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Interaksi antara Persepsi, Kognisi, dan Kesejahteraan pada Orang dengan HIV: Tinjauan Cakupan

The Interplay of Perception, Cognition, and Well-being in People Living with HIV: Scoping Review

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Abstrak

Meskipun telah mencapai supresi virus, orang dengan HIV terus mengalami penurunan yang signifikan dalam kualitas hidup (QoL) dan fungsi kognitif. Literatur saat ini menunjukkan adanya interaksi yang kompleks antara mekanisme biologis dan persepsi psikologis; namun, jalur yang menghubungkan faktor-faktor tersebut dengan kesejahteraan masih terfragmentasi. Tinjauan cakupan ini bertujuan untuk memetakan interaksi antara persepsi penyakit, fungsi kognitif, dan kesejahteraan pada orang dengan HIV, dengan fokus pada identifikasi mediator neurobiologis dan psikologis yang mendasarinya. Tinjauan cakupan ini dilakukan dengan mengikuti kerangka kerja Arksey dan O'Malley serta pedoman PRISMA-ScR. Pencarian sistematis pada EBSCOHost, SCOPUS, dan ScienceDirect dibatasi pada artikel yang diterbitkan antara tahun 2020 dan 2025. Sebanyak 17 studi memenuhi kriteria inklusi. Analisis tematik mengidentifikasi tiga domain yang saling berkaitan: 1) Pendorong Neurobiologis, di mana aktivasi imun kronis (misalnya, kelelahan sel T, aktivasi monosit) dan berkurangnya dukungan neurotropik (BDNF) dikaitkan dengan atrofi kortikal dan penurunan kognitif; 2) Mediator Psikologis, di mana gangguan tidur dan persepsi penyakit yang maladaptif (misalnya, ruminasi) memperburuk defisit kognitif; dan 3) Dampak Fungsional, di mana gangguan kognitif merupakan prediktor disabilitas dan penurunan QoL yang lebih kuat dibandingkan viral load saja. Kesejahteraan pada orang dengan HIV dibentuk oleh interaksi yang saling memperkuat antara kerentanan neurobiologis dan proses psikologis yang maladaptif. Mengintegrasikan skrining kognitif rutin, manajemen tidur, dan intervensi berbasis perilaku ke dalam perawatan HIV sangat penting untuk meningkatkan hasil fungsional dan kualitas hidup secara keseluruhan.
Kata kunci : HIV, persepsi penyakit, gangguan kognitif, kesejahteraan

Abstract

Despite viral suppression, people living with HIV continue to experience significant declines in quality of life (QoL) and cognitive function. Current literature suggests a complex interplay between biological mechanisms and psychological perceptions; however, the pathways linking these factors to well-being remain fragmented. This scoping review aims to map the interplay between illness perception, cognitive function, and well-being in people living with HIV, with a focus on identifying underlying neurobiological and psychological mediators. A scoping review was conducted following the Arksey and O'Malley framework and PRISMA-ScR guidelines. A systematic search across EBSCOHost, SCOPUS, and ScienceDirect was limited to articles published between 2020 and 2025. A total of 17 studies met the inclusion criteria. Thematic analysis identified three interconnected domains: 1) Neurobiological Drivers, where chronic immune activation (e.g., T-cell exhaustion, monocyte activation) and reduced neurotrophic support (BDNF) were associated with cortical atrophy and cognitive decline; 2) Psychological Mediators, where sleep disturbances and maladaptive illness perceptions (e.g., rumination) exacerbated cognitive deficits; and 3) Functional Impact, where cognitive impairment was a stronger predictor of disability and reduced QoL than viral load alone. Well-being in people living with HIV is shaped by a self-reinforcing interaction between neurobiological vulnerability and maladaptive psychological processes. Integrating routine cognitive screening, sleep management, and behavioral-based interventions into HIV care is essential to improve functional outcomes and overall quality of life.
Keywords: HIV, illness perception, cognitive impairment, well-being

