

THE CHALLENGES OF RENAL EQUIPMENTS HANDLING IN THE MANAGEMENT OF CHRONIC KIDNEY DISEASE (CKD) IN NIGERIA.

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ABSTRACT

Renal equipments handling encompasses proper care (maintenance) and manipulation (application) of dialysis equipments for proper treatment and care of patients with kidney problems. In Nigeria this is still a common challenge as many of us do not have the required handling skills or do not really take it serious where the skills exist. This has resulted in the dumping and underutilization of many of these machines.

A visit to many of our dialysis centers shows that most dialysis and reverse osmosis (RO) machines have been abandoned soon after installation or are in poor state of disrepairs. In some cases, even the few functioning ones often breakdown due to poor handling thereby causing frequent disruption of services and forcing clients to either wait or seek care elsewhere. Most times where these services are rendered, the quality of care becomes a

challenge due to poor functioning of the machines. Therefore there is the need to address this problem.

The aim of this work is to closely examine these challenges and presents the Planned Preventive Maintenance (PPM) approach which is a new concept as a way forward using my local and international experiences. PPM is a schedule of planned

maintenance actions geared towards the prevention of breakdowns and failures. It involves regular repetitive work done to keep the equipment in a good working condition so as to optimize its efficiency and accuracy

The PPM concept is intended to create attitudinal change among operators from the maxim of '*I operate to breakdown and the maintenance personnel (Engineer) fix*'. to '*Operator involvement in preventive maintenance activities*'. What this means is that the operator does not only operates but doubles as the maintenance person involving in simple maintenance activities like regular inspection, cleaning of dialysis machines etc and strict compliance with equipment safety/standard operating procedures (SOPs) as stated by the manufacturer. This guarantees continuous functioning of the machines, reduces cost and equipment downtime to enhance affordability and the quality of care for our dialysis patients in Nigeria.

Therefore PPM highly recommended for all dialysis centers in Nigeria.

Keywords: Poor Maintenance culture, Planned preventive maintenance (PPM), Equipment handling, quality renal care in Nigeria.

INTRODUCTION

Generally, maintenance in any form implies some measure of inspections, tests, observations, calibrations, measuring, cleaning, repairs etc in order

to have an acceptable result.⁽¹⁾ There are basically two types of maintenance; breakdown (corrective/reactive) and preventive or planned preventive (predictive) maintenance.

1. Breakdown maintenance-implies fixing of faulty equipments to restore functions⁽²⁾. The altitude is *'I operate to breakdown and the maintenance personnel (Engineer) FIX'*.⁽³⁾ This means the user of for example dialysis machine has no business with even simple maintenance activities as stated earlier but stick strictly to the business machine operation only. The common language often heard is 'it is not my work'.

Breakdown maintenance is best for equipment whose downtime does not significantly affect health outcomes and more expensive to maintain than replace.

2. Preventive maintenance (PM) or Planned preventive maintenance (PPM) - Involves daily inspection, cleaning, oiling, fine turning or adjustment etc to keep the equipment in a healthy condition.⁽⁴⁾ It encompasses those actions geared towards the prevention of breakdowns and failures. It is regular repetitive work done to keep equipment in good working condition and to optimize its efficiency and accuracy⁽⁵⁾. Here the operator is also the maintenance person engaging in preventive maintenance activities as highlighted earlier.

Just like human life is extended by preventive medicine, the equipment service life can be prolonged by doing PPM⁽⁶⁾. In fact the ideal preventive

maintenance program would prevent all equipment failures and prolong its service life. This type of maintenance is good for equipments like dialysis and reverse osmosis machines whose downtime significantly affect health outcomes and as such most preferred to breakdown maintenance. It is important to note that while the dialysis patient waits for the faulty machine to be fixed, complications and even death may result.

In the developed world like the united states of America and Europe PPM is taken seriously to guarantee system and of course equipment functionality and reliability⁽⁷⁾. This is one of the reasons why many countries in the developing world including Nigeria seek renal care services in such countries at every slightest opportunity.

