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improve pre-hospital care in
ambulances during the transport of 1-
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By Abhinaya Jeyaraman

A quality improvement initiative to improve pre-hospital care in ambulances during the transport of 1-month to 12 years old children to a tertiary care hospital

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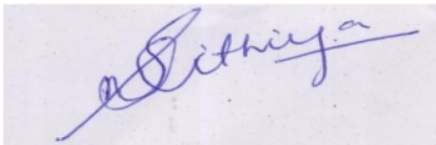
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CONFLICT OF INTEREST STATEMENT:

“I undersign and certificate that I do not have any financial or personal relationships that might bias the content of this work.”

Best regards,



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ABSTRACT

Background. Our emergency department receives many referred children in transport ambulances in a critically ill state. While most children received appropriate pre-hospital stabilization, certain areas needed improvement. Our study aims to improve the quality of pre-hospital care and provide “Excellent” pre-hospital care for at least 90% of children between 1 month to 12 years who are transported in ambulances to our pediatric ED over eight weeks.

Methods. This was a Quality improvement study conducted in our Pediatric ED in 3 phases: Assessment phase, implementation phase, and sustenance phase. We have graded the percentage of quality of pre-hospital care based on the consensus from the QI meeting as follows: <50% - Sub optimal, 50-75% - Optimal, and >75% - Excellent care. The problem areas were analyzed using various QI tools like fishbone diagrams, PDSA cycles, Pareto charts, and P control charts.

Results. The quality of pre-hospital care provided has improved from a baseline of 50.3% to 93.3% and also 96% of children received “Excellent” pre-hospital care during our study period. The total number of children included in the study was 538.

Conclusion. The pre-hospital care awareness and education significantly improved the quality of care. Continued support from various levels starting from the primary health care centre will be required for sustained improvement in pre-hospital care.

Keywords: pediatric emergency department, transport checklist, training sessions, pre-arrival intimation

INTRODUCTION

Many critically ill patients require transfer to a higher-level hospital for intensive care [1].

Among the referred children, many are critically ill upon arrival. While most children received appropriate pre-hospital stabilization, certain areas needed improvement. The reasons people cannot receive the appropriate pre-hospital care include a lack of infrastructure, basic facilities, qualified personnel, and necessary equipment supplies [2]. In addition, the clinical expertise and understanding of health professionals needed to deliver high-quality care need improvement [2]. We

observed that evidence-based interventions in pre-hospital care are often delivered to patients with suboptimal quality and may result in untoward treatment outcomes by increasing morbidity and mortality. Since studies in this field were not fully established in resource-limited settings, we used Quality Improvement (QI) methodology to address concerns, such as lack of services, by rearranging treatment within the constraints of available resources. Measuring the quality of pre-hospital care in any healthcare setting is highly contingent and depends solely on how quality is defined or viewed within that setting [1]. Hence we aimed to improve the quality of pre-hospital care given to the children transported to our hospital by this quality improvement initiative.

MATERIALS AND METHODS

Study design and setting

This study was a cross sectional Quality improvement study conducted in the emergency department of Pediatrics in a tertiary care teaching hospital in Chengalpattu, Tamilnadu, India from November 2021 to August 2022. We got approval from the ethical committee in our institute-IEC/APPROVAL/19/2021 Dated 11/2021.

Inclusion criteria: All children presenting to the pediatric ED in transport ambulances between 1 month & 12 years of age during the study period.

Exclusion criteria: Children with surgical illnesses and congenital anomalies.

We have obtained the informed consent from the parents/legal guardians of the children before enrollment in the study.

Phases in Quality improvement:

Assessment phase – 1 month (November 2021):

Implementation phase – 2 months (December 2021-January 2022)

The Sustenance phase – 7 months (February 2022 - August 2022)

Team formation: We formed a team comprising total of 30 members comprising of ambulance personnel, medical officers of the peripheral government and private hospitals, staff nurses of the peripheral government and private hospitals, pediatric ED staff nurses, resident doctors, and faculties. The ED staff nurse was chosen as a team leader.

SMART (Specific, Measurable, Attainable, Relevant, Time-bound)

Aim Statement:

To improve the quality of pre-hospital care and provide “Excellent” pre-hospital care for at least 90% of children between 1 month to 12 years who are transported in 108 ambulances to our paediatric ED, over a period of 8 weeks.

