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ORIGINAL RESEARCH

Varying Psychological Stress Among Rwandan Patients with Chronic Diseases

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Background: While psychological stress cannot be dissociated from chronic diseases, the extent to which it impacts the management of chronic diseases is poorly understood. This cross-sectional study investigated the prevalence and impact of psychological stress among Rwandan patients with chronic diseases, particularly hypertension, heart failure, malignancies, diabetes, and kidney failure.

Methods: This cross-sectional study was conducted among internal medicine patients receiving treatment for chronic diseases at the University Teaching Hospital of Kigali (n = 81) and the University Teaching Hospital of Butare (CHUB) (n = 78) between May 1 and June 30, 2024.

Results: There was a very high prevalence of psychological stress (91.8%) among Rwandan patients with various forms of chronic diseases. Despite the regular monitoring of their disease progression by their healthcare providers (92.4%) and compliance with their medication (89.9%) and dietary (89.3%) regimens, many of them still experienced frequent complications (96.8%) and worsening outcomes (95.5%), though there was an improvement in symptoms (94.3%). Furthermore, there was a weak relationship *($r = 0.210$, $\rho = 0.000$)* between the severity of psychological stress experienced by patients with chronic diseases and their treatment outcomes. Finally, patients with heart failure ($p<0.001$), hypertension ($p<0.001$), diabetes ($p<0.001$), and malignancies ($p<0.001$) experienced higher levels of psychological stress.

Conclusion: Hypertension, heart failure, malignancies, and diabetes, but not kidney failure, predict psychological stress among Rwandan patients.

Keywords: diabetes, heart failure, hypertension, kidney failure, malignancy, psychological stress

Introduction

Psychological stress, manifested through perceived stress, anxiety, depression, post-traumatic stress disorder (PTSD), and obsessive-compulsive disorder, has emerged as a pivotal factor influencing the management and prognosis of chronic illnesses.[1] People with chronic illnesses have a higher chance of developing psychological stress than the general population.[2,3] Moreover, the global burden of chronic diseases is exacerbated by the pervasive presence of psychological stressors. In Sub-Saharan Africa, where healthcare resources are often scarce, the confluence of chronic diseases and psychological stress presents formidable challenges. Limited healthcare infrastructure, inadequate access to essential medications, and socio-economic disparities compound the impact of chronic diseases in Sub-Saharan Africa.[4] Chronic stress not only compromises individuals' mental well-being but also causes physiological dysregulation, like inflammation and oxidative stress. These biological mechanisms have been implicated in the pathogenesis and progression of various chronic diseases, such as cancer, diabetes, and cardiovascular ailments.[5]

Most of the currently used procedures for diagnosing various medical conditions in the healthcare system are based on the biomedical model, which relies on bodily concepts such as the pathophysiology of diseases and derangements of

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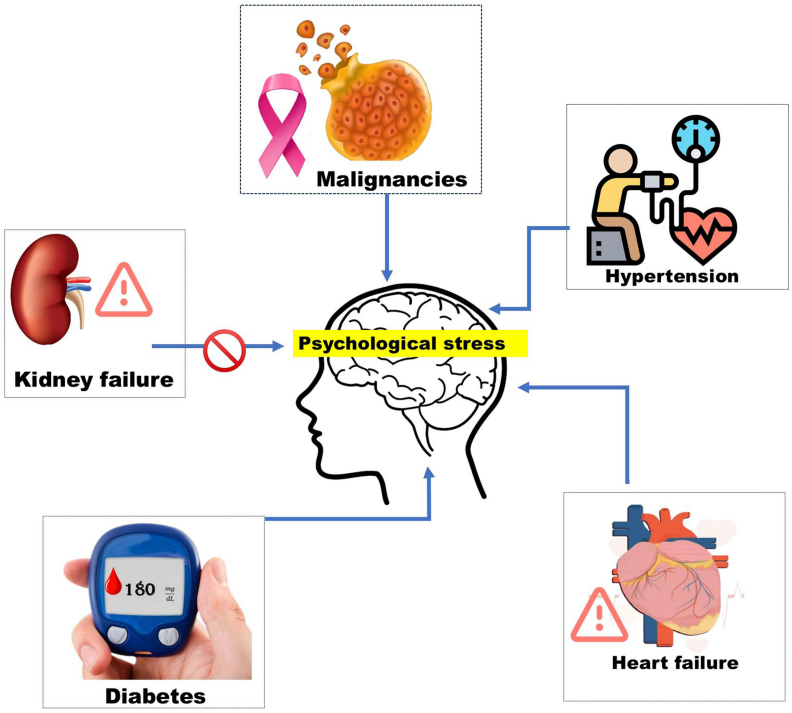
Graphical Abstract



