



## REVIEW ARTICLE

# COPING WITH CANCER OF THE LUNG: PSYCHOLOGICAL ADAPTATION AND RESILIENCE PATHWAYS

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### Abstract

Lung cancer poses not just serious physical obstacles but also considerable emotional suffering, affecting patients' mental well-being and overall quality of life. The diagnosis frequently provokes strong emotional responses such as fear, anxiety, and sorrow, further intensified by stigma and changes to identity. Psychological adjustment the manner in which individuals emotionally and cognitively adapt to the truths of their condition is essential for effective coping. Resilience, which is the capacity to sustain or recover psychological health in the face of challenges, is crucial for promoting positive adaptation to lung cancer. This review compiles existing insights on the coping mechanisms and resilience approaches used by lung cancer patients. Adaptive coping strategies like cognitive reframing, solving problems, and obtaining social support assist in reducing distress and enhancing emotional regulation. Factors that protect, such as robust social connections, spirituality, and previous coping experiences, enhance resilience. Therapeutic approaches, particularly cognitive-behavioral therapy, mindfulness-based stress reduction, and meaning centered psychotherapy, additionally boost patients' ability to handle psychological difficulties and maintain hope. Healthcare professionals play a crucial role in promoting psychological adjustment and resilience through compassionate communication, regular mental health assessments, and coordinated psychosocial assistance

**Keywords:** Lung cancer, coping strategies, psychological adaptation, psycho-oncology, resilience.

## INTRODUCTION

Lung cancer is still one of the most widespread and lethal cancers worldwide, with approximately 2 million new cases and over 1.7 million fatalities each year<sup>1,2</sup>. Despite improvements in diagnosis and treatments, the prognosis for lung cancer often remains bleak, creating considerable physical and emotional challenges for patients<sup>3,4</sup>. Receiving a diagnosis typically initiates a difficult journey filled with complicated medical choices, severe symptoms, and significant psychological strain<sup>5,6</sup>. This psychological strain is a vital, yet frequently over-looked, facet of lung cancer treatment that greatly affects patients' quality of life and their treatment results<sup>7</sup>. Adjusting psychologically to lung cancer is a complex process where patients attempt to accept their diagnosis and its consequences for their futures<sup>8</sup>. This includes coping with powerful emotions like fear, anxiety, depression, and sorrow, as well as adapting to the physical restrictions and changed social roles brought about by the disease<sup>9,10</sup>. Patients

with lung cancer frequently face distinct stressors, such as a high risk of mortality and social stigma associated with the disease's strong connection to smoking<sup>11</sup>. These elements can undermine patients' sense of identity and hinder their capacity to preserve a coherent self-image, making psychological adaptation even more challenging<sup>12,13</sup>.

The stigma linked to lung cancer intensifies psychological distress by provoking emotions of shame, self-blame, and social withdrawal. Patients often absorb negative societal views that hold them responsible for their condition, particularly if they smoked in the past. This self-stigmatization not only heightens emotional pain but also hinders the pursuit of psychosocial support, obstructing effective coping<sup>14-17</sup>. Tackling this stigma is vital for enhancing mental health results and encouraging adaptive coping mechanisms. Resilience the ability to sustain or recover psychological well-being amidst challenges is becoming increasingly acknowledged as an essential element in managing lung cancer<sup>18,19</sup>. It allows patients to handle the emotional distress of

diagnosis, treatment, and disease advancement while maintaining hope and purpose in their lives.<sup>20</sup> Factors like social support, spirituality, and adaptive coping strategies foster resilience<sup>19</sup>. Additionally, psychological approaches designed to boost resilience have proven effective in alleviating distress and enhancing life quality<sup>21</sup>.

Coping strategies in lung cancer patients vary widely, ranging from problem-focused efforts to manage symptoms and treatment to emotion-focused approaches that regulate distress and promote acceptance. Adaptive coping strategies, such as seeking information, engaging in social support, and cognitive reframing, have been linked to better psychological adjustment<sup>22-24</sup>. Conversely, maladaptive strategies like avoidance and denial often lead to poorer mental health outcomes<sup>25</sup>. Healthcare providers play a pivotal role in supporting patients' psychological adaptation and resilience. Effective communication, early identification of distress, and integrated psychosocial care are key elements in fostering mental well-being<sup>26,27</sup>. Multidisciplinary care models that incorporate psycho-oncology services alongside medical treatment improve emotional outcomes and patient satisfaction<sup>28,29</sup>.

