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ASSESSMENT OF KNOWLEDGE AND PRACTICE OF PHARMACEUTICAL INVENTORY MANAGEMENT AMONG PHARMACY PROFESSIONALS

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ABSTRACT

Aim:

The main objective of our study was to assess the Knowledge and Practices in inventory control management among pharmacy professionals in Chennai, South India.

Methods:

This prospective cross-sectional study was carried out for a period of three months. The knowledge and practice assessment questionnaire was developed and it was cross verified by expert committee of members. Pharmacists of community and hospital of either gender who were willing to participate were included in the study. The details of the pharmacists including the socio-demographic parameters were collected and recorded. Statistical analysis of the data was performed by using SPSS version 23. Qualitative data were presented as frequency and percentage. Quantitative data were presented as mean and standard deviation. Chi square test was used to find the difference between the categorical variables.

Results:

A total of 80 pharmacists satisfying the inclusion criteria were enrolled in the study. The pharmacists have better knowledge about the inventory management. A statistically

significant difference was observed in managing inventory ($p = 0.003$), maintaining the register ($p = 0.042$), and frequency of monitoring the stock ($p = 0.014$) between hospital and community pharmacist.

Conclusion:

Our study revealed that hospital and community pharmacists have a moderate level of knowledge of inventory management. Based on the results of this study, it is obvious that in order to enhance the efficiency and efficacy of the pharmacists, more training initiatives and education about inventory control is essential.

Keywords: Knowledge, Practice, Pharmacist, Inventory

INTRODUCTION

The pharmaceutical sector plays a crucial role in preserving and improving both human and animal life. In our industry, integrity is non-negotiable. Security, identity, and quality are the top preservation priorities. In pharmacy operations, inventory represents the stockpiled medicinal products intended for future patient requirements [1]. The inventory of the pharmacy, with its escalating value due to the increasing variety and cost of pharmaceutical products, is its greatest asset. For pharmacies, efficient inventory management is essential for both operational success and financial stability. An organization's inventory represents a detailed record of its owned assets, including supplies, medications, and machinery. Maintaining an optimal stock level for medicine supplies reduces buying and stocking costs [2].

Managing the flow of drugs from suppliers to storage facilities and eventually to point-

of-sale is termed pharmaceutical inventory management. Proper stock levels are maintained through the process of ordering, receiving, stocking, issuing, and reordering, all while preventing overstocking and stock-outs. Effective management minimizes wastage, and holding costs, and facilitates decision-making and demand forecasting. Properly managing inventory financially reduces pharmaceutical product costs and related expenses, boosting gross and net profits [3]. In a pharmacy, inventory costs comprise shortage costs, carrying costs and procurement costs. The costs related to product storage, including those due to emergencies, are called carrying costs. The costs incurred while purchasing goods, including order submission and receipt, stocking, and invoice payment, are known as procurement costs. The lack of goods on the shelves results in stock out or shortfall charges [4].

The goal of inventory management in pharmacies is to ensure drug availability for patients while reducing pharmaceutical costs. Properly managing prescription stock, including using prescriptions before they expire and routinely processing returns, can lower medication costs [5]. Nearly one-third of a hospital's annual budget is allocated to purchasing supplies, such as medications, with pharmacies grappling with challenges like manual inventory tracking, uncertain demand forecasts, limited real-time visibility, and expiration management.

Diverse inventory management strategies are used for pharmaceutical spending analysis. ABC-VED (Always Better Control- Vital, Essential, Desirable) analysis is the most widely used technique for evaluating medication expenses due to its ability to consider both public health significance and cost implication [6].