organ-system functions.[6] This model has been criticized for regarding patients as disease-based objects, ignoring the importance of subjective patients' experiences in clinical care. However, the biopsychosocial model that assumes that the disease outcomes are attributed to the intricate blend of biological, psychological, and social factors is now believed to be an ideal representation of science and humanism in medical practice, even though it is hard to implement in clinical practice.[7] It accommodates social contexts in the understanding of the aetiology of diseases. The biopsychosocial model faces criticism because its application needs a thorough evaluation of the behavioural, psychological, sociocultural, and spiritual dimensions of patients' problems, which requires huge efforts of the healthcare providers who are already overburdened with clinical, administrative, and possibly research tasks. It is believed that diseases demonstrating structural changes in tissues and organs will benefit more from the biomedical approach, while those without known pathological changes may be suitable for the biopsychosocial approach.[8] The relevance of the biopsychosocial model is well appreciated when considering the comorbidity of chronic diseases and psychological stress from the context of the diathesis–stress model, which explains the emergence of psychological disorders from an interaction between an individual's inherent vulnerability (diathesis) and the individual's experience of stressful events. Based on this model, the greater an individual's vulnerability to a disorder, the smaller the amount of stress needed to trigger the development of the disorder.[9]

Data from the World Health Organisation (WHO) revealed that in 2019, NCDs accounted for 51% of all deaths in Rwanda, including cardiovascular diseases (17%), cancers (9%), chronic respiratory diseases (3%), diabetes (3%), and other NCDs (18%). During that period, the probability of premature mortality from NCDs was 20%, the percentage of NCD deaths occurring under 70 years was 63%, and the NCD age-standardized death rate was 615 per 100,000 population.[10] A recent countrywide study among 19,110 Rwandan population showed the prevalence of mental disorders to be 23.2% in women and 16.6% in men, and the prevalent mental disorders were major depressive episode (12.0%), panic disorder (8.1%), and PTSD (3.6%). Specifically, among the 1271 survivors of the 1994 genocide in Rwanda, the prevalence of any mental disorder was 53.3% for women and 48.8% for men, and the most prevalent disorders were

major depressive episode (35.0%), PTSD (27.9%), and panic disorder (26.8%).[11] While psychological stress cannot be dissociated from chronic diseases, the extent to which such stress impacts the management of chronic diseases is not well understood. Through an examination of the prevalence of psychological stress among individuals with chronic diseases, this research sought to establish the impact of psychological stress on the treatment outcomes among patients with chronic diseases in Rwanda, which could reveal insights about the appropriate interventions and support for the patients. In this Rwandan study, we reported the prevalence of psychological stress among patients with chronic diseases, the treatment outcome of chronic diseases among patients exhibiting psychological stress, and the type of chronic diseases with a high risk of psychological stress.

Methodology

Research Design

The cross-sectional study employed three research design methods. The descriptive evaluative research design was used to evaluate the effectiveness of treatment modalities in managing chronic diseases among patients with psychological stress. A descriptive correlational research design was employed to investigate the relationship between the severity of psychological stress and treatment outcomes for chronic diseases. The descriptive comparative research design was used to compare the prevalence of psychological stress among various forms of chronic diseases.

Study Setting

This study was conducted in 2024 at two tertiary hospitals in Rwanda. They were selected due to their significance in providing healthcare services to a diverse patient population in Rwanda, covering different catchment areas.

Study Population and Sampling Techniques

All internal medicine patients receiving treatment for chronic diseases at the University Teaching Hospital of Kigali (CHUK) and the University Teaching Hospital of Butare (CHUB) between 1st May and 30th June 2024, particularly those with hypertension, heart failure, malignancies, diabetes, and kidney failure, were invited to participate in the study. To ensure that the sample represents the population and responds to the geographical diversity, a stratified random sampling technique was employed. Two strata-specific "fishbowls" were created, one for each hospital. In each fishbowl, 81 patients from CHUK and 78 patients from CHUB were randomly selected, ensuring consistency and fairness across the strata. This approach yielded a total sample size of 159 patients, chosen based on Slovin's formula.[12] Adult patients who were recently diagnosed with hypertension, heart failure, malignancies, diabetes, and kidney failure were included in the study. Patients who were less than 18 years old, had advanced cases of chronic diseases, had underlying psychiatric illnesses, and/or refused to consent were excluded from the study.

