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Time and Motion Study of Functioning of Immunization Clinic in Rural Primary Health Training Center in Coimbatore, Tamil Nadu, India

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ABSTRACT

Background: Time and motion study will help us to identify the bottlenecks in healthcare delivery system. So, an observational study was conducted with the objectives of evaluating the operational efficiency and functioning of an immunization clinic. **Materials and Methods:** The study was conducted at the immunization clinic of Rural Primary Health Training Center in Coimbatore, Tamil Nadu in India from February to April 2018. Systemic random sampling method was used to select 732 mothers/caregivers attending the immunization clinic. **Results:** The waiting time in immunization clinic was found to be 56.4% of the total time spent. For new cases, the mean time taken for initial registration and receiving post vaccination advice were found to be significantly longer than old cases. Delivering health care services took more time during Mondays and also during the first hour of the day. **Conclusion:** The perception of quality of healthcare received can be improved by reducing the waiting time.

1. INTRODUCTION:

Time and motion study developed by Frederick Taylor was first used in the field of industrial engineering during the earlier part of the twentieth century. It addressed the concerns related to inefficiencies and wastage of resources in industrial field [1]. To improve the quality of available healthcare, time and motion study is nowadays used extensively in healthcare research. As healthcare settings are faced with more and more challenges, time and motion study which employs financial, logistic and other advanced management techniques can be used to solve ever increasing healthcare problems [2].

The quality of healthcare available to people living in remote and rural areas is considered as a major issue in achieving universal health coverage. Improvement in quality is associated with decreased mortality and morbidity rates. Time and motion study will help in improving the quality, efficient use of available resources and reduces the cost of healthcare settings. Therefore, in recent years, healthcare enterprises all over the world have begun applying time and motion studies and system analysis tools to improve their operations and overall efficiency [3].

Immunization is considered as an important public health tool in reducing the mortality and morbidity in under-five children. Most of the childhood mortality in developing countries can be attributed to diseases like acute respiratory infections, diarrhea, meningitis and vector borne diseases. Most of these can be avoided by routine immunization. Immunization is a keystone in achieving Millennium Development Goals (MDG). MDG goal 4 aims to reduce the death of under-five children by immunization [4].

In India, the data from National Family Health Survey-1 (NFHS-1) shows that only 36% of children were fully vaccinated. In NFHS-2 and NFHS-3, the values were 42% and 44% respectively. This shows that there is only little improvement in vaccination coverage over the years in spite of the fact that huge amount of money being invested in Universal Immunization Programme (UIP) and concerted efforts through National Rural Health Mission (NRHM) [5].

The functioning of healthcare systems in India is guided by Indian Public Health Standards (IPHS). IPHS for primary health centre emphasis the fact that they should be well equipped and efficient in conducting immunization clinics. This includes giving full immunization to all infants and children against vaccine preventable diseases as per guidelines of Government of

India (GOI), Vitamin A prophylaxis as per national guidelines, nutritional assessment of infants/children along with plotting of growth chart, health education to mother/caregiver followed by post vaccination advice and maintaining a vaccine record [6].

The efficient functioning of healthcare system depends on its proper utilization of its resources. Although there are many ways to perform a task, one method will be superior to the other. By performing the time and motion study, we can identify the time taken by different methods to perform the tasks and select the most efficient method. The tasks carried out by the immunization clinic are already structured. Hence, time and motion study can be used to evaluate its efficiency. Therefore, the present time and motion study was conducted to evaluate the operational efficiency and time taken to perform different tasks in an immunization clinic in a rural primary health training centre in Coimbatore, Tamil Nadu.

2. MATERIALS AND METHODS:

2.1. Study design: An observational cross sectional study was conducted at the immunization clinic of Rural Primary Health Training Center, Chandrapuram which is a field practice area of the Department of Community Medicine, Government Medical College and ESI Hospital, Coimbatore, Tamil Nadu, India. The study was done between September and November 2019. The study was conducted in two stages, a passive observation and a time and motion study.

