



Research Article

REVERSE LOGISTIC DISPOSAL PRACTICES OF HOUSEHOLD PHARMACEUTICAL MEDICINES AND ITS IMPACT ON ENVIRONMENT IN TRICHY, TAMILNADU, INDIA

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ABSTRACT

Reverse logistics refers to managing a supply chain in reverse direction from the consumers to the manufacturers. Reverse logistics is the part of supply chain management practice that flow of products and information from the customers to the manufacturers for the purpose of value recreate and proper disposal. To explore the knowledge, attitude, beliefs about drug wastage and methods adopted by customers to dispose unused medicines at home. Storing numerous medicines in the home or throwing excess medicines in the trash without first securing them can lead to misuse. This study reviewed various published journals and identified various disposal practices to build a conceptual model for disposal practices of household medicines. By extending that research, a specific study that carried out in Tiruchirappalli district in Tamilnadu state. A total of 300 customers were participated in this study from various medical stores. Questionnaire was aimed to examine the disposal practices of pharmaceutical medicines and its implication on environment. Collected data was analyzed by using SPSS. The main objective of this study is to estimate the quantum of medicines disposed by customers and its impact on environment.

KEYWORDS: Disposal of Medicines, Environmental hazards, Household medicines, Reverse logistics *practices*.

INTRODUCTION

Reverse logistics is defined as “all activities associated with a product/service after the point of sale, the ultimate goal to optimize or make more efficient aftermarket activity, thus saving money and environmental resources” Reverse Logistics Association, (2009). Reverse logistics is defined as the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recreate value or proper disposal”. The three activities of reverse logistics namely recycle, reuse, and disposal which can be applied on the basis of the reliability of medicines. The main purpose of reverse logistics is to reduce the handling cost while increasing the value from the goods, or proper disposal.

Reverse Logistics in Pharmaceutical Industry

Reverse logistics in the pharmaceutical industry is particularly important from the economic, environmental as well as regulatory point of view. Reverse logistics as process of handling of products back to manufacturers or producers end. Reverse logistics practices in pharmaceutical industry as four practices. That are donation, disposition, store, return and the disposal practices of unwanted medicines are throw (Threw them into the trash), flush (Flushed down into the toilets or sink), bury (Dumped in environment) and burn (Incineration). Several important considerations for the industry when it comes to reverse logistics are the safekeeping of the returned goods, maintaining the cost low with the assist of computerization,

traceability of the goods returned from the customer to the final point of disposition. People may not use all the medications provided to them due to side effect, treatment changes, withdrew the medication, or medicines reached the expiration date. Therefore, it is not unusual for patients to be in possession of unused or expired medications. Review of pharmaceuticals have been widely identified in the environment and in a few cases can lead to harmful effects on natural world.

The objectives of the study are a) To identify the major reasons for disposal of household medicines to the environment b) To identify the various disposal practices enhanced by the consumers. c) To estimate the quantum of unused or expired medicines kept at home (Solid, Semi solid, liquid medicines. d) To analyze the relationship between disposal practices and location of people. e) To analyze the relationship between demographic variables and aware about improper disposal. f) To find out the impacts to the environment by various disposal practices.

Literature Review

Kabir M I discussed the perception of those industry practices on the environment and sustainability practiced by organizations has shown less enthusiasm than once thought¹. Haidar Abbas and Jamal A Farooque discussed the logistics practice of pharmaceutical operations with return and disposal practices as throw, flush, bury, burn and return management². Manal El-Hamamsy conducted this study to know about the disposal methods of unused medicine, returned medicines to pharmacies and how cost in Cairo, Egypt with the variables: classified drugs

