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A Study on Problems Faced by Freight Forwarders with Reference to Yashimarine Logistics

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Abstract: ***Cold chains are common in the food and pharmaceutical industries and also in some chemical shipments. One common temperature range for a cold chain in pharmaceutical industries is 2 to 8 °C. but the specific temperature (and time at temperature) tolerances depend on the actual product being shipped. Unique to fresh produce cargoes, the cold chain requires to additionally maintain product specific environment parameters which include air quality levels (carbon dioxide, oxygen, humidity and others), which makes this the most complicated cold chain to operate. Through this study, the researcher tries to identify the key areas to be enhanced to improve the overall efficiency of the cold chain logistics for pharmaceutical products like vaccines. The general objective of this study is to assess the problems faced by freight forwarders in cold chain supply logistics on safety of vaccines in pharmaceutical distributors. The other objectives are to determine how storage conditions in pharmaceutical distributors influences safety of vaccines, evaluate the influence of packaging in pharmaceutical distributors on the safety of vaccines and to establish the extent to which technical capacity in pharmaceutical distributors influence safety of Vaccines. Convenience sampling method has used in the research work. Multiple choice questions have been chosen to collect the responses from 100 members involved in cold chain logistics of pharmaceutical products. The data collected has been analyzed through various statistical tools like Karl Pearson's Correlation, Chi- square test and One-way Anova test. Numerous new findings has been derived from this research has helped to provide few suggestions to improve the efficiency of the cold chain logistics for pharmaceutical products like vaccines of Yashimarine logistics.***

Keywords: Freight forwarders, Cold chains, Pharmaceutical Industry, Vaccines, transportation in climate controlled vehicles, logistic challenges in transportation

1. Introduction

A cold chain is a monitored temperature-controlled supply chain. The goal of the cold chain is to keep a sample or material within a certain temperature range during all stages of delivery, processing and storage .Cold chains are widely used to ensure the viability of products in the pharmaceutical and agricultural sectors, and are critical components of vaccination programs and bio-medical surveillance activities.

Many biological samples deteriorate when exposed to heat, sunlight, or fluorescent light. When transporting and storing such biological substances, it is imperative that field and laboratory teams control environmental conditions, ensuring that exposure to potentially damaging environmental factors is minimized.

The cold storage, handling, and distribution of temperature-sensitive drugs represent an increasingly important component of the global pharmaceutical supply chain. Clinical trial material (CTM) or investigational medicinal products (IMP) are an important part of the earliest stages of the life science supply chain. Given the increased number of global regulatory and standards-based guidance documents issued over the past two years, members of the pharmaceutical supply chain are taking notice and making changes to ensure product quality and protect patient safety. The purpose of this paper is to review the various factors affecting Good Cold Chain Management Practices for Clinical Trial Materials/Investigational Medicinal Products.

Cold Chain is a system of storing and transporting vaccine at the recommended temperature range from the point of manufacture to point of use. In order to provide potent and effective vaccine to the beneficiaries a vast cold chain infrastructure is required, which should have a network of Vaccine Stores, Walk-in-coolers (WIC), Walk-in-freezers (WIF), Deep Freezers (DF), Ice lined Refrigerators (ILR), Refrigerated trucks, Vaccine vans, Cold boxes, Vaccine carriers and icepacks from national level to states up to the out reach sessions.

The cold chain system and vaccine flow in the country:- The vaccines are transported from the manufacturer through air transport under the temperature range of 2-8oC to the primary vaccine stores (GMSDs/State head quarter).

1.1 Need for the Study

Cold chains are common in the food and pharmaceutical industries and also in some chemical shipments. One common temperature range for a cold chain in pharmaceutical industries is 2 to 8 °C. but the specific temperature (and time at temperature) tolerances depend on the actual product being shipped. Unique to fresh produce cargoes, the cold chain requires to additionally maintain product specific environment parameters which include air quality levels (carbon dioxide, oxygen, humidity and others), which makes this the most complicated cold chain to operate. Through this study, the researcher tries to identify the key areas to be enhanced to improve the overall efficiency of the cold chain logistics for pharmaceutical products like vaccines with special reference to Yashimarine logistics

1.2 Scope of the Study

The major scope of the analysis on cold chain logistics in pharmaceuticals are

a) To increase the longevity of the medical characteristics
b) Maintain the temperature level for the vaccines

c) Retain the nutritional value of vaccines
d) Maintain the chemical substance of vaccines
e) Reduce wastage and return of expired stock of vaccines

1.3 Objectives

Primary Objective
The general objective of this study is to assess the problems faced by freight forwarders of cold chain supply logistics on safety of vaccines with special reference to Yashimarine logistics

Secondary Objectives
1) To determines how storage conditions in pharmaceutical distributors influences safety of vaccines.
2) To determine the influence of transport systems on the safety of vaccines in pharmaceutical distributors.
3) To evaluate the influence of packaging in pharmaceutical distributors on the safety of vaccines.
4) To establish the extent to which technical capacity in pharmaceutical distributors influence safety of vaccines.

