

Knowledge on Pen-Plus Model, Barriers to Action, and Cultural Awareness: Their Influence on Nurses’ Utilization Towards Non-Communicable Disease Management

Aime Fidele Ndayiragije Mvuyekure*¹, Joyosthie B. Orbe², Berly Ben Mergal³

¹²³Adventist University of the Philippines

mvuyekureaime833@gmail.com*

ABSTRACT

Purpose: This study aimed to determine the predictors of nurses' utilization in the management of Non-Communicable Diseases (NCD's) and the relationship between knowledge of the PEN-Plus model, barriers to action, and cultural awareness, as moderated by demographic variables. A total of 283 respondents were selected using stratified random sampling from 15 district hospitals across Rwanda. **Methods:** The study employed a descriptive evaluative, descriptive correlational, and descriptive comparative research design. The results indicated that respondents had *high* knowledge of the PEN-Plus model, *low* intrapersonal barriers to action, *high* interpersonal barriers to action, *high* structural barriers to action, and *low* cultural awareness. Despite these barriers, there was a *high* utilization of the PEN-Plus model in NCD management among the respondents. **Findings:** The study found that knowledge of the PEN-Plus model had *a weak but significant positive correlation* with nurses' utilization of the model in NCD management. Conversely, interpersonal barriers to action, intrapersonal barriers to action, structural barriers to action, and cultural awareness exhibited *moderate positive significant correlations* with the utilization of the PEN-Plus model. **Value:** The findings suggested that higher knowledge of the PEN-Plus model, along with low interpersonal, intrapersonal, and structural barriers to action, as well as greater cultural awareness, were associated with better utilization of the PEN-Plus model in managing NCD's. Structural barriers to action, interpersonal barriers to action, cultural awareness, and knowledge of the PEN-Plus model were identified as significant predictors of nurses' utilization of the PEN-Plus model in the management of NCD's. Based on these findings, it is recommended to enhance nurses' education and training on the PEN-Plus model, provide robust policy and institutional support to address structural barriers and interpersonal barriers to action, foster team building, and conduct further research on additional factors influencing the PEN-Plus model's utilization.

Keywords: *knowledge PEN-PLUS Model, Barriers to Action, Cultural Awareness, PEN-Plus Model*

The Non-communicable diseases (NCDs) present a significant global health challenge, contributing substantially to both mortality and morbidity worldwide. The World Health Organization (WHO) has identified NCDs as the leading cause of death globally, accounting for over 70% of global deaths (WHO, 2017). Within Sub-Saharan Africa, NCDs impose a substantial burden, with cardiovascular diseases, neoplasms, mental disorders, and diabetes leading the statistics in terms of morbidity (Gouda et al., 2019).

In response to the health challenges posed by severe chronic NCDs, countries like Rwanda have initiated collaborative efforts with stakeholders to develop strategies such as the Package of Essential NCD Interventions – Plus (PEN-Plus) model. PEN-Plus is an integrated care delivery approach aimed at enhancing access to high-quality care for severe chronic NCDs, particularly targeting vulnerable populations such as children and young adults (WHO, 2017). By improving the accessibility and quality of chronic care services for conditions like type 1 diabetes, rheumatic heart disease, and sickle cell disease, the PEN-Plus model seeks to address critical gaps in NCD management.

Within Rwanda, as in many low-and middle-income countries (LMICs), the prevalence of NCDs is rising, constituting a significant portion of Disability-Adjusted Life Years (DALYS) (Institute for Health Metrics and

Evaluation [IHME], 2019). Diseases such as cardiovascular diseases, injuries, cancers, chronic respiratory diseases, and diabetes contribute significantly to NCD-related mortality in the country (Ministry of Health [MOH], 2020). Despite efforts to curb this burden, challenges persist, particularly in rural areas served by district hospitals, where access to essential treatment and care remains limited, leading to premature deaths, especially among vulnerable populations.

Nurses play a pivotal role in the management of NCDs, serving as frontline healthcare providers. However, they encounter various challenges in fulfilling their roles effectively, including heavy workloads, time constraints, and limited resources (Kamvura et al., 2022; Faro et al., 2023). Targeted initiatives such as health promotion interventions and comprehensive training are crucial for overcoming these challenges and optimizing nurses' contributions to NCD prevention and management efforts (Kayaroganam et al., 2022; Phiri et al., 2014).

