

Research paper

Older adults with hypertension have increased risk of depression compared to their younger counterparts: Evidence from the World Health Organization study of Global Ageing and Adult Health Wave 2 in Ghana

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ABSTRACT

Background: Depression and hypertension interact through a complex interplay of social, behavioral and biological factors. Despite the huge burden of hypertension in the African sub-region, very little information exists on depression among hypertensive patients. This study assessed the prevalence and factors associated with depression among young and older adult hypertensive patients in Ghana.

Method: Data from the World Health Organization Study on Global AGEing and Adult Health wave 2 (2014/2015) for Ghana was used. Depression was estimated among participants with blood pressure 140/90mmHg and above. Weighted descriptive statistics and logistic regression with adjusted predictions were carried out. The analysis was performed using Stata 15.

Result: The overall prevalence of depression was 6.3%. Older hypertensive patients had almost twice the prevalence of depression compared with younger patients (8.4% vs 4.5%). The factors which predicted depression among hypertensive patients were educational level, marital status, religion, region of residence, work status, self-rated health (SRH), and unhealthy lifestyle. Participants with no religion were more than 7 times likely to be depressed compared with Christians [aOR(95%CI) = 7.52(2.11-26.8)]. Those in the Volta region were more than 8 times likely to be depressed compared to those in the Greater Accra region [aOR(95%CI) = 8.58(2.51-29.3)].

Conclusion: Older adult hypertensive patients were more likely to experience depressive symptoms. Multiple factors predicted depression in both young and old hypertensive patients; thus a comprehensive care package including psychological support for patients with hypertension is essential for optimum clinical management.

1. Introduction

Non-communicable diseases (NCDs) have become a major public health problem and the burden has increased many folds in low-to-middle income countries (LMIC) compared to infectious diseases (Lim et al., 2012; World Health Organization, 2008). Hypertension, a very common NCD, is the main risk factor for cardiovascular disease and the predominant cause of death globally (World Health Organization, 2008). World Health Organization (WHO) estimates revealed that, by 2020, NCDs would account for 80% of the global burden of disease and 70% of deaths. The majority of these deaths will be in LMICs (Mathers and Loncar, 2006; WHO, 2020). The global prevalence of hypertension of 26% is projected to rise to 29% by the year 2025 (Kearney et al., 2005) and affects between 11 and 42% of Africans

(Adedoyin et al., 2008; Tesfaye et al., 2009; Twagirumukiza et al., 2011). A systematic review of hypertension in Ghana in 2012 showed that hypertension increased with age with a prevalence of 19.3% in rural settings and 54.6% in urban areas (Addo et al., 2012). A recent Ghanaian study showed the prevalence of hypertension among the young aged 15 to 49 years to be 13.0% (Sanuade et al., 2018).

As a chronic illness, hypertensive patients in the long-term are prone to psychological problems. The most common mental health disorder encountered by patients with a chronic illness is depression (Vetere et al.,; DeJean et al., 2013). Depression can be a cause or a consequence of NCDs. The prevalence of depression among patients with NCDs ranged from 22% to 33% while the prevalence among hypertensives is 29% (Organization). The prevalence of depression among hypertensives in a Nigerian study was 48%[14] while in a Ghanaian

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study it was 4% (Kretchy et al., 2014) while another study conducted in Ghana and Nigeria among hypertensives showed a prevalence of 41.7% and 26.6% respectively (Ademola et al., 2019). The factors associated with depression in hypertensives in previous studies were; age, educational status, employment status, socioeconomic status, physical activity, and family history of hypertension (Mahmood et al.,; Neupane et al., 2015).

Hypertension and depression represent a complex interplay of social, behavioral, and biological factors (World Health Organization, 2008). When these co-morbid conditions co-exist, there is an increased risk of stroke, ischaemic heart disease, medication non-compliance, poor quality of life, and high risk of suicide (Bogner et al., 2005; Saboya and Zimmermann PR; 2010, Li et al., 2015). Social, behavioral, and biological factors can cause depression and hypertension and there is a bidirectional relationship between depression and hypertension.

