Designing an intelligent system for the automatic distribution of narcotic drugs

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Abstract
The anti-pain Opioid medicines (narcotics) is being used in the special wards of hospitals for pains after operations, general anesthesia or patients which are under operations in which their blood circulation store is generally low, cancer pains, chronic pains and episodic pains. In studying this system, first the consumption amount of the mentioned medicine used by different sections of hospitals during a period of 6 months has been observed and the methods used during injection of a narcotic medicine to a patient have been observed.
The purpose of the study: studying the importance and necessity of the intelligent Narcotic Medicine system in medical centers and hospitals.
Key words: Electro mechanical systems, ATM system, Opiodic medicine (Narcotics)

1. Introduction

Narcotic medicines in their injective forms, has so many applications for reducing severe pains. These medicines are usually used in hospitals and medical centers for dealing with different types of pains especially pains after operations. And like other medicines there are chances of abuse and incorrect use of these medicines and this can create some problems for the patient. The main part of these problems can be attributed to the unreasonable prescription of these medicines which includes the prescription of improper medicine, insufficient doze, large intervals between the inscribed doze, misuses of the medicine and unnecessary prescription of it and getting addicted to them [1] on one hand in a universal level also some studies has been performed regarding the consumption patterns of using the injective narcotics, but however there are rare. The only studies in this regard which are available are in America, Spain and Finland. And a study of Drug Utilization Evaluation (DUE) in 1997, done by American researchers in America, shows that most of the operated patients are not having enough decrease pain after their operation and their pain is not relieved [2]. In the research done by Sachar and Marks, they concluded that the prescription of narcotics has been less that the necessary amount [3,4]. Naturally in every hospital, there are a

significant number of patients who refer to that hospital daily and they need narcotics for their cure and improvement of this physical condition. But utilizations of narcotic medicines require a prescription from a trusted doctor of the hospital and the confirmation of the relevant authorities and it is not that for any kind of pain these medicines will be utilized. In fact utilization of narcotics is only allowed and permitted in vital and top urgent cases and of course the number of such cases is so much higher. Therefore due to the abundance of utilization of narcotics in hospitals the possibilities of misuses will increase in poisoned societies. Therefore in preventing these misuses, we need some filters in the terms of rules and regulations. Of course these rules and regulations can at the same time have both advantages and some disadvantages and restrictions which are not desirable and they cannot make up for which will be discussed later on in details. Before going any further we need to have a general definition of anti-pain opiodics: these anti-pain optics are normally considered as the primary part of the general plan. The opiodic includes complete Agonist, relative agonist and antagonist medicines. For examples morphine is a complete agonist for receiver opiodic mmμ the main optical receiver of anti-pain. From opiodic narcotic anti-pain we can name: morphine, dya morphine, methadone, Pentazocine, Pethidine, Tramadol, Fentanil and so on. The prescription for using these medicines are taking it orally, taking injections, taking in spinal and these are having the longest effect. The maximum potential activity, the cure period, undesirable side effect and the history of the patient with episodes should all be considered. Severe pains and continuous ones

