PNEUMATIC TRANSPORT SYSTEM AT MEDANTA (MEDICITY) GURUGRAM

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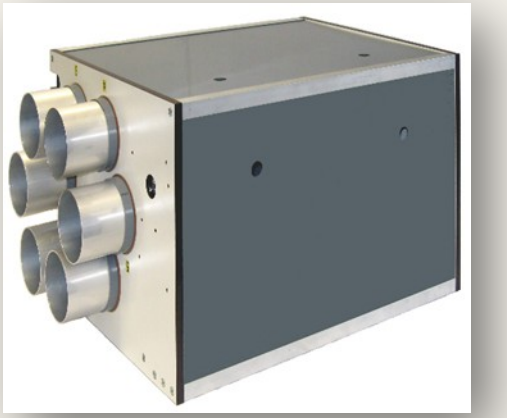
INTRODUCTION

Pneumatic tubes System are that propel cylindrical containers through networks of tubes by compressed air or by partial vacuum. They are used for transporting solid objects, as opposed to conventional pipelines, which transport fluids.

The hospital pneumatic tube system transports : medicine, laboratory samples, emergency samples, units of stored blood and so on. By doing so, the pneumatic tube system creates a direct connection between all hospital wards, such as blood banks, outpatient departments, nursing wards, reception or administration office.

COMPONENTS OF PTS

1. Carriers: are the capsules that actually travel through tubes. Leak-resistant and leak-proof carriers are ideal for hospitals and labs that need to transport sensitive liquid materials.
2. Stations are the ports that send and receive carriers. They include docks to insert carriers and user interface panels to send them to the desired end-station.



3. Diverter: A diverter is used to create branching paths in a tube system. There are 3-way Diverter (16Nos) & 6-way Diverter (5Nos) in our Pneumatic Tube System that are used to connect multiple tubes and multiple system lines in the hospital.

4. Blowers: are the fans that cause the carriers to move through the pneumatic tubes In Medanta Hospital the Pneumatic Tube System Plant Room consist of five heavy-duty 3-phase Blower.

5. Linear Coupler: The linear coupler is generally used in hospitals with multiple lines combined with high send frequencies and many stations. The Telecom linear coupler takes waiting carriers from the line and places them in a storage area.

6. Control System: The advanced and user-friendly control system has a graphical layout that is easy to configure and administer on location or remote, while the system remains operational.

RESEARCH QUESTION

1. What is Pneumatic transport systems (PTS) and how was it implemented?
2. What are the opinions of staffs about benefits of Pneumatic transport systems (PTS) over human based transport?
3. What are the reasons of missing carriers deployed using Pneumatic tube system in various departments?

AIM & OBJECTIVE

SPECIFIC AIM

The study's specific aim is to learn more about concerns and problems, including user and system errors, as well as to learn about crucial considerations for system installation.

OBJECTIVES

1. To describe Pneumatic transport systems (PTS) and its implementation in the hospital.
2. To assess the opinions of staffs about benefits of Pneumatic transport systems (PTS) over human based transport.
3. To find out the reasons of missing carriers deployed using Pneumatic tube system in various departments.

METHODOLOGY

- **Study Design:-** Observational cross-sectional descriptive study
- **Setting –** Tertiary care hospital Medanta- The Medicity Gurugram 1600+ bedded
- **Duration of study –** The duration of study was of 12 weeks from 23rd March 2022 to 17 June 2022.
- **Sample size-** 40 Pneumatic Tube stations present on all 14 floors -Number of users using the Pneumatic system on all floors- 300 + Nursing staff, Pharmacist and GDA staff.
- **Sampling technique –** Convenience sampling
- **Data collection procedure/tool–** Interview, Questionnaire and Observational Audits

Data analysis & interpretation

The project took 12 weeks where 352 PTS system users from 19 different departments were taken into account and survey/ questionnaire was distributed amongst them.

All the data, including survey responses, was imported from the Google form, and then entered an MS (Microsoft Excel) spreadsheet.

To analyse data distribution was performed Quantitative variables are analysed using frequency or percentage and also using mean and SD.

Data was analysed and interpreted with help of tables and pie charts.

