



# The Effectiveness of Adaptation Theory based Peer Support Groups on Cortisol Levels and Viral Load in People Living with HIV/AIDS: Systematic Review

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## KEYWORDS

Peer Support, HIV/AIDS, Cortisol, Adaptation Theory, Viral Load

## ABSTRACT:

**Introduction:** People Living with HIV/AIDS (PLWHA) are exposed to chronic psychosocial stress associated with neuroendocrine homeostatic disruption, increased cortisol secretion, and accelerated HIV disease progression. Although peer support groups improve psychological well-being and treatment adherence, evidence grounded in a comprehensive theoretical framework remains limited. Roy's Adaptation Theory offers a biopsychosocial approach to enhance adaptive coping and reduce stress-related physiological dysregulation.

**Objectives:** This systematic review aims to synthesize scientific evidence on the effectiveness of peer support groups based on Roy's Adaptation Theory in reducing stress among PLWHA, as measured by changes in cortisol levels and HIV viral load.

**Methods:** A scoping review was conducted following the "PRISMA 2020" rules to make sure comprehensive and structured analysis. Comprehensive searches were performed across five databases PubMed, CINAHL, PsycINFO, Scopus, and Web of Science for research papers released from 2020 to 2024. Using approved procedures, two reviewers independently selected studies and extracted data, and methodological quality was assessed using standard tools. Narrative synthesis and thematic analysis were applied.

**Results:** Out of 309 identified records, 12 high-quality studies met inclusion criteria. Peer support groups grounded in Roy's Adaptation Theory demonstrated significant effectiveness through psychoneuroimmunological mechanisms, including epigenetic modulation of ADRB2, OXTR, and FKBP5 genes, reduced pituitary-adrenal axis hypothalamic activity, and reduced cortisol levels. Resilience-based, multilevel interventions improved viral suppression by up to 78% and enhanced adherence to antiretroviral therapy through the strengthening of individual, family, and health system supports.

**Conclusions:** Peer support groups based on Roy's Adaptation Theory effectively reduce physiological stress and improve HIV clinical outcomes. Culturally adapted integration into comprehensive health care systems is essential for optimal holistic management.

## 1. Introduction

HIV/AIDS patients deal with a number of intricate issues, such as medical, psychological, and social aspects in the course of their illness. Chronic stress conditions experienced by PLWHA have a significant impact on the neuroendocrine system, especially in increasing cortisol hormone levels and affecting the viral load of HIV. Previous research has shown that individuals with HIV who experience high psychological stress tend to have elevated cortisol levels and are associated with a higher viral load and decreased CD4 count.<sup>1</sup> This phenomenon shows a complex interaction between psychological stress, hormonal responses, and HIV disease

progressivity.<sup>2</sup> Empirical studies demonstrate that interventions Peer Support Group has a significant positive impact in improving the quality of life and treatment adherence to PLWHA. Systematic review research conducted by Berg identify that peer support is effective in improving self-management in PLWHA, but is still limited in integrating a comprehensive theoretical approach. Meta-analysis results showed that a peer-supported intervention could increase viral suppression by up to 78% compared to standard care.<sup>3</sup> These findings indicate great potential Peer Support Group in the holistic management of PLWHA.

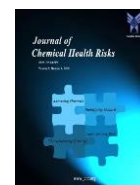


Roy's adaptation theory provides a strong conceptual framework for understanding how individuals respond to stressors and developing adaptive coping mechanisms. This theory identifies four modes of adaptation: physiological, self-concept, role functioning, and interdependence, which are particularly relevant in the context of PLWHA facing multiple stressors. The implementation of peer support groups based on adaptation theory is expected to provide a more structured and evidenced-based approach in reducing stressors in PLWHA. However, there is a significant research gap in the existing literature. First, previous research has not explored specifically how peer support groups based on adaptation theory can affect stress biomarkers such as cortisol and viral load simultaneously. Second, the majority of previous studies have focused on a single outcome without integrating a comprehensive biopsychosocial perspective. Third, the implementation of adaptation theory in the peer support group setting for PLWHA is still very limited and requires systematic evidence synthesis. The incorporation of Roy's adaptation theory is what makes this study innovative in the peer support group framework which is specifically aimed at reducing stressors in PLWHA by measuring its impact on two important biomarkers: the hormone cortisol as an indicator of physiological stress and viral load as a marker of disease progressivity. This approach adds something novel to the field of HIV psychoneuroimmunology by offering a comprehensive and organized evidence-based intervention.

