International Journal of Diabetes Research 2019, 8(2): 30-40
DOI: 10.5923/j.diabetes.20190802.03

Factors Influencing the Adoption of Health Information Technology for Optimal Chronic Disease Management: Diabetes Management in Southwestern Nigeria as a Case Study

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Abstract Despite diabetes management techniques already in use in Nigeria, desired care outcomes are not acceptable and due to this, patient satisfaction is not optimal. On this note, and having known the prevalence and the nature of diabetes as a chronic disease that needs optimal management, this study therefore investigates the factors influencing optimal management of diabetes in Nigeria using Health Information Technology. However for this study, the model of Donabedian that proposed a healthcare quality systems-based framework of *structure*, *process* and *outcome,* to measure quality of health care, so as to give an idea of where problems are stirring, and how they could be addressed was used. Both qualitative and quantitative data collection methods were used. The quantitative data were collected through questionnaire, while the qualitative data were collected through key informant interviews. Thirty nine (39) factors were presented, and after using factor analysis and some other statistical tools, the seven most important factors that emerged were inadequate monitoring of patient risky indicators; increased unplanned evil occurrences; unavailability of needed/complete confidential patient data; lack of patient involvement and education; erratic power supply; not reasonable staff to patient ratio; and inadequate staff skills and expertise. The first factor accounted for most variance of 23.03, while the rest of the six factors accounted for 17.81, 17.21, 8.15, 7.46, 5.12 and 4.70, respectively. Thus, all the factors accounted for a cumulative of 83.5%. It was then concluded that the use of Health Information Technology could alleviate some of these factors if used meaningfully.

Keywords Chronic diseases, Health Information Technology, Diabetes, ICT

1. Introduction

In many countries, especially developing countries, the rate of complications and death rates of chronic diseases, especially diabetes, have increased rapidly over the last two decades, due to changing behavioural patterns, for example in diets and exercise (Ifijeh, 2016). Among the chronic diseases, the prevalence of *diabetes mellitus* (simply called diabetes) particularly is on the rise in Nigeria, as it is fast becoming the most recurrent disease, associated with premature death of thousands of Nigerians, robbing the country of notable leaders and scholars. According to Obinna (2018) and Duru (2012), Nigeria has the highest number of people living with diabetes in Africa, with not less than 3.9M estimated to be with diabetes, while close to 846,000 are yet to be aware they have the disease. Furthermore, WHO (2011) still alerted globally that diabetes will remain to be a major threat to public health beyond the year 2030. This is because in the year 1985, just thirty (30) million people had diabetes and presently, more than three hundred and sixty six (366) million have diabetes, and by 2030, five hundred and twenty two (522) million people will be living with diabetes if the pandemic is not contained.

Diabetes is a chronic disease that ensues when the pancreas is not able to make insulin, or when the body cannot utilize the insulin it produces, which leads to raised glucose levels in the blood, known as hyperglycaemia. It results in many complications and permanent disabilities like blindness, amputation of limbs, impotence, kidney failures, still births, pregnancy wastages, among others, which could be the reason of its high rate of death (Chinenye and Ogbera, 2013). Therefore, WHO (2008a) noted that diabetes has a profound impact on longevity of life of its patients, because for instance, a person diagnosed to have Type 2 diabetes during his middle age (40-60 years), stands to lose as much

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Published online at http://journal.sapub.org/diabetes

as ten years of life expectancy. Health systems are thus only as effective as the services they provide, and strengthening service delivery quality is a key strategy to achieve the Millennium Development Goals (WHO, 2008b). Thus, optimal healthcare delivery can be related to the quality of healthcare services being provided.

Several researchers have proposed many models of measuring quality indicators, for optimal disease management in the health sector. For example, WHO (2008b) explained that a high healthcare quality is a *timely* care that is *effective*, *safe* and *centered on the patient* as shown in Table 1, listing some of the possible parameters.

Table 1. Sample Indicators for Consideration in Assessing Healthcare Quality

Healthcare Service Indicator	Indicators
Effectiveness	Hospital admission rate Health worker counsel etc
Safety	Providers knowing hand hygiene guidelines Providers asking about other prescriptions being taken etc.
Patient Centeredness	Providers always listen to all what is being said Providers explain things clearly to patients Providers showing respect to patients etc.
Timeliness	Emergent patients leaving without being seen Having usual source of care etc.

Source: WHO, 2008b.