Introduction

HIV, once considered a fatal diagnosis, has evolved into a chronic condition characterized by persistent physical and psychological challenges, significantly impacting health-related quality of life. Globally, more than 75 million people have been infected, with approximately 32 million deaths attributed to the disease (Onu and Ugwu, 2021). As survival rates improve due to antiretroviral therapy, people living with HIV face a disproportionate burden of comorbidities compared to HIV-negative populations. Among these, HIV-associated neurocognitive disorders (HAND) represents a major concern, occurring even in individuals with sustained viral suppression. Conservative estimates suggest that between 14% and 28% of people living with HIV in the United Kingdom experience cognitive impairment, which is strongly associated with reduced well-being (Alford *et al.*, 2023).

In the context of Asia and other low- and middle-income regions, the burden of cognitive impairment among people living with HIV is equally significant, yet often under-recognized. Emerging evidence from Asian populations indicates that cognitive impairment remains prevalent despite effective antiretroviral therapy, particularly among older adults and those with comorbid mental health conditions (Lui *et al.*, 2025). Limited regional data suggest that challenges related to health literacy, stigma, and delayed diagnosis may further exacerbate cognitive and functional decline, highlighting the need for more context-specific evidence and interventions.

Beyond biological impairment, the subjective experience of illness plays a critical role in shaping health outcomes. Illness perception is a cognitive-affective construct that shapes an individual's understanding and experience of illness. Grounded in the Common-Sense Model of Self-Regulation (CSM), illness perception comprises five core cognitive dimensions: identity, timeline, cause, consequences, and control/cure (Leventhal, Phillips and Burns, 2016). The way individuals perceive their illness significantly influences their health behaviors. While cognitive representations—such as perceived consequences—often correlate with medication adherence, maladaptive perceptions can also trigger psychological distress, further exacerbating the burden of the disease (Anakwa, Teye-Kwadjo and Kretchy, 2021).

However, a critical gap remains in the literature. The current state of the art often examines cognitive deficits (the biological "hardware" driven by neuroinflammation and aging) and illness perceptions (the psychological "software") in isolation. There is a paucity of studies synthesizing how these two domains interact mechanistically. Understanding this interplay is vital, as cognitive impairment may hinder the development of adaptive illness perceptions, while negative perceptions (such as rumination) may exacerbate cognitive load and accelerate neurodegeneration.

Therefore, this study seeks to elucidate the complex relationship between perception, cognition, and well-being in people living with HIV. Specifically, this scoping review aims to map the existing literature to understand how individual perceptions influence cognitive processes—and vice versa—and subsequently impact overall quality of life.

Method

This scoping review was conducted in accordance with the methodological framework developed by Arksey and O'Malley (2005) and further refined by Levac, Colquhoun and O'brien (2010). The review process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines to ensure transparency and rigor (Tricco *et al.*, 2018). A review protocol was not

registered for this study. This decision was made considering the exploratory nature of a scoping review, which aims to map the breadth and scope of available evidence rather than to answer a narrowly defined question. However, methodological rigor was maintained through strict adherence to established scoping review frameworks and reporting guidelines. To systematically examine the literature pertaining to illness perceptions and their associations among people living with HIV, specific inclusion criteria were applied: a) Studies published between 2020 and 2025; b) Articles written in English; c) A primary focus on illness perception, cognition, and HIV/AIDS; and d) Studies involving a population of people living with HIV.