Result

Installation of Pneumatic transport system at Medanta- The Medicity Gurugram: -

Steps in implementation:

1. **Initial Planning:** The hospital, which has more than 1600 beds, aimed to establish a pneumatic transport system throughout its 14 floors, including the ICU, triage/emergency rooms, post- and pre-operative ICUs, outpatient departments, and intensive care units, among other areas.

2**. Process for vendor selection:** Vendor was selected based on technical superiority and speedy completion of the project. Telecom Systems were opted out of the options provided.

3. **Pre implementation challenges:**

- The hospital has a sizable area with connected blocks at different levels. Such a design makes it difficult to route pipes.
- The system was installed in April 2010, took 2 years to do trial and run and caused many problems at first like Carriers broke, tubes broke, motors got electrocuted, Electronic and operational difficulties were to be seen and then were corrected later on to successfully run the system.

4. **End user issues:** Personnel training took close to 20–30 days, and it took another 30 days for staff to get used to the new system. The incorrect dialling of stations was also frequently reported.

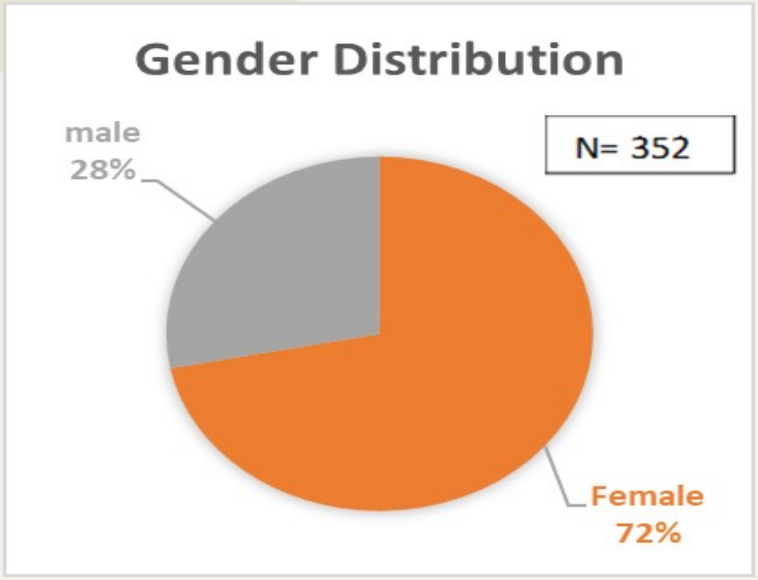
Total Project cost

Total installation and equipment cost of PTS	**Rs. 2,2300000**

Total Estimated Cost of Functioning of PTS in Financial Year (2021-2022)

Electricity charge	**Rs. 7,56,000**
Maintenance	Rs. 4,16,397
Repair charge	Rs. 9,63,660
Total AMC and Repair charge with GST	Rs. 16,28,000
Total	Rs. 23,84,000

Survey Result



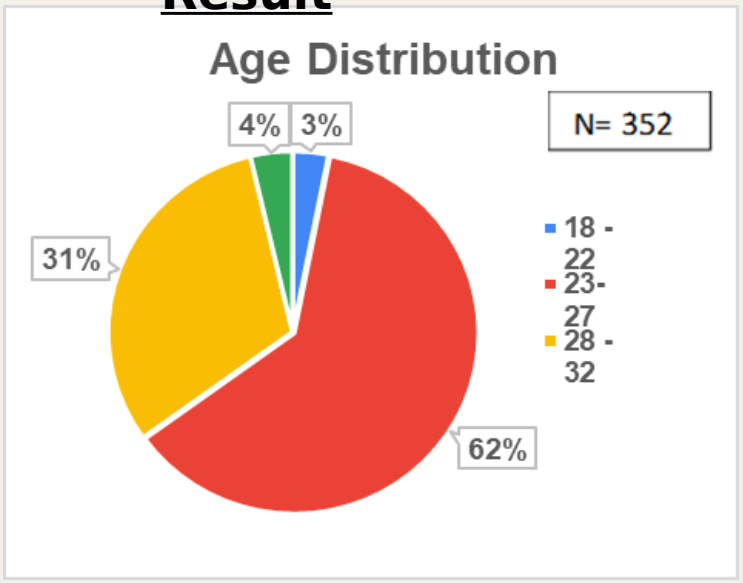


Figure 1& 2 represent the Demographic & Background characteristics distribution of respondents

