



A TIME MOTION STUDY FOR ROUTINE IMMUNIZATION IN MEDICAL COLLEGE KOLKATA, WEST BENGAL.

Community Medicine

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ABSTRACT

Time motion studies were first described in the early 20th century in industrial engineering, referring to a quantitative data collection method where an external observer captured detailed data on the duration and movements required to accomplish a specific task, coupled with an analysis focused on improving efficiency. Since then, they have been broadly adopted by biomedical researchers and have become a focus of attention due to the current interest in clinical workflow related factors. However, attempts to aggregate results from these studies have been difficult, resulting from a significant variability in the implementation and reporting of methods.

Materials and Methods: This was an observational cross sectional study done in the immunization clinic of Medical College, Kolkata, over a period of 1 month (January 2021). The study population included mother/caregivers attending the immunization clinics with their children. The total sample was 97. Predesigned and pretested schedule containing observational checklist & pre-synchronized stopwatches were used to record service delivery time at the different activity points.

Results: Data was collected from observing immunization sessions conducted on 103 children over the period of 1 month. Mean waiting time was 4 minutes 58 seconds. The vaccination process time ranged from 2 minutes to 6 minutes 12 seconds with median value of 5 minutes 24 seconds. The mean time taken at nutrition and health assessment table was 5 minutes 03 seconds and median time was 4 minutes 55 seconds. Post vaccination advice took mean and median time of 3 minutes 52 seconds and 3 minutes 46 seconds, respectively. Mean overall stay time at the clinic excluding waiting time was 24 minutes 43 seconds. Service delivery took longer for beneficiaries receiving multiple injectable vaccines with oral vaccine, age group of 12 months - 24 months, having new registration. Waiting time was maximum for those coming in between 12.00 PM - 1.00 PM. Not all people are abiding by the instruction of staying 30 minutes post vaccination.

Conclusion: Efficient functioning of immunization clinics is required to achieve seamless service delivery as more and more vaccines are being incorporated in NIS. This study dealt on utilization of time at a Medical college immunization clinic where key finding is that a substantial amount of time is lost for child consolation which delays post vaccination advice and overall procedure as a whole.

KEYWORDS

Immunization clinic, Time-motion study, queuing.

INTRODUCTION:

Time motion study is a systematic observation, analysis, and measurement of the separate steps in the performance of a specific job for the purpose of establishing a standard time for each performance, improving procedures, and increasing productivity. It is a major part of scientific management. This integrated approach to work system improvement is known as methods engineering (Kim, 2017) and it is applied today to industrial as well as service organizations, including banks, schools and hospitals. At a very fundamental level, time studies were described as detailed observations of workers using a stop-watch to determine the time required to accomplish specific tasks. Later Frank and Lilian Gilbreth focused on motion also with time (Baumgart & Neuhauser, 2009). The Motion Study method sought to make processes more efficient by reducing the motions involved. These two techniques, time studies and motion studies, became integrated into a widely accepted method in scientific management referred to as Time Motion Studies (TMS). Productivity plays an important role in a time motion study. There are many reasons for which the productivity decreases and there are various methods to improve productivity. But, choosing which method to use according to the situation is a wise decision. Determination of standard work cycle times is one of the important step used in work study, which provides critical inputs for improvement activities.

Prolonged waiting time has a significant association with patient's dissatisfaction (Capuano et al., 2015). Partly, waiting time is associated with the patient turn over but the hospital management must be geared to tackle any such obvious situation and try all measures to reduce the waiting times. Every institution has Immunization clinic for vaccinating children and adults. Immunization clinic is an important place of an institution where healthcare providers perform various operations without compromising the quality of services. The principle philosophy of a time motion study is observe in the immunization clinic.