A comprehensive literature search was conducted across three electronic databases: EBSCOHost (Medline), SCOPUS, and ScienceDirect, utilizing Boolean operators with the following combination of keywords: "(People living with HIV OR People living with HIV/AIDS OR PLWH) AND (Illness perception OR Illness representation OR Cognition) AND (HIV OR HIV/AIDS)". The study selection process followed a multi-stage screening approach visualized in the PRISMA flow diagram (Figure 1). The initial search yielded a total of 312 articles, consisting of 91 from EBSCOHost, 46 from SCOPUS, and 175 from ScienceDirect. Following the removal of duplicates, titles and abstracts were screened for relevance, excluding studies that did not focus on the interplay of the key variables. Subsequently, full-text articles were retrieved and critically assessed against the eligibility criteria, resulting in a final total of 17 studies. Data were extracted using a standardized charting form capturing author, year, country, study design, sample size, and key findings, then synthesized using a narrative thematic analysis approach to categorize findings into neurobiological, psychological, and functional domains. Consistent with the methodological guidance for scoping reviews, formal quality appraisal of included studies was not conducted, as the primary objective was to map the range and nature of existing evidence rather than to evaluate the methodological quality of individual studies. Nevertheless, studies were selected based on relevance and clarity of reported findings to ensure the robustness of the synthesis.

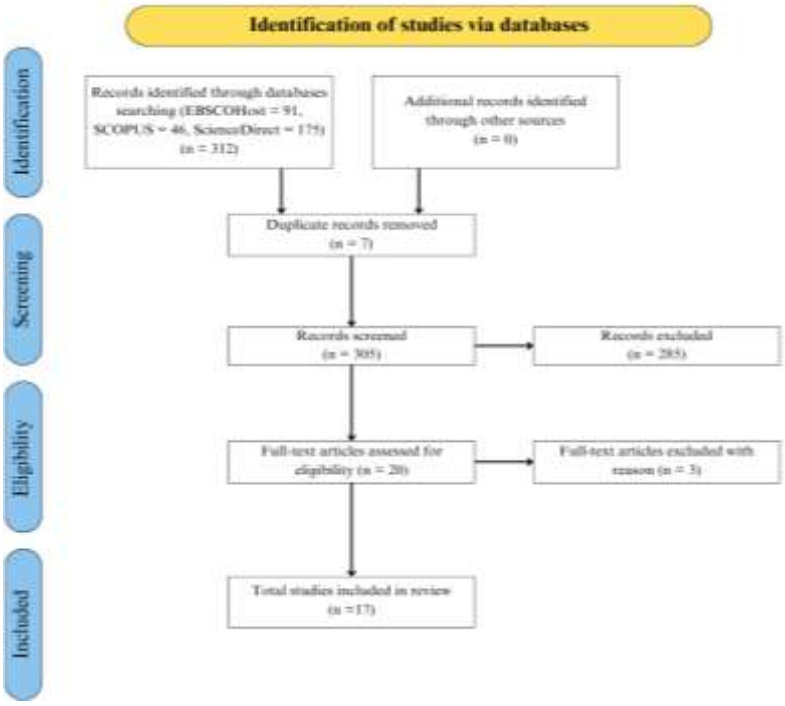


Figure 1. PRISMA flow diagram of the study selection procedure

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Results and Discussion

A final selection of 17 studies met the inclusion criteria and were synthesized for this review. The included literature, published between 2020 and 2025, reflects the most recent advancements in HIV neurocognition and psychosocial research. Geographically, the studies offer a diverse global perspective, representing populations from Africa (South Africa, Uganda, Nigeria, Zimbabwe), Asia (China, Kazakhstan, South Korea), Europe (UK, Netherlands), and North America (USA). In terms of methodology, the review captures a rich heterogeneity of study designs. While the majority employed cross-sectional surveys to assess associations, the inclusion of longitudinal cohort studies and ecological momentary assessments (EMA) allowed for the analysis of temporal trajectories in cognition and mood (Michael *et al.*, 2025; Qiao *et al.*, 2025). The study populations predominately consisted of people living with HIV on antiretroviral therapy (ART) with viral suppression, with a notable subset of studies specifically focusing on the aging HIV population. The detailed characteristics of each study are summarized in Table 1.

