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FORTUNE JOURNAL OF HEALTH SCIENCES

ISSN: 2644-2906

Research Article

Integrated Community Analysis Transformation (ICAT) Model: A Tool for Community NCD Prevention and Improved Quality of Life

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Abstract

Purpose: To develop a model that would be used to address Non-Communicable Diseases (NCDs) in communities for the improvement of the quality of life of People with HIV living with Hypertension and Diabetes.

Methods: A cross-sectional survey was conducted in Wakiso, Uganda, among HIV patients receiving antiretroviral therapy and drug refills from CDDP. 219 participants completed questionnaires. Data was analyzed using Pearson's product-moment correlation, simple linear regression, path analysis, and structural equation modeling (SEM) techniques to validate and assess the model.

Results: Community-based NCD services, such as health promotion (β=0.58, P=0.006), community support systems (β=0.24, P=0.000), and patient monitoring systems (β=0.46, P=0.000), had a direct impact on quality of life. The moderating effect revealed both significant (marital status, education level, and NCD services) and insignificant (age and gender) direct and indirect pathways.

Conclusion: The structural equation modeling and path analysis results showed that community support systems, patient factors, and patient monitoring systems as direct effects had weak loadings on patients' quality of life. The model fitted perfectly, according to the goodness of fit test's overall indicators. Therefore, to boost service use and enhance patients' overall quality of life, the government, together with the Ministry of Health and District Health Officers, should put the ICAT model into practice.

Keywords: Quality of Life, Community, HIV, People Living with HIV, Services, Uganda, Non-Communicable Diseases

Introduction

The National Health Policy by the Ministry of Health (MOH), Uganda (29), highlights an increasing prevalence of non-communicable diseases (NCDs) and their risk factors among HIV patients receiving Anti-Retroviral Therapy (ART). (1). For this reason, the policy delegates the MoH-Uganda to put in place a program aimed at preventing and controlling NCDs in all public health facilities, though the health workers do not offer the services to the community drug distribution points (CDDPs). To address the SDGs, the program formulated community-based strategies aimed at reducing co-morbidities related to non-communicable diseases (NCDs) (2); these strategies are hallowed in SDG-3, indicator 3.4, which focuses on decreasing one-third

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Citation: Christopher Ddamulira, Stephen S. Kizza, Eria Muwanguzi, James Wanzima, Lawrence Sserwanga, Frank Pio Kiyingi. Integrated Community Analysis Transformation (ICAT) Model: A Tool for Community NCD Prevention and Improved Quality of Life. Fortune Journal of Health Sciences, 8 (2025): 196-211.

Received: February 18, 2024
Accepted: May 13, 2024
Published: March 13, 2025

of premature mortalities resulting from NCDs, to be achieved through enhancing prevention and treatment by 2030, in addition to promoting mental health and well-being (3). Due to the psychological impacts of HIV, antiretroviral therapy (ART), and the fast-rising number of individuals living and surviving with HIV, Uganda, like other sub-Saharan African nations, faces the double burden problem of NCDs (4,5). In Uganda, about 250,000 people face a double burden of HIV and NCDs, with diabetes mellitus and hypertension prevalence rates of 14% and 28.7% respectively among the people living with HIV who are on ART (6). Yet, according to the published information, “the present community service delivery models of ART do not include the integrated community management of co-morbidities and co-infections” (7) (pg. 4). Hence, this calls for innovative integrated care models that will address the anticipated changes as a result of test and treat strategy that will increase the number of patients seeking care at the health facilities, which facilities are already facing human resource constraints (8).

In Uganda, most of the focus has been put on integrating HIV care with reproductive health, malaria, tuberculosis (TB), and other sexually transmitted infections compared to any other NCDs like diabetes or hypertension (9). Yet, such a situation creates a very big threat to the health system, affecting health service delivery most especially for HIV and NCDs (4,5,10). In response to address Sustainable Development Goal 3 (SDG 3), the Ministry of Health Uganda (9), designed a strategic objective that targeted all public, NGO, and private health facilities to implement appropriate HIV and NCD health interventions in these institutions to fight NCD as well as improve QoL among the entire Ugandan population (9). About the World Health Organization (11), SDGs (2015), and the ministry of health Uganda (8) strategies, there were gaps in not providing HIV patients with community-based NCD services, that is, those patients who received ARVs from the CDDPs.

Background

The study’s conceptual component involved variables community-based NCD (CBNCD) and QoL of PLHIV. According to the current study, chronic NCDs can be defined as those diseases affecting individuals for a longer period without known causative agents responsible for the transmission of the disease in a population (12). HIV patients who are on ART are commonly associated with having co-morbidities related to hypertension and Diabetes Mellitus (DM), and these co-morbidities can result in health effects like reduced environmental health, physical health, and social relationship QoL. World Health Organization (12) emphasizes the importance of community-based NCD services, which include patient monitoring systems, community support networks, and health promotion initiatives. These services aim to prevent and address the underlying causes of illness, improving health and quality of life. Rotger et al. (13) highlight early identification and screening of NCD risk factors, referral, early treatment, and increasing knowledge of risk factors and risk reduction. Health promotion services such as behavior modification counseling, community support, lifestyle change, treatment adherence, routine monitoring, self-management, rehabilitation, pain management, and psychosocial support are important, (14). Adopting NCD programs is crucial for preventing or controlling diabetes mellitus and hypertension in rural areas.

The World Health Organization (WHO) defines Quality of Life (QoL) as "an individual's perception of their position within the cultural and value systems in which they live, as well as their goals, expectations, standards, and concerns (12). QoL is inherently subjective and varies from person to person, influenced by individual experiences, culture, beliefs, and personal values, as well as how these factors align with or differ from expected life outcomes (15). While most patients acknowledge that antiretroviral therapy (ART) and overall health improvements enhance their quality of life, those with co-morbidities such as diabetes and hypertension face challenges in accessing community-based non-communicable disease (NCD) care.

Furthermore, the World Health Organization (58) highlights that community HIV settings in developing nations often experience poor quality of life across physical, emotional, social, and environmental domains. The inability to perform daily tasks, lack of public acceptance, and insufficient assistance or support for day-to-day living significantly impact patients' well-being (16). Patients' quality of life is impacted when they are unable to perform daily tasks. They believe that they are not accepted by the public. In addition, they don't have assistance or support for day-to-day living. Similarly, Peck et al. (6) observed that the co-burden of illness leads to a decline in social interactions due to limited friend support, dissatisfaction with sex life, restricted access to health services, and distressing emotions such as melancholy, hopelessness, anxiety, and sadness.

Health Promotion Activities and QoL

Health promotion activities play a crucial role in improving the quality of life (QoL) for individuals living with HIV. A Randomized Clinical Trial (RCT) conducted in Nepal found that social self-value empowerment through health promotion activities significantly enhanced the QoL of HIV-positive individuals receiving antiretroviral treatment (17). These findings align with the research of Bateganya et al. (18), who discovered that an empowerment intervention utilizing health-promoting activities and community system support was effective in enhancing the quality of life for HIV-positive individuals.

