# Ending Out-of - Stock Syndrome in Hospital Pharmacies through Computer - Based Forecasting

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**Abstract** — *Hospital pharmacies usually stock a variety of drugs. The primary reason for holding stock in hospital pharmacies is to ensure the availability of these essential items all the time. This is not the case in many hospital pharmacies as many of them are affected by the unavailability of these drugs especially at a time they are needed. This paper discusses ways of ending this problem of the shortage of these drugs, known as out –of –stock syndrome, through the application of computer based forecasting.Forecasting is the process of making predictions of the future based on past and present data and most commonly by analysis of trends. In order to solve the out- of –stock syndrome in hospital pharmacies, we propose a computer- based forecasting system that uses time series data to provide for both trend and seasonal forecasts of different type of drugs required in a hospital pharmacy. We adopted Object Oriented Analysis and Design Methodology (OOADM) for the design of our computer based-forecasting system using Visual Basic 6.0 programming language to program and implement the application while Microsoft Access was used to design the database as the back-end for the storage and retrieval of the stored information when required.The benefits of application of computer based forecasting in hospital pharmacies include ensuring availability of drugs, improved management of inventories, facilitate better planning and greater efficiency all the areas in the hospitals due to an efficient stock analysis in the hospital pharmacy department.*

**Keywords** — *Computer-based Forecasting, Health care, Hospital Pharmacy, Inventory, Out-of-Stock syndrome*

## I. INTRODUCTION

### A. Background of the study

One of the main aims of every hospital pharmacy department is to make inventory decisions that will ensure that drugs are always available whenever they are required. It is often more critical and expensive in a hospital pharmacy department to experience out –of – stock syndrome whereby the items are not readily available at the pharmacies. This can be life threatening in some instances where timely administration of such medications is needed to avert loss of lives. Running out of a drug used in such critical care might result to increased morbidity and mortality, which is not an acceptable situation. Secondly, it might be more expensive to obtain the item from outside the hospital pharmacy and sometimes the genuineness of such drugs obtained outside the hospitals pharmacy department cannot be guaranteed. For example, in a retail pharmacy, if a customer is unable to obtain their medication, they may go somewhere else and the pharmacy may lose future purchases. Most pharmacy inventory decisions involve replenishment – how much to order and when to order. Given that, the basic forecasting concepts can be applied to hospital pharmacies inventory control when appropriate to reduce these situations that may arise because of out – of – stock syndrome in hospital pharmacies.

Many hospitals must hold stocks of supplies in order to match separate phases of activity. Health care institution supplies are required for the treatment and rehabilitation of the patient. Food, pharmaceuticals, laundry and cleaning materials, surgical and medical supplies are all inputs by which the goal of improved health care is attained. The status of inventory control is compared with that in industry, and short term demand forecasting selected as an important component of inventory management. Statistical demand forecasting is one method of determining likely future demand for each individual item stocked by the hospital.

Given access to a computer, it is established that simple forecasting methods can be applied which will enable greater control over inventories to be exercised. This in turn will enable funds to be released for other important purposes. This paper discusses the application of computer –based forecasting in ending the out –of stock syndrome being experienced by many hospital pharmacy departments.

### B. Motivation

Hospital Pharmacy department usually experience the situation where the required drugs are not available within the pharmacy. This situation is commonly known as out –stock - syndrome. Available records

show that many hospital pharmacies have become accustomed to this out- of- stock syndrome of drugs over the years. For example, in 2010, 94% of Canadian pharmacists surveyed claimed that they had had difficulty locating a drug during the previous week [1]. A survey of some directors of the American Society of Health-System Pharmacists show that Pharmacists and pharmacy technicians spent more time managing drug shortages than did physicians and nurses. There was a significant association between the times spent managing shortages and the size of the institution[2].Furthermore, out – of- stock syndrome are not limited to Nigerian hospitals pharmacy departments, but rather is a global issue. Most times the drugs are not only out of stock, they are not available from places where they can be sourced [3]. The immediate and remote causes of this phenomenon of out- of- stock syndrome (drug shortages) of drugs are multifaceted and they include financial constraints, monopolization of manufacturing , changes to regulatory requirements, shortages of raw materials, recalls, government pricing strategies, and supply disruptions [1]. Considering the above scenario, there is the need to find a solution to the anomaly in order to end the out- of- stock syndrome in many hospital pharmacies, hence this study.

### C. Aim and Objectives of the Study
The aim of this study is to explore the ways of ending out – of – stock syndrome in hospital pharmacies through the application of Computer-Based Forecasting. The specific objective is to highlight the applications of Computer-Based Forecasting in various areas of human endavour with particular emphasis on hospital pharmacies and to design and develop a computer based forecasting system that can be used to end theout-of- stock syndrome and reduce waste of scarce resources in hospital pharmacies.

