IMPACT OF PRE-HOSPITAL CARE ON THE OUTCOME OF THE CHILDREN PRESENTING TO THE PEDIATRIC EMERGENCY SERVICE (PES) WITH ACUTE RESPIRATORY ILLNESS IN A TERTIARY CARE CENTER IN SOUTH INDIA

A dissertation submitted in partial fulfillment of the requirements to the Tamil Nadu Dr MGR Medical University, Chennai for the MD Degree in Pediatrics

May 2018

DECLARATION

I hereby declare that the dissertation titled **"Impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service (PES) with acute respiratory illness in a tertiary care center in South India"** is the bonafide work done by me in the Department of Paediatrics, Christian Medical College and Hospital, Vellore towards partial fulfillment of the requirements to the MD Degree in Paediatrics for the examination of The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamilnadu, to be held in May 2018, done under the guidance of Dr .Debasis Das Adhikari. This is an original study done by me and no part of it has been published or submitted to any university previously.

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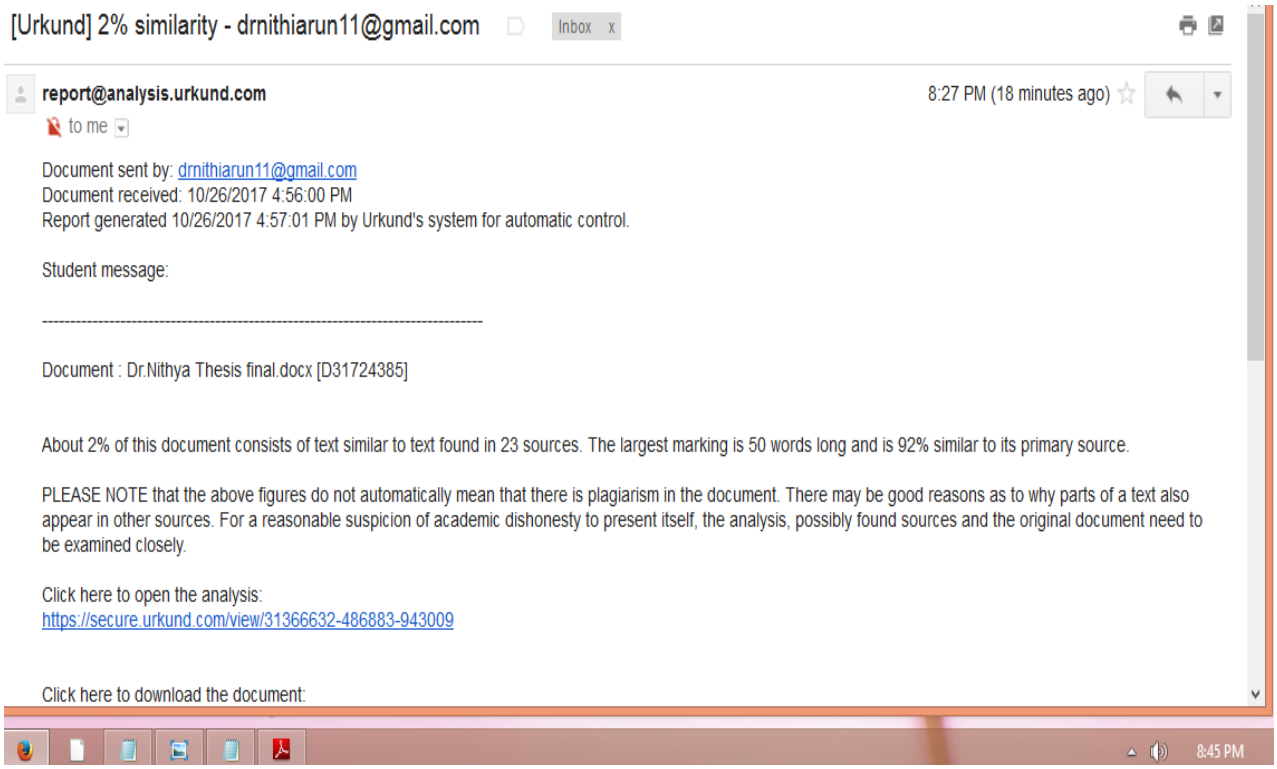

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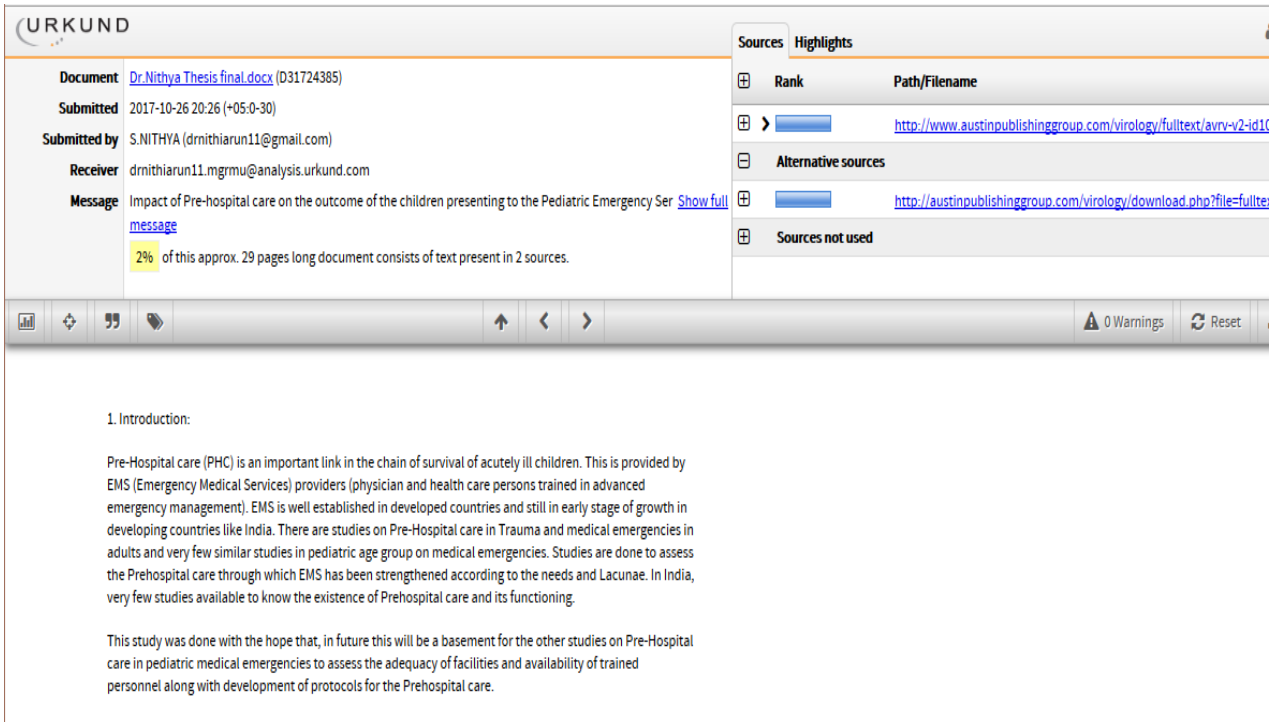