2.2. Study Participants: The study participants included mothers/caregivers attending immunization clinic with their children. The registration records present at the immunization clinic for the last two months were reviewed and the average daily registration including both the old and new cases were found to be 60 in number. Every fifth mother/caregiver registering in the immunization clinic on the day of study was selected by systemic random sampling method. Considering the average number of working days in a month to be 20, the minimum sample size to be achieved was fixed at 720. Finally, 732 study participants were included in the study. Informed written consent was obtained from each mother/caregiver included in the study.

2.3. Data collection:

2.3.1. Stage 1: This is a stage of passive observation. We spent one week initially passively observing the immunization clinic to become familiar with the specific core functions that each

staff member in immunization clinic is performing. We identified five core functions performed by them registration of new and old cases, nutritional assessment of under-five children, providing nutritional advice and health education about preventing common childhood illnesses, vaccine administration and finally post vaccination advice.

2.3.2. Stage 2: The actual time and motion study was performed in this stage. Predesigned and pretested schedules were used to record time and other information. Stopwatches were used to record total time taken for each of the above mentioned activities. Start and end times were based on both visual and verbal cues. For example, the "start time" of an observation may have been the initial registration-related task for a new client (i.e. began a new data form, engaged the client in related conversation). "End time" was defined as the point when a staff member had completed all tasks associated with that particular activity.

2.4. Data analysis: Statistical analysis was done using SPSS version 21. The variables used in the analysis were waiting time at different service delivery points, service delivery time at different activity points, time taken for nutritional assessment, nutritional advice, vaccine administration and post vaccination advice. The time has been expressed as mean and standard deviation. Trimmed mean was used in certain places as data was very much skewed leading to large standard deviations. The mean observation time per task was calculated and average times were compared using analysis of variances and unpaired‘t’ test.

2.5. Ethical issues: The Permission was obtained from Institutional Ethics Committee before starting the study. All procedures performed in the study were in accordance with the ethical standards of the Institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments.

3. RESULTS:

The total number of study participants took part in the study were 732. Out of them, 152 came for the first time to the immunization clinic while 580 were old cases. Each study participant on an average had spent 2532.6 ± 622.1 seconds in immunization clinic. The average total waiting time was 1428.4 ± 423.4 seconds while the average total service delivery time received by each study participant was 1104.2 ± 292.4 seconds. The average waiting time at different service delivery points is given in table 1.

Table No. 1: Waiting time at different service delivery points (n = 732)

Activity	Mean ± SD (in seconds)	% of total waiting time
Initial registration	742.8 ± 521.3	52.0
Nutritional assessment	119.9 ± 95.8	8.4
Health education	235.7 ± 142.4	16.5
Vaccine administration	168.6 ± 86.2	11.8
Post vaccination advice	175.6 ± 124.4	12.3

The study participants had spent 56.4% of their time at immunization clinic in waiting to get the service. Most of the total waiting time was spent in initial registration (52.0%) followed by health education (16.5%). The waiting time spent for vaccine administration and post vaccination advice were 11.8% and 12.3% respectively.

The service delivery time at different activity points is shown in table 2. The mean time taken during initial registration was 234.1 seconds and it constitutes 21.2% of the total activity time. The mean time taken for registering new cases was longer (286.6 ± 211.2 seconds) when compared with the average time taken for registering old cases (146.3 ± 90.8 seconds) and the difference was found to be statistically significant (p value = 0.000).

Table No. 2: Service delivery time at different activity points (n=732)

Activity	Mean ± SD (in seconds)	% of total activity time
Initial registration	234.1 ± 123.3	21.2
Nutritional assessment	188.8 ± 108.5	17.1
Health education	248.4 ± 156.1	22.5
Vaccine administration	288.2 ± 112.4	26.1
Post vaccination advice	144.6 ± 121.3	13.1

The mean time for nutritional assessment was 188.8 seconds and it took 17.1% of the total activity time. Mothers/caregivers of children spent most of their time in health education and vaccine administration which constituted 22.5% and 26.1% of the activity time respectively. The mean time spent in post vaccination advice was 144.6 seconds. The time taken for giving post

vaccination advice for new cases was longer (284.6 ± 205.1 seconds) when compared with old cases (108.3 ± 106.2 seconds) and the difference was found to be statistically significant (p = value = 0.000).

