

Poverty, Affordability of Anti-Diabetic Drugs and Glycemic Control: An Unholy Alliance in a Developing Economy ?

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ABSTRACT

Purpose: To determine the Relationship between Poverty, Affordability of Anti-Diabetic Drugs and Glycemic Control in a Developing Economy in 2010.

Methods: A cross-sectional study using questionnaire to assess World Bank socio-economic indicators of poverty for each subject and information from prescriptions and case-notes about affordability and glycemic control respectively was conducted and evaluated. Sample Size, n=1200. Subjects were selected by systematic random sampling (Sampling Interval = 1).

Results: Majority (93.8%) of the poor subjects could not afford at-least one anti-diabetic drug. Most (98.6%) of the non-poor subjects could afford all available prescribed anti-diabetic drugs. Poor and non-poor subjects significantly differ in affordability of anti-diabetic drugs ($\chi^2 = 169.7$, $df = 1$, $p = 0.000$). Majority (67.4%) of the poor subjects had poor glycemic control. Three hundred and fifty six (81.3%) of the non-poor subjects had good glycemic control. Poor and non-poor subjects significantly differ in glycemic control ($\chi^2 = 128.77$; $df = 2$; $p = 0.000$). Majority (83.3%) of the subjects that could afford all available prescribed anti-diabetic drugs had good glycemic control. Five hundred and twenty (72.1%) of the subjects that could not afford at-least one of the available prescribed anti-diabetic drugs had poor glycemic control. Subjects that could afford all their drugs and those who could not, significantly differ in glycemic control ($\chi^2 = 154.86$; $df = 2$; $p = 0.000$).

Conclusions: Poverty is an hindrance to good glycemic control in terms of anti-diabetics purchase (non-affordability)

Keywords: Poverty, Affordability, Glycemic-Control, Socio-Economic Status, Unholy Alliance, Pharmaco-Economics

INTRODUCTION

Diabetes Mellitus is a chronic, incurable condition that affects 3% of Nigerian population [1]. There is evidence that prevalence of non-communicable diseases is increasing, including diabetes mellitus, which if not adequately managed, can result in a wide range of complications that have clinical, social and economic implications. Although World Health Organization (WHO) accorded priority status to diabetes mellitus, many public health planners remain largely unaware of its magnitude and the seriousness of its complications [2]. Of equal consequence is the increasing prevalence of the disease and the long-term cost of therapy, due to the fact that use of anti-diabetic drugs in the management of diabetes mellitus is for lifetime of the patients from time of diagnosis. This translates into a substantial cost in drug therapy to the patients, health sector, nation/ government in economic terms [3]. Effort designed to reduce expenditure on this class of drugs as well as use them more effectively would be advantageous [3].

Poverty is a multidimensional problem which include various forms of deprivation, lack of access to social services and production inputs [4]. Socio-economic indicators of poverty include income, education, housing, access to water, average household size, access to health care, nutrition, communication, transportation and electricity facilities [4]. An unholy alliance of poverty, sickness and medicines resulting into vicious circle of poverty and sickness, a situation described as "Men and Women were sick because they were poor. They become poorer because they were sick and sicker because they were poorer" has been reported [5]. The issue here is to determine whether the same situation exist between Poverty, Glycemic Control (Sickness) and Affordability of Anti-Diabetic Drugs (Medicine).

Millennium development goal 7 emphasizes equitable access to essential drugs. One third of world population (1.7-2.1 billion) lacked access to essential drugs [6]. A major obstacle to achieving equitable access to drugs is price [7], especially in countries where drugs are paid out of pocket. Drug financing in Nigeria, a developing economy, for example, is generally out of pocket, with 70.2% people living below poverty line of less than 1USD per day [8]. Strategies which would contain and moderate drugs' prices are needed to improve access to drugs. All these should be considered in an anti-diabetic therapy policy, although, "maximum benefit" and "minimum price" can seldom be achieved together. Drugs are often the most cost-effective form of intervention with the most immediate effects [9].

