Implementation and Evaluation of Automated First Dose Dispensing at a Community Teaching Hospital in the USA

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Abstract. Automated dose dispensing is one of the perks of automated technology that has reduced the chances of error in medication dispensing and thus has increased the quality of patient care, especially of elderly and patients with multiple comorbidities that require multiple medications. The purpose of our study was to determine the difference in the amount of time pharmacists spend checking first doses before implementing a robot-filled first dose process. A descriptive study was performed by pharmacists to check the time taken for first doses before implementing a robot-filled first dose process. Data was collected from Medboard®, a web-based medication tracking system currently in use in central pharmacy. Data collection was done during November 1st until March 31st of 2014.The average time taken by central pharmacists to check first doses was 15.92 minutes. Total 162 dispensing errors involving wrong medication selection were caught. Of total 12 pharmacists 91.6% believed that robot first dose will succeed, 58.3% believed that it will increase the efficiency. More than half pharmacists had positive perception related to robot-filled first dose. Through this cross-sectional study we concluded that in central pharmacy at Midtown Medical Center in Columbus, GA where automated first dose dispensing system had not been established during the time of the study, errors were reported by pharmacists through a manual dispensing system. Moreover, pharmacists had a positive attitude towards implementation of an automated system as they believed that through this system the chances of medication errors will be reduced and overall effectiveness of medication dispensing will be increased. However, current study has been conducted on a very small sample size thus further studies are needed to evaluate the perception of pharmacists. A multicenter study maybe conducted and collaborate Midtown Medical center in Columbus with other health care facilities in a developing country to have more wider and representative population sample.

Keywords: Pharmacists; Perception; Automated dispensing dose; Medication errors

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1. INTRODUCTION

Medication errors are the most common problem for healthcare institution that can occur during in-patient and/or out-patient care. (1-3) even developing countries of high- income groups such as Saudi Arabia have identified major challenges in medication safety (21). However, these errors are preventable through advancement in technologies among healthcare institutions. (1, 2) Automated dose dispensing is one of the perks of automated technology that has reduced the chances of error in medication dispensing and thus has increased the quality of patient care, especially in elderly and patients with multiple comorbidities that require multiple medications. (1-4) Not only ADD has improved the dispensing of medication but it has also relived the workload of healthcare professionals so that they can serve more time for patients' care. (5)

Worldwide ADD is used in primary healthcare centers. In Sweden, Denmark, Norway and Finland ADD service are commonly practiced. (6-10)A case study of a 760-bed teaching, facility showed that by using the carousel dispensing technology (CDT); 96% reduction in errors that were done by technicians in picking the correct medication was reported. Not the only improvement in medication error was achieved but inventory savings of $125,000 was also achieved. (11) Moreover, many other studies worldwide documented medication safety and effective dispensing of medication through ADD. Studies conducted in 2012 by Sjöberg et al, in 2010 by Olsson et al, in 2008 by Johnell and Fastbom in Sweden, Wekre et al in 2010 in Norway, in 2009 by van den Bemt et al in Netherland all reported medication safety through ADD. (12-15)

In developing countries such as Riyadh region, Saudi Arabia centralized distribution is the commonly used model for inpatient pharmacies and none of the hospitals are using a robotic distribution system to automate the dispensing of unit doses and 21% uses automated dispensing cabinets (ADCs). It was revealed that inspite that hospital pharmacies in the Riyadh region are well developed in providing dispensing and administration services, further improvement by increasing the use of new technologies are required. (22)

Robot-Rx is one of several automated medication dispensing technologies that increases efficiency and accuracy in pharmacy while reducing the space requirements needed by medication inventories. (5) Medication storage, selection, restocking is being done with accuracy, control and compliance through this system. It utilizes barcoded medication dosage forms. Through this process only the process of documentation and administration of medication has been simplified but also the use of robot has made the overall process of dispensing very efficient and less time consuming. (5)

The pharmacy department at Midtown Medical Center is acquiring (Robot-Rx) for 24- hour cart-fill, automatically dispensing to envelopes imprinted with the patient's name and barcode. The patient-specific envelopes are then transported via carts to the nurse servers. The system is so accurate that pharmacists require to randomly check 5% on robotically picked medications. However, pharmacy department still needs to dispense first doses manually and central pharmacists need to check first doses before dispensing them.