1.4 Limitations of the Study

For anything there should be some limitations like that my project also have certain limitations. The following are some limitations what I faced:
1) The information provided by majority of the respondents could also be biased or inaccurate. No independent verification of the data was possible.
2) Time is one major constraint, which limits the effective data collection.
3) Non-availability of data collection from all the people involved in cold chain logistics of pharmaceutical products
4) The sample size is only 100 so the sample may not be truly representative of the total population
5) Reliability and accuracy of the analysis depends on the respondents' openness and trueness towards each question in the questionnaire.

2. Review of Literature

Laboratory Cold Chains
As medicine developed through the centuries the advances created the basis for diagnostic discoveries. In the latter part of the 19th century the clinical laboratory started to be established. By the turn of the century many specific chemical, hematological and bacteriological tests had been developed due to innovations in basic science (Berger, 1999a) enabling the clinical laboratory to be used for diagnostic purposes. Different types of laboratories started to emerge, including physiological, pharmaceutical, forensic, public health, clinical chemistry and microbiological (Berger, 1999b).

Laboratories developed similarly in Britain and the United States of America (USA) due to the influences of medical faculties in Europe (Petts, 2012; Race, Tillery, & Dysert, 2004). The number of laboratory tests available increased dramatically over the 20th century. The first half of the century was involved in developing individual biochemical methods for the variety of parameters that medical professionals were interested in such as ion concentration of elements in serum (Berger, 1999b). Because the refrigerator was not invented until the late 1910s to early 1920s these methods did not require refrigeration. Today the range of different analyses available is now well over 3000, and still increasing, although not all will be available at each laboratory (Wians, 2009).

Requests for laboratory investigations increased as medical professionals found the data useful in establishing diagnoses. The desire to have this data prior to treatment led to the expectation of faster turnaround times for testing (Seligson, 1966), so more efficient methodologies needed to be introduced. The first convenient and accurate kit-type diagnostic test, Clinitest®, was introduced in 1941 and measured reducing sugars in urine 3 (Chemical

Heritage Foundation, 2010). This was followed by Clinistix® in 1956, the first dipstick which measured glucose in urine (Chemical Heritage Foundation, 2010).

Although Clinitest® has long been discontinued in modern laboratories dipsticks continue today with up to 10 parameters being measured by one dip in the urine. These types of tests did not require refrigeration. Mechanisation followed with the first clinical autoanalyser being introduced in 1959 (Berger, 1999b) and it was around this time that sub-ambient storage of some reagents became essential. Such analysers could perform multiple tests on much smaller samples of the patient's blood (Seligson, 1966). In the 1960's culture media became more sophisticated with antibiotics included as selective agents (Smith, 2005) necessitating storage at sub-ambient temperatures. The sixties also saw computers introduced into laboratories in Europe, Britain and the USA but they did not become mainstream until the 1970's-1980's (Keller, 1982). Miniaturisation of laboratory techniques began in the 1970s with microbiology and immunoassays being the initial beneficiaries' and this has progressed through all disciplines (Fung, 2002; Hansen, Hardesty, & Myers, 1974; McGlennen, 2001).

The reagents for these kit/reagents needed to be stored at sub-ambient temperatures (Ammann, 2011; Ramanujam, Koelbl, & Ting, 1993). An example of this type of kit is the API® range manufactured by bioMériuex Inc. More recently these techniques have moved onto full automation especially in larger laboratories (Wu, 2006). The molecular era started in 1943 when Oswald Avery (1877-1955) demonstrated that deoxyribonucleic acid (DNA) played a significant role in the carriage of genetic information (Bersch, 2006). Research into DNA moved forward on multiple fronts with James Watson (b. 1928), Francis Crick (1916-2004), Maurice Wilkins (1916-2004) and Rosalind Franklin (1920-1958) all working on defining DNA's structure in the early 1950's (Bersch, 2006).

In 1953 the peer reviewed academic journal Nature published this research and the findings were widely accepted. This along with further discoveries of critical enzymes and manipulation techniques led to the development of new laboratory procedures. However, it was not until the invention of the polymerase chain reaction

(PCR) technique by Kary Mullis (b. 1944), in 1983, that molecular methodologies moved from the research laboratory into the clinical laboratory (Tang, Procop, & Persing, 1997) providing enhanced sensitivity and faster turnaround times. Kits that use this technique require sub-ambient temperatures. Kits such as the Hain Lifescience Genotype® Mycobacterium CM/AS, Genotype® MDR TBplus and Genotype® SL require a mix of temperatures for storage.

The primers and probes need to be kept at 4o C and the master mix that contains the enzymes and dinucleotides at -20o C but are provided together in the same kit. Today, the diagnostic industry is starting to move towards "black box" type testing methods (Bersch, 2006) that includes the three main phases of PCR, extraction, amplification and detection. This type of testing often does not require specialised staff or sub-ambient storage conditions for reagents. An example of this is the Gene Expert® range of cartridges manufactured by Cepheid. To complicate matters the supply chain's national and international regulations are moving towards "controlled room temperature" (CRT) requiring additional monitoring steps for ambient temperature packages, and adding complexity to the transportation process (Healthcare Commerce Media Corporation, April 09, 2010). Ultimately, even the ambient temperature "black box" products being developed by the diagnostic industry will come under the CRT auspices.