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Furthermore, Van van Heijden et al. (19) found that psychosocial group interventions improved coping mechanisms and daily functioning among individuals living with HIV, helping them accept their diagnosis and adhere to long-term care plans. These findings align with those of Motohashi et al. (20) and Mohan et al. (21), who reported that psychosocial techniques enhanced overall quality of life and effectively prevented non-communicable diseases in Japan and India. However, the studies reviewed focused solely on the social connection aspect of quality of life (QoL) and did not address services that promote physical and environmental well-being.

Building on this, a systematic review by Medley et al. (23) found that social and behavioral interventions positively influenced the QoL of HIV-positive individuals receiving ART. Similarly, Wageman (22) observed a moderate impact of these treatments on life quality. However, Bateganya et al. (18) emphasized that for these interventions to have a measurable effect on key QoL outcomes, studies must be designed with innovation and methodological rigor. One major limitation of previous studies, including those by Medley et al. (23), Wageman (22), and Bateganya et al. (18), was their reliance on secondary data, which restricted the ability to evaluate patient behaviors comprehensively. By gathering empirical data from patients to better understand the elements that enhance quality of life, the study aimed to close this knowledge gap. The study was designed using the health belief model as a theoretical framework, which limited the ability to evaluate patient behavior and the surroundings in which they interact. To fill the gap, the current study employed the socio-ecological model.

Community Support Systems and QoL

According to the Ministry of Health, community support systems, also known as structures, are client psycho-social groups that work within the communities to link and refer people to different health services as well as to encourage people and families to follow health messages and treatments (8). In a similar spirit, Decroo et al. (24) investigated how community support networks, which included community ART groups, affected ART patients' retention in care in Tete Province, Mozambique. In comparison to patients receiving individual care from the facilities, the study results demonstrated that patients in community ART groups had higher clinical outcomes and higher retention in care. In a similar vein, Greve (25) found that patients receiving dual services from the community had a higher quality of life than those receiving ART therapy only from medical facilities in a study of disabled individuals on ART conducted in Europe. The cross-sectional design of the examined studies left a gap in the evaluation of the intervention's efficacy. To fill the vacuum left by the prior research listed, the study employed a quasi-experiment to assess the efficacy of the Integrated Community Analysis Model (ICAT). The integrative and decentralized community HIV care approach is preferred by patients on methadone maintenance, according to Tran et al. (26) in a cross-sectional study carried out in Vietnam. The study provided evidence supporting the efficacy of methadone and HIV treatment for drug users in Vietnam, as well as the benefits of integrating with already-existing community-based HIV and health services.

Grimsrud (7) observed that changes in behavior and quality of life outcomes across different HIV service models highlight the need for HIV-related interventions. He emphasized the importance of a comprehensive healthcare approach that addresses the co-morbidity of HIV and non-communicable diseases (NCDs) to improve quality of life. However, both Grimsrud (7) and Tran et al. (26) used a cross-sectional approach, which is not ideal for establishing causal relationships between interventions and outcomes, presenting a limitation in their studies. Additionally, the use of convenience sampling and self-reported data in the data collection process introduced methodological weaknesses, reducing the generalizability of their findings.

According to UNAIDS (36), several studies on task shifting among people living with HIV (PLHIV) provide strong evidence that community-based service delivery models can effectively address skill imbalances and labor shortages in healthcare. However, Fulton et al. (27) identified several challenges in their analysis of task shifting in HIV and AIDS care in sub-Saharan Africa, including professional and institutional resistance, concerns about quality and safety, and the need to sustain motivation and performance among healthcare workers. This suggests that while utilizing lower-level cadres may be more cost-effective, it can raise quality concerns (22). The studies by Fulton et al. (27) and Wageman (22) focused primarily on task shifting as a standalone factor in healthcare quality, emphasizing physical health outcomes while overlooking other critical dimensions of quality of life (QoL), such as emotional well-being, environmental factors, and social relationships.

Callaghan et al. (28) discovered that patients seen by mid-level workers (with 2.5 years of training) in Mozambique had a nearly 30% higher chance of having CD4 counts taken six months after the start of ART than patients seen by doctors, and they also had a 44% lower chance of being lost to follow-up. When comparing the middle-level workers to the doctors at a 12-month point, there were notable variations in mortality and CD4 counts. Similarly, in Rwanda, nurses correctly determined almost 99% of HIV patients' eligibility for ART (29). To improve the QoL of patients on ART, professional clients were employed for task-shifting as a potential tactic to raise the QoL of patients on ART in

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the communities. The research used human flourishing ideologies, focusing on the physical aspects of QoL rather than emotional health, surroundings, and social connections. A new model integrated into psychosocial services and policy to support all aspects of the patient's life while receiving care. Building on these findings, a community-based program in Uganda that provided home-based ART through lay providers demonstrated significant success when compared to routine clinic visits (8). After field officers and lay counselors were introduced, there was an improvement in ART adherence. Comparable research from South Africa and Malawi demonstrates that patients who received community support had far higher rates of survival and care retention than those who did not (30). Both investigations used quantitative methodology, considering service providers' opinions. Callaghan et al. (28) found that home-based ART in Uganda through community lay counselors leads to improved social outcomes like increased family support and relationships. However, the studies were urban-based, neglected the integration of NCD care with HIV services, and relied on systematic reviews instead of collecting empirical data from respondents following the introduction of community-based NCD services. Research conducted by Callaghan et al. (28) brought attention to the operational costs associated with task shifting. Among these were an increase in workload without receiving additional compensation, a lack of tools to do the tasks given, and insufficient knowledge and expertise to complete the new tasks. The study was backed by Shumbusho et al. (29), who reported that certain patients "refused" to be treated by non-professionals or health personnel of a lower cadre. They thought they might receive subpar care or inappropriate treatment. The lack of national guidelines and regulations to apply task-shifting models was the cause of the poor skills mix (28). The scholarly community's disagreement on the efficacy of task shifting resulted in a vacuum in the corpus of knowledge required to assess task shifting's efficacy using the Integrated Community Analysis Model (ICAT) at the community level.

