Regimen Complexity and Social Support as Correlates of Adherence to Antiretroviral Medication Among Adolescents Living with HIV/Aids in Benue State, Nigeria

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Abstract
Adherence to antiretroviral medication is essential for viral suppression, prevention of drug resistance, and long-term health among adolescents living with HIV/AIDS. However, adolescents may find it difficult to integrate treatment into school, family, and social life, particularly when medication regimens are demanding and social support is limited. Although regimen complexity and social support are recognised as important influences on HIV treatment outcomes, adolescent-specific evidence from Benue State, Nigeria, remains limited. A cross-sectional survey was conducted among 284 adolescents aged 10–17 years receiving antiretroviral treatment at General Hospital Makurdi, General Hospital Katsina-Ala, and Federal University of Health Sciences Teaching Hospital, Otukpo. Participants were selected through proportionate stratified sampling from a target population of 1,050 adolescents. Data were collected using a sociodemographic questionnaire, a 15-item Adolescent HIV Medication Regimen Complexity Scale, a 12-item Multidimensional Scale of Perceived Social Support, and a 10-item Medication Adherence Report Scale. Pearson's product–moment correlations were used to examine the relationships among the study variables. Regimen complexity was significantly and negatively associated with adherence to antiretroviral medication, $r = -.421$, 95% CI [-.512, -.320], $p < .001$. Social support was significantly and positively associated with adherence, $r = .468$, 95% CI [.372, .554], $p < .001$. Regimen complexity was significantly and negatively associated with social support, $r = -.276$, 95% CI [-.380, -.165], $p < .001$. Higher regimen complexity was associated with lower adherence, whereas higher social support was associated with better adherence. Adolescent HIV services should routinely assess treatment burden and strengthen supportive relationships. Because the study was cross-sectional and used self-reported measures, the findings should be interpreted as associations rather than causal effects.

Keywords: *adolescents living with HIV/AIDS; antiretroviral medication; medication adherence; regimen complexity; social support; Benue State; Nigeria.*

Introduction

Adherence to antiretroviral medication is central to effective HIV treatment and long-term health outcomes. Consistent medication-taking supports viral suppression, reduces the risk of treatment failure and drug resistance, and improves the quality of life of adolescents living with HIV. Adolescence is, however, a critical period for treatment management because responsibility for medication-taking increasingly shifts from caregivers to young people. During this transition, adolescents must manage school demands, peer relationships, stigma,

disclosure concerns, family expectations, and changing daily routines.

Regimen complexity refers to the burden involved in managing a prescribed medication regimen. It includes the number of medicines, dosage forms, dosing frequency, pill burden, administration instructions, storage requirements, and the need to coordinate medication with meals or daily activities. The Medication Regimen Complexity Index was developed to capture these dimensions because a simple count of medicines does not adequately represent the practical demands of medication management (George et al., 2004).

For adolescents, a complex regimen may create practical barriers to adherence. Multiple daily doses increase opportunities for forgetting, while different medication times may conflict with school schedules, travel, social activities, and irregular household routines. Storage concerns, swallowing difficulties, unpleasant taste, and fear of unwanted HIV-status disclosure may further increase the difficulty of taking medication consistently.

Social support may buffer these treatment demands. Support from parents, guardians, relatives, friends, health-care workers, and peers may help adolescents remember medication, attend clinic appointments, manage stigma, and discuss treatment-related concerns. Supportive relationships may also strengthen adolescents' confidence in managing their health and reduce the emotional burden associated with living with HIV.

The relationship between regimen complexity and social support is particularly important. Adolescents who experience greater difficulty managing their medication may require more support, while those with stronger support networks may be better able to manage complex treatment demands. However, the direction of this relationship cannot be determined in a cross-sectional study. Although regimen complexity and social support have received attention in HIV research, adolescent-specific evidence from Benue State remains limited. Few studies have examined whether treatment-management difficulty and social support are associated with adherence among adolescents receiving HIV care in the state. This study therefore examined the relationships of regimen complexity and social support with adherence to antiretroviral medication among adolescents aged 10–17 years living with HIV/AIDS in selected health facilities in Benue State.