The PEN-Plus model primarily operates at the first-level referral health facilities, specifically district hospitals, in Rwanda. It aims to bridge the gap in access to treatment and care for patients suffering from chronic and severe NCDs, particularly in rural settings where such services may be scarce. By introducing life-saving chronic care for severe NCDs at the first level of care, PEN-Plus seeks to address the historical deprivation of essential treatment for severe conditions, ultimately reducing premature deaths among vulnerable populations.

Despite the promise of models like PEN-Plus, barriers to effective NCD management persist, especially in LMICS. These barriers include poor access to medication, high private care costs, poor working conditions, limited awareness, heavy workloads, and time constraints among nurses (Tesema et al., 2020; Kamvura et al., 2022).

Overcoming these barriers requires organizational support, recognition for nurses, and targeted interventions to enhance their capacity in NCD management. Cultural awareness significantly influences nurses' utilization in NCD management, impacting aspects such as pain management, pharmacotherapy adherence, and self-care practices (Turkson-Ocran et al., 2022). Recognizing and valuing cultural awareness is imperative for providing responsive healthcare and improving health outcomes.

While existing studies identify challenges faced by nurses in LMICS regarding NCD management and recognize the significance of models like the PEN-Plus, a critical research gap persists. This study seeks to address a critical gap in healthcare delivery by delving into the understanding and utilization of the PEN-Plus model among nurses. Specifically, it aims to explore nurses' knowledge regarding the PEN-Plus model, identify barriers impeding its effective implementation, and examine the role of cultural awareness in shaping attitudes toward NCD management.

Statement of the Problem

This study aimed to determine the relationship between knowledge regarding the PEN- Plus model, barriers to action, cultural awareness, and nurses’ utilization of PEN-Plus in the management of NCD’s as moderated by demographic variables (age, sex, marital status, educational attainment). Specifically, this investigation will answer the following questions:

1. What is the level of respondents' knowledge regarding PEN-Plus Model use in NCDs Management?
2. To What extent do the following barriers to action influence nurses' utilization of PEN- Plus in the management of NCDs?
 - A. Intrapersonal Barriers
 - B. Interpersonal Barriers
 - C. Structural barriers
3. To what extent does cultural awareness influence nurses' utilization of PEN-Plus in the management of NCDs?
4. To what extent do nurses utilize the PEN-Plus Model in the management of NCDs?
5. Is there a significant relationship between the following variables and nurses’ utilization of PEN-Plus in the Management of NCDs?
 - A. Knowledge regarding the PEN-Plus Model
 - B. Barriers to action
 - C. Cultural awareness
6. Which among the following variables significantly predicts nurses’ utilization in the management of NCDs?

- A. Knowledge on the PEN-Plus model
- B. Barriers to action
- C. Cultural Awareness
- D. Age
- E. Sex
- F. Marital status
- G. Education Attainment

METHOD

This study used a quantitative research design to gather structured data and gain a comprehensive understanding of the factors influencing nurses' utilization in Non- Communicable Disease (NCD) management. It employed three distinct research designs: Descriptive Evaluative, Descriptive Correlational, and Descriptive Comparative.

A total of 283 participants were gathered through a stratified random sampling technique from 15 district hospitals across Rwanda. This method ensured a representative sample that reflected the geographical diversity of the country.

Data were gathered through a hybrid approach of face-to-face and online surveys. In-person data collection was facilitated by a research assistant who introduced the study to nurses, emphasizing ethical considerations such as voluntary participation and the right to withdraw at any time. Photographic documentation, with blurred faces to ensure privacy, was also taken to provide evidence of participation. Online surveys were distributed via

Google Forms links sent through email or hospital platforms, allowing participants to complete them at their convenience. The data collection period lasted for seven weeks. Statistical analyses included Frequency and

Percentage to describe the distribution of demographic characteristics and responses, as well as Mean and Standard Deviation to summarize the central tendency and dispersion of the collected data. Pearson r moment-product correlation was used to explore relationships between variables. Data were analyzed using the Statistical Package for Social Sciences (SPSS). Participants were assigned pseudonyms to preserve confidentiality and data privacy. All collected data were stored in password-protected electronic devices, with access limited to authorized personnel, and were scheduled to be destroyed six months after the study's completion to ensure confidentiality.

RESULTS AND DISCUSSION

Respondents ‘Level of Knowledge of the Pen-Plus Model

Table 6 shows the results based on the provided data; accordingly, item 1 disclosed a very high frequency of 254 (89.8%) which indicates that *the respondents had very high knowledge of the utilization of the PEN-Plus Model in addressing the management and treatment of non-communicable diseases*. However, item 11 got the lowest frequency count of 72 (25.4%) signifying *a low level of knowledge of the respondents regarding the use of the PEN-Plus Model that exclusively targets urban healthcare settings and is not suited for rural healthcare settings*.