Instrumentation and Data Collection

Before administering the questionnaire, a content validation process was conducted to ensure clarity, adequacy of items for data collection, alignment with study objectives, lack of bias, and relevance. Seven experts and two laymen participated in the content validation process. The expert panel included a statistician, a methodologist, four medical doctors, and one public health specialist, while two laymen provided additional perspectives. Suggestions and corrections from these experts were carefully considered when formulating the final questionnaire. Furthermore, a pilot test of the questionnaire was conducted among 20 patients from an unselected pool. The data collection primarily involved a face-to-face survey (with an online option for a few patients who could not attend the in-person session) to capture quantitative data on the prevalence of psychological stress and qualitative insights into the experiences and perceptions of patients regarding their psychological well-being and chronic disease management. The survey questionnaire comprised four self-constructed sections, with 12 questions in section 1 and 14 questions each in sections 2–4.

The first section extracted valuable insights from the patients about their perceptions and experiences of their treatment outcomes, focusing on disease progression, management adherence, and quality of life (QoL). A true or false test was administered to gauge the patient's understanding of disease progression, adherence to treatment regimens,

and the impact of their condition on their overall QoL. Each correct response (true) was assigned a score of 1 point, while an incorrect response (false) received a score of 0 points. The composite score was calculated by tallying the frequency of correct answers and computing the percentage. The descriptive interpretation of scores was categorized as follows: Very Low (0–64, 0–25%); Low (65–95, 26–50%); High (96 −127, 51–75%); and Very High (128–159, 76–100%).

The second section delved into the medical history, diagnosis, and current management strategies for chronic diseases. The third section explored the patients' perception of the common contributing factors to psychological stress among patients with chronic diseases, where patients were asked to identify and rate various factors that they believed contributed to their psychological stress. The last section assessed the level of psychological stress among patients with chronic diseases, where the patients were asked to self-report their levels of psychological stress and indicate the specific stressors or challenges they faced. In sections 2–4, each was scored on a 4-point Likert scale: 1 - Very Low (Strongly Disagree with a mean interval score of 0.5–1.5); 2 - Low (Disagree with a mean interval score of 1.51–2.5); 3 - High (Agree with a mean interval score of 2.51–3.5), and 4 – Very High (Strongly Agree with a mean interval score of 3.51–4.0). Assessment of psychological stress was done by a subjective method, which measures the individuals' perception of how stressful they regard their general life.[13]

Informed Consent and Ethical Approval

The participating patients provided informed consent and knew that their responses would be published as an undergraduate dissertation and an article in a peer-reviewed journal. The study protocol got ethical approval from the ethics committee of the University of Rwanda College of Medicine and Health Sciences, CHUK, and CHUB. Furthermore, the study complies with the Declaration of Helsinki.

Data Analysis

The data were analysed using the Statistical Package for Social Sciences (SPSS) version 21.0. Frequency and percentage distributions were calculated to determine the prevalence rate of psychological stress among patients with chronic diseases. Pearson's product-moment correlation coefficient was used to examine the relationship between variables, particularly exploring the correlation between the severity of psychological stress and treatment outcomes among patients with chronic diseases. One-way ANOVA and *t*-test were used to compare means between groups and determine whether there were significant differences in treatment outcomes among patients with chronic diseases who experienced psychological stress compared to those who did not. Regression analyses were limited to disease type as a predictor of psychological stress, since detailed sociodemographic (eg, age, sex, and income) and clinical variables (eg, disease severity and treatment duration) were not collected.