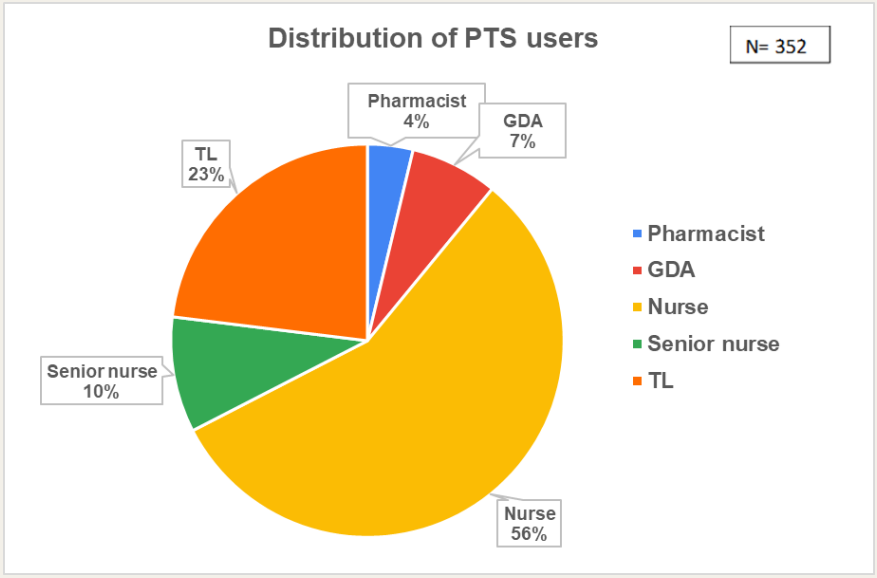


Figure 3 shows distribution of staff according to Pneumatic Tube system users

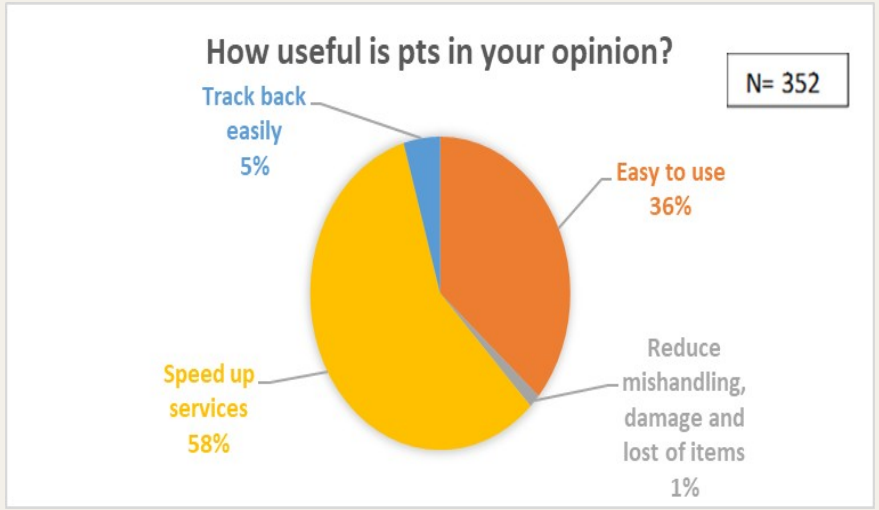


Figure 4 depicts the Opinion of staff about different aspects of PTS system

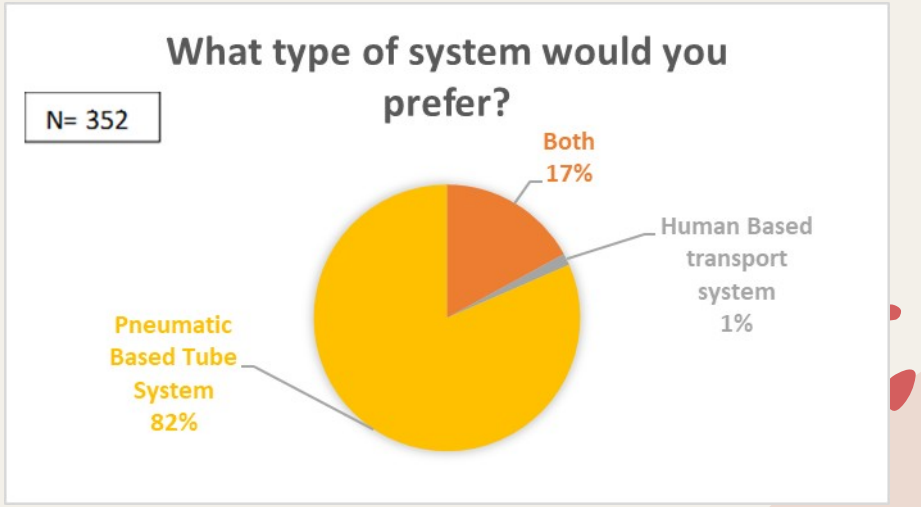