This narrative review aims to explore the psychological adaptation processes and resilience pathways in individuals diagnosed with lung cancer. It seeks to examine the coping strategies employed by patients, identify protective factors that foster resilience, and evaluate the role of healthcare interventions in supporting mental well-being. The review intends to provide insights that can inform comprehensive psycho-oncology care and improve psychological outcomes for lung cancer patients.

### Psychological adaptation in lung cancer

Psychological adaptation refers to the ongoing process through which lung cancer patients adjust to

the emotional, cognitive, and social challenges posed by their diagnosis and treatment<sup>30,31</sup>. The diagnosis of lung cancer often triggers a profound emotional response, characterized by shock, fear, anxiety, depression, and grief.<sup>32</sup> These initial reactions reflect the existential threat posed by the disease, as well as uncertainty about prognosis and treatment outcomes. Patients must grapple not only with physical symptoms but also with the psychological impact of facing a potentially life-threatening illness<sup>33</sup>. As patients move through the cancer trajectory, adaptation involves finding ways to manage distress and integrate the illness experience into their sense of self<sup>34</sup>. This process can include acceptance of the diagnosis, emotional regulation, and the development of coping strategies that facilitate adjustment<sup>34,35</sup>. Effective psychological adaptation enables patients to maintain hope, engage actively with treatment, and preserve their quality of life despite adversity. Conversely, maladaptive responses such as denial, avoidance, or excessive rumination may exacerbate psychological distress and interfere with medical adherence and social functioning<sup>36</sup>.

Several factors influence the course of psychological adaptation in lung cancer. The severity of symptoms, stage of disease, and treatment side effects can affect patients' emotional resilience<sup>37</sup>. Social determinants, including access to support networks and healthcare resources, also play critical roles<sup>38</sup>. Furthermore, individual psychological traits such as optimism, self-efficacy, and prior coping history shape how patients respond to their diagnosis<sup>39,40</sup>. Healthcare providers can support adaptation by fostering open communication, validating patients' emotions, and offering targeted psychosocial interventions aimed at building adaptive coping skills and enhancing emotional well-being (Table 1).

**Table 1: Psychological adaptation in lung cancer.**

Theme	Common psychological responses	Illustrative findings/notes
Initial Emotional Reactions	Shock, denial, fear, anxiety	Many patients experience acute distress immediately following diagnosis; fear of mortality is prevalent
Identity Disruption	Loss of self, altered roles, diminished self-esteem	Lung cancer challenges personal identity, especially with physical limitations and social stigma
Stigma and Self-Blame	Shame, guilt, social withdrawal	Associated with smoking-related stigma, leading to internalized blame and isolation
Coping Strategies	Problem-focused, emotion-focused, avoidance	Adaptive coping linked to better psychological outcomes; avoidance can prolong distress
Resilience Factors	Hope, meaning-making, social support	Protective factors that promote psychological adjustment and quality of life
Psychological Symptoms	Depression, anxiety, distress	High prevalence among lung cancer patients, often underdiagnosed and undertreated
Impact of Physical Symptoms	Fatigue, pain, dyspnea contributing to distress	Symptom burden exacerbates emotional challenges, complicating adaptation
Role of Social Support	Emotional, instrumental support from family/friends	Strong social networks correlate with better psychological well-being and treatment adherence
Influence of Healthcare Providers	Communication style, empathy, psychosocial support	Positive provider interactions improve coping and patient satisfaction
Effect of Psychosocial Interventions	CBT, mindfulness, support groups	Evidence-based interventions reduce distress and enhance coping

