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Research Article

Effects of Paucity of Medical Equipment Maintenance Manpower: A Case Study of the Health Care Delivery Systems, South-Eastern Nigeria

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Abstract

Maintenance entails all activities carried out on equipment in terms of proper installation, good servicing, routine checks, repairs and replacement of faulty parts in order for such equipment to give off its best throughout its useful life. Every item has its own operational characteristics which it must possess or exhibit in the course of its use. A termination in the characteristics under working condition is considered as fault and this may be due to lack of proper maintenance. Medical equipments are designed in the diagnosis, monitoring or treatment of medical conditions. The aim of this study is to identify the reasons for the paucity of medical equipment maintenance manpower in the South-Eastern Nigeria. A total of one hundred and fifty (150) questionnaires were sampled amongst some cadres of health workers in 15 health facilities and diagnostic centers in the selected states of the South Eastern States. In 61% of the respondents were males while 39% were females, 40.7% were doctors, 23.3% were biomedical engineers/technicians while 35% were medical laboratory scientists. The study showed succinctly that there are really few equipment maintenance manpower in the health facilities and medical laboratory centers of the south-eastern Nigeria as 17.3% nurses on short course training, 20.6% electrical engineers service and maintain the available medical equipment as against 35.3% biomedical engineers/technicians as the study revealed. The study showed that there are very few equipment maintenance manpower due to myriads of reasons which include lack of effective training/re-training of young personnel's, influx of obsolete equipment by donor agencies, difficulty in getting or sourcing for spare parts, no support from the government, maintenance manual written in foreign languages, poor practical contents in BMET curricula, technological complexity of modern equipment, no good motivation, no proper enlightenment campaigns etc. Thus, the solutions given by respondents should be upheld with all sense of responsibility for the betterment of BMET in Nigeria.

Keywords: Medical equipment; Paucity; South eastern; Nigeria; Maintenance; Manpower

Introduction

Medical equipments are designed in the diagnosis, monitoring or treatment of medical conditions. These medical equipments in their different types and uses help the medical workers to diagnosis, monitor, mitigate, rehabilitate and help in seeking the best remedies for specific medical conditions and in health promotion. Many of them have saved and supported live of millions of patients and people [1].

Medical equipments are essential for safe and effective prevention, diagnosis, treatment and rehabilitation of illness and disease. The achievement of health-related development goals, including the Millennium Development Goals upon proper manufacturing, regulation, planning, assessment, acquisition, management and use of medical devices which are good quality, safe and compatible with the settings in which they are used [2]. However, in the health care delivery system, the importance of medical equipments can't be overemphasized as they are veritable and of great significance in Primary Health Care Centers, District Hospitals, Rural Clinics, Nursing Homes, Private Hospitals, Specialists Hospitals, Teaching Hospitals and other Healthcare Parastatals [3].

Today, there are more than 10,000 types of medical equipments available and the selection of appropriate medical equipment always depend on local, regional or national requirement; factors to consider include the type of health facility, Disease Pattern, work force available and the burden of disease experienced in the specific catchment area [4]. Thus, the maintenance of medical equipments was essential to ensure that they function correctly and efficiently to ensure proper clinical management of the patients [5]. It is therefore, important that adequate standards of usage and maintenance are achieved. Yet, in some countries more than 60% of biomedical equipments are not used in even in their Primary Healthcare Centers because of lack of maintenance and repairs [6].

Obviously, in many health facilities several patients die, major part of the reason attributable to the fact the equipments needed to monitor, treat, mitigate their situation are either mal-functional, broken down due to lack of maintenance or lack of knowledge in their usage [7]. Patients experiencing life-threatening situations in a healthcare facility are at huge risks due to lack of correct and efficient maintenance of the medical equipment and supplies readily available to treat or help the situation [8]. Also, one of the problems militating against medical equipment and health care technology in Nigeria is lack of effective maintenance and repair of medical equipment [9]. That is why it is imperative to carry out this study on the effects of

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paucity of medical equipment maintenance manpower in the south-eastern Nigeria.

General objective

To identify the reasons for the paucity of medical equipments maintenance manpower in the South-Eastern Nigeria.

Specific objectives

The specific objectives of this study are:

1. To ascertain the major reasons for the paucity of medical equipment maintenance manpower in the South Eastern Nigeria.
2. To determine the rate biomedical engineering technology practice in Nigeria.
3. To assess the available maintenance arrangements of these medical equipment.
4. To find out the major effects of the paucity of medical equipment maintenance manpower in the South-Eastern Nigeria.

Materials and Methods

Study design

This is a descriptive cross-sectional study.

Study population

The study populations are secondary and tertiary hospitals in the sampled states in the south east, Nigeria. However, a sample of randomly selected in secondary and tertiary hospitals in south eastern States was assessed to be a representative sample of the study population; where vital information were obtained from the healthcare workers working in these hospitals.