Table 6
Respondents ‘Level of Knowledge of the Pen-Plus Model

NO.	Knowledge of the PEN-Plus Model	Frequency of Correct Answer	Percentage of Correct Answers	Qualitative Descriptor
1	PEN-Plus Model addresses the management and treatment of non-communicable diseases.	254	89.8%	Very High
2	The purpose of the PEN-Plus Model is to reduce the mortality rate of persons with NCD’s.	236	83.4%	Very High

3	PEN-Plus Model is an integrated care delivery strategy focused on alleviating the noncommunicable disease (NCD) burden among the poorest young adults	203	71.7%	High
4	The implementation of PEN-Plus Model is uniformly done across countries regardless of healthcare infrastructures.	211	74.6%	High
5	PEN-Plus Model is used to specifically target low income countries.	199	70.3%	High
6	PEN-Plus Model is exclusively for non-communicable disease and does not address infectious disease.	217	76.7%	High
7	PEN-Plus Model is designed to be cost-effective to all NCD patients.	176	62.2%	High
8	PEN-Plus Model is primarily focused in curative aspect than preventive measures.	211	74.6%	High
9	PEN-Plus Model emphasizes on community engagement and empowerment of healthcare professionals.	190	67.1%	High
10	The essential components of PEN-Plus Model include educational initiatives and training programs for health care professionals.	207	73.1%	High
11	PEN-Plus Model exclusively targets urban healthcare settings and is not suited for rural healthcare settings.	72	25.4%	Low
12	PEN-Plus Model is a centralized care for NCD’s in tertiary hospitals.	110	38.9%	Low
13	PEN-Plus Model is a physician-focused care for NCD’s	96	33.9%	Low
14	Community feedback and involvement are integral to the success of the PEN-Plus Model.	204	72.1%	High
Average		185	65.35%	High

Legend: 0-20= Very Low; 21-40=Low; 41-60=Average; 61-80=High; 81-100= Very High

Respondents’ Extent of Intrapersonal Barriers to Action

Table 7 presents the grand mean of nurses' intrapersonal barriers to action in utilizing the Pen-Plus Model for NCD management, which is 2.44 with a standard deviation of 1.152. Based on these results, it is generally observed that the respondents experience low intrapersonal barriers to action. The highest mean score was recorded for item 6 (*mean* = 2.77, *SD* = 1.153), which stated that *respondents agree their attitude towards NCD management impacts their ability to advocate for patients*. This high mean suggests that attitude is a significant intrapersonal barrier for nurses in action. Conversely, item 7 recorded the lowest mean score (*mean* = 2.17, *SD* = 1.137), which stated that *respondents disagreed with the statement, implying lower barriers related to addressing*

personal reservations for improving the quality of care for NCD patients.

Table 7
 Respondents’ Extent of Intrapersonal Barriers to Action

No.	Intrapersonal Barriers to action	Mean	SD	Scale Response	Qualitative Descriptor
1	I have the ability to overcome challenges when proactively engaged with NCD management.	2.35	1.161	Disagree	Low
2	I put aside biases when addressing patients' needs even when faced with personal reservations.	2.52	1.140	Agree	High
3	I feel comfortable in discussing and implementing the PEN-Plus model in my professional role.	2.28	1.144	Disagree	Low
4	I seek additional knowledge and resources related when managing NCD’s.	2.28	1.146	Disagree	Low
5	My personal beliefs positively influence my engagements with patients.	2.73	1.181	Agree	High
6	My attitude towards NCD management impacts my ability to advocate for patients.	2.77	1.153	Agree	High
7	I address my personal reservations that is crucial for improving the quality of care for NCD patients.	2.17	1.137	Disagree	Low
Grand mean (Intrapersonal Barriers to action)		2.44	1.152	Disagree	Low

Legend: 0.5-1.5 = Strongly Disagree; 1.51-2.5 = Disagree; 2.51-3.5=Agree; 3.51-4.00 = Strongly Agree

Respondent Extent of Interpersonal Barriers to Action

Table 8 reveals the grand mean of nurses' interpersonal barriers to action in utilizing the Pen-Plus Model for NCD management is 2.72 with a standard deviation of 1.128. Based on the results, it is generally observed that respondents experience *high interpersonal barriers*. The highest mean score was recorded for items 4 and 5, both with a mean of 2.98 (*SD*= 1.103), reflecting high agreement. This indicates that *the respondents had high interpersonal barriers in action, particularly in participating in collaborative environments for NCD management and freely expressing concerns and issues in a clinical environment*. Similarly, item 7, "Trust issues in the team significantly impact the implementation of the PEN-Plus model," had a mean score of 2.89 (*SD* = 1.051), highlighting the significant impact of trust issues among team members. Conversely, item 2, "I have built a trust relationship with colleagues in carrying out my duty in treating NCD patients," had the lowest mean score of 2.20 (*SD* = 1.205), indicating that trust is an area needing improvement.