Furthermore, Tabriz et al. (2010) explained that quality management of chronic diseases can be grouped into two: *Technical quality (TQ)* and *Functional quality*. Technical quality in the health care sector is defined mainly on the basis of the technical accuracy of the medical diagnoses and procedures, and the conformance to professional specifications. That is, it is all about accuracy of the disease diagnosed and the outcome of the treatment (Wanjau *et al.*, 2012). Moreover, TQ also refers to the clinical or disease-specific aspects of care that deals with what the customers receive relative to what is known to be effective. Thus, it depends on the appropriateness of the services provided and service provider’s skills (Tabrizi *et al.*, 2010). On the other hand, functional quality refers to the method in which the health care service is delivered to the patients. It involves how a treatment is done, the process of treatment or management of a disease (Wanjau *et al.*, 2012).

Similarly, according to American Diabetes Association (2001), optimal diabetes management can be explained with respect to three components: *Assessment*, *Treatmen*t and *attainment of target*. Assessment, according to Riella (2013), has to do with the detection, diagnosis, classification and prediction of a particular disease. In other words, assessment involves following both national and international guidelines in assessing a diabetic patient, which includes among others, systolic and diastolic blood pressure targets, glycemic targets, body mass index (BMI), pressure targets and other anthropometric indices, self-management, lipid levels and behavioural targets (American Diabetes Association, 2008). On the other hand, *Treatment* according to Connor (2010) who suggested that for diabetes management, optimal treatment is how far complications are reduced in diabetic patients. This is because complications reduction leads to decrease in the rate of morbidity and mortality (Chinenye *et al.*, 2012). Lastly, correct assessment and treatment bring about attainment of target, which is with respect to morbidity, mortality, and quality of life (Riella, 2013).

Likewise, Burns et al (2013) described optimal care as best achieved by the healthcare stakeholders that are informed, motivated, prepared and able to work together. Likewise on this note, the World Health Organization (WHO, 2006) fully explained that an optimal healthcare management must be able to: (1) improve the health status of individuals, families and communities; (2) defend the population against what threatens its health; (3) protect people against the financial consequences of ill-health; (4) provide equitable access to people-centred care; and (5) make it possible for people to participate in decisions affecting their health and health system.

However for this study, the model of Donabedian (1980) that proposed a healthcare quality systems-based framework of *structure*, *process* and *outcome,* to measure quality of health care so as to give an idea of where problems are stirring, and how they could be addressed was used. According to his framework, *structure* refers to input and service delivery environment, *process* signifies actual care delivery and content of care, while *outcome* denotes interaction between patient and health care. In other words, Quality *structures* have to be in place to offer optimal services according to accepted standards of practice, so they are usual infrastructures that have to be provided for improved services to be on, such as health information technology. Following known standard, the *process* of care can be enhanced by a variety of tools, including collaborations where groups of providers or hospitals can work together on common clinical problem areas, especially using health information technology such as internet, teleconferencing etc. Also, *outcome* refers to a patient's health status or change in health status (e.g. an improvement in symptoms or mobility), resulting from the medical care received. This includes intended outcomes, such as the relief of pain and unintended outcomes, such as complications. Further examples under each parameter as suggested by Shaw *et al.* (2002) are shown in Table 2.

Despite diabetes management techniques already in use in Nigeria, desired care outcomes are not acceptable and due to this, patient satisfaction is not optimal (Obinna, 2018). On this note, and having known the prevalence and the nature of diabetes as a chronic disease that needs optimal management, there is therefore a need to investigate the factors influencing optimal management of diabetes in Nigeria using Health Information Technology, hence this study.

Table 2. Dimensions in the Assessment of Quality of Care

	Dimensions of Quality of Care
Structure (Input)	How resources are allocated in terms of time, place and responsiveness to the needs of populations (access)
	Fairness in sharing costs and benefits (equity)
Process	How the resources are applied (stewardship)
	Use of time and resources (efficiency)
	Avoidance of waste (economy)
	Reduction of Risk (safety)
	Evidence-based practice (appropriateness)
	Patient-focused care (continuity)
	Public/Patient information (choice, transparency and accountability)
Outcome	Population health (Health improvement)
	Clinical outcome (effectiveness)
	Meeting expectations of public and workforce (cost-benefit)

Source: Shaw *et al.* 2002.

2. Materials and Methods

The study location is the Southwestern part of Nigeria. Though, Nigeria has six geopolitical zones, out of which one (Southwestern) zone was taken because of security issues in the country among other reasons. This zone has six states and to avoid bias about any state, one tertiary hospital was selected from each state, so that all the states would have equal representation in the study. Therefore, purposive sampling was used so that both State and Federal tertiary hospitals were included across the states, thus making a total of six tertiary hospitals (three Federal and three State hospitals).