In Nigeria; the public and private health sectors lack the culture of PPM⁽⁸⁾. This can be seen in so many sectors cutting across health, education, transportation etc. In the health sector for instance many of our dialysis equipments like dialysis and reverse osmosis machines etc are affected as stated earlier. The structures are not left out as some of these buildings that were beautifully builds to provide care are now in bad shape of disrepairs.

This is affecting the quality of care for dialysis patients in Nigeria as no faulty (sick) dialysis machine can give quality treatment or result. This may not be far from the justification while many Nigerians are seeking renal care services abroad especially in India.

fig 1 below is a typical structure of a Nigerian primary health care centre (PHC) that has suffered from poor maintenance.



Fig1. Owolona primary health care centre (PHC), an example of poorly maintained health structure.

Poor maintenance culture is either due to lack of trained staff or poor altitude ⁽¹⁰⁾.

In Nigeria for instance we currently have about 107 dialysis centers (Government and private) but only twenty (20) original equipment manufacturer (OEM) trained technical staff to man these centers. This ratio of trained technical staff to dialysis centers is obviously inadequate hence the need for user involvement in what to do to prevent frequent breakdown of dialysis equipments.

In this article, attempt has been made briefly look at types of PPM, its benefits in the management of chronic kidney disease and the scope as it affects the key actors: the policy maker, the engineer and the user in Nigeria. The PPM activities in a Nigerian dialysis unit where there had been a paradigm shift from break down maintenance to PPM shall be x-rayed and compared.

COMMON EQUIPMENTS IN A TYPICAL DIALYSIS CENTER

The major equipments include: dialysis machines, reverse osmosis (RO) machines, suction machines, hospital beds and trolleys, weighing scales, wheel chairs, oxygen cylinders with humidifier. Others are water pumps, generators, uninterruptable power supply (UPS). Experience shows that all these require PPM for proper functioning.

TYPES OF PPM

PPM can either be in-house or outsourced ⁽¹¹⁾. In-house PPM simply means raising a maintenance team within the system while outsourced PPM is raising the same team but outside the system ⁽¹¹⁾.

The in-house PPM team is preferred over the out-sourced team ⁽¹²⁾. This is because of its obvious advantages that include; quick response time to distress calls due to proximity to point of service thereby reducing equipment downtime. There is also ease of control within the system and drastic reduction in cost of maintenance as in most cases there are no issues of transportation and accommodation cost ⁽¹²⁾.

In Ahmadu Bello university teaching hospital (ABUTH) Zaria, an in-house PPM team has been inaugurated in order to reap these benefits. This can be emulated other dialysis centres and hospitals for the sake of better quality and cost of care for our dialysis patients.

OBJECTIVES /BENEFITS O F PLANNED PREVENTIVE MAINTENANCE

- To maintain effective use of existing dialysis equipments.
- To ensure accurate management of dialysis equipments and tools.
- To educate, train and build manpower for effective dialysis equipment maintenance and enhance quality of care.
- To make dialysis centres comfortable and friendly.
- To increase reliability of dialysis service delivery in all our centres.
- Reduction of client loss to follow up due to service disruptions arising from frequent breakdowns.
- To create attitudinal change among operators from *'I operate to breakdown and maintenance personnel fix'* to *'operator involvement in preventive maintenance activities'*
- Decreased in cost of maintenance and services and
- Check dialysis equipment downtime.

SCOPE OF PRACTICING PPM

The policy maker, the engineer, and the user are the three actors involved at different stages/levels of PPM. This means that the maintenance of dialysis equipments is every body's business, including the doctor and the nurse.

Let us look at some typical examples of break downs that can be checked by practicing PPM and level of involvement of the three actors.

1. At the level of Policy Makers- Basically involve policy formulation to guarantee equipment functionality and sustainability. Complete system failure or under utilization can be checked by good maintenance policy formulation and implementation. It starts right at the procurement stage where the equipment serviceability and OEM's training for staff ought to be considered and factored in the agreement before the award. This must also include regular staff re-training programs, selection of design to improve on weakness of presently in use equipment etc. The failure of Government or Management to have a well defined maintenance policy for proper management of all medical (dialysis) equipments and infrastructures will result in poor service delivery cum frequent service disruption. A renal care policy that will fully embrace the concept and practice of PPM will check these ugly trends and improve the quality of care in Nigeria.