Inventory control management commonly involves ABC and VED analysis techniques. ABC analysis categorizes items based on their investment capital using the Pareto principle to distinguish major contributors from minor ones. The impact of drugs is assessed based on their usage and cost. Through critical values and deficiency costs, VED analysis evaluates items. The ABC-VED matrix, a combination of ABC analysis and VED

analysis, enables substantial control over material supplies. The ABC-VEN analysis categorizes health commodities for effective inventory management [7]. Category I comprises essential, costly, and rapidly moving healthcare products for patient care. These items require cautious monitoring as they hold a substantial investment. Category II consists of moderately priced, vital healthcare delivery products. Though not as vital as Category I items, they remain essential for providing excellent care. Category III products, which are non-essential and less expensive, serve ancillary roles in healthcare operations. Healthcare facilities can effectively allocate resources by categorizing commodities based on their clinical importance and cost [8, 9]. Implementing systematic, selective, and scientific inventory management techniques such as ABC and VED analysis in the institute's pharmacy development stages could prioritize and improve planning for critical items and areas, ultimately enhancing patient care. The stocking of less frequently used drugs with short expiry dates can also be justified [10]. We evaluated pharmacists' knowledge and practices in inventory control management through a questionnaire survey. Hospital and community pharmacists' were compared regarding their knowledge and practice of inventory management. The goal

of this study was to assess pharmacy practitioners' proficiency in applying various inventory management systems. Evaluating pharmacy staff members' inventory management abilities is crucial for effective delivery of healthcare services. By examining staff members' application skills and understanding of concepts like expiry management, VED analysis, and ABC analysis, healthcare companies can evaluate and enhance their inventory control procedures. Measuring pharmacy personnel's competence with inventory management systems and tools can optimize inventory, reduce waste, and ensure pharmaceutical access for patients. To maximize healthcare services and improve pharmacy practitioners' efficacy, ongoing assessment and training are essential.

MATERIALS AND METHODS

Study design:

This prospective cross-sectional study was carried out in and around Chennai for a duration of three months after obtaining permission from the Institutional Ethics Committee.

Inclusion and exclusion criteria:

- The participants must be either a hospital pharmacist or a community pharmacist in and around Chennai.

- The participants must be pharmacy graduate with any degree of D.Pharm, B.Pharm, M.Pharm or Pharm.D .
- Pharmacists not willing to participate were excluded from the study.

Data collection:

The sample size was found to be 80 using epi-info software. Data was collected using a specially designed questionnaire. We have done a preliminary literature review to outline our protocol and have designed a questionnaire form to document the data. The form included participant's details consisting of age, gender, educational qualification, year of graduation, work experience, type of pharmacy, location of pharmacy, ownership of pharmacy, number of persons working in pharmacy, working hours of pharmacy, leisure hours per day, working type, a questionnaire framed to assess the knowledge and practice of inventory management among pharmacist. The form was collected through face-to-face interviews from the pharmacists of Chennai. The questionnaire has two sections in which the first section contains 9 knowledge-based questions, and the second section contains 13 practice questions. The questionnaire consists of a total of 22 questions.

Validation of questionnaire:

A pilot study is a small-scale exploratory investigation carried out to refine the study

design prior to the execution of the main research project. Fifteen people participated in a pilot study. Based on the results obtained from the pilot study participants, the study design remained unchanged, and the questionnaire is subjected to content validation by an expert committee of members, consisting of faculty members of pharmacy background and hospital pharmacists.

Statistical analysis:

Data were analyzed using the statistical package for the social sciences (SPSS) version 23.0 (IBM corp., Armonk, NY, USA). Demographic variables and responses to the knowledge and practices questions were represented using descriptive statistics. Chi-square test was used to analyse the difference between the categorical variables.