### D. Significance of the Study
This study focuses on the problem of non-availability of medications in hospital pharmacies and the lessons learnt here can be extended to non-hospital pharmacies and organizations where non availability of some medications can life threatening in critical moments. The study can also be a springboard for other researchers who may interested in this area of research.

Therefore there is a need to reduce and possibly eliminate the challenge of out – of- stock syndrome currently experienced by hospital pharmacies. This can be done through the application of forecasting techniques in these pharmacies. Forecasting is the process of using past and present data to determine the direction of future trends and most commonly by the analysis of these trends.

## II. REVIEW OF RELATED LITERATURE

Two features of the contemporary world make forecasting a significant subject for study: one is uncertainty, and the other is scarcity. With certain knowledge of future request, or with unlimited resources to meet future request, success could be guaranteed. However, since there is unpredictability in request for resources, and since resources to meet that request are inadequate, success is based on the optimal use of resources to meet demands. Thus, forecasting is critical to success in the contemporary world: optimal forecasts provide the opportunity for optimal usage of resources [4].

This paper discusses the problem of shortages of drugs also known as out –of –stock syndrome in hospital pharmacy departments as such this section reviewed literature related to the subject matter under discussion. Usually, forecasting in health care usually considers long-term forecasts of resource utilization, rather than hour-to-hour forecasts.

### A. Overview of Hospital Pharmacy
Hospital pharmacy departments are pharmacies usually found within the premises of a hospital. Hospital pharmacy departments usually stock a larger range of medications, including more specialized and investigational medications (medicines that are being studied, but have not yet been approved), than would be feasible in the community setting. Hospital pharmacies typically provide medications for the hospitalized patients only, and are not retail establishments and therefore typically do not provide prescription service to the public. Hospital pharmacies may provide a huge quantity of medications per day which is allocated to the wards and to intensive care units according to a patient's medication schedule. Larger hospitals may use automated transport systems to aid in the efficient distribution of medications. [5]

Hospital pharmacy deals with: procuring and dispensing of drugs and health aids, drug compounding, drug control and recording, dispensing and compounding of laboratory chemicals and laboratory diagnostics, drug policy and drug handling safety.

Hospital pharmacy provides pharmacy care to: inpatients, patients of outpatient clinics, patients being released from health care facilities, ambulatory patients and patients in the system of home care.

Its specialized care is also available to the inhabitants, the health care facilities it is a part of and other health care and non-health care entities. A hospital pharmacy provides clinically oriented care on a level meeting the needs of the hospital, in direct

cooperation with other experts on a multidisciplinary medical team (a doctor of medicine, a pharmacist, a nurse, a psychologist, etc.) [6].

### B.  Stock Control within Hospital Pharmacy

A lot of wastes occur in hospital pharmacies. These wastes are caused sometimes by drugs expiring within the pharmacy itself. Thorough stock control procedures will minimise wastage but, with the pressure of other activities, it is easy to forget routine tasks (such as stock rotation and checking expiry dates).

With rapidly increasing drug spends in hospitals the cost of wastage within pharmacy may only be a small percentage of the total drug budget; however, this does not alter the fact that expensive drugs are expiring (sometimes needlessly) within pharmacy departments. Measures should be put in place to enable staff to be aware of the drugs held within their departments that are about to expire. Ideally, any procedures for expiry date checks should be linked to a list of critical drugs for the hospital. Without clear procedures it is difficult to ensure that, in an emergency when a patient needs a critical but rarely used drug, there will be a sufficient supply of in-date drug available [7].

### C. Overview of Forecasting

Forecasting is the use of historic data to determine the direction of future trends. Stock analysts use forecasting to extrapolate how trends, such as GDP or unemployment, will change in the coming quarter or year

Forecasting techniques can be categorized in two broad categories: quantitative and qualitative. Qualitative forecasting techniques are subjective, based on the opinion and judgment of consumers, experts; they are appropriate when past data are not available. They are usually applied to intermediate- or long-range decisions. The techniques in the quantitative category include mathematical models such as moving average, straight-line projection, exponential smoothing, regression, trend-line analysis, simulation, life-cycle analysis, decomposition, Box-Jenkins, expert systems, and neural network.

Quantitative forecasting models are used to forecast future data as a function of past data. They are appropriate to use when past numerical data is available and when it is reasonable to assume that some of the patterns in the data are expected to continue into the future. These methods are usually applied to short- or intermediate-range decisions. The techniques in the qualitative category include subjective or intuitive models such as jury or executive opinion, sales force composite, and customer expectations [8].