Patient Monitoring Systems and QoL

Effective patient monitoring is essential for improving the quality of life (QoL) of individuals on ART. Research highlights the role of interventions such as exercise programs in enhancing patient outcomes. For instance, Bemelmans et al. (30) found that regular aerobic exercise training improves immune function, reduces risk factors for chronic diseases, and increases CD4 counts in individuals with chronic illness. This finding aligns with Pedersen and Hoffman Goetz's (31) study on the impact of a 12-week interval training program on CD4 count in 28 HIV-positive participants. The study suggests that patient monitoring systems for lifestyle modification therapies can improve quality of life. However, the small sample size of 28 participants in the previous studies prevented the results from applying to all HIV patients. The study used a larger sample size of 219 participants. In a study published in 2016, Lewington et al. (32) used closely monitored dietary modification as a behavioral intervention to lower salt intake in patients with hypertension who typically consumed low, intermediate, or high sodium levels. According to Lewington et al. (32), the results showed a 3.0–6.8 mmHg decrease in systolic blood pressure. On the other hand, exercise appears to lower body weight, glucose, insulin, triglyceride, and proatherogenic lipoprotein levels in HIV-negative individuals with CVD risk factors. The results provide credence to the idea that exercise is one of the conventional lifestyle changes that can be utilized to control and lower systolic and diastolic blood pressure in pre-hypertensive HIV-positive individuals. Accordingly, the investigations hypothesized that patient quality of life (QoL) was enhanced by health promotion interventions.

Kavishe et al. (33) state that undiagnosed and untreated hypertension is a significant issue in East Africa and that there is a high incidence of NCD risk factors in the region. There is a chance for prevention due to the low prevalence of DM and other NCDs that can be avoided. Significant efforts must be made to improve health care for the prevention, early detection, and treatment of chronic diseases in Tanzania, Uganda, and most likely other parts of Africa (33). The NCD movement may benefit greatly from many of the lessons learned from the HIV experience. The studies lacked policies and procedures for integrating non-communicable diseases (NCDs) into HIV mainstreaming in households and communities, highlighting the need for responsibility distribution among HCW cadres, comprehensive clinical monitoring systems, medication adherence assistance, and patient-centered care (34). Given the limited resources available for HIV and AIDS responses, integration has been emphasized as a top priority (35). Potential benefits of emphasizing the patient's enhanced quality of life in the HIV/NCD model integration include leveraging the community structures already in place for ART delivery, health promotion initiatives, and HIV and related disease monitoring (17).

Furthermore, an investigation conducted by Tran et al. (2012) verified that the provision of integrated HIV and AIDS services was more effective than that of standalone services (26). Nevertheless, according to UNAIDS (36), no study examined the effectiveness of combining HIV and NCD care with conventional community service delivery sites for ART. The study's conclusions have an impact on how non-communicable diseases are managed and expanded among HIV patients getting ARVs in Ugandan communities. Numerous studies have compared the treatment outcomes of HIV patients getting antiretroviral medication (ART) in community adherence groups to those who are not in groups. According to Jobarteh et al. (37), the results indicated that the groups' clinical outcomes were better. Research conducted in Zambia, Mozambique, Lesotho, Swaziland, and Haiti revealed that clinical results and retention rates varied between 81% and 98.7% for the community adherence groups (7,38). While other trials conducted in other nations mostly concentrated on retention and mortality, the investigations included CD4 counts and viral load suppression as indications of clinical outcomes. As a result, one aspect of the physical QoL was highlighted in this research rather than the social and environmental aspects of the HIV patients' QoL.

Methods and Materials

The study aimed to explore the impact of NCD services on the QoL of HIV-positive individuals in Wakiso District. It used a community-based cross-sectional study methodology to develop a model for treating NCDs and improving the QoL for those with HIV and NCDs. The study provided statistical information on community-based NCD services and variables affecting patients' quality of life using a quantitative method. The research was conducted in Uganda's Wakiso area. The center district of Wakiso is bordered to the north by Mpigi, Luweero, Nakaseke, and Kiboga District; to the east is Mukono District; and to the south is Kalangala District. Wakiso is 2,807.7 square kilometers in total size. The study was specifically carried out in Busiro County, which contains a mix of rural and urban areas; this helped to mitigate the bias associated with urban settings. Eight sub-countries make up the county; four of these were chosen at random and stratified for the study. These included the sub-counties of Gombe, Masulita, Kakiri, and Namayumba. The study's participants were people living with HIV in Wakiso District, Uganda, who were receiving long-term treatment from Community Drug Distribution Points (CDDPs). These were adult HIV-positive patients receiving long-term antiretroviral therapy (ART) at CDDP in four sub-counties within the Wakiso district that were chosen at random. The ART registries at the medical facilities in the chosen counties provided the sample frame for the patients. The Ministry of Health Uganda stated that all the medical facilities were at level III. The produced lists of active participants from the registers who were receiving ART care and management from the communities at the time of research implementation were used to randomly choose the study participants.

The study included 219 HIV patients who were receiving chronic treatment from the Community Drug Distribution Points (CDDPs) in Wakiso District and had either diabetes or hypertension as NCDs. The individual level was the analytical unit. A systematic questionnaire for the WHO Quality of Life (QoL) was used to collect data (16). All eligible HIV participants who were 18 years of age or older and getting ART in the communities were asked to formally consent. The Uganda National Council for Science and Technology and the Mildmay Uganda Research Ethics Committee gave their approval to the project. Amos statistical software and the Statistical Package for the Social Sciences (SPSS) software were used to examine quantitative data. To verify the association between moderator characteristics, quality of life, and community-based NCD services, Amos statistical software was used to perform path analysis and partial least square–-structural equation modeling (SEM) on all the direct and indirect QoL predictors. To investigate the independent latent variables affecting life quality, SEM was employed. As shown in Table 1 below, the impact of patient factors and NCD services (community support, health promotion, and patient monitoring systems) on the developed model was examined in this study.

Results of the Study

FUNCTIONAL INTER-RELATIONS BETWEEN HEALTH PROMOTION, COMMUNITY SYSTEMS SUPPORT, PATIENT MONITORING SYSTEMS, PATIENT FACTORS, AND QUALITY OF LIFE AS EXPRESSED IN THE STRUCTURAL EQUATION MODELING

Table 1: Structural Equation Modelling (SEM) for Model Testing and Validation

Variables	Coefficient (β)	Standard Error (S.E)	p-value	95% Conf. Interval	
				Lower	Upper
Direct Effects					
Quality of Life (QoL)					
Health Promotion	0.58	0.07	0.006**	0.057	0.633
Community Support Systems	0.24	0.058	0.000**	0.129	0.355
Patient Monitoring Systems	0.46	0.059	0.000**	0.147	0.578
Gender	0.059	0.091	0.513	0.119	0.237
Marital Status	0.58	0.095	0.002**	0.291	0.581
Education Level	0.76	0.059	0.000**	0.191	0.839
Age in years	-0.0023	0.005	0.619	-0.011	0.007
Indirect Effects					

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Health promotion					
Gender	0.036	0.112	0.744	-0.255	0.182
Marital Status	0.047	0.116	0.002**	0.18	0.273
Education Level	0.32	0.071	0.000**	0.108	0.172
Age in years	0.014	0.006	0.802	-0.009	0.013
Community Support Systems					
Gender	0.069	0.112	0.536	-0.15	0.289
Marital Status	0.288	0.116	0.013**	0.061	0.516
Education Level	0.186	0.072	0.009**	0.046	0.327
Age in years	-0.0069	0.006	0.231	-0.004	0.018
Patient Monitoring Systems					
Gender	0.18	0.134	0.189	-0.438	0.087
Marital Status	0.016	0.139	0.000*	0.289	0.254
Education Level	0.032	0.086	0.000*	0.136	0.2
Age in years	0.004	0.007	0.522	-0.018	0.009