The study would indicate whether cost effective spending for management of diabetes mellitus (pharmacoeconomics) should be considered in health policy in a developing economy like Nigeria. Cost-Effective therapy of diabetes mellitus will not only ensure rational drug use but also reduce patients dropping out of anti-diabetic treatment, thereby reducing incidence of therapeutic failure by enhancing economic, clinical and humanistic outcome of therapy. Complications due to this disease would be reduced and improvement of patients' quality of life would be achieved.

This study was aimed at determining the relationship between socio-economic status (poverty), affordability of anti-diabetic drugs and glycemic control among Type II diabetes mellitus patients attending University of Maiduguri Teaching Hospital, North-Eastern Nigeria in 2010 and explore the place of pharmaceutical health system reform to promote effectiveness of anti-diabetic drug therapy and efficiency of health service.

MATERIALS AND METHODS

The study was conducted at the University of Maiduguri Teaching Hospital (UMTH), Maiduguri, Borno State, Nigeria. The Hospital was chosen because it was the only University Teaching Hospital in North-Eastern Nigeria, serving the six catchment states of North-Eastern Nigeria. Diabetes Mellitus cases were usually referred to UMTH from these catchment states as at the time of conducting this study.

Ethical Approval was obtained from Research and Ethics Committee of UMTH. The selected diabetic patients were told that they would be interviewed and that their prescriptions and case-notes would be examined and used for research purposes.

Their consent was sought and obtained at the point of exit from the pharmacy, before interview and data collection.

Type II diabetes mellitus patients that were registered with and attended the Diabetes clinic of UMTH were the subjects for the study. Their population from inception of UMTH in 1983 to December 2009 was obtained from Medical Record Department and was assumed /used as the estimate of the population size of serviced Type II diabetes mellitus patients. This was 2,528. Fischer's Formula [10] was applied to determine sample size from this estimate. The required sample size was 351. However, 1, 200 of estimated population were studied due to availability of resources and to reduce error.

A cross-sectional study of old and new cases of Type II diabetes mellitus by systematic random sampling (sampling interval=1) of diabetic patients that fit the inclusion criteria and their prescriptions at the point of exit from out-patient pharmacy was carried out on diabetes clinic days until a total of 1,200 cases were obtained. This was carried out on diabetes clinic days, which had pool of the cases. A retrospective review of their case-notes was also carried out.

A standardized pre-tested interviewers' administered questionnaire (Appendix I) was developed for socio-economic indicators of subjects based on literature review that identified socio-economic indicators of poverty. Identified socio-economic indicators were refined and framed into questions.

A cross-sectional study, using this questionnaire at the point of exit from out-patient pharmacy of UMTH was adopted for collection and grading of world bank socio-economic indicators of poverty on consecutive diabetes clinic days (Tuesdays) using a systematic random sampling (sampling interval=1) of subjects that fall within the inclusion criteria until a total of 1,200 subjects were interviewed. Prospective study of their filled prescriptions and retrospective review of their traced case-notes was also carried out. Information on affordability of anti-diabetic drugs and glycemic control category based on latest monitoring tests were extracted from filled prescriptions and traced case-notes respectively, into respective questionnaires, coded by the hospital number of individual subject.

Any subject that was able to buy all available prescribed anti-diabetic drug (s) at the the point of prescription filling by the pharmacist was assumed to afford the anti-diabetic drug (s) and categorized as afford all anti-diabetic drugs while any subject that could not afford at-least one of the prescribed available anti-diabetic drug (s) was categorized as can't afford all anti-diabetic drugs.

Physician remark on glycemic control for each subject based on latest fasting blood sugar and glyculated haemoglobin as documented in case-notes was recorded as the glycemic category for each subject. Physician remark was either good glycemic control, fair glycemic control or poor glycemic control for each subject.

On socio-economic status, for every question or indicator in the questionnaire, there were four alternative categories. The four categories were assigned a rating interval in ascending order 1-25%, 26-50%, 51- 75%, 76-100%.