Few such studies has been reported in outpatient care department of an institution ([PDF] *A Time Motion Study in the OPD Clinic of a Rural Hospital of West Bengal | Semantic Scholar*, n.d.), in emergency room

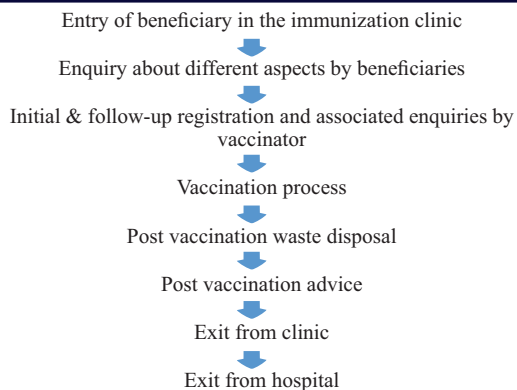
of paediatric department, community mental health worker. (Chebolu-Subramanian et al., 2019) So, this present study was conducted on routine immunization procedure, to which PHNs are quite familiar but still queuing is a regular picture in medical colleges. This health services research aims to systematically find out the flow of vaccination systems to identify which areas need further improvements to decrease waiting time and improve service delivery.

METHOD & METHODOLOGY:

It was an observational cross-sectional study carried out in immunization clinic of Medical College Kolkata over a period of one month (January, 2021). The study population included mother/caregivers attending the immunization clinics with their children. The total sample was 97. Before starting the study, ethical clearance for conducting the study was taken from the Ethical Committee of Medical College, Kolkata. Informed consent was taken from every mother/caregiver for the study beforehand. Predesigned and pretested schedule containing observational checklist were used to record time and other motion related information, and pre-synchronized stopwatches were used to record total activity time (which included waiting time + service time). As the immunization clinic was open from 10.00 am till 2.00 pm, data collection started at 10.00 am. Time was recorded at the following points:

- At the entrance (entry time)
- Immunization table 1 (after completion of initial registration by public health nurse)
- Immunization table 2 (after completion of nutritional assessment of child and health education to mothers by interns)
- Immunization table 1 (after completion of final registration by public health nurse)
- Immunization table 3 (after completion of vaccination and post vaccination advice delivery by public health nurse)
- Exit time.

The following actions are noted in the immunization clinic and they are depicted in the flow chart below



Apart from that any other function performed by workers and time spent for that was also noted.

In case of initial registration of new cards, a serial number was given and in final registration; In addition, in case of old cards, information related to previous vaccination date, expected date of this vaccination doses were checked and the already allotted registration number were verified and matched with the records maintained in the immunization clinic.

In case of delay enquiry was made about the reason of delay by the vaccinator. Immunization table 1 was maintained by 2 PHNs. One of them did the whole registration and counselling and enquiry and another PHN did perform the vaccination proper

In the vaccination proper following functions were performed by the vaccinator

1. Pre vaccination hand wash
2. Vaccine vial opening
3. Reconstitution
4. Auto disable syringe opening
5. Vaccine draw
6. Injecting /orally giving the vaccine
7. Use of cotton
8. Post vaccination hand wash

For all these actions time was noted for beneficiaries using stop watch. Among the above mentioned actions 1, 4, 5, 6, 7, 8 were expected to be performed for all beneficiaries of injectable vaccines. There were no one who received only oral vaccine in this study period. After recording individual timing for all these steps total time spent for this vaccination process was calculated.

After vaccination appropriate post vaccination advice was given that were focused on AEFI, to wait for 30 minutes after vaccination, date of next visit etc. all these advices were noted and total time taken for post vaccination advice was also noted.

On immunization table 2 nutritional assessment was done by interns for under 5 children only. Nutritional assessment of the child was done by clinical and anthropometric methods along with plotting of growth chart and health education was given to mother/caregiver.

Comparison with previous records was done in the case of existing records

As per the layout of the immunization clinic the sequence of movement of mother/caregiver was as follows: After entry the participants waited for their turn to come in the waiting area, then went to immunization table 1 for initial registration and vaccination and post vaccination advice after which caregivers under 5 children approached immunization table 2 for nutritional assessment of the child and health education and then they exited from the clinic. After exit from clinic they should wait for at least 30 minutes in the outside waiting area. When the beneficiaries exited from hospital was also noted.

