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AWARENESS OF SICKLE CELL DISEASE AMONG UNIVERSITY STUDENTS IN NIGERIA: AN ECOLOGICAL MODEL STUDY IN A LOW- AND MIDDLE-INCOME COUNTRY SETTING

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Abstract

Sickle Cell Disease (SCD) poses a significant yet underexplored challenge in public health among students in higher education, particularly in low- and middle-income countries (LMICs). Despite its prevalence, limited research has examined the lived experiences of affected students within institutional contexts. This study aimed to explore the level of awareness of SCD, the nature of social relationships among students living with SCD, and the presence or absence of university policies or guidelines addressing their needs. Grounded in Bronfenbrenner's Ecological Systems Theory and guided by interpretivist epistemology, the study adopted a qualitative case study design. Semi-structured interviews were conducted with 13 undergraduate students at Kaduna State University, Nigeria. Thematic analysis of 127 narratives yielded 12 categories, which were further synthesized into four ecological constructs: intrapersonal factors, interpersonal relationships, community perceptions, and societal policy awareness. Findings revealed basic awareness of SCD among students, diverse social experiences ranging from inclusion to stigmatization, and a critical absence of institutional policy support. The study concludes that these gaps hinder effective health outcomes for students with SCD. It recommends the establishment of inclusive, culturally sensitive support systems, targeted awareness programs, and enforceable policy frameworks. These findings have practical implications for universities, policymakers, NGOs, and development partners seeking to promote health equity and inclusive education in LMICs.

Keywords: *Sickle cell disease*, *university students*, low- and middle-income settings, *ecological model*

Introduction

Sickle cell disease (SCD) is a hereditary hemoglobinopathy that affects more than 50 million people globally, with its prevalence continuing to rise (Acharya et al., 2023; Okocha et al., 2022; Kato et al., 2018; John et al., 2020). It is projected that approximately 15 million children will be born with SCD worldwide in the coming decades (Carden & Little, 2019; Beri et al., 2021). Sub-Saharan Africa is expected to bear more than 80% of this burden, with the majority of cases concentrated in countries with limited healthcare infrastructure (Arnold et al., 2016; Inusa et al., 2018). SCD is the most prevalent inherited blood disorder across the African continent, accounting for an estimated 75% of global cases

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(Wastnedge et al., 2020; Inusa et al., 2018). These figures are anticipated to increase further due to ongoing population growth and cross-border migration trends (Gouda et al., 2019).

Despite its widespread impact, SCD remains significantly under-recognized and under-prioritized, often referred to as an "invisible disability" due to the lack of public awareness and policy attention it receives (Berghs et al., 2021; Srikanthan, 2023). This invisibility contributes to a multitude of challenges across various levels of society. At the healthcare system level, disparities in care and poor clinical outcomes remain pervasive (Dyson et al., 2021; Hegeman et al., 2023). At the interpersonal and community levels, individuals living with SCD frequently experience stigma, discrimination, and social marginalization (Blakey et al., 2022; Buser et al., 2021; Ndula, 2023; Depetris-Chauvin & Weil, 2018). On an individual level, the psychosocial toll is evident through elevated levels of chronic stress and reduced quality of life (Dong et al., 2023). In terms of policy, governmental responses have often been inadequate, marked by fragmented services and insufficient resource allocation (Tusuubira et al., 2018).

Efforts to address these challenges have emerged through a variety of initiatives. National programs in countries such as Ghana and the United States have adopted newborn screening and universal prophylaxis strategies. Clinical advancements include the establishment of specialized treatment centers, such as the Sickle Cell Foundation Nigeria, the adoption of hydroxyurea protocols, and the development of standardized pain management guidelines by institutions like the National Institutes of Health (NIH). Community-based approaches have focused on awareness campaigns and genetic counseling services, exemplified by the work of organizations like the Sickle Cell Aid Foundation Nigeria. In addition, innovative therapies such as gene editing (e.g., CRISPR-Cas9) and bone marrow transplantation are gaining traction, especially in high-resource settings. Policy-level interventions have introduced national SCD registries and frameworks for disability protections. However, in high-burden contexts such as Northern Nigeria, the implementation of these interventions remains limited and inconsistent.