The average performance in percentage, for each socio-economic indicator per subject was determined by taking the median of the applicable rating interval of each indicator. For example, rating interval 1-25%, 26-50%, 51-75%, 76-100% has median value of 13%, 38%, 63% and 88% respectively.

The average performance in percentage, of all measured socio-economic indicators was calculated for each subject by determining the mean of the median values of the measured ten indicators. This was used to categorize each patient into either core-poor, moderately poor or non-poor. For example, if the median values of all ten measured indicators (Appendix 1, Indicator 1-10) for a particular subject are respectively 38%, 13%, 38%, 63%, 63%, 38%, 38%, 88%, 63% and 13%,

$$\text{then, the average performance} = \text{mean} = \frac{38+13+38+63+63+38+38+88+63+13}{10} \\ = 45.5\%$$

In categorizing the subject, the conventional examination scores assessment system was assumed i.e. 0 to 39 was rated as failure \equiv core poor, 40 to 49% was rated as below average \equiv moderately poor, 50 and above was rated as average/above average respectively \equiv non-poor. Therefore, in the above example, the subject with average performance 45.5% would be categorized as being moderately poor.

The collected data were analysed using EPI- INFO software version 3.4.1 2007. Data were presented as frequency distribution tables and charts. Chi-Square analysis was used to compare proportions and test hypothesis. P-Values < 0.05 were considered significant.

RESULTS

Seven Hundred and Sixty (63.3%) out of 1200 subjects were poor while 440 (36.7%) were non-poor ($\chi^2 = 12.5$; $df = 1$; $p = 0.0004$). Seven Hundred and Twenty One (60.1%) out of 1200 subjects could not afford one anti-diabetic drug or the other while 479 (39.9%) could afford all available prescribed anti-diabetic drugs ($\chi^2 = 46.96$; $df = 1$; $p = 0.0000$). Seven Hundred and Fifteen (93.8%) out of the 762 poor subjects could not afford one anti-diabetic drug or the other, while 47 (6.2%) could afford all available prescribed anti-diabetic drugs. Four Hundred and Thirty Two (98.6%) out of 438 non-poor subjects could afford all available prescribed anti-diabetic drugs, while 6 (1.4%) could not afford one anti-diabetic drug or the other ($\chi^2 = 169.7$; $df = 1$; $p = 0.000$). Five Hundred and Fourteen (67.4%) out of 762 poor subjects had poor glycaemic control, while 201 (26.4%) and 47 (6.2%) had fair and good glycaemic control respectively. Three Hundred and Fifty Six (81.3%) out of 438 non-poor subjects had good glycaemic control, while 74 (16.9%) and 8 (1.8%) had fair and poor glycaemic control respectively ($\chi^2 = 128.77$; $df = 2$; $p = 0.000$).

Three Hundred and Ninety Nine (83.3%) out of 479 subjects that could afford all available prescribed anti-diabetic drugs had good glycaemic control, while 78 (16.3%) and 2 (0.4%) had fair and poor glycaemic control respectively. Five Hundred and Twenty (72.1%) out of 721 subjects that could not afford at-least one of the available prescribed anti-diabetic drugs had poor glycaemic control, while 197 (27.3%) and 4 (0.6%) had fair and good glycaemic control respectively ($\chi^2 = 154.86$; $df = 2$; $p = 0.000$).

DISCUSSION

Upon consideration of the developing nature of Nigerian Economy and the fact that majority (63.3%) of the subjects were found to be poor (see Table 1) significant proportion, 60.1% had affordability problem (see Table 2), efforts designed to reduce public and private expenditure on anti-diabetic therapy as well as to use anti-diabetic drugs in a more cost-effective manner would be advantageous. Use of anti-diabetic drugs in the management of diabetes mellitus is for the lifetime of the patients from time of diagnosis and this translates into a substantial cost in drug therapy to the patients and government [3].