Source: Primary data, 2020

The findings from Table 1 showed that the domains of the community-based NCD services such as health promotion (β=0.58, P=0.006), community support systems (β=0.24, p=0.000), and patient monitoring systems (β=0.46, p=0.000) had a direct causal effect in the improvement of quality of life. Overall community-based NCD services had a significant causal effect in improving the QoL of the participants who received the NCD services. It implies that the study participants' QoL improved when they embraced the community support networks, health promotion initiatives, and patient monitoring activity schedules. Similarly, the education level (β=0.76, P=0.000) and marital status (β=0.57, P=0.002) of the study participants had a significant direct impact on improving their quality of life. This suggests that being married and attaining higher education levels are key factors in enhancing QoL. Additionally, family support, particularly partner involvement, can further contribute by ensuring medication adherence and fostering a peaceful environment—both of which play a crucial role in managing hypertension and diabetes. Therefore, integrating community-based NCD services into MOH policies and guidelines is essential to ensure all communities have free access to these services. The results showed that the participants' marital status and educational attainment had an impact on the utilization the community NCD services. It was inferred that the use of community-based NCD services to enhance overall QoL was influenced by marital status and educational attainment. Thus, community-based NCD services and patient demographics are significant determinants of improving the QoL for HIV-positive individuals with NCDs.

The hypothesized conceptual paths in Figure 1, showed the causal and effect relationships between the community-based NCD services such as health promotion activities, community support systems, patient monitoring systems, and the QoL. Furthermore, patient factors like; age, marital status, level of education, and gender as predictors of the utilization of the community-based NCD services as the outcome (Dependent variable). Similarly, the patient's demographic characteristics as a cause would predict the poor or good QoL. Hence, they influenced both the community-based NCD services and the QoL as per the various hypothesized conceptual paths in Figure 1 above.

Assessment of the Different Paths

The multiplicative model was adopted in an attempt to choose the most significant path in contributing to the QoL of HIV patients living with NCDs in Wakiso District, Uganda. The direct and indirect total effects are depicted in Table 2.

The results from Table 2 indicate that the factors directly influencing the quality of life were health promotion (0.58), patient monitoring systems (0.46), marital status (0.57), and education level (0.76). Additionally, marital status and education level indirectly enhanced the community support systems, contributing to a significant total effect of 0.528, which is indicative of an improved quality of life. According to Sekaran and Bougie (2016), factor loadings below 0.5 are considered poor and should be deleted, those between 0.6 and 0.69 are acceptable, and those above 0.7 are considered good. Therefore, the factor loadings for routes are acceptable and good for predicting the causal relationship between the community NCD services, patient factors, and the improvement in the QoL among the patients.

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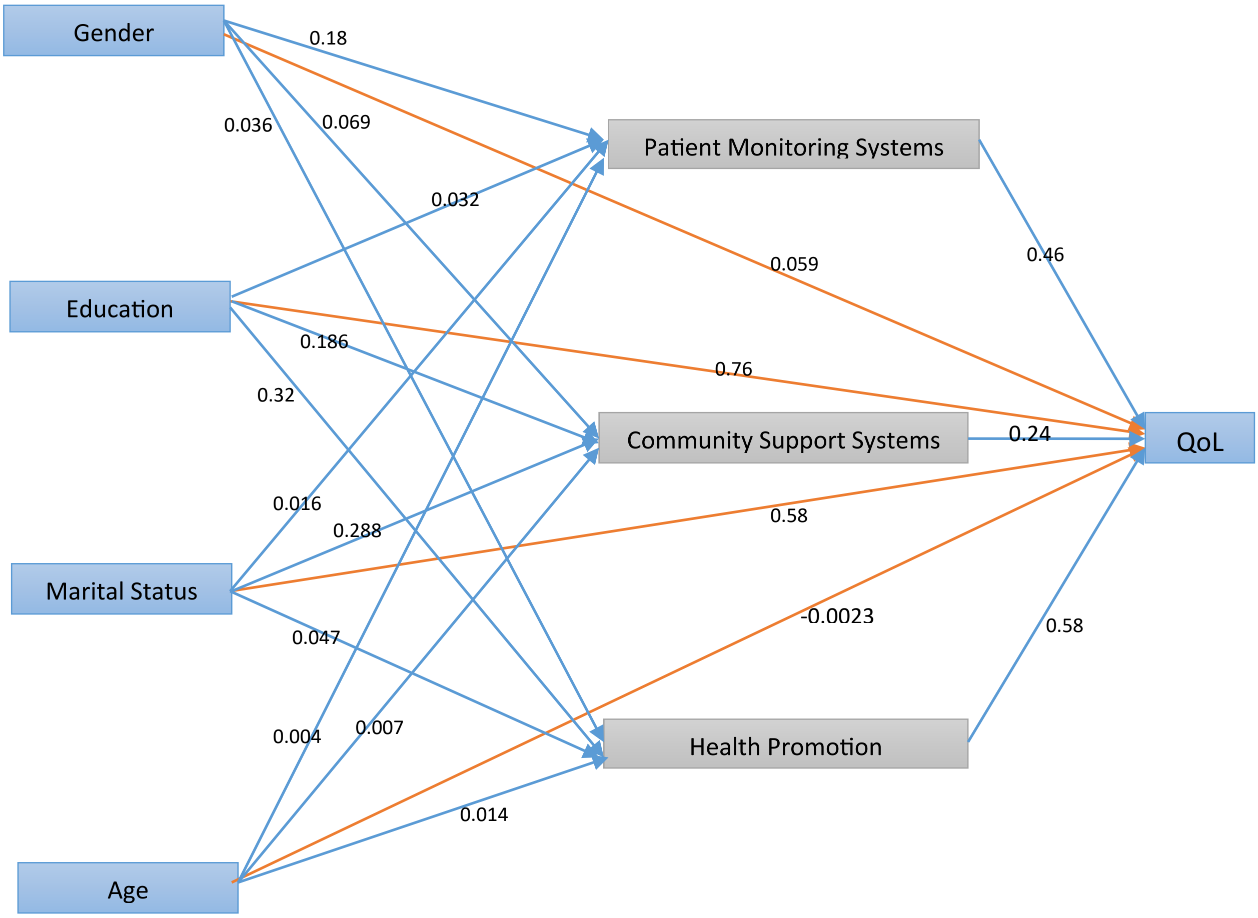

Figure 1: Path Analysis of NCD Services, Patient Characteristics and QoL.

Source: Primary data, 2020.