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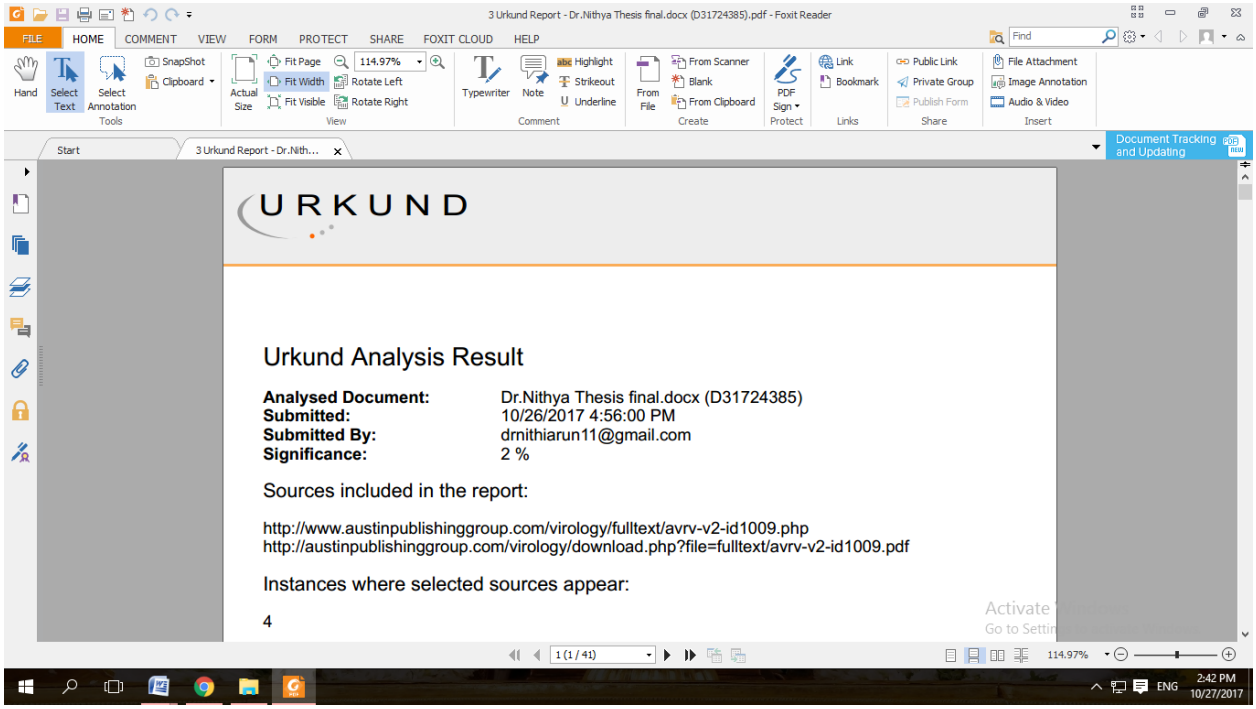
1. Introduction:

Pre-Hospital care (PHC) is an important link in the chain of survival of acutely ill children. This is provided by EMS (Emergency Medical Services) providers (physician and health care persons trained in advanced emergency management). EMS is well established in developed countries and still in early stage of growth in developing countries like India. There are studies on Pre-Hospital care in Trauma and medical emergencies in adults and very few similar studies in pediatric age group on medical emergencies. Studies are done to assess the Prehospital care through which EMS has been strengthened according to the needs and Lacunae. In India, very few studies available to know the existence of Prehospital care and its functioning.

This study was done with the hope that, in future this will be a basement for the other studies on Pre-Hospital care in pediatric medical emergencies to assess the adequacy of facilities and availability of trained personnel along with development of protocols for the Prehospital care.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CERTIFICATE - II

This is to certify that this dissertation work titled "Impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service (PES) with acute respiratory illness in a tertiary care center in South India" the candidate Dr. S. Nithya with registration Number 201617453 for the award of Degree of MD Paediatrics branch VII. I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows TWO percentage of plagiarism in the dissertation.

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I thank God for giving me this opportunity and for mercy and faithfulness that has sustained me.

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1. INTRODUCTION:

Pre-Hospital care (PHC) is an important link in the chain of survival of acutely ill children. This is provided by EMS (Emergency Medical Services) providers (physician and health care persons trained in advanced emergency management). EMS is well established in developed countries and still in early stage of growth in developing countries like India. There are studies on Pre-Hospital care in Trauma and medical emergencies in adults and very few similar studies in pediatric age group on medical emergencies. Studies are done to assess the Prehospital care through which EMS has been strengthened according to the needs and Lacunae. In India, very few studies available to know the existence of Prehospital care and its functioning.

This study was done with the hope that, in future this will be a basement for the other studies on Pre-Hospital care in pediatric medical emergencies to assess the adequacy of facilities and availability of trained personnel along with development of protocols for the Prehospital care.

In Pediatric Emergency Service (PES) children present with varied system illnesses. Since studying the Pre-hospital care in various systems is practically difficult, in view of uniformity in assessing the illness, the children presenting with acute respiratory illness (ARI) was taken as study population. Among all the systemic illness in children, ARI was considered, since it remains the major disease contributing in mortality and morbidity of children.

2. AIM AND OBJECTIVES

Aim:

To analyze the impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service (PES) with acute respiratory illness in a tertiary care center in South India.

Objectives:

Primary outcomes:

To find the impact of pre-hospital care among the children presenting to PES with acute respiratory illness (ARI), by assessing the severity of illness using PRESS score and by analysing the outcome namely the nature of respiratory support required and nature of admission.

Secondary outcome:

1. To determine the utility of Ambulance as transport care among the study group.

2. To determine the effect of other significant demographic, clinical factors of the study group on the outcome.

Null hypotheses:

There is no difference in severity of illness and the outcome between the two groups, children who received adequate pre-hospital care and inadequate pre-hospital care among those presenting to pediatric emergency (PES) with acute respiratory illness and needing hospitalization.

Hypotheses:

To disprove null hypotheses: Among the children presenting to (PES) pediatric emergency services with (ARI) acute respiratory illness and requiring hospitalization, those who received adequate pre-hospital care will have less severity of illness and better outcome.

3. REVIEW OF LITERATURE

PRE-HOSPITAL CARE

Pre-Hospital care is a emergency medical care provided to patients soon after activation of Emergency Medical Services (EMS) ranging from bystander resuscitation to statutory EMS and transfer [1]. Pre-hospital EMS includes response to the scene by ambulance, treatment, trained EMS personnel to triage and transport through air or ground ambulance to an appropriate Hospital. EMS units represent the first stage of series of Emergency care which includes Hospital emergency departments, Trauma-system, Inpatient care, and the interfaculty transport systems [2]. Quick decision making and intervening greatly influence the outcome of Pre-Hospital care given to severely ill and injured patients. Management of pathologies, and challenging environmental factors/hazardous situations are done according to clinical setting and patient needs [1].

Wilson et al [1] states that Pre-hospital emergency medicine needs rescue competencies , scene management skills along with logistics and clinical care. It also requires understanding of pathologies, and ability to do specialized procedures in an unusual setting. This is always time-dependent which applies techniques in initial course of the disease that can change disease progression and outcome.

Jewekes at al [3] in Dilemmas in Pre-hospital care stated that definitive care cannot be provided in a out-of hospital, for a very sick or seriously injured child. Therefore, very sick children must be transported promptly without any treatment-so called “scoop and run”. Current teaching tries to strike a middle road-to teach adequate background knowledge that an Immediate care doctor or a paramedic can gain the benefit of a

particular skill against the possible detriment to the patient due to the delay in transportation.

STATUS OF THE PRE-HOSPITAL CARE IN THE WORLD AND IN DEVELOPING COUNTRIES

CARE PROVIDER AND TRANSPORT IN VARIOUS COUNTRIES:

In United States of America, Pre-Hospital care has been provided by EMS personnel, where as in United States, voluntary organizations provide the same .In Australia; physicians provide the care as the Royal Flying Doctor Services developed. In countries of Europe and Asia, Supplementary Physician or Physician-paramedic model provides the care [1].

The training has been provided as a formal medical subspecialty education to the trainees of Emergency Medicine and Anesthesiologists. The skills of Paramedics will vary depending on the country which permits them to do procedures [1].

U.S. army developed an organized ambulance system for the transport of wounded in the civil wars. After which developed the resuscitation teams, society for the recovery of drowned persons in 1767 in Amsterdam [4].

First Hospital based ambulance was started in Cincinnati commercial Hospital in the year 1865, Bullet proof ambulance was introduced for the military use in 1905. During the world war buses were used to mobilize the wounded victims.

In 1960's and 1970's mobile coronary care unit were introduced with all resuscitation equipments and trained personnel in Britain, U.S. and Australia. Resuscitation equipments were initially large, which were later replaced by transportable and compatible ones.