To better understand and address these systemic gaps, this study adopts the ecological model of healthcare, which conceptualizes health outcomes as the result of interacting factors across multiple levels. Specifically, this model enables the exploration of individual-level variables (such as health literacy and self-management), interpersonal experiences (such as stigma and family support), institutional dimensions (such as access to and quality of care), community influences (including prevailing social attitudes), and policy structures (notably governmental commitment and resource distribution).

This study, therefore, aims to assess the level of awareness of SCD among university students in Kaduna, Nigeria, using the ecological model framework. By analyzing key variables across the model's

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five domains, the research seeks to identify context-specific strategies to improve awareness and reduce the inequities associated with SCD in a low- and middle-income country (LMIC) setting.

Statement of the Problem

Over the last four decades, health behavioral research (Boateng et al., 2018 & Michie et al., 2017) has been conducted to find and assess the most effective ways to achieve health behavior change. The data from this period has provided key insights for SCD, prompting developed communities (Fawcett, 2016 & Badawy et al., 2018) to design remedies and interventions. These strategies have been used to combat the spread and management of SCD in areas such as newborn screening, annual influenza vaccine, hydroxyurea therapy, TCD skills training, primary stroke prevention, red blood cell transfusions, and antenatal screening (Depetris-Chauvin & Weil, 2018; Anderson et al., 2018 & Williams & Tanabe, 2016) to mention a few. All of the interventions mentioned are available in the UK, the Netherlands, the United States of America, Belgium, and Spain, as well as France, Ireland, Italy, and Germany.

The scenario is different in LMICs, where two disturbing concerns of recurring worry about sickle cell illness are prominent. They are first, an insufficient community knowledge of the disease Esoh et al., (2021) & Egesa et al., (2022) and second, insufficient policies, laws, and regulations governing the disease's incidence (Thomson et al., 2023 & Bello-Manga et al., 2016). Inadequate community information and sparse norms and regulations (Inusa et al., 2018 & Akinsete, 2022) governing the occurrence of SCD results in, first, imperceptible personal and communal suffering caused by the disease (Kasai et al., 2022) and also a reduction in measures Tshilolo et al., (2019) to help the community.

Even though SCD experts with a special focus on emerging economies (Barro et al., 2018; Ebomoyi, 2015; Qiang et al., 2023 & Nsangou & Scelles, 2020) have performed various studies aimed at gaining a better knowledge of societal behavior to increase intervention for the disease. Despite all of these studies, there is still a lack of understanding Dampier et al., (2017) & Chakravorty et al., (2018) and a lack of policies, rules, and regulations governing the occurrence of Adewoyin, (2015) the disease. Improving insufficient understanding and progress on the meager norms and regulations controlling the occurrence of SCD in emerging communities necessitates a proactive perspective. A potentially proactive perspective is engaging students as knowledgeable members of a community to provide a deeper understanding of SCD using an Ecological Model (Wold & Mittelmark, 2018; & Kennedy et al., 2021). Students, as knowledgeable community members, will provide the much-needed behavioral awareness of SCD to attract interventions.

Research Questions:

This study, therefore, raised three fundamental questions:

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1. What is the awareness of sickle cell disease among undergraduate students at LMIC higher education institutions?
2. What difficulties do undergraduate students with SCD confront in higher education institutions in low-income communities?
3. What role does the ecological model have in explaining the rules, regulations, and policies that govern SCD in LMICs?