from pharmacies, disposal methods³. YC Tong A et al discussed the valid disposal practices is returning the medicines to the pharmacies will reduce the environmental issues. Suggested that a need for increased environmental awareness amongst community pharmacists in New Zealand⁴. Singh S et al discussed the strategic framework for reverse logistics with variables: Quality defect, Loss of effectiveness and proposed framework of Enterprise Resource Planning system for recovery⁵. Aghalaya S.N. et al analysed the difficulty affecting the reverse logistics processes in the Indian pharmaceutical industry⁶. Sreekanth K. et al analysed Reverse Logistics in the Indian Pharmaceuticals Industry with the variables: Forms of waste, Regulation, waste management approach, Drug characteristics⁷. Innocent A. Et al discussed the issues of incineration disposal method of waste management with objective to reiterate that incineration is not a sustainable waste management system⁸. Asante OB. Et al found out the practices of healthcare waste management and its impact, they analysed the health care policies of Ghana and enforces the local government to improve the current situation and to protect the environment and human health⁹. Natasha S. et al provided a solution for environmental impacts by pharmaceutical wastes. By various groups involved to make the environment eco-friendly¹⁰. Shailendra Kumar Mandal and Joydeep Dutta discussed the solid waste management plan for Patna city. A model is proposed by authors for the solid waste management (bio medical) to the institute of town planners¹¹. Vika Lutui discussed the Tongan waste management tends to impact on environment. They suggest the waste management practices with regulated policies, waste minimization initiatives¹². Liz Breen et al discussed the issue of how to reduce the volume of waste medicine by creating a framework with Customer advice and support, customer relationship management, product management, effective inventory management and drivers of customer compliance¹³. Md. Abul Kalam et al conducted this study with the aim that create awareness among the effect of environment by medicine wastes and suggested that to develop of public awareness and there is also need to develop dispensing policies & delivered to collection bag which deduction the volume of medication waste¹⁴. Ying Xie and Liz Breen Approach: Cross boundary green pharmaceutical supply chain resulted in fewer preventable medication waste and more recycling of inevitable medication waste, therefore improved environmental, economic and safety performances¹⁵. Ana Margarida Santos Bravo & José Crespo de Carvalho performed this study with the goal was to merge finding from previous work developed by the authors in areas like pharmaceutical recalls, retains and sustainable practices, challenges that the industry is facing not only to be accounted as responsible¹⁶. Helene Morissette gives out the project report highlighted a variety of issue associated with the current process of disposal of unused drugs¹⁷. Radhakrishna Lagishetty et al conducted this study to evaluate the practice towards disposal of medicines. They analysed the disposal methods with that recommended Physicians, Pharmacists have to create awareness to the patients of environmental issue¹⁸. Wan-Chih Tom gives out an article about federal disposal guidelines to the medicines which can be disposed throw trash and flushed down in toilets¹⁹. Asma Khan and Masood Subzwari described the Reverse Logistics practices in pharmaceutical industries in Pakistan as the reverse logistics (RL) process management can improve the efficiency of overall supply chain with the variables: Medicines return, Inventory management through RFID²⁰. Kwame Owusu Kwateng et al revealed a gap in the flow of reverse logistic activities; from drug returns to its disposal and gives out efficient method for drug disposal by pharmaceutical manufacturing companies in Ghana²¹. A. Pruss et al prepared a book that gives out the Safe management of wastes from health-care activities concerned

with environmental implications²². Tadele Atinafu et al described the main objective of this paper was to assess unused medications disposal practice of patients of university with the variables: Demographic, Reason for disposal²³. There is increasing concern at the amount and cost of prescribed medicines that are unused and then have to be disposed off, in their study they found that increasing amount of wastage when the customer purchasing the drug in bulk and the pharmacists are responsible for creates awareness about proper disposal of medicines.²⁵

Model Building

By extending the previous research, the Fig.1 conceptual framework model for disposal practices was carried out in tiruchirappalli district. In that various disposal practices of medicines are identified as throw into trash, flushed into toilet, buried in the ground and burned them. After identifying the disposal practices, the quantum of household medicines are estimated by classifying the medicines as solid medicines, liquid medicines and semi solid medicines. The environmental impacts can be identified by relating the quantum of medicines and various medicine disposal practices.

MATERIALS AND METHODS

This study was conducted from the period of February 2016 to May 2016. In this study, the descriptive research is carried out. A problem is described by the researcher using questionnaire and schedule. The methods of data collected are primary and secondary, primary data are fresh data collected through survey with the customers from medical stores using questionnaire. The secondary data are collected from internet source, books and various journals to get information regarding research problem.

Sample Element	: Customers from medical stores
Sample Size	: 300
Sampling Method	: Convenience Sampling
Sample Media	: Questionnaire

The tools used for this study are percentage analysis and non parametric chi-square test. To analyze the data, analysis tool SPSS version 23 is used. Questionnaire helps to recognize the customer's opinion about the disposal practices and its implication on environments. The questionnaire includes questions like customer's frequency of buying medicines, reason for keeping household medications, type of drug class which mostly used, disposal practices that respondents preferred most, awareness about medication wastes, awareness about consequences of improper disposal medicines to the environment, respondent's opinion about control of hazardous effect due to unused or expired medicines disposal, responsible to create awareness for proper disposal of medicines, knowledge about drug -take-back system, best source of awareness for society.

Chi square test

For Table 2 calculated χ^2 value 10.891 is lesser than tabulated χ^2 value 12.592. There is no significant relationship between disposal practices and residency. For Table 3 calculated χ^2 value 41.11 is greater than tabulated χ^2 value 5.991. There is significant relationship between Educational qualification and Awareness about environmental impact.

From Table 4 Interval Estimation for Quantum of solid medicine disposed by the consumers is from 408gms to 560gms, Quantum of liquid medicine disposed by the consumers is 42 to 45 litres

and Quantum of semi solid medicine disposed by the consumers is 5820gms to 6360gms.

FINDING

From this survey of 300 respondents, (From Table 1) 55 %(166) of the respondents belong to male, 45 %(134) of the respondents belong to female. Majority of the respondents (25%) comes under the age group 31-40 years, 18 -30 yrs (30%), 41 – 50 yrs (26%), and Above 50 yrs (16%). (54%) Majority of the respondent’s come under married category. Majority of the respondents (52%) are degree holders and Illiterate (17%), Grades 1-12 (31%). Majority of the respondent’s (58%) monthly income level is below 10,000. Majority of respondent’s residency come under urban group (37%).