Table 8
 Respondents’ Extent of Interpersonal Barriers to Action

No.	Barriers to action	Mean	SD	Scale Response	Qualitative Descriptor
1	I am able to engage in effective clinical supervision.	2.84	1.171	Agree	High
2	I have built a trust relationship with colleagues in carrying out my duty in treating NCD patients.	2.20	1.205	Disagree	Low
3	I have developed specific skills required for successful clinical dynamics.	2.23	1.188	Disagree	Low
4	I participate in collaborative environments for NCD management.	2.98	1.103	Agree	High
5	I can freely express concerns and issues in a clinical environment.	2.98	1.103	Agree	High
6	I can navigate language barriers in the context of NCD care.	2.94	1.078	Agree	High

7	Trust issues in the team significantly impact the implementation of the PEN-Plus model.	2.89	1.051	Agree	High
Grand Mean (Interpersonal Barriers to action)		2.72	1.128	Agree	High

Legend: 0.5-1.5 = Strongly Disagree; 1.51-2.5 = Disagree; 2.51-3.5=Agree; 3.51-4.00 = Strongly Agree

Respondent Extent of structural Barriers to Action

Table 9 reveals the grand mean of nurses' structural barriers to action in utilizing the Pen-Plus Model for NCD management is 2.78 with a standard deviation of 1.132. Based on the results, it is generally observed that respondents experience *high* structural barriers.

The highest mean score was recorded for item 6, "I understand that workforce capacity building is necessary to address inadequate staffing in NCD management," with a mean of 2.92 ($SD = 1.111$), reflecting high agreement. This states that *respondents had high structural barriers in action related to workforce capacity building*. Similarly, items 1, 2, 3, 5, and 8 all had *high mean scores*, indicating that respondents *agreed on the importance of overcoming protocol availability, finding solutions to infrastructure limitations, addressing limited availability of protocols, recognizing the importance of political commitment, and considering data monitoring* as essential for NCD patient management. Conversely, item 4, "I am familiar with working in an environment with infrastructure limitations and can adapt accordingly," had the lowest mean score of 2.27 ($SD = 1.167$), stating that *respondents had low structural barriers in terms of adapting to infrastructure limitations*.

Table 9
 Respondents' Extent of Structural Barriers to Action

No.	Structural Barriers to action	Mean	SD	Scale Response	Qualitative Descriptor
1	I believe that overcoming protocol availability is crucial for effective NCD management.	2.88	1.161	Agree	High
2	I believe finding solutions to infrastructure limitations affecting NCD management is essential for optimal patient care.	2.86	1.132	Agree	High
3	I am actively involved in addressing the limited availability of protocols in my workplace.	2.83	1.123	Agree	High
4	I am familiar with working in an environment with infrastructure limitations and can adapt accordingly.	2.27	1.167	Disagree	Low
5	I recognize the importance of political commitment in overcoming challenges related to protocol availability.	2.86	1.113	Agree	High
6	I understand that workforce capacity building is necessary to address inadequate staffing in NCD management.	2.92	1.111	Agree	High
7	I understand that workforce capacity building is necessary to address inadequate staffing in NCD management.	2.81	1.111	Agree	High
8	I consider data monitoring as important in NCD patient management of treatment.	2.86	1.141	Agree	High
Grand Mean (Structural Barriers to Action)		2.78	1.132	Agree	High

Legend: 0.5-1.5 = Strongly Disagree; 1.51-2.5 = Disagree; 2.51-3.5=Agree; 3.51-4.00 = Strongly Agree

Respondents' Overall Extent of Barriers to Action

Table 10 reveals the grand mean of barriers to action in utilizing the Pen-Plus Model for NCD management is 2.66 with a standard deviation of 1.119. Based on the results, it is generally observed that *respondents experience high barriers to action*. The highest mean score was recorded for "Structural Barriers to Action" ($mean = 2.78, SD = 1.132$) with an interpretation of *high*, which indicates that the respondents had *significant structural barriers in action*. This reflects that issues related to infrastructure, protocol availability, and workforce capacity are perceived as major challenges in the implementation of the Pen-Plus Model. However,

"Intrapersonal Barriers to Action" received the lowest mean score of 2.44 ($SD = 1.152$) with an interpretation of low, indicating that respondents had fewer intrapersonal barriers in action. This suggests that while personal motivations and attitudes are less of an obstacle, external factors play a larger role in hindering effective NCD management.