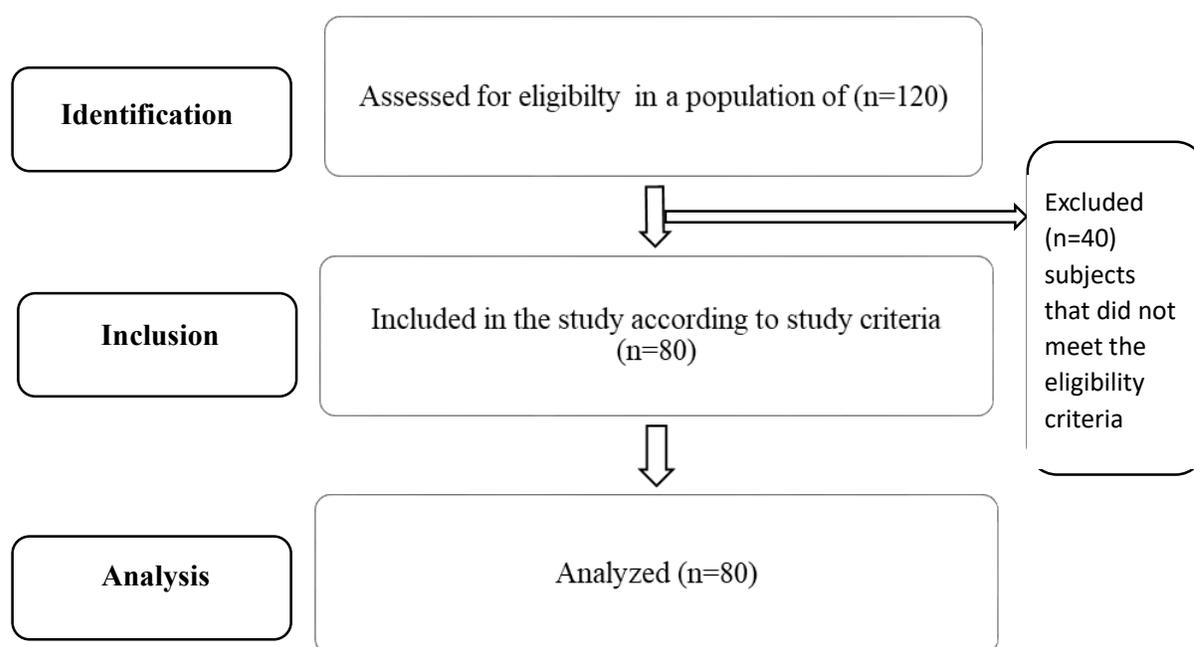


Figure 1: STROBE flow chart

RESULTS

The demographic details of the study participants are shown in table 1. The study comprised of 80 pharmacists, of which 40 were community pharmacists (CPs) and the other 40 were hospital pharmacists (HPs). The mean age of the participants was similar in the two groups: HPs averaged

27.97±7.86 years while CPs averaged 27.30±7.00 years. The participants' gender distribution showed that 46% were female and 54% were male. There was no statistically significant difference ($P = 0.1782$) in the gender distribution between the two groups.

Table 1: Demographic Details of the Study Participants

Parameter	Total (n=80)	Community Pharmacist (n=40)	Hospital Pharmacist (n=40)	P value
Age	27.3±7.40	27.30±7.00	27.97±7.86	0.6864
Gender				0.1782
Male	43(54)	18(45)	25(63)	
Female	37(46)	22(55)	15(37)	
Education				0.0946
D. Pharm	22(30)	7(18)	15(38)	
B. Pharm	49(61)	26(65)	23(57)	
M. Pharm	2(2)	2(5)	-	
Pharm. D	7(9)	5(12)	2(5)	
Working Hours	8.15±2.25	7.23±1.55	8.97±2.53	0.0008*
Work Experience				0.1550
<1 year	34(43)	21(53)	13(32)	
1-5 years	24(30)	9(23)	15(38)	
5-10 years	17(21)	9(22)	8(20)	
>10 years	5(6)	1(2)	4(10)	

Most participants had a Bachelor of Pharmacy (B. Pharm) degree; 57% of HPs and 65% of CPs owned this credential. Compared to HPs (5%), CPs (12%) had a slightly larger percentage of Doctor of Pharmacy (Pharm. D) holders. Nonetheless, (P = 0.0946) indicated that there were no statistically significant differences between the two groups' educational backgrounds. When it came to Working Hours and Professional Experience, CPs reported a daily average of 7.23±1.55 hours, which was less than HPs' 8.97±2.53 hours. In terms of professional experience, HPs

(38%) claimed 1–5 years of experience, whereas 23% of CPs.