Along with qualitative and quantitative, forecasting models can be categorized as time-series, causal, and judgmental. A time-series model uses past data as the basis for estimating future results. The models that fall into this category include decomposition, moving average, exponential smoothing, and Box-Jenkins. The premise of a causal model is that a particular outcome is directly influenced by some other predictable factor.

These techniques include regression models. Judgmental techniques are often called subjective because they rely on intuition, opinions, and probability to derive the forecast. These techniques include expert opinion, Delphi, sales force composite, customer expectations (customer surveys), and simulation [8].

### D. Combining Forecast Methods

There are many methods that can be used to forecast. Which are relevant to your situation depends upon your objectives and the conditions you face (such as what types of data are available Often, there is no single best method. In fact, it is best to use different methods and combine their forecasts.

It seems clear that no forecasting technique is appropriate for all situations. There is substantial evidence to demonstrate that combining individual forecasts produces gains in forecasting accuracy. There is also evidence that adding quantitative forecasts to qualitative forecasts reduces accuracy. Judgmental forecasting usually involves combining forecasts from more than one source. Informed forecasting begins with a set of key assumptions and then uses a combination of historical data and expert opinions. Involved forecasting seeks the opinions of all those directly affected by the forecast (e.g., the sales force would be included in the forecasting process). These techniques generally produce higher quality forecasts than can be attained from a single source.

Combining forecasts provides us with a way to compensate for deficiencies in a forecasting technique. By selecting complementary methods, the shortcomings of one technique can be offset by the advantages of another. [9] Therefore using a combination of both these methods to forecast in the pharmacy departments, it will help a long way in achieving an optimal result in health forecast.

### E. Applications of Forecasting

 Forecasting has applications in a wide range of fields where estimates of future conditions are useful. Not everything can be forecasted reliably, if the factors that relate to what is being forecast are known and well understood and there is a significant amount of

data that can be used very reliable forecasts can often be obtained. If this is not the case or if the actual outcome is affected by the forecasts, the reliability of the forecasts can be significantly lower [10].

The discipline of demand planning, also sometimes referred to as supply chain forecasting, embraces both statistical forecasting and a consensus process. An important, albeit often ignored aspect of forecasting, is the relationship it holds with planning. Forecasting can be described as predicting what the future will look like, whereas planning predicts what the future should look like. [11]. There is no single right forecasting method to use. Selection of a method should be based on set objectives and the conditions such as data. Forecasting has application in many situations:

**Health forecasting** is predicting health situations or disease episodes and forewarning future events. It is also a form of preventive medicine or preventive care that engages public health planning and is aimed at facilitating health care service provision in populations [12]. Health forecasting has been commonly applied to emergency department visits, daily hospital attendance and admissions [13, 14–16]

**Sales forecasting**: Sales forecasting uses past sales figures to predict the short-term or long-term future performance to enable sound financialplanning [17]. Many different factors can affect future sales: economic downturns, employee turnover, changing trends and fashions, increased competition, manufacturer recalls and other factors. Without sales forecasts, it's very difficult for you to steer the company in the right direction. For shops and stores, marketresearch may yield the following indicators for deriving initial forecasts:

- Average sales volume per unit area for similar shops in similar locations of similar size
- Number of consumers or consumer households in appropriate vicinity of the store and their annual expenses on the product in question. [18]

**Weather forecasting** is the application of science and technology to predict the conditions of the atmosphere for a given location and time.. Weather forecasts are made by collecting quantitative data about the current state of the atmosphere at a given place and using meteorology to project how the atmosphere will change.

Once a human-only endeavor based mainly upon changes in barometric pressure, current weather conditions, and sky condition, weather forecasting now relies on computer-based models that take many atmospheric factors into account [19]. In 2014, the US spent $5.1 billion on weather forecasting [20].

**Flood forecasting** is the use of forecasted precipitation and streamflow data in rainfall-runoff and streamflow routing models to forecast flow rates and water levels for periods ranging from a few hours to days ahead, depending on the size of the watershed or river basin. Flood forecasting is an important component of flood warning, where the distinction between the two is that the outcome of flood forecasting is a set of forecast time-profiles of channel flows or river levels at various locations, while "flood warning" is the task of making use of these forecasts to tell decisions on warnings of floods. Real-time flood forecasting at regional area can be done within seconds by using artificial neural network [21]. Effective real-time flood forecasting models could be useful for early warning and disaster prevention.

Computers are currently often used in making complex investment decisions. However, the rapid development of sophisticated computer equipment has increased the usefulness of computer-based analysis of complex investment decisions. For example, computer can be used to simulate future energy demand for a gas plant. After hundreds of these simulations, the computer generates a distribution on the expected rates of return from this decision [31].