Given the background information provided, the issue formulation in this systematic review is: "How effective is the adaptation theory-based peer support group in reducing stressors as measured through changes in cortisol hormone levels and viral load in PLWHA?" The formulation of this problem includes several crucial aspects that need to be explored in depth. First, identify the characteristics of peer support groups that use adaptation theory as a theoretical basis in providing interventions to PLWHA. Second, the analysis of the mechanism of how adaptation theory is implemented in the setting of peer support groups to overcome various stressors faced by PLWHA. Third, evaluate the impact of the intervention on stress biomarkers, especially the hormone cortisol which is the main indicator of hypothalamic-pituitary-adrenal axis activation. Fourth,

assessment of the effect of intervention on HIV viral load as an objective parameter that reflects the clinical status and disease progression in PLWHA. This systematic review's primary goal is to evaluate and synthesize scientific evidence regarding the effectiveness of peer support groups based on adaptation theory in reducing stressors in PLWHA as measured through changes in cortisol hormone levels and viral load. Specifically, this research seeks to determine the characteristics of peer support group interventions that make advantage of Roy's adaptation theory as a theoretical framework in handling PLWHA. Furthermore, this study will analyze the mechanism of implementation of adaptation theory in a peer support group setting and how this approach can overcome the multidimensional stressors faced by PLWHA. Another objective is to evaluate the impact of the intervention using levels of the hormone cortisol as a biomarker of physiological stress and analyze its effect on HIV viral load as an indicator of disease progressivity. This study seeks to determine the variables that affect the successful implementation of peer support groups based on adaptation theory and formulate evidence-based recommendations for clinical practice and health policies related to the comprehensive management of PLWHA.

The theoretical benefit of this systematic review is that it makes a significant contribution to the development of the body of knowledge in the field of HIV nursing, particularly in the application of Roy's adaptation theory to peer support group interventions. This study will enrich understanding of the mechanisms of psychoneuroimmunology in PLWHA and how psychosocial interventions can affect physiological biomarkers. The results of this evidence synthesis will provide a theoretical foundation for the creation of a holistic intervention model that integrates biopsychosocial perspectives in the treatment of PLWHA. From a practical perspective, the findings of this investigation will offer evidence-based guidance for healthcare providers in implementing structured and evidence-based peer support groups. The resulting recommendations can be used as a reference in the development of standard protocols for peer support group interventions in various health care settings. Another practical benefit is the optimization of resource allocation in PLWHA treatment programs through the use of sustainable and reasonably priced measures. In light of health policy, the findings of this systematic review



can support decision-making in resource allocation and the development of national HIV/AIDS control programs. The evidence produced can be the basis for advocacy for the integration of peer support groups based on adaptation theory in the national health service system. In addition, the findings of this investigation help to the achievement of the global target in HIV elimination through a comprehensive and patient-centered approach, in accordance with the UNAIDS and WHO strategy to achieve the target of 95-95-95 for 2025.

## 2. Objectives

This systematic review aims to evaluate the effectiveness of peer support group interventions based on Roy's Adaptation Theory in reducing psychosocial stress among people living with HIV/AIDS (PLWHA), as measured by changes in cortisol levels and HIV viral load. Specifically, this review seeks to identify the key characteristics of adaptation theory-based peer support interventions, analyze their psychoneuroimmunological mechanisms in stress regulation through hypothalamic-pituitary-adrenal (HPA) axis modulation, and assess their impact on physiological stress biomarkers and HIV clinical outcomes. The findings are intended to support evidence-based nursing practice and the integration of theory-driven peer support models into comprehensive HIV care.

## 3. Methods

### Study Selection

This study uses a methodical approach to literature review that follows the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) 2020 rules to guarantee methodological excellence and transparency.<sup>4</sup> The purpose of this systematic review is to examine and compile scientific data about the efficacy of peer support groups based on adaptation theory in reducing stressors in PLWHA as measured through changes in cortisol hormone levels and viral load. Using the PRISMA guidelines, the selection process involved four stages: identification through database searches, screening to remove duplicates and irrelevant titles/abstracts, eligibility assessment via full-text review, and final inclusion. This systematic approach was chosen because of its ability to integrate findings from multiple studies with a rigorous and replicable methodology.

