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Redesigning Medication Delivery System of Compounded Medications: Interventional Evidence from Tertiary Care Hospital

Farhat Zaheer
Dept. of Pharmacy,
Aga Khan University hospital, Karachi, Pakistan

Nosheen Zehara
Dept. of health management,
Institute of business management, Karachi, Pakistan

Abstract:- The main objective of this project was to enhance quality of compounding services in ambulatory care pharmacy of a tertiary care hospital by reducing turnaround time through process redesigning. PDSA (Plan-do-study-act) cycle was adopted for this project. Pre and post intervention data was analyzed using SPSS software. The findings showed that Cycle time from 2 hours to 0.6 hours for non-sterile preparations . P-value determined through statistical analysis was less than 0.05% rejecting null hypothesis.

Keywords:- *Compounding pharmacy, Process redesigning, product standardization, Process time, Turnaround time.*

I. INTRODUCTION

Health care organizations in today's world have been facing numerous challenges in terms of resource allocation Vis~a ~ Vis customer satisfaction. In health care organizations, one of the major issues is how to enhance customer satisfaction and bring efficiencies in business process. Health systems are afflicted by challenges such as timely access to services, reduced waiting time, customized care, and fulfillment of individual patient's needs (Rust, 2012). In health care set-up, there is a need to redesign operational processes and systems and to assess the impact of improvement strategies on cost effectiveness and operational performance of the health care institution (Smits, 2010; young et al, 2004; Bower and Gilbody, 2005).

There are various international standards like USP <797> for sterile compounding and USP<795> for non-sterile compounding (Kestango, Bradshaw; 2004) providing complete guidelines and standards pertaining to compounding services. Compounding enhances patients Compliance in circumstances where traditional dosage form doesn't fulfill the individual patient's need. It requires specialized set-up, training, handling, verification, and environmental control to ensure safe preparation and dispensation. Keeping in mind the increasing demand and volumes of patients with customized needs, the compounding pharmacy of a tertiary care hospital took innovative steps and redesigns its business process. This study has been conducted to evaluate the impact of process redesigning and innovative strategies to reduce turn around timings of non-sterile compounding medications in an ambulatory care setting.

A. *Research Objective:*

To evaluate the outcome of process redesigning and other cost-effective strategies in improving the turnaround time of compounding pharmacy service in a private tertiary care hospital .

B. *Hypothesis:*

Process redesigning brings efficiency in Turn around timings of compounding pharmacy services.

II. LITERATURE REVIEW

Various articles and research work has been done to improve quality of service and customer satisfaction in health care organizations. One of the articles published in journal of health care management, authors discussed the effects of various factors on health care organizations in terms of demographics, increased customer expectation and increased competition which require health care organizations to undergo fundamental change and to seek new ways to bring efficiency and create future value. The article describes the use of balance score card that can be adopted to meet customer expectation and new challenges. The internal processes must satisfy current and future customer satisfaction. (N.W.Zelam, 2003).

In an article published in National center for biotechnology system journal, author discussed the role of health care organizations like AHRQ (Agency for health care research and quality), the joint commission and other health care organizations in the use of valid and reliable measures of quality and patient safety to improve health care.

In past few years, quality improvement methods have emphasized the importance of identifying a process with less ideal outcome and redesign its existing process and reassess the performance to determine if the change in process was successful. Author said that quality improvement projects emphasize on new strategies that appear to be effective. The article focused on standardization of care processes to enhance efficiency and redesigning care processes to maximize efficiency and effective ness, improving patient outcomes and satisfaction. (Grossman Claudia, 2011)

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Various standards have been described for sterile /nonsterile compounding medications and these standards help compounding practitioners to adhere the scientifically proven procedures and enhance safety and compliance of treatment.(Kestango, Bradshaw; 2004) In an article published American research journal, the author highlights the deficiencies in sterile compounding section. Author suggests that this is the filed which is being overlooked as compared to other aspects of health care system. The managers should redesign their standard operating procedures and practices. First they need to completely assess the operations and then they need to utilize that information in the development and implementation of operational processes to achieve low costs , expanded production capabilities , predictable outcomes , improved employee job satisfaction and retention of employees (Kestango , Douglas ; 1999)