Table 2: Direct Effects, Indirect Effects, and Total Effects of Community-Based NCD Services and Patient Factors on the QoL

Variables	Direct Effects	Indirect Effects	Total Effects
Health Promotion	0.58	-	0.58
Community Support Systems	0.24	0.288	0.528
Patient Monitoring Systems	0.5	-	0.5
Marital Status	0.57	-	0.57
Education Level	0.76	-	0.76

Source: Primary data, 2020

Table 3 shows the overall indicators that the model fitted perfectly well; Root Mean Squared Error of Approximation (RMSEA) = 0.000, Comparative Fit Index (CFI) =1.000, Tucker-Lewis Index (TFI) =1.000). Gao and Maydeu-Olivares (2020) concluded that RMSEA values range from 0 to 1, < 1 indicates a better model fit; CFI & TLI values range from 0 to 1, > 0.95 indicates a better fit. Likewise, according to Gao and Maydeu-Olivares (40), SRMSR values <0.08 generally indicate adequate fit. This meant that the NCD services and patient factors (marital status and education level) both direct and indirect improved the QoL. This implied that if the model were implemented, the QoL of patients would improve.

Table 3: Goodness of Fit Results for the Hypothesized Model

Test	Result	Interpretation
Root Mean Squared Error of Approximation (RMSEA)	0.000 (95%CI: 0.000-0.000)	Very Good Fit
Pclose	1.000, <= 0.05	
Comparative Fit Index (CFI)	1	Very Good Fit
Tucker-Lewis Index (TFI)	1	Good Model Fit
Standardized Root Mean Squared Residual (SRMSR)	0	Perfect Fit
Coefficient of determination (CD)	0.038	

Source: Primary data, 2020.

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Reduced model

The reduced model in Figure 2 showed routes that significantly contributed to the improved QoL as predicted by the community NCD services.

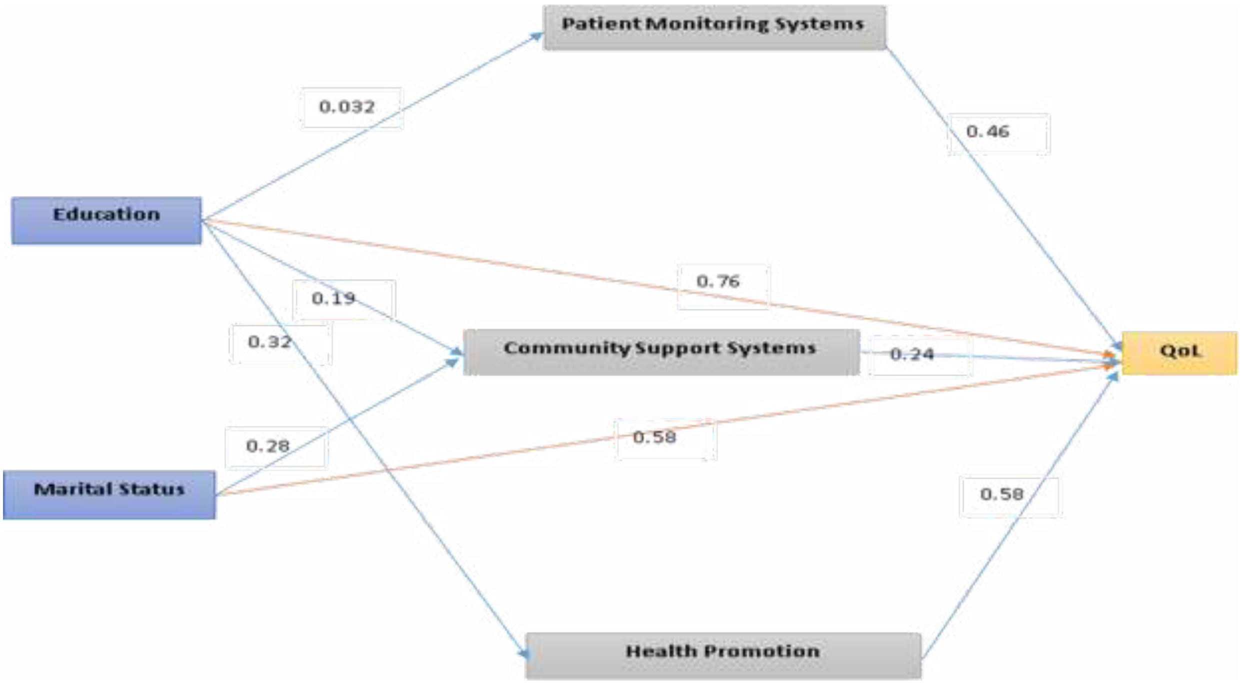

Figure 2: Reduced Model

Discussion of Results

Community-based NCD services had an impact on the markedly beneficial effects of health promotion, patient monitoring systems, and community support networks on the QoL. According to the indirect pathways in the model, the participant's marital status and educational attainment had a substantial impact on how often they used community-based NCD services. Positive outcomes were observed for patients with noncommunicable diseases (NCDs) getting chronic therapy in the community, according to earlier UNAIDS (36) studies that focused on patient monitoring in improving QoL. Thus, the introduction of community-based NCD services would be a crucial tactic to get over the obstacle to the management and prevention of NCDs in the communities among HIV-positive individuals who are living with NCDs. The plan could be modified to fit Uganda's and Sub-Saharan Africa's particular cultural contexts.

The outcomes demonstrated the beneficial impact of community support networks on raising quality of life. Inconclusive findings were found in systematic reviews that examined the quality of life (QoL) of populations infected with HIV and were based on various interventions and observational studies (26). The model paths' important results demonstrated that the degree of education and marital status had an impact on the uptake of community support systems services to enhance overall quality of life. Similarly, the cohort study by Decroo et al. (24) on the influence of community support networks via community ART groups confirmed that ART patients in Tete Province, Mozambique, were staying in treatment. The study found that compared to patients receiving one-on-one care from the facility, patients in community ART groups had superior clinical outcomes and higher rates of patient retention. Based on the study, patient-driven community distribution groups for HIV and NCDs through community support groups that utilize knowledgeable clients lay cadres like VHTs, and community volunteers would enhance patient retention and quality of life for patients on ART with NCDS in the communities.

The findings showed that married people with higher levels of education than secondary school may more readily access support networks than single people with lower levels of education. The study's conclusions are consistent with cross-sectional research done in India, which found that married individuals with post-secondary educations were more likely to use community support networks to enhance their quality of life (41,42). Age and gender, however, did not significantly affect the model's ability to improve QoL in the study. The findings of previous research by Melis et al. (43), which demonstrated that age and married status were significant predictors for the uptake of community NCD services and improvement in QoL, conflicted with the findings of Ha et al. and Joshi et al. (41,42). Earlier research compared chronic illness risk factors to age beyond 40. Since all study participants had non-communicable diseases (NCDs) and the average participant age was 56, there was no comparison group consisting of people with and without NCDs.