Table 1: Distribution of Subjects According to Socio-economic Status

Socio-Economic Status	Frequency	Percent
Poor	760	63.3
Non-poor	440	36.7
Total	1200	100

*($\chi^2 = 12.5$; $df = 1$; $p = 0.0004$)

*There was a statistically significant difference in the proportion of poor and non-poor subjects.

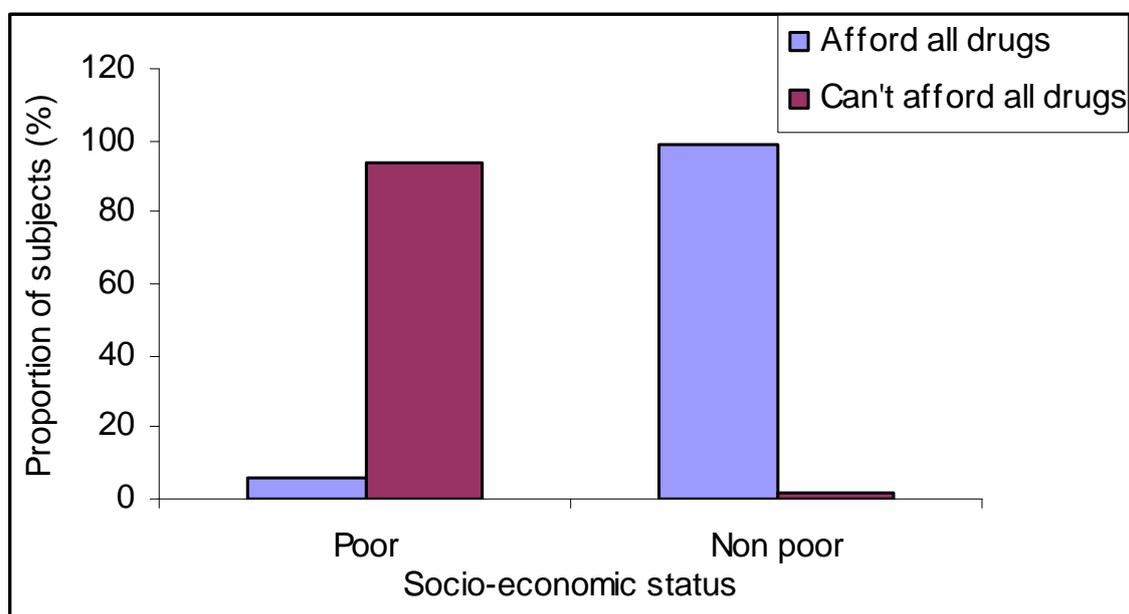
Table 2: Distribution of Subjects According to Affordability of Available Prescribed Anti-Diabetic Drugs

Affordability	Frequency	Percent
Yes (afford all available prescribed anti-diabetic drugs)	479	39.9
No (could not afford at-least one of the available prescribed anti-diabetic drugs)	721	60.1
Total	1200	100

*($\chi^2 = 46.96$; $df = 1$; $p = 0.0000$)

*There was a statistically significant difference in the proportion of subjects that could afford all available prescribed anti-diabetic drugs and those that could not afford one anti-diabetic drug or the other.

Poor and non-poor subjects significantly differ in affordability of anti-diabetic drugs (see Figure 1). The fact that people may be ill or require medical services and drugs but not have enough money to pay for them (non-affordability) because of low economic status have been reported [11]. This is a matter of great concern which needs urgent attention as it can erode the credibility of our health care system because patients that could not afford prescribed drugs usually come up with therapeutic failure (e.g. poor glyceimic control) and waste of limited health care resources. There is therefore a need for pharmacist-phycsian feedback system about patients that could not afford prescribed drugs to be institutionalized in our public and Private Pharmacies by appropriate policy formulation, implementation, monitoring and evaluation. The basis for this policy change and pharmaceutical health system reform clearly established by this study is valuable for kick starting the process. This reform is presently lacking in Nigeria. When institutionalized, it would prevent avoidable therapeutic failure (e.g. poor glyceimic control) and waste of limited health care resources. It will bring about effectiveness and significant cost savings in anti-diabetic therapy.



s*($\chi^2 = 169.7$, $df = 1$, $p = 0.000$).