Theoretical Framework

The ecological model known as Urie Bronfenbrenner's Ecological Framework for Human Development was established as a conceptual model in the 1970s, defined as a theory in the 1980s, and revised by Bronfenbrenner regularly until he died in 2005. The essence of the model is to approach and understand human behavior in the community. The model considers the complex interplay between individual, relationship, community, and societal factors. This has positioned the model to be positioned around four basic constructs. For this study, only four basic constructs were adopted: (1) Construct of Intrapersonal/individual factors (CIIF), (2) Construct of Interpersonal factors (CIF), (3) Construct of Community factors (CCF), and (4) Construct of society policy factors (CSPF). The constructs of the model are further discussed thus:

The Construct of Intrapersonal/individual Factors (CIIF) explains a person's knowledge, attitudes, abilities, and beliefs (Tudge et al., 2022). Gender, economic status, age, race, ethnicity, education, genetics, and other factors influencing how people view themselves can all be considered. Individuals' perspectives and impressions of life events may thus be influenced by the culture in which they are immersed. While the Construct of Interpersonal Factors (CIF) is concerned with contacts with others, which can either provide social support or impede interpersonal growth that promotes good conduct. This level extends to a person's social networks, including family, friends, schoolmates, and coworkers (Xia et al., 2020). Individuals' environment may affect them, whether they are aware of it or not.

The Construct of Community Factors (CCF) presents issues around formal or informal social norms are associated with this construct, matters that exist among individuals, groups, or organizations (Soyer, 2019), can limit or enhance healthy behaviors. This construct focuses on the immediate neighborhoods, adjacent businesses, the physical environment, and local infrastructure are all part of a community. In certain cases, an individual wishes to change, but their community does not allow them to do so owing to a lack of resources and safety concerns. Lastly, the Construct of Society Policy Factors (CSPF) deals with rules, regulations, policies, and informal structures that constrain or promote healthy behaviors in local, state, and federal policies and laws that regulate or support health actions and practices for disease prevention, including early detection, control, and management (Miles & Fassinger, 2021 & Carrad,

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2019). The constructs deal with people in the larger society. Organizational and institutional decisions can limit what their members can and cannot accomplish and are beyond an individual's control. As a result, the outcomes may affect both positive and negative groups within a given organization.

Previous Studies Using the Ecological Model in Health Research

Ecological models, particularly Bronfenbrenner's, are important in health research because they allow us to examine how different systems influence individual behavior. These frameworks guide culturally and contextually appropriate multi-level interventions. Previous research, such as Williams et al. (2017) & Okonkwo and Dlamini (2025), addressed how cultural norms and system-level factors affect mentorship and adolescent HIV care in Sub-Saharan Africa.

McCormack et al. (2017) highlighted the need to address institutional barriers in health literacy efforts. Recent studies build on this foundation. Chilongani et al. (2022) linked maternal health behaviors in Tanzania to both partner support and access barriers. Adeyemi and Uzochukwu (2023) showed how misinformation and institutional distrust drive vaccine hesitancy in Nigeria. Nguyen et al. (2024) stressed the importance of culturally rooted community health programs in Southeast Asia. Okonkwo and Dlamini (2025) found that post-pandemic changes significantly influenced youth mental health, underscoring the importance of chronosystem dynamics in health interventions.

Four key themes emerged from the usefulness of Bronfenbrenner’s ecological model in health research as discussed thus:

Interventions must be culturally grounded and regionally relevant, as proven by Malawian-influenced mentoring (Sawatsky et al., 2016) and maternity care behavior in rural Tanzania (Chilongani et al., 2022). Additionally, health outcomes are systemically generated—they develop from interactions between individuals and their surrounding social and institutional ecosystems, as evidenced by adolescent HIV care (Williams et al., 2017) and vaccine hesitancy patterns in Nigeria (Adeyemi & Uzochukwu, 2023). Structural and institutional impediments are important, and effective treatments must address challenges at the organizational and policy levels, not only individual knowledge gaps, as claimed by McCormack et al. (2017) and demonstrated by Nguyen et al (2022). The chronosystem remains important and understudied; changes throughout time, such as those caused by pandemics or shifting policies, have a considerable impact on behavioral health pathways, as highlighted by Okonkwo and Dlamini (2025).

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These studies demonstrate the importance of comprehensive, system-wide, and context-sensitive approaches in public health. The ongoing corroboration and evolution of Bronfenbrenner's approach reveal its continuing relevance and applicability to present global health concerns.