In (World War I) Nazi-Germany, aircraft were used for patient transport. In Australia fixed – wing civilian air ambulance was started in 1928. After which fixed wing ambulances was started in U.K., Africa and so. In the same way Helicopter ambulances was started and still used for under developed area of the world. Initially during the war, the nurses were care givers. Flight nurses were trained during the World War II.

List of recommended competencies for transport nurses were made by commission on Accreditation of medical Transport system CAMTS[5] and many other similar organization which improved the ability of the Staffs

In one of the prospective observational cohort of children younger than 18 years with OOHRA (Out of hospital arrest) cared for 1 yr done by New York City emergency medical services (EMS) system from April 12,2002 to March 31,2003. Bystander cardiopulmonary resuscitation (CPR) was performed in 31% of respiratory arrests (RAs)-(109 OOHRAs required resuscitation) with survival of hospital discharge was 79%. The median EMS response-time was 4.4 minutes (range-0-12 min) .

MODE OF TRANSPORT:

In the developed countries, Pre-hospital care is provided through land Air ambulance by doctors and staff nurses .Where as in developing countries like India still transport remains as challenge. In the study done by Sankar et al [6] in a tertiary care center, it was

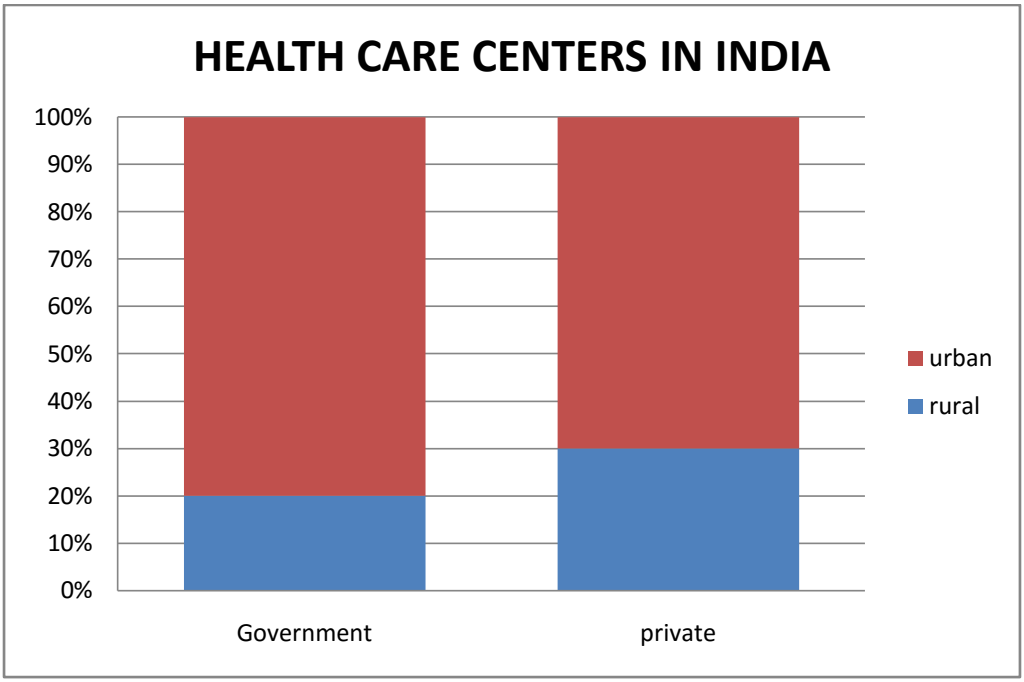
shown that ambulances are run by government and private agencies in which there were no trained personnel.

The South Indian study on trauma Patients [7] showed that first aid was done to 18.5% of the victims on-site, but only 7.5% of the patients were brought to the hospital by ambulances. In 80% of the ambulances, no attending doctor was present and resuscitation equipment was present in only 13.3% of those ambulances.

HEALTH CARE SERVICES STATUS IN INDIA AND TAMIL NADU:

The Infant mortality rate (IMR) of India came down to 53 per 1000 Live Birth in 2008 to 40 per 1000 LB in 2013, where as in Tamil nadu, IMR which came down from 31 per 1000 LB in 2008 to 21 per 1000 Live Birth in 2013 [8]. It is found that there is significant interstate difference in health outcomes. The social determinants of health play an important role in health equity, income, caste ,education and social group determining to the distribution of health outcomes [9]. The number of hospital beds per population in urban areas is found to be more than twice the number in rural areas in government hospitals, and it is found that urban areas have four times more health workers per population [10].

The first level care is provided by primary health care services between the population and the health providers. Hence many government , other government related agencies started creating similar infrastructure and man power to deliver the health care services[11] through sub-centers ,primary health and community health centers, taluk hospitals, urban health services, ESI hospitals. In 2015 there were 8682 sub-centers, 1380 primary health care centers and 35 community health centers in Tamil Nadu [12].



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Currently, secondary health centers in urban hospitals and district hospitals are responsible for primary health care in city and town. There is a development in the provision of taluk, district, and medical college levels of government-funded, hospital-based care in our country. After the 1980s, there has been an increase in tertiary care-private institutions, initially in big cities and later in smaller towns. So this private tertiary care developed with the active support of the government and also because of the lack of government investment in such hospital-based care. In private hospital, the mode of tertiary care focuses mainly on diseases, lab/radiological investigations and treatments that increase the profitability, and this has led to the catastrophic costs and debts that result when patients access hospital-based care in the private sector [13].

About three fourth of medical practitioners who work in private sector provide the primary health care need. Though there is an increase in number of tertiary care centers past 2 decades, government sectors and private sectors are facing problems due to overcrowding. The other problems in government sectors are resource crunch, difficulties in equipment maintenance, upgrading the infrastructure in order meet the rapidly growing demand for the increasing complex diagnostic as well as therapeutic modalities [14].

In 1991, Delhi government formed an autonomous body – Centralized Accident and Trauma services (CATS) for the improvement of pre-hospital trauma services. Emergency Management and Research institute (EMRI), Foundation and Emergency Accident Relief Centre (EARC), Ambulance Access for All (AAA) are the other service providers in Andhra Pradesh, Tamil Nadu and Maharashtra respectively [15].

In Ludhiana, Christian Medical College started Ambulance Motorbike and Rescue Service (AMARS) March 2003 by to provide support in Himachal Pradesh, Punjab, Jammu and Delhi. Similarly, National Rural Health Mission (NRHM) initialized National ambulance services via 108 telephone number. Recently, through 102, Active Network Group of Emergency Life Savers (ANGELS) was started. Trained paramedics had been involved by all the above agencies for offering pre-hospital emergency care [4]. This emergency response system was mainly initiated to address the patients critical care, trauma and accident victims etc.

In a study done by Sankar et al in a tertiary care center, it was shown that ambulances are run by government and private agencies in which there were no trained personnel. Hence in developing countries like India still transport remains as challenge [6].

The South Indian study on trauma Patients showed that first aid was done to 18.5% of the victims' onsite, but only 7.5% of the patients were brought to the hospital by ambulances. In 80% of the ambulances, no attending doctor was present and resuscitation equipment was present in only 13.3% of those ambulances [7].

In South India, a prospective observational comparison study was done on pre-hospital care of trauma patients in 2000-2001 and in 2010-2011. Study showed in "on spot rescue team" , 2.5% were non- medicals with first aid training and only 0.75% was paramedic in 2000-2001, where as in 2010-2011, 11.5% were non-medicals with first aid training and 12% were paramedics [7].

NEED FOR PRE-HOSPITAL CARE TRAINING IN PEDIATRIC EMERGENCY:

In children, the event that compromise the cardiac status is usually respiratory[16] .Seidel js(1986) stated that data survey from training programs demonstrated that education in pediatric emergency was inadequate. This led to dissemination of advanced life support courses and pediatric resuscitation program.

In 1987, Kallsen and Albert studied retrospectively over a period of 12 months about the difficulties during Resuscitation of children in EMS leading to prolonged scene time [17] indicating the need for training in Pediatric Emergencies. In 1988, Johnston and King studied retrospectively that 6% of ambulance calls are for pediatric run which led to Emergency personnel training to treat motor vehicle injuries, seizures, poisoning and upper air way obstruction [18] .