Most of the studies on hypertension and depression were conducted in developed countries with very few in Ghana. Aside from the scarcity of data on depression among hypertensives in Ghana, the population of Ghana is ageing with an increase in life expectancy from 45 years in 1960 to 63.5 years in 2017. To improve the quality of life of the next generation of older adults, **the outcome of this analysis will provide baseline data to inform policy change and clinical management of older adults including treatment of associated co-morbidities of hypertension.** This study assessed depression among hypertensives and involved a **larger number of participants in a steadily increasing older adult population.** Also, we compared depression among young and older adult hypertensives and determined the factors that predict depression in this cohort.

2. Methods

2.1. Study setting

This study was conducted using WHO Study on Global Ageing and Adult Health (SAGE) Wave 2 which was conducted in 2014–2015, as part of the multi-country study on aging.

2.2. Study participant

The dataset of the WHO Study on Global Ageing and Adult Health (SAGE) wave 2 for Ghana was used for this analysis. The SAGE data was a longitudinal data on the health and well-being of adult populations, obtained through primary data collection and secondary data analysis. SAGE Wave 2 was carried out from 2014 to 2015 in six lower-to-middle income countries including; China, Ghana, India, Mexico, Russian Federation, and South Africa (WHO, 2013). Two target populations were used in the SAGE Wave 2 study, which includes a large sample of persons aged 50 years and older (focus group for SAGE) and a smaller comparative sample of persons in the reproductive age group (aged 18–49 years). Households were classified into mutually exclusive categories where one or more persons aged 50 years and older were selected from households classified as “50+ households” and one person aged 18–49 years from a household classified as an “18–49 household”. In the older households, all persons aged 50 years and older were invited to participate while proxy respondents were identified for respondents who were unable to respond for themselves. Multistage cluster sampling design was used for Ghana wave 2 with 250 Primary Sample Unit and 20 strata (WHO, 2013; Biritwum et al., 2015). Detailed study design and procedure for data collection adopted for the SAGE survey is available in Kowal et al., (2012).

In all, about 4735 respondents were involved in the SAGE wave 2 with the inclusion of both adults and those in their reproductive age. However, based on the objective of our study, 1388 respondents were involved in the study comprising of 149 young adults (aged 18–49 years) and 1259 older adults (those aged 50 years and above). The

selection of the sample size in this research was based on the anthropometric measurement for hypertension where respondents with systolic and diastolic measurement 140/90mmHg were considered.

2.3. Dependent variables

Depression was used as the main outcome variable in this research. SAGE survey measured depression among the respondents with 15 series of questions which looked at the following questions; whether a respondent is taking any medications or other treatment for depression and/or, whether during the last 12 months; when you felt sad lasting several days; empty or depressed and/or; you lost interest in most things you usually enjoy such as personal relationships, work or hobbies/recreation lasting several days; and/or; you had a period lasting several days when you have been feeling your energy decreased or that you are tired all the time? These variables have the responses “Yes or No” and a “Yes” answer to any of these allow a potential respondent to answer an additional set of 15 depression assessment tool questions used to clinically diagnose depression among the respondents. Refer to Supplementary Table 1 for details of these questions which was validated in the Ghanaian context.

The 15 questions have responses “Yes or No”, out of these, an index variable was generated with scores from among two categories of domains (set 1 and 2). The depressive episode was based on if participant answer “yes” in either one of the following; if during the last 12 months and for a period lasting several days; when they were feeling sad, empty or depressed; when they lost interest in most things they usually enjoy such as personal relationships, work or hobbies/recreation; when they felt their energy had decreased or felt tired all the time. If the response is yes to any of these questions, SAGE wave 2 further used the above 15 standard questions to assess depression among those participants. Set 1 of the 15 validated questions contained depressive feelings within two weeks and symptoms are present nearly every day/most of the day. The symptoms include; tiredness or loss of energy, anhedonia (loss of interest or pleasure in activities including decreased sexual activity). Set 2 contained 12 items of depressive symptoms; loss of appetite, slowing down in thinking and moving around, problems falling asleep and waking up too early, have difficulty concentrating; for example, listening to others, working, watching TV, listening to the radio, feel anxious and worried most days, restless or jittery nearly every day, feel negative about yourself or lost confidence, feeling hopeless - that there was no way to improve things, think of death, or wish dead and tried to end life. Each item was coded as 1 “Yes” and 0 “No” and for each category, depressive disorder over the 12 months was considered if the score was ≥ 2 and ≥ 4 -plus respectively for set 1 and 2. This method of diagnosing depressive episode was first adopted by Arokiasamy and colleagues (Arokiasamy et al., 2015).