III. OPERATIONAL DEFINITIONS

- **Nonsterile compounding services:** "The production of solutions, suspensions, ointments and creams, powders, suppositories, capsules administered through oral, topical, rectal routes.
- **Process redesigning:** Complete overhaul of core business process so as to bring radical change in performance measures such as cost reduction and quality of service.
- **Cycle time:** Time required completing an entire process, from its first to last step.
- **Study Design and Setting:** Quasi-experimental study with pre and post-test. This study was conducted in Compounding pharmacy section for non-sterile products at Private hospital.
- **Duration of Study:** The study took place over a period of 4 months. PDSA cycle was adopted.
- **Target Population:** Prescriptions of Non-sterile compounded medications received and compounded in pharmacy.
- **Sample Size:** Sample Size was 393 for non-sterile products.
- **Sampling Technique:** The difference between the timings of order receiving and dispensing was calculated. Secondary data (data used for operational aspects) were used and relevant information extracted for study purpose. Sampling technique was Simple random.
- **Project Goal:** 45% improvement in turn around timings of non-sterile products. (PDSA methodology was used (also known as Deming's cycle)
- **Proposed interventions:**
  - Business process redesigning by differentiating between urgent and non-urgent operational tasks and redesigning staff activities and timings.
  - Product standardization of formulations with high volumes, fixed composition, and longer stabilities.
  - Preparation in bulk quantities of products having longer stability during evening shifts so as to reserve daytime / peak hours for extemporaneous preparations and urgent tasks.
  - Pre-packaging and stock keeping of compounded drugs (non-sterile) in ambulatory care pharmacies for immediate dispensing and reducing drug transportation time.
- **Study Variables:** Quantitative variables were used like order receiving time, order delivery time , number of products standardized, quantity of standardized products dispensed in pharmacies.
- **Data Analysis Procedure:** Data was analyzed using SPSS version 20. Paired T-test was applied and p values less than 0.05 considered as significant.

IV. RESULTS AND ANALYSIS

Activity #	Description	Cycle time (minutes)
1.	Compounding prescriptions received in OPD pharmacy	N/A
2.	Order verification and processing by pharmacist	5 minutes
3.	Label printing in Compounding Section	5 minutes
4.	Compounding pharmacist receives and verifies the label	7 minutes
5.	Ingredient's selection , calculation, and preparation	70 minutes
6.	Final drug checking	80 minutes
7	Delivery in respective pharmacy and documentation	120 minutes
	Total Cycle time	**120 minutes (2 Hours)**

Table 1: Cycle Time for Non-Sterile (Pre-Intervention)

Table 1: shows Cycle time of non-sterile drug before Process redesigning from receiving till final dispensation.

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Activity #	Description	Alternate process	AVERAGE CYCLE TIME
1	Compounding prescriptions received in OPD pharmacy		
2	Order verification and processing by pharmacist	-	5 minutes
3	Label printing in compounding section	-	5 minutes
4	Compounding pharmacist receives and verifies the label	-	2 minutes
5	Extemporaneous product	5a : Standardized Product	
6	Ingredient selection, calculation, preparation, checking.	6a: Drug filling, checking and Labeling.	20 minutes
7	Drug delivery in next round	7a : drug delivery in next round	38 minutes
	Total Cycle time		**38 minutes (0.6 hours)**

Table 2: Cycle Time of Non-Sterile (Post Intervention)

Table 2: shows Total Cycle time reduced from 2 hours to 0.6 hours indicating 70% improvement in Cycle time after process redesigning and interventions

V. STATISTICAL ANALYSIS

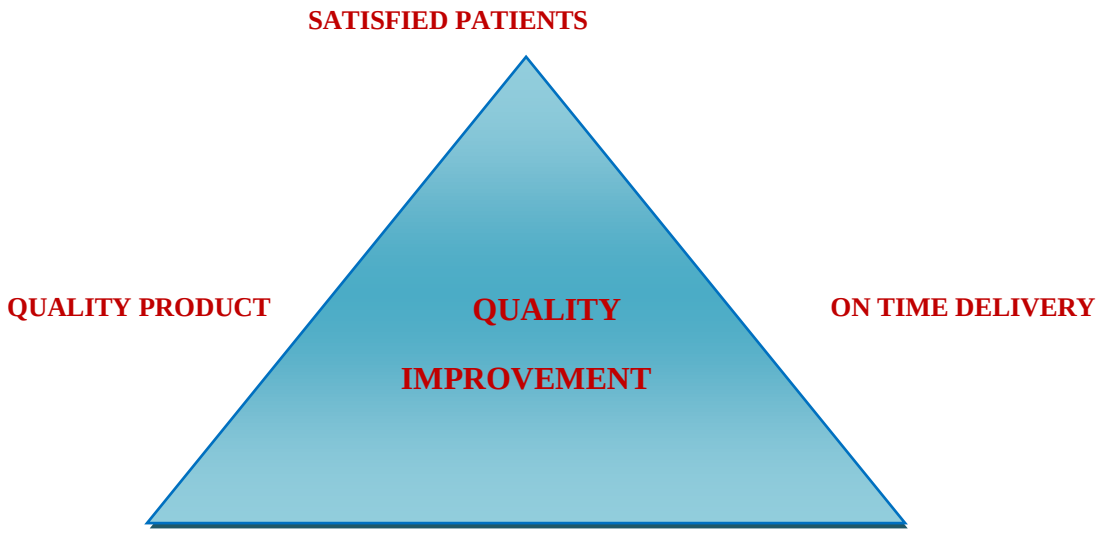
Paired Samples Test (Paired T test)									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pre - post	1:26:30.687	1:55:39.112	0:05:50.032	1:15:02.512	1:37:58.862	14.829	392	.000

Table 3: Paired Samples Test of Non-sterile drugs

Table 3: shows Pre and Post T-test for non-Sterile drugs. P-value is .000 which is less than 0.05 and statistically significant, therefore we can reject null hypothesis