Objectives

1. To examine the relationship between regimen complexity and adherence to antiretroviral medication among adolescents living with HIV/AIDS in Benue State.
2. To examine the relationship between social support and adherence to antiretroviral medication among adolescents living with HIV/AIDS in Benue State.
3. To examine the relationship between regimen complexity and social support among adolescents living with HIV/AIDS in Benue State.

Hypotheses

1. Regimen complexity will significantly correlate with adherence to antiretroviral medication among adolescents living with HIV/AIDS in Benue State.
2. Social support will significantly correlate with adherence to antiretroviral medication among adolescents living with HIV/AIDS in Benue State.
3. Regimen complexity will significantly correlate with social support among adolescents living with HIV/AIDS in Benue State.

Medication adherence among adolescents living with HIV

Medication adherence refers to the extent to which individuals take medication as prescribed. Among adolescents living with HIV, adherence may be influenced by developmental changes, stigma, disclosure concerns, peer relationships, mental health, family circumstances,

and the practical demands of daily medication-taking. Adolescents may also experience treatment fatigue after prolonged use of antiretroviral therapy.

The transition from caregiver-managed treatment to self-management may be particularly challenging. Adolescents may need to take medication during school hours, while travelling, or in social settings where they wish to conceal their HIV status. These circumstances may increase the risk of missed doses, delayed doses, and treatment interruptions.

Regimen complexity

Regimen complexity includes the number of medications, dosage forms, dosing frequency, and additional instructions associated with a regimen. George et al. (2004) developed the Medication Regimen Complexity Index to capture these dimensions because a simple count of medicines does not fully represent the burden of medication management.

For adolescents living with HIV, regimen complexity may be experienced through difficulty remembering multiple doses, coordinating medication with meals, swallowing tablets, storing medicines safely, and maintaining routines during school or social activities. Higher regimen complexity may therefore increase the likelihood of missed or delayed doses.

In the present study, regimen complexity was expected to be negatively associated with adherence. This expectation was based on the view that greater treatment-management demands may reduce the consistency with which adolescents take antiretroviral medication.

Social support and adherence

Social support refers to actual or perceived assistance received from family members, friends, significant others, and health-care providers. Such support may be emotional, informational, instrumental, or practical in nature. Among adolescents living with HIV, supportive family environments, safe disclosure, peer support, and adolescent-friendly clinical services may promote adherence. Social support may be particularly important when adolescents experience stigma, live apart from parents, or have limited access to health-care services. Supportive relationships may help adolescents remember medication, attend clinic appointments, and cope with treatment-related stress. In the present study, social support was expected to be positively associated with adherence. This expectation was based on the view that adolescents who perceive greater support may be better able to manage the demands of antiretroviral treatment.

Regimen complexity and social support

The relationship between regimen complexity and social support is also relevant to adolescent HIV care. Adolescents who experience greater difficulty managing medication may require more support, while adolescents with stronger support networks may be better able to manage complex treatment demands. However, the direction of this relationship cannot be established in a cross-sectional study. It is possible that low social support makes complex regimens more difficult to manage. It is also possible that adolescents experiencing greater treatment difficulty perceive less support or have different social circumstances.

In the present study, regimen complexity was expected to be negatively associated with social support.

Gap in literature

Although prior research has examined HIV treatment adherence among adolescents, few studies have simultaneously examined regimen complexity and social support as correlates of adherence among adolescents living with HIV/AIDS in Benue State. Most available studies focus either on general adherence barriers or on adult populations. There is therefore limited

context-specific evidence to guide adolescent-friendly HIV services in Benue State.
This study addressed that gap by examining the relationships among regimen complexity, social support, and adherence to antiretroviral medication among adolescents receiving HIV care in the state.

Design
The study adopted a cross-sectional survey design to examine the relationships of regimen complexity and social support with adherence to antiretroviral medication among adolescents living with HIV/AIDS in Benue State. This design was appropriate because it allowed data to be collected from participants at one point in time and enabled examination of associations among the study variables. The independent variables were regimen complexity and social support, while the dependent variable was adherence to antiretroviral medication.