Two major advantages of modern computers are the incredibly high speed and great accuracy with which they can do calculations. These advantages offered by modern computers can be applied in forecasting. The use of computers for forecasting process is otherwise known as computer based forecasting. Hence any forecasting method can be programmed to run on a computer.

### F. Review of Related Works
Several approaches and techniques have been proposed in different literatures for forecasting on various issues in the heath sector. Some of these works are discussed below:

Kasapoglu worked on the selection of the forecasting model in health care. The author concluded that there is no method which could be considered as the best one among the others, although there is the best method that forecasts our data. Error indicators help us to make this decision. It could be considered that the method which has least error is considered to be better than the others [22]

Soyiri and Reidpath did an overview of health forecasting. The authors stated that health forecasting is a dynamic process and requires frequent updates.

This can be done with novel techniques and data, taking into consideration the principles of health forecasting. The methodologies currently used involve time series analyses with smoothing or moving average models, and less probabilistic forecasting models like QRM, which offers a useful alternative for predicting and forecasting extreme health events. The patterns of health data can be exploited in health forecasting, using time series analysis or other probabilistic techniques. Health forecasting is a valuable resource for enhancing and promoting health services provision; but it also has a number of drawbacks, which are related either to the data source, methodology or technology [23]

Vicente et al. worked on the development of the certified environmental management in hospital and outpatient haemodialysis units. Their objectives were to determine the degree of implementation of environmental management systems in hospital units and outpatient haemodialysis in the Spanish National Health System to provide a group of reference centres in environmental management in this healthcare activity [24].

Zepeda, Nyaga and Young worked on the supply chain risk management and hospital inventory and the effects of system affiliation [25]. In this study they examined the effects of horizontal inter-organizational arrangements on inventory costs for hospitals facing two key environmental conditions, namely the logistics services infrastructure where the hospital is located and the demand uncertainty for clinical requirements that a hospital experiences.

Nikolopouloset. al. studied on the forecasting branded and generic pharmaceuticals [26]. They forecasted UK pharmaceutical time series before and after the time of patent expiry. They forecasted the numbers of units of branded and generic forms of pharmaceuticals dispensed and they said that it is becoming increasingly important, due to their huge market value and the limited number of new 'blockbuster' branded drugs, as well as the imposed cost for national healthcare systems .

Daniels worked on forecasting hospital bed availability using computer simulation and neural networks. The author employed a computer simulation model of the hospital and a time-dependent neural network to learn from the simulated model and forecast the availability of beds. The computer simulation model was found to be well suited to the task of describing a general hospital system and creating training data for a neural network. The neural network was found to provide accurate performance in predicting bed availability in the short term [4]

Reference [27] studied the forecasting daily attendance at an emergency department. Emergency department (ED) has become the patient's main point of entrance in modern hospitals causing it frequent overcrowding. Thus hospital managers are increasingly giving attention to the ED in order to provide better quality service for patients. One of the key elements for a good management strategy is demand forecasting. In this case, forecasting patients flow, which will help decision makers to optimize human (doctors, nurses etc) and material (beds, boxes) resources allocation.

Jurado et al studied stock management in hospital posing chance-constrained model predictive control [28]. One of the most important problems in the pharmacy department of a hospital is stock management.

Schweigler*et al,* investigated whether time series based methods can make short-term forecasts of emergency department bed occupancy in hospitals. The authors observed that a sinusoidal model with auto regression (AR) – structured error term and a seasonal ARIMA models produce robust forecast in short-term time frame of 12 hour [29].

Kadri*et al*, developed forecasting models for predicting daily attendance at a hospital emergency services in short-term frame of 12 hours [30].

## III. METHODOLOGY AND DESIGN

In order to solve the out- of –stock syndrome in hospital pharmacies, we designed a computer- based forecasting system using time series model. This computer based forecasting system used time series data collected from a hospital pharmacy department in Nigeria. We adopted Object Oriented Analysis and Design Methodology (OOADM) for the design of our computer based-forecasting system. Since OOADM principles are fundamentally based on real world objects, it's quite easy to understand what an object name means or how a particular object behaves. This computer forecasting approach for predicting future drugs demands in hospital pharmacies will provide a means to reduce to the barest minimum or possibly end the issue of out- of- stock- syndrome in hospital pharmacies based on the projected drugs capacity requirements in the hospitals.

To achieve the objective of this system, the authors chose Visual Basic 6.0 programming language to program and implement the front-end which is the application's interface while Microsoft Access was used to design the database as the back-end for data storage and information retrieval when the need arises. The graphical user interface of the VB-IDE provides intuitively appealing views for the

management of the program structure in the large and the various types of entities (classes, modules, procedures, forms, e.t.c). When editing program texts, the intelligence technology of the programming language informs you in a little pop up window about the types of constructs that may be entered at the current cursor location. This relieves the developer from thinking of the next construct that he/she may want to use.