The purpose of our study was to determine the difference in the amount of time pharmacists spend checking first doses before implementing a robot-filled first dose process

2. RESEARCH METHODOLOGY

A descriptive study was performed by pharmacists to check the time taken for first doses before implementing a robot-filled first dose process. Data was collected from Medboard®, a web-based medication tracking system currently in use in central pharmacy. Data collection was done during November 1st until March 31st of 2014.

Time taken for completing the dispensing process was tracked via Medboard®; measured from the time labels printed to the time pharmacist completed checking doses. In order to evaluate dispensing error rates before the implementation of robot first dose, data collection logs were created and posted at checking stations in central pharmacy. Pharmacists were trained to make one mark on the appropriate day on the data collection form for each wrong medication picked by pharmacy technicians. Errors identified by nurses on the floor were also measured.

Surveys were distributed by email to pharmacy staff before robot-filled first dose implementation. These surveys assessed pharmacy personnel's perception of pharmacy dispensing services and the related transparency in the process. The questions were designed with answers in rank order and therefore were of valuable in providing a subjective measure of quality at that point in time.

During data collection, patient identifiers were replaced with a random anonymous study identifier. The random study identifier was secured on a protected electronic file accessible only to the research team. All data collection was conducted at Midtown Medical Center, Columbus Regional Health. Every effort was made to protect and secure patients' health information.

3. RESULTS

The average time taken by central pharmacists to check first doses before implementing a robot-filled first dose for the total of five months before was 15.92 minutes. During this same time period, 162 dispensing errors involving wrong medication selection were caught before the medication reached the patient. This represents approximately 0.14% of total doses dispensed. Of these, 155 technician errors were caught by the pharmacist and seven pharmacist errors were caught by the nurse. (Fig 1)

Overall, central pharmacy staff had more favorable attitudes about the use of the robot for the first dose before its implementation. Of total 12 pharmacists 91.6% believed that robot first dose will succeed, 58.3% believed that it will increase the efficiency and 75.0% believed that frequent robots breakdown should be anticipated. (Fig 2)

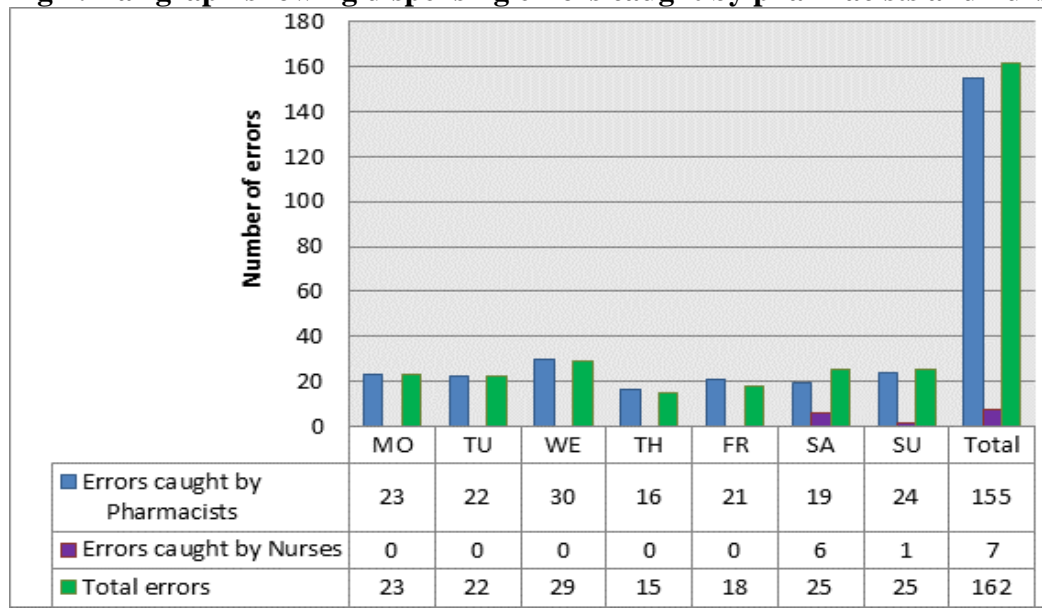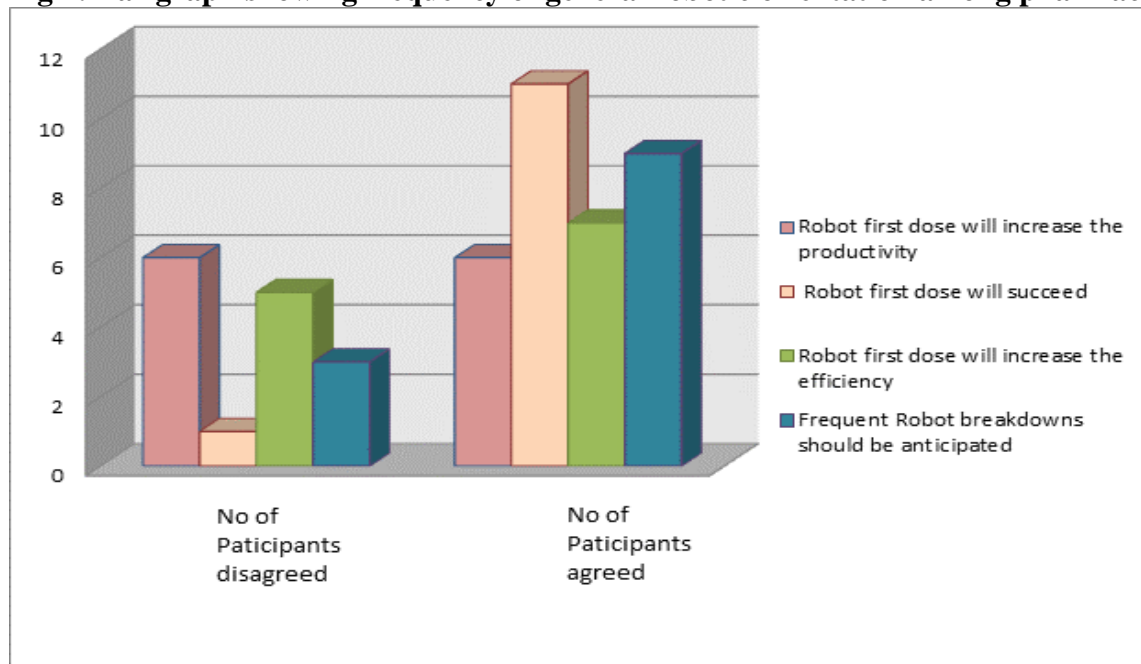**Fig 1: Bar graph showing dispensing errors caught by pharmacists and nurses**