The disparities in work experience across the groups did not reach statistical significance (P = 0.1550) despite these differences. In conclusion, there were no statistically significant variations found in the age range, gender distribution, educational background, or professional experience of CPs and HPs. Comparing HPs to their community colleagues, HPs reported working an average of more hours every day.

Table 2: Knowledge Assessment

Question	Option	Total (n=80)	Hospital Pharmacist (n=40)	Community Pharmacist (n=40)	P value
Awareness of the term 'INVENTORY'	Yes	55(69)	30(76)	25(63)	0.2283
	Partly	24(30)	9(22)	15(37)	
	No	1(1)	1(2)	0(0)	
Knowledge on 'Inventory control Techniques'	Yes	38(48)	22(55)	16(40)	0.0248*
	Partly	33(41)	11(28)	22(55)	
	No	9(11)	7(17)	2(5)	
Knowledge about 'ABC' analysis	Yes	44(55)	28(70)	16(40)	0.0048*
	Partly	23(29)	5(12)	18(45)	
	No	13(16)	7(18)	6(15)	
Knowledge about 'VED' analysis	Yes	33(41)	20(50)	13(32)	0.0246*
	Partly	23(29)	6(15)	17(43)	
	No	24(30)	14(35)	10(25)	
Knowledge about 'EOQ' analysis	Yes	31(39)	20(50)	11(28)	0.0274*
	Party	22(28)	6(15)	16(40)	

	No	27(33)	14(35)	13(32)	
Knowledge about 'FIFO' analysis	Yes	52(65)	23(58)	30(75)	0.2449
	Partly	9(12)	6(15)	3(8)	
	No	18(23)	11(27)	7(17)	
Awareness of the term 'Safety Stock'	Yes	62(78)	29(73)	33(83)	0.4621
	Partly	14(17)	8(20)	6(15)	
	No	4(5)	3(7)	1(2)	
Awareness of any software for inventory management	Yes	32(40)	17(42)	15(38)	0.8976
	Partly	17(21)	8(20)	9(22)	
	No	31(39)	15(38)	16(40)	
Knowledge on the calculation of 'lead time'	Yes	19(23)	17(43)	2(5)	0.0004*
	Partly	27(34)	9(22)	18(45)	
	No	34(43)	14(35)	20(50)	



Figure 2: Assessment of Knowledge

Table 2 exhibits the responses of participants to knowledge questions on inventory control management. The study covered the concepts of inventory management that pharmacists were aware of and knew. 69% of pharmacists affirmed they were aware of the phrase "inventory," with HPs (76%) and CPs (63%) reporting slightly higher levels of awareness ($P = 0.2283$). Pharmacists reported knowing "Inventory Control Techniques" in 48% of cases; HPs (55%) had better knowledge about it than CPs (40%) ($P = 0.0248$). 55% of pharmacists were aware of 'ABC' analysis in terms of specific approaches; HP (70%) had a greater understanding than CPs (40%) ($P = 0.0048$). 41% of respondents

claimed to be aware of the "VED" analysis; HPs (50%) and CPs (32%) had similar levels of awareness ($P = 0.0246$). 39% of respondents were knowledgeable about the 'EOQ' analysis; HPs (50%) were more knowledgeable than CPs (28%).

Awareness of the 'FIFO' analysis was similar among hospitals (58%) and CPs (75%), with an overall awareness of 65% and no significant difference between the two groups ($P = 0.2449$). 78% of pharmacists were aware of the term 'Safety Stock', and there was no significant difference between the two groups ($P = 0.4621$). There was limited awareness of inventory management software, with 40% of participants being knowledgeable,

indicating a minor contrast between HPs (42%) and CPs (38%) ($P = 0.8976$). 23% of respondents were knowledgeable about calculating 'lead time', with HPs showing significantly higher awareness (43%)

compared to CPs (5%) ($P = 0.0004$). **Figure 2** represents the knowledge scores of the respondents which represent poor (0-6), better (7-12), and good (13-18).