Where the percentage of Quality of transport is graded, based on the consensus from the QI meeting, as follows: <50% - Sub-optimal, 50-75% - Optimal and >75% - Excellent.

Assessment phase:

The first QI team meeting was conducted on November 1st, 2021 wherein the factors that resulted in inappropriate pre-hospital care were listed by each of the team members from their perspective and as there were no existing protocols or criteria to analyse the quality or standards of pre-hospital care given to children, the quality of transport had been decided to be assessed using the following parameters shortlisted by this team discussion.

Filling of transport checklist: In our setup, the patient case record form, itself is structured by the Emergency Management and Research Institute as a comprehensive checklist that contains basic details of the child, chief complaints, place referred from, time of referral, time of arrival, physiological status assessment of the child at scene/ primary health care and during the handover and details of pre-hospital care given.

Giving pre-arrival intimation to our ED- by either medical officer/ ambulance personnel: Pre-arrival intimation is an essential step to be given by the referring medical officer and/or ambulance personnel before taking the child to any tertiary care hospital, as it alerts the caregivers at the receiving end, about the condition of the child and to plan for stabilization.

Entry in the ambulance registry maintenance at our ED and feedback given to ambulance personnel: One-to-one feedback can be shared among ambulance personnel and the QI team members from the hospital by maintaining the registry in which the ambulance personnel enters details such as the basic data of the child,

referred from Primary Health Centres/Government Hospitals/ Scene, pre-hospital care given during transport of child such as oxygen support, intravenous fluids, etc.

Intervention for stabilization of airway, breathing, circulation, disability, and CBG (capillary blood glucose) levels:

Early recognition of critical illness and timely intervention is crucial in the stabilization of a sick child and check if stabilization was done correctly as per pediatric sick child assessment protocol [3,4].

After the assessment phase over 1 month (November 2021), the second QI meeting was conducted on December 1st, 2021 which included the ambulance personnel along with our ED team and was conducted with a PowerPoint displaying all the baseline data and statistics. Bi-directional feedback was given and taken among the team members when every team member suggested various solutions for the problems listed in the presentation.

A post-graduate junior resident suggested that if a register is maintained separately for the children received in ambulance, it would be helpful to identify and fill the gaps, in the quality of pre-hospital care, by providing one-to-one feedback to the EMT (Emergency Medical Technician) personnel during the transport of children.

The ED staff nurse suggested that the quality of transport will significantly improve if the transport checklist (patient case record form) is duly filled by the personnel after the physiological assessment of the child at the scene/ PHC(Primary Health Centre) itself, which will help the team to identify the abnormal physiological status and provide early intervention at the right point of time.

EMT personnel suggested that a separate phone connection shall be given for the paediatric ED since the landline number at our PICU(Pediatric Intensive Care Unit) cannot be reached by them while attempting to provide pre-arrival intimation.

On further discussion, one of the EMT personnel said that she had difficulty in confidently assessing a child, since she needs training in paediatric emergency, to assess the physiological status of a child like how she does an assessment in an adult.

We constructed a fishbone diagram (Figure 1) and key driver diagram (Figure 2) to identify the root causes of problems.

Considering the above-discussed interventions, the Pareto Principle (80% of a problem is due to 20% of the causes) (Figure 3) was applied to construct a prioritisation matrix for the order of target interventions that were to be made.

The following measures were subsequently tested by four PDSA cycles: completing a transport checklist, providing an estimated arrival to our ED, maintaining a registry of ambulance personnel and staff nurses documenting the patient condition in the ED, and training sessions.

Implementation phase (December 2021-January 2022): The changes and results were analyzed using four PDSA (Plan-Do-Study-Act) cycles. Each cycle lasted 2 weeks, and we have also displayed the P control chart in the unit.

By the end of the 8 weeks of the Implementation phase, the quality improvement team worked to improve the quality of pre-hospital care in ambulances and continued to collect data on pre-hospital stabilization every day. The PDSA cycles were repeated and the standard operative protocols were formed from the changes made by the quality improvement team in the implementation phase and were sustained by building enthusiasm among the team members and motivating them with appreciation and honours.

Statistical analysis: The quality of pre-hospital care was plotted on a P-control chart. The paired T-test was used for the analysis of pre and post-test results.

12 RESULTS

The total number of children included in the study was 538. The baseline demographic data has been recorded (Table 1).

