

# Screening of Depression Among Medical Outpatients Visiting the University Teaching Hospital of Kigali, Rwanda

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**Background:** Depression is a significant global public health concern, affecting individuals across different age groups and cultural backgrounds. However, screening for depression remains an essential but often neglected aspect of healthcare, particularly in outpatient settings. This study aimed to assess the prevalence of depression among outpatients visiting the internal medicine department of the University Teaching Hospital of Kigali in Rwanda and evaluate the feasibility of implementing a depression screening program in this setting.

**Methods:** An institution-based cross-sectional study design was employed, involving 300 adult medical outpatients through convenience sampling, aged 18 years and above, who visited the internal medicine department between October 7 to November 6, 2019. The Patient Health Questionnaire-9 (PHQ-9) was used as the screening tool to assess depressive symptoms. Additionally, socio-demographic and clinical data were collected to explore potential risk factors associated with depression using a binary logistic regression model.

**Results:** A high prevalence of depression was identified among internal medicine outpatients, with 45.7% of participants screened positive for depression, with moderate, moderately severe, and severe depression accounting for 21%, 17%, and 8%, respectively. The following factors were significantly associated with positive screening for depression: lack of formal education (OR=4.463,  $p=0.011$ , 95% CI= [1.410; 14.127]), secondary education (OR=3.402,  $p=0.003$ , 95% CI= [1.517; 7.630]), low-income (OR=2.392,  $p=0.049$ , 95% CI= [1.003; 5.706]) and headache as a chief complaint (OR=3.611,  $p=0.001$ , CI= [1.718; 7.591]).

**Conclusion:** This study highlights the high prevalence of depression among medical outpatients. Due to the stigma associated with mental health, patients frequently seek help for physical symptoms such as headaches and other bodily complaints rather than mental health concerns. Introducing routine depression screening in medical departments could potentially facilitate early identification, and intervention, and lead to improved patient care. Future research should focus on evaluating such screening programs' effectiveness and long-term outcomes in resource-limited settings like Rwanda.

**Keywords:** depression, screening, medical outpatients, internal medicine department

## Introduction

Depression is a common mental health problem and can affect both the mental and physical status of the patient.<sup>1</sup> The global prevalence of depression has been increasing worldwide in the past period, and the highest prevalence has been reported in the African region where Rwanda is located.<sup>1,2</sup> Based on findings from the 2018 Rwanda Mental Health Survey, depression emerges as the predominant mental health disorder, affecting 12% of the 19,110 individuals surveyed

across the general population and a significantly higher proportion, 35%, among survivors of the genocide<sup>3</sup> The prevalence of depression varies with age and gender.<sup>1,2</sup> The lower rate is recorded in those aged less than 15 years old and a higher rate in older adults.<sup>2</sup> The data estimate more than 7.5% among females and more than 5.5% among males aged 55–74.<sup>2</sup>

Depression is among the major causes of disability and disease burden worldwide.<sup>2,4</sup> Unfortunately, a low detection of depression by primary healthcare providers posed a challenge to scaling up mental health care in low- and middle-income countries.<sup>5</sup> Patients with depression may consult general healthcare services due to somatic expression of their disease including generalized weakness, headache, joint pain, burning and tingling sensations, crawling sensations, and vague pain.<sup>6</sup> The affected persons will more likely consult neurologists, gastroenterologists, or cardiologists and in case of a non-trained eye, the patient may be misdiagnosed. The common somatic complaints may include headache, dizziness, palpitation, weakness, abdominal discomfort, burning, and tingling sensations, and vague pain.<sup>6–9</sup> The consequences of depression include high medical expenses,<sup>10–12</sup> dissatisfaction with healthcare services, deterioration of the doctor–patient relationship, increased level of disability, negative impact on society in general and on the patient's family and prognosis, and particularly on individual's chronic suffering.<sup>13,14</sup> Furthermore, depression may complicate the situation of co-occurring disease conditions; especially chronic medical diseases among older adults,<sup>15</sup> and it is an often unrecognized comorbidity in patients consulting non-mental health care focused health facilities.<sup>16</sup> Factors associated with depression are diverse and include chronic diseases,<sup>17</sup> personal and family history, and marital and socioeconomic status among others.<sup>18–20</sup> Individual and genealogy history of depression was linked with the prevalence of depressive disorders.<sup>21</sup> For example Weissman et al<sup>21</sup> reported that people who had their biological relatives affected with major depressive disorder in two previous generations were at the highest risk of developing major depression. In a study conducted across European countries, they found that a higher socioeconomic index score acted as a protective factor against depression. Nevertheless, income was the predictor of depression in some countries but not in others.<sup>18</sup> Unemployed young adults had more than three times the odds ratio of having depression compared with employed adults.<sup>22</sup> Screening for depression in primary care or general population is recommended in some countries,<sup>23</sup> while in others, there are recommendations against general screening for depression in general primary care.<sup>24</sup> In Rwanda, mental health service utilization encounters significant obstacles due to the pervasive stigma attached to mental health. There is a prevailing belief that mental issues arise from various causes such as evil spirits, violations of ancestral laws, feigning illness to avoid responsibilities, or fate. Consequently, many individuals turn to traditional healers and religious leaders for assistance rather than seeking help from healthcare providers. Often, patients only consider seeking medical assistance when they experience physical symptoms, leading to further delays in accessing appropriate mental health care.