Table 10

Respondents' Overall Extent of Barriers to Action

No.	Barriers to action	Mean	SD	Scale Response	Qualitative Descriptor
1	Intrapersonal Barriers to Action	2.44	1.152	Disagree	Low
2	Interpersonal Barriers to action	2.72	1.128	Agree	High
3	Structural Barriers to Action	2.78	1.132	Agree	High
Overall Grand Mean (Barriers to Action)		2.66	1.119	Agree	High

Legend: 0.5-1.5 = Strongly Disagree, 1.51-2.5 = Disagree, 2.51-3.5=Agree, 3.51-4.00 = Strongly Agree

Respondents' Extent of Cultural Awareness

Table 11 presents the extent of cultural awareness of the PEN-Plus model among nurses. The grand mean is 2.74 and the standard deviation is 1.09. The results revealed that the overall respondents' cultural awareness was *low*. Specifically, the highest mean ($Mean = 2.83$ and $SD = 1.09$) was from item 14, "I effectively manage to work with patients with different cultural/health beliefs among patients." This was followed by item 13, "I navigate challenges related to stigma in managing NCD patients from different cultural backgrounds," with a mean of 2.80 ($SD = 1.08$). The third among the options was item 12, "I recognize and address cultural barriers," with a mean of 2.80 ($SD = 1.08$), followed by item 11, "I play a pivotal role in addressing communication challenges arising from rich cultural diversity," with a mean score of 2.79 ($SD = 1.07$).

Next, the cultural awareness by items 15, 9, and 10 was nearly similar, with mean values of 2.76 ($SD = 1.08$), 2.76 ($SD = 1.07$), and 2.75 ($SD = 1.06$), respectively. Two items nearly showed similar mean values: item 8, "I collaborate with colleagues from diverse cultural backgrounds," with a mean of 2.72 ($SD = 1.08$), and item 2, "I recognize the influence of cultural nuances on health behaviors, particularly in the management of NCD's using the PEN-Plus Model," with a mean of 2.72 ($SD = 1.10$). Second to the last, item 3, "I play a pivotal role in fostering cultural care within the nursing profession," had a mean score of 2.74 ($SD = 1.15$). Finally, the lowest is item 1, "I actively engage in programs that enhance my cultural competence," with a mean score of 2.67 ($SD = 1.11$).

Table 11

The extent of cultural awareness of the PEN-Plus model among Nurses

No	Cultural awareness	Mean	SD	Scale Response	Qualitative Descriptor
1	I actively engage in programs that enhance my cultural competence.	2.67	1.11	Agree	Low
2	I recognize the influence of cultural nuances on health behaviors, particularly in the management of NCD's using the PEN-Plus Model.	2.72	1.10	Agree	Low
3	I play a pivotal role in fostering cultural care within the nursing profession.	2.74	1.15	Agree	Low
4	I understand the importance of cultural competence as a foundation within the PEN-Plus Model.	2.67	1.10	Agree	Low
4	I acknowledge the challenges associated with a lack of cultural knowledge within the PEN-Plus Model.	2.71	1.09	Agree	Low
5	I recognize the significance of addressing language barriers for effective cultural competence within the PEN-Plus Model.	2.68	1.12	Agree	Low

6	I effectively engage in cross-cultural communication within the PEN-Plus Model framework.	2.67	1.12	Agree	Low
7	I collaborate with colleagues from diverse cultural backgrounds.	2.72	1.08	Agree	Low
8	I adapt communication strategies to ensure patient-centered care in a culturally diverse setting	2.76	1.07	Agree	Low
9	I contribute to fostering an environment of cross-cultural collaboration for improved healthcare outcomes	2.75	1.06	Agree	Low
10	I play a pivotal role in addressing communication challenges arising from rich cultural diversity	2.79	1.07	Agree	Low
11	I recognize and address cultural barriers	2.80	1.08	Agree	Low
12	I navigate challenges related to stigma in managing NCD’s patients from different cultural backgrounds.	2.80	1.08	Agree	Low
13	I effectively manage working with patients with different cultural/health beliefs among patients	2.83	1.09	Agree	Low
14	I mitigate language barriers to enhance communication and properly implement treatment plan.	2.76	1.08	Agree	Low
Grand Mean		2.74	1.09	Agree	Low