In addition, research conducted in China by He et al. (44) and Yadav et al. (45) revealed that men were more likely than women to acquire hypertension and Diabetes Mellitus (DM). Because of this, there was no comparison group in the trial and every participant had an NCD. This explains why the model's results with NCD services and QoL as direct effects did not demonstrate any significant causal relationships between the moderating factors (age and gender). The use of community-integrated HIV-NCD interventions, such as using patient monitoring systems, community support structures, and health promotion strategies on patients receiving ART from the communities, improved the general quality of life for HIV and AIDS-affected individuals in Napel, according to earlier research by Bhatta and Liabsuetrakul (17). Furthermore, the empowerment intervention using health promotion initiatives with the support of community systems substantially increased the quality of life for HIV-positive people.

The Gaps

The researcher based the evolution of the model on critical analysis of the gaps that existed in literature, theory, and philosophy, and in the findings. The gaps were based on studies reviewed on community-based NCD services and the quality of life. The research on community-based NCD services and QoL that were reviewed served as the basis for the gaps. Several academics' reviews of the literature revealed the inadequacies and UNAIDS (7,36) suggested conducting research for the community's comprehensive NCD package. Community HIV and NCD services were not integrated in underdeveloped nations. Reidpath et al. (46) state that while SEM considered an individual's surroundings, it did not take into account people's attitudes, beliefs, or level of health knowledge. Research by Callaghan et al. (28) and Jaffer et al. (47) used systematic reviews instead of cross-sectional data collection to gather empirical data (35), which created a methodological gap that the study attempted to fill. The gaps necessitated the development of an inventive and comprehensive approach to enhance the quality of life in the areas of social interactions, environmental wellness, and physical health.

Philosophical gaps as noted by Tountas (48) and Ntshakala (49) were based on improving the physical quality of life without considering the person in the view of the emotional well-being, environmental and social relationships domains. Therefore, the new model designed for psychosocial services and policy improved all the domains of QoL. Therefore, all QoL dimensions would be improved by the new model's psychological services and policies. Schölmerich and Kawachi (50) claim that the socio-ecological model-based theoretical framework was insufficient to direct multidimensional interventions, such as interventions at the individual level that focus on raising health literacy and altering social norms within a community regarding NCD risk prevention and management. Moreover, Abraham and Sheeran pointed out that the Health Brief Model (HBM) overlooked peer influence and the potential usage of role models, as well as how individuals interact with their surroundings (51). The interplay between the patients' unique personal characteristics, attitudes, and surroundings, which include their relationships with friends, family, social institutions, and community networks—could not be well captured by the model. To improve all QoL variables, the study employed a new paradigm that included psychosocial treatments and policy as a bridge.

The results from structural equation modeling and path analysis highlighted major weak or poor paths for the direct effects for the patient factors and quality of life (weaker direct paths): Age→QoL (0.0023), gender→QoL (0.059). The indirect paths in the model with weak factor loadings were the patient factors and quality of life. For example, age→utilization of health promotion activities (0.0014), age→utilization of patient monitoring systems (0.0044), age→utilization of community support systems (0.0069), gender→utilization of health promotion activities (0.036), gender→utilization of patient monitoring systems (0.18), and gender→utilization of community support systems (0.069). The gaps in the paths were contrally to the earlier prediction in the conceptualization of the study as predicted by the literature cited. The hypothesized paths from the conceptualization of the study predicted that patient factors such as age and gender would improve the uptake of the utilization of the community based NCD services as indirect effects and improve the quality of life as direct effects. The weaknesses in the results showed poor effects of the variables on the services and quality of life. Therefore, based on the gaps, the study sought a new model called Integrated Community Analysis Transformation Model (ICAT Model).

Integrated Community Analysis Transformation Model (ICAT Model)

The model was developed after the analysis of gaps in literature, theory, philosophy, and the findings. The simplified model (Figure 3 below) illustrated the relationship between the external variables such as community-based NCD Services, the patient factors (age, gender, education level, and marital status), ICAT model services, and QoL as the dependent variable. Therefore, the model will be instrumental in improving all the domains of QoL of patients living with HIV with NCDs. The researcher hopes that the ICAT model will be integrated into the existing policies for

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the co-management and prevention of HIV and NCDs for the Differentiated Service Delivery (DSD) models, especially the Community Drug Distribution Points (CDDPs) and Client Led ART Delivery (CLAD) models of ART delivery.

The concepts of the model are: A. Community Based NCD Services (CBNS), B. Quality of Life (QoL), C. Patient Factors (PF), D. Integrated Community Analysis Transformation (ICAT)