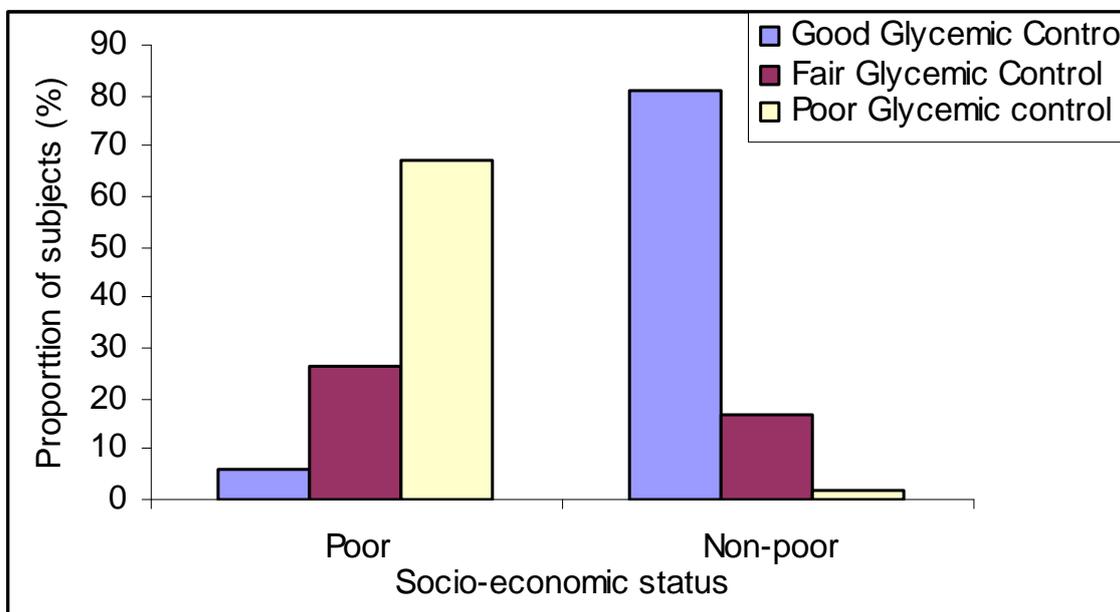
Fig 1: Relationship between Socio-economic Status of Subjects and Affordability of Available Prescribed Drugs

Can't afford all drugs in the above key means the subject could not afford at-least one of the prescribed anti-diabetic drugs.

*Poor and non-poor subjects significantly differ in affordability of anti-diabetic drugs.

Poor and Non-Poor subjects significantly differ in glyceimic control (see Figure 2). Similarly, Subjects that could afford all their drugs and those who could not, significantly differ in glyceimic control (see Figure 3). The high