Sample and sampling techniques

The sample size was calculated using the following formula:

$N= Z2pq/e2$

Where, N=the desired sample size; Z=the reliability co-efficient for 95% confidence level set at 1.96; P=proportion (89%); Q=1-p set at 0.20 for 95% confidence interval; E=level of precision or decision of accuracy (0.05) [10,11].

Thus, p=0.89, q=1-0.89=0.11 substituting;

$$N= \frac{(1.96)2 \times (0.89) \times (0.11)}{(0.05)^2}$$

$$= \frac{3.8416 \times 0.0979}{(0.0025)}$$

$$= \frac{0.37344934}{0.0025}$$

=149.37 (approx 150)

Thus, 150 questionnaires were sampled amongst the clinicians (doctors, biomedical engineers and medical laboratory scientists) in the randomly selected secondary and tertiary hospitals of the sampled states as calculated below.

Sampling procedure

A Multi-stage sampling procedure was employed in this study, where samples were selected in stages and in each stage either a simple random sampling method or purposive sampling technique was employed also.

- **Stage 1:** The 5 states in the south eastern states (Abia, Ebonyi, Enugu, Imo and Anambra) were randomly sampled through balloting and 3 states (Imo, Ebonyi and Abia) were randomly selected without bias.
- **Stage 2:** The capital cities of these selected states were chosen for the study, thus (Owerri, Abakiliki and Umuahia).
- **Stage 3:** The some secondary and tertiary hospitals were selected in these capital cities to be sampled

Thus, 5 health facilities each in these 3 states were sampled i.e., 50 questionnaires to each state (10 health workers in each hospital).

Nature/source of data collection

Both primary and secondary data were sourced during this study. In primary data collection, the researcher was directly involved in collecting raw data and recruiting four sound health undergraduates to avoid discrepancies in the data analysis. The secondary data was sourced from literature materials such as textbooks, internet, and journals.

Data was collected and edited to exclude errors, re-organized, coded and manipulated with clear statistics calculation for effective analysis. Access to the data was limited to the researcher and the supervisor at the initial stage of the research till completion [12].

Methods of data collection/instrumentation: The survey instruments used are:

Questionaires: A mixture of close and open ended semi-structured, self- administered questionnaire was disseminated amongst the available doctors, biomedical engineers/technicians and medical laboratory scientists in these sampled health facilities and diagnostic centers to obtain vital information. A total 150 numbers of questionnaires were disseminated. The questionnaire was used to examine parameters like Socio-demographic data (Age, sex, ethnicity, and religious affiliation, level of education, occupation/cadre, and years of working experience), Biomedical engineering technology practice in Nigeria, and reasons for paucity of medical equipment engineers and Solutions to the paucity of medical equipment maintenance manpower [13].

Interviews: The researcher also had face to face interactions with some interested respondents over the major issues revolving in the study; with these he gathered salient explained information [14].

Method of data analysis

Data was analysed in the Microsoft windows 7 using percentage calculation. Data was analyzed for frequency of distribution, proportion and percentages for the variables in the questionnaires. Results were presented in tables and interpretations of findings were made.

Ethical considerations

Ethical clearance and approval for this study was obtained from the ethics committee, college of Biomedical Engineering and Technology also the informed consent of the respondents of this study was obtained. However, privacy and confidentiality was ensured.

Results and Discussion

Presentation of data

A total of one hundred and fifty (150) questionnaires were sampled amongst some cadres of health workers in 15 health facilities and diagnostic centers in the selected states of the south eastern states. 61% of the respondents were males while 39% were females, 40.7% were doctors, 23.3% were biomedical engineers/technicians while 35% were medical laboratory scientists, out of which 19% (21-30 age group), 54.6% (31-40 age group), while 25.4% (41 and above age group). 92% attended tertiary institution while just 8% stopped at secondary education and probably did some trainings, 94.7% were of Christian folds while 5.3% were Muslims by religion, 83.5% were Igbos, 2% Hausa, 3% Yoruba and 11.5% wrote others, 17% of the respondents had 1years to 5 years working experience, 50.6% had 6 years to 10 years working experience, 20.4% had 11 years to 15 years experience while the least fall on those with 16 years and above working experience (12%).

Biomedical engineering technology practice in Nigeria

From the field, it was noted that there are not enough medical equipment maintenance manpower as not up to 50% biomedical personnel service the equipment of the sampled hospitals and diagnostic centers. Table 1 also presented the poor BMET practices in Nigeria as 83% respondents affirmed that BMET practice in Nigeria is very poor thus only 14% agreed that the percentage ratings in healthcare is 50% and above while 41% rated it 31% to 40% as 21.3% rated it 21% to 30%.

Who maintains the medical equipment of the sampled health facilities and poor practice of BMET in the healthcare centers?

The results of this study showed significantly that even nurses who were sent on few months short course maintain medical equipment. This is quite absurd. BMET, a formidable profession that takes years to study has now become what can be studied in weeks by a mere nurse. The study showed also that others like the electrical engineers, electronics engineers, computer engineers and even auto electricians who may have little knowledge on repairs also serve as medical equipment maintenance personnel. This finding is not in conformity with the World Health Organization (2004) assertion that maintenance equipment should be carried out laboratory and hospital equipment personnel employed to operate, by service personnel employed in the hospital biomedical department, by biomedical technicians with specialized knowledge of particular equipment or biomedical engineers with special expertise.