|	MO	TU	WE	TH	FR	SA	SU	Total
Errors caught by Pharmacists	23	22	30	16	21	19	24	155
Errors caught by Nurses	0	0	0	0	0	6	1	7
Total errors	23	22	29	15	18	25	25	162

Fig 2: Bar graph showing frequency of general robotic orientation among pharmacist

Regarding the general perception of pharmacists towards robot-filled first doses only 16.6% agreed that robot first dose will make them less useful as a worker, 33.3% agreed that it will reduce their job security and it will reduce the workload from individuals. Moreover, 50.0% agreed that it will enhance the opportunities to provide pharmaceutical care however 50.0% disagreed. Lastly, 58.3% agreed that it will free up time for more professional activities. (Fig 3)

Fig 3: Bar graphs showing frequency of general perception of pharmacists towards robot-filled first dose
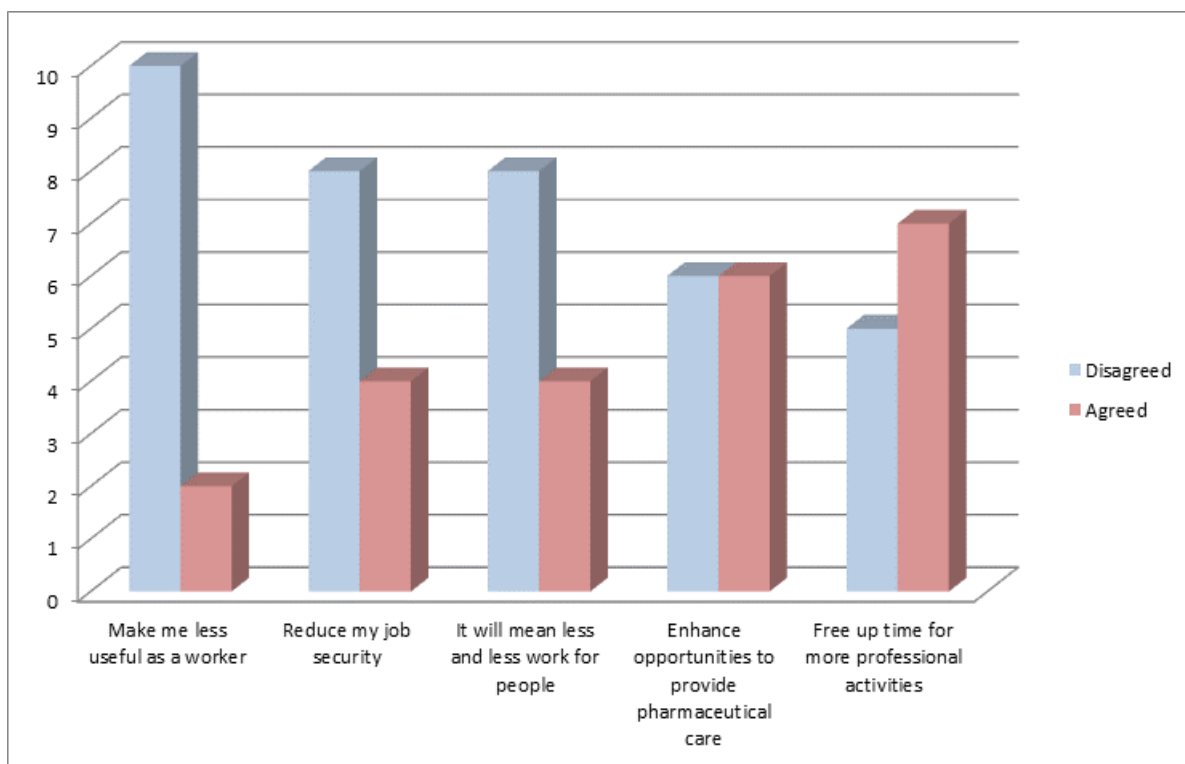
4. DISCUSSION

Through this cross-sectional study, we aimed to explore the perception of pharmacists towards the implementation of robot-filled first dose. Main findings of this study include that in the period of 5 months total 162 dispensing errors were caught, of which 155 were caught by a pharmacist. Regarding implementation of robot-filled first dose, most of the pharmacists had a positive response in terms of increase productivity and efficiency. Moreover more than half had positive perception about implementing robot-filled first dose. Literature has shown that medication errors are common and could create great trouble to the patients. Many factors such as work environment, workload, communication and lack of knowledge could cause such errors by technicians, pharmacists and doctors. (16) Thus invention like robot filled dispensing of medication has not only reduces the workload but has also improved the current practices related to the dose dispensing and thus has reduced the overall rate of errors. A Study conducted among nurses in 2000 regarding their perception towards reliability of an automated medication dispensing system, reported that nurses were distrustful and skeptical about the functioning of such automated system. (17) Unlike the findings of our study nurses were less influenced by the idea of automation for dispensing of medication. However recently a study conducted in 2010 reported that most of the nurses favored the use of automated dispensing system as it reduced overall medication error in the intensive care unit. (18) Moreover, a study conducted in the USA among pharmacist also reported that pharmacists believed that automated dispensing systems are