Particularly in Rwanda, depression has a high prevalence,<sup>25,26</sup> and suicide causes about 9.5 deaths per 100,000 persons per year and men are at higher risk with a ratio of men to women being 3:1 as per WHO data from 2021. Furthermore, a considerable portion of the Rwandan population does not use mental healthcare services.<sup>27</sup> In Rwanda, there are only 18 psychiatrists employed across Ndera Neuropsychiatric Teaching Hospital, Kigali Mental Health Referral Center, two University Teaching Hospitals, King Faisal Hospital Rwanda, and Ruhengeri Referral Hospital. At the University Teaching Hospital of Kigali (CHUK), patients referred from district hospitals by general practitioners form a significant portion of the patient population. However, despite this influx, regular screening for depression is not conducted. This is largely due to the prevailing emphasis on physical health concerns within the medical community. Additionally, general practitioners, responsible for conducting screenings, receive limited exposure to mental health issues during their training. Typically, this exposure comprises only a two-week rotation in psychiatric settings during the junior clerkship. Unfortunately, there is no further exposure during senior clerkship and internship, leaving general practitioners ill-equipped to effectively screen for depression and other mental health disorders. Hence, our study sought to screen for depression and related factors among patients visiting the outpatient clinic of the internal medicine department at the University Teaching Hospital of Kigali. This clinic was chosen due to its high likelihood of encountering patients presenting with somatic complaints. Additionally, there has been no prior investigation conducted to understand the demographic profile of individuals with depression at this hospital.