Majority of the respondents buying medicines every month (68%) and others daily (11%), Weekly (21%), 78% Majority of the respondents keep their medicines at home until it expired. (32%) Majority of respondents keeping medicines at home due to their medical conditions improved or resolved. (69%)

Majority of respondents preferred disposal practice as throw into the trash. (28%) Majority of the respondents are using analgesic drug class. Every year, about 500gms of solid medicines, 45liters of liquid medicines and 6000gms of semi solid medicines are disposed to the environment. The mostly used drugs are identified as paracetamol, brufen, overan, citizen, candex-B, benedryl, mox, stamelo etc., (64%) of the respondents are not aware of medications waste. (67%) of the respondents are not aware of environmental consequences of improper medicines disposal. (53%) Majority of the respondent’s opinions, by providing proper guidance to the consumer about disposal practices to control or minimize the hazardous effect. 84% of the respondents are not having much knowledge about drug take-back system. (49%) Majority of respondent’s opinion, Government should responsible for create awareness about proper disposal of medicines. (43%) Majority of respondents opinion, Electronic media is the best source for create awareness about disposal practices.

Table 1: Frequency distribution of demographic classification

Demographic classification		Frequency	Percentage
Age	18 - 30 years	91	30
	31 - 40 years	84	28
	41 - 50 years	76	25
	Above 50 years	49	17
Gender	Male	166	55
	Female	134	45
Marital status	Single	138	46
	Married	162	54
Educational Qualification	Illiterate	51	17
	Grades (1- 12)	94	31
	Degree	155	52
Income group	Below 10,000	176	58
	10000 - 20000	68	23
	20001 - 40000	36	12
	Above 40,000	20	7
Residency	Urban	112	37
	Semi Urban	84	28
	Rural	104	35

Table 2: Cross Tabulation for Residency and various disposal practices

Cross Tabulation		Residency			Total
		Urban	Semi Urban	Rural	
Disposal Practices	Flush	18	12	15	45
	Throw	84	61	65	210
	Bury	5	5	14	24
	Burn	5	6	10	21
TOTAL		112	84	104	300

Table 3: Cross Tabulation for Education and awareness about environmental impact

CROSS TABULATION		Awareness		Total
		Yes	No	
Educational Qualification	Illiterate	10	40	50
	Grades	12	83	95
	Degree	77	78	155
Total		99	201	300

Table 4: Interval Estimation for Quantum of Medicines

Quantum of solid medicines				Quantum of liquid medicines				Quantum of semisolid medicines			
		Statistic	Std. Error			Statistic	Std. Error			Statistic	Std. Error
Mean		5.84	0.199	Mean		145.48	2.622	Mean		2.03	0.045
95% Confidence Interval for Mean	Lower Bound	5.45		95% Confidence Interval for Mean	Lower Bound	140.32		95% Confidence Interval for Mean	Lower Bound	1.94	
	Upper Bound	6.23			Upper Bound	150.64			Upper Bound	2.12	

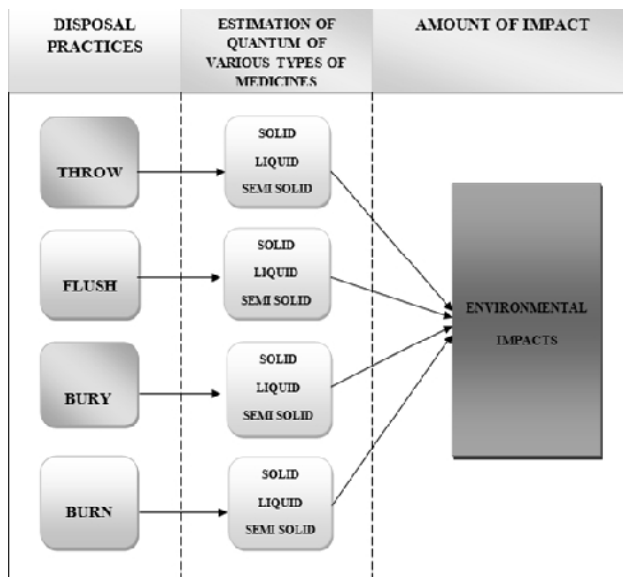


Figure 1: Conceptual Model for Disposal Practices and Its Environmental Impact ²⁴

RESULTS

The improvement of respondent’s medical condition is the major reason for keeping medicines at their home that leads to disposal of those medicines to the environment. Throw into the garbage is mostly preferred disposal practice by the consumers. The quantum of unused or expired medicines kept respondent’s home Solid medicine disposed every year 408gms to 560gms, Liquid medicine disposed every year 42 to 45 liters and Solid medicine disposed every year 5820gms to 6360gms. There is no significant relationship between disposal practices and residency among people in tiruchirappalli district. There is significant relationship between educational qualification and awareness about environmental impact among people in tiruchirappalli district.

CONCLUSION

This study suggest that majority of the respondents are not aware about disposal practices that implication to the environment. The improper disposal of medicines to the environment should be minimize or control. The Government should responsible for creating awareness about disposal practices to protect the environment and human life through the electronic media as opinion of respondents.

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