There is an abundance of literature and regulations on the development of drugs for human use including stability, experimental design and data analysis for the pharmaceutical industry but for the in vitro device (IVD) manufacturers, who manufacture kits for the clinical laboratory, there are guidance documents but few regulations. However, the need for regulation was reinforced by a study performed in 2011 that showed that devices that had been deemed low risk and were not covered by regulations had resulted in serious health problems or death for some patients (Zuckerman, Brown, & Nissen, 2011). A draft document was issued by the Food and Drug Administration (FDA) that covered companion diagnostic tests, with a deadline of 31 March 2013 but as late as October 2013 the FDA were still talking about regulating but with no definitive action to date (Novales-Li, 2013). Currently, licenced laboratory developed tests (LDTs) and IVDs must be validated and any reagents used, including calibrators, controls, and sample diluents, must undergo stability testing so consumers know the temperature and storage limits of the product. In order to deliver an accurate and precise result each of these components must be functioning properly. Stability studies cover the following: expected shelf life or expiration date, temperature, humidity and photostability, stress testing and storage conditions (Food and Drug Administration, 2003; International Conference on Harmonisation, 2003). Environmental factors such as temperature, humidity and light can affect the quality and shelf life of a product. Stability

Fundamental to the success of any formal marketing research project is a sound research design. A good research design has the characteristics of problem definition, specific methods of data collection and analysis, time required for research project and estimate of expenses to be incurred. The function of a research design is to ensure that the require data are collected accurately and economically. A research design is purely and simply the framework or plan for an analysis of data. It is a blue print that is followed in completing a study. It resembles the architect`s blue-print (map) for constructing a house. It may be worthwhile to mention here that a research design is nothing more than the framework for the study ensures that the study will be relevant to the problem and the study will employ economical procedures. Claire seltizetal defines Research Design as “Research design is a catalogue of the phases and facts relating to the formulation of a research effort. It is the arrangement of collection and analysis of data in a manner that aims to combine relevant to the research purpose with economy in procedure”.

Three important about research design are

1) The design of investigation should stem from the problem
2) Whether the designs are productive in a given problem setting depends on how imaginatively they are applied. An understanding of the basic design is needed so that they can be modified to suit specific purpose
3) The three basic design are as follows
   a) Exploratory Research design
   b) Descriptive Research design
   c) Casual Research design

The Research design used in the study is descriptive research design

2.1 Research Design

Descriptive research design is also called explanatory design. This is the one that simply describes something such as demographic characteristics. The descriptive study is typically concerned with determining frequency with which something occurs or how two variables vary together.

2.2 Sample Size

It refers to the number of elements of the population to sample. The sample size chosen for the survey is 100.

2.3 Data Sources

After identifying and defining the research problem and determining specific information required to solve the problem, the researcher`s task is to look the type and sources of data which may yield the desired results. Data sources are of two types through which data is collected. Data sources may be classified as

- Primary data
- Secondary data

Primary Data

Primary data is the original data collected by the researcher first hand. It is collected for the first time through field survey. These are those that are gathered specifically, for the problem at hand. The various sources for collecting primary data are questionnaire, observation, interview etc. The primary source used for the study is questionnaire.

Secondary Data
Secondary data is the information which is already available in published or unpublished form. When the needed information is collected from the census of population available in a library means then it is a secondary data. It is also used for collecting historical data. The various sources of secondary data are books, periodicals, journals, directories, magazines, statistical data sources etc. The secondary source used for this study is company profile, scope, need, review of literature.

2.4 Research Instruments

Research instrument are the instruments which is used for gathering or collecting information. The instruments used in the study are
1) Direct questions
2) Close end questions
3) Dichotomous questions
4) Multiple choice questions

Direct Questions
Direct questions are just what their names indicate. They explicitly ask for the desired data. However the directness of the question also relates to the way a response is interpreted.

Close End Questions
Such questions are also called fixed alternative questions they refer to those questions in which the respondent is given a limited number of alternative response frame which he/she is to select one that most closely matches his/her opinion or attitude.

Dichotomous Questions
A dichotomous question refers to one which offers the respondent a choice between only two alternatives and reduces the issue to its simple terms. The fixed alternatives are of the type, yes/no, agree/disagree, true/false etc.

Multiple Choice Questions
A multiple choice question refers to one which provides several set alternatives for its answers. Thus, it is a middle ground between free answers and dichotomous question.

2.5 Sampling
Collecting Data About Each And Every Unit Of The Population Is Called Census Method. The Approach, Where Only A Few units of population under study are considered for analysis is called sampling method. There are two main categories under which various sampling method can be put.

The two categories are
1) Probability sampling
2) Non-probability sampling
The sampling method adopted for the study is convenience sampling under non-probability sampling.

Non-Probability Sampling
In non-probability sampling, the chance of any particular unit in the population being selected is unknown, since randomness is not involved in the selection process. But this does not mean that the findings obtained from non-probability sampling are of questionable value. If properly conducted their findings can be accurate as those obtained from probability sampling. The three frequencies used non-probability designs are
1) Judgment sampling
2) Convenience sampling
3) Quota sampling

2.6 Convenience Sampling:

In this method, the sample units are chosen primarily on the basis of the convenience to the investigator. The units selected may be each person who comes across the investigator.

2.7 Sample Frame

A Sample frame may be defined as the listing of the general components of the individual units that comprise the defined population.