Percentage ratings of BMET in the healthcare centers: From the study, the mean average ratings of BMET practice in the health facilities is not up to 40% and this is not a pass mark at all.

Major reasons for the paucity of medical equipment maintenance manpower: The study succinctly revealed as the respondents open ended gave in that some reasons behind the fewness of Medical Equipment Maintenance manpower in the south eastern Nigerian Health facilities are as follows:

- Lack of training/ re-training of personnel
- Poor practical contents of the course in the few institutions offering BMET
- Very few institutions offering BMET discipline
- Poor condition of service, thus, some equipment professionals are not motivated, hence they leave for developed countries
- Difficulty in sourcing spare parts of many equipment, especially the automated ones
- Maintenance manual written in foreign language giving room for inability to decipher maintenance and installation instructions
- Inappropriate training
- Indolence to practice BMET on the part of some personnel's who studied BMET
- Hoarding of skills, expertise and accurate knowledge of senior professionals
- No proper mentoring spirit
- Technological advancement (complexity/sophistication) of some medical equipment
- Low political will
- Low standard of care
- Devaluation in currency
- Low socio-economic status
- No effective enlightenment campaign of the profession.

Conclusion

Medical equipments are essential for safe and effective prevention, diagnosis, treatment and rehabilitation of illness and disease. The achievement of health-related development goals, including the

Table 1: Biomedical engineering practices in Nigeria.

Variables	Group variable	Frequency	Percentage (%)
Who maintains your equipment	Nurses on short course Training	26	17.3
	Biomedical Technicians	53	35.3
	Electrical Engineers	31	20.6
	Others	40	26.6
	Total	150	100
Poor BMET Practice in Nigeria	Yes	83	55.3
	No	67	44.7
	Total	150	100
Percentage ratings of BMET practice in the healthcare facilities	1% to 10%	7	4.4
	11% to 20%	29	19.3
	21% to 30%	32	21.3
	31% to 40%	61	41
	50% and above	21	14
	Total	150	100

Millennium Development Goals upon proper manufacturing, regulation, planning, assessment, acquisition, management and use of medical devices which are good quality, safe and compatible with the settings in which they are used. However, in the health care delivery system, the importance of medical equipments can't be over-emphasized as they are veritable and of great significance in Primary Health Care Centers, District Hospitals, Rural Clinics, Nursing Homes, Private Hospitals, Specialists Hospitals, Teaching Hospitals and other Healthcare Parastatals.

The empirical reviews in chapter two elucidated the researchers' views on health, medical equipment, and importance of maintenance and problems of BMET. The methodology buttressed that the study is a descriptive cross sectional study whose study population is secondary and tertiary healthcare facilities and medical diagnostic centers.

The study showed that there are very few equipment maintenance manpower due to myriads of reasons which include lack of effective training/re-training of young personnels, influx of obsolete equipment by donor agencies, difficulty in getting or sourcing for spare parts, no support from the government, maintenance manual written in foreign languages, poor practical contents in BMET curricula, technological complexity of modern equipment, no good motivation, no proper enlightenment campaigns etc. Thus, the solutions given by respondents should be upheld with all sense of responsibility for the betterment of BMET in Nigeria.

Recommendations

Hospitals are run with the sole intention to diagnose and treat various diseases. They are staffed with licensed medical professionals who require a variety of medical equipment in order to efficiently perform their duties. For an increase in proactive and diligent Medical equipment maintenance manpower, I here in recommend the following:

- There should be adequate training/ re-training and empowerment of personnel.
- The institutions offering BMET as department should inject lots of practical contents to lace up the class works and field trips.
- Many institutions should develop or start offer BMET as a discipline to train sound equipment manpower
- The condition of service of practicing biomedical personnel's should be stepped up like that of other allied health professions, at least to enhance the job satisfaction which would make some equipment professionals are motivated and not leave our dear country for developed countries.
- There should be no difficulty in sourcing for spare parts of many equipment, especially the automated ones
- Maintenance manual written foreign language should as well be translated to English so that the equipment manpower can be able to decipher maintenance and installation instructions and thus does his maintenance work effectively.
- Anyone who chooses BMET as a discipline should work hard and make the best of it, and not to remain Indolent to practice BMET.
- There should be cross breed of knowledge and skills thus professionals should not be stingy or hoard skills, expertise and accurate knowledge from colleagues or beginners in the profession.
- There should be spirit of proper mentorship in BMET.
- Regular trainings should be encouraged so as to outshine some technological advancement (complexity/ sophistication) of some medical equipment.
- Government should really support the institute governing medical equipment in Nigeria.
- There should be effective enlightenment campaign of the profession. Those in it already should not be discouraged no matter what.

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