In 1995, Boswell et al in a retrospective and descriptive study on pediatric airway control done over a period of six years mainly on Prehospital Pediatric and adult

intubation showed that pediatric intubation needs improvement in the level of training as well as experience [19] .

The effectiveness of Pre-hospital trauma care course was studied prospectively which used estimation of the cost and cost-effectiveness of improving the training of lay people 307 trainees were included. Of whom, 188(62%) were followed up for their knowledge in training after initial training. The study concluded that lack of knowledge was not a barrier and confidence level of trainees in providing first-aid [20] was high after a training.

DEVELOPING PROTOCOLS IN PRE-HOSPITAL CARE:

Based on studies done previously, an online project Pre-hospital Evidence-based Protocols (PEP) was developed as an evidence of research to make protocols. One of those was Canadian PEP which has one hundred and three protocols, with 182 interventions in the PEP. Disadvantage was, interventions found to be repeated in different protocol (e.g., bag mask ventilation was found in cardiac arrest, also in respiratory arrest), resulting in false high interventions (547 interventions protocols) were seen in database [21] .

Another evidence-based source of protocols is the resuscitation guidelines which is published every 5 years by the ILCOR [22,23]. These protocols were established to improve the Prehospital care.

In US, committee was made to outline the roles and responsibilities of EMS in crisis standards of care (CSC) plans which is made to explain the legal responsibilities [24] .

SCORING SYSTEMS AND ITS NEED

In the need of early identification of severity of illness and prioritize in emergency services, and also to predict the outcome based on scoring at arrival, scoring systems are required in Emergency Services and Critical Care system.

SCORING SYSTEM IN PEDIATRIC ICU:

Many scoring systems were developed in emergency to assess the mortality risk after admission to PICU. PRISM [25] Scoring was used to determine the mortality risk factors. PRISM uses 14 physiologic values to be collected during the 1st 24hours after admission to the PICU. Respiratory rate, blood pressure (systolic/diastolic), heart rate, $PaCO_2$, prothrombin time,PaO_2/FiO_2, partial thromboplastin time PTT, total bilirubin, calcium, glucose, HCO_3^-, potassium and pupillary reactions are used as predictor variables for PRISM .

Similar scorings developed were PIM, PIM2 [26]. Elective admission, underlying condition, response of the pupils to bright light, mechanical ventilation, systolic blood pressure, base excess, and FiO_2/PaO_2 are the exact predictor variables for PIM. For PIM2 Elective admission, recovery post-procedure, cardiac bypass, high risk diagnosis, low risk diagnosis, no response of the pupils to bright light, mechanical ventilation, systolic blood pressure, base excess, and FiO_2*100/PaO_2 are the exact predictor variables.

SCORING SYSTEM IN EMERGENCY SYSTEM:

TOPRS scoring was developed in 2012([27]) to predict the severity of illness as well as the outcome at admission in the emergency services.Variables of 'TOPRS' score were

Temperature, Oxygen saturation, Pulse rate,Respiratory rate, Sensorium and Seizures. Variables were divided as normal (score zero) or abnormal (score 1) based on systemic inflammatory response syndrome (SIRS) criteria and criteria mentioned in advanced pediatric life support (APLS).

SCORING SYSTEM IN ASTHMA:

The scoring systems used in Asthma are mostly based on observed clinical signs. Few are Asthma Score (AS), Pediatric Respiratory Assessment Measure (PRAM) Clinical Asthma Evaluation Score 2 (CAES-2), Asthma Severity Score (ASS) and (RAD) Respiratory rate, Accessory muscle use, Decreased breath sounds. Validation was done on these scoring system to analyze the scoring system which helps in assessment of dyspnoea severity and management and found AS and PRAM were found to be most valid [28].

SCORING SYSTEM IN BRONCHIOLITIS

Scoring systems developed for asthma was also used in Bronchiolitis in less than 24 months. Modified wood's Clinical asthma score (M-WCAS) uses following five components namely expiratory wheeze, cerebral function, accessory muscles use, saturation, inspiratory breath sounds were considered ,each sign is given score of 0-2. Severity was graded as mildly ill ,moderately ill, and severely ill based on scores[29]. This was used to assess the severity as well as clinical response following the management in Bronchiolitis.

Another scoring system namely Tal et al. severity score, uses 4 components namely respiratory rate, wheeze, cyanosis and accessory respiratory muscle utilization, each ranging 0-3.

'PRESS'-scoring system in acute respiratory illness:

PRESS – Paediatric Respiratory severity scoring system (Annexure 3) is one of the simple respiratory scoring systems for assessing the severity of illness during the initial bed side assessment. This was established and used in a tertiary hospital in Japan [30] for identifying the need for hospitalization and further examination /assessment in Emergency setting. Hence 'PRESS-scoring' is used in our study for assessing the severity in respiratory illness in pediatric emergency.

PRESS has five components – Respiratory rate at rest in room air, wheeze, accessory muscle use, SpO2 in room air and feeding difficulties. Each component is given score of 0 or 1 based on the absence or presence of components.

EFFECTIVENESS OF PRE-HOSPITAL CARE

EFFECTIVENESS OF PRE-HOSPITAL CARE TRAUMA:

In a time-period cohort study done (1997 – 2006), paramedics (non-graduates) managed successfully the patients injured in land mines, war as well as traffic accidents by a trauma system. This study was done in an area where there was a long out-of-hospital times, and done for identification of pre-hospital life support interventions which

enhance survival. It was observed that trauma related mortality was reduced during the study period of ten years significantly from 17% to 4% (with (95% CI 15 -19) and (95% CI 3.5 – 5 respectively) [31].

Davis et al [32] showed that there was decrease in survival rate among the moderate-severe traumatic brain injury who were intubated during the prehospital care. It was specified that critical patients will be benefit from prehospital intubation, but difficult to identify these critical patients prospectively. A systematic review and Meta analysis of six analyses including 4772 patients by Bossers et al [33] was done in 2015 showed with limited experience, Prehospital intubation which was done by providers was found to be associated with two fold increase of mortality odd ratio 2.33,with 95% CI 1.61 to 3.38,while there was no such increase in mortality when intubation done by those who received extended training program odd ratio 0.75,with 95% CI 0.52 to 1.08.This was confirmed by meta-regression ($p = 0.009$).

"RUN TIME" IN EMERGENCY AND ITS EFFECT ON OUTCOME:

Franschman et al [34] found the run time for prehospital care as 74 ± 54 min. Two emergency services with similar out of hospital time were compared based on run time for prehospital intubation and the outcome based on it. In EMS and P-HEMS (physician-based helicopter emergency medical services) treated patients, runtime was found to be similar 59 (41-88 min) and 66 (51-80 min) respectively. In this study unexpectedly, the mortality was found to be high in patients treated by EMS.

Many similar EMS systems uses response times and on scene times as a parameter for effectiveness [35,36]. One such study done by collecting details from

Mecklenburg EMS data records showed that when response time increases more than 5 minutes, the mortality risk was found to be 1.58% while compared to those with Response Time of less than 5 minutes who have mortality risk of 0.51% ($p = 0.002$). It was found that mortality-risk curve was flat when Response Time exceeds 5 minutes[35].

Sampalismet al [37] showed that there was significant adjusted relative OR =3.0 of dying when prehospital time was more than 60 min.

PRE-HOSPITAL CARE AND SEPSIS:

Systematic review on sepsis management in emergency services showed that 8 studies were on sepsis identification, 7 studies were on identification and management of sepsis and only one study was on both identification and management. Systemic inflammatory response (SIRS) syndrome criteria with vital signs were used for early identification with sensitivity 0.43 - 0.86 with or without provider impression [38] in prehospital emergency.

PRE-HOSPITAL CARE AND OHCA-OUT OF HOSPITAL CARDIAC ARREST:

Systematic review done on prehospital critical care as well as on Advanced Life support-ALS for OHCA consists of 6 observational studies. Three of which concluded that there is no benefit in prehospital critical care. Remaining 3 studies showed there is benefit from prehospital critical care given by physicians. Based on prognostic factors and hospital treatment given in these studies, systematic review favored the Pre-hospital critical care group.