2.4. Independent variables

The independent variables considered in this research include; sex (male vs female), marital status (Never married, married, separated and widowed), religion (None, Christian, Islam, and Primal Indigenous), place of residence (urban vs rural), region (the then 10 administrative regions in Ghana), working status (working and not working), place of birth (same locality vs other locality), Ever hungry and no money for food (yes, every month, yes, some months and never.), SRH (Good, Moderate and Poor), Unhealthy lifestyle (None, One, Two and Three and above) Presence of NCDs (None, 1 NCD and 2+NCD) and Oral health (Yes or No). Unhealthy lifestyle was estimated and a score of 1 was regarded as not achieving the recommended behavior for (1) currently smoking or tobacco use, (2) currently drinking any alcoholic beverage, (3) eating fewer fruits and vegetables as part of the diet (less than 3 servings per day), (4) physical inactivity (less than 150 minutes moderate-intensity activities on a typical day and (5) BMI (low or high) (score 0 = None, 1 = One, 2 = Two and 3+ = Three and above). The

NCDs comprise; angina, arthritis, asthma, cataract, depression, diabetes, hypertension, chronic lung disease, and stroke NCDs) (score 0 = None, 1 = 1 NCD and, 2 + = 2 + NCD).

2.5. Data analysis

This study adjusted for the clustering (the primary sampling units), stratification, and the sampling weights used in the SAGE survey in all estimates due to the complex nature of the SAGE survey. Weighted Cronbach alpha test of reliability for depression measurement was performed. Two approaches of data analysis were adopted comprising descriptive and inferential statistics. Weighted descriptive estimates were performed by assessing independent variables associated with depression separately for young adults, older adults, and overall sample size. This was done to estimate the prevalence of depression among hypertensive respondents with a Rao-Scott chi-square. Secondly, an inferential analysis was carried out to estimate the factors influencing depression using logistic regression. Marginal means predictions of the fit logistic regression model were also performed by using margin Stata command. All analyses were carried out using Stata 14. P-value < 0.05 was considered significant.

2.6. Ethical requirements

This research used data from the WHO SAGE Ghana survey. SAGE was approved by the World Health Organization's Ethical Review Board (reference number RPC149) and the Ethical and Protocol Review Committee, College of Health Sciences, University of Ghana, Accra, Ghana. Written informed consent was obtained from all study respondents.

3. Results

Table 1 shows the prevalence of depression among young and older adults with hypertension and associated demographic features. A total of 1388 subjects were involved in this analysis. The overall prevalence of depression among hypertensive patients was 6.3% with a prevalence of 4.5% and 8.4% among young and older adult hypertensives respectively (Fig. 1). There was no significant difference in the prevalence of depression among older male and female hypertensives and younger female and male hypertensives ($p = 0.993$). Depression prevalence was significantly higher among older hypertensives who had none or up to senior secondary school education (11.0% and 10.9%) compared with younger adults who had up to the same educational level [3.9% and 8.0%] ($p = 0.024$) from the overall sample].

The prevalence of depression was significantly higher among young and older hypertensives who were widowed (15.0% and 13.0% respectively) or separated (6.0% and 8.0% respectively) from their spouses ($p = 0.003$). Besides, younger widowed adult hypertensives had a higher rate of depression compared to older adults. There was a significant difference in the prevalence of depression among young and older adult hypertensives in terms of religion. Older and young adult hypertensives who had no religion (27.9% vs 31.3%) had a higher prevalence of depression compared to those who were either Christians (8.3% vs 4.1%) or Muslims (5.1% vs 4.3%). There was a regional difference in the prevalence of depression among young and older adult hypertensives. Young and older adult hypertensive who reside in the Volta region had significantly higher rates of depression compared to those in the other regions in Ghana ($p < 0.001$ from the overall sample). Further, younger adult hypertensives in the Volta region had more than twice the prevalence of depression compared to older adults in the same region (36.2% vs 16.8%). Those who never worked had a higher prevalence of depression compared to those who were workers among young (11.4% vs 2.4%) and older (13.2% vs 5.1%) adult hypertensive patients. Further, younger (17.5%) adult hypertensives who had no monthly money for food and were hungry had a higher prevalence of

depression compared to older (7.9%) adults with no monthly money for food (Table 1).