2. At the level of the engineer- leakages from worn out rubber tubing resulting in F16 positive pressure error common with Fresenius 4008 family dialysis machines causing un-necessary delays or even complete disruption of services is a typical example. Here, lack of adequate skills of staff or I don't care altitude can be responsible.

3. At the level of the user-Is non compliance with equipment safety/standard operating procedures (SOPs) and lack of regular inspection and cleaning of dialysis machines. This can results to un-necessary breakdowns cum service hiccups. Training and change of altitude required to check this trend.

Certainly, practicing PPM will help check the burden of CKD patients in Nigeria. Let us consider the maintenance activities in a Nigerian dialysis unit where there had been a paradigm shift from break down maintenance to PPM.

CASE STUDY:

We review the dialysis equipments maintenance service reports from June 2007 to December 2013.

The differences in down time and maintenance costs before and after the drastic change were compared. The effect of PPM on equipment failure rate tabulated, periods of service loss and costs were worked out for the duration when breakdown maintenance was the main focus. These were compared with the same parameters when the focus shifted to planned preventive maintenance (**PPM**).

Some technical challenges and lessons learnt were also reviewed during the same period.

Table 1 below illustrates the effect of practicing PPM on dialysis machine failure rate as represented by the service report. As seen, in year 2007; there was practically very little or no attention was given to PPM (i.e. only PPM was done only once) and seven breakdowns (ie.equipment failure rate) were recorded even though the machine was new. In year 2008, there was an improved altitude towards PPM.The machine was serviced twice (2) in that year reducing breakdown to six (6) times within the period. As the shift in altitude from breakdown maintenance to PPM was intensified (i.e. PPM carried out 4times per year), a drastic reduction in dialysis machine breakdown was recorded.Infact even as low as one (1) breakdown per year despite the aging of the machine. Details are as tabulated below.

TABLE 1. The effect of PPM on dialysis machine failure rate⁽¹³⁾

Period in years	No. Of PPM Per Year	Equipment Failure Rate
2007	1	7
2008	2	6
2009	2	5
2010	3	3
2011	4	3
2012	4	2
2013	4	1

From the table above, one can imagine the benefits of practicing PPM when failure rate of the machine has been reduced from 7times a year to once (1) a year.

Let us look at some of these benefits in terms of percentage and compare them with the consequences of poor maintenance culture. Specifically, the frequency of equipment break down, period of service loss and cost were considered. See details in table 2 below.

Table2.PPM benefits

Description	Before ppm	After ppm
Frequency of equipment breakdown	90%	15%
Period of service loss due to down time (No dialysis)	65%	10%
Cost:		
a) Direct cost (spare parts, transport ,service charge,etc)	70%	40%
b) Indirect cost (Time wastage resulting to loss of lives, loss to follow up etc)	50%	20%

RESULT ⁽¹⁴⁾

1. Return on investment: up to 3 times
2. Reduction in costs: up to 30%
3. Elimination of breakdowns: up to 75%
4. Reduction in downtime: up to 45%
5. Increase in out put: up to 25% etc

SETTING UP PPM: What does it takes and who is involved?

The major resources are: Diagnostic tools, Repair tools, Service parts, OEM manuals, Maintenance Software (e.g. win cash), PPM Committee (personnel) ⁽¹⁴⁾

A functional workshop or tool shop (This may cost \$18,875.00) ⁽¹⁵⁾

PPM TASK : ^(16,17)

1. Equipment Inventory: Equipment Selection for PPM
2. Information system and library: Vendor/manufacturer recommended PPM (e.g. use of manuals etc)
3. Equipment experience: Training of PPM Personnel
4. Policy formulation: Definition of task like a well defined maintenance policy to, include PPM funding etc

5 Establishing Intervals/ schedule of maintenance e.g. daily, weekly, monthly etc

6 Reminder system (use of maintenance soft wares e.g. Maintenance-pro)

7 Dialysis patients and health care worker's (HCW) safety

Training duration 3-12 weeks depending on the equipments involved.