normally get relieved by utilization of strong episodes. Among anti-pain narcotics we can name the following, utilization of anti-pain episodes in clinical patients having cancer, chronic diseases which are hard to cure, acute pulmonary edema, myocardial infarction, utilization in anesthesia and so on. [5,6]. The manual to taking narcotics in hospital sections: the medicine is being kept in the nursing office and in operating rooms in the form of stock. And in the event of necessity of them in different sections of the hospital it is provided by the nursing office. Keeping narcotics in stock in emergency sections are not permitted but in case of necessity and with the permission of the doctor they can be obtained from the stock of the nursing office and in some cases from CCU and after using it, the empty container and the prescription of the narcotic should be submitted to the CCU or nursing office. After using the medicine the empty container together with the prescription of it will be attached to the file of the patient with a report including the doctor inscribing it, the person who has injected it and the Matron of the hospital would sign and stamped it. This report will be submitted to drugstore in two copies (this copy will be registered in the book of the narcotics and the relevant system) and one copy would be submitted to the narcotic office of the province and the other one will be attached to the file of the patient after labeling the price for it. After receiving the medicine from the office of the narcotic medicines a store receipt is issued for it and the availability of the stock is registered in the system and book of the narcotics. The drugstore would submit a new full narcotic against receiving the empty one and the prescription to be replaced [7]. The important notes considered by a hospital staff today are as follows: 1- prescription requesting stock should be with the signature of the doctor in charge of the ward the Anesthesiologist or the person in charge of the operation room. 2- Against each injection one prescription should be written and in each of them more than one injection shouldn't be prescribed. 3- Anesthesia injection due to their utilization for a couple of patient or vice versa are not included in this rule. 4- With each prescription one empty container of the medicine should be submitted to the drugstore and the drugstore cannot accept the prescription without the empty container (the prescription for Anesthesia medicines are exempt from this rule). 5- the narcotics in medical centers and hospitals should be utilized for clinical patient 6- the drugstore of a hospital is only permitted to give the provision of two days of the award or operating room as stock supply in the custody of the Matron of the ward or the person in charge of the operating room (this supply or stock should be deducted from the availability and be registered in the sealed book). 7- it is necessary that the list of the stock items of the narcotics will be prepared in two copies and one will be kept in the drugstore and one in the nursing office. 8- the Matron of the ward at the end of each shift should count the narcotics and their empty containers and after registering them in the daily report of the ward, and give it to the Matron of the next shift together with the key of the place they are being kept, it should be in a way that the day and time of occurrence of any event should be able to inspect. 9- Inspectors of the food and medicine deputy of the university are obliged to inspect all the medical centers who are receiving narcotics and in the event of observing any violation make a report of it and follow the violators. It is obvious that supervising that all the mentioned rules are being followed in the utilization of narcotics is in the charge of the head of the relevant Medical Sciences University and the deputy of the food and medicine of the relevant organization [8]. In this paper we are studying on of the operating rooms in a hospital so that we can have an estimate from the relative decrease and increase and decrease the efficiency in the manual and proposed system. According to observations, in the ward of the research there is 86 staff in 3 shifts. If we calculate the working hours of each staff in this ward and add all the working hours of all the personnel of the ward (in one day), the work which is done in this ward is equal to 600 working hours. On the other hand on an average basis for going through the above process for each patient we need 90 minutes. And if we multiply this time to the number of the patients who are needing narcotics (35) in one day, the result would present us with the time needed for providing the narcotics to all the patients. In this case for the 35 numbers of patients we need 3150 minutes (53 hour) of time so that we can give them the narcotics. And when comparing this time with the total time of working hours in the ward in one day, we can see that it occupies 9% of the time of each day. And this time in a year is equal to 20000 hours and equal to 810 days. This wastage of time is equal to 657730000 of Rial and in fact is a loss.

2. Problem Statement

Study on providing better services to patients in the minimum time possible and also improving the conditions of the nursing staff and decreasing the wastage of time of the personnel and also increasing the accuracy rate in providing the services to patients are among the goals which has been discussed more often and so much in scientific and medical communities and by providing and proposing this system we have tried to remove and solve some of the problems. The intelligent system of narcotic medicines is an electro-mechanical system which takes the responsibility of receiving and submitting the medicine from nurses according to the instructions of a PC like a robot. The advantages of this system

are the following: 1- the high speed of giving the medicine to the nurse, 2- lack of necessity to go through the office processes for only receiving an injection, 3- the high security due to the control system with the use of finger print and the systems for processing the image (for recognizing and authentication of the empty container), 4- following the process of receiving the empty container of the medicine by the system would increase the security of the system, 5- connection with PC and sending necessary alarms to the nursing office and the possibility of supervising all the receipts and 6- more satisfaction of patients in receiving pain relievers due to the ease of receiving process.