Table 1. Summary of included studies

No	Title, author	Objective	Method	Results
1	Status and factors associated with patient activation and its relationship with HIV clinic outcomes among Yi minority people living with HIV in Liangshan, China: a cross-sectional study An et al. (2023)	To analyze the status and factors associated with patient activation and its relationship with HIV clinical outcomes.	Design: Cross-sectional Sample: n=403 (Yi ethnic minority) Location: China	Patient activation was positively associated with viral suppression (p=0.011). Gender and illness perceptions mediated the relationship between patient activation and clinical outcomes.
2	Sex-specific associations between cerebrospinal fluid inflammatory marker levels and cognitive function in antiretroviral treated people living with HIV in rural Uganda Vecchio et al. (2021)	To identify sex-specific disparities in neuroinflammation and its impact on cognitive function.	Design: Cross-sectional Sample: n=400 (ART-naïve) Location: Uganda	Identified sex-specific disparities in neuroinflammation. MIP-1β was a pivotal mediator linking neuroinflammation to cognitive function, specifically in men.
3	The nomological network of cognitive fusion among people living with HIV: Associations with	To examine the relationship between cognitive fusion, rumination, shame, and depressive	Design: Cross-sectional Sample: n=111 Location: USA	Cognitive fusion strongly correlated with shame (general & HIV-related) and low self-compassion. Fusion was associated with

	rumination, shame, and depressive symptoms O'Loughlin, Bennett and O'Hayer (2020)	symptoms.		depressive and anxiety symptoms, suggesting a maladaptive cognitive process.
4	Cognitive and Behavioral Contributions to Depression Severity, Quality of Life, and Functioning Among People Living With HIV in South Africa Andersen et al. (2023)	To assess cognitive and behavioral contributions to depression severity, quality of life, and functioning.	Design: Cross-sectional Sample: n=274 Location: South Africa	Behavioral Activation (BA) was significantly associated with reduced depression severity and improved Quality of Life (QoL). Conversely, rumination was positively correlated with increased depressive symptoms.
5	How mental health relates to everyday stress, rumination, trauma and interoception in women living with HIV: A factor analytic study Millon and Shors (2021)	To analyze how mental health relates to everyday stress, rumination, trauma, and interoception.	Design: Cross-sectional Sample: n=38 (Women) Location: USA	Rumination served as a bridge connecting trauma/stress to current mental health symptoms. Women with higher symptom loads reported decreased trust in their own bodily sensations (interoception).
6	Health-Related Quality of Life in People Living With HIV With Cognitive Symptoms: Assessing Relevant Domains and Associations Alford et al. (2023)	To assess relevant HRQoL domains and associations in people living with HIV with cognitive symptoms.	Design: Cross-sectional Sample: n=103 Location: UK	Cognitive symptoms (e.g., forgetfulness) were significantly associated with lower scores in physical, mental, and functional domains of HRQoL. Social connectedness and stigma were not significant predictors in this specific model.
7	Mental health and cognition in relation to adherence to antiretroviral therapy among people living with HIV in	To investigate the relationship between mental health, cognition, and antiretroviral therapy adherence.	Design: Cross-sectional Sample: n=230 Location: Kazakhstan	Depressive and anxiety symptoms were associated with lower adherence self-efficacy. Better cognitive function (memory/attention) was linked to higher adherence self-efficacy

	Kazakhstan: a cross-sectional study Mergenova et al. (2024)			scores.
8	The association of peripheral immune markers with brain cortical thickness and surface area in South African people living with HIV Williams et al. (2020)	To assess the association of peripheral immune markers with cortical thickness and brain surface area.	Design: Cross-sectional Sample: n=91 Location: South Africa	Higher peripheral immune markers (NGAL, TYMP) were associated with reduced cortical thickness in frontal and temporal brain regions. Demonstrates a direct link between systemic inflammation and brain structure alterations.
9	Neurocognitive Functioning is Associated with Self-Reported and Performance-Based Treatment Management Abilities in People Living with HIV with Low Health Literacy Fazeli et al. (2020)	To examine the relationship between neurocognitive function and medication management abilities in patients with low health literacy.	Design: Cross-sectional Sample: n=171 Location: USA	Health literacy interacts with neurocognitive function. Participants with both low health literacy and neurocognitive impairment exhibited the poorest medication management abilities.
10	Cognitive function and drivers of cognitive impairment in a European and a Korean cohort of people living with HIV De Francesco et al. (2020)	To determine drivers of cognitive impairment in European and Korean people living with HIV cohorts.	Design: Cross-sectional Sample: n=134 (Europe), n=194 (Korea) Location: Europe & Korea	Cognitive impairment is multifactorial; driven by older age, lower education, and comorbidities, rather than HIV status alone in suppressed patients.
11	Negative centralisation of HIV trauma influences health-related quality of life: Does posttraumatic growth buffer the link? Onu and Ugwu (2021)	To investigate the influence of negative HIV trauma centralization on health-related quality of life.	Design: Cross-sectional Sample: n=869 Location: Nigeria	Negative Centralisation of Trauma (NEC) was negatively associated with HRQoL. Post-Traumatic Growth (PTG) buffered this effect, attenuating the impact of trauma on quality of life.