Legend: 3.51-4.0=Very Low,2.51-3.5=Low,1.51-2.5=High ,0.5-1.5=Very High

Respondent’s Extent of Utilizing the PEN-Plus Model in the Management of NCDs

Table 12 presents the extent of nurse utilization of the PEN-Plus model in the management of NCD’s. The grand mean is 2.87 and the standard deviation is 1.01. The result revealed that the overall respondents’ nurse utilization of the PEN-Plus model was *high*. Specifically, the highest mean (*Mean = 2.93 and SD = 1.10*) was from item 6, “I am consistently courteous to non-communicable disease patients.” This was followed by item 2, “I encourage non-communicable disease patients to have lifestyle change,” with a mean of 2.92 (*SD = 1.07*). The third among the options was item 4, “I manage care related to NCD patients’ medical condition,” with a mean of 2.92 (*SD = 1.12*), followed by item 5, “I accomplish my goals in managing NCD patients,” with a mean score of 2.90 (*SD = 1.12*). Next, the utilization items by items 8, 7, 14, and 15 were nearly similar, with mean values of 2.90 (*SD = 1.09*), 2.89 (*SD = 1.08*), 2.89 (*SD = 1.11*), and 2.89 (*SD = 1.14*), respectively. Two items nearly showed similar mean values: item 1, “I find effective solutions for problems that occur in the management of non-communicable disease patients,” with a mean of 2.83 (*SD = 1.10*), and item 3, “I am competent in dealing with non-communicable disease patients,” with a mean of 2.83 (*SD = 1.10*). Second to the last, item 10, “My skills are applied in treating patients under the PEN-Plus Model in managing NCD’s,” had a mean score of 2.83 (*SD = 1.11*). Finally, the lowest is item 11, “I have expertise in utilizing the PEN-Plus Model in the management of NCD’s,” with a mean score of 2.80 (*SD = 1.10*).

Table 12
 Respondents’ Extent of Utilizing the PEN-Plus Model in the Management of NCDs

NO.	NURSES’ UTILIZATION OF NCD MANAGEMENT	Mean	SD	Scale Response	Qualitative Descriptor
1	I find effective solutions for problems that occur in the management of non-communicable disease patients	2.83	1.10	Agree	High
2	I encourage non-communicable disease patients to have a lifestyle change	2.92	1.07	Agree	High
3	I am competent in dealing with non-communicable disease patients	2.83	1.10	Agree	High

4	I manage care related to NCD patients’ medical condition	2.92	1.12	Agree	High
5	I accomplish my goals in managing NCD patients	2.90	1.12	Agree	High
6	I am consistently courteous to noncommunicable disease patients.	2.93	1.10	Agree	High
7	I succeed in the projects I undertake in the management of non-communicable disease Patients	2.89	1.08	Agree	High
8	I am willing to work for the hospital and maintain a positive work environment.	2.90	1.09	Agree	High
9	I use PEN-Plus Model in managing non communicable disease patients as per hospital’s requirements	2.84	1.10	Agree	High
10	My skills are applied in treating patients under PEN-Plus Model in managing NCD’s	2.83	1.11	Agree	High
11	I have expertise in utilizing PEN-Plus Model in the management of NCD’s	2.80	1.10	Agree	High
12	I understand the requirements of the hospital in the use of PEN-Plus Model	2.83	1.13	Agree	High
13	I make proper use of physical facilities in managing noncommunicable disease patients	2.88	1.10	Agree	High
14	I deliver quality care in managing NCD’s	2.89	1.11	Agree	High
15	I share relevant information among colleagues in the management of non-communicable disease patients	2.89	1.14	Agree	High
Grand Mean		2.87	1.01	Agree	High

Legend: 0.5-1.5=Very low, 1.51-2.5=low, 2.51-3.5=High, 3.51-4.0=Very High

Relationship Between Knowledge Regarding PEN-Plus Model and Nurses’ utilization of PEN-Plus in the Management of NCDs

Table 13 presents the correlation analysis to determine the relationship between knowledge regarding the PEN-Plus model and nurses’ utilization of the PEN-Plus model in the management of NCDs. As shown in Table 13, knowledge on the PEN-Plus model had a *weak positive relationship* to the utilization of the PEN-Plus model in the management of NCDs ($\rho = 0.217^{***}$, $p = .001$). Therefore, the hypothesis that stated *there is no significant relationship between knowledge regarding the PEN-Plus model and nurses’ utilization of the PEN-Plus model in the management of NCDs* is rejected. It is important to note that, according to Schober et al. (2018), the interpretation standards suggest that a $\rho = 0.217$ value between knowledge of the PEN-Plus model and nurses’ utilization of the PEN-Plus model in managing non-communicable diseases (NCDs) indicates a *weak correlation*.