Table 3: Assessment of Practice

Question	Options	Total (n=80)	Hospital Pharmacist (n=40)	Community Pharmacist (n=40)	P-value
Using inventory	Yes	52(65)	30(75)	22(55)	0.100
	No	28(35)	10(25)	18(45)	
Manage inventory	Physical method	9(11)	0(0)	9(23)	0.003*
	Computerized	16(20)	7(17)	9(23)	
	Both	55(69)	33(83)	22(54)	
Using inventory software	Yes	56(70)	32(80)	24(60)	0.086
	No	24(30)	8(20)	16(40)	
Maintaining register	Hard copy	13(16)	3(7)	10(25)	0.042*
	Softcopy	17(21)	7(18)	10(25)	
	Both	50(63)	30(75)	20(50)	
Ever ran out of stock	Never	11(14)	6(15)	5(12)	0.948
	Sometimes	65(81)	32(80)	33(83)	
	Often	4(5)	2(5)	2(5)	
Had sufficient stock to fulfill consumer needs	Yes	74(93)	37(93)	37(93)	0.999
	No	6(7)	3(7)	3(7)	
Frequency of monitoring stock level	Everyday	47(59)	27(68)	20(50)	0.014*
	Weekly	19(23)	5(12)	14(36)	
	2 weeks once	3(4)	0(0)	3(7)	
	Monthly	11(14)	8(20)	3(7)	
Reordering the products at right time and right frequency	Yes	73(91)	37(93)	36(90)	0.999
	No	7(9)	3(7)	4(10)	
Calculate EOQ before ordering the products every time	Yes	27(34)	11(27)	16(40)	0.344
	No	53(66)	29(73)	24(60)	
Is adopted Inventory method efficient?	Yes	72(90)	33(83)	39(97)	0.056
	No	8(10)	7(17)	1(3)	
Have adequate facilities to warehouse the stock received	Yes	60(75)	33(83)	27(68)	0.196
	No	20(25)	7(17)	13(32)	
Factors affecting inventory	Seasons	29(36)	16(40)	13(33)	0.336
	Nearby clinic/hospitals	16(20)	5(12)	11(27)	
	Discount	24(30)	12(30)	12(30)	
	Services	11(14)	7(18)	4(10)	
Manage your Pharmacy, if the lead time is extended for a particular product	No stock/Refer nearby Pharmacy/Buying stock from other pharmacy	24(30)	8(20)	16(40)	0.141
	Use alternate product	8(10)	5(12)	3(7)	
	Use alternate brand	48(60)	27(68)	21(53)	

The responses of participants to practice questions are shown in **Table 3**. The research assessed how pharmacists (40 from hospitals, 40 from community

settings) manage their inventory. The study revealed that 65% of pharmacists utilized an inventory system, with a higher adoption rate seen among HPs (75%) in comparison

to CPs (55%) with no significance ($P = 0.100$). 69% of pharmacists utilized both manual and electronic management techniques, with HPs showing a higher preference (83%) compared to CPs (54%) ($P = 0.003$). Seventy percent of pharmacists utilized inventory software, with HPs (80%) more frequently using it than CPs (60%) ($P = 0.086$). In terms of keeping records, 63% of individuals used both paper and electronic copies, with HPs having a higher frequency (75%) compared to CPs (50%) ($P = 0.042$). Despite 81% experiencing occasional stock shortages, both groups had enough stock at the same rate (93%, $P = 0.999$), with HPs being more inclined to check stock daily (68% vs. 50%, $P = 0.014$). In terms of efficiency, 90% of pharmacists were satisfied with their inventory methods, with CPs showing higher satisfaction (97%) compared to HPs (83%) ($P = 0.056$). In addition, 75% said they had sufficient warehouse space, with HPs (83%) reporting higher adequacy compared to CPs (68%) ($P = 0.196$). In the end, 60% of pharmacists dealt with longer lead times by opting for different brands, with HPs (68%) doing so more often than CPs (53%) ($P = 0.141$).