After obtaining ethics clearances from these selected hospitals, and to obtain data for this study, a mixed method of quantitative and qualitative data collection was used. The quantitative data were collected through questionnaire, while qualitative data were collected through key informant (semi-structured) interviews. Some of the purposes why mixed method was used for this study is shown in Table 3. For questionnaire administration, the study population was adult type-2 diabetic out-patients attending the hospitals under study; the Doctors (both senior registrars and the consultants) and Nurses attending to them. Also, the Pharmacists; Laboratory scientists (e.g. for blood test, x-ray, urine test etc); Medical record officers; and ICT unit professionals of the hospitals were included in the study. Furthermore, two of the top management board members making decisions for the hospitals, randomly selected based on their availability, were interviewed, so also to explore their views about the factors influencing optimal management of chronic diseases in Nigerian hospitals.

Table 3. Purposes of Mixed Methods Modified after Clark and Creswell (2008:127)

Purpose	Rationale	Key Theoretical Sources
TRIANGULATION seeks convergence, corroboration, correspondence of results from the different methods.	To increase the validity of constructs and inquiry results by counteracting or maximizing the heterogeneity of irrelevant sources of variance attributable especially to inherent method bias but also to inquirer bias, bias of substantive theory, biases of inquiry context.	Campbell & Fiske, 1959 Cook, 1985 Denzin, 1978 Shotland & Mark, 1987 Webb *et al*., 1966
COMPLEMENTARITY seeks elaboration, enhancement, illustration, clarification of the results from one method with the results from the other method.	To increase the interpretability, meaningfulness and validity of constructs and inquiry results by both capitalizing on inherent method strengths and counteracting inherent biases in methods and other sources.	Greene, 1987 Greene & McClintock, 1985 Mark & Shotland, 1987 Rossman & Wilson, 1985
DEVELOPMENT seeks to use the results from one method to help develop or inform the other method, where development is broadly construed to include sampling and implementation, as well as measurement decisions	To increase the validity of constructs and inquiry results by capitalizing on inherent method strengths.	Madey, 1982 Sieber, 1973
INITIATION seeks the discovery of paradox and contradiction, new perspectives of frameworks, the recasting of questions or results from one method with questions or results from one method with questions or results from the other method	To increase the breadth and depth of inquiry results and interpretations by analysing them from the different perspectives of different methods and paradigms.	Kidder & Fine, 1987 Rossman & Wilson, 1985
EXPANSION seeks to extend the breadth and range of inquiry by using different methods for different inquiry components.	To increase the scope of inquiry by selecting the methods most appropriate for multiple inquiry components.	Madey, 1982 Mark & Shotland, 1987 Sieber, 1973

Table 4. Distribution of Questionnaire for Data Collection in the Study Area

Location	No of administered questionnaires	Average number of Respondents	Questionnaire administration
FMC, Owo	60	Patients (30) Nurses (3) Pharmacists (7) Medical Record officers (4) Laboratory scientists (6) ICT unit professionals (6) Doctors: Consultants and Senior Registrars (4)	One-to-one/Personal administration
LASUTH, Lagos	60	Patients (30) Nurses (3) Pharmacists (7) Medical Record officers (4) Laboratory scientists (6) ICT unit professionals (6) Doctors: Consultants and Senior Registrars (4)	One-to-one/Personal administration
OOUTH, Sagamu	60	Patients (30) Nurses (3) Pharmacists (7) Medical Record officers (4) Laboratory scientists (6) ICT unit professionals (6) Doctors: Consultants and Senior Registrars (4)	One-to-one/Personal administration
EKSUTH, Ado-Ekiti	60	Patients (30) Nurses (3) Pharmacists (7) Medical Record officers (4) Laboratory scientists (6) ICT unit professionals (6) Doctors: Consultants and Senior Registrars (4)	One-to-one/Personal administration
OAUTHC, Ile-Ife	60	Patients (30) Nurses (3) Pharmacists (7) Medical Record officers (4) Laboratory scientists (6) ICT unit professionals (6) Doctors: Consultants and Senior Registrars (4)	One-to-one/personal administration
UCH, Ibadan	60	Patients (30) Nurses (3) Pharmacists (7) Medical Record officers (4) Laboratory scientists (6) ICT unit professionals (6) Doctors: Consultants and Senior Registrars (4)	One-to-one/Personal administration

Based on the background knowledge about the number of Staff available for a diabetes clinic on a particular day in each of the selected hospitals, the minimum number was taken across all the hospitals. For example, the number of nurses available in a diabetes clinic in all the six hospitals ranged from 3 to 4. Thus, three nurses were taken across all the hospitals under study and so on. Likewise, a random sampling was used in a situation whereby the number available is more than the number of respondents needed. For example, where there are more than 30 patients in the clinic, random sampling was used to select the needed number of respondents. Therefore, the questionnaires, which were developed by the researchers, were administered among Patients (30); Nurses (3); Pharmacists (7); Medical record officers (4); Laboratory scientists (6); ICT unit professionals (6) and Doctors (4) in six tertiary hospitals that have diabetes clinic in the six states in Southwestern Nigeria, thus making a total of three hundred and sixty (360) questionnaires, sixty (60) in each state, as analysed in Table 4. The small samples of the respondents in each hospital were based on the smaller number of health practitioners that are usually available in a clinic, unlike in the totality of the whole hospital.