Research Methodology

The research employs a qualitative methodological approach (Iosifides, 2016 & Windsong, 2018), following the philosophy of social constructionism. Qualitative methodology is a method of inquiry used to thoroughly understand phenomena and human behavior (Mogashoa, 2014), particularly feelings or experiences, as well as the reasons that control conduct.

A qualitative approach is used to examine theory formulation and testing (Gergen et al., 2015), or simply as a learning tool. The goal of this research is to better understand the constraints that undergraduate students with SCD encounter in their daily lives. The case study research design, Hancock et al. (2021), on the other hand, was used in this study. A case study research design employs several types of data to produce an in-depth case and often selects a small number of people as the subjects of study. As a result, a case study research design is well-known to be best suited for this study because the objective of this study is to select a small number of respondents as the study's emphasis.

A total of 23 individuals were chosen from a pool of 80 using a purposive technique Campbell, namely, criterion-based sampling (Andrade, 2020). Purposive sampling is choosing individuals who can best assist the researcher in understanding the problem and answering the study questions. The choice of inclusion is based on the following reasons that is a respondents for this survey must meet the following inclusion criteria: one, must be an undergraduate students at Kaduna State University in Nigeria from any of the colleges which include the (a) College of Arts, Education, Humanities, and Law, (b) College of Agriculture and Environmental Sciences, (c) College of Allied Health and Pharmaceutical Sciences, (d) College of Basic Studies & Continuing Education, (e) College of Communication, Management and Social Sciences, (f) College of Computing, engineering and (g) College of medicine. All the colleges in the university were involved to avoid the skewness of responses from the participants. Also, the students from all the colleges may not have had good information about SCD. Two, must be willing to participate in the study. The three students should be in the 100 and 200 levels. It is noticeable that the 100 and 200 level students are freshers in the university, and sampling them creates more awareness about the disease, which they can, in time, pass down to other students. The Kaduna State University was picked due to the educational assistance that it provides. The university is recognized to have a

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population of students from all over Nigeria because it is located in the country's fourth most populous state.

Data Collection

A semi-structured interview was used to obtain data for this investigation. According to (Magaldi & Berler, 2020). A semi-structured interview allows the scholar and study participant to recreate the past, explain the present, and envision the future. The interview began with the distribution of an informed consent form. The consent form requested permission from participants to willingly participate in the interview, as well as permission to record the conversations. Furthermore, respondents were guaranteed the privacy and confidentiality of their responses.

The interview took place at the main campus of the Kaduna State University, Tafawa Balewa Way, the Kakuri campus, and the Kafanchan campus, all in Kaduna State, Nigeria. This is because the colleges are not situated in one location, and the researchers intend to cover the entire university. Undergraduate students were asked about their knowledge, attitudes, beliefs, and ideas concerning sickle cell illness. What limitations do undergraduate students with sickle cell disease face? What rules, regulations, and policies limit or promote improved living conditions for undergraduate students with sickle cell disease?

The overall length of all initial interviews was 23 hours, approximately an hour and seventeen minutes per respondent. During the interviews, the researchers employed probing techniques to get detailed information and/or to expand on respondents' comments. This provided the researchers with a wealth of detailed information. The data was saturated by the time 18 people were interviewed. According to (Husband, 2020) data saturation occurs when no new themes emerge from the data. The information was transcribed in preparation for the analysis.

The analysis of interview transcripts in this study was based on an inductive approach procedure that identified patterns in the data using thematic codes. To complete these tasks, the researcher followed Miles and Huberman's verified by Linneberg & Korsgaard, (2019) three-phase approach in theme analysis, which involves (a) data reduction, (b) data display, and (c) conclusion drafting and verification. Using these three coding steps, the narratives were thoroughly read and re-read, and significant statements narrated by respondents were considered to develop meaningful themes that report on awareness of sickle cell disease and constraints faced by undergraduate students in Nigeria with sickle cell disease.