### Resilience pathways and protective factors

Resilience in lung cancer patients refers to their capacity to maintain or regain psychological well-being despite the substantial physical and emotional challenges posed by the disease<sup>41</sup>. This dynamic process enables patients to adapt positively to adversity, reducing the impact of distress and enhancing quality of life. Resilience is not a fixed trait but rather a multifaceted construct influenced by individual characteristics, social contexts, and external support systems<sup>18</sup>. A key pathway to resilience involves social support, which acts as a crucial buffer against the isolating effects of lung cancer<sup>42</sup>. Family members, friends, support groups, and healthcare providers offer emotional comfort, practical assistance, and a sense of belonging, helping patients navigate the uncertainties of their illness<sup>43</sup>. Social connectedness fosters hope and reinforces patients' sense of identity and purpose, which are often threatened by the disease. Peer support groups, in particular, provide a unique platform for sharing experiences, normalizing feelings, and learning coping skills from others facing similar challenges. Spirituality and meaning-making also play important roles in fostering resilience<sup>44,45</sup>. Many lung cancer patients draw on spiritual beliefs or personal values to find meaning in their illness experience, which can mitigate existential distress and promote acceptance<sup>6</sup>. This process of meaning-making helps patients reframe their cancer journey as part of a larger life narrative, enhancing psychological flexibility and emotional regulation. Therapeutic interventions such as meaning-centered psychotherapy and mindfulness-based approaches have been shown to strengthen this pathway, equipping patients with skills to manage suffering and foster hope<sup>47</sup>. Individual psychological factors such as optimism, cognitive flexibility, and prior coping experiences contribute to resilience by enabling patients to respond adaptively to stressors<sup>48,49</sup>. Optimism supports positive expectations for the future and motivates engagement with treatment and self-care. Cognitive flexibility allows patients to adjust their thoughts and attitudes in response to changing circumstances, facilitating acceptance and emotional balance<sup>50,51</sup>. Importantly, resilience is cultivated through learning and practice, meaning that psychological interventions can enhance these adaptive capacities even in the face of severe illness.

### Role of healthcare providers

Healthcare providers play a pivotal role in supporting lung cancer patients' psychological adaptation and resilience throughout the illness trajectory<sup>52</sup>. Given the complex emotional and cognitive challenges associated with lung cancer diagnosis and treatment, providers must go beyond the traditional biomedical model to address patients' psychosocial needs comprehensively. Empathic communication is foundational, allowing patients to feel heard, validated, and supported in expressing fears, concerns, and uncertainties<sup>53,54</sup>. Early identification and routine screening for psychological distress are essential components of quality cancer care. Tools

such as the Distress Thermometer or Hospital Anxiety and Depression Scale (HADS) can help clinicians detect anxiety, depression, and other mental health issues that may otherwise go unrecognized<sup>55</sup>. Prompt referral to psycho-oncology specialists or mental health professionals ensures timely intervention, which can mitigate symptom severity and improve patients' coping capacity.

Multidisciplinary care models that integrate psychosocial support with medical treatment have been shown to enhance patient outcomes<sup>56-58</sup>. Psycho-oncologists, social workers, nurses, and counselors collaborate to provide tailored interventions including cognitive-behavioral therapy, mindfulness training, and supportive counseling<sup>59,60</sup>. Educating healthcare teams to recognize signs of maladaptive coping, stigma-related distress, and identity disruption further enhances care quality. Ultimately, a holistic approach that addresses the physical, emotional, and social dimensions of lung cancer fosters resilience, promotes treatment adherence, and improves overall quality of life<sup>61</sup>.

### The impact of lung cancer symptoms on psychological well-being

Lung cancer patients frequently endure a constellation of debilitating physical symptoms that exert a profound influence on their psychological well-being. Common symptoms such as persistent cough, dyspnea (shortness of breath), chest pain, fatigue, and weight loss are not only distressing in themselves but also serve as constant reminders of the severity of the disease.<sup>62</sup> These symptoms contribute significantly to emotional distress, increasing the risk of anxiety, depression, and feelings of helplessness<sup>63</sup>. For many patients, the unpredictability and chronic nature of these symptoms can lead to heightened psychological vulnerability. Dyspnea, in particular, stands out as one of the most feared and anxiety-provoking symptoms among lung cancer patients<sup>64</sup>. The sensation of breathlessness often triggers panic attacks and catastrophic thoughts about suffocation or imminent death. This fear can exacerbate respiratory difficulties, creating a feedback loop wherein anxiety intensifies dyspnea, and worsening dyspnea increases anxiety. Such symptom-driven psychological distress can impair patients' ability to engage in daily activities, reduce social interactions, and diminish overall quality of life<sup>65</sup>.