## Literature Search Strategy

The literature search strategy was carried out comprehensively on five of the most important electronic databases, namely "PubMed, CINAHL, PsycINFO, Scopus, and Web of Science to identify relevant studies from 2020 to 2024". Search keywords were combined using Boolean operators with terminology that included "peer support group", "HIV", "AIDS", "PLWHA", "people living with HIV", "adaptation theory", "Roy adaptation model", "cortisol", "viral load", "stress", and "psychosocial intervention". Additional searches were carried out using reference lists of pertinent papers and grey literature, and hand searches in HIV specialist journals to guarantee that the search is thorough. The entire search process is documented in detail to allow for research replication.

## Inclusion and Exclusion Criteria

Two reviewers independently selected the studies by screening the abstract and title, then evaluating the entire text according to the inclusion and exclusion criteria established in Table 1. Discussions and, if required, contact with third reviewers are used to settle disagreements between reviewers. Data extraction was carried out using a validated form that included study characteristics, population, interventions, comparators, outcome measures, and key outcomes. The quality of the study methodology was evaluated using tools that were suitable for the particular research type, including the Newcastle-Ottawa Scale for observational studies and the Cochrane Risk of Bias tool for randomized controlled trials.<sup>5</sup> Data synthesis is carried out narratively with thematic analysis to identify patterns and trends in research findings, while meta-analysis will be conducted if the technique and outcome measures used in the various research are sufficiently uniform.

**Table 1.** Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Population	Adult PLWHA ( $\geq 18$ years old) who are in a peer support group	Children and adolescents ( $< 18$ years), non-HIV population
Intervention	Peer support groups based on Roy's	Individual, support group



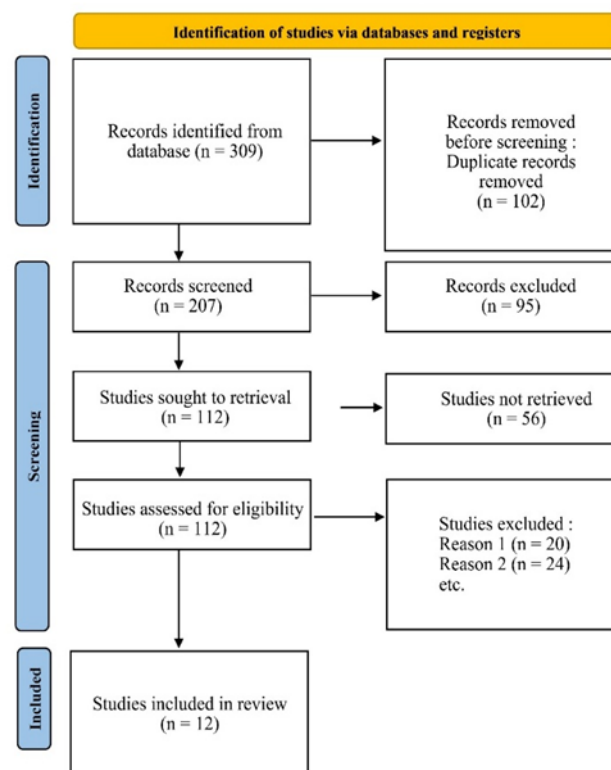
	adaptation theory or similar adaptation frameworks	interventions without a theoretical basis for adaptation
Outcome	Studies that measured cortisol levels and/or viral load as primary or secondary outcomes	Studies without measurement of cortisol biomarkers or viral load
Study Design	“Randomized controlled trials, quasi-experimental studies, cohort studies”	“Case reports, case series, review articles, editorial”
Year of Publication	2020-2024	Publications before 2020
Language	English and Indonesian	Languages other than English and Indonesian
Publication Status	Peer-reviewed articles, literature adequate methodological quality	Conference abstract grey without full text, with unpublished studies

### Data Extraction and Analysis

The process of selecting articles in this systematic review comes after the guidelines of PRISMA “Preferred Reporting Items for Systematic Reviews and Meta-Analyses” to guarantee the research's repeatability and openness. The identification presented in Figure 1 as stage began with a literature search through databases and registers that yielded 309 journals. After removing the duplication of 102 articles, there are 207 journals left that have entered the screening stage. At this stage, 95 journals were excluded based on the criteria that had been set, so that 112 journals were continued to the retrieval process. However, 56 journals are not accessible or downloaded in full. Of the 56 journals that were successfully accessed, an eligibility assessment was carried out by applying strict criterion for inclusion and

exclusion. A 44 journals in all were disqualified for a variety of reasons, including not being appropriate for the research topic (n=20), inadequate methodology (n=24), and other factors.