Population
The target population comprised 1,050 adolescents receiving antiretroviral treatment at three selected health facilities in Benue State: General Hospital Makurdi (n = 328), General Hospital Katsina-Ala (n = 436), and Federal University of Health Sciences Teaching Hospital, Otukpo (n = 286).

Sample-size determination
The sample size was determined using the Krejcie and Morgan (1970) table for determining sample size for research activities. For a population of 1,050, the appropriate sample size is 285. Therefore, 285 adolescents were targeted for the study.
A total of 284 adolescents provided complete data on the principal study variables. This represented a usable-response rate of 99.6%.

Sampling technique
Proportionate stratified sampling was used to select participants across the three health facilities. The number of participants allocated to each facility was proportional to its population of adolescents receiving antiretroviral treatment.
The allocation was calculated as:

$n_h = \frac{Nh}{N}$ x n

where n_h is the sample allocated to a facility, N_h is the facility population, N is the total population, and n is the planned sample.
The allocation was:

i. General Hospital Makurdi: 328/1,050 x 285 = 89 participants.
ii. General Hospital Katsina-Ala: 436/1,050 x 285 = 118 participants.
iii. Federal University of Health Sciences Teaching Hospital, Otukpo: 286/1,050 x 285
78 participants.

The total allocated sample was 285 participants.

Participants
The participants were 284 adolescents aged 10–17 years living with HIV/AIDS and receiving antiretroviral medication at General Hospital Makurdi, General Hospital Katsina-Ala, and Federal University of Health Sciences Teaching Hospital, Otukpo.
In terms of age, 74 participants (26.1%) were aged 10–12 years, 123 (43.3%) were aged 13–15 years, and 87 (30.6%) were aged 16–17 years. Among the 279 participants with valid information on sex, 246 (88.2%) were male and 33 (11.8%) were female.

In terms of ethnic group, 142 participants (50.5% of valid responses) were Tiv, 98 (34.9%) were Idoma, and 41 (14.6%) belonged to other ethnic groups. Regarding religion, 152 participants (54.3% of valid responses) were Muslims, 114 (40.7%) were Christians, and 14 (5.0%) practised other religions.

Concerning place of residence, 152 participants (53.5%) lived in rural areas, while 132 (46.5%) lived in urban areas. Among the 277 participants with valid information on educational level, 44 (15.9%) had no formal education, 96 (34.7%) had primary education, 82 (29.6%) had secondary education, and 55 (19.8%) had tertiary education.

A total of 161 participants (56.7%) were in school, while 123 (43.3%) were out of school. Among the 283 participants with valid information on living arrangement, 138 (48.8%) lived with parents or guardians, 62 (21.9%) lived with relatives, 53 (18.7%) lived with friends or partners, and 30 (10.6%) reported other arrangements.

For employment status, 101 participants (35.6%) were not employed, 72 (25.4%) were employed part-time, 41 (14.4%) were employed full-time, and 70 (24.6%) were apprentices or students. A total of 162 participants (57.0%) had disclosed their HIV status, while 122 (43.0%) had not. Regarding access to health care, 179 participants (63.0%) reported access, while 105 (37.0%) reported no access. Among the 278 participants with valid information on duration on antiretroviral therapy, 68 (24.5%) had received treatment for less than six months, 74 (26.6%) for six months to one year, 92 (33.1%) for one to three years, and 45 (15.8%) for more than three years.

Instruments

Regimen Complexity Scale. Regimen complexity was measured using a 15-item adolescent scale developed from established regimen-complexity concepts. The scale assessed difficulty with medication timing, daily routines, swallowing, storage, varying medication schedules, and general treatment-management demands. Responses were scored on a four-point format: Never = 0, Rarely = 1, Sometimes = 2, and Always = 3. Total scores ranged from 0 to 45, with higher scores indicating greater perceived difficulty managing the medication regimen. The scale was expert-validated and pilot-tested among 103 adolescents living with HIV. The pilot reliability coefficient was Cronbach's alpha = .764.