Table 3.1: The Major Issue for the Transport Problems in Cold Chain Supply Logistics in Pharmaceutical Industry

Particulars	No. of Respondents	% of Respondents
Lack of planning for maintenance and cold chain rehabilitation	25	25%
Incorrect use of the Vaccines Vial Monitor (VVM) as a management tool	32	32%
Lack of planning for emergencies	27	27%
Frequent breakdowns in cold chain	16	16%
Total	**100**	**100%**

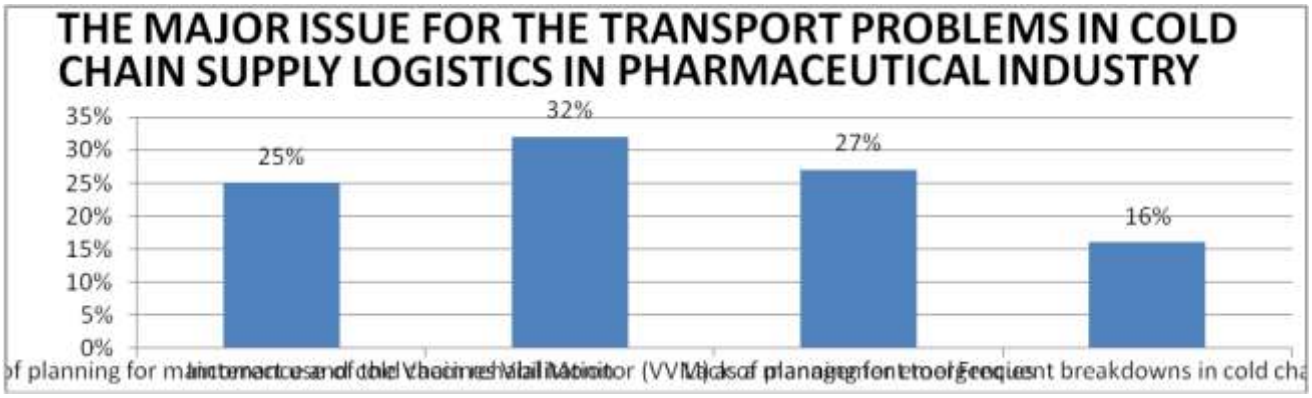


Chart 3.1

Inference:
32% of the respondents mention that the incorrect use of the Vaccines Vial Monitor (VVM) as a management tool causes the major issue for the transport problems in cold chain supply logistics in pharmaceutical industry , 27% of the respondents mention that the lack of planning for emergencies causes the major issue for the transport problems in cold chain supply logistics in pharmaceutical industry, 25% of the respondents mention that the lack of planning for maintenance and cold chain rehabilitation causes the major issue for the transport problems in cold chain supply logistics in pharmaceutical industry, 16% of the respondents mention that the frequent breakdowns in cold chain causes the major issue for the transport problems in cold chain supply logistics in pharmaceutical industry.

Therefore 32% of the respondents mention that the incorrect use of the Vaccines Vial Monitor (VVM) as a management tool causes the major issue for the transport problems in cold chain supply logistics in pharmaceutical industry.

Table 3.2: The Most Preliminary Requirement In Cold Chain Supply Logistics for Vaccines

Particulars	No. of Respondents	% of Respondents
Refrigerated warehouse	28	28%
Refrigerated transportation	32	32%
Both Refrigerated warehouse & Refrigerated transportation	40	40%
Total	**100**	**100%**

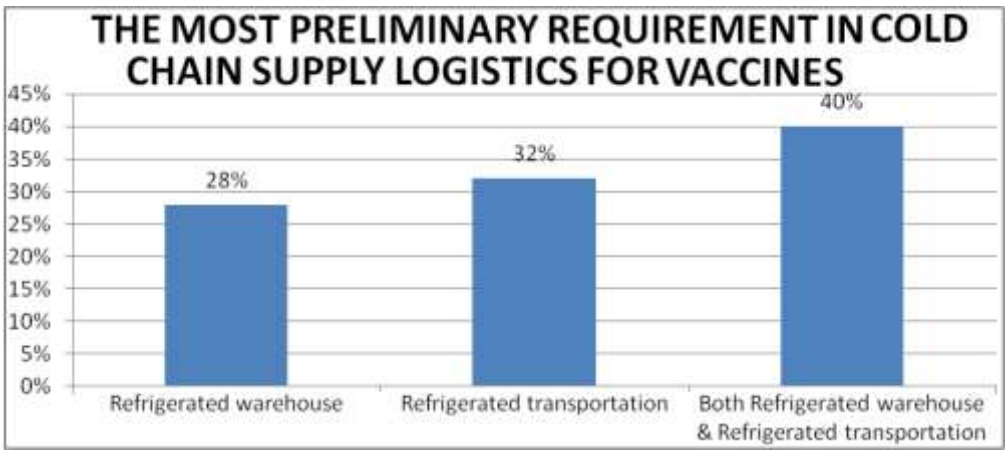


Chart 3.2

Inference:
40% of the respondents preferred both the refrigerated warehouse & refrigerated transportation for the most preliminary requirement in cold chain supply logistics for vaccines**,** 32% of the respondents preferred the refrigerated transportation for the most preliminary requirement in cold chain supply logistics for vaccines, 28% of the respondents preferred the refrigerated warehouse for the most preliminary requirement in cold chain supply logistics for vaccines. Therefore 40% of the respondents preferred both the refrigerated warehouse & refrigerated transportation for the most preliminary requirement in cold chain supply logistics for vaccines.