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Data Analysis

The text was coded in the analytical phase by merging the template codes and the inductive codes obtained from the original transcriptions. The codes and potential themes were then brought together and extensively scrutinized to depict the reality of the original analysis and the designated codes characterizing the interpretative phase. The analysis was carried out independently by four researchers with experience in qualitative research. To ensure the veracity of the interpretation, the disparities were reviewed with a fifth, more experienced qualitative researcher.

The narratives were coded into 127 open codes (meaning derived directly), recorded in the spreadsheet. The 127 open codes were condensed into 20 lower categories and identified as classification subcategories. The classification subcategories were then further collapsed into 12 emergent categories. The strategy for the data analysis is summarized in the table below as adopted in this study by Miles and Huberman.

Table 1. Summary of data analysis

Data Reduction	**Data Display**	**Conclusion Drawing and Verification**
Initial reading and rereading of interview transcripts while underlining themes for similarities and differences (free code). Plain sheets of paper were recorded. The goal is to reduce the size of the data to a more manageable quantity.	The data presentation process begins with a list of all the codes and the creation of meaning from suitable text segments (open codes). Narratives were coded into 127 different open codes. Open codes with similar meanings were selected and grouped to form subcategories.	There are 20 subcategory labels, with the final overarching themes or categories divided into 12 emerging categories (broader categories). The resulting categories were then refined and fit into four theoretical constructions.

Source: Summary of data analysis method adopted from Miles and Huberman [10]

Description of Emergent Categories

This section describes the seven (12) categories and sixteen (20) sub-categories that emerged from the one hundred and twenty (127) open codes. The categories, sub-categories, and quotations were arranged properly. They are presented in this style to allow the reader an opportunity to draw on the reflection of thought given to the participants’ responses. The section is also organized based on questions asked in the process of data collection. The table below shows the 12 categories

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Table 1: Summary of categories according to research questions

Research Question	Themes 1	Theme 2	Theme 3
What is the awareness of sickle cell disease among undergraduate students at LMIC higher education institutions?	**Knowledge:** all participants are aware of SCD	**Belief:** the disease is hereditary, and it is transmissible	**Support:** All participants are not aware of any support given to SCD warriors
How do the KASU undergraduate students identify other students living with SCD?	**SCD warriors are:** shy, bold, arrogant, timid, stubborn, and active	**The behavior of SCD warriors**: they are always sick, they are strong-willed, and they want to be pampered	**Relationship:** They socialize easily, they want people around them and sometimes they keep to themselves
What difficulties do undergraduate students with SCD confront in higher education institutions in low-income communities?	Some people do not know about the disease	Some people think that SCD warriors can die at any time	Some people avoid them, they face unequal treatment, and they are stigmatized in the community.
What role does the ecological model have in explaining the rules, regulations, and policies that govern SCD in LMICs?	People are not aware of any policies	Policies are not available. However, the availability of the policy will reduce unequal treatment and the Stigmatization of SCD warriors	The policy is helpful to SCD warriors and their careers, medical experts, the general public, and the government on how to manage the disease

Source: researcher’s compilation

Data in the form of phrases and sentences on the perception of undergraduate students, constraints, and rules and regulations guiding sickle cell disease from 13 respondents. The responses provided multiple views on the knowledge they have about their perception of sickle cell disease, the constraints faced by students living with sickle cell conditions, and their ideas about rules and regulations regarding sickle cell disease at Kaduna State University, Nigeria.

What is the awareness of KASU undergraduate students about SCD (their knowledge, attitude, and belief)?

Data collected from 18 respondents were in the form of phrases and sentences that provided multiple views on the perception of undergraduate students about SCD.