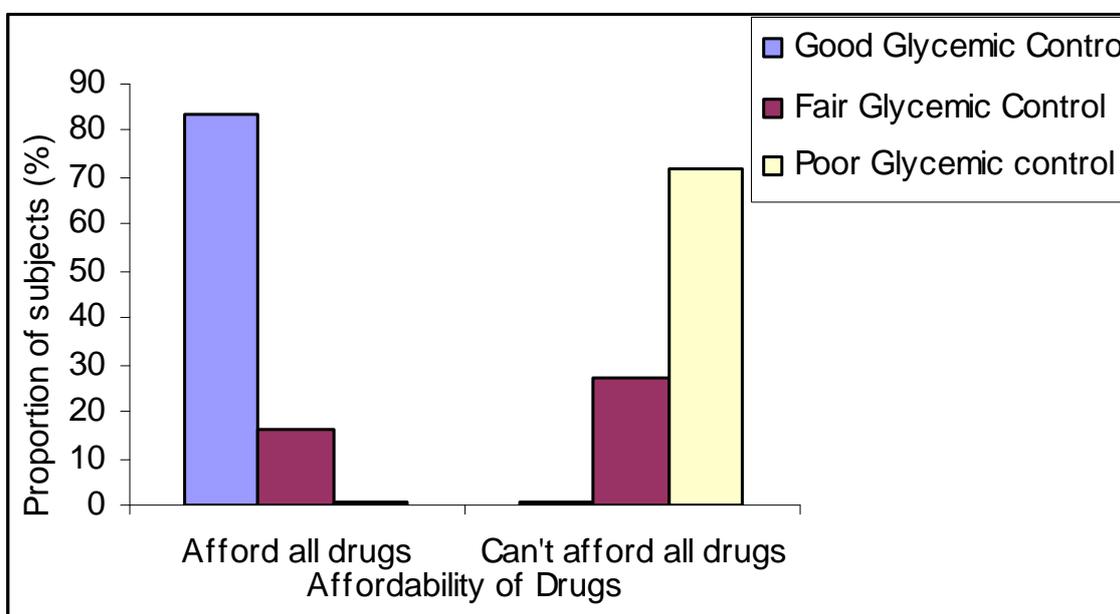
proportion of subjects with poor glycemic control which was due to irregularity on medication as remarked by the physician in case-notes could be due to lack of affordability by the poor subjects. This is in agreement with a fact that non-affordability of medicines due to cost/poverty has negatively affected therapeutic outcome because people may not have enough money to pay for adequate medical services [11]. This implies that poverty is a hindrance to glycemic control (good health) in terms of anti-diabetics purchase (non-affordability)- an unholy alliance. Prescribers have been reported to irrationally traded off prescription of more cost-effective drugs for less cost-effective ones, ironically, in a developing economy, like Nigeria [12], [13], [14].



*($\chi^2 = 128.77$; $df = 2$; $p = 0.000$).

Figure 2: Relationship between Socio-economic Status and Glycemic Control

*Poor and non-poor subjects significantly differ in glycemic control



*($\chi^2 = 154.86$; $df = 2$; $p = 0.000$).

Fig 3: Relationship between Drug Affordability and Glycemic Control

Can't afford all drugs in the above chart means subject could not afford at-least one of the prescribed anti-diabetic drugs.

*Subjects that could afford all their drugs and those who could not, significantly differ in glycemic control.

Similarly, Branded pharmaceutical products which were much more expensive were more frequently prescribed than cheaper generic equivalents [15]. This would further complicate the non-affordability picture of anti-diabetic drugs in predominantly poor population as found in the present study. This is a strong justification for a form of Pharmaceutical Health System reform to break unholy alliance of poverty, affordability of anti-diabetic drugs and poor glycaemic control such as observed in the current study. This would involve adoption of pharmaco-economic principles in our national health policy, hence, its application at all levels of our healthcare delivery system in taking therapeutic and other healthcare intervention decisions. The objective of pharmaco-economic study is to provide evidence based information that would make a person or group of people change their behaviour and persuade them that a new course of action is a 'better' one. Better simply means- in economic sense, it is more efficient [16], [17]. Such information could be used to change prescription practice: irrational prescription of more expensive branded anti-diabetic drugs which are used for lifetime from diagnosis of a patient than cheaper generic equivalents. The information could also be used for educational intervention at prescribers' and managerial levels, which could then be followed by legislative intervention for regulatory purposes. The resultant effect will be cost savings in anti-diabetic drug therapy, affordability of anti-diabetic drugs and improved outcome of therapy (glycaemic control).

The finding in the current study is also consistent with report of unholy alliance of poverty, sickness and medicines resulting into vicious cycle [5]. To break the unholy alliance of poverty, affordability of anti-diabetic drugs and glycaemic control found in this study, Health policy under conditions of poverty should have both a short-term and a long-term component.