Social Support Scale. Social support was measured using the 12-item Multidimensional Scale of Perceived Social Support (MSPSS), which assesses perceived support from family, friends, and significant others (Zimet et al., 1988). Items were rated on a seven-point scale ranging from 1 (*very strongly disagree*) to 7 (*very strongly agree*). Total scores ranged from 12 to 84, with higher scores indicating greater perceived social support. The pilot reliability coefficient obtained in the present study was Cronbach's alpha = .851.

Adherence to Antiretroviral Medication Scale. Adherence to antiretroviral medication was measured using a 10-item self-report scale adapted for antiretroviral medication. Items assessed regular medication-taking, missed doses, dose alteration, treatment interruption, and taking medication as prescribed. Higher scores indicated better reported adherence. The pilot reliability coefficient obtained in the present study was Cronbach's alpha = .854.

Procedure

The study was conducted among adolescents living with HIV/AIDS receiving antiretroviral treatment at General Hospital Makurdi, General Hospital Katsina-Ala, and Federal University of Health Sciences Teaching Hospital, Otukpo. The researcher obtained approval from the relevant health authorities and the management of the selected facilities. After approval was

obtained, parental or guardian consent and adolescent assent were sought from eligible participants. Those who willingly agreed to participate were assured of the confidentiality of their responses and the protection of their identity. Participants were assured that the study would not cause them harm and that their participation or withdrawal would not affect the health-care services they received. Questionnaires were administered privately, and participants completed them at their own pace.

Data analysis

Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to describe the participants and study variables. Pearson's product–moment correlations were used to test the three study hypotheses.

Correlation coefficients were interpreted as follows: .10 to .29, weak correlation; .30 to .49, moderate correlation; and .50 and above, strong correlation. Statistical significance was set at $p < .05$. Participants with missing values on regimen complexity, social support, or adherence were excluded from the correlation analysis using listwise deletion. The final correlation analysis included 284 participants.

Results

Descriptive statistics

The mean regimen-complexity score was 38.42 (SD = 8.56). The mean social-support score was 56.82 (SD = 10.25). The mean medication-adherence score was 31.45 (SD = 7.93).

Table 1

Descriptive Statistics for Principal Study Variables

Variable	M	SD	Minimum	Maximum
Regimen complexity	38.42	8.56	0	45
Social support	56.82	10.25	12	84
Adherence to antiretroviral medication	31.45	7.93	—	—

Note. N = 284.

Correlation analysis

Regimen complexity was significantly and negatively associated with adherence to antiretroviral medication, $r = -.421$, 95% CI [-.512, -.320], $p < .001$. This moderate negative relationship indicated that adolescents who reported greater difficulty managing their medication regimens tended to report lower adherence.

Social support was significantly and positively associated with adherence to antiretroviral medication, $r = .468$, 95% CI [.372, .554], $p < .001$. This moderate positive relationship indicated that adolescents who reported higher social support tended to report better adherence.

Regimen complexity was significantly and negatively associated with social support, $r = -.276$, 95% CI [-.380, -.165], $p < .001$. This weak-to-moderate negative relationship indicated that adolescents who reported greater regimen complexity tended to report lower social support.

Table 2
Correlation Matrix Showing the Relationships Among Regimen Complexity, Social Support, and Adherence to Antiretroviral Medication

VARIABLE	1	2	3	M	SD
3. Adherence to antiretroviral medication	-.421*** [-.512, -.320]	.468*** [.372, .554]	—	31.45	7.93
2. Social support	-.276*** [-.380, -.165]	—		56.82	10.25
1. Regimen complexity	—			38.42	8.56

Note. N = 284. Values in brackets are 95% confidence intervals.
*** p < .001.

Summary of hypothesis testing

Table 3
Summary of Hypothesis Testing

HYPOTHESIS	RELATIONSHIP TESTED	RESULT	DECISION
1	Regimen complexity and adherence	r = -.421, 95% CI [-.512, -.320], p < .001	Supported
2	Social support and adherence	r = .468, 95% CI [.372, .554], p < .001	Supported
3	Regimen complexity and social support	r = -.276, 95% CI [-.380, -.165], p < .001	Supported