Table 3.3: Transport Systems Influence the Safety of Vaccines in Pharmaceutical Distributors

Particulars	No. of Respondents	% of Respondents
Strongly agree	27	27%
Agree	29	29%
Neutral	25	25%
Disagree	10	10%
Strongly Disagree	9	9%
Total	**100**	**100%**

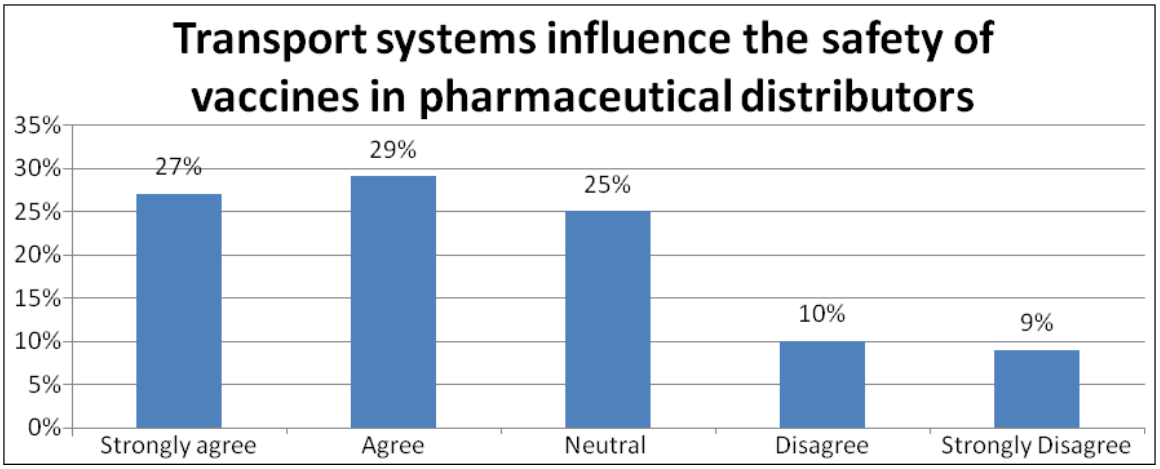


Chart 3.3

Inference:
29% of the respondents agreed with the transport systems which influence the safety of vaccines in pharmaceutical distributors, 27% of the respondents strongly agree with the transport systems which influence the safety of vaccines in pharmaceutical distributors, 25% of the respondents neutrally agreed with the transport systems which influence the safety of vaccines in pharmaceutical distributors, 10% of the respondents Disagreed with the transport systems which influence the safety of vaccines in pharmaceutical distributors, 9% of the respondents Strongly Disagreed with the transport systems which influence the safety of vaccines in pharmaceutical distributors.

Therefore 29% of the respondents agreed with the transport systems which influence the safety of vaccines in pharmaceutical distributors, 27% of the respondents strongly agree with the transport systems which influence the safety of vaccines in pharmaceutical distributors.

Table 3.4: Ranks the Problems Faced from Carriers during Cold Chain Supply Logistics in Maintaining the Safety of Vaccines

Particulars	No. of Respondents	% of Respondents
Delivery delay	13	13%
Damaging of packages	21	21%
Frequent rise in forwarding cost	17	17%
Lack of proper communication	19	19%
Bulk- Order Priority	40	40%
Total	**100**	**100%**

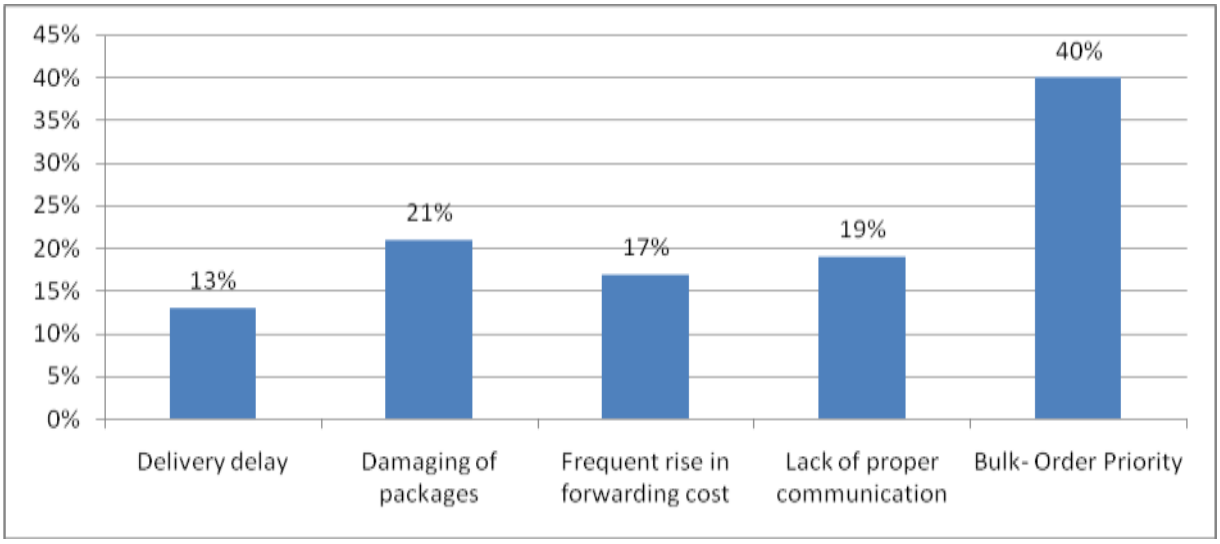


Chart 3.4: Ranks the Problems Faced From Carriers during Cold Chain Supply Logistics in Maintaining the Safety of Vaccines