To achieve these, the following were considered:

a. **Functional Requirements (What the system does):** These are functions done by the system such as store the necessary information of drugs, project the trend and season forecasts of drugs, prepare bill, give weekly report, easy searching of medicine, update, delete and save drug data efficiently

and also give notifications when the need arises.

b. **Non-functional Requirements (How it does it):** These have to do with the system being able to achieve the following characteristics:

i. Usability: With the user friendly interface which has the instruction menus on how to use it with self-directive application, the system can be used without ambiguity.

ii. Reliability: The system is designed based on the user needs, only the authorized users such as the pharmacists have control over the system.

iii. Performance: Here, the system operates optimally without any delay in performing its functions.

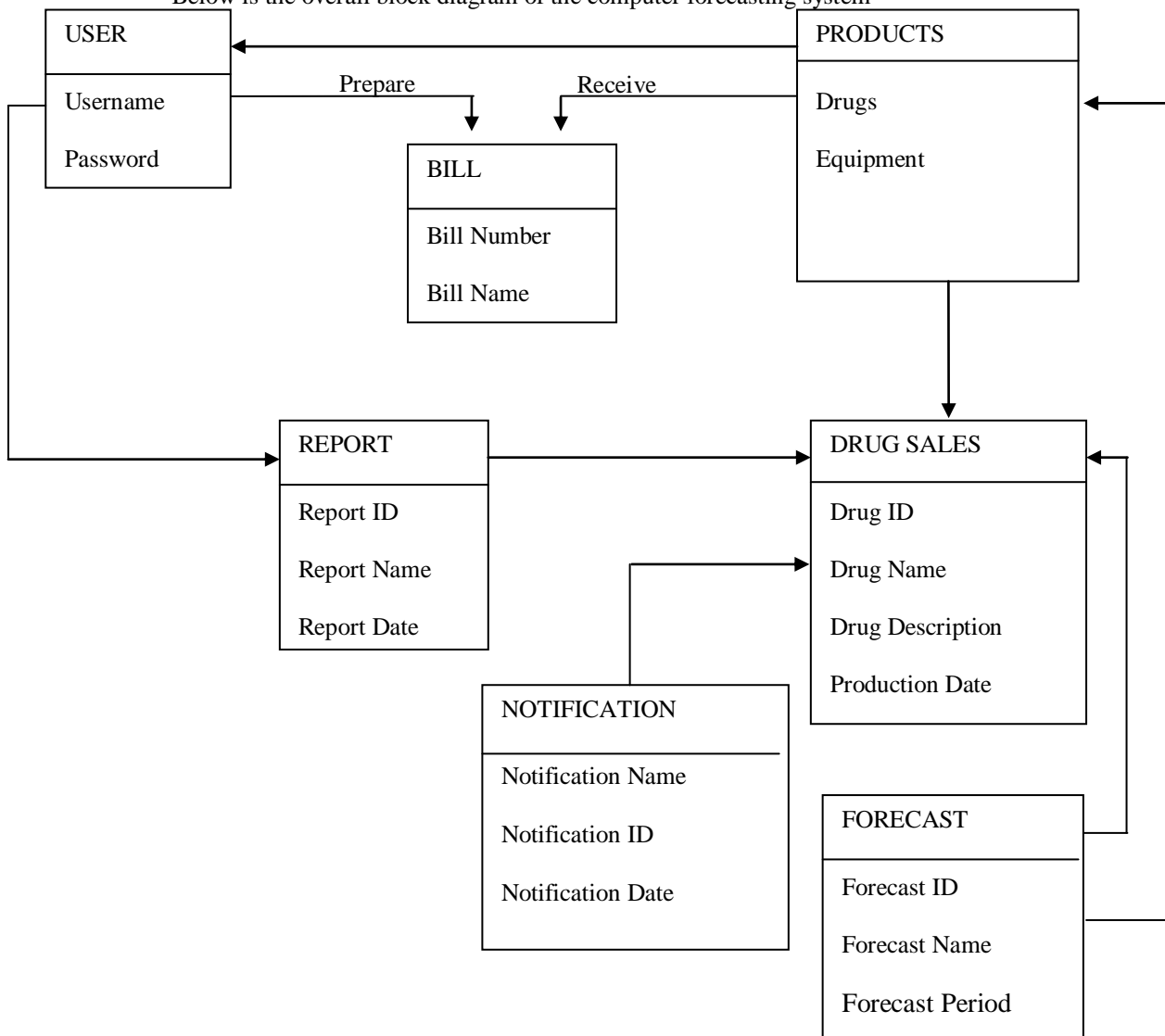Below is the overall block diagram of the computer forecasting system