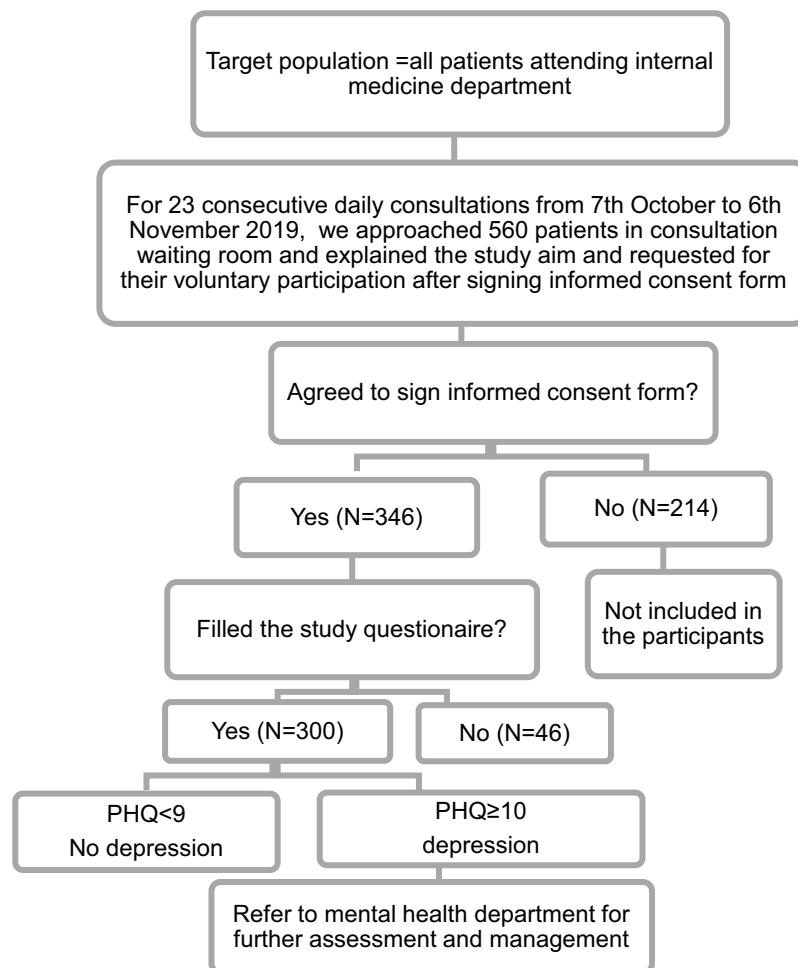
## Materials and Methods

### Study Description and Settings

This was a descriptive cross-sectional study conducted in the outpatient clinic of the internal medicine department of CHUK from October 7 to November 6, 2019. CHUK is the largest hospital located in the District of Nyarugenge at KN 4 Ave, Kigali City, Rwanda. It is the medical facility that is closely associated with the university's medical school, it serves as a crucial center for medical education, training, and research, in addition to providing medical care to patients. The hospital is essential for the practical training of medical students, residents, and other healthcare professionals, students learn their clinical skills by interacting with patients under the supervision of experienced faculty members. Research conducted by this hospital helps to advance medical knowledge, develop new treatments, and improve patient care. It offers specialized care through departments such as internal medicine, surgery, pediatrics, and more. It also serves as the referral hospital in the country with a capacity of 519 beds. CHUK provides quality healthcare to the population; participates in the education of future healthcare professionals and clinical research, and offers technical support to district hospitals. The internal medicine department at this hospital has an inpatient service and an outpatient department (OPD), the latter receives at least 1200 patients per month, and the patients are referred from district hospitals for further investigation of physical symptoms.

### Participants

The participant's recruitment process is outlined in Figure 1. The participants were patients who consulted the internal medicine department outpatient clinic during the predefined period. The sample size was calculated according to Slovin's



**Figure 1** Flowchart for participants' recruitment process.

formula  $n = N/(1 + Ne^2)$  where sample size  $n=300$  was taken from the given population  $N = 1200$  with the largest margin error ( $e$ ) of 0.05. The patients were approached for participation in the study while they were waiting for their appointments with their treating physicians. We included patients aged 18 years and above, proficient in Kinyarwanda language and able to provide a signed voluntary, written informed consent (53,6%). We excluded patients who were severely ill and those with cognitive impairment (8.2%).

## Data Collection and Analysis

The socio-demographic data were collected using a structured questionnaire while the screening for depression was based on the Patient Health Questionnaire-9 (PHQ-9).<sup>28,29</sup> The Kinyarwanda version of PHQ-9 has been adapted and validated in people with epilepsy and it has shown good psychometric properties. The optimum cut-off was  $\geq 5$  for the detection of mild depression with a sensitivity of 72.4 and specificity of 69.6 with a Cronbach alpha of 0.87.<sup>30</sup> Though we used a cut-off  $\geq 10$  as it is similarly used in the general population and patients with physical complaints of African countries.<sup>31,32</sup> The validated PHQ-9 Kinyarwanda version for the screening of depression in Rwanda was used as a research tool. The clinical questions were aggregated into four domains: family psychiatric history, personal psychiatric history, chronic medical illness, and current chief complaints. A score of 10 on the PHQ-9 was used as the cut-off point to classify probable depressive disorder, and different levels of severity were assigned based on PHQ-9 scores as follows:  $<10$  equals no depressive syndrome, 10–14 equals moderate depression, 14–19 equals moderate depression, and 20–27 equals severe depression.<sup>33</sup> The data collected were entered into Stata/MP 17 for analysis ([Supplementary Material S1](#)). Logistic regression was used to predict binary outcomes, the outcome variable was coded 1 as the presence of depression and 0 as the absence of depression, the relevant factors including demographic and clinical characteristics were identified and entered into the model as independent variables. The analysis estimated coefficients for each independent variable, indicating their association strength and direction of depression. Odds ratios were calculated to quantify the likelihood of depression associated with each predictor variable. The analysis provided valuable insights into significant predictors of depression among study participants.