Results

Patients with Chronic Diseases Have a Very High Prevalence of Psychological Stress and Poor Treatment Outcomes

There was a very high prevalence of psychological stress (91.8%) among Rwandan patients with various forms of chronic diseases. This psychological stress was mostly in the form of being overwhelmed by the demands of managing the chronic illness (98.7%). Moreover, many patients associated the financial burden of their chronic illness with their high psychological stress (88.1%) and further expressed frustration about how their chronic illness negatively affected their mental well-being (96.8%) and daily life (94.3%), raising serious concerns about their future health (95.5%). They also had challenges in managing their emotional burdens (92.4%) and communicating their concerns to healthcare providers (93.1%), leading to discouragement and defeat (91.1%), hopelessness and difficulty in maintaining a positive outlook (89.3%), and disconnect and social isolation (81.7%). These findings highlight the multifaceted nature of psychological stress experienced by patients with chronic diseases in Rwanda, encompassing emotional, financial, and social dimensions (Table 1).

Furthermore, most patients also reported a very high understanding of the stages and progression of their chronic diseases (98.7%). Despite the regular monitoring of their disease progression by their healthcare providers (92.4%) and

Table 1 Psychological Stress Among Patients with Chronic Diseases in Rwanda (n=159)

Psychological Stress Among Patients with Chronic Diseases	Frequency of "YES" Answer	Percentage of "YES" Answer	Qualitative Descriptor
I feel overwhelmed by the demands of managing my chronic illness.	157	98.7	Very High
My chronic illness has a significant negative impact on my mental well-being.	154	96.8	Very High
I often feel anxious or worried about my future health due to my chronic condition.	152	95.5	Very High
Managing my chronic illness creates substantial stress in my daily life.	150	94.3	Very High
I struggle to communicate effectively with healthcare providers about my illness-related concerns.	148	93.1	Very High
I find it challenging to cope with the emotional burden associated with my chronic disease.	147	92.4	Very High
Despite efforts to manage my chronic illness, I often feel discouraged or defeated	145	91.1	Very High
I experienced stress related to my chronic illness.	145	91.1	Very High
My chronic illness frequently leads to feelings of hopelessness or despair.	142	89.3	Very High
I have trouble maintaining a positive outlook on life because of my chronic condition	142	89.3	Very High
The financial implications of my chronic illness contribute to my overall stress levels.	140	88.1	Very High
I often feel socially isolated or disconnected because of my chronic illness	130	81.7	Very High
Average	146	91.8	Very High

compliance with their medication (89.9%) and dietary (89.3%) regimens, many of them still experienced frequent complications (96.8%) and worsening outcomes (95.5%), though there were improvement in symptoms (94.3%) (Table 2).

The Severity of Psychological Stress is Weakly Associated with Treatment Outcomes of Chronic Diseases

Pearson correlation was used to test the relationship between the severity of psychological stress experienced by patients with chronic diseases and their treatment outcomes. We noted a weak but significantly positive relationship between the severity of psychological stress and outcome of chronic disease treatments *($r = 0.210$, $\rho = 0.000$)*. This suggests that additional factors other than the severity of psychological stress could be impacting the treatment outcomes of chronic diseases in the Rwandan population.

Table 2 Treatment Outcomes Among Patients with Chronic Diseases (N=159)

Treatment Outcomes Related to Chronic Diseases	Frequency of "YES" Answer	Percentage of "YES" Answer	Qualitative Descriptor
I understand the stages and progression of my chronic disease.	157	98.7	Very High
I have experienced frequent complications related to my chronic disease.	154	96.8	Very High
I feel that my disease is worsening despite following my treatment plan.	152	95.6	Very High
I have noticed a significant improvement in my symptoms over the last six months.	150	94.3	Very High
My healthcare provider regularly monitors my disease progression.	147	92.4	Very High
I feel that my treatment has had little to no impact on my overall health.	145	91.1	Very High
I strictly adhere to the medication regimen prescribed by my healthcare provider.	143	89.9	Very High
I follow the dietary recommendations provided to me by my healthcare provider.	142	89.3	Very High
I regularly attend follow-up appointments as scheduled.	142	89.3	Very High
Average	148	93.0	Very High

Table 3 Regression Analysis for Predictors of Psychological Stress Among Patients

Predictor	Estimate	Standard Error	T-value	*p*-value	R^2 Change
Intercept	−0.2862	0.1935	−1.48	0.140	
Heart Failure	0.3788	0.0621	6.10	<0.001	0.570
Malignancies	0.3405	0.0594	5.73	<0.001	0.617
Diabetes	0.2363	0.0495	4.77	<0.001	0.637
Hypertension	0.0580	0.0158	3.68	<0.001	0.653

Prediction of Psychological Stress Among Chronic Disease Patients

Regression analysis demonstrated that heart failure, malignancies, diabetes, and hypertension were significant predictors of psychological stress ($p<0.001$). Analyses were restricted to disease type due to the available data (Table 3).