Fig.1: Overall Block Diagram of the computer System

## IV. DISCUSSION OF RESULTS

### A. Time Series and Health Forecasting

The model used time series data to provide for both trend and seasonal forecasting of different type of stock required in the hospital pharmacy departments. Time series is defined as a collection of data points that are typically measured at successive and uniformly spaced

time intervals. In relation to health forecasting, the emphasis is places on the "uniformly spaced time intervals", which is important in the use of health data for health forecasting [23]. *Trend* is the long-term variation in a time series that is not influenced by irregular effects or seasonally related components in the data. For instance, in health data, an overall record of a progressively increasing incidence over a specified period would show an increasing trend, irrespective of any random or systematic fluctuations. *Seasonality* is a cyclic phenomenon, but is related to annual events, and is described as the predictable and repetitive positions of data points around the trend line.

For the purpose of this research, the equation selected for trend forecasting is:

$$b_1 = \frac{n\sum tyt - \sum t\sum yt}{n\sum t^2 - (\sum t)^2} \text{ and } T1 = b_0 + b_1$$

Were b1 and b0 are the coefficients

n is the number of periods (t)
$\sum tyt$ is the sum of the historical data after being multiplied
$\sum t$ is the sum of all the period
$\sum yt$ is the summation of the historical data
$\sum t^2$ is the sum of period squared
$(\sum t)^2$ is the sum of the periods all squared
$\bar{y}$ Is the average of $\sum yt$
$\bar{t}$ Is the average of $\sum t$

For seasonal:
$F_T = F_{t-1} + \propto (A_{t-1} - F_{t-1})$ or $F_2 = F_1 + \propto (A_1 - F_1)$
Were $\propto$ (alpha) is the smoothing constant
FT = the exponentially smoothed forecast for period (t)
Ft-1 = the exponentially smoothed forecast made for the prior period
At-1 = the actual demand in the prior period.

In summary, New forecast = Previous forecast + $\propto$ (Actual Data – Previous forecast)