Fatigue, another pervasive symptom in lung cancer, has a multifactorial origin including disease burden, treatment side effects, and psychological factors such as depression and sleep disturbances<sup>66</sup>. Cancer-related fatigue is often described as overwhelming and unrelenting, severely limiting physical functioning and contributing to feelings of frustration and demoralization<sup>67</sup>. The cumulative effect of physical symptoms and psychological distress can lead to social withdrawal, impaired coping capacity, and decreased adherence to treatment regimens. Effective symptom management is therefore crucial not only for physical comfort but also for mitigating psychological distress. Interventions may include pharmacologic treatments such as opioids for pain

and dyspnea, corticosteroids, and non-pharmacologic approaches including pulmonary rehabilitation, breathing techniques, energy conservation strategies, and psychological therapies targeting anxiety and depression<sup>68</sup>. Comprehensive symptom assessment and integrative care models that address both physical and emotional symptoms are essential to improving patients' mental health and enhancing their capacity to cope with the challenges posed by lung cancer<sup>69</sup>.

#### **The role of social determinants in coping and resilience**

Social determinants of health including socioeconomic status, education, cultural background, and social support play a pivotal role in shaping how lung cancer patients cope with their diagnosis and build resilience<sup>70-72</sup>. Patients from lower socioeconomic backgrounds often face additional challenges such as limited access to quality healthcare, financial strain, and inadequate transportation, which can increase stress and impede timely treatment<sup>73,74</sup>. These barriers can undermine psychological well-being and hinder adaptive coping, leading to worse outcomes both physically and emotionally. Educational level also influences patients' understanding of their illness and treatment options, affecting their ability to engage actively in decision-making and self-management<sup>75</sup>. Lower health literacy can result in feelings of confusion, fear, and helplessness, thereby exacerbating psychological distress<sup>76</sup>. Conversely, patients with higher health literacy may employ more effective coping strategies and demonstrate greater resilience in managing the complexities of their illness.

Cultural beliefs and norms further shape patients' experiences of lung cancer and their coping mechanisms<sup>77</sup>. For example, in some cultures, lung cancer may carry significant stigma, particularly due to its association with smoking, leading to self-blame and social isolation<sup>78</sup>. Cultural perceptions about illness and death may influence patients' willingness to seek psychological support or discuss emotional concerns openly. Health professionals must be culturally sensitive and aware of these factors to provide tailored psychosocial care that respects patients' backgrounds and values<sup>79</sup>. Social support from family, friends, and community networks is a well-documented protective factor that buffers against psychological distress and fosters resilience<sup>80</sup>. Emotional support, practical assistance, and a sense of belonging enhance patients' capacity to cope with the multifaceted challenges of lung cancer<sup>81</sup>. Conversely, social isolation or strained relationships can increase vulnerability to depression and anxiety. Interventions aimed at strengthening social networks and community engagement can therefore significantly improve psychological adaptation and quality of life.

#### **Influence of family and caregivers on patient psychological adaptation**

Family members and caregivers are often the primary source of emotional and practical support for lung cancer patients, playing a crucial role in shaping patients' psychological adaptation to their illness<sup>82</sup>.

The diagnosis of lung cancer can trigger significant emotional upheaval not only for patients but also for their close relatives, who frequently assume care giving responsibilities<sup>83</sup>. This dyadic relationship means that caregivers' well-being and coping strategies directly influence the patient's mental health and resilience. Emotional support from family and caregivers including empathy, reassurance, and encouragement provides patients with a sense of security and belonging, which helps buffer against feelings of anxiety, depression, and isolation<sup>84</sup>. Practical assistance with daily activities, medical appointments, and treatment management further alleviates patient stress and promotes a sense of control amid the uncertainty of illness. The presence of a supportive caregiver can enhance patients' motivation to adhere to treatment regimens and engage actively in their care<sup>85</sup>.

However, care giving can be a double-edged sword. The intense physical and emotional demands placed on caregivers often lead to caregiver burden, characterized by stress, fatigue, and psychological distress<sup>86</sup>. Caregivers who struggle with their own mental health may inadvertently diminish the quality of support they provide, impacting the patient's psychological adaptation negatively<sup>87</sup>. Therefore, it is critical to assess and support caregiver well-being through counseling, respite care, and educational resources. Family dynamics and communication patterns also significantly influence psychological adaptation<sup>88</sup>. Open, honest discussions about diagnosis, prognosis, and emotional concerns foster mutual understanding and shared coping, while conflict or avoidance can exacerbate distress for all involved. Family-centered psychosocial interventions that include both patients and caregivers can improve communication, reduce emotional burden, and strengthen adaptive coping mechanisms<sup>89</sup>.