Figure 5 represents the system preference of the users

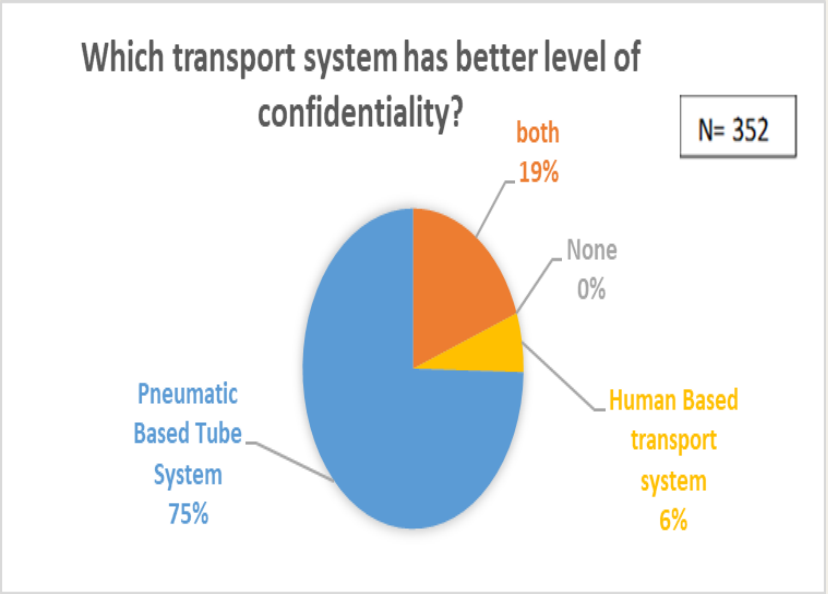


Figure 6 shows PTS system is preferred in terms of confidentiality amongst the system users .

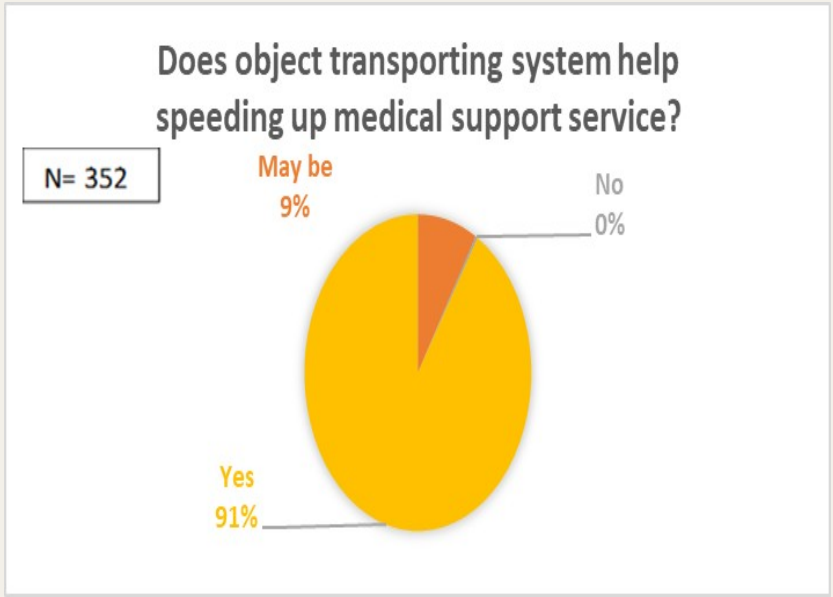


Figure 7 shows that the responders agree the system has a faster speed per transaction than messengers