To ensure research validity and reliability, the questionnaire were not given to the respondents when they were too tired in the afternoon, ready to close for the day's work. Moreover, the questionnaires were not given early in the morning, when they would see the questionnaires as disturbances to their daily work.

3. Results and Discussions

3.1. Factors Influencing Optimal Diabetes Management Using the HIT Options in the Study Area

Out of the three hundred (360) copies of questionnaire that were administered, only three hundred (300) copies were able to be retrieved, thus making the response rate to be 83.33%. In the questionnaire, thirty-nine (39) factors altogether identified in the literature were investigated to know the ones influencing optimal diabetes management in the study area. The model after Donabedian (1980) earlier discussed was followed, which categorised the factors under Structure, Process and Outcome. Statistical Package for Social Sciences (SPSS) version 20.0 was used to do the analysis for the study.

3.1.1. Structure-Based Factors Influencing Optimal Diabetes Management

Fourteen (14) factors were examined under the Structure parameter. The mean ranking, in descending order of the variables are presented in Table 5. There were 300 respondents (N) examined (both Staff and Patients) on a 5-point Likert rating scale of measurement, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). From the table, it is obvious that' Access to Complete Records' has the highest mean ranking of 4.05, which is in line with what Herrin *et al*. (2012) discussed that having a complete record is a vital factor for diabetes management, in that it allows the physicians to make an excellent decision, having all the information needed at his fingertips.

Also from the table, 'Supply of needed drugs' does not have enough weight (1.98) compared with other items under the Structure parameter. This might be because even if the hospital of the diabetes clinic does not have the needed drugs, the patient can go to any other good pharmacy shop to get the prescribed medicine. Although, this will not be beneficial to the patients on NHIS (National Health Insurance Scheme), on which he will only pay 10% of the cost of drugs/services rendered. This is because the patient has to attend the hospital registered for NHIS, so if a particular hospital is taken as primary for NHIS, any other hospital cannot be used for treatment or buying of drugs, unless based on emergent referral solely from the primary hospital, which is only for the reason of better health services.

Table 5. Factors Influencing Optimal Management of DM Measured under 'Structure' Parameter

S/N	Factor	N	Min	Max	Mean
1.	**Access to Complete Records**	300	1	5	*****4.05
2.	**State of Art Facilities and Equipment**	300	1	5	3.99
3.	**Power Supply**	300	1	5	3.93
4.	**Departmental Communication**	300	1	5	3.88
5.	**Health Policy Implementation**	300	1	5	3.67
6.	**Equipment Maintenance**	300	1	5	3.66
7.	**Regular Staff Training**	300	1	5	2.62
8.	**Staff to Patient Ratio**	300	1	5	2.54
9.	**Safety Devices**	300	1	5	2.43
10.	**Data Security and Confidentiality**	300	1	5	2.30
11.	**Capital and Expertise**	300	1	5	2.28
12.	**Use of Space**	300	1	5	2.25
13.	**Staff Professional Experience**	300	1	5	2.18
14.	**Supply of Needed Drugs**	300	1	5	1.98

***** Mean for Agreed items
5.0: Strongly Agreed, 4.0-4.99: Slightly Agreed, 3.0-3.99: Neither Agreed nor Disagreed, 2.0-2.99: Slightly Disagreed and 1.0-1.99: Strongly Disagreed.

3.1.2. Process-Based Factors Influencing Optimal Diabetes Management

Eighteen (18) factors were examined under the Process parameter. The mean ranking, in descending order of the factor variables are presented in Table 6. There were also 300 respondents (N) examined (both Staff and Patients) on a 5-point Likert rating scale of measurement ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). From the table, it is evident that 'Patients Symptoms Monitoring', has the highest mean of 4.41. This agrees with what Andry *et al.* (2009) suggested that optimal diabetes management depends on how well health practitioners could monitor patient symptoms indicators like blood glucose, blood pressure, BMI etc so as to avoid complications.