#### **Psychological interventions and therapies**

Psychological interventions play a vital role in supporting lung cancer patients as they navigate the emotional challenges posed by their diagnosis and treatment<sup>90</sup>. Given the high prevalence of anxiety, depression, and existential distress among this population, targeted therapies aim to enhance coping skills, reduce psychological symptoms, and improve overall quality of life.

##### **Cognitive-Behavioral Therapy (CBT)**

It is one of the most extensively studied approaches in oncology settings. CBT helps patients identify and modify negative thought patterns and maladaptive behaviors related to their illness, such as catastrophic thinking about symptoms or feelings of hopelessness<sup>91</sup>. By fostering more adaptive cognitive appraisals and coping mechanisms, CBT has been shown to reduce anxiety and depression, enhance emotional regulation, and improve treatment adherence<sup>92</sup>.

##### **Mindfulness-Based Interventions (MBIs)**

It has gained prominence as effective tools for managing cancer-related distress. Techniques such as mindfulness meditation, body scan, and mindful breathing cultivate present-moment awareness and



acceptance of uncomfortable thoughts and emotions<sup>93</sup>. MBIs can reduce rumination, improve stress tolerance, and alleviate symptoms of anxiety and depression, while also helping patients manage physical symptoms like pain and dyspnea.

#### **Meaning-Centered Psychotherapy (MCP)**

It addresses the existential concerns that often arise with a life-threatening diagnosis. By helping patients explore sources of meaning, purpose, and legacy, MCP fosters spiritual well-being and hope, reducing feelings of despair and isolation<sup>94</sup>. This approach is particularly valuable for patients facing advanced disease or palliative care.

#### **Supportive-expressive group therapy**

It provides a forum for patients to share experiences, express emotions, and receive social support from peers facing similar challenges. Group therapy can diminish feelings of isolation, reduce stigma, and promote collective resilience<sup>95</sup>. Peer support networks, both in-person and online, also offer ongoing emotional connection and practical advice.

In addition to these evidence-based therapies, psycho education about the disease, treatment side effects, and symptom management empowers patients to engage actively in their care<sup>96,97</sup>. Education combined with skills training such as relaxation techniques, problem-solving, and communication skills can enhance patients' sense of control and self-efficacy. Healthcare providers should assess patients' psychological needs routinely and tailor interventions to individual preferences, cultural backgrounds, and stages of illness<sup>98</sup>. Integrating mental health professionals into multidisciplinary oncology teams facilitates timely referral and comprehensive care. Overall, psychological therapies are essential components of holistic lung cancer management, promoting emotional resilience and improving patients' quality of life.

#### **The intersection of lung cancer and stigma: Psychological consequences and coping**

Lung cancer is uniquely burdened by stigma, often linked to its strong association with smoking and perceptions of self-infliction. This stigma profoundly affects patients' psychological well-being, complicating their emotional adaptation and coping processes. Patients frequently internalize societal blame, experiencing feelings of shame, guilt, and self-recrimination that can intensify depression and anxiety<sup>99</sup>. The internalized stigma may lead to diminished self-esteem and identity disruption, compounding the psychological toll of the disease beyond the physical symptoms and treatment burdens. Social stigma can also manifest in external discrimination, including negative attitudes from healthcare providers, family members, or peers<sup>100</sup>. Such experiences can discourage patients from seeking social support or disclosing their diagnosis, thereby fostering isolation and loneliness. The fear of judgment may inhibit patients from accessing psychological services or participating fully in treatment, adversely affecting adherence and health outcomes. Moreover, stigma can exacerbate disparities in care, particularly for marginalized

groups who face intersectional stigma based on race, socioeconomic status, or other factors<sup>101</sup>.

Coping with stigma requires multi-level strategies. On an individual level, psychological interventions such as cognitive-behavioral therapy can help patients reframe self-blaming thoughts and build self-compassion<sup>102</sup>. Peer support groups offer a validating environment where patients can share experiences and reduce feelings of isolation. At the community and societal levels, public health campaigns aimed at reducing lung cancer stigma and increasing awareness of its complex etiology are critical. Healthcare providers have a vital role in fostering a non-judgmental, supportive atmosphere, actively addressing stigma, and encouraging open communication<sup>103</sup>.