12	Understanding the lived experience research priorities for improving health-related quality of life in people living with HIV with cognitive impairment Alford et al. (2024)	To explore lived experience priorities of people living with HIV with cognitive impairment.	Design: Qualitative (focus groups) Sample: PLWH & Stakeholders Location: UK	Patients prioritize interventions addressing emotional distress and social isolation caused by cognitive failures. Highlights that cognitive care must be integrated with mental health support to improve QoL.
13	Cognitive and mental health significantly contribute to disability in people ageing with HIV in Asia: an observational case-control study Lui et al. (2025)	To investigate determinants of disability in aging people living with HIV in Asia.	Design: Observational case-control Sample: Aging PLWH vs Controls Location: Asia (Multi-site)	Cognitive status and mental health (depression/anxiety) were stronger predictors of disability than HIV-specific clinical factors (e.g., viral load). Emphasizes the shift from viral suppression to managing functional impairments.
14	Dual Trajectories of Serum Brain-Derived Neurotrophic Factor and Cognitive Function in People Living with HIV Michael et al. (2025)	To analyze trajectories of serum BDNF and cognitive function over time.	Design: Longitudinal cohort (96-week) Sample: n=154 Location: South Africa & Zimbabwe	BDNF levels closely track cognitive performance over time. Suggests that loss of neurotrophic support is a distinct biological mechanism driving cognitive decline in people living with HIV.
15	Dynamics of peripheral T cell exhaustion and monocyte subpopulations in neurocognitive impairment and brain atrophy in chronic HIV infection Mitchell et al. (2024)	To examine cellular drivers of brain atrophy and cognitive impairment in chronic HIV infection.	Design: Observational (Flow Cytometry & Neuroimaging) Sample: Not specified in summary Location: USA	Peripheral T-cell exhaustion and specific monocyte subpopulations are directly associated with reduced brain volume and neurocognitive impairment. Confirms that chronic immune activation persists and damages brain structure despite ART.
16	Sleep quality, emotional moods, and cognitive outcomes among	To link sleep, mood, and cognition in real-time using daily	Design: Longitudinal (Ecological Momentary	Sleep quality significantly predicts next-day mindfulness, positive affect, and

	people living with HIV: An ecological momentary assessment study Qiao et al. (2025)	monitoring.	Assessment/EMA) Sample: n=22 (962 daily assessments) Location: USA	cognitive control. Demonstrates that cognitive and psychological states fluctuate daily and are driven by physiological rest.
17	CD8+T cells and monocytes were associated with brain alterations in human immunodeficiency virus-infected individuals with cognitive impairment Zhang et al. (2025)	To investigate immune markers and brain structure in HIV-infected individuals with cognitive impairment.	Design: Cross-sectional (Multi-modal MRI & Immunological analysis) Sample: Not specified in summary Location: China	Elevated CD8+ T cells and monocytes are significantly associated with reduced gray matter volume (atrophy). Specifically linked these immune-mediated brain alterations to deficits in executive function and attention.