Inference:
40% of the respondents rank no 1 for Bulk- Order Priority which causes the problems faced from carriers during cold chain supply logistics in maintaining the safety of vaccines, 21% of the respondents rank no 2 for damaging of packages which causes the problems faced from carriers during cold chain supply logistics in maintaining the safety of vaccines, 19% of the respondents rank no 3 for lack of proper communication which causes the problems faced from carriers during cold chain supply logistics in maintaining the safety of vaccines, 17% of the respondents rank no 4 for frequent rise in forwarding cost which causes the problems faced from carriers during cold chain supply logistics in maintaining the safety of vaccines, 13% of the respondents rank no 5 for delivery delay which causes the problems faced from carriers during cold chain supply logistics in maintaining the safety of vaccines.

Therefore 40% of the respondents rank no 1 for Bulk- Order Priority which causes the problems faced from carriers during cold chain supply logistics in maintaining the safety of vaccines.

3. Statistical Tools and Analysis

Chi- Square Test I – (ψ^2)
Chi-square is the sum of the squared difference observed (o) and the expected (e) data (or the deviation, d), divided by the expected data in all possible categories.

Null hypothesis (Ho):
There is a relationship between the Experience and Income.

Alternate hypothesis (H1):
There is no relationship between the Experience and Income.

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Experience*Income	100	100.0%	0	.0%	100	100.0%