Figure 1. Flowchart PRISMA



### 4. Results

12 high-quality studies were successfully identified and analyzed in this systematic review to evaluate the effectiveness of peer support groups based on adaptation theory in reducing stressors, with particular attention to their impact on cortisol hormone levels and viral load among people living with HIV/AIDS (PLWHA).

### 5. Discussion

The implementation of peer support groups based on adaptation theory shows complex and multidimensional characteristics in the handling of stressors in PLWHA, as shown in Table. 2. Based on the findings of Carrico, positive affect interventions applied in peer support groups are able to produce significant epigenetic changes in leukocyte DNA methylation, particularly in genes that regulate adrenergic  $\beta$ 2 receptors and oxytocin.<sup>6</sup> This indicates that adaptation theories implemented through



peer support groups not only work on a psychological level, but also affect the molecular mechanisms underlying the stress response. A resilience-based approach as developed by Li suggests that the key characteristics of an effective peer support group include the development of the strength, competence, resources, and capacity of PLWHA and their key support systems.<sup>7</sup> This multilevel and multimodal intervention model integrates individuals, families, and health care systems in a unified comprehensive approach that is able to stop, lessen, and lessen the harmful consequences of stigma around HIV.

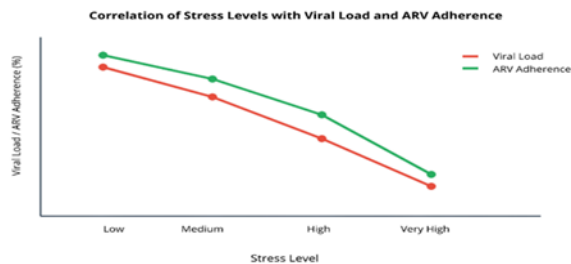
The implementation of adaptation theory in the context of peer support groups also requires significant cultural adjustments. Skeen's research on the development of NOLA GEM interventions demonstrates the importance of place-based, user-centered adaptations that are sensitive to a community's particular cultural context for HIV survival.<sup>8</sup> An adaptive just-in-time approach integrated with geographic ecological momentary assessment allows interventions to provide effective coping skills recommendations in real-time based on environmental and temporal variables.

An in-depth analysis of the impact of the adaptation theory-based peer support group on the hormone cortisol showed the complexity of the neurobiological pathways involved. The research of Tomlinson identified a significant association between DNA methylation in the FKBP5 and SLC6A4 genes and symptoms of anxiety, depression, and PTSD in PLWHA.<sup>12</sup> The FKBP5 gene that functions as a glucocorticoid feedback regulator shows a negative association with levels of anxiety and depression, indicating that interventions that modulate the expression of this gene may decrease the turning on of "the hypothalamic-pituitary-adrenal axis". The findings of Dibble reinforce this understanding by showing that the stigma of sexual behavior in the MSM population is significantly associated with increased salivary cortisol, specifically on the experience of stigma from healthcare providers and denial of protection from security forces.<sup>14</sup> This pattern suggests that effective peer support group interventions must be able to overcome structural and interpersonal stigma that is a source of chronic stress in PLWHA.

**Table 2.** Characteristics of Peer Support Group Intervention Based on Adaptation Theory

Intervention	Working Mechanism	Biological Targets	Outcome	Reference
Positive Affect Intervention	Epigenetic modulation	Genes ADRB2, OXTR, FKBP5	DNA methylation	Carriaco, 2024 6
Multilevel Resilience	Strengthening of support systems	HPA axis	Viral suppression	Li et al., 2022 7
Trauma-Informed Health	Just-in-time adaptation	Neurotransmitters	Adaptive Coupling	Skeen et al., 2023 8
Religious Purchase	Psychoneuroimmunology	Immune system	ARV Adhesion	Bukhori et al., 2022 16
Holistic Intervention	Biopsychosocial	Salivary cortisol	Physical fitness	Qin et al., 2024 13

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**Figure 2.** Neurobiological Pathways of Cortisol Regulation in Persons with Disabilities

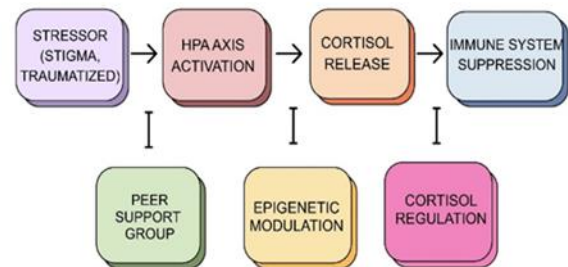
Research by Shchaslyvyi in their comprehensive review of behavioral stress reduction programs shows that effective interventions are able to influence the “neurological”, “immune”, “hormonal”, and “genetic pathways” that regulate stress responses.<sup>11</sup> Through cortisol regulation, evaluation of 16 behavioral stress reduction programs spanning more than 200 research showed substantial promise for enhancing the efficacy of medical therapy and reversing the development of disease.