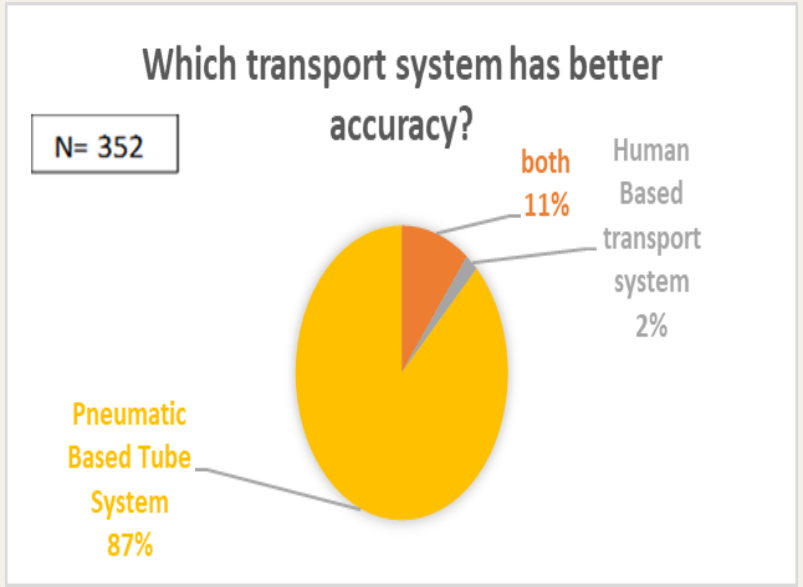


Figure 8 depicts that PTS has a higher accuracy rate than messenger

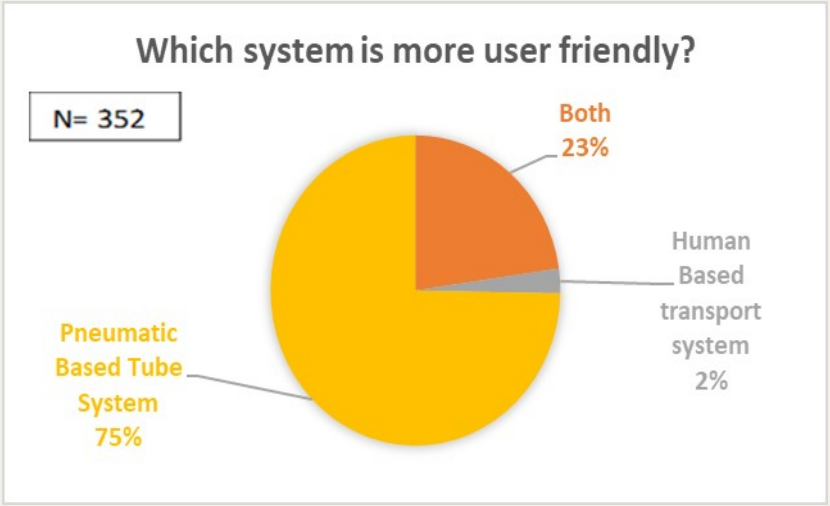


Figure 9 shows PTS System is easy to operate and is user friendly

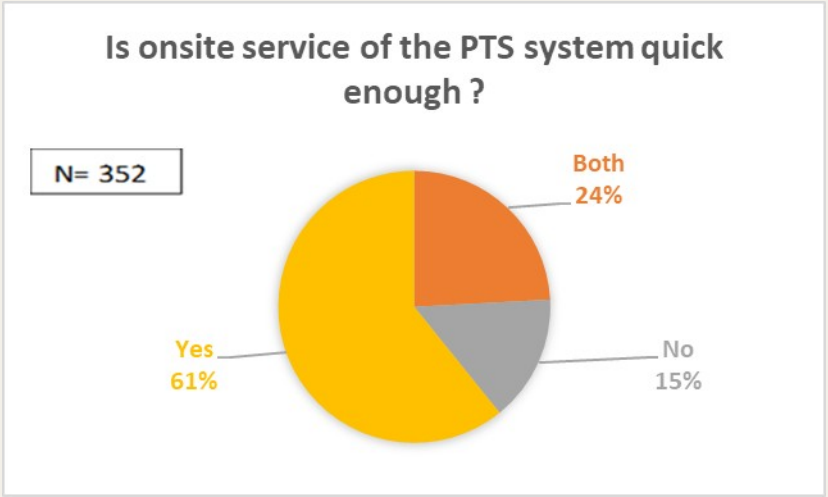


Figure 10 depicts system repair service on site is fast

Errors encountered while transferring through PTS

Pneumatic Carrier Deployment								
S.No	Department	Floor	Speciality	tation cod	Carrier as per Inventory	Carrier Physicall y found (April)	Short	Reason
1	5 Th B Wing	5th floor	Thoracic Surgery	501	2	1	1	Breakage of carrier
2	6 Th B Wing	6th floor	Neurology	601	2	1	1	Wrong Code entered by nursing staff
3	9 Th B Wing	9th floor	CTVS & Pediatric	901	2	1	1	Breakage of carrier
4	12 Th B Wing	12th floor	Gi surgery	121	2	1	1	Wrong Code entered by nursing staff
5	14 Th B Wing	14th floor	Liver transplant	131	2	0	2	Operational defect/problem
6	8 Th A Wing	8th floor	CTVS	608	2	1	1	Wrong Code entered by nursing staff
7	12 Th A Wing	12th floor	Nephro and urology	612	2	1	1	Wrong Code entered by nursing staff
8	10 th OPD	10th floor	Medical oncology, hematology, pediatric hematocology	910	2	1	1	Wrong Code entered by nursing staff
9	ICU 8	2nd floor	Mix speciality	202	2	0	2	Wrong Code entered by nursing staff
10	ICU 9	2nd floor	Gastro and GI surgery	203	2	1	1	Breakage of carrier
11	ICU 11	2nd floor	Mixed	304	2	1	1	Operational defect/problem
12	Ortho ICU	2nd floor	Ortho	106	2	1	1	Breakage of carrier
13	Triage OBS &	UG	Emergency OBS &	56	2	1	1	Wrong Code entered by nursing staff

The Main causes of Missing Carriers were found to be: -

- Wrong dialling of code by the nursing staff causing the specimen to be lost or routed to the other department and not returned to the desired destination.
- Breakage of carrier due to inappropriate use of PTS.
- System Malfunction which can be an operational defect causing the carrier to be stuck within the tubes and failing to be retrieved at the desired destination

Recommendations

- To create a process control that makes sure the deadline for material delivery is always met. When used effectively, the PTS can be a useful strategic tool for delivering prompt and effective patient care.