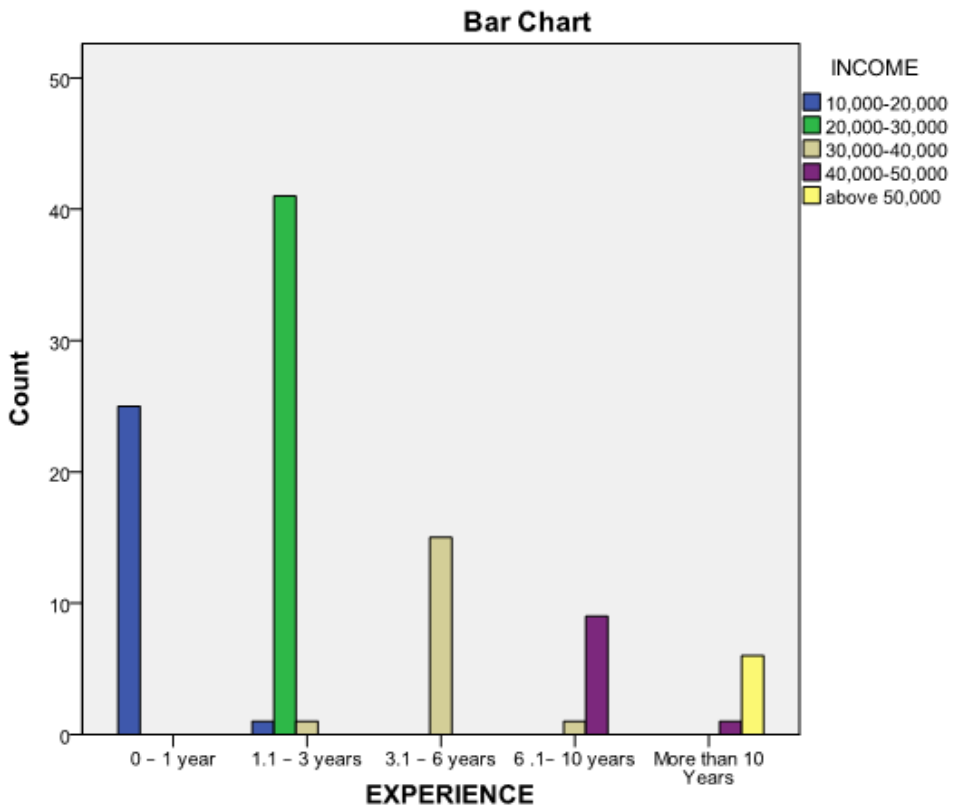
Experience * Income Crosstabulation

			INCOME					Total
			10,000-20,000	20,000-30,000	30,000-40,000	40,000-50,000	above 50,000	
Experience	0 – 1 year	Count	25	0	0	0	0	25
		% within EXPERIENCE	100.0%	.0%	.0%	.0%	.0%	100.0%
		% within INCOME	96.2%	.0%	.0%	.0%	.0%	25.0%
		% of Total	25.0%	.0%	.0%	.0%	.0%	25.0%
	1.1 – 3 years	Count	1	41	1	0	0	43
		% within EXPERIENCE	2.3%	95.3%	2.3%	.0%	.0%	100.0%
		% within INCOME	3.8%	100.0%	5.9%	.0%	.0%	43.0%
		% of Total	1.0%	41.0%	1.0%	.0%	.0%	43.0%
	3.1 – 6 years	Count	0	0	15	0	0	15
		% within EXPERIENCE	.0%	.0%	100.0%	.0%	.0%	100.0%
		% within INCOME	.0%	.0%	88.2%	.0%	.0%	15.0%
		% of Total	.0%	.0%	15.0%	.0%	.0%	15.0%
	6 .1– 10 years	Count	0	0	1	9	0	10
		% within EXPERIENCE	.0%	.0%	10.0%	90.0%	.0%	100.0%
		% within INCOME	.0%	.0%	5.9%	90.0%	.0%	10.0%
		% of Total	.0%	.0%	1.0%	9.0%	.0%	10.0%
	More than 10 Years	Count	0	0	0	1	6	7
		% within EXPERIENCE	.0%	.0%	.0%	14.3%	85.7%	100.0%
		% within INCOME	.0%	.0%	.0%	10.0%	100.0%	7.0%
		% of Total	.0%	.0%	.0%	1.0%	6.0%	7.0%
Total		Count	26	41	17	10	6	100
		% within EXPERIENCE	26.0%	41.0%	17.0%	10.0%	6.0%	100.0%
		% within INCOME	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	26.0%	41.0%	17.0%	10.0%	6.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	348.695[a]	16	.000
Likelihood Ratio	252.024	16	.000
Linear-by-Linear Association	96.062	1	.000
N of Valid Cases	100		

a. 19 cells (76.0%) have expected count less than 5. The minimum expected count is .42



Degree of Freedom= (r-1) *(c-1)
= 4*4= 16

Calculated value = 348.695
Tabulated value = 26.296
Z = Z cal >Z tab
Z= 348.695>26.296
Hence, the Alternate hypothesis [H1] is accepted

Inference:
Since the calculated value is greater than the tabulated value, we accept the alternate hypothesis and hence there is a relationship between the Experience and Income.

One-Way ANOVA Classification

Null hypothesis (Ho): There is a significance difference between the Transport systems influence the safety of vaccines in pharmaceutical distributors and the packaging has a big influence in pharmaceutical distributors on the safety of vaccines.

Alternate hypothesis (H1): There is no significance difference between the Transport systems influence the safety of vaccines in pharmaceutical distributors and the packaging has a big influence in pharmaceutical distributors on the safety of vaccines.

Descriptives

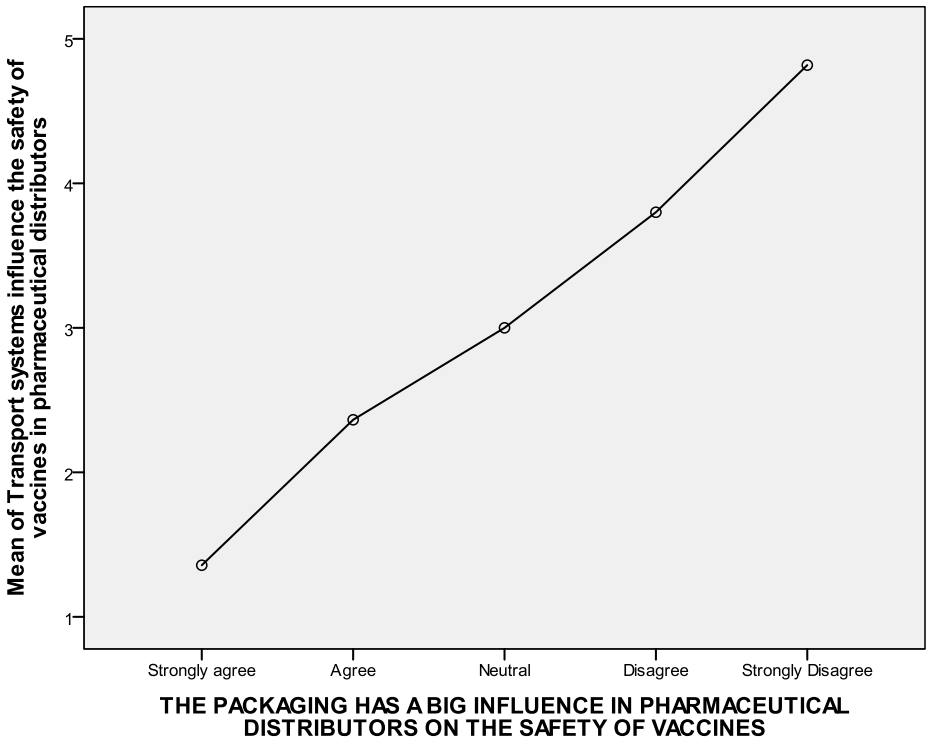
Transport systems influence the safety of vaccines in pharmaceutical distributors								
					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Strongly agree	42	1.36	.485	.075	1.21	1.51	1	2
Agree	22	2.36	.492	.105	2.15	2.58	2	3
Neutral	15	3.00	.000	.000	3.00	3.00	3	3
Disagree	10	3.80	.422	.133	3.50	4.10	3	4
Strongly Disagree	11	4.82	.405	.122	4.55	5.09	4	5
Total	100	2.45	1.242	.124	2.20	2.70	1	5

Test of Homogeneity of Variances

Transport systems influence the safety of vaccines in pharmaceutical distributors			
Levene Statistic	df1	df2	Sig.
26.161	4	95	.000

ANOVA

Transport systems influence the safety of vaccines in pharmaceutical distributors					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	134.780	4	33.695	178.130	.000
Within Groups	17.970	95	.189		
Total	152.750	99			



Calculated value = 178.130
Tabulated value = 2.47
F = F cal >F tab
F=178.130> 2.47
Hence, the Alternate hypothesis [H1] is accepted.