Priority setting and availability of basic medicines as short term measures should be founded on principles of low-cost, high cost-effectiveness and visibility. Type II Diabetes Mellitus should be prioritized because it is of public health importance as it has no known cure, affects 1 to 2% of global population and the prevalence is increasing with a wide range of complications that have clinical, social and economic implications since patients use this class of drugs for lifetime from time of diagnosis [3].

Free availability of anti-diabetic drugs is desired in a developing economy like Nigeria.

Drugs provide a significant opening for development policy. They can quickly bring about changes that are visible and felt to be positive (e.g cure disease, alleviate symptoms/pains, prevent disease), Irrespective of improvement in the living conditions of the poor. By breaking the vicious circle of poverty and fatalism, rational use of drugs can help awaken hope for a better future. Once these individual changes are seen over a period of time, their social potential can be more easily mobilized and progress consolidated.

Long Term components of health policy in condition of poverty should involve changing the poverty environment by satisfying the basic needs that bring about mortality and morbidity. That is, development policy that satisfies the basic need of people and thus prevent diseases and/ or therapeutic failure (poor glycaemic control) arising from poverty." for example job creation to create wealth and enhance affordability of anti-diabetic drugs, hence good glycaemic control, access to education, adequate nutrition and health care, which are all essential for diabetic control. Lifestyle and dietary modification can be a very effective way to keep diabetes mellitus in control. A comprehensive health education programme on lifestyle and dietary modification improved and maintained glycaemic control in a sustainable manner [18], [19], [20], [21].

The findings in this study have policy implications also to many drugs used in managing other Non-Communicable Diseases. Giving the increasing incidence of Non-Communicable Diseases in developing economy such as Nigeria, instituting a comprehensive pharmaceutical health system reform with a progressive and pro-poor focus would impart positively against the unholy alliance between poverty, drug purchase (affordability) and outcome of therapy.

CONCLUSION

Significant proportion of the subjects were poor. There was a statistically significant difference in the proportion of subjects that could afford all available prescribed anti-diabetic drugs and those that could not. Poor and non-poor subjects significantly differ in affordability of anti-diabetic drugs. Poor and non-poor subjects significantly differ in glycaemic control. Subjects that could afford all their drugs and those who could not, significantly differ in glycaemic control.

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Appendix I

Questionnaire on Socio-Economic Indicators of Selected Diabetes Mellitus Patients Attending a University Teaching Hospital in a Developing Economy

Patient's Code Number..... Age..... Sex.....

1. INCOME What is your average income per month?

Below ₦7, 500.00 (50 USD) per month Between ₦7, 500.00 – ₦15, 000.00
 Between ₦15, 000.00 – ₦30, 3000.00 Above ₦30, 000.00 (200 USD) per month

2. EDUCATION What is your level of education attained?

No formal education Primary Education Secondary Education
 Tertiary and Above

3. HOUSING What type of apartment do you live?

Single Room Room and Palour Two Bed-Room Apartment
 Three Bed-Room Apartment/Above

4. FAMILY SIZE/DEPENDANTS

What is your family size/number of dependants?

10 and Above 6 – 9 2 – 5 1

5. NUTRITION How can you assess your nutrition in terms of balance nature of diet?

Unsatisfactory Fairly satisfactory Satisfactory Very satisfactory

6. ACCESSIBILITY TO PORTABLE WATER

How often do you have supply of portable water?

Rarely Monthly Weekly Every day

7. ACCESSIBILITY TO HEALTHCARE FACILITIES

What type of Healthcare facilities do you use frequently?

Not Available Traditional Healer Health centre Hospital

8. ACCESSIBILITY TO COMMUNICATION

Which of the following communication facilities do you use frequently?

Postal services Telephone/G.S.M E-mail/Internet Fax

9. TRANSPORTATION

What is your usual means of transportation?

Water Rail Road Air

10. ELECTRIC POWER SUPPLY

How will you assess your supply of electric power?

Not Available Irregular Regular Very Regular