Discussion

The extent to which psychological stress impacts the management of chronic diseases among Rwandan patients is not well understood. In this study, we reported the prevalence of psychological stress among patients with chronic diseases, the treatment outcome of chronic diseases among patients exhibiting psychological stress, and the type of chronic diseases with a high risk of psychological stress. This study provides three key information. Firstly, there is a very high prevalence of psychological stress among chronic disease patients in Rwanda, leading to poor treatment outcomes. Secondly, the severity of psychological stress is weakly associated with treatment outcomes of chronic diseases in Rwanda. Finally, hypertension, heart failure, malignancies, and diabetes, but not kidney failure, predict psychological stress among Rwandan patients. However, we were unable to adjust for potential confounders such as age, sex, income, and disease severity, since these were not collected in the present study. Consequently, our regression model may not fully capture the independent contribution of disease type to psychological stress.

A study in Ethiopia reported that the prevalence of psychological stress among patients (62%) with chronic diseases surpasses that seen in the general population.[14] Another study in Ghana noted an elevated level of psychological stress among chronic kidney disease patients undergoing haemodialysis.[15] In South Africa, 89% of patients with chronic diseases experienced psychological stress.[16] Similarly, in Rwanda, varying levels of psychological stress have been reported among patients with chronic diseases,[17] which was further exacerbated by the COVID-19 pandemic.[14,18] The same observation has been made in the non-African population in India,[19] Greece,[20] and China.[21,22] Factors like marital status, family history of chronic illness, low social support, rural residence, co-infection with HIV, stigma, presence of other chronic diseases, and smoking have been associated with psychological stress among patients with chronic diseases in some African countries.[14,23] Furthermore, age,[14] gender,[24] and socio-economic status[14] have been shown to affect psychological stress among patients with chronic diseases. Consistent with these findings, we also observed that 91.8% of patients with chronic diseases, including hypertension, heart failure, diabetes, malignancies, and kidney failure, have psychological stress in Rwanda. Our data show that the psychological stress among Rwandans with chronic diseases was multifaceted, such as being overwhelmed by the demands of managing the chronic illness and the financial burden of their chronic illness, among others.

It is known that chronic diseases can cause various forms of psychological stress and vice versa.[25,26] We investigated whether the severity of psychological stress determines the treatment outcomes of chronic diseases among the Rwandan population. We noted that the comorbidity of psychological stress and chronic diseases among the patients leads to frequent complications and worsening treatment outcomes, albeit with improved symptoms. Despite the regular monitoring of their disease progression by their healthcare providers and patient compliance with their medication and dietary regimen, many of them still experienced frequent complications and worsening outcomes. Our finding agrees with Zhang et al[27] who demonstrated the detrimental effect of psychological stress on the treatment outcomes of chronic diseases among the Chinese population. It is also consistent with previous reports that psychological stress harms the disease progression,[28] management adherence,[29] the QoL,[30] and treatment outcomes[14] of patients with chronic diseases.

Interestingly, a review study showed that the comorbidity of depression with other chronic diseases consistently worsens health compared with depression alone, with any of the chronic diseases alone, and with any combination of chronic diseases without depression.[31] However, there was a weak, albeit significantly positive, relationship between the severity of psychological stress and treatment outcomes of chronic diseases among the patients. Simply put, this means that as psychological stress increases, the treatment outcomes become adversely affected. Notwithstanding, this weak relationship suggests that additional factors other than the severity of psychological stress could impact the treatment outcomes of chronic diseases in the Rwandan population.

Findings on the relationship between psychological stress and chronic diseases have been inconsistent. Some reported that chronic stress positively correlates with chronic diseases,[30–35] including ischaemic heart disease,[36] diabetes,[37] obesity,[38,39] and other metabolic syndromes.[40] Suffering from a chronic disease is a stressful factor in itself that influences individual psychological well-being.[41,42] Where this interconnection exists, psychotherapeutic interventions as an essential part of chronic disease treatment have been suggested since they are effective in reducing symptoms of psychological distress that may affect the progression of and mortality from chronic diseases.[43–45] On the contrary, other researchers reported that there is no correlation between various forms of psychological stress and the development or progression of some chronic diseases.[46–48] In this study, we noted that psychological stress is significantly associated with heart failure, hypertension, diabetes, and malignancies, as patients with these diseases reported a higher incidence of psychological stress. Interestingly, kidney failure did not emerge as a significant predictor of stress in our regression model. However, we could not stratify patients by treatment duration or dialysis status, variables that may influence psychological stress in this population. The lack of these data may partly explain the absence of association in our findings.