Table 1. Demographic characteristics of study population

Characteristics		N(%)
AGE	0-3 years	304(57)
	4 -6 years	100(16)

	7-9 years	73(16)
	10 -12 years	61(11)
SEX	males	303(56)
	females	235(44)
Cause of referral	Respiratory illness	140(26)
	Toxins/bites/stings	120(22)
	CNS disorders	118(22)
	Infections	112(21)
	GIT disorders	8(1)
	Hematological disorders	5(1)
	Miscellaneous	27(5)

Based on the SMART aim, the team members prompted the EMT personnel transporting the child to complete the transport checklist (Patient Case Record) in 100% of children transported and sustain the same percentage for at least ten months as the first PDSA cycle (Table 2). The checklist constituted details regarding the place of referral, physiological status of the child at scene/ primary health care and during the handover, type of pre-hospital care given, time of dispatch, ¹⁷ estimated time of arrival (ETA), the actual time of arrival, and EMT details. We considered partially filled physiological status assessments as incomplete. The EMT personnel opined that it was difficult to complete the checklist in sick cases especially shifted from the scene since they were busy monitoring the child's status and providing care during transport. On the other hand, ambulance personnel were motivated to complete the transport checklist for all cases. We have also regularly reminded the EMT personnel to complete the transport checklist before shifting the children when the EMT calls the ED to give the ETA (Estimated Time of Arrival). By the end of two

weeks, the percentage of children transported with completed transport checklists increased from a baseline of 73% to 88% immediately after initiating the intervention and gradually further improved to 100% during the sustenance phase.

The next “change idea” proposed was to arrange a separate phone connection for the pediatric ED since the landline number cannot be reached, in many instances, by the ambulance personnel while attempting to provide an ETA. Hence, we have procured a mobile phone, and the contact number was provided to all PHCs and ambulances through coordinators and WhatsApp groups. We have also requested that the medical officers of the peripheral hospitals ensure that the ETA was promptly given to us before referring any child. The ambulance personnel and the medical officers agreed to our request and assured us they would give the ETA through the number provided. By the end of two weeks, the percentage of children transported after giving pre-arrival intimation, increased from a baseline of 50% to 75% immediately after the arrangement of a separate mobile number and gradually further improved to more than 90% during the sustenance phase.

The team members of the quality improvement study assembled for the next QI meeting, where we discussed the improvement in quality by the previous interventions, focussing on areas that needed further improvement. The next “change idea” proposed based on the Pareto principle was to maintain a registry and enter the details of children transported in ambulances to our ED. One-to-one feedback was shared among ambulance personnel and the QI team members from the hospital by maintaining the registry in which the ambulance personnel enters details such as the basic data of the child, referred from PHC/Government hospital/ Scene, pre-hospital care given during transport of child such as oxygen support, intravenous fluids, etc. after which the faculty/resident conducted a one on one interaction to discuss the improvement solutions (Table 2).

By the end of two weeks, the percentage of cases entered into the registry and provided feedback regarding the same increased from a baseline of 69% to 100% immediately after the arrangement of a separate registry maintained at our ER and remained the same during the sustenance phase.

Another QI meeting was arranged after two weeks with the plan for the final PDSA cycle. It was decided to conduct training sessions for PHC medical officers,

doctors, and nurses from government and private hospitals who refer cases to our hospital in ambulances as special training on pediatric emergencies would facilitate the caregivers to stabilize critically ill children in a better way and refer to a tertiary care center (Table 2). The training sessions were conducted for 15 sessions (3 hours/session) by the ED medical officer in groups consisting of 20-30 persons per session by conducting hands on workshop and pre-test was conducted before the session and post-test was conducted after the completion of training and also showed a significant number of correct responses in the post-test ($p < 0.0001$). Feedback from the healthcare providers about the training session was received where 95% of the participants strongly agreed that the training session provided them a better perspective in many pediatric emergencies.