When the time series data is feed to the computer system, trend and seasonal forecasts of the stock are produced. The computer based trend forecast gives a forecast view of the drug stock in the hospital pharmacy over a period of time while the seasonal forecast gives an annual forecast view around the trend line in a particular year or within a particular season. The computer system also provides a stock balance of the various stocks (drugs) in the hospital pharmacy at a given time. The sample screen shots of the computer based system are shown below:
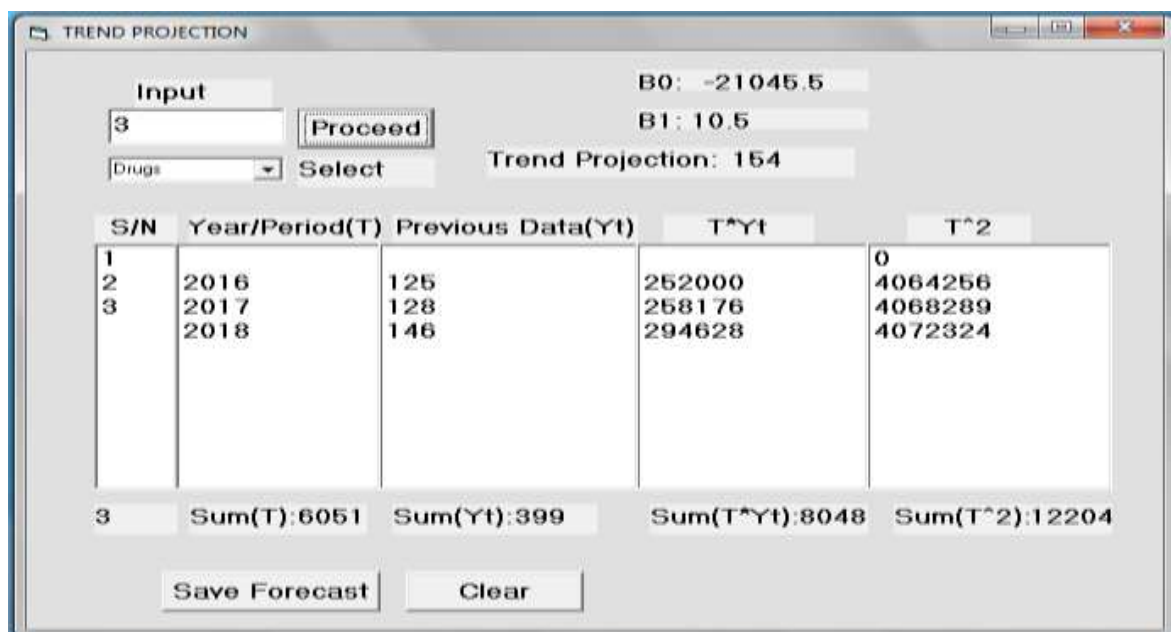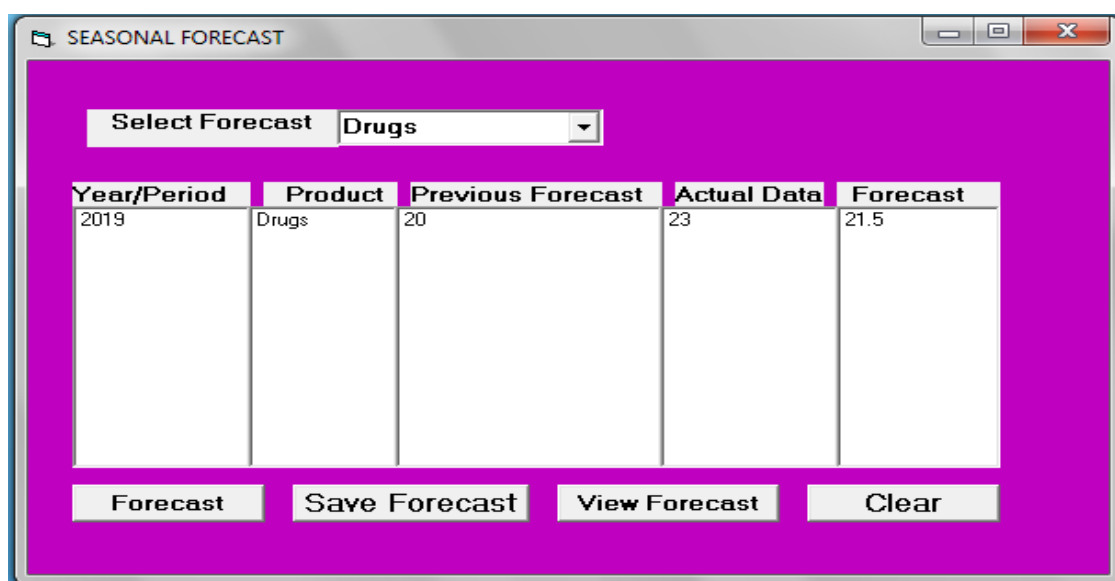


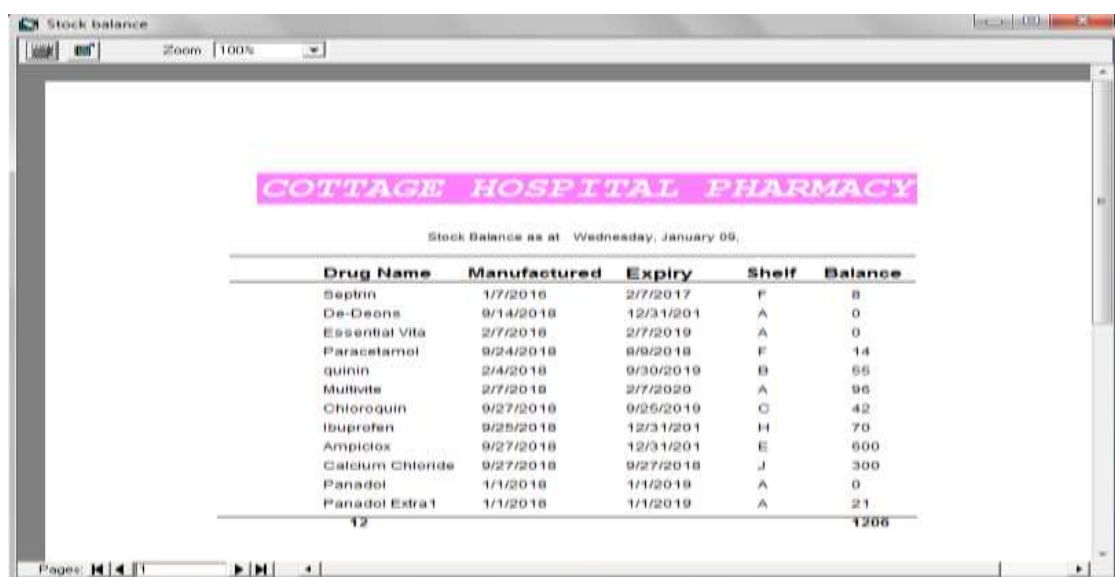Fig.2 : Trend Projection window

Fig.3: Seasonal Forecast window



Fig.4: Drugs Stock balance Window

### A. Benefits of Computer –Based Forecasting in Hospital Pharmacy Departments

The benefits of using computer based forecasting in hospital stocks include the following:

- ❖ **Facilitates Planning**: Computer based forecasts help to improve the access, coverage and quality of health care services rendered in hospital pharmacy department by facilitates planning such that these services are well planned, organised and managed efficiently.