How long have KASU undergraduate students known SCD? This research subcategory indicated that the respondents have been fully aware of the disease for a long time, and others do not know about the disease very well. One respondent recounted, **“Actually, Sickle cell disease is something I have come across since I was coming up. Even in my primary**

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school, I had people who had such kind of disease, and also when I was growing up, I still came across people even in my tertiary institution, I still come across people who also are infected with such disease". Another respondent noted that **"I know Sickle Cell not too long ago like a period of 3-4 years ago and I do not always talk about it"** while other respondent recounted **"It is not too long that I started hearing of sickle cell disease".**

What they think/believe of the disease: This subcategory includes narratives related to undergraduate students thinking about SCD. All thirteen participants believed that SCD is inherited. To confirm that the disease is hereditary, one respondent narrated, **"Okay, my own belief is I think it is hereditary. At some point, maybe due to some parents not listening to whatever the doctor tells them, like AS can't get married to SS, and they will go ahead with religious beliefs and say God will forbid it.** Another added, **"I think it is inherited from the parents, and I usually feel pity for them".**

How do the KASU undergraduate students identify other students living with SCD? These findings revealed that students living with sickle cell conditions could be bold, shy, and arrogant; three respondents said they are shy, and one said they are arrogant. One respondent lamented that they are always sick, and another said they are timid and inactive. As one respondent rightly observed, **"They are just timid, they are not shy.** Another respondent noted that "**They are just in one spot not associating themselves with others maybe because they are sick or something**". This narration was confirmed by another respondent, "**For the ones that I have come across with and been friends with, they are very stubborn in as much as they are sickle cell, they believe they can do things and get away with but they are cool people when you get to know them., they always want people around them, they always want people to pamper them and they always want to be around people".** Another responded that "**At some point, they tend not to be shy, I have met one lady who is active and well to do, you can never even know if really, she is a sickle cell victim".**

How do students in KASU living with SCD behave? This question was to unveil the natural behavior/ personality of KASU students living with SCD. 12 participants revealed that they are their level of socialization is not too good. One respondent pronounced that it is not the case that they behave strangely, declared that "**Yes, it affects them when other students are aware that they have the disease, so most of the students withdraw from them, believing that it is a communicable disease. Their socialization with other colleagues is very low because of what they go through; there are so many things that they do not participate in, so that it does not trigger the disease to start.**" One participant narrated that "**Like during cold**

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season, they tend to isolate themselves and not socialize with people, but there are some that even at that, it does not affect their social life.

What kind of relationship exists between the students living with SCD and others? This sub-category is the evaluation of the relationship between students living with the disease and their co-students. Findings indicated that the respondents revealed that there is no social gap, while others said there is a pathway between them. One participant narrated, **"I think they are also humans like us, and they need to be treated equally irrespective of their status. After all, they are not the ones that brought themselves into this world that way it is their parents that are the cause of their predicament. So, I feel we shouldn't treat them differently, like at first, they tend to be loved more than people that are not of that genotype".** One other respondent noted that "**SCD has created a gap in their social life in terms of relating with other students."**

The constraints that students living with sickle cell condition encounter in KASU: To ascertain the constraints that students living with sickle cell condition encounter in KASU, the undergraduate students were asked to describe what they realized in their daily encounters with them.

Constraints from the community about the SCD:

To uncover the constraints faced by KASU students living with Sickle cell conditions. The objective of this is to understand the common constraints that they face. From the responses gotten three categories of challenges emerged from the 13 respondents. They are **people who don't know about SCD people see them as sicklers and can die at any point in time, and people stigmatize them** as discussed below. From the 13 respondents, three categories of constraints emerged, which are people who do not understand the disease and the problem of stigmatization. One participant voiced out, "**In terms of awareness, I feel SCD needs to be addressed and looked into; people do not know about it".** Another said that "**the only thing is that they just know they are just sicker."** Yet another revealed that **"People want to avoid them, let me say, stigmatize sort of.**

What rules and regulations support students living with sickle cell conditions? To uncover guidelines (rules/policies), the support for SCD, and the benefits of having the guidelines for SCD. The objective is to understand the guidelines in support of SCD. Respondents were asked about their awareness and benefits of the guidelines in support of SCD for KASU students.

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Looking at the result, two categories emerged, which are a **lack of awareness of any guidelines, and how policy would be of gain to support SCD,** and **who stands to gain.**

Lack of awareness of any policy/guidelines: all 13 participants revealed that they were not aware of any rules, policy, or laws guiding SCD in KASU or anywhere outside KASU.

How can guidelines be of help in support of SCD?