- Staff from the pharmacy services department to ensure that the patient identity on the substance being transported is accurate.
- State clearly how often workers must check the station to help with the rapid removal of material in tubes. Think about packing any tubed materials with labels and documents, as well as a routing sheet in case the delivery gets diverted.
- Display a list of prohibited items that should not be transported at tube stations. Avoid using the PTS for anything other than what is was intended for. The integrity of the PTS is compromised by improper use, which also limits the capability of the institution to deliver excellent patient care.
- Display a timetable detailing when approved items can be delivered to addresses.
- A sticker tracker should be applied to the PTS system's canister so that any samples that are misplaced or delivered to the wrong location can be brought back to their original location. This technology could make it possible to identify missing canisters for future use.

Conclusion

The pneumatic transport system (PTS) is a useful substitute for traditional human-dependent transportation. The goals of this study were to compare the functions and outcomes of object transportation systems for enhancing hospital medical support services.

One of the creative approaches to increase service efficiency is to implement any logistic system for the transportation of goods, documents, and samples. In hospitals, a variety of technologies, including the human-based transport system and the pneumatic tubes system, can be utilised to move objects, documents, and specimens.

According to this analysis, respondents believe that Pneumatic tube system helps in speeding up the medical services, is accurate and is user friendly. Modern hospitals and healthcare facilities should transition to employing these technologies because of the growing emphasis on resource efficiency in order to reduce operational costs in hospitals.

Therefore, it is preferable to take these facilities into account throughout planning for a hospital. And lastly, PTS systems are a boon for any hospital building type


THANK
YOU!