A bias adjusted meta analysis was done using 83 studies on success in all intubations and intubations which succeeded in first attempt .It showed only 2% difference in success between physicians and non-physicians in total intubations whereas 10% difference in first pass rapid sequence intubation success was noted between physicians and non-physicians. Although the precision in this study is lacking, this study focuses on improvement of intubation skills for non-physicians.

PREHOSPITAL CARE AND MYOCARDIAL INFARCTION

Attempts were made to analyze the effectiveness in North America and Europe [39,40]. One of the Studies done in Switzerland used survival rate as an indicator of effectiveness. It was done to study the trends of Pre-hospital emergencies over ten years which showed 48 hours survival rate 89% with increasing rate of cardiac arrest and myocardial infarction.

PREHOSPITAL CARE AND ADVANCED LIFE SUPPORT (ALS):

After the Emergence of Advanced Life Support the value of Pre-hospital care has improved [41],[42],[43]. The outcome of the patient and influence of prehospital care on discharge and transfer of the live patient to a hospital [44] were taken as predictors of effectiveness of ALS in prehospital care.

Studies on association of prehospital care with outcome:

1. Murad et al [31] in a time period-cohort study done over a period of ten years, showed that prehospital trauma care reduced the mortality rate by 13% in period 1(4 yrs) and in

Period 2 and 3 (each 3 yrs consecutively) reduction was by 15% (from 16 to 1.3 %) with the expansion of trauma care.

2. Husum et al [45] 15% mortality reduction was noted in study done in cambodia landmine as well as war victims following pre-hospital trauma care training among the first responders and it also improved the RT(response time)

3. Davis et al [32] in a study done impact of Prehospital intubation on outcome of moderate to severe traumatic brain Injury showed increase in mortality(P <0.0001 and with OR=0.36 with 95% confidence interval 0.32-0.42).But the study also concluded that ,in critically ill children prehospital intubation helps.

4.Bossers et al [33] in similar study on Prehospital care in severe traumatic brain injury showed mortality increased by two fold when it was done by less trained people.

ACUTE RESPIRATORY ILLNESS IN PEDIATRICS:

In developing countries, acute respiratory illness is the major killer of children although frequency of illness remains same in developed countries [46].

In 2008,Rudan et al found that in population, South east Asian region the incidence of pneumonia was 0.36 episodes /child year [47].

In studies done in South Indian urban slum area in 2010,it was shown ARI contributed 58.2% of childhood morbidities while in 2013 it increased to 60.2% with 7.5 episodes /child year [48]. In studies done in South Indian urban slum area in 2010, it was shown ARI contributed 58.2% of childhood morbidities while in 2013 it increased to 60.2% with 7.5

episodes /child year. In another study done in Vellore district it was found that Lower respiratory infection as the most common cause of hospitalization in children. Vaccination has decreased bacterial causes of ARI.

Stephen Berman [49] found that the 4.5 million deaths per year in the children in developing countries were due to acute respiratory infections. Pneumonia without measles contributes 3/4 of the deaths, pneumonia-post measles contributes 15%; pertussis contributes 10%; and while bronchiolitis/croup syndromes together contributes 5%.

Broor et al found in a prospective study in rural India that viruses are the common cause of respiratory illness. Respiratory Syncytial virus (RSV) was found to be commonest(15%–20%), followed by Para Influenza viruses, Influenza-A and adenovirus were detected by antigen detection [46],[49].

Respiratory viruses has an influence on the function of smooth muscle of bronchus by following mechanisms: 1. Direct effects in the intrinsic contractility of smooth muscle in airway, 2. Increase in Ig E antibodies specific to virus causing epithelial injury, 3 inflammation due to polymorphonuclear cells, and 4. Increased release of mediator. Hence RSV through all these mechanisms leads to enhanced airway reactivity which leads to obstruction of airway and bronchial reactivity and obstruction are increased. Hence leading to exacerbations during the viral illness [50].

Since the Viral infections increases the hyper reactivity, these children are found to be susceptible to recurrent wheeze in later age increasing the incidence of asthma in childhood and adolescence [51].

In study done by Taneja et al ,among the bacterial etiology of pneumonia Klebsiella (32.2%) was found to be commonest following which S. pneumonia

contributes 10%, where as E. coli - 10% P. aeruginosa - 5.7%, S. aureus- 2.8% and H. influenzae -1.4% of the children less than 10 yrs with pneumonia.(p=0.03).

Although upper respiratory illness contributes more than 95% of ARI, being the commonest cause of hospitalization, lower respiratory infection is crucial to reduce the morbidity and mortality [52] .

In 1990, ARI control program was started in India and implemented as a part of CSSM in 1992 and later with RCH which introduced protocols for management of Pneumonia. IMNCI (Integrated management Of Neonatal and child hood Illnesses) training was started to train the health care persons in the management of 5 dreadful diseases of childhood which included pneumonia [13] .

RESPIRATORY EMERGENCIES AND PRE-HOSPITAL CARE

The Pre-hospital care providers are trained in the early recognition and intervention of pediatric pathology leading to Cardiac Arrest: 1. first is respiratory failure followed by 2.cardiac failure. Cardiac arrest is characterized by slow worsening in cardiac function initiated by acidosis following hypoxemia, hypercarbia, followed by hypotension leading to cessation of cardiac activity. Successful prevention of Cardiac arrest can be done at this stage by reversing the respiratory failure before the period of hypoxemic hypo perfusion sets in [53],[54].

In a study done in United States on OHPA- Out of hospital Pediatric airway management done in 949,301 pediatric events. 4.5% of children required airway management procedures (42,936 events) and 1.5% required invasive airway /ventilation

(i.e. 14,107 events). .Hasen et al studied that 81.1% ((95% CI 79.7–82.6) as overall success rate of endotracheal intubation. Among children aged 1-12 months, and those with cardiac arrest that there was low success rate of 72.1% (95% CI 68.3–75.6) and 75.5% (95% CI 79.7–82.6) respectively [25].

A meta-analysis on success rates of Oro-tracheal Intubation (OTI) and Nasotracheal intubation (NTI) in Pre-hospital air way control techniques. For non-arrest patients, success rate increased with use of drugs DFI-drug-facilitated intubation and RSI (Rapid Sequence Intubation).Among all the clinicians, Nasotracheal intubation (NTI) has a low success rate, raising doubts about the safety as well as efficacy of the procedure [55].

NEED FOR STUDY IN PRE-HOSPITAL CARE IN PEDIATRICS:

Hsia et al [56] showed Pre-hospital Emergency care can significantly improve mortality rates from emergent conditions and be highly cost-effective. About 24 million deaths related to emergency medical conditions occur in Low and middle income countries annually, accounting for an estimated 932 million years of life lost. The outcome in such conditions depends on the status of Emergency care system.

Although many studies have attempted to assess the effectiveness, Cochrane [44] review has showed that there is a lack of enough evidence in assessing the Pre-hospital care. The basic problem is lack of indicators to measure effectiveness in common because of large number of variables used. Only few studies were done on prehospital care in pediatric emergencies and very few on the impact of prehospital care in respiratory problems

One of the study done by Adhikari et al [57] on impact of prehospital care among the children coming with agonal breathing, which showed significant higher survival rate among the children who were intubated and transferred.

As respiratory illness especially Acute Respiratory illness are the most common cause for hospitalization, children with ARI were chosen as our study population.

Our study was initiated with aim to attempt in analyzing the existing status of prehospital care and also indirectly assessing its effectiveness by comparing the severity score of acute respiratory illness at admission, among the children who received and not received the prehospital care. There by making a way for improving the pre-hospital care system.

4 METHODOLOGY:

1 IRB MIN NUMBER : 10353 (OBSERVE) dated 03.11.2016

(Annexure 1)Approved on 13.01.2017

2 STUDY DESIGN : A Prospective observational cohort analysis

3. FUNDING : Internal Funding from Fluid research Grant

4. SETTING :

Location : Department of Pediatrics in Christian Medical College, Vellore, India.