## Results

The sociodemographic and clinical characteristics of the participants are listed in [Table 1](#). A total of three hundred participants were included in the study (53,6%) with a mean age of  $45 \pm 16$  years and range from 18 to 96 years. The majority of participants were female (65.3%) and 53.7% were married or in stable relationships. Regarding the level of education, 9% did not any formal education, 44% had a primary level, 28.7% had a secondary level, and 18.7% had a tertiary level. Regarding the clinical characteristics of the participants, several factors were assessed, including the presence of chronic medical conditions, chief complaints, and patients' psychiatric and family histories, specifically focusing on whether they had received formal psychiatric treatment or had been informed of any psychiatric conditions or a family history of psychiatric disorders, inquiring about relatives who may have been diagnosed with or treated for such conditions, with the aim of assessing patients' mental health backgrounds and potential genetic predispositions to psychiatric illnesses.

The prevalence of depression among outpatients in internal medicine was found to be 45.7% (95% CI) based on the PHQ-9 cut-off score. Of the participants identified as potentially depressed, 21% had a moderate level of depression, 17% had moderately severe depression, and 8% had severe depression. The statistical model depicted in [Table 2](#) served as a prerequisite for establishing the adjusted logistic regression model of depression among medical outpatients, as illustrated in [Table 3](#). There is a statistically significant association between depression and lack of formal education (OR=4.463,  $p=0.011$ , 95% CI= [1.410; 14.127]), secondary education (OR=3.402,  $p=0.003$ , 95% CI= [1.517; 7.630]), low-income (OR=2.392,  $p=0.049$ , 95% CI= [1.003; 5.706]) and headache like chief complaint (OR=3.611,  $p=0.001$ , CI= [1.718; 7.591]).

The majority of participants in the study reported experiencing depressive symptoms, as illustrated in [Figure 2](#). The most commonly presented cited symptoms included feelings of fatigue or low energy (84.3%), difficulties with falling asleep, staying asleep, or experiencing excessive sleep (75.0%), followed by feelings of sadness, depression, or hopelessness (72.7%). Additional symptoms included challenges related to appetite, such as poor appetite or overeating

**Table I** Socio-Demographic and Clinical Characteristics of Our Study Population

Variables		With Depression	Without Depression	Frequency (n=300)	(%)
Age	19 to 29 years	31	36	67	22.3
	30 to 44 years	35	38	73	24.3
	45 to 64 years	55	65	120	40.0
	65 years and over	16	24	40	13.3
Gender	Male	42	62	104	34.7
	Female	95	101	196	65.3
Education status	Without formal education	18	9	27	9.0
	Primary	59	73	132	44.0
	Secondary	47	39	86	28.7
	Tertiary	13	42	55	18.3
Employment status	Employed	61	91	133	44.3
	Unemployed	76	72	167	55.7
Marital status	Married	69	92	161	53.7
	Widowed	30	21	51	17.0
	Divorced	8	4	12	4.0
	Single	30	46	76	25.3
Living status	Living with others	112	156	268	89.3
	Living alone	25	7	32	10.7
Income status	Low	20	11	31	10.3
	Middle	46	53	99	33.0
	High	71	99	170	56.7
Chief complaints	Abdominal pain	26	44	70	23.3
	Musculoskeletal pain	16	22	38	12.7
	Headache	42	21	63	21.0
	Goiter	7	7	14	4.7
	Cardiorespiratory Symptoms	9	11	20	6.3
	Neurological Symptoms	7	5	12	4.0
	Other Symptoms	2	4	6	2.0
	Follow-up of CMD	28	50	78	26.0
CMD	Hypertension	26	47	73	24.3
	Diabetes	11	9	20	6.7
	Hypertension and Diabetes	17	15	32	10.7
	HIV infection	4	3	7	2.3
	Epilepsy	3	3	6	2.0
	Others conditions	4	5	9	3.0
	Without chronic disease	72	81	153	51.0
	Previous Psychiatric illness	18	8	18	6.0
Past Psy. Hx	Without any previous Psy disorder	127	155	282	94.0
	Family Psychiatric illness	14	10	24	8.0
Family Psy. Hx	Without any Family Psy disorder	123	153	276	92.0

**Abbreviations:** CI, Confidence Interval; CMD, Chronic medical disease, HIV, Human immunodeficiency Virus; Hx, History; Psy, psychiatric.