All 13 participants revealed that the availability of any rule, policy, or law guiding SCD in society could be helpful. One respondent has this to say: "**Yes, if at all, there are rules, it should be that they should know their genotype. It might create awareness among other people within the community".** One other noted this about a policy**: "It will help in knowing the statistic of people leaving with SCD",** yet another voiced out, **"Yes, I believe so because imagine them missing exams or tests and getting a makeup for it that will make their lives a bit easier".** A similar response was that **"The lack of policies in the country generally should be considered to make lives easier for them and to prevent the further spread of the disease through awareness campaigns".**

Who will the policies and laws be of help to?

All 13 participants noted that the policy would help the people living with the disease and also society. A participant voiced out that "**all of us will gain because we will all know about the disease,"** while another one revealed that "**the policy will help those affected by the disease by forcing the government to give them equal attention and rights. They will enjoy every privilege, they will get jobs like everyone else."**

The discussion of the findings is focused on utilizing Bronfenbrenner's Ecological Model as thus:

The Intrapersonal/Individual Factors (CIIF) showed that KASU undergraduates understand the hereditary nature of sickle cell disease (SCD) but lack awareness of university support services. This reflects Chawłowska et al. (2022) and Schneider et al. (2022), who found that general health knowledge often lacks depth and does not translate into action. The study underscores that knowledge alone is insufficient for effective health behavior. As McCormack et al. (2017) emphasized, intrapersonal literacy must be complemented by institutional and systemic support to drive meaningful health outcomes. Additionally, the Interpersonal Factors (CIF) argued that Students with SCD were perceived in mixed terms—bold, shy, or attention-seeking—highlighting interpersonal misunderstandings. Some socialized freely; others withdrew. This supports findings by Williams et al. (2017) and Sawatsky et al. (2016) that stigma and cultural norms shape peer relationships. Culturally sensitive social support is therefore essential

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More so, the Community Factors (CCF) deduced that Students with SCD were perceived in mixed terms—bold, shy, or attention-seeking highlighting interpersonal misunderstandings. Some socialized freely; others withdrew. This supports findings by Williams et al. (2017) and Sawatsky et al. (2016) that stigma and cultural norms shape peer relationships. Culturally sensitive social support is therefore essential. Finally, the Societal Policy Factors (CSPF) maintained that students at KASU are largely unaware of any policies supporting individuals with SCD, reflecting a broader policy visibility and implementation gap. This aligns with WHO (2015) and McCormack et al. (2017), who emphasized the need for clear, enforceable policies to remove access barriers. The absence of sustained policy engagement limits advocacy and highlights the chronosystem's role in hindering long-term, systemic health improvements.

Implications

The findings across all ecological levels emphasized that understanding health outcomes is not merely determined by individual attributes. It is shaped by dynamic and consistent influences at the personal, interpersonal, structural, and policy levels. This study adds to the growing body of literature by Williams et al., McCormack et al., and Sawatsky et al., who advocate for multi-level, context-specific interventions.

In addition, the study holds both conceptual and practical significance. Philosophically, the findings contribute to the theoretical advancement of Bronfenbrenner’s ecological model by illustrating its applicability to chronic disease management in low- and middle-income contexts. Practically, the results offer actionable insights for multiple stakeholders. For policymakers, there is a clear need to develop and implement institutional policies that explicitly support students living with Sickle Cell Disease (SCD), including the establishment of campus-based health services, peer-support programs, and anti-stigma campaigns. Non-governmental organizations (NGOs) should prioritize community-based education and awareness initiatives that target harmful cultural narratives and promote social inclusion. Donor agencies can support capacity-building programs that enhance institutional readiness and promote policy visibility at both university and national levels. Collectively, these actions can foster health promotion, reduce disparities, and facilitate meaningful community participation in SCD management across low- and middle-income countries.

Future Work

To improve the life of those living with sickle cell disease, the need to conduct this research emerged using the ecological model. This research focuses on undergraduate students at

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Kaduna State University only; it can be applied to other study universities in Nigeria, and this same study can be done by adopting other theories or models in low-resource communities.

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