Other factors under 'Process' parameter with high mean are Data Fragmentation (Mean 4.18), Patient Involvement (Mean 4.15), Patients education (Mean 4.10) and delay in locating patient files (Mean 4.06). Data have to be complete in one place so that the practitioners will be able to have access to, easily and quickly for excellent medical decisions (Herrin *et al*., 2012). Thus, data fragmentation (such as scattering of test results, prescriptions etc) could be a critical factor in achieving optimal disease management for diabetes patients. Likewise, lack of patient involvement and education on his treatment plans could hinder optimal management of diabetes. For instance, several researchers (e.g. Inzucchi *et al*. 2012 and Andry *et al*. 2009) have called diabetes a patient self-managing disease, in that it is the patient that will determine his survival by eating healthy food, living an active lifestyle (exercise-based to normalise his BMI) and so on. So to avoid complications, the patient has to be carried along in his treatment plans and be educated on how he can manage his disease.

Table 6. Factors Influencing Optimal Management of DM Measured under 'Process' Parameter

S/N	Process	N	Min	Max	Mean
1.	**Patients Symptoms Monitoring**	300	1	5	*4.41
2.	**Data Fragmentation**	300	1	5	*4.18
3.	**Patient Involvement**	300	1	5	*4.15
4.	**Patients Education**	300	1	5	*4.10
5.	**Delay in Locating Patient Files**	300	1	5	*4.06
6.	**Coordination between Care Stages**	300	1	5	3.92
7.	**Complications during Treatment**	300	1	5	3.83
8.	**Illegible Handwriting**	300	1	5	3.56
9.	**Process of Seeing Healthcare Provider**	300	1	5	2.49
10.	**Coordination between Staff from Various Disciplines**	300	1	5	2.45
11.	**Audio-Visual Comforts Provision**	300	1	5	2.39
12.	**Interaction and Communication**	300	1	5	2.34
13.	**Inappropriate Treatment**	300	1	5	2.32
14.	**Inaccurate Diagnosis**	300	1	5	2.32
15.	**Management of Patient Waiting Time**	300	1	5	2.31
16.	**Staff Attitude**	300	1	5	2.27
17.	**Untimely Diagnosis**	300	1	5	2.19
18.	**Referral Rates**	300	1	5	2.09

***** Mean for Agreed items
5.0: Strongly Agreed, 4.0-4.99: Slightly Agreed, 3.0-3.99: Neither Agreed nor Disagreed, 2.0-2.99: Slightly Disagreed and 1.0-1.99: Strongly Disagreed.

Moreover, use of traditional paper-based health record system which has many challenges such as 'Delay in locating patients files', which gets worst when the patient gets a referral, thus difficulty in sharing the patient medical records, could be a vital factor influencing optimal diabetes management (Gupta1 and Mann, 2014). This is time-consuming in a way that the time that the medical record officers could be using to do other tangible things, he uses the time to search for piled-up files and folders constituting the patient files during a clinic or appointment. More so, the patient too will have to waste time waiting for his files to be found, if not lost. However, referral rate might not be a serious factor (Mean 2.09) influencing optimal disease management, if the patient is going to receive optimal disease management in the hospital he is being referred to.

3.1.3. Outcome-Based Factors Influencing Optimal Diabetes Management

Six (6) factors were examined under the Outcome parameter. The mean ranking, in descending order of the factors are presented in Table 7. There were also 300 respondents (N) examined (both Staff and Patients) on a 5-point Likert rating scale of measurement ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). From the table, it is apparent that 'Increased Complications' is the most-influencing factor (Mean 4.31) in the outcome range. This might be because of what Connor (2010) and Free *et al.* (2013) noted that when there is no/minimal diabetes complication, then diabetes is being managed optimally.

Table 7. Factors Influencing Optimal Management of DM Measured under 'Outcome' Parameter

		N	Min	Max	Mean
1.	**Increased Complications**	300	1	5	*4.31
2.	**Increased Death Rates**	300	1	5	3.42
3.	**Ineffective Treatment**	300	1	5	2.91
4.	**Patients Satisfaction**	300	1	5	2.70
5.	**Recurrent Re-admission**	300	1	5	2.48
6.	**Increased Infections**	300	1	5	2.29
7.	**Other Factors**	300	1	5	1.04

***** Mean for Agreed items
5.0: Strongly Agreed, 4.0-4.99: Slightly Agreed, 3.0-3.99: Neither Agreed nor Disagreed, 2.0-2.99: Slightly Disagreed and 1.0-1.99: Strongly Disagreed.

3.1.4. General Factors Influencing Optimal Diabetes Management in the Study Area

Taking all the factors together (Structure, Process and Outcome Parameters), a total of thirty nine (39) factors, mean ranking and factor analysis were used to examine the paramount factors influencing diabetes management in the study area.