#### **Longitudinal perspectives on coping and psychological adaptation**

Coping with lung cancer is a dynamic process that evolves over time, influenced by changing physical symptoms, treatment phases, and psychosocial circumstances<sup>104</sup>. Longitudinal studies offer critical insights into how patients' psychological adaptation unfolds from diagnosis through treatment, survivorship, or end-of-life care. Understanding these trajectories helps identify critical periods of vulnerability and resilience, enabling timely and targeted psychosocial interventions. In the initial phase following diagnosis, patients commonly experience shock, fear, and uncertainty, which may trigger acute distress and maladaptive coping strategies such as denial or avoidance. Over time, many patients gradually adjust by developing acceptance and employing problem-focused coping mechanisms, such as seeking information and mobilizing social support<sup>105</sup>. However, this adaptation is not linear; patients often experience fluctuations in psychological well-being, influenced by treatment side effects, disease progression, or changes in personal circumstances.

During active treatment, psychological distress may peak due to the cumulative burden of symptoms and treatment-related toxicities. Resilience during this phase is often supported by effective symptom management, strong social networks, and access to psychological care<sup>18</sup>. Survivorship introduces new challenges, including fear of recurrence, identity shifts, and long-term physical limitations, requiring ongoing adjustment. For patients with advanced disease, coping strategies may shift toward meaning-making, legacy building, and preparing for end-of-life, underscoring the need for palliative and psychosocial support<sup>106</sup>. Longitudinal research also highlights the importance of early psychosocial assessment and continuous monitoring to capture evolving needs. Personalized interventions that adapt to the changing psychological landscape can foster sustained resilience and improve quality of life throughout the lung cancer trajectory<sup>107</sup>.

#### **Future directions and research priorities**

The psychological dimensions of coping and resilience in lung cancer patients remain an evolving field that calls for further exploration to improve

patient centered care. Future research should focus on longitudinal, multi-site studies that capture the diverse experiences of lung cancer patients across different stages of disease, treatment modalities, and demographic backgrounds. This will enable a nuanced understanding of how coping mechanisms and psychological adaptation vary over time and across populations, informing more tailored interventions. Advancements in digital health and telepsychology present promising avenues for expanding access to psychological support, particularly for patients in remote or underserved areas. Future research should investigate the efficacy, feasibility, and acceptability of virtual interventions, mobile applications, and online peer support communities tailored specifically for lung cancer patients. These technologies could help bridge gaps in care and provide continuous support throughout the cancer journey.

Another priority is to deepen understanding of the biological underpinnings of psychological resilience in lung cancer, including neurobiological and immunological correlates. Integrating psychosocial and biomedical research may uncover novel biomarkers predictive of psychological outcomes, paving the way for personalized mental health care. Additionally, there is a need to explore the impact of social determinants such as socioeconomic status, race, and cultural factors on psychological adaptation, resilience pathways, and treatment disparities. Developing culturally sensitive, stigma-reducing interventions is crucial, given the unique burden of lung cancer stigma on patients' mental health. Research should evaluate community-based educational programs and health policy initiatives that address stigma and promote equity in cancer care. Finally, integrating caregiver focused interventions and assessing their effects on both patient and caregiver psychological well-being warrant further attention.

## CONCLUSIONS

Lung cancer presents profound psychological challenges that significantly affect patients' quality of life and treatment outcomes. Coping with this illness involves complex processes of psychological adaptation and resilience, which are influenced by individual traits, social support, spirituality, and the quality of healthcare interventions. Adaptive coping strategies and resilience pathways help patients manage distress, maintain hope, and reconstruct their identities in the face of adversity. Healthcare providers have a critical role in recognizing and addressing the psychological needs of lung cancer patients through empathic communication, routine distress screening, and integrated psychosocial care. Tailored interventions that enhance coping skills and promote resilience can substantially improve patients' emotional well-being and engagement with treatment. Reducing stigma and fostering supportive environments are equally important in facilitating positive psychological adaptation.

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## AUTHOR'S CONTRIBUTION

**Obeagu EI:** conceived the idea, writing the manuscript, literature survey. **Parray AR:** formal analysis, critical review. Final manuscript was checked and approved by the both authors.

## DATA AVAILABILITY

Data will be made available on request.

## CONFLICT OF INTEREST

None to declare.

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