C. (2016). Stigma and mental health in Nigeria: Some suggestions for law reform. *Journal of Law Policy and Globalization, 55*, 63–68.

Osasona, S. O., & Koleoso, O. N. (2015). Prevalence and correlates of depression and anxiety disorder in a sample of inmates in a Nigerian prison. *The International Journal of Psychiatry in Medicine, 50*(2), 203–218. https://doi.org/10.1177/0091217415605038

Patel, V., & Kleinman, A. (2003). Poverty and common mental disorders in developing countries. *Bulletin of the World Health Organization, 81*(8), 609–615.

Parreira, B. D. M., Goulart, B. F., Haas, J., da Silva, S. R., Santos Monteiro, J. C. D., & Gomes-Sponholz, F. A. (2017). Common mental disorders and associated factors: A study of women from a rural area. *Revista da Escola de Enfermagem, da Universidade de Sao Paulo, 51*, 1–8. https://doi.org/10.1590/S1980-220X2016033103225

Phillimore, P. (1993). How do places shape health? In S. Platt (Ed.), *Rethinking locality and lifestyle in North-east England Locating Health: Sociological and Historical Implications.* Aldershot: Avebury.

Pignon, B., Schurhoff, F., Baudin, G., Ferchiou, A., Richard, J., Saba, G., Leboyer, M., Kirkbride, J. B., & Szöke, A. (2016). Spatial distribution of psychotic disorders in an urban area of France: An ecological study. *Scientific Reports, 6,* 26190. https://doi.org/10.1038/srep26190

Stanke, C., Murray, V., Amlot, R., Nurse, J., & Williams, R. (2012). The effects of flooding on mental health: Outcomes and recommendations from a review of the literature. *PLoS Currents, 4,* e4f9f1fa9c3cae. https://doi.org/10.1371/4f9f1fa9c3cae

Suleiman, D. E. (2016). Mental health disorders in Nigeria: A highly neglected disease. *Annals of Nigerian Medicine, 10,* 47–48. https://doi.org/10.4103/0331-3131.206214

Termorshuizen, F., Smeets, H. M., Braam, A. W., & Veling, W. (2014). Neighborhood ethnic density and psychotic disorders among ethnic minority groups in Utrecht City. *Social Psychiatry and Psychiatric Epidemiology, 49,* 1093–1102.

Tizón, J. L., Ferrando, J., Artigue, J., Parra, B., Parés, A., Gomà, M., Pérez, C., Pareja, F., Sorribes, M., Marzari, B., Quijada, Y., & Català, L.

(2009). Neighborhood differences in psychoses: Prevalence of psychotic disorders in two socially-differentiated metropolitan areas of Barcelona. *Schizophrenia Research, 112,* 143–148. https://doi.org/10.1016/j.schres.2009.04.008

Weaver, L. J., & Hadley, C. (2009). Moving beyond hunger and nutrition: A systematic review of the evidence linking food insecurity and mental health in developing countries. *Ecology of Food and Nutrition, 48,* 263–284.

Weich, S., Twigg, L., Holt, G., Lewis, G., & Jones, K. (2003). Contextual risk factors for the common mental disorders in Britain: A multilevel investigation of the effects of place. *Journal of Epidemiology and Community Health, 57,* 616–621. https://doi.org/10.1136/jech.57.8.616

World Health Organization. (2006). *WHO-AIMS report on mental health system in Nigeria.* Ibadan, Nigeria: WHO and Ministry of Health. https://extranet.who.int/mindbank/item/1303

Zhang, Y., Augusto, O., Asbjornsdottir, K., Akullian, A., Cumbe, V., Rao, D., Gimbel, S., Sherr, K., Wagenaar, B. H., & INCOMAS Study Team. (2019). Geographic distribution and determinants of mental health stigma in central Mozambique. *Social Psychiatry and Psychiatric Epidemiology, 54*(11), 1391–1410. https://doi.org/10.1007/s00127-019-01708-8