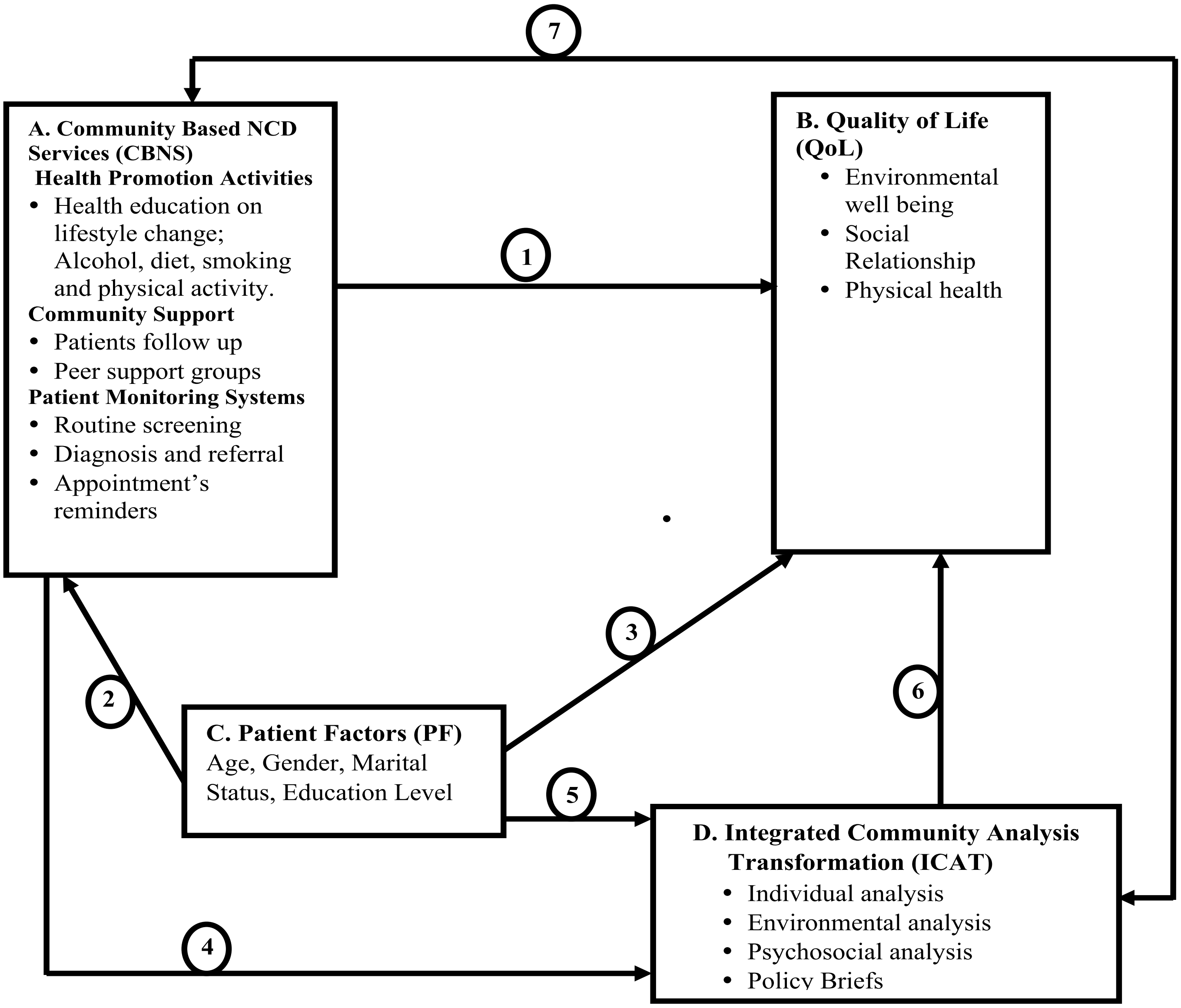

Figure 3: Simplified ICAT Model:

Source: Primary data, 2020

I: Assumptions of the ICAT Model

The ICAT model has seven assumptions described by the paths in Fig. 3.

Assumption 1: A → B

The model assumes that HIV-positive patients' quality of life will increase if community-based NCD services, such as health promotion initiatives, patient monitoring programs, and community support networks, are implemented as stand-alone interventions in various settings. The Van der Heijden et al. (19) a study found that health promotion initiatives involving community volunteers enhanced the ability of people living with HIV to cope with their diagnosis and follow long-term care plans. This was also consistent with the observations made by Rotger et al. (13), who stated that the uptake of services and general QoL would increase

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if community health workers were taught to mobilize and monitor community members.

Assumption 2: C → A

It is believed that the characteristics of each patient, including their age, gender, marital status, and educational attainment, directly affect how many use the community-based NCD services. Individual patient variables, including age, sex, marital status, and educational attainment, were found to be predictive of treatment consumption and enhanced quality of life (52). For instance, married patients were more likely to encourage their spouses to follow treatment plans and abstain from dangerous lifestyle choices. Similarly, educated patients had a higher likelihood of adhering to health-preventive messages for enhanced QoL and NCD services.

Assumption 3: C → B

It is crucial to emphasize that increased QoL is predicted by patient variables. Notably, the QoL was improved by being aware of the underlying causes and taking precautions to reduce the dangers associated with the patient's factors. For instance, aging increases a person's risk of DM and HT, but these conditions may be avoided if they adopt safe lifestyle habits. According to a 2003 Joshi et al. (41) study conducted in India, older unmarried people had a higher risk of developing chronic morbidity than married people. Thus, a higher QoL was predicted by the patient's marital status. In a similar vein, research by Trivedi et al. (53) that looked at the relationship between psychosocial support and behaviors related to hypertension found that being single was associated with higher blood pressure (BP), worse medication adherence, more trouble sticking to a diet and exercise regimen, and smoking when compared to married individuals. In a similar vein, Ha et al. (42) study results showed that the formal education level attained by adults over 40 was a significant determinant of improved health outcomes and primary prevention of chronic diseases. Thus, if managed to reduce the risks linked to NCDs, patient variables as determinants of health may lead to an improvement in the QoL.

Assumption 4: A → D

The comprehension and use of the ICAT model services are strengthened by community-based NCD services, particularly if those services are focused on enhancing individual analysis strategies to enhance physical quality of life. When paired with environmental well-being and psychosocial support services, community NCD services may enhance the QoL in social relationships. Therefore, if the policies to adopt such strategies were translated into recommendations for policy implementation, the community-based NCD and ICAT model services would accelerate the enhanced QoL.

Assumption 5: C → D

The ICAT model projected that patient characteristics like age, gender, marital status, and educational attainment would have a favorable impact on the use of ICAT services. The model's services were used by the patient's age, gender, marital status, and educational attainment. Age and marital status were found to be significant predictors of the use of psychological services and policy recommendations for community-based NCD services aimed at improving quality of life, as previously reported by Melis et al. (43). Previous research compared individuals who were female and over 40 as risk factors for chronic illnesses. As a result, the model's indicators are crucial for comprehending both individual and community analyses, which inform the creation and application of policies that bring about change and enhance people's QoL.

Assumption 6: D → B

To improve people's quality of life, the model examines people, the environment, psychosocial services, and policy that establishes standards and processes for implementing ICAT services.

Assumption 7: A → B

Following the ICAT model analysis, health planners could plan the appropriate NCD services to improve the QoL domains. Community-based NCD services serve to reinforce the understanding and uptake of the ICAT model services. The model's analysis aids in understanding the NCD service gaps that now exist and might be filled to improve the QoL for people.

Individual Analysis

The individual analysis could act as a precursor to improving the physical quality of life after the analysis of the individual and the services that are tailored to the diagnosis of the issues that impact the physical health domain of the quality of life. Health strategies use individual conditions as avenues for the prevention of HIV and NCDs among individuals in the communities.

Environmental Analysis

The analysis emphasizes the importance of understanding the environment patients interact with to design health interventions that improve their health and well-being. It also highlights the role of communities in disease prevention, as health workers living and working in communities can be shaped to respond to HIV and NCDs as diseases based on community perception and engagement in health promotion initiatives.

Psychosocial Analysis

The role of psychosocial analysis is to understand the clients' or groups' condition that affects the social relationships

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to design services and interventions to improve the social relationship quality of life. The analysis of the psychology and emotional well-being of individuals and groups in society guides the social and psychological interventions in the community to improve the patients' social relationships in the communities. The social analysis helps to identify and evaluate social problems, which impact the social relationship quality of life of PLHIV.

II: Operationalizing the ICAT Model

Operationalization of the ICAT model elaborates on the testability and workability of the model. Fig. 4 below shows that the operationalization of the ICAT model is proposed to go through four stages.

Step 1

Once the ICAT policy brief is adopted, then the community-differentiated service delivery models for HIV patients will be influenced to integrate ICAT services. The Ministry of Health (MOH) Uganda will adapt changes in the existing policy and create an ICAT policy. The process of the ICAT policy creation and adoption will be enhanced by engaging the MOH and its stakeholders.