Table 13

Relationship Between Knowledge Regarding PEN-Plus Model and Nurses’ utilization of PEN-Plus in the Management of NCDs

Variable	Spearman’s rho	df	P-value	Interpretation
Knowledge on PEN-Plus model	0.217***	281	<.001	Significant Weak

Legend: 0.00-0.10 = Negligible; 0.10 -0.39 = weak Correlation ;0.40-0.69= moderate Correlation ;0.70-0.89 = strong correlation;0.90-1.00= Very strong correlation

Relationship Between Barriers to Action and Nurses’ Utilization of Pen-Plus in the Management of NCDs

Table 14 presents the correlational analysis of barriers to action (intrapersonal, interpersonal, and structural) and nurses’ utilization of PEN-Plus in the management of NCD’s. As shown in Table 14, there was a *moderate positive relationship* between intrapersonal barriers to action and nurses’ utilization of the PEN-Plus model in the management of NCD’s with a correlation result of ($\rho = 0.553^{***}$, $P\text{-value} < 0.001$). Furthermore, there was a *moderate positive relationship* between interpersonal barriers to action and nurses’ utilization of the PEN-Plus model in the management of NCD’s with a correlation result of ($\rho = 0.627^{***}$, $P = 0.001$). In addition to that, there was a *moderate positive relationship* between structural barriers to action and nurses’ utilization of the PEN-Plus model in the management of NCDs with a correlation result of ($\rho = 0.684^{***}$, $P = 0.001$). Therefore, the hypothesis that stated *there is no significant relationship between barriers to action and nurses’ utilization of the PEN-Plus model in the management of NCDs* is rejected. The relationship between barriers to action and nurses’ utilization of the PEN-Plus model in the management of NCDs was considered a *moderate correlation* according to Schober et al. (2018).

Table 14
 Relationship Between Barriers to Action and Nurses’ Utilization of Pen-Plus in the Management of NCDs

Variable	Spearman’s rho	P-value	Decision	Interpretation
Intrapersonal Barriers to Action	0.553***	< .001	Reject H0	Moderately Significant
Interpersonal Barriers to Action	0.627***	< .001	Reject H0	Moderately Significant
Structural Barriers to Action	0.684***	< .001	Reject H0	Moderately Significant

Legend: 0.00-0.10 = Negligible; 0.10 -0.39 = weak Correlation ;0.40-0.69= moderate Correlation ;0.70-0.89 = strong correlation;0.90-1.00= Very strong correlation

Relationship Between Cultural Awareness and Nurses’ Utilization of PEN-Plus in the management of NCDs

Table 15 presents the correlational analysis to determine the relationship between cultural awareness and nurse utilization of the PEN-Plus model in the management of NCDs. As shown in Table 15, there was a *moderately significant relationship* between cultural awareness and nurses’ utilization of the PEN-Plus model in the management of NCDs with a correlational result of ($p = .001$, $\rho = 0.542^{***}$). Therefore, the hypothesis that stated *there is no significant relationship between cultural awareness and nurses’ utilization of the PEN-Plus model in the management of NCD’s* is rejected. Table 14 revealed that the relationship between cultural awareness and nurses’ utilization of the PEN-Plus in the management of NCD’s was a *moderate correlation* according to Schober et al. (2018).

Table 15
 Relationship Between Cultural Awareness and Nurses’ Utilization of PEN-Plus in the Management of NCDs

Variable	Spearman’s rho	P-value	Decision	Interpretation
Cultural Awareness	0.542***	$P < 0.001$	Reject H0	Moderately Significant

Legend: 0.00-0.10 = Negligible; 0.10 -0.39 = weak Correlation ;0.40-0.69= moderate Correlation ;0.70-0.89 = strong correlation;0.90-1.00= Very strong correlation

Predictors of Nurses’ Utilization in the Management of NCDs

As shown in Table 16, using the *multiple regression method*, among the variables (Knowledge on Pen-Plus model, intrapersonal barriers to action, interpersonal barriers to action, structural barriers to action, cultural awareness, age, sex, marital status, and educational attainment), only structural barriers to action ($R^2 = 0.570$), interpersonal barriers to action ($R^2 = 0.617$), cultural awareness ($R^2 = 0.637$), and knowledge on the PEN-Plus model ($R^2 = 0.653$) come out as significant predictors of nurses’ utilization in the management of NCD’s.