(58.7%), diminished interest or pleasure in activities (55.7%), feelings of worthlessness or guilt (51.7%), psychomotor retardation or restlessness (45.7%), difficulty concentrating on tasks (42.3%), and thoughts of suicide (22.7%).

## Discussion

The present study aimed to assess the prevalence of depression among outpatients consulting the Internal Medicine Department of the University Teaching Hospital of Kigali and evaluating the effectiveness of a screening tool in identifying individuals at risk for depression. The discussion focused on the implications of the findings, the significance

**Table 2** Statistical Model of Depression in Outpatients of the Internal Medicine Department of the University Teaching Hospital of Kigali

Covariate (Reference)	Level	Odds Ratio	Std. Err.	z	P>z	95% CI
Sex (Female)	Female	1.045	0.323	1.140	0.887	[0.570; 1.916]
Age ( $\geq 65$ years)	18 to 29 years	2.908	1.864	1.660	0.096	[0.828; 10.217]
	30 to 44 years	1.602	0.830	0.910	0.363	[0.580; 4.421]
	45 to 64 years	1.099	0.485	0.210	0.831	[0.462; 2.612]
Education (tertiary)	Without education	5.489	3.411	2.740	0.006*	[1.624; 18.557]
	Primary	2.348	1.043	1.830	0.068	[0.983; 5.610]
	Secondary	3.609	1.575	2.940	0.003*	[1.535; 8.488]
Employment (Employed)	Unemployed	0.715	0.201	-1.190	0.233	[0.412; 1.241]
Marital status (Married)	Widowed	2.285	1.033	1.830	0.068	[0.942; 5.544]
	Divorced	1.776	1.322	0.770	0.440	[0.413; 7.639]
	Single	0.509	0.249	-1.380	0.167	[0.195; 1.327]
Living status (with others)	Living alone	0.694	0.332	-0.760	0.446	[0.271; 1.775]
Income (High)	Low	2.733	1.296	2.120	0.034*	[1.079; 6.923]
	Middle	1.184	0.357	0.560	0.575	[0.656; 2.137]
Chief complaints (follow-up of CMD)	Abdominal pain	1.303	0.607	0.570	0.570	[0.523; 3.246]
	Musculoskeletal pain	1.619	0.856	0.910	0.362	[0.574; 4.563]
	Headache	3.594	1.653	2.780	0.005*	[1.459; 8.854]
	Goiter	2.948	2.108	1.510	0.130	[0.726; 11.969]
	Cardiorespiratory Sx	2.025	1.288	1.110	0.267	[0.582; 7.044]
	Neurological Sx	4.471	4.767	1.400	0.160	[0.553; 36.138]
	Other Sx	1.415	1.431	0.340	0.731	[0.195; 10.274]
CMD (without chronic disease)	Hypertension	0.720	0.301	-0.790	0.432	[0.317; 1.635]
	Diabetes	2.346	1.490	1.340	0.179	[0.676; 8.145]
	HTN and Diabetes	1.602	0.900	0.840	0.401	[0.533; 4.819]
	HIV infection	0.743	0.717	-0.310	0.758	[0.112; 4.927]
	Epilepsy	0.552	0.769	-0.430	0.669	[0.036; 8.464]
	Others conditions	0.617	0.518	-0.570	0.565	[0.119; 3.201]
Past Psy Hx (none)	Previous Psy illness	1.829	1.035	1.070	0.286	[0.603; 5.547]
Family Psy Hx (none)	Family Psy illness	1.950	0.974	1.340	0.181	[0.733; 5.188]

**Note:** \*significant association at P value < 0.05.

**Abbreviations:** CI, Confidence Interval; CMD, Chronic medical disease; HIV, Human immunodeficiency Virus; Hx, History; Psy, psychiatric; Sx, Symptoms.

of depression screening in an internal medicine department, and potential interventions to enhance detection and treatment. Referring to a study done in 2008 by Munyandamutsa et al<sup>34</sup> where it was reported that 22.7% of the general population of our country had major depression; the present study revealed a high prevalence of depression among the outpatients visiting the Internal Medicine Department. The prevalence rate of 45.7% highlights the substantial burden of depression within this study population ranging from moderate to severe forms. The finding was comparable to the systematic review and meta-analysis done by Wang et al, where the rate of depression in different medical specialties varied between 17.0% and 53.0% in developing countries.<sup>35</sup> They found that the highest prevalence rates occurred in studies of outpatients from the otolaryngology department (53.0%), followed by the dermatology department (39.0%), and the neurology department (35.0%).<sup>35</sup> Furthermore, the prevalence found in our study is much higher than the global prevalence of depression reported by the WHO reported by the WHO of 4.4%.<sup>2</sup> Differences in prevalence rates between studies may be due to differences in demographic and clinical characteristics of the populations studied, which may differ between clinical and general populations. Other possible sources of difference could be attributed to the use of different tools for screening for depression as well as to socio-cultural differences.