When service delivery time was compared with the day of visit, it was found that the maximum time for initial registration was on Monday (204.2 seconds). Tuesday took maximum time for nutritional assessment (168.9 seconds) and post vaccination advice (150.4 seconds). Friday took maximum time for giving health education (211.8 seconds) while Thursday and Monday took almost equal time for administering vaccines. The results are shown in table 3.

Table No. 3: Service delivery time (trimmed mean) in relation to day of visit

Activity	Time (trimmed mean) in seconds					
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Initial registration	204.2	164.5	178.4	182.3	172.1	184.1
Nutritional assessment	153.2	168.9	157.6	152.4	155.2	150.6
Health education	182.5	209.7	201.3	199.4	211.8	203.9
Vaccine administration	250.1	241.5	245.4	251.6	244.9	239.2
Post vaccination advice	150.4	162.4	155.7	149.8	154.2	152.4

The service delivery time was at its maximum for all the functions of immunization clinic between 10 to 11 AM on any day. This was followed by 11 AM to 12 PM session. The service delivery time was at its minimum between 12 PM to 1 PM. The results are shown in table 4.

Table No. 4: Service delivery time (trimmed mean) in relation to time of visit

Activity	Time (trimmed mean) in seconds		
	10 - 11 AM	11 AM - 12 PM	12 PM - 1 PM
Initial registration	185.3	178.1	168.7
Nutritional assessment	161.3	154.5	142.4
Health education	219.6	207.4	198.8
Vaccine administration	261.4	247.3	135.1
Post vaccination advice	168.5	154.9	141.2

4. DISCUSSION:

Different studies have found that long waiting times along with insufficient and inefficient staff as major obstacles faced by healthcare facilities in many developing countries [7]. In the present study, it was found that the waiting time of the study participants in immunization clinic to be 56.4%. It was slightly lesser than the results obtained from a similar conducted in Delhi in which, the waiting time was found to be 64.1%[8]. About half of their waiting time was spent on initial registration. The long waiting time could be due to lack of adequate health care workers. Though there are three healthcare workers posted in the immunization clinic, it is not proportionate to the amount of cases they handle.

Perception of the quality of healthcare received also depends upon the timeliness of the services which they receive [9].In our study, we found that the actual service delivery time to be 43.6% which is less than half of the time they were at the healthcare facility. This will negatively impact their perception about the quality of healthcare they received.

In our study, we found that most of service delivery time was spent in vaccine administration followed by health education. For new cases, more time was taken during initial registration process. This may be due to healthcare workers filling socio-demographic particulars for the new cases. By placing more healthcare workers at these service delivery points will quicken the entire process and improve the efficiency of immunization clinic. These results were similar to the results obtained in Delhi [8] and Kolkata [7].

One of the important agenda in achieving universal health coverage is to ensure the availability of quality healthcare all round the clock 24/7. In the present study, the service delivery time was found to be at its maximum during Mondays. This could be due to more number of beneficiaries availing the healthcare facility during Mondays. Such differential access to health centre can be due to number of staff present on the particular day of study, unequal efficiency of the number of staffs and availability of vaccines uniformly.

When we consider a single working day, the service delivery time was at its maximum at the beginning of the day and it gradually decreases during subsequent sessions. Again various factors could be responsible for this difference observed in relation to time of visit like total case

load, waiting time and service time in getting various services at the immunization clinic. However, these variations need to be studied in depth.

This study represents one of the very few studies applying time and motion techniques in healthcare settings especially in the functioning of immunization clinic. These studies will provide baseline data to conduct more elaborate such studies in future. Developing countries have their own unique constraints like poor availability of funds, lack of manpower and insufficient logistics. Time and motion studies are helpful in identifying the bottlenecks and constraints in the system.

The present study being an observational study, it has its limitations on its own. The results of the study cannot be generalized since the data was collected from single immunization clinic attached to a rural primary health training centre in Coimbatore, Tamil Nadu. The study can be done on a wider area and further research can be done to evaluate the effectiveness of integrating the time and motion model into the existing healthcare model.

5. CONCLUSION:

The waiting time in the immunization clinic was found to be 56.4%. By reducing the waiting time, we can improve the perception of quality of healthcare received. This study shows that time and motion study designs can be used at all levels in planning and implementation of various healthcare programs.

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Conflicts of interest: None

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