For the mean ranking, Tables 8a and 8b present the summary of all the factors influencing optimal diabetes management in the study area. Thus the factors, in descending order of mean, include Patient Symptoms Monitoring (being the highest because it will determine the disease complication); Increased complications; Data fragmentation; Patient Involvement; Patients education; Delay in locating patient files; and access to complete records. In addition, the total number of factors was also reduced using factor analysis. However before using factor analysis, some tests were carried out on the data to be sure the statistical tool would be appropriate. Some of the tests are Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy; and Bartlett's Test of Sphericity as shown in Table 9.

Table 8a. Overall Factors Influencing Optimal Diabetes Management in the Study Area

S/N	Factor	N	Min	Max	Mean
1.	**Patients Symptoms Monitoring**	300	1	5	*4.41
2.	**Increased Complications**	300	1	5	*4.31
3.	**Data Fragmentation**	300	1	5	*4.18
4.	**Patient Involvement**	300	1	5	*4.15
5.	**Patients Education**	300	1	5	*4.10
6.	**Delay in Locating Patient Files**	300	1	5	*4.06
7.	**Complete Records Access**	300	1	5	*4.05
8.	**State of Art Facilities and Equipment**	300	1	5	3.99
9.	**Power Supply**	300	1	5	3.93
10.	**Coordination between Care Stages**	300	1	5	3.92
11.	**Departmental Communication**	300	1	5	3.88
12.	**Complications During Treatment**	300	1	5	3.83
13.	**Health Policy Implementation**	300	1	5	3.67
14.	**Equipment Maintenance**	300	1	5	3.66
15.	**Illegible Handwriting**	300	1	5	3.56
16.	**Increased Death Rates**	300	1	5	3.42
17.	**Ineffective Treatment**	300	1	5	2.91
18.	**Patients Satisfaction**	300	1	5	2.70
19.	**Regular Staff Training**	300	1	5	2.62

***** Mean for Agreed items
5.0: Strongly Agreed, 4.0-4.99: Slightly Agreed, 3.0-3.99: Neither Agreed nor Disagreed, 2.0-2.99: Slightly Disagreed and 1.0-1.99: Strongly Disagreed.

Table 8b. Overall Factors Influencing Optimal Diabetes Management in the Study Area (Contd)

S/N	Factor	N	Min	Max	Mean
21.	**Process of Seeing Healthcare Provider**	300	1	5	2.49
22.	**Recurrent Re-admission**	300	1	5	2.48
23.	**Coordination between Staff from Various Disciplines**	300	1	5	2.45
24.	**Safety Devices**	300	1	5	2.43
25.	**Audio-Visual Comforts Provision**	300	1	5	2.39
26.	**Interaction and Communication**	300	1	5	2.34
27.	**Inappropriate Treatment**	300	1	5	2.32
28.	**Inaccurate Diagnosis**	300	1	5	2.32
29.	**Waiting Patients Management**	300	1	5	2.31
30.	**Data Security and Confidentiality**	300	1	5	2.30
31.	**Increased Infections**	300	1	5	2.29
32.	**Capital and Expertise**	300	1	5	2.28
33.	**Staff Attitude**	300	1	5	2.27
34.	**Use of Space**	300	1	5	2.25
35.	**Untimely Diagnosis**	300	1	5	2.19
36.	**Staff Professional Experience**	300	1	5	2.18
37.	**Referral Rates**	300	1	5	2.09
38.	**Supply of Needed Drugs**	300	1	5	1.98
39.	**Other Factors**	300	1	5	1.04

***** Mean for Agreed items
5.0: Strongly Agreed, 4.0-4.99: Slightly Agreed, 3.0-3.99: Neither Agreed nor Disagreed, 2.0-2.99: Slightly Disagreed and 1.0-1.99: Strongly Disagreed.

Table 9. KMO and Bartlett's Tests for Factor Analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		*.873
	Approx. Chi-Square	1.451E4
Bartlett's Test of Sphericity	df	741
	Sig.	**.000

** Sig at 0.001 (p<0.001) showing that there is no multicollinearity between the variables
*KMO value of .873

KMO Test is necessary to be sure that the sampling is adequate to generate reliable results. However, for this study, three hundred samples were used and KMO value is 0.873, which is a *great* value according to Kaiser (1974) that suggested the following values for KMO measurement: KMO 0.5: Fair; KMO 0.51-0.7: Mediocre; KMO 0.71-0.8: Good; **KMO 0.81-0.9: Great;** and KMO>0.9: Superb. Therefore, since the value of KMO generated is 0.873, the sampling adequacy is great for the factor analysis to be used. Furthermore, Bartlett's Test of Sphericity was used to test if there is multicollinearity between the factor variables to be measured. According to the same table (Table 9), the Bartlett's value is significant at 0.01 level (p<0.01), which is an indication that there is no multicollinearity between the factor variables.