Through a thematic synthesis, the findings elucidate the complex interplay between HIV infection and well-being through three distinct pathways: 1) neurobiological determinants of cognitive decline; 2) psychological mechanisms involving sleep and rumination; and 3) the functional impact on self-management and quality of life. The principal finding indicates that poor quality of life in this population is driven by a "neuro-psychological vicious cycle".

Neurobiological Pathways: From Cellular Exhaustion to Atrophy

Recent investigations have shifted focus from general inflammation to specific cellular mechanisms driving cognitive decline. Mitchell et al. (2024) provided breakthrough evidence that peripheral immune dysregulation—specifically T-cell exhaustion and specific monocyte subpopulations—is directly associated with brain volume loss and neurocognitive impairment. This finding was corroborated by Zhang et al. (2025), who utilized multi-modal MRI to demonstrate that elevated CD8+ T cells and monocytes correlate significantly with reduced gray matter volume in the frontal cortex, directly impacting executive function. While previous literature broadly linked inflammation to cognitive decline, these recent studies provide a more granular mechanistic explanation. This suggests that the brain is not merely "inflamed" but is actively sustaining structural damage due to persistent immune senescence. Furthermore, neurotrophic support plays a critical mediating role. In a longitudinal analysis, Michael et al. (2025) identified that serum BDNF (Brain-Derived Neurotrophic Factor) levels follow distinct trajectories that mirror cognitive performance over time. Their finding that serum BDNF trajectories mirror cognitive decline suggests that people living with HIV may lose the brain's natural ability to repair itself. This biological vulnerability creates the "hardware" deficits that patients experience as forgetfulness and brain fog, which subsequently triggers psychological distress.

Psychological Mechanisms: The Role of Sleep, Rumination, and Activation

Beyond biological damage, this review identifies that the impact of HIV on well-being is mediated by dynamic psychological and physiological states. Qiao et al. (2025), using Ecological

Momentary Assessment (EMA), demonstrated a direct link between physiological rest and psychological function; sleep quality significantly predicted next-day mindfulness, cognitive control, and positive affect. This suggests that addressing basic physiological needs, particularly sleep, is a fundamental prerequisite for maintaining cognitive and emotional stability. When these resources are compromised, individuals may enter a "cognitive trap" characterized by maladaptive processing patterns. Millon and Shors (2021) and O'Loughlin, Bennett and O'Hayer (2020) highlighted that maladaptive processing such as cognitive fusion and rumination serve as bridges connecting HIV-related stress to depressive symptoms, exacerbating mental distress. Importantly, the literature suggests that behavioral-based approaches may offer a more accessible and effective intervention pathway compared to purely cognitive strategies. Andersen et al. (2023) found that Behavioral Activation (BA)—engagement in meaningful activities—was associated with improved quality of life, serving as a robust buffer against depression. This aligns with An et al. (2023), who reported that higher patient activation was linked to positive illness perceptions. This indicates that facilitating action-oriented engagement may help disrupt maladaptive cognitive cycles.

Compared to cognitive restructuring, which requires higher-level cognitive processing, Behavioral Activation may be more feasible for people living with HIV experiencing cognitive impairment (Andersen *et al.*, 2023; Mergenova *et al.*, 2024). Cognitive deficits, particularly in executive function and memory, severely limit patients' abilities to process complex health information and manage intricate treatment demands (De Francesco *et al.*, 2020; Fazeli *et al.*, 2020). In contrast, Behavioral Activation emphasizes engagement in simple, structured activities—an approach that Andersen (2023) found to significantly improve quality of life and reduce depression in this population. From a nursing perspective, these findings have practical implications for routine care delivery. Behavioral Activation can be integrated through low-resource strategies by encouraging daily achievable activities. For instance, maintaining regular sleep routines has been shown to improve daily cognitive control and mood (Qiao *et al.*, 2025), while strengthening social connections directly addresses the emotional distress and isolation prioritized by patients (Alford *et al.*, 2024). Simple goal-setting approaches, such as identifying one meaningful daily activity, may enhance patients' sense of control and purpose. Additionally, brief motivational interviewing and activity scheduling can be incorporated into patient education to reinforce positive behavioral engagement. These approaches are particularly relevant in resource-limited settings across Asia, where the burden of disability is heavily driven by unmanaged mental health and cognitive impairments (Lui *et al.*, 2025), yet access to specialized psychological interventions is often constrained. Given that Behavioral Activation effectively reduces psychological distress (Andersen *et al.*, 2023) and addresses the profound deterioration of well-being frequently observed in this population (Alford *et al.*, 2023), these findings suggest that integrating this approach into routine nursing care may provide a practical and scalable clinical strategy.