VI. CONCLUSION

Health care organizations have been facing multifaceted challenges that demands efficient delivery of services, compliance of quality and health care standards and patient's satisfaction. Any delay in the provision of health care service may lead to dissatisfaction among patients and healthcare providers. There is a need to identify real bottlenecks of process flow by redefining the work and change the underlying processes . Our Study proved that process redesigning has been successful in reducing patient's waiting time and in fulfilling patient's focused needs in health care organization. Operational processes need to be redesigned in order to achieve desired outcome. Post intervention results depicts that quality of the product doesn't compromised due to bulk manufacturing/standardization and product retained its efficacy and shelf life. The process redesigning resulted in delivery of quality product to the patient with significant improvement in turnaround time.



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VII. RECOMMENDATIONS

- Healthcare systems in developing countries need interventions that are more creative, workable, and less expensive. Health care managers need to build systems that are directed to the heart of problems. They need to make best use of existing human and economic resources.
- Process redesigning and reengineering are fundamental for enhancing quality and efficiencies in business processes especially in complex health care environment. Radical changes in complex and sensitive health care organizations can only be achieved through proper training and development of health care professionals, managers, and clinicians.
- Periodic gap analysis and satisfaction surveys would help identifying the grey areas and future strategies for improvement and redesigning of core processes.

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REFERENCES

[1.] Andersen, O., Zweidorff, O. K., Hjelde, T., & Redland, E. A. (1995). [Problems when swallowing tablets. A questionnaire study from general practice]. *Tidsskrift for den Norske laegeforening: for praktisk medicin, NY raekke*, *115*(8), 947-949.

[2.] Cain Carol , Haque Saira (2008); Patient safety and quality , organizational work flow and its impact on Work Quality

[3.] Chapter 31 . http://www.ncbi.nlm.nih.gov/books/NBK2638/ Colen, H,Neef.c,Schuring, R.W Pharmacy World and Science June 2003, Volume 25, Issue 3, pp. 118-125

[4.] COMPOUNDING, N. Practice Spotlight: Compounding Pharmacy Coyne, P. J., Hansen, L. A., & Watson, A. C. (2003). Compounded Drugs: Are customized prescription drugs a salvation, snake oil, or both .*AJN the American Journal of Nursing*, *103*(5), 78-85

[5.] Flynn, E. A., Pearson, R. E., & Barker, K. N. (1997). Observational study of accuracy in compounding iv Admixtures at five hospitals. American Journal of Health-System Pharmacy, 54(8), 904-912.

[6.] Giam, J. A., McLachlan, A. J., & Krass, I. (2012). Characterizing specialized compounding in community pharmacies. *Research in Social and Administrative Pharmacy*, *8*(3), 240-252.

[7.] Kalman, M. K., Witkowski, D. E., & Ogawa, G. S. (1992). Increasing pharmacy productivity by expanding the role of pharmacy technicians. *American Journal of Health-System Pharmacy*, *49*(1), 84-89.

[8.] Kastango, E. S., & Bradshaw, B. D. (2004). USP chapter 797: establishing a practice standard for compounding sterile preparations in pharmacy. AMERICAN JOURNAL OF HEALTH SYSTEM PHARMACY, 61, 1928-1937.

[9.] Kastango, Douglass (1999); International Journal of Pharmaceutical CompoundingVol.3 No.4

[10.] Lee Thomas, Portar (2013); The strategy that will fix health care , Harvard business review , Oct 2013

[11.] Lombardo, A., Morabito, G., & Schembra, G. (2004). A novel analytical framework compounding Statistical traffic modeling and aggregate-level service curve disciplines: network performance and efficiency implications. Networking, IEEE/ACM Transactions on, 12(3), 443-455.

[12.] Myers, C. E. (2013). History of sterile compounding in US hospitals: Learning from the tragic lessons of the past. Am J Health Syst Pharm, 70(16), 1414-1427.

[13.] McPherson, T. B., Fontane, P. E., Jackson, K. D., Martin, K. S., Berry, T., Chereson, R., & Bilger, R. (2005). Prevalence of compounding in independent community pharmacy practice. *Journal of the American Pharmacists Association: JAPhA*, *46*(5), 568-573.

[14.] Page, Susan, The power of business process improvement

[15.] Rust, T., Saeed, K., Bar-On, I., & Pavlov, O. Re-designing policy and process in health care service delivery: a system dynamics case study.

[16.] Rusho, W. J. (1996). Clinical issues and concerns in the use of extemporaneously compounded medications. Journal of Pharmaceutical Care in Pain & Symptom Control, 4(4), 5-20.

[17.] Smits, M. (2010). Impact of policy and process design on the performance of intake and treatment processes in mental health care: a system dynamics case study. Journal of the Operational Research Society, 61(10), 1437-1445.

[18.] Varkey, P., Reller, M. K., & Resar, R. K. (2007, June). Basics of quality improvement in health care. In *Mayo Clinic Proceedings* (Vol. 82, No. 6, pp. 735-739). Elsevier.