Table 2. Showing PDSA cycles at various interventions

PDSA	TIMELINE	PLAN	DO	STUDY	ACT
Completion of transport checklist	1 st December to 15 th December 2021	Ensuring 100% completion of transport checklist	Encourage the ambulance personnel to assess the child on scene and enter the patient case record	Process indicator: The percentage of children transported with completed transport checklists.	Ambulance personnel completed the transport checklist before shifting the children
Pre-arrival intimation	16 th December – 31 st December 2021	Ensuring 100% pre-arrival intimation	Arranging a separate contact number for ED and intimate to all PHCs and ambulances through coordinators.	Process indicator: The percentage of children transported after giving pre-arrival intimation	Medical officers of the PHCs and GH and the EMT give us the pre-arrival intimation before transporting the children

Register entry	1 st January-15 th January 2022	Ensuring 100% entry of cases in the register.	Encourage the personnel to enter the details of cases in the register and encourage the duty resident at ED to provide feedback about the case.	Process indicator: The percentage of cases entered in the register	Both ambulance personnel and the ED duty resident ensure that the register is filled before the EMT leaves the ED.
Training sessions	16 th January-31 st January 2022	¹⁶ To improve the quality of care by enlightening the knowledge of pre-hospital healthcare providers	Conduct training sessions for pre-hospital healthcare providers	Feedback from the healthcare providers about the training session.	Conducted training sessions at regular intervals and received feedback

² The quality of pre-hospital care provided has improved from a baseline of 50.3% to 93.3%. Thereby, at least 96% of children received “Excellent” pre-hospital care during our study period (Figure 4).

¹ DISCUSSION

This study was designed to observe the quality of referral by ambulance personnel accompanying children referred to our pediatric ED, create awareness among healthcare providers at different referring healthcare facilities, and assess the impact of this intervention on the quality of referral. ¹⁹ Government-run ambulances were used

1 mostly in our study. A significant proportion (94%) of those who required admission were 'referred' patients, primarily from nearby government hospitals, similar to Ezhumalai et al. study[5]. Respiratory illness(28%) constituted the most common cause of referral followed by toxins and central nervous system illnesses which was similar to the study by Santhanam et al [6]. The Well-documented checklist is crucial for maintaining continuity of care, especially in sick children. Lack of patient information concerning clinical status and treatment received poses many problems for the receiving facility. Since most patients in our facility were critically ill, we highly depend on the details of pre-hospital management. The transport checklists in the pre-intervention phase had missing information related to illness, clinical examination, treatment given, and pre-referral stabilization and we have made ambulance personnel to document checklist which significantly improved quality of care similar to sankar et al study [7] in which they used proforma for documentation and Haugland et al [8] used referral checklist. In our study, we conducted a training session and awareness programs for appropriate documentation by quality improvement study, which significantly impacted the outcome. The proportion of inappropriate pre-hospital care had significantly reduced and a corresponding significant increase in the proportion of appropriate pre-hospital care was noticed. Referral content concerning clinical examination findings, pre-referral stabilization, and treatment during transport had improved significantly. The proportion of patients received in a physiologically unstable state significantly decreased in the post-intervention period. Educational interventions and awareness programs thus improved the quality of transport checklists, pre-arrival intimations, and physiologically unstable referrals. Recently advances like smart health systems [9] have been used for improving the quality of ambulance services which can be implemented in developing countries in the future.

2 To summarise, we aimed to improve the quality of pre-hospital care of sick children admitted to our center. We found that only 51% of children during the assessment phase had received optimal pre-hospital care. We could improve our pre-hospital care and were able to achieve our SMART aim by conducting brainstorming sessions among our staff, faculties, referral centers medical officers, and ambulance personnel.

13 The strength of our study is that our's is the first quality improvement study done for pre-hospital care in resource-limited settings. Our limitations are that our

study was done in a single center and needs to be studied in multiple tertiary centers. In addition, since there are no standardized protocols for transport quality in resource-limited settings, future studies in this field are required using the QI model.

CONCLUSION

This initiative aimed ² to improve the quality of pre-hospital care and provide “Excellent” pre-hospital care for at least 90% of children between 1 month to 12 years who are transported in 108 ambulances to our paediatric ED, over a period of 8 weeks and it resulted in an improvement from a baseline of 50.3%, to 93.3%. The initiative also helped to provide “Excellent” pre-hospital care for at least 96% of children. The simple interventions that were done can be safely practised at all tertiary care hospitals receiving children for higher level care for better outcomes. Continued support from various levels will be required for sustained improvement in pre-hospital care as this is the continuous process. However, the standardized protocols to measure pre-hospital care quality need further studies.

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FIGURE LEGENDS:

Figure 1 Showing fishbone diagram

Figure 2 showing key driver diagram

Figure 3 showing pareto chart depicting interventions that will improve the quality of pre-hospital care

Figure 4 showing grading the quality of hospital care