Regarding self-rated health (SRH), young and older adult hypertensives who rated their health status as bad were more depressed than those who rated their health status as good ($p < 0.001$). Similarly, young adult hypertensive who rated their health status bad had a higher prevalence of depression compared to older adults who rated their status as bad (25.0% vs 19.6%). Young adult hypertensives who score high (32.6%) for an unhealthy lifestyle had a significantly higher rate of depression compared to those who score low (5.5%). By contrast, older adults scoring low (12.4%) for unhealthy lifestyles had a higher rate of depression compared to those who scored high on an unhealthy lifestyle (5.0%) ($p = 0.039$ from the overall sample). (Table 1).

Factors significantly influencing overall depression among hypertensives were; religion, work status, the experience of hunger SRH. Interestingly, respondents with no religion were more than 7 times likely to be depressed compared to those affiliated to religious groups [aOR(95%CI) = 7.52(2.11-26.8)]. Those who have never worked were found to be more than 3 times likely to be depressed compared with those who ever worked [aOR(95%CI) = 3.73(1.64-8.44)] (see Table 2). Participants who experienced hunger every month and rated their health as bad were approximately 5 and 3 times respectively likely to experience depressive episodes [aOR(95%CI) = 4.54(1.08-18.9) and 3.02(1.01-9.06) respectively].

As presented in Fig. 1, there was a significant difference in the proportion of depression between older and young adult hypertensives, the probability of log count among young and older adults shows a higher rate of depression among older adults across factors that significantly influence depression. Participants with no religion showed a higher probability count of depression by 0.29 among older adults compared to 0.21 among younger adults [β [95%CI = 0.29(0.10-0.48) vs 0.21(0.04-0.37)]. Moreover, widowed adults had a higher probability count of depression among young and older adults [β [95%CI = 0.07(0.04-0.10) vs 0.10(0.07-0.13)]. Notwithstanding, workers and those with bad SRH significantly had an increased depressive episode probability count among young and older adults (see Table 3).

4. Discussion

This study set out to compare the prevalence of depression among young and older adult hypertensives and to determine the factors associated with depression among young and older adults with hypertension. The overall prevalence of depression among hypertensive patients was 6.3% with older adult hypertensives having almost twice the prevalence of depression compared to young adults. Widowed hypertensive patients had higher rates of depression, more so among the young compared to the older adults. This association requires further interrogation in that intuitively, relatively younger persons who lose their life partners may be exposed to live stressors of which depression is a key component. These stressors as a result of the loss can in themselves increase the blood pressure of the individuals. The loss of a life partner does therefore potentially increase the risk for both hypertension and depression and not necessarily a direct relationship between hypertension and depression. The role of social support on depression is beyond the scope of this paper, however other studies have demonstrated that lack of social support is a determinant of mental health problems (Alsubaie et al., 2019); thus the relationship between social support and depression should be explored in this population.

Previous studies reported a high prevalence of depression among hypertensive patients more so among older hypertensive patients compared to their young counterparts (Hamrah et al., 2018; Chowdhury et al., 2019; Xue et al., 2017). In our study, the prevalence in older patients was more than twice that of young hypertensive

Table 1
Prevalence of depression among young and older adults with hypertension and associated demographic characteristics in Ghana.