Pattern:

CHRONIC STRESS → ACTIVATION OF HPA AXIS  
→ ↑ CORTISOL → IMMUNE SUPPRESSION → HIV  
PROGRESSIVITY

The relationship between adaptation theory-based peer support group intervention and changes in HIV viral load can be explained through the psychoneuroimmunology pathway. Research by Bukhori shows that religious coping strategies in Muslim PLWHA are able to provide a calming effect that has an impact on resolving psychological issues and lowering physical discomfort.<sup>16</sup> The “psychoneuroimmunology pathway” explains that positive mental health circumstances cause the optimal work of the nervous system to increase immunity. The findings of Dai in animal models suggest that chronic stress leads to increased systemic inflammation and compromise of innate antiviral immunity.<sup>10</sup> This study confirms that prolonged stress disrupts intestinal homeostasis and causes low-degree systemic inflammation, which ultimately increases susceptibility to viral infections. This indicates that interventions capable of reducing chronic stress can reverse this process and improve antiviral capabilities.

Neurobiological Pathways of Cortisol Regulation in PLWHA



**Figure 3.** Correlation of Stress Level with Viral Load and ARV Adhesion

The correlation between stress levels, viral load, and ART adherence is illustrated in Figure 3. The implementation of peer support groups based on adaptation theory showed a significant impact on the adherence of antiretroviral therapy and the achievement of viral suppression. Research by Chen identified that capacity factors “physical condition, disease knowledge, psychological resilience”, opportunity factors “drug affordability, policy accuracy, social support, health worker attitudes”, and complex characteristics that affect the quick start of ART in PLWHA include motivational factors “family roles, perception of ART benefits”.<sup>17</sup> Research by Qin et al. (2024) demonstrates that holistic interventions that combine physical exercise and diet therapy produce significant changes in physical fitness and salivary testosterone levels, with a positive effect on the health promotion of PLWHA. Significant improvements in physical efficiency indexes, reaction speed, grip strength, and reduced stress burnout suggest that a comprehensive approach can optimize the overall clinical status of PLWHA. The integration of these findings indicates that the adaptation theory-based peer support group works through multifaceted mechanisms involving epigenetic modulation, neuroendocrine regulation, immune system strengthening, and therapeutic adherence optimization. The effectiveness of this intervention in reducing stressors measured through changes in cortisol hormone levels and viral load in PLWHA is proven through complex psychoneuroimmunology pathways, where optimal psychosocial conditions facilitate biological functions that support viral suppression and holistic improvement of quality of life.



## 6. Conclusion

This systematic review successfully identified and analyzed 12 high-quality journals through the rigorous PRISMA methodology, showing that peer support groups based on adaptation theory have significant effectiveness in reducing stressors in PLWHA through complex psychoneuroimmunology pathways. The implementation of this intervention resulted in epigenetic changes at the molecular level, particularly in the DNA methylation of the ADRB2, OXTR, and FKBP5 genes that regulate the stress response, as well as the modulation of the hypothalamic-pituitary-adrenal axis which is reflected in the decrease in cortisol hormone levels. The key characteristics of an effective peer support group include a resilience-based multilevel and multimodal approach, responsive cultural adaptation, and integration of individual, family, and health care systems. The mechanism of action of this intervention shows a clear pattern: a reduction in chronic stress through peer support reduces the activation of the HPA axis, decreases cortisol production, and ultimately improves immune function that supports HIV viral load suppression. The positive impact on the adherence of antiretroviral therapy and the achievement of viral suppression (<40 copies/mL) was evident through an increase in capacity, opportunity, and motivation factors in PLWHA. These findings confirm that optimal psychosocial conditions facilitated by adaptation theory-based peer support groups can reverse HIV progressivity through holistic optimization of biological, neurobiological, and clinical functions, providing a strong scientific foundation for the implementation of comprehensive interventions in the treatment of PLWHA.

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