Moreover, Scree plot diagram was generated to know the adequate number of factors that would be extracted. The number of factors is known by looking at the factor number corresponding to where the graph tails down as shown in Figure 1, which is 7 factors in this case. Therefore, seven factors would be extracted using the Rotated Factor Matrix in Tables 10a and 10b. The variables under each factor are presented based on their factor loadings, regardless of the sign, and also the more the factor loading for a variable, the more the importance of that variable under the factor. The signs beside the factor loadings are just showing the direction of the variable, that is, the way the item relates to the factor, thus negative factor loadings are as important as positive factor loadings.

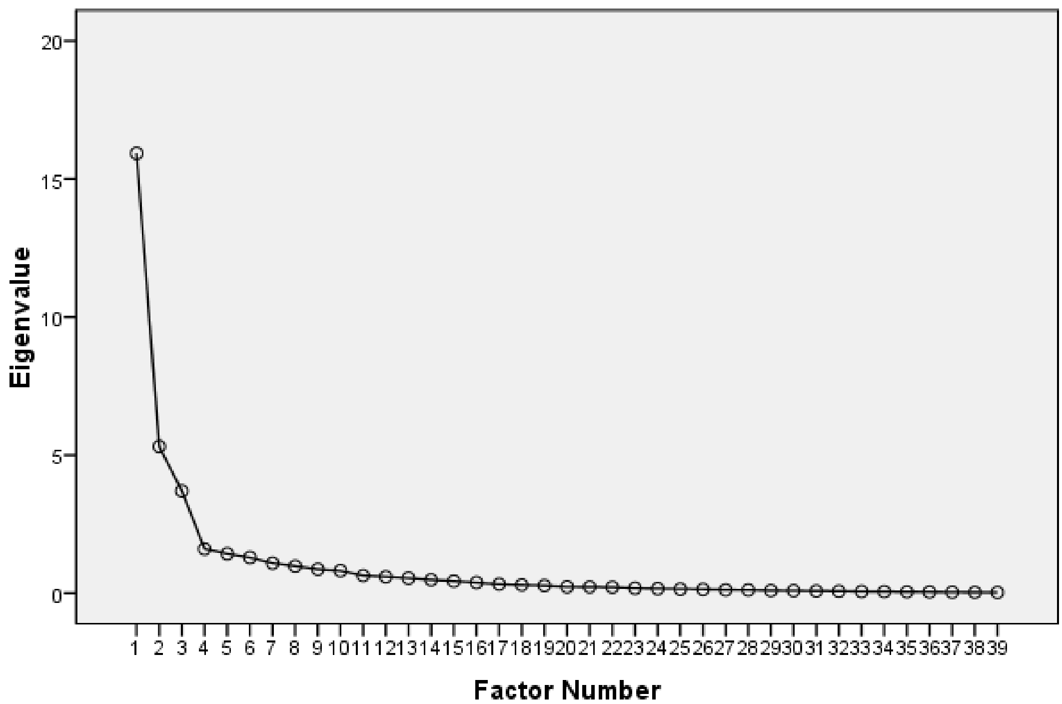

Figure 1. Scree Plot Diagram Showing the Number of Factors Extracted Using the Factor Analysis: 7 Factors

Table 10a. Pattern Matrix Showing the Extracted Factors

		Factor						
S/N		**1**	**2**	**3**	**4**	**5**	**6**	**7**
1.	**State-of-Art Facilities and Equipment**	*.905						
2.	**Lack of Coordination between Care Stages**	*.845						
3.	**Lack of Coordination between Staff**	*.746						
4.	**Lack of Constant Patient Symptoms Monitoring**	*.668						
5.	**Staff-to-Patient Ratio**						*-.664	
6.	**Patient Satisfaction**	.553						
7.	**Untimely Diagnosis**	-.501						
8.	**Untimeliness of Diagnosis**	-.488						
9.	**Inaccuracy of Diagnosis**	-.485						
10.	**Inappropriateness of Treatment**	-.454						
11.	**Increased Death Rates**		*-.663					
12.	**Increased Complications**		*-.606					
13.	**Use of Space**		.580	.472				
14.	**Waiting Patients Management**		.525					
15.	**Attitude of Staff**		.505					
16.	**Illegible Handwriting**		-.504					
17.	**Process of Seeing Healthcare Provider**		.479					
18.	**Data Fragmentation**			*-.858				
19.	**Access to Complete Records**			*.700				
20.	**Delay in Locating Patient Files**			*-.610				
21.	**Interaction and Communication between Patient and Healthcare Provider**				*.657			

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 27 iterations.

***** Higher factor loading > 0.6: Factor Loading <0.6 are ignored. The sign on the loading (-/+) refers to the way the item relates to the factor.