less likely to contribute to dispensing errors and thus they favored it over the manual system. (19)

Regarding job security, we found that pharmacists were less worried about their job security, likewise, a qualitative study also reported that these automated systems have not threatened the pharmacists in the past as pharmacists have restricted the use of this automation in order not to risk their own jobs. (20) As our study was conducted before the implementation of robot-filled first dose it is difficult to predict long- term behavior of pharmacists.

Nevertheless, current findings reported that pharmacists of our setting are contended to welcome this innovation and they are less threaten their job security and are more positive that through such intervention they will get some extra time to spend on other professional activities.

Through this study, we tried to provide the perception of pharmacist towards robot-filled dose. Further studies are needed to be conducted on this topic as the present study has been conducted on a very small sample. Further multicenter studies with large sample size are needed to evaluate the perception of pharmacists. Moreover, we need to evaluate the perception of pharmacists after the implementation automated dispensing system.

5. CONCLUSION

Through this cross-sectional study we concluded that in central pharmacy at Midtown Medical center in Columbus where automated dose dispensing system had not been established during the time of study, errors were reported by pharmacists through manual dispensing system. Moreover pharmacists had positive attitude towards implementation of automated system as they believed that through this system the chances of medication errors will be reduce and overall effectiveness of medication dispensing will be increased. However, current study has been conducted on a very small sample size thus further studies are needed to evaluate the perception of pharmacists. A multicenter study maybe conducted and collaborate Midtown Medical center in Columbus with other health care facilities in a developing country to have more wider and representative population sample.

CONFLICT OF INTEREST

No conflict of interest

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