Demographics	Young adults Depressed = 4.5	Total	Older adults Depressed = 8.4	Total	Overall Depressed = 6.3	Total	P-value (from overall depression)
	Weighted %	n	Weighted %	n	Weighted %	n	
Sex							0.993
Male	6.0	57	6.7	475	6.3	532	
Femmale	3.3	92	9.7	764	6.3	586	
Education							0.024
None	3.9	36	11.0	619	8.3	655	
Primary	1.5	59	4.0	289	2.6	348	
SHS	8.0	52	10.9	283	9.0	335	
Tertiary	0.0	2	1.5	48	0.8	50	
Marital Status							0.003
Never Married	0.0	30	4.9	40	0.5	70	
Currently Married	5.0	95	6.3	606	5.5	701	
Separate	6.0	16	8.3	157	7.2	173	
Widowed	15.0	8	13.0	436	13.4	444	
Religion							0.001
None	31.3	2	27.9	47	29.0	49	
Christian	4.1	110	8.3	881	6.0	991	
Islam	4.3	32	5.1	232	4.7	264	
Primal i	0.0	3	6.5	68	5.0	71	
Resident							0.484
Urban	4.9	76	6.1	566	5.5	642	
Rural	4.1	73	11.6	673	7.4	746	
Region							0.000
Ashanti	5.4	30	11.1	209	7.7	239	
Brong Ahafo	0.0	12	1.9	105	1.0	117	
Central	0.0	14	5.3	153	2.8	167	
Eastern	0.0	8	5.4	98	3.2	106	
GT Accra	1.4	34	5.9	194	3.2	228	
Northern	0.0	10	3.7	111	2.3	121	
Upper East	0.0	2	14.1	58	5.2	60	
Upper West	0.0	5	15.0	45	5.2	50	
Volta	36.2	10	16.8	126	25.9	136	
Western	0.0	24	12.0	140	3.6	164	
Ever work							0.004
No	11.4	40	13.2	558	12.5	598	
Yes	2.7	109	5.1	681	3.6	790	
Where were you born							0.627
Same Location	5.2	92	8.5	826	6.7	918	
Different	3.4	57	8.2	413	5.5	470	
Hungry, no money for food							0.020
Yes, every month	17.5	30	7.9	160	13.9	190	
Some month	0.0	9	23.6	89	11.3	98	
Never Married	3.2	110	7.2	990	4.5	1100	
SRH							0.000
Good	3.0	117	5.9	647	4.1	764	
Mderate	4.8	14	8.7	418	7.5	432	
Bad	25.0	9	19.6	150	21.6	159	
Level of NCD							0.360
None	4.9	118	7.6	826	6.1	944	
1 + NCD	0.0	25	11.1	280	5.5	305	
2 + NCD	21.5	6	7.9	133	11.1	139	
Oral health	No prevalence						0.002
Yes			7.8	1165	6.2	1301	
No			25.4	55	25.4	55	
BMI							0.332
Ubderweight	0.0	1	13.6	135	12.8	136	
Normal	2.7	60	7.6	570	5.0	630	
Overweight	8.2	40	5.6	252	7.1	292	
Obesity	1.9	29	8.1	169	4.3	198	
Alcohol intake							0.478
No	3.3	116	8.5	1000	5.7	1116	
Yes	8.2	33	8.1	239	8.2	272	
Ever smoke							0.122
No	4.7	142	8.5	1191	6.5	1333	
Yes	0.0	7	6.1	48	2.8	55	
Less activity							0.642
No	2.7	112	9.3	988	5.9	1100	
Yes	9.3	37	4.9	251	7.6	288	

NOTE: Weighted estimation. P-value indicate overall depression test of independence.