3 . Materials and methods

For solving we will propose a system. For this purpose we have designed a device that this device would perform all the above mentioned processes in an intelligent manner and there will be no need to go through heavy and lengthy official processes for receiving one medicine. This device would work as a computer in a network that the central PC is connected through the ground and satellite links to the main Server or host. The fingerprint of the authorized people would be registered in the system as ID and give them the permission to use the system and in this way in every ward there would be a system installed which is called the medicine bank and the narcotics are kept in that. The internal structure of this system is a kind of refrigerating medicine container and when a patient is in need of narcotics, the nurse informs the doctor about this. The doctor with the accompanying scanner which has been designed for him, give the permission of receiving the medicine to the nurse and then the nurse will enter her finger print in the scanner section of the system. The system will downloads the specifications of the user from the central server and in the case that the person is authorized the permission to use the system will be issued otherwise even the display page of the device will not be activated. In the event that the person is an authorized user, the display page will be activated and the user can choose the type of the required medicine and receive it. It should be mentioned that the whole processes of receiving the medicine and giving back the empty container to the system, is registered by the memory of the system on the specification of the person who has received and submitted it with the date and time of it. And all this information is available so that they can be inspected in case of necessity. After injecting the medicine, the nurse will again refer to the system and submit the empty container to it and enters her finger print to the system. In this case the system by processing the image, will evaluate the authentication of the empty container and registers the process in the file. Also if a nurse would receive a medicine and until the end of her or his shift will not submit the empty container of it, the system automatically fine the file of the nurse and an alarm would appear on the main display page of the server. It should be mentioned that the system performs all the accounting process of the medicines automatically and gives the report to the head of nursing and the authorized individuals. This device has the following technical specifications: 1- is based on the packages switching 2- the high speed of communication and the least delay in the internal points of the network 3- the cells are sent to the destination with the same order 4- ability to use it in different speeds, even connecting with different speeds to the network 5 – sending inconsistencies based on creating a path (connection oriented). 6- use of virtual channels for communication 7- eliminating the ability to evaluate and correcting the errors and transferring these tasks to upper layers. 8- dividing the traffic according to the different specifications of the quality of the service. 9- How the system recognizes the identity of the nurse: first, the identity of the nurse system ATM is identified. One nurse is having the responsibility to create the Use Case manuals that play the role of a user or the nurses of the systems in a defined way. Of course it is in the case that it has been defined by the system. This subject is a transaction and it has a result and output. The authorized nurses can be a person who uses the hardware. A nurse necessarily is not a physical element, for example a physical element can only play the role of one or a couple of different nurses or vice versa. But a specific and recognized nurse can be a couple of physical elements and play their roles. The device of finger print registration and automatic keeper which are the elements of an ATM, should be able to accurately and cautiously evaluate the identity of the nurse who is need the system and recognize the fact that she or he is authorized or not. Function: the process of receiving the medicine and submitting its empty container has been described above, the estimated time for performing these processes is around 9 minutes. If in the same manner of the manual system, multiply this time to the numbers of patients (35) who need narcotics, the result would show the required time for providing this medicine to all the patients in need. In this case of 35 patients we need 315 minutes (5.2 hours) to provide them with the medicine. This time comparing to the total working hours of daily in a ward, would waste 0.9% of the working hours of each day and in a year this time is equal to 1900 hours. This amount of wastage is equal to 64532000 Rial of wastage expenses and in fact is the loss.

4 . Results

Comparing the gained results from the efficiency of the manual system and the proposed system we have: the expenses of this system has became 0.1 and in fact we have made equal to 90% of savings.

Table No. 1. The results obtained from the performed researches on the medical centers

Ward of hospitals	Saving in time	Decreasing probable errors	Increasing the accuracy of personnel	Rate of personnel satisfaction
ICU ward	85-95%	80-90%	90-95%	90-95%
CCU ward	85-95%	80-90%	90-95%	90-95%
Infection ward	85-95%	90-95%	80-95%	90-95%
Neurology surgical ward	85-95%	90-95%	80-90%	95-100%
General surgical ward	85-95%	80-90%	90-95%	95-100%

5. Conclusion

This system has a significant increase in the quality of the medical staff services including improving the efficiency of the hospital staff, eliminating the repetitive and unnecessary works and preventing human errors.

Generally the results of this research, which is the different ways of the medical centers which are the most important service section of each society, can equip them with more organized electronic services which would increase the quality of services, ease and more confident access to information and saving time and preventing human errors.

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