Physiologically, disturbing stimuli are sensed and responded to by the cortical centres by activating pathways that stimulate peripheral networks through the limbic system, including the sympathetic-adrenal-medullary axis and the renin-angiotensin system, followed later by the hypothalamic-pituitary-adrenal (HPA) axis.[49] Most body tissues and organs express glucocorticoid receptors and respond to the glucocorticoids induced by stress, which regulate stress-associated processes like modulation of cardiovascular and immune functions and dampening of the stress response by inhibition of the HPA axis when adaptation is attained.[50] Chronic stress arises when the stressor is overwhelmed and cannot be resolved, and glucocorticoid-dependent negative feedback that controls the stress response does not work due to glucocorticoid receptor resistance, leading to elevated levels of molecular stress mediators, a compromised immune system, and long-term damage to multiple tissues and organs.[51] Psychological stress increases the levels of circulating cytokines and various biomarkers of inflammation,[49] as it is perceived by the brain as "danger" and elicits neuroimmune circuits to prevent or repair the damage and restore homeostasis.[52] Thus, psychological stress promotes inflammation, oxidative and nitrosative stress, and decreases immunosurveillance, in addition to its potential to cause dysfunctional activation of the autonomic nervous system and the HPA axis.[53,54] Furthermore, stress induces adrenaline release, which downregulates chemokine CXCL12 in the mesenchymal stem cells, thereby causing cell division and leukocyte mobilisation into the bloodstream.[55] These have adverse effects on the progression and recovery from chronic diseases like hypertension, atherosclerosis, diabetes, heart failure, malignancies, and kidney failure, among others.[50]

Conclusions

In conclusion, this study shows a high prevalence of psychological stress among patients with chronic diseases in Rwanda. It also shows that psychological stress is apparent among patients with hypertension, heart failure, malignancies, and diabetes, but not kidney failure. This study has some limitations. First, we did not collect detailed socio-demographic and clinical variables such as income, disease severity, or treatment duration, which limited our ability to perform multivariate regression analyses controlling for these factors. Future research should include such variables to provide a more robust assessment of predictors of psychological stress among patients with chronic diseases. Second, we did not collect treatment-specific data (eg, dialysis status, duration of illness), which limited our ability to perform subgroup analyses in the kidney failure population. Third, the patients were only those referred to CHUK and CHUB hospitals, which may not fully represent the broader population of individuals with chronic diseases in Rwanda. Fourth, the duration of the study is short, thereby necessitating a longitudinal study in the future. Despite these limitations, the

study has a strength in enriching our understanding of the relationship between psychological stress and chronic diseases in Rwanda. Thus, a country-wide longitudinal study assessing the prevalence and impact of psychological stress among Rwandan patients with chronic diseases within Rwanda's broader healthcare system, including private hospitals, is worth conducting in the future. Moreover, there is a need to develop a validated and Rwanda-compliant stress assessment tool to assess the progression of psychological stress among chronic disease patients by controlling for the prevalent genocide-induced psychological disorders. Based on the study's findings, policymakers and healthcare providers are advised to adopt a multifaceted approach to healthcare delivery that addresses physical, psychological, socioeconomic, and educational aspects to reduce the high levels of psychological stress among patients with chronic diseases in Rwanda. Some of these should include integrating mental health services into routine chronic disease management protocols, developing tailored patient education programs that focus on stress management techniques, providing training programs for healthcare providers to improve communication skills, and empowering patients to actively participate in their treatment plan, among others. If adopted, an interventional trial that will subsequently assess the impact of the multifaceted healthcare delivery approach on the psychological stress among chronic disease patients will be useful in the future.

Data Sharing Statement

The corresponding author would provide information about the raw data for this study upon a reasonable request.

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, or interpretation. They also participated in the drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article had been submitted; and agreed to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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