It is particularly important to note that 22.7% of patients had suicidal ideation, this rate might be explained by the depression and hopelessness that are associated with the risk of suicidal ideation, suicidal attempts and suicide.<sup>36</sup> In 2019, WHO estimated a suicide rate varying between 4.9 and 9.3 per 100,000 in the Rwandan population.<sup>37</sup> Muwonge et al<sup>38</sup>



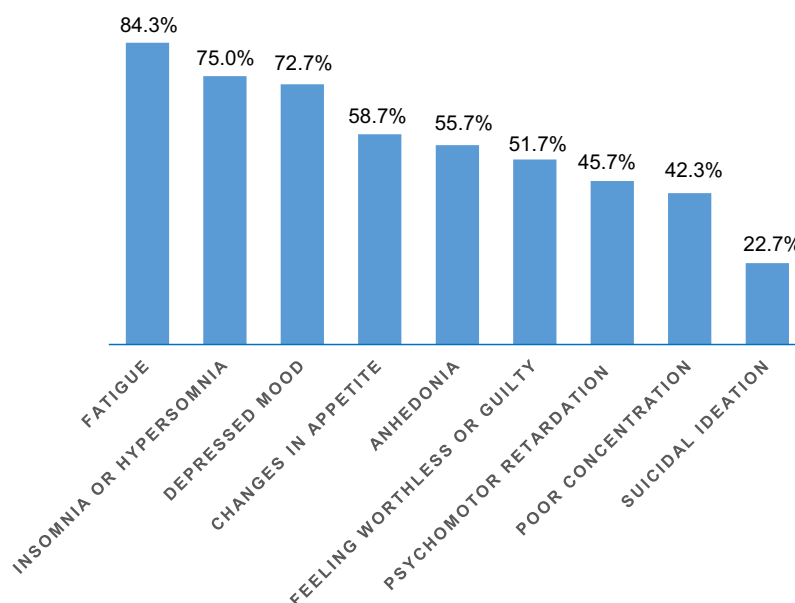
**Table 3** Adjusted Logistic Regression Model for the Depression in Outpatients of the Internal Medicine Department of the University Teaching Hospital of Kigali

Covariate (Reference)	Level	Odds Ratio	Std. Err.	z	P>z	95% CI
Education (Tertiary)	Without education	4.463	2.624	2.540	0.011*	[1.410; 14.127]
	Primary	2.057	0.857	1.730	0.083	[0.909; 4.653]
	Secondary	3.402	1.402	2.970	0.003*	[1.517; 7.630]
Marital status (married)	Widowed	1.573	0.568	1.260	0.209	[0.775; 3.191]
	Divorced	1.947	1.386	0.940	0.349	[0.483; 7.856]
	Single	0.844	0.290	-0.490	0.621	[0.430; 1.654]
Income (high)	Low	2.392	1.061	1.970	0.049*	[1.003; 5.706]
	Middle	1.272	0.364	0.840	0.400	[0.726; 2.229]
Chief Complaints (follow-up)	Abdominal pain	1.224	0.446	0.550	0.579	[0.599; 2.500]
	Musculoskeletal pain	1.526	0.670	0.960	0.336	[0.645; 3.610]
	Headaches	3.611	1.369	3.390	0.001*	[1.718; 7.591]
	Goiter	2.234	1.390	1.290	0.197	[0.660; 7.566]
	Cardiorespiratory Sx	1.775	0.986	1.030	0.301	[0.598; 5.270]
	Neurological Sx	3.184	2.164	1.700	0.088	[0.840; 12.062]
	Other Sx	1.276	1.211	0.260	0.797	[0.199; 8.196]

**Note:** \*significant association at P value < 0.05.

**Abbreviations:** CI, Confidence Interval; CMD, Chronic medical disease; HIV, Human immunodeficiency Virus; Hx, History; Psy, psychiatric; Sx, Symptoms.