Functional Impact: Disability and Lived Experience

The interplay of neurobiological deficits and psychological distress manifests concretely in significant functional disability. Lui et al. (2025), studying an aging Asian cohort, revealed that cognitive status and mental health are now stronger predictors of physical disability than HIV-specific clinical factors (such as viral load). This underscores a profound paradigm shift: it indicates that for a virally suppressed

patient, the main threat to independence is no longer the virus, but the neurocognitive aftermath. This impact translates into challenges with health literacy and self-management (Fazeli *et al.*, 2020), where cognitive deficits hinder medication adherence (Mergenova *et al.*, 2024). Ultimately, these deficits shape the lived experience of patients. Alford et al. (2024) emphasized that people living with HIV explicitly prioritize interventions that address the emotional distress of cognitive impairment over purely medical treatments. When patients cannot manage these complex demands due to low health literacy or depression (Fazeli *et al.*, 2020; Mergenova *et al.*, 2024), their Health-Related Quality of Life (HRQoL) deteriorates across all domains (Alford *et al.*, 2023).

Conclusion and Recommendations

This scoping review demonstrates that the pathway from HIV infection to well-being is driven by a dynamic interplay between biological "hardware" and psychological "software." Evidence from 2020–2025 reveals that even with viral suppression, persistent immune dysregulation and loss of neurotrophic support create a vulnerability for cognitive decline. This biological risk is further modulated by daily physiological states—specifically sleep quality—and psychological patterns, where maladaptive rumination acts as a "cognitive trap" that exacerbates distress. However, the synthesis offers a compelling solution: behavioral activation. Active engagement in meaningful activities serves as a robust protective buffer against these deficits. Consequently, the paradigm of HIV care must shift from a singular focus on viral markers to a functional preservation model—one that integrates routine cognitive screening, sleep management, and behavioral interventions to optimize the holistic quality of life for people living with HIV.

This review is subject to several limitations, including the predominance of cross-sectional evidence which limits causal inferences, significant methodological heterogeneity across studies ranging from objective biomarkers to subjective self-reports, and the restriction to English-language articles from specific databases. Despite these limitations, the findings have direct implications for nursing practice. Routine assessment in HIV care should extend beyond viral suppression to include screening for cognitive impairment and illness perception, particularly in older adults and those with lower educational attainment. Nurses play a pivotal role in identifying patients at risk of 'cognitive traps' such as rumination. Furthermore, interventions should prioritize behavioral activation and sleep hygiene strategies. Encouraging patients to engage in meaningful daily activities and maintaining regular sleep patterns may serve as practical methods to buffer against the negative effects of cognitive decline and depression. Lastly, patient education materials must be tailored to accommodate varying levels of health literacy and cognitive function to ensure effective self-management.

To address the current gaps in the literature, future research should prioritize longitudinal study designs, particularly in developing countries and resource-limited settings, to establish causal relationships and better understand the long-term trajectories of cognitive and psychosocial changes among people living with HIV. Furthermore, there is a critical need for rigorous randomized controlled trials (RCTs) to compare the effectiveness and scalability of different behavioral interventions, such as Behavioral Activation combined with sleep interventions, digital-based approaches, or nurse-led behavioral programs. These studies should evaluate key outcomes, including cognitive function, treatment adherence, and quality of life, to generate

clinically actionable evidence for integrated HIV care.

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