Step 2

At the level of the District Health Facilities (DHFs), the Standard Operating Procedures (SOPs) for the ICAT services would be designed to guide the implementation of the community NCD services by the District Heath Office, headed by the District Health Officer, (DHO). The pilot of the SOPs would be implemented to improve the quality of life of the patients at the selected District Hospitals at the District level, Health Centre IV (HC IV) at the county level, Health Centre III (HC III) at the sub-county level, Health Centre II (HC II) at the parish level and Health Centre I (HC I) at village level.

Step 3

The study found that community support systems, patient factors, and patient monitoring systems improved patients' quality of life. The goodness of fit test showed the model fits perfectly. The government and the Ministry of Health should implement the ICAT model to improve the quality of life for patients with NCDs living with HIV in communities. This will help improve NCD and HIV co-prevention and management.

Step 4

The final stage of the operationalization outlines procedures for implementing transformed community-based NCD Services (CBNCDS) at all service points, including individual, environmental, and psychosocial analysis services to improve physical health, environmental well-being,

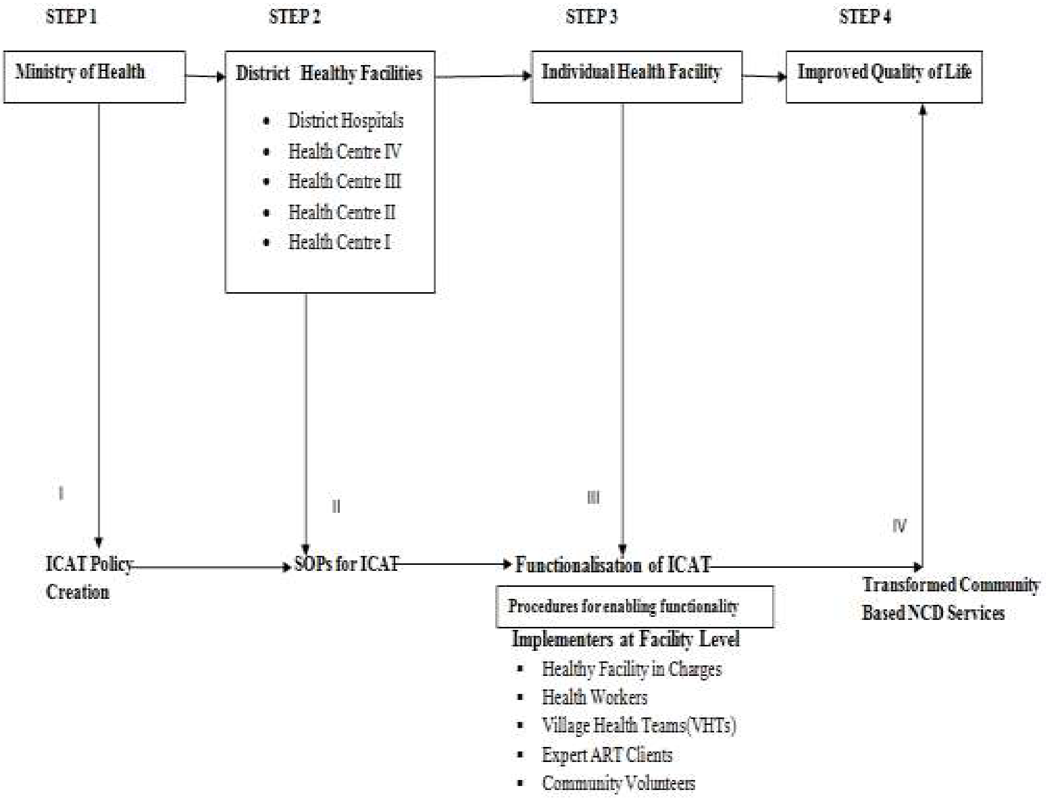

Figure 4. Operationalization of ICAT Model, Source: Primary data, 2020.

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and social relationship QoL. The ICAT policy will guide monitoring and evaluation for the sustainability of expected health outcomes and improved QoL.

III: Testability of ICAT Model

The integrated community analysis transformation model (ICAT) was tested in Uganda's districts, Luweero as intervention and Mukono as control for six months. The model integrated HIV and NCD services to improve physical health, environmental well-being, and social relationship domains of quality of life. Expert clients were trained in health education, social-economic strengthening activities, social support, and counseling services. Health workers conducted routine screenings at the CDDP, while lay counselors/expert clients provided routine counseling on NCD prevention, support, and referral. District community development officers supported income-generating activities. Data from participants was analyzed using independent t-tests to analyze the influence of ICAT services on quality of life. The results are summarized in Table 4.

The results in Table 4 showed that the means in the treatment group are higher than the control groups, though not statistically significant with p-value>0.05. The average mean was higher in the social relationship domain (3.36) compared to the environmental (2.64) and physical (2.56) domains. The social relationship with the highest score supports the use of a community-based approach for the NCD services. Hence, the use of health workers, VHTs, and community volunteers in this approach is important if the quality of life of patients in the communities is to improve.

Table 4: ICAT Model Testability Results for QoL

QoL Domains	Treatment	Control	Mean Difference	tα	p-value
Physical Health Domain	2.56	1.73	0.83	13.6	0.74
Environmental Domain	2.64	1.93	0.71	12.6	0.63
Social Relationship	3.36	2.56	0.80	13.1	0.71

Mean Range Scale: 1.00-1.79= Very Poor, 1.80-2.59= Poor, 2.60-3.39= Fair, 3.40-4.19= Good, 4.20-5.00= Very Good, * Significant at $p < 0.05$; Source: Primary data, 2020.

IV: Workability of the ICAT Model

The results in Table 4, showed that the mean in the treatment group across all the domains of QoL were higher than the control group. The provision of NCD services in the treatment group improved the QoL of the patients who received the services. It implied that, if the ICAT model is implemented in the communities, then the patients would experience an improvement in the QoL. This meant that the ICAT model was applicable in communities where patients with HIV living with NCDs receive ART services.

Conclusions and Recommendations

The study found that community support systems, patient factors, and patient monitoring systems improved patients' QoL. The goodness of fit test showed the model fits perfectly. The government and the Ministry of Health should implement the ICAT model to improve the QoL of patients in the communities. This will help improve NCD and HIV co-prevention and management.

Limitations

The study's limitations include potential bias from self-reported data, limited generalizability to different populations, and the need for external validation of the model. While the goodness-of-fit test showed a good model fit, other factors like socioeconomic status and mental health support were not extensively explored. Additionally, implementing the ICAT model may face challenges such as resource constraints, policy adoption, and healthcare infrastructure limitations.

Conflict of Interest

The writers have no competing interests.

Funding

Funding was solely covered by the researcher.

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Citation: Christopher Ddamulira, Stephen S. Kizza, Eria Muwanguzi, James Wanzima, Lawrence Sserwanga, Frank Pio Kiyingi. Integrated Community Analysis Transformation (ICAT) Model: A Tool for Community NCD Prevention and Improved Quality of Life. Fortune Journal of Health Sciences. 8 (2025): 196-211.