Table 16
 Predictors of Nurses’ Utilization in the Management of NCDs

Predictor	Estimate (β)	SE	T	P	R ² change
Intercept	-0.2862	0.1935	-1.48	0.140	
Struc_Var	0.3788	0.0621	6.10	< .001	.570
Inter_Var	0.3405	0.0594	5.73	< .001	.617
CA_Var	0.2363	0.0495	4.77	< .001	.637
K_Var	0.0580	0.0158	3.68	< .001	.653

Legend: P-value < 0.001, R² = .658

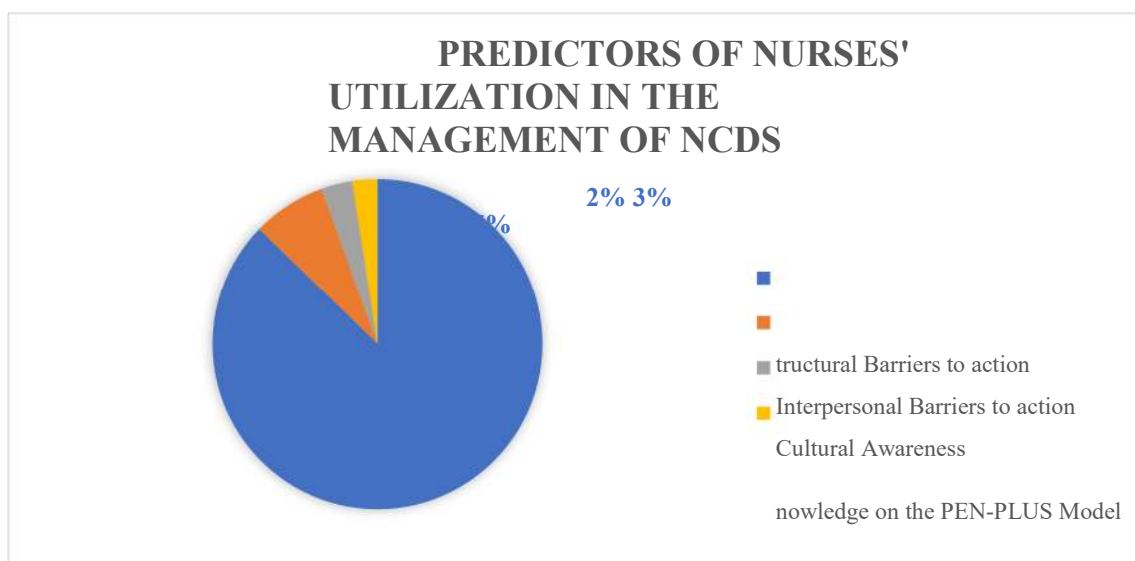


Figure 6. Predictors of Nurses utilization in the management of NCDS

CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

Nurses in Rwanda have high knowledge of the PEN-Plus model, low intrapersonal barriers to action, high interpersonal barriers to action, high structural barriers to action, and low cultural awareness, coupled with high utilization of the PEN-Plus model in NCD management. However, their utilization of the model has not reached its maximum potential effect.

Knowledge of the PEN-Plus model has a weak positive significant correlation with nurses’ utilization of the PEN-Plus model in the management of NCDs. Conversely, interpersonal barriers to action, intrapersonal barriers to action, structural barriers to action, and cultural awareness have moderate positive significant correlations with nurses’ utilization of the PEN-Plus model in the management of NCDs. The higher the knowledge of the PEN- Plus model, interpersonal barriers to action, intrapersonal barriers to action, structural barriers to action, and cultural awareness, the higher or better the utilization of the PEN-Plus model in the management of NCDs.

The results of the study supported and confirmed that the utilization of the PEN-Plus Model was influenced by a combination of knowledge, interpersonal, intrapersonal, and structural barriers to action, as well as cultural awareness. Based on these findings, it is recommended to enhance nurses’ education and training on the PEN-Plus model, provide robust policy and institutional support to address structural barriers and interpersonal barriers to action, foster team building, and conduct further research on additional factors influencing the PEN-Plus model’s utilization.

However, the researcher faced several limitations. A significant constraint was time; despite an extended

data collection period, some registered nurses who were willing to participate were unable to complete the surveys due to their busy schedules and daily tasks, leading to delayed responses or biased answers from those who felt rushed. Additionally, the researcher encountered challenges with unfamiliar procedures and protocols, such as the requirements and presentation to obtain approval from the Ethics Review Board (ERB) and securing permissions from District Hospitals. Navigating these new administrative processes added complexity and potential delays to the study.

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