found that 4.7% of females and 1.4% of males attempted suicide in the previous month in a study assessing suicidal behaviour in young adults aged 20–35 years in the general population of the Southern Province of Rwanda. Adjusted logistic regression has shown a statistically significant association between depression and lack of formal education (OR=4.463,  $p=0.011$ , 95% CI= [1.410; 14.127]) or secondary education (OR=3.402,  $p=0.003$ , 95% CI= [1.517; 7.630]). This association could be attributed to the lower utilization of mental health services in Rwanda and stigma.<sup>3</sup> at the same time low-income was found to be the risk factor for depression (OR=2.392,  $p=0.049$ , 95% CI= [1.003; 5.706]). As had been found by the previous study, high income was associated with a lower rate of depression. The causal relationship between poverty and depression was well explained by Ridley et al<sup>20</sup> where the higher income was a protective factor and it also helped people get their medication attention because they can pay the medical bills which is not the case for

**Figure 2** Most frequent depressive symptoms among study participants.

people with low income, they have always worries that affect their mental health due to inadequate housing which expose them to environmental stressors, poor nutrition resulting in biochemical imbalances.

In agreement with previous studies, headache-like chief complaint was significantly statistically associated with depression (OR=3.611,  $p=0.001$ , CI= [1.718; 7.591]), the headache and depression has been found to have an association as was evidenced by the study assessing the prevalence rate of depression as a complication or cause of headache in outpatients with a chief complaint of headache in Chinese general hospitals.<sup>39</sup>

## Strengths and Limitations of Our Study

The primary strength of this study lies in its focus on promoting the acceptability of depression screening within medical departments, aiming to reduce stigma and encourage participation among physicians and patients. Notably, this is the first study conducted in the teaching hospitals of Rwanda, potentially encouraging heightened awareness among healthcare providers and policymakers regarding the significance of addressing mental health concerns within healthcare settings, and it is important to acknowledge the limitations of our study. Firstly, the cross-sectional design limits the ability to establish causal relationships between depression and various factors. Secondly, the study was conducted at a single hospital in Rwanda, which may limit the generalizability of the findings to other settings. Thirdly, the instrument used in this study (PHQ-9) is a validated useful self-reporting instrument for screening and long-term follow-up of depression, recently it has been criticized for overestimating depression.<sup>40</sup> Future research could include a longitudinal design, involve multiple healthcare facilities, and use diagnostic tools for depression to provide a more comprehensive understanding of depression in this patient population.

## Conclusion

Our study demonstrated a high prevalence of depression among medical outpatients visiting the Internal Medicine Department. Addressing this issue requires a multifaceted approach, including increased awareness and integrated depression screening for patients with various risk factors. The promotion of education should help people gain knowledge about their mental health. Attention should also be paid to patients with headaches like complaints, as they might be manifested as cause or complication of depression. Additionally, efforts to alleviate poverty and its associated stressors into the mental health strategies. This study highlights the importance of screening in promoting early detection and intervention to improve the overall well-being of medical patients.

## Abbreviations

CHUK, University Teaching Hospital of Kigali; CI, Confidence Interval; CMD, Chronic medical disease; CMHS, College of Medicine and Health Sciences; HIV, Human Immunodeficiency Virus; Hx, History; IRB, Institutional Review Board; OPD, outpatient department; PHQ-9, Patient Health Questionnaire – 9; Psy, psychiatric; Sx, Symptoms; WHO, World Health Organization.

## Data Sharing Statement

All data generated or analyzed during this study are included in this published article and its [Supplementary Information Files](#).

## Ethics Approval and Informed Consent

The study was approved by the institutional review board (IRB) of the University of Rwanda College of Medicine and Health Sciences (IRB Notice N° 352/CMHS IRB/2019) and the Ethics Committee (EC) of CHUK (EC notice N° EC/CHUK/157/2019). All participants were informed about the purpose of the study and gave a written informed consent form before participating in the study. This study was carried out in accordance with Rwandan national regulations and the Helsinki Declaration.

## Acknowledgments

We would like to express our deepest appreciation for administrative support from the different staff of the University of Rwanda, School of Medicine and Pharmacy, and staff of the University Teaching Hospital of Kigali.



## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

## Funding

This study has not received any funds.

## Disclosure

The authors declare that they have no competing interests in this work.

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