Children were recruited to the study, in Pediatric Emergency Service and follow up, severity assessment till 48 hrs was done after admission (in Paediatric Intensive Care Unit, paediatric-HDU, paediatric ward, short stay unit in Paediatric Emergency).

5. PERIOD OF RECRUITMENT : 6 months (January 2017 to June 2017)

Methods:

Data collection:

Using the structured proforma, details of the children were included in the study, Demographic data, details of prehospital care and severity assessment, were collected by investigator or co-investigator in PES. Assesssment and intervention (PALS) done in PES, severity scoring was done and noted by investigator or co-investigator at 0 hr,12 hr,24 hr,48 hrs.

Participants (Study population):

Inclusion criteria:

1.All children presenting to the Paediatric Emergency Service in Christian Medical College with acute respiratory illness from I st Jan.2017 to June 2017 requiring IP admission (Children with respiratory distress and respiratory Failure).

2.Age group from 1 month to 16 years.

3.Duration of illness less than 3 days.

4. Parents or Local Guardians who were willing to give informed consent

(Annexure 2)

Exclusion criteria:

1. Children with trauma or road traffic accident

2. Returned to PES within 72 hrs of discharge from the same institution of study

3. Children with underlying chronic systemic illness

4. Children on immune compromise or on immunosuppressant

DEFINITIONS

STUDY GROUP

Children admitted with ARI-Acute Respiratory Illness i.e. respiratory distress or failures (study group) were grouped based on Pre-hospital care status during data collection, as those received 1.Nil treatment 2.OP treatment 3.IP treatment.

1. **NIL group:** Group includes children in study group who did not receive prehospital care (PHC) treatment for the present illness.
2. **Out Patient group:** Group includes children in study group who received prehospital care treatment on Outpatient basis in another hospital.
3. **Inpatient group:** Group includes children in study group who received prehospital care treatment as Inpatient in another hospital.

During analysis the study group was categorized for studying the impact of prehospital care as **1. Adequately treated group and 2. Inadequately treated group**

"**Adequately treated group**" included the Inpatient group because child who needs hospitalization has received Inpatient care, hence taken as adequate. (not by assessing the treatment received in another hospital). Treatment received was documented in the form of - either one or both of the three namely, 1. Oxygen 2.Nebulisation 3.Antibiotics.

"**Inadequately treated group**" included the "NIL group" as well as Outpatient group" because the child requiring admission and monitoring, was not treated as needed. Treatment includes both or either of 1.Nebulisation 2.oral antibiotics / Intramuscular injection on Outpatient basis.

Duration of treatment received was noted in proforma.

Referral details:

Referral letter/discharge summary from the referring doctors was collected as a source of referral details.

In case of non-availability, details from the prescriptions were taken as **incomplete details** of treatment received.

Type of Health center:

In India, Tertiary care is the setting within which medical education and research take place along with disease management, While primary and secondary care mainly in the public health system .

1. **Primary health center:** Care provided by physician, which provides Essential health care for a community which is easily accessible. It includes government primary/rural health centers, private dispenseries without inpatient care.

2. **Secondary Health center:** Specialist provides the medical care with basic diagnostic and treatment facilities and this connects primary health care center with tertiary care center. Governement Taluk head quarters hospitals, District government hospitals, Community health centers provides such care(both outpatient and inpatient care) along with private nursing homes.

3. **Tertiary Health center:** Health care is provided by specialists and super specialists in aid with advanced diagnostics and treatment. This is provided by Government and private medical college hospitals and it is a referral unit for both primary and secondary health centers.

Transport is defined as **appropriate** if children were transported in Ambulance and those transported other than ambulance were termed as inappropriate transport.

Outcome:

The outcome of our study is assessing the impact of prehospital care by comparing the following among the adequately treated and inadequately treated groups:

1.Severity scoring (PRESS score-given below and PALS) at admission,

2.Level of respiratory support (Low flow Oxygen,High flow Oxygen and advanced airway – Invasive or Non-invasive based on PALS guidelines)

3. Nature of admission (i.e Ward, PHDU or PICU)

Assessment of severity of respiratory illness based on PALS (Annexure) and PRESS score for assessing at 0,12,24,48 hours.([30])

PRESS score system:

PRESS –Respiratory scoring system

PRESS Score Component	Operational definition	Scoring	
Respiratory rate	Respiratory rate at rest, on room air*	0	1
Wheezing	High-pitch expiratory sound heard by auscultation	0	1
Accessory muscle use	Any visible use of accessory muscles	0	1
SpO_2	Oxygen saturation <95% on room air	0	1
Feeding difficulties	Refusing feedings	0	1

	Sum of five components						Interpretation
PRESS score	**0**	**1**	**2**	**3**	**4**	**5**	**0-1: mild; 2-3: moderate; 4-5: severe**

*Respiratory rate at rest, on room air- as per AHA- PALS (Annexure)

- Accessory muscle use was defined as visible retraction of one or more of the sternomastoid/ suprasternal, intercostal, and subcostal muscles.
- Wheezing was defined by auscultation performed by experienced pediatricians.
- SpO2 was evaluated as above or below 95%.
- Feeding difficulties were assessed using information provided by the parents.

VARIABLES:

Base line: Age (years. months) , gender , distance (kilometres) from and Time (hours. minutes) to reach-study center (CMC, vellore) , Duration of illness(hours), chronic illness, type of pre-hospital care, Details of Hospital and doctors treated , details regarding treatment and referral, Details regarding transport, after arrival to PES-Initial and secondary assessment , Respiratory illness and its severity based on PRESS at 0,12,24,48 hrs, treatment details , nature of admission.

SOURCES OF DATA:

a. Demographic details from Proforma (Annexure 3)
b. Source of outpatient treatment details - prescription and medicines given were noted in case of no referral letter.
c. Source of Inpatient treatment details: IP referral letter, IP discharge summary or / IP prescription in case of Discharge against medical advice, were noted
d. Transport details were collected from the accompanying health care person, from the relatives accompanying the child.
e. Adverse events during transport were enquired from the health person accompanying only if the child was transported by ambulance.

Bias: Observer bias in assessing was eliminated because atleast 2 experts -pediatrician assess the child in pediatric emergency other than the primary investigator.

Sample size:

Sample size was calculated according to a prospective longitudinal study done to test a model for rural prehospital trauma systems in low-income countries [58]. In this study, required sample size to show that there is a difference in mortality of about 13% (over a period of 3 yrs) in trauma before and after the initiation of pre-hospital trauma care was found to be 230 in each arm with 80% power and 5% level of significance, although our study was designed to assess the severity of illness and not the mortality assuming that the difference of severity among the groups who received and not received Prehospital care, the same

In this study we included only the children with acute respiratory illness and grouped during data collection as 3 groups: 1. Not received treatment (Nil group) 2.Treated as out-patient (OP group). and 3. Treated as in-patient(IP group).

For analysis of the outcome , the study group was regrouped as 1. adequately treated and 2. inadequately treated

Hypothesis Testing - Large Proportion - Equal Allocation

Proportion in group I	0.53	0.53	0.53	0.53	0.5	0.53
Proportion in group II	0.43	0.33	0.4	0.35	0.35	0.23
Estimated risk difference	0.1	0.2	0.13	0.18	0.15	0.3
Power (1- beta) %	80	80	80	80	80	80
Alpha error (%)	5	5	5	5	5	5
1 or 2 sided	2	2	2	2	2	2
Required sample size for each arm	391	95	**230**	118	169	40

Hence the sample size calculated in each arm was 230 and total sample size was 460.