Motion of every mother/caregiver selected for the study was followed from the entry till exit from the immunization clinic in the above sequence, and time spend in the above-mentioned activity points was recorded. Statistical analysis was done by using SPSS 11. Time has been expressed as mean, median, mode and range. All fractional values of seconds were rounded up to the next integer value.

RESULTS:

Data was collected from observing immunization sessions conducted on 103 children over the period of 1 month. Among them 88 were under 5 children. Mean waiting time was 4 minutes 58 seconds and it was found out that waiting time is less in case of beneficiary coming before 11.00 AM (mean =2 minutes) & it is maximum of the beneficiaries entering between 12.00 PM to 1.00 PM (10 minutes 56 seconds).

Table 1 presents the service delivery time at the different activity points. In the initial registration table the mean time taken was 3min 58 s while the median value was 4 minutes 05 seconds. The vaccination process time ranged from 2 min to 6 min 12 s with median value of 5 min 24 s. The mean time taken at nutrition and health assessment table was 5 minutes 03 seconds and median time was 4 minutes 55 seconds. Post vaccination advice took mean and median time of 3 minutes 52 seconds and 3 minutes 46 seconds respectively.

Among the other activities consolation of children ranged from 15 seconds-10 minutes 25 seconds with a median value of 2 minutes 15 seconds. In case of nutritional assessment, record keeping took more time than actual assessment (mean 3 minutes 07 seconds and 1 minutes 56 seconds respectively for record keeping and measurement).

Mean overall stay time at the clinic excluding waiting time was 24 minutes 43 seconds and though all of them were advised to stay at waiting area 30 minutes after exit from vaccination but this time varied widely with many complying but some leaving the hospital immediately.

Mean time for vaccination and post vaccination counselling consisted 16.9% and 15.6% of overall mean clinic stay respectively. Whereas mean time for child consolation was 17.8% of total time.

Table 1: Mean, median and range of time taken for different activities in the routine immunization clinic (n=103)

Service delivery	Time taken		
	Mean	Median	Range
Pre vaccination enquiry	2 min 59 s	2 min 36 s	1 min 59 s - 4 min 32 s
Registration	3 min 58 s	4 min 05 s	3 min 45 s - 4 min 25s
Vaccination process	4 min 12 s	5 min 24 s	2 min 0 s - 6 min 12 s
Post vaccination advice	3 min 52 s	3 min 46 s	3 min 2 s - 5 min 15 s
Waste disposal	44 s	35 s	30 sec -50 sec
Interpersonal talks between vaccinators	3 min 13 s	4 min 0 s	0 sec - 10 min
Consoling the child after vaccination	4 min 24 s	2min 15 s	15 s- 10min 25 s
Nutritional assessment by weight measurement	1 min 56 s	1 min 57 s	1 min 45 s- 2 min 04 s
Recording and plotting the nutritional data	3 min 07 s	2 min 58 s	2 min 43 s- 4 min 02 s
Total clinic stay	24 min 43 s	25 min 0 s	10 min - 45 min
Stay in hospital after exiting clinic	11 min 0 s	15 min 0 s	0 min - 30 min

Table 2 shows the service delivery in relation to old/new registrations, time of visit & vaccine received. All the vaccines given to the beneficiary are noted. According to vaccine received beneficiary are divided as 'single injectable vaccine received', 'multiple injectable vaccine received' & 'injectable & oral vaccine received'.

In case of new registration pre-vaccination enquiry took maximum time whereas previously registrar beneficiary's post-vaccination advice took longer. When analysing according to the age of the beneficiary it is seen that mean vaccination time longest in case of children aged between 12 months to 24 months. According to vaccine received average time per vaccine was maximum who received multiple injectable & oral vaccines.