Inference
The calculated value of F is greater than the tabulated value. Hence, we reject the null hypothesis and conclude that there is no significance difference between the Transport systems influence the safety of vaccines in pharmaceutical distributors and the packaging has a big influence in pharmaceutical distributors on the safety of vaccines.

Analysis Using Karl Pearson's Correlation
Correlation analysis is the statistical tool used to measure the degree to which two variables are linearly related to each other. Correlation measures the degree of association between two variables.

Null hypothesis (H0)
There is positive relationship between the major purpose of cold chain supply logistics in pharmaceutical industry and the main objective of cold chain supply logistics in pharmaceutical industry.

Alternate hypothesis (H1)
There is negative relationship between the major purpose of cold chain supply logistics in pharmaceutical industry and the main objective of cold chain supply logistics in pharmaceutical industry

Correlations

		The Major Purpose of Cold Chain Supply Logistics in Pharmaceutical Industry	The Main Objective of Cold Chain Supply Logistics in Pharmaceutical Industry
The Major Purpose of Cold Chain Supply Logistics In Pharmaceutical Industry	Pearson Correlation	1	.913**
	Sig. (2-tailed)		.000
	N	100	100
The Main Objective of Cold Chain Supply Logistics In Pharmaceutical Industry	Pearson Correlation	.913**	1
	Sig. (2-tailed)	.000	
	N	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

$$r = \frac{N\sum XY - \sum X \sum Y}{\sqrt{N\sum X^2 - (\sum X)^2}\sqrt{N\sum Y^2 - (\sum Y)^2}}$$

r= .913

Inference
Since r is positive, there is positive relationship between the major purpose of cold chain supply logistics in pharmaceutical industry and the main objective of cold chain supply logistics in pharmaceutical industry.

4. Findings

- Therefore most of the respondents belong to age group 20-30.
- Therefore most of the respondents are male.
- Therefore most of the respondents are graduate.
- Therefore most of the respondents have 1.1 – 3 years experience.
- Therefore most of the respondents are earning 20,000-30,000.
- Therefore most of the respondents say that maintain the temperature level for the vaccines.
- Therefore most of the respondents are Increase customer satisfaction.
- Therefore most of the respondents are incorrect use of the Vaccines Vial Monitor (VVM) as a management tool.
- Therefore most of the respondents are Both Refrigerated warehouse & Refrigerated transportation.
- Therefore most of the respondents are Agree with Transport systems influence the safety of vaccines in pharmaceutical distributors.
- Therefore most of the respondents are Bulk- Order Priority.
- Therefore most of the respondents are Refrigerated transport.
- Therefore most of the respondents are Reefers.
- Therefore most of the respondents are Strongly agree with the packaging has a big influence in pharmaceutical distributors on the safety of vaccines.
- Therefore most of the respondents are FDI restrictions in retail.
- Therefore most of the respondents are Strongly agree with the common temperature range for a cold chain in pharmaceutical industries is 2 to 8 °c.
- Therefore most of the respondents are Highly Satisfied with the overall quality system(non conformances and capa's) in the cold chain supply logistics for vaccines.
- Therefore most of the respondents having Excellent opinion about the technical capacity in pharmaceutical distributors.
- Therefore most of the respondents are Communication channel.

5. Suggestions

1) Yashimarine logistics has to improve their planning for emergencies
2) Necessary measures need to be taken for maintenance and cold chain rehabilitation
3) Frequent breakdowns in cold chain has be avoided to improve the overall efficiency of cold chain logistics in handling pharmaceutical products

4) Frequent rise in forwarding cost can be avoided by owning the cold chain transportation and the cold storage.
5) Government can take suitable actions to reduce the high energy cost. This will help Yashimarine logistics involved in cold chain logistics to reduce their cost. When both the cost reductions happen, the end customers can avail the pharmaceutical products for a lesser price
6) Incorrect use of the Vaccines Vial Monitor (VVM) as a management tool has be avoided. Proper process has to be followed during the overall cold chain logistics for vaccines.

6. Conclusion

Cold chains are common in the food and pharmaceutical industries and also in some chemical shipments. There have been numerous events where vaccines have been shipped to third world countries with little to no cold chain infrastructure (Sub-Sahara Africa) where the vaccines were inactivated due to excess exposure to heat.

This study has been undertaken to assess the feasibility in handling the pharmaceutical products like vaccines in cold chain logistics with special reference to Yashimarine logistics. For this purpose, responses from the members involved in cold chain logistics have been collected and analyzed. Based upon the findings out of the research, few valuable suggestions like proper use of Vaccines Vial Monitor (VVM) as a management tool, improve the planning for emergencies etc have been suggested to Yashimarine logistics. These suggestions will pave way for improving the overall efficiency of the cold chain logistics for pharmaceutical products like vaccines.

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