- ❖ **The anticipation of future problems and events to accelerate early achievements of objectives:** Health forecasts are most valuable when they provide sufficient warning for timely, remedial action to be taken. Providers make critical decisions and resource allocations to meet the potential demand for health care services. This will go a long way in ensuring the availability of medications in the hospital pharmacies and prevent the out- of- stock syndrome being experienced in many hospital pharmacies.

- ❖ **Easy Controlling:** Health forecasting is a valuable resource for enhancing and promoting health services provision.

- ❖ **Reduce the unreasonable stocks**: The need for accurate forecasting made possible by computer technology has increased. With the difficult economic climate, government spend can now focus on reducing unreasonable stocks particularly in government owned hospitals pharmacies.

- ❖ **Accelerate cash flow**: Robust computer-based forecasts of future demand and costs are an essential element of the financial management needed to plan and prioritize services effectively for the different organizations which include hospitals. This help to increase cash flow in the hospitals and increase the revenue base of the hospital.

- ❖ **Improve risk management measures at all levels**: Forecast especially reliable and accurate one that can be facilitated by computers can help staff at all levels of an organization understand what is expected to occur and the range of uncertainty to inform planning and risk management.

- ❖ Give full play to the hospital management functions in order to guarantee the safety and integrity of hospital medicines.

- ❖ Forecasts can reflect simple trend extrapolations, but ideally involve computer-based modeling and more complex quantitative analysis.

### B. *Limitation of Computer –Based Forecasting*
- ❖ Forecasting is usually made on the basis of certain expectations and human judgments.
- ❖ Too much of expectation will cause disappointment and impair the initiative of the management.
- ❖ It requires high degree of expertise and the process must be undertaken by professionals.
- ❖ Long-term forecasts will be less accurate as compared to short-term forecast
- ❖ Heavy cost and time is involved

### C. *Ways of Ending Out- of - Stock Syndrome in Hospital Pharmacy departments*
Reference [32] suggested that innovative methods should be adopted to proffer solution to drug shortages and that will not only maintain healthy competition in the drug market but will allow hospitals and other health workers to take care of their patients. With the benefits of computer –based forecasting in hospital pharmacy departments, there is no doubt that the deployment of computer based forecasting will go a long way in curbing the menace of out- of - stock syndrome in hospital pharmacy departments

Managing drug inventory has now become a team effort in hospital pharmacy and it would benefit every team member involved to stay alert and communicate all of the moving pieces so that the best care can be provided to patients [33].

There is a need to keep proper record so that hospital pharmacy staff will be aware of the drugs held within their department that are about to go out of stock. Ideally, any procedures for stock checks should be linked to a list of critical drugs for the hospital. Without clear procedures it is difficult to ensure that, in an emergency when a patient needs a critical but rarely used medicine, there will be a sufficient supply of in-date medicines available [7].

## V. CONCLUSION AND RECOMMENDATIONS

Hospital pharmacy departments are pharmacies usually found within the premises of a hospital. Hospital pharmacies usually stock a variety of drugs. The primary reason for holding drug stock in hospital is to ensure the availability of these drugs all the time. In common with industry, hospital must hold stocks of supplies in order to match separate stages of activity. Health care institution supplies are required for the treatment and rehabilitation of the patient. Food, pharmaceuticals, laundry and cleaning materials, surgical and medical supplies are all inputs by which the goal of improved health care is attained.

Computer based forecasting is one method of determining likely future demand for each individual drug stocked by hospitals. Because short-term demand forecasting is undertaken as a means of better inventory management and ending the out of-stock syndrome in hospital pharmacies, we developed computer-based forecasting system which will provide trend and seasonal forecasts of drugs used in a hospital pharmacy at any given time. The system also provides a stock balance of drugs at the hospital pharmacy at any given time. Computers are currently often used in making important health decisions [34]. Given access to a computer, it is demonstrated that simple forecasting methods can be applied which will enable greater control over inventories of drugs needed for adequate health care in hospitals. This in turn will enable funds to be released for other important purposes in hospitals.

The benefits of application of computer based forecasting in hospital pharmacies include ensuring availability of drugs, improved management of inventories, facilitate planning, greater efficiency in

the medical sectors due to scientific stock analysis, and the release of funds for use by other areas of the hospital.

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