DISCUSSION

Inventory Control management is vital in maintaining an effective pharmaceutical delivery, particularly in preventing stock-

outs and overstocking. It must be implemented and operated properly to provide effective health services and maintain its reputation [11]. The goal of this study is to highlight the important differences between HPs and CPs in terms of knowledge and practices related to inventory control management.

The study included 80 participants, equally divided between the HPs and the CPs. The average age of the participants was 27.3 years with the minimal difference between the two groups. Gender distribution showed a higher frequency of males in the HPs group than that of the CPs group, anyhow there was no statistical difference between the gender distribution ($p=0.178$). In contrast to this a study by *Sai Ashwini et al.*, showed more frequency of female pharmacists (75%) than that of male [13]. Educational background varied with a higher frequency of CPs holding a B. Pharm compared to their HPs. The diversity in educational qualifications among HPs, including a notable proportion of M. Pharm and Pharm. D degrees suggest that advanced education could play a role in enhanced knowledge of inventory control. Work experience and working hours also showed some differences but these were not statistically significant.

Overall, 69% of the respondents were aware of the term 'inventory' whereas the

HPs had a little higher awareness than CPs (76% vs 63%). There was a significant difference in knowledge about 'Inventory Control Techniques and specific analyses such as ABC, VED, and EOQ. Even in this the HP's had better knowledge than the CPs. In study written by *Tadesse Jobira et al.*, 60% of the respondents did not hear about the inventory control methods and 80% of the respondents did not know the methods used correctly [11]. The majority of pharmacy professionals working in health settings, as indicated by KIs response, did not receive any training on the subject before starting their jobs. Furthermore, institutions that aim to provide quality health services to the community have no plans for continuous professional development for their pharmacy professionals. Additionally, the emphasis on administrative and management components in pharmacy courses is limited in the curriculum [12].

In contrast to the gaps in knowledge, the basic concepts such as 'FIFO' (68%) and; Safety Stock (78%) were relatively high with no significant difference between the two groups. This suggests that there is good knowledge about certain topics in both groups but still require further training and education on inventory control. There was also no significant difference in the knowledge about using software for

inventory control. Software like the Hospital Information System (HIS) and Wondersoft were the common responses from the participants.

HPs are more likely to use computerized methods for managing inventory control as it may align with the need for sophisticated inventory systems in hospitals to handle larger stocks. Conversely, CPs predominantly used hard copies (0.042) for registries whereas HPs tend to use both hard and soft copies. This may be indicative of different scales and documentation required in community settings. In a study by *Saida Rashid Kochi et al.*, about 87.71% of respondents said record-keeping methods were mainly manual in medicine stores [14].

The two groups differ in frequencies for stock-level monitoring; CPs report greater weekly monitoring frequencies than HPs ($p=0.014$). The difference in stock levels and inventory turnover rates between community and hospital settings might be the cause of this discrepancy. There were no appreciable variations in the reordering methods of the two groups, which both showed high rates of reordering items at the proper periods and keeping enough inventory to satisfy customer requests ($p=0.999$). Furthermore, HPs exhibit a higher proportion of switching brands or products in response to longer lead times

($p=0.141$), indicating the flexibility required to maintain continuous pharmaceutical supply in hospital settings. Pharmaceutical supply system efficacy is impacted by a discrepancy in pharmacy professionals' professional understanding and application of inventory control management methods [12].

CONCLUSION

Inventory control is the heart of the pharmaceutical supply system. This shows that there are similarities in the knowledge and practices about inventory control anyway there were significant differences in certain areas such as knowledge of inventory control techniques, lead time, and analysis techniques. The complexity of hospital pharmacy systems likely contributes to the greater degree of knowledge and practices that HPs often display. Based on the results of this study, it is obvious that in order to enhance the efficiency and efficacy of the pharmacists, more training initiatives and education are essential. In the future we can further learn more about how inventory control management might affect pharmacy services in hospital and community settings by doing more studies on different strategies to enhance operational effectiveness and patient outcomes.

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