Table 2: Mean waiting and service delivery time among different groups of beneficiaries (n=103)

	Waiting time (mean)	Service delivery time (mean)
Arrival time of beneficiaries in the clinic		
10.00 AM -11.00 AM	2min 0 s	22 min 12 s
11.00AM -12.00 PM	2 min 54 s	26 min 44 s
12.00PM -1.00 PM	10 min 56 s	24 min 24 s
1.00PM – 2PM	4 min 02 s	25 min 32 s
Type of registration		
Old registration	4min 52 s	21 min 32 s
New registration	5 min 04 s	27 min 54 s
Number of vaccines received		
Receiving single injectable vaccine	4 min 45 s	12 min 15 s
Receiving multiple injectable vaccine	5 min 05 s	28 min 22 s
Receiving multiple injectable vaccine with oral vaccine	5 min 04 s	33 min 32 s
Age of beneficiary		
Infant	4 min 32 s	21 min 10 s
12 months - 24 months	4 min 50 s	30 min 16 s
25months - 60 months	5 min 17 s	22 min 12 s
>=5 years	5 min 13 s	25 min 14 s

DISCUSSION:

Time taken at the different tables during the first half of the clinic (10.00 AM–12.00 PM) was more probably due to more number of mother/caregivers attending the clinic in the first half. Waiting time was maximum in between 12.00 PM- 1.00 PM, this probably because at first half beneficiary inflow is maximum & also time spent in overall vaccination process is also more which ultimately leads to cumulative queuing after 2 hour of vaccination procedure. It is also noted that in 1st hour (10.00 AM-11.00 AM) mean time taken by the vaccinators to perform registration and vaccination proper is least that somehow slows down by 1 minute 44 seconds on an average in the second hour (11.00 AM-12.00 PM). This may also be a reason of longer waiting time in the time range of 12.00 PM-1.00 PM.

Time taken for vaccination procedure is longer for children aged between 12 months-24 months because they feel more agitated and difficult to control by the mother/caregiver especially in case of multiple vaccination.

The time increases more when an oral vaccine is also given to them as opening the mouth properly especially for an agitated child is more time consuming. In case of new registration mothers of caregivers are often sceptical and asked questions like problems of vaccination, what to feed the child, what are the benefits of vaccines etc. that took longer time to explain and convince the mother. Whereas in case of old registrations preventing drop out was main concern so advices after vaccination like when to come next, how to preserve card and bring it back took some longer time to explain. Also in general previously registered children are older in age group and needed more time to console by the mother after vaccination. Only after the child is no more restless vaccinators could proceed for post vaccination advices, which in turn increased the time taken.

A similar study conducted way back in 2010 in a tertiary hospital pointed out that more time is taken for vaccination and post vaccination advice in case of new registration which result goes hand in hand with this study. Similar to this study they also reported that time taken for the whole procedure is more in the 1st half than the second half.(Chattopadhyay et al., 2012) This study ventured further and found out other factors that may be contributing to the time of service delivery like age of the child and delivery of multiple vaccines and also calculated waiting time for the beneficiaries.

Such bottlenecks identified may have relations to number of staff present, unequal efficiency of the members of the staffs, pattern of arrangement of activity Tables in the immunization clinic, varying number of participants in relation to different hour of visit, etc.

The quality and efficiency of the immunization services can be improved if the constraints and bottlenecks in the system are identified,

analysed and attempts are made to overcome them. Perhaps this study will help in the initiation of further in-depth analysis of the bottlenecks related to this particular system of health care delivery.

CONCLUSION:

This study pointed out that the said immunization clinic, though well managed by 3 staffs but can do with one more staff to reduce the time taken for actions specially in case of nutritional assessment. Another important finding is that a lot of time is lost in time of post vaccination advices mothers are busy consoling the child. A separate waiting room may be arranged where immediately after vaccination mothers with beneficiaries can be sent for this purpose and also for waiting 30 minutes. Once the baby is manageable another staff may be posted at that waiting room solely for post vaccination counselling purpose which in turn reduce the time lost and decrease waiting time and queuing.

Conflict of interest: None

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