Table 10b. Pattern Matrix Showing the Extracted Factors (Contd)

		Factor						
S/N		**1**	**2**	**3**	**4**	**5**	**6**	**7**
22.	**Patient Involvement**				*.632			
23.	**Patient Education**				*.682			
24.	**Departmental Communication**			*605				
25.	**Provision of Audio-Visual Comforts**					.491		
26.	**Erratic Power Supply**					*-.678		
27.	**Supply of Needed Drugs**				.513		.548	
28.	**Safety Devices for Staff**						.504	
29.	**Other Factors**							
30.	**Staff Professional Experience**							*.909
31.	**Staff Training**							*.720
32.	**Referral Rates**							*-.706
33.	**Ineffective Treatment Plans**							*-.687
34.	**Capital and Expertise**							*.656
35.	**Recurrent Re-admission**							*-.639
36.	**Hospital-acquired Infections and Disability**							*-.636
37.	**Data Security and Confidentiality**			*.600				
38.	**Complications during Treatment**							*-.614
39.	**Equipment Maintenance**							-.455

***** Higher factor loading >0.6: Factor Loading <0.6 are ignored. The sign on the loading (-/+) refers to the way the item relates to the factor.

Table 11. The Percentage of Total Variance Accounted for by the Extracted Factors

Factor	Rotation Sums of Squared Loadings		
	Total	**% of Variance**	**Cumulative %**
1	8.984	*23.035	23.035
2	6.945	17.808	40.843
3	6.711	17.209	58.052
4	2.007	8.146	66.198
5	1.349	7.460	73.658
6	1.217	5.121	78.779
7	1.055	4.704	83.483
Extraction Method: Principal Axis Factoring.			

***** Highest percentage variance

Therefore, it is the absolute value that is of interest, when deciding a cut-off. That is, an item that loads -0.7 is as important as an item that loads +0.7. Therefore following Field (2013) suggestions, the following latent variable were used to describe the significant factors based on the factor loadings of 0.6: Factor 1: Monitoring of Patient risky indicators; Factor 2: Increased unplanned evil occurrences (Death and complications); Factor 3: Availability of needed confidential patient data; Factor 4: Patient involvement and education; Factor 5: Erratic power supply; Factor 6: Staff to patient ratio: because lower number of patients to be attended to by the physicians will make them deliver their best without being tired; and Factor 7: Staff Skills and expertise. The percentages of total variability accounted for by the extracted factors are shown in Table 11. The first factor correspondingly accounted for most variance of 23.03, while the rest of factor 2, 3, 4, 5, 6 and 7 factors accounted for 17.81, 17.21, 8.15, 7.46, 5.12 and 4.70, respectively. Thus, all the factors accounted for a cumulative of 83.5%.

Furthermore, going by the research objective and the corresponding research instruments, it is obvious that interview method was additionally used to validate the questionnaire responses to investigate the factors influencing optimal diabetes management in the study area. NVivo software was used to generate the themes/ keywords in the interviews conducted. Therefore, in investigating the factors influencing optimal diabetes management using semi-structured interviews, unaffordable costs of treatment due to high level of poverty in Nigeria, because many patients are old and are even illiterates; lack of needed infrastructure; data fragmentation; lack of expertise; erratic power supply; patient education; attitude of Staff; and increased complications, emerged. As revealed in the interviews, many patients may not be able to afford quality treatment in a quality hospital, but rather go to where they can afford, thus not receiving optimal treatment. Furthermore, some respondents believed that the country needs more expertise when it comes to chronic disease management. Also, lack of needed infrastructure, for example because of the paper system still in use in most of the selected hospitals, leading to data fragmentation and so on, aggravates the problem of not having optimal management of diseases. Likewise, none/erratic power supply in the system can even frustrate the care giver, and the existing infrastructure in place. Patients also have to be carried along in the course of their treatments, because for example, diabetes itself is patient-self managing; while the staff of the hospitals also must have good attitude to patients, so as to bring none/minimal complications of the disease, all to bring optimal management of chronic diseases like diabetes.

4. Conclusions

This study investigated the factors influencing optimal management of chronic diseases in Southwestern Nigeria, taking diabetes as a case study. The factors were grouped according to Donabedian (1980) under the structure; process; and outcome-based with fourteen, eighteen and six variables respectively under each of them. These variables were analysed under each group, and also altogether. It was therefore found out that adequate patients monitoring, reducing complications, avoiding data fragmentation, involving patient in his treatment, encouraging patients' education, avoiding delay in locating patients' files and access to complete records among others, are very critical in the management of chronic diseases such as diabetes. It is therefore recommended that the use of health information technology should be encouraged more in the management of chronic diseases so as to alleviate all these factors, and to enhance optimal management of chronic diseases in Nigeria.

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