Discussion

Hypothesis one tested whether regimen complexity would significantly correlate with adherence to antiretroviral medication among adolescents living with HIV/AIDS in Benue State. The finding showed a significant negative correlation between regimen complexity and adherence, r = -.421, 95% CI [-.512, -.320], p < .001. This implies that adolescents who reported greater difficulty managing their medication regimens tended to report lower adherence. This finding finding is consistent with the conceptualisation of regimen complexity as a multidimensional treatment burden. George et al. (2004) developed the Medication Regimen Complexity Index to capture dosage forms, dosing frequency, and additional administration instructions because these characteristics influence the effort required to manage medication. A regimen may therefore become difficult to follow not only because it contains several medicines but also because it requires repeated daily dosing, different administration times, special instructions, or coordination with meals.

The finding is particularly relevant to adolescents. Young people may need to take medication during school hours, while travelling, or in social settings where they wish to conceal their HIV status. These circumstances may make a regimen difficult to follow even when the medication is clinically appropriate.

Hypothesis two tested whether social support would significantly correlate with adherence to antiretroviral medication. The result showed a significant positive correlation between social support and adherence, r = .468, 95% CI [.372, .554], p < .001. This implies that adolescents who perceived greater social support tended to report better adherence.

This finding suggests that supportive relationships may help adolescents manage the demands of HIV treatment. Family members, friends, significant others, and health-care workers may provide reminders, encouragement, transport assistance, and emotional reassurance. Social support may also reduce the psychological burden of stigma and disclosure concerns.

Hypothesis three tested whether regimen complexity would significantly correlate with social support. The result showed a significant negative correlation between regimen complexity and social support, r = -.276, 95% CI [-.380, -.165], p < .001. This implies that adolescents who reported greater regimen complexity tended to report lower social support.

However, the cross-sectional design prevents conclusions about directionality. It is possible that low social support makes complex regimens more difficult to manage. It is also possible that adolescents experiencing greater treatment difficulty perceive less support or have different social circumstances.

The study did not conduct a multiple regression analysis with regimen complexity and social support entered simultaneously. Therefore, the study cannot determine the independent contribution of each variable to adherence after controlling for the other predictor. The study also did not test whether social support moderated the relationship between regimen complexity and adherence. Future studies should conduct a multiple regression analysis with regimen complexity and social support entered as simultaneous predictors of adherence. Such an analysis would show the unique contribution of each variable after accounting for the other. A moderation analysis could also examine whether social support changes the strength of the relationship between regimen complexity and adherence.

Recommendations

Based on the findings of this study, the following recommendations were made:

i. Health-care providers should routinely assess medication-management difficulties among adolescents receiving antiretroviral therapy.

ii. Treatment reviews should consider dosing frequency, pill burden, swallowing difficulties, storage requirements, meal-related instructions, and school-related challenges.

iii. Future studies should use multiple regression and moderation analysis to determine the independent and interactive effects of regimen complexity and social support on adherence.

Contributions to Knowledge

This study contributes to knowledge in the following ways:

i. Development of an adolescent-specific regimen complexity instrument: The researcher developed and validated an instrument for measuring medication regimen complexity among adolescents living with HIV/AIDS. Unlike existing measures that focus mainly on the number of medications or doses, the instrument captures adolescent-relevant dimensions of regimen burden, including pill burden, dose frequency, timing requirements, formulation, dietary or administration instructions, and the practical demands of taking medication within school, family, and peer contexts. This represents an original contribution by providing researchers and clinicians with a context-appropriate tool for assessing regimen complexity in adolescent HIV care.

ii. It demonstrates that social support is positively associated with adherence among adolescents living with HIV/AIDS in the selected health facilities.

iii. It provides a foundation for future studies using multiple regression, longitudinal designs, and moderation analysis.

Limitations

The study had some limitations.

i. the cross-sectional design did not establish temporal or causal relationships among the study variables.

ii. the regimen-complexity measure was study-specific and requires further validation across additional adolescent HIV-care settings.

iii. the study was conducted in selected health facilities, which limits generalisation to adolescents receiving care elsewhere or those disengaged from treatment.

iv. the study used bivariate correlations and did not adjust for other potential determinants of adherence, including stigma, disclosure, mental health, socioeconomic conditions, medication availability, and viral suppression.

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