All equipment users and engineers should be trained and retrained on PPM.

SUCCESS MEASURES⁽¹⁸⁾

- The life span achieved for the equipment
- The rate of decay of infrastructure is checked
- The improved service delivery
- Expansion of active equipment inventory
- The active response and participation of dialysis staff trained in PPM
- The emergence of Master trainers/ Supervisors from our dialysis centres
- Reduction to about zero incidences of equipment down time inclusive of emergency (unplanned) breakdown

PPM FINANCING

In Nigeria maintenance has not received the attention it deserves. Since 1960, many

Government policies aimed at improving health care delivery system in Nigeria make little or

no provision for maintenance of medical equipments and infrastructures. Even where the

provision is made, one wonder where the money goes as little or nothing is seen at the

implementation stage. The reason is not far from our poor attitude towards maintenance

including corruption. A typical example is as seen in the structure shown in figure 1 above.

We are however happy of the new National health care policy which has just been signed to

law as adequate provision for maintenance is provided. We hope that this will be well

implemented so that our dialysis patients in Nigeria can reap fully the benefits of PPM.

There are different options of PPM financings all over the world, some of which i have

highlighted below. Nigeria can also tap in to these options.

Community Based Health Insurance Fund^(19, 20)

Community Based Health Insurance Fund is a mechanism to fund health care for the poorest people in the world. It has been tried out in various developing countries. The essential components are:

a) The community pays an insurance premium to a Health Maintenance Organization (HMO) which provides care

through a network of public & private medical (dialysis) service providers

b) The HMO provides financial administration of the fund

c) There is often co-funding by donor, government etc

d) The approach is community based with shared risk. Community members participate in management

e) The fund will usually cover basic health care, like treatment of dialysis, HIV and TB, patients etc

OUTSOURCING OF RENAL CENTRES MANAGEMENT

Many countries have experimented with outsourcing of primary and secondary health facilities including renal centers to try and improve services.

An example is the Rogi Kalyan Samiti (Patient Welfare Committee / Hospital Management Society) in India. ⁽²⁰⁾

It is a registered society that acts as trustee to manage affairs of dialysis centers and hospitals. Trustees include government, non Governmental organization (NGOs), and professional bodies. It imposes user charges and may raise funds elsewhere (government, donors etc). It has a specific focus on declining infrastructure and medical (dialysis) equipment maintenance. This has worked well and today most Nigerians renal patients are seeking quality care in India. We can do same in Nigeria.

DIALYSIS REVOLVING FUND.

Most hospital charge for each dialysis session / laboratory tests provided to patients. This is part of the cost recovery for such services.

The money is put into a dialysis revolving fund account of the hospital where it is also used for purchase of dialysis

consumables and maintenance of dialysis machines.

A LRF is different from a Drug Revolving Fund (DRF) as it provides more opportunity to evolve into a business model.

Some renal centers in Nigeria have already tapped into this but most of them have no budget for maintenance which is highly needed. If well manage, it will created a surplus that could be used for staff motivation and other hospital services.

PPM FEEDBACK AND REVIEW MECHANISIM ⁽²¹⁾

- Continuous mentoring and follow up is very important for the success of PPM.
- There is always room for improvement and this must be explored and employed continuously
- Continuous reporting and documentation of experiences must be encouraged

RECOMMENDATIONS

1) All dialysis centers in Nigeria should as matter of urgency set up PPM committees so as to reap the benefits.

2) Government/management of all hospitals rendering renal care services must include OEM training for staff of dialysis units as a pre-condition for buying any dialysis equipment from vendors and manufactures so as to prevent dumping and underutilization.

3) An advocacy to include ppm in the biomedical engineer's national training curriculum and that of all equipments users (doctors, nurses, laboratory scientist, etc) necessary in order to catch them young.

4) It is imperative that we should practice PPM on all our dialysis equipments so as to optimize their accuracy and efficiency

in order to provide quality and affordable dialysis care services to all our patients and reduce their burden.

5) Our dialysis centres should endeavour to include PPM/equipment maintenance as a line budget item where it does not exist.

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