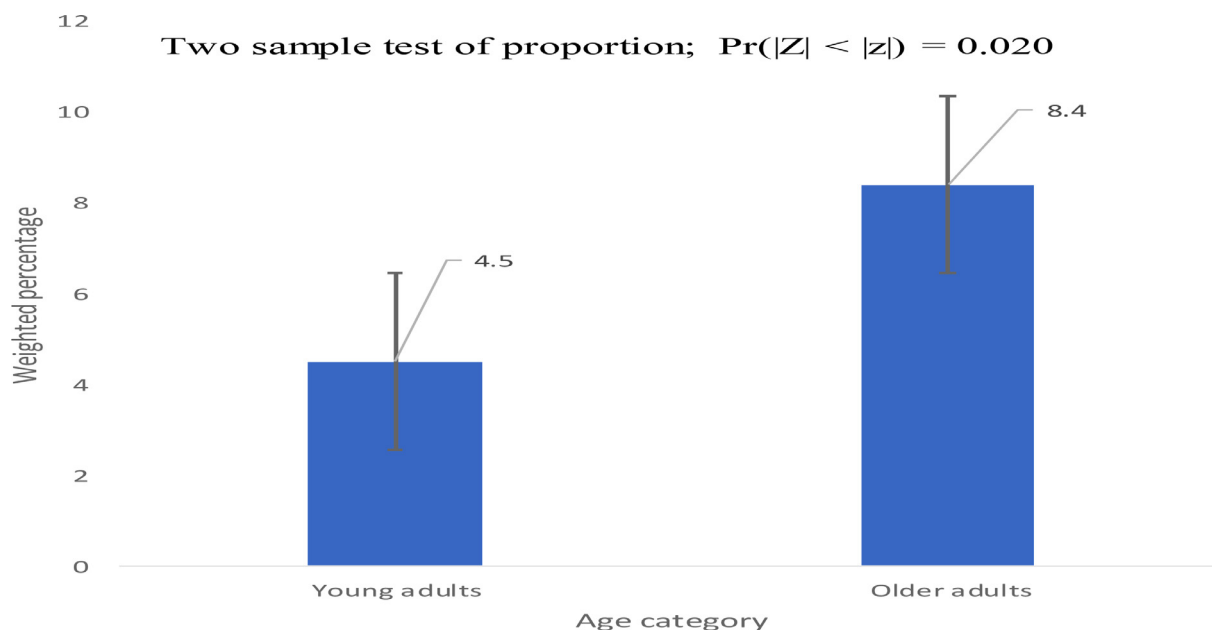


Fig. 1. Significant difference of depression prevalence among young and older adults with hypertension showing 95% CI error bar chart.

patients. Likewise, the prevalence of depression among older hypertensive patients was more than thrice the prevalence among younger folks, as demonstrated by a Nigerian study (Iloh et al., 2018). Other studies reported similar findings (Hamrah et al., 2018; Chowdhury et al., 2019; Xue et al., 2017). In a Chinese study involving more than 10,000 participants, the prevalence of depression among older hypertensive patients was 12.8% (Xue et al., 2017) while in our study involving more than 1000 participants, the prevalence of depression was 8%. In a prospective study involving more than 6000 participants, the prevalence of depression among hypertensives at baseline was 5% while a further 15% developed depression during the follow-up period [28]. Most of the other studies recorded much higher prevalence of depression among young and older hypertensives compared to our study and the Chinese study. For instance, the study by Shoaib et al showed that the prevalence of depression among young hypertensives was more than 25% while among older hypertensives it was more than 60% (Emre et al., 2018). The differences observed in these later studies compared to our study and the Chinese study may be due largely related to differences in sample size, which ranged from 100 to 400 participants. Another difference observed was the mean age of the study population in the various studies. The mean age in the last two studies was above 60 years while in our study the mean age 50.5 years. Moreover, cultural and socioeconomic differences and tools used in measuring depression may also play a role in the differences observed.

Most studies did not show a significant association between marital status and depression among hypertensives (Iloh et al., 2018; Hamrah et al., 2018; Xue et al., 2017; Ademola et al., 2019), in contrast to the finding from our study where widowed young hypertensive patients were more likely to have depression. However, the prevalence of depression among widows and widowers who were not hypertensives was found in a prospective study to be 24% (Zisook and Shuchter, 1991). This suggests that widowhood predisposes to depression and additional stressors such as chronic illness in the form of hypertension will potentially increase the risk of depression among hypertensives.

Hypertensive patients with no religion were more depressed compared to those affiliated to religious groups. Social support networks are important for the wellbeing of older adults and individuals without such support may be more prone to depression and other psychological problems. A meta-analysis of 147 studies showed that a high level of

religiosity was associated with a lower likelihood of developing depressive symptoms (Smith et al., 2003). This finding is corroborated by our study findings where hypertensive patients with no religion had a higher prevalence of depression compared to those affiliated to religious groups. Again, it has been reported that individuals who attend religious services regularly or sporadically were less likely to have depressive symptoms compared to those who do not (Blazer, 2010; Braam et al., 2004). A Ghanaian study showed a significant relationship between spirituality and depression among hypertensives in which spirituality was found to be protective against depression (Kretchy et al., 2014). Given this, it appears being religious is potentially protective against depression especially among those who are predisposed (Ellison and Flannelly, 2009).

Interestingly, hypertensive patients in the Volta region were about 5-10 folds likely to be depressed compared to those who live in other regions. Contrary to the nationwide trend, young adult hypertensives in this region had more than twice the prevalence of depression compared to their older folks. **The Volta region of Ghana has one of the highest unemployment and poverty rates in Ghana (Ghana Statistical Service 2015). However, this does not explain the above observation entirely, as there are regions with similar unemployment and poverty status in Ghana. Perhaps, an exploratory study to determine personal belief systems and behaviors, socio-cultural practices and health service utilization patterns could potentially provide explanations. This analysis has demonstrated that people who never worked and relatively poor were more likely to be depressed. In nutritional psychiatry, the diet has been recommended as an important component that enhances mental health (Lim et al., 2016), thus being poor and unable to afford adequate nutrition and diet significantly influenced depression among hypertensive patients.**

More social intervention programmes for the extremely poor older adults and economic planning to improve the livelihoods of the younger adults would generate a healthier population.

More so, hypertensive patients who never worked and cannot afford to buy food monthly had a high rate of depression. Again, young adult hypertensive patients who live an unhealthy lifestyle had a higher rate of depression compared to those who score low on an unhealthy lifestyle. In contrast, older adult hypertensives who scored low for an unhealthy living had a higher rate of depression compared to those who score high for unhealthy living. Finally, those who rated their health as

Table 2
Unadjusted and adjusted logistic regression showing factors influencing depression among young and older adults with hypertension at 95%CI.

Predictor	uOR[95%CI]	aOR[95%CI]
Sex		
Female	Ref	
Male	0.99[0.41-2.41]	
Education		
Tertiary	Ref	Ref
None	11.47[1.38-94.9]*	2.92[0.37-22.62]
Primary	3.36[0.37-30.3]	2.71[0.31-24.14]
SHS	12.52[1.36-115.1]*	8.80[0.98-78.75]
Marital Status		
Currently Married	Ref	Ref
Never Married	0.09[0.01-0.55]*	0.09[0.01-0.55]
Separate	1.33[0.44-3.96]	0.73[0.21-2.51]
Widowed	2.63[1.15-6.03]*	1.45[0.70-3.01]
Religion		
Christian	Ref	Ref
None	6.42[1.97-20.8]***	7.52[2.11-16.8]***
Islam	0.77[0.29-2.08]	1.35[0.48-3.78]
Primal indigenous	0.83[0.26-2.67]	1.76[0.59-5.27]
Place residence		
Rural	Ref	
Urban	0.73[0.30-1.77]	
Region		
Southern sector	Ref	
Northern sector	1.14[0.52-2.52]	
Ever work		
Yes	Ref	Ref
No	3.80[1.43-10.1]**	3.73[1.64-8.44]**
Where were you born		
Different	Ref	
Same Location	0.81[0.35-1.89]	
Hungry, no money for food		
Never	Ref	Ref
Yes, every month	3.42[1.11-10.6]*	4.54[1.08-18.9]*
Some month	2.71[1.23-5.97]**	1.86[0.75-4.57]
SRH		
Good	Ref	Ref
Mderate	1.91[0.87-4.17]	1.76[0.87-3.55]
Bad	6.47[2.47-16.9]***	3.02[1.01-9.06]*
Level of NCD		
None	Ref	
1 + NCD	0.91[0.43-1.63]	
2 + NCD	1.93[0.63-5.94]	
Oral health		
No	Ref	Ref
Yes	5.18[2.03-13.2]***	2.63[1.01-6.82]*
BMI		
Normal	Ref	Ref
Uderweight	2.81[1.20-6.57]*	1.61[0.72-3.60]
Overweight	1.45[0.49-2.45]	2.23[0.72-6.94]
Obesity	0.86[0.33-2.21]	1.04[0.39-2.71]
Alcohol intake		
No	Ref	
Yes	1.46[0.50-4.25]	
Ever smoke		
No	Ref	
Yes	0.41[0.13-1.31]	
Less activity		
No	Ref	
Yes	1.31[0.40-4.24]	

NOTE: Logistic model for depression, goodness-of-fit test: F(9,185) = 1.19, Prob > F = 0.301 *p-value < 0.05, **p-value < 0.01, ***p-value < 0.001.

bad were more depressed and this was more so among young adult hypertensives compared to older adults.

Also, most studies did not show any relationship between employment status and depression among hypertensives (Iloh et al., 2018; Hamrah et al., 2018; Ademola et al., 2019) which did not corroborate our finding where hypertensive patients who never worked and have no monthly money for food had a higher prevalence of depression. **This is an important finding** with national policy implications. **Improved economic status has a positive effect on rate of depressive**

Table 3
Probability estimations of significant factors influencing depression among young and older adults with hypertension at 95%CI.

Predictor	Young adults β[95%CI]	Older adults β[95%CI]
Marital Status		
Never married	0.01[-0.01-0.01]	0.01[-0.01-0.02]
Married	0.05[0.02-0.08]**	0.07[0.04-0.11]***
Separate	0.04[0.01-0.07]*	0.06[0.02-0.09]**
Widowed	0.07[0.04-0.10]***	0.10[0.07-0.13]***
Religion		
Christian	0.04[0.03-0.06]***	0.06[0.04-0.08]***
None	0.21[0.04-0.37]*	0.29[0.10-0.48]**
Islam	0.04[0.01-0.08]*	0.07[0.01-0.13]*
Primal i	0.05[-0.01-0.12]	0.08[0.01-0.16]*
Ever work		
Yes	0.10[0.04-0.16]**	0.12[0.07-0.17]***
No	0.03[0.01-0.06]*	0.04[0.02-0.06]***
SRH		
Good	0.04[0.02-0.06]***	0.05[0.03-0.08]***
Mderate	0.06[0.03-0.11]**	0.09[0.05-0.12]***
Bad	0.09[0.01-0.18]*	0.13[0.04-0.21]**

NOTE: Logistic model for depression, goodness-of-fit test: F(9,185) = 0.31, Prob > F = 0.9706; Weighted estimation. *p-value < 0.05, **p-value < 0.01, ***p-value < 0.001.

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symptoms and that a specific relationship between depression and unemployment exist; i.e. young adults more at risk (Breslin and Mustard, 2003). Financial hardship resulting from unemployment may cause individuals to lose their sense of agency to connect with their environment and communities which can increase their risk of depression (Fryer). In addition, evidence exist that job loss predicts major depression among adult men and women (Andreeva et al., 2015). Further, our study showed that young hypertensive patients who lived an unhealthy lifestyle were more likely to be depressed while it is the reverse for older hypertensive patients. The reason for this difference is not clear and calls for further exploration. In some studies, hypertensive patients with metabolic syndrome with an unhealthy diet were more likely to have depression (Bonnet et al., 2005; Taylor et al., 2008). Other studies looked at physical activity and depression among hypertensives instead of unhealthy living. One study showed that hypertensives who were physically inactive had a higher prevalence of depression (Iloh et al., 2018) and others did not indicate a significant association between depression and physical activity (Neupane et al., 2015). In a study among African American hypertensives, lower self-reported health was associated with the likelihood of becoming depressed (Taylor et al., 2008) as shown in our study where those who rated the health status bad had a higher prevalence of depression.

Strengths and weaknesses: The use of nationally representative data and the use of a standardized tool to measure the same outcomes of interest and variables across the regions ensured that our results are generalizable nationally. However, we anticipate that there may be unmeasured variables that could influence the relationship between

hypertension and depression. In addition, primarily due to the use of cross-sectional data inferences on causality could be problematic.

5. Conclusion

The proportion of depression between young and older adult hypertensives was statistically different and significant. In all, older adults were more likely to experience depressive symptoms. Further, older widowed hypertensives, those affiliated to no religion and those who rated their health status as poor were more likely to be depressed. A comprehensive care package including psychological support for older and younger adults with hypertension is essential for optimum clinical management.

Data availability

The data used to support the findings of this study is available from the corresponding author upon request.

Data available at the WHO SAGE Wave 2 office and data acquisition can be found through the WHO website <http://www.who.int/healthinfo/sage/cohorts/en/>.

Authors' contributions

JT, BV, YE, AT, and YAE conceptualized the study and sought approval for access to the SAGE wave 2 data. MG, BR and YAE are members of the WHO SAGE Wave 2 Ghana Team. JT undertook the statistical analysis. BV, YE, AT, JT and YAE drafted the initial manuscript. MG and BR read and provided intellectual content revisions and suggestions for clarity and precision on the subject matter. All authors read and approved the final review manuscript.

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Declaration of Competing Interest

Authors declare no conflicts of interest in this submission.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jad.2020.08.033](https://doi.org/10.1016/j.jad.2020.08.033).

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