Quantitative variables:

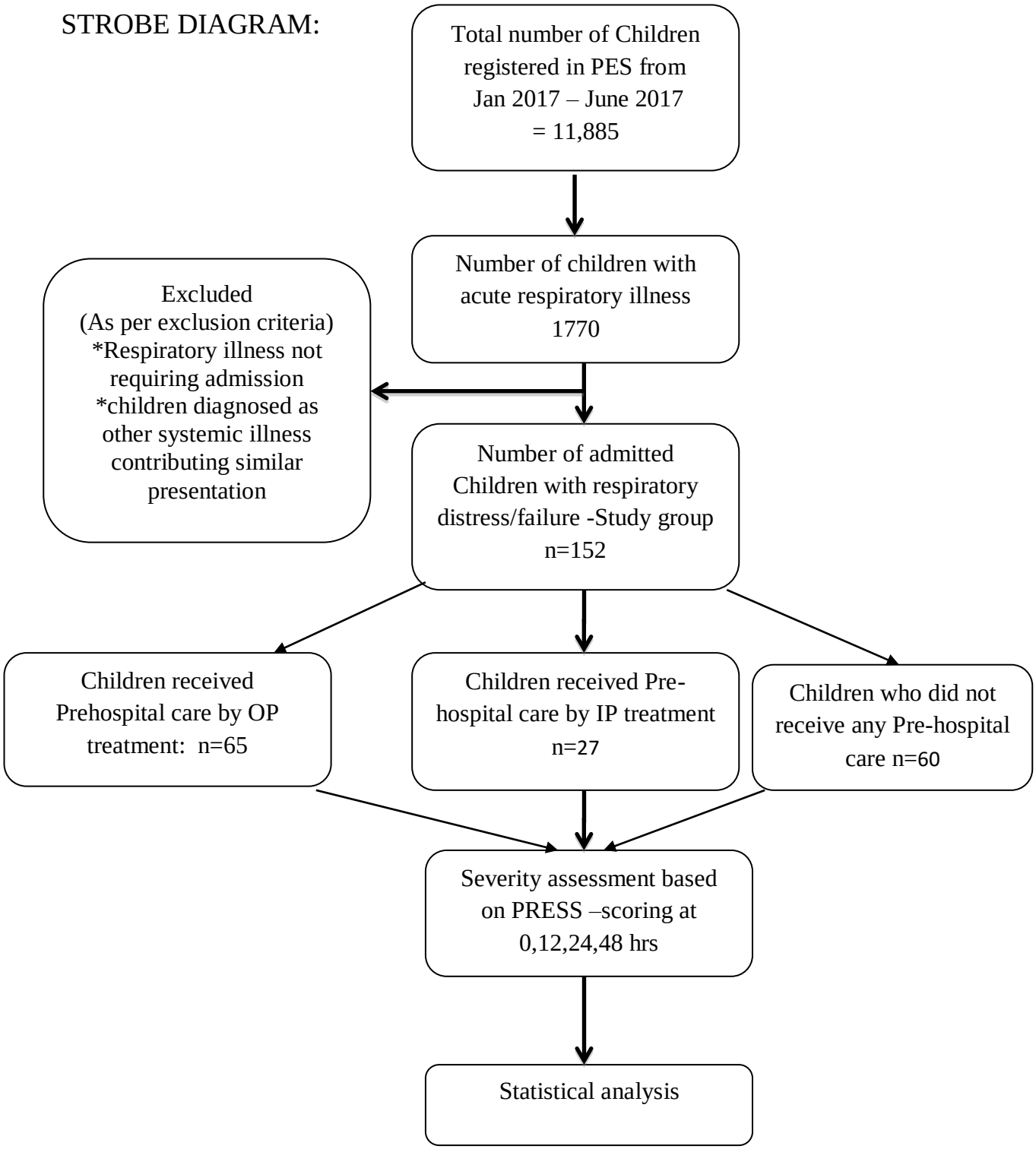
Statistical methods:

The continuous variables were presented using mean with SD or median with IQR. The univariate analysis for continuous variables was done by comparing the means across the **two groups (Inadequate and adequately treated)** using independent t-test or Mann Whitney U test which was decided after plotting the histogram or the QQ plot. The categorical variables were compared across the **two groups** using Fisher's exact test.

. Diagnostic accuracy of the model will be assessed by plotting the chi-square residuals against the predicted probabilities. P value < 0.05 will be considered to be statistically significant.

5. RESULTS AND ANALYSIS

STROBE DIAGRAM:



DEMOGRAPHY AND CLINICAL PROFILE:

Total number of children hospitalized who presented with ARI (acute respiratory illness) included in our study was 152. They were grouped as 3 groups 1. NIL group (Not received prehospital care) 2. OP group (received Out-patient treatment) 3. IP group (received In-patient treatment). They were further categorized during analysis of Outcome as 1.Adequately treated and 2.Inadequately treated.

AGE DISTRIBUTION:

Among IP group, 48% were in age group 1-2 months, followed by age group 12-60 months (33.3%).In Op group, both the age group 1-2 months and 12-60 months were equal. In Nil group, children in age group 12-60 months were maximum (38.3%) (Table-1)

Table 1: Age distribution among the study group

Pre-hospital care group	**Age in months**		
	1-12	**12-60**	**>60**
Nil (n=60)	**30 (50%)**	**23(38.3%)**	**7(11.7%)**
OP (n=65)	**34 (52.3%)**	**26(40%)**	**5(7.7%)**
IP (n=27)	**16 (59.2%)**	**9(33.3%)**	**2(7.4%)**

GENDER DISTRIBUTION:

Of the study population of 152, 111(73%) were male and 41(27%) were female**.**

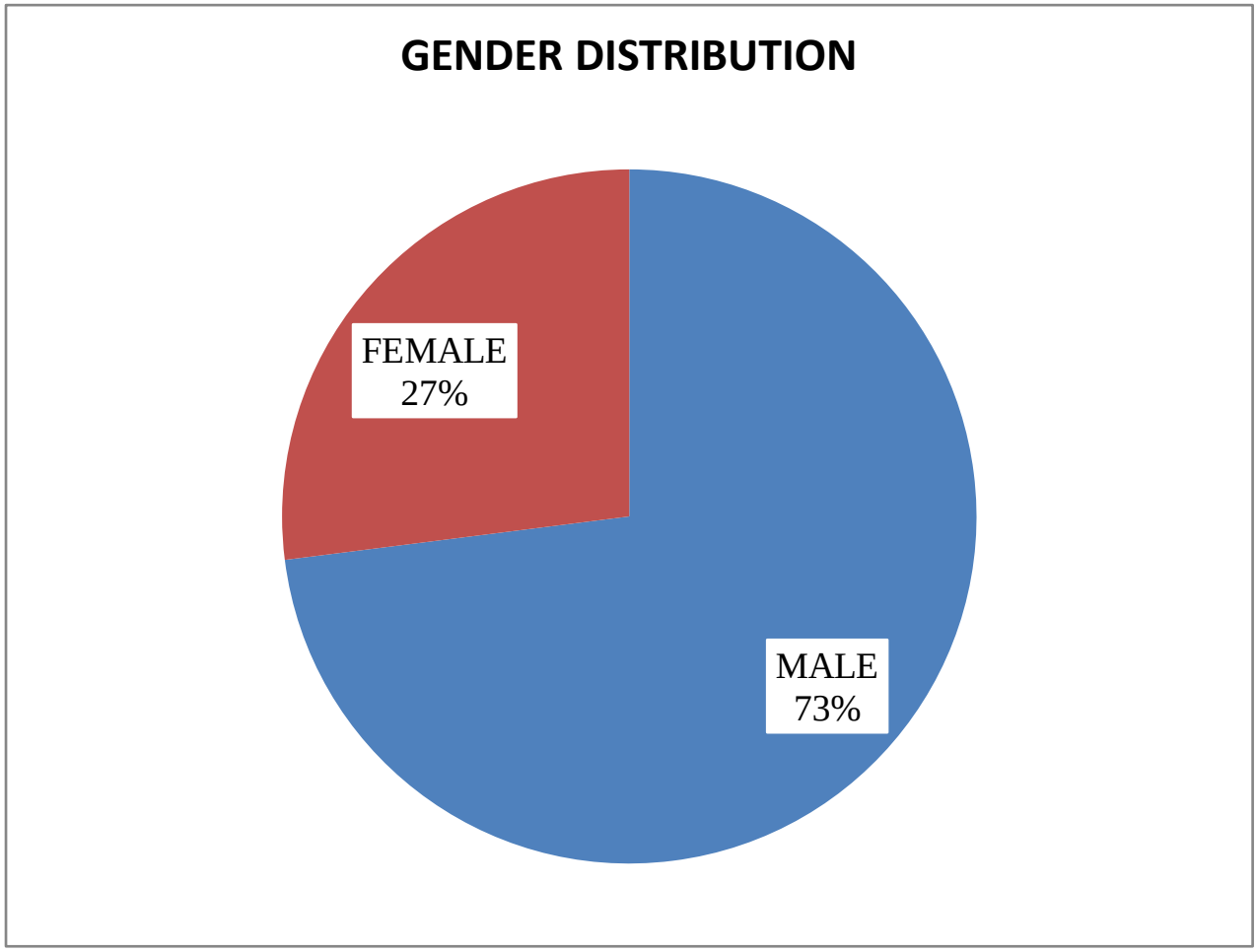


Figure 1.Gender distribution

GENDER DISTRIBUTION AMONG THE PREHOSPITAL GROUPS

Gender distribution was same in all the three groups

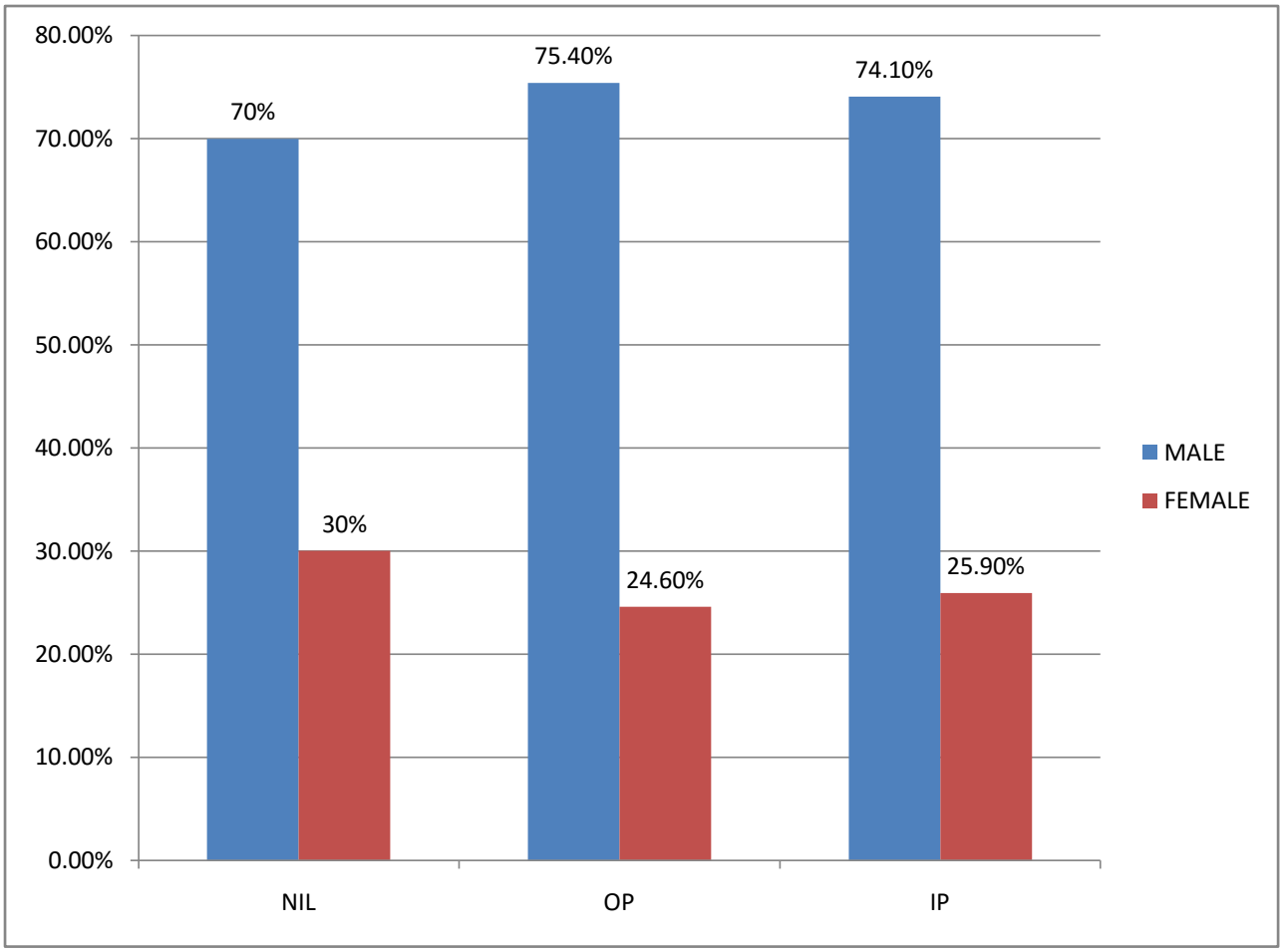


Figure 2:Gender distribution among the Prehospital groups

DURATION OF ILLNESS:

Duration of illness was divided into < 48hrs and > 48hrs as it can influence the severity of illness. It was found that number of children whose duration of illness was more than 48 hrs was 121 (79.7%) of the study group among whom 33.9% of children came without receiving prehospital care ,47 % of children received outpatient care and 19% of children received IP care. There was significant difference in percentage when compared to those who reach within 48 hrs of illness (p value = 0.02)

Table 3: Duration illness

Duration of illness (hours)	**Pre –hospital group**		
	NIL (60)	**OP(65)**	**IP(27)**
<48 n=31	19(61.3%)	8(25.8%)	4(12.9%)
>48 n=121	41(33.9%)	57(47.1%)	23(19%)

PAST SIMILAR ILLNESS:

Children with no similar illness in the past were contributing about 70 % of study group (p value – 0.000). It also shows that among the children with previous similar illness 46.7% of children receive tertiary care without receiving any prehospital care.

Table 4: Clinical data- Past illness (other than chronic systemic illness)

Past similar illness	**Prehospital care group**		
	NIL (60)	**OP(65)**	**IP(27)**
RAD/WALRI/asthma	28 (46.7%)	15 (23.1%)	2(7.4%)
Nil	32 (53.4%)	50(76.9%)	25(92.6%)

TYPE OF HEALTH CARE CENTER:

In India, primary health care is taken care by government primary health centers in rural area where as in Urban, many private dispensaries provide the primary health care who refer patients to either secondary or tertiary care center

In our study, among the prehospital received group, 83% of OP group were referred from primary health care center (either government or private). Whereas 81 % of IP care group were referred from secondary health care center. Only 7.4% of IP care group children were referred from tertiary care center. The difference was statistically significant (p value 0.000).

Table 5: Details of hospitals of PHC

Type of health care center	**Prehospital care group**	
	OP(65)	**IP(27)**
Primary health center	54 (83%)	3(11.1%)
Secondary health center	11(17%)	22(81.5%)
Tertiaty care center	0	2(7.4%)

TYPE OF HOSPITAL SECTOR AND TREATING PHYSICIAN

Nearly 90 % of both OP and IP group children have received prehospital care in a private dispenseries /hospitals .Only around 10 % of children in both the group received treatment in Government hospitals .

Among the prehospital group, 95% of OP group and 100% of IP group received treatment from pediatricians, only 4.6% of OP group received treatment from general practitioner.

Table 6: Type of hospital sector and treating physician

	Prehospital Care received group (N%)	
	OP n=65	**IP n=27**
Type of hospital sector		
Government sector	7(10.8%)	3(11.1%)
Private sector	58(89.2%)	24(88.9%)
Treating physician		
a. General practitioner	3(4.6%)	0
b. Pediatrician	62(95.4%)	27(100%)

REFERRAL DETAILS

Among the prehospital care group, 100% of OP group and 85% of IP group referred for not responded/worsening while 14% of IP group came as DAMA.

In OP group 17% of children had discharge summary or referral letter and remaining 83% of children had incomplete treatment details.

In IP group, 85% of children were referred with complete details and only 14% of children had incomplete treatment details. There was statistically significant difference among the 3 groups considering the referral details and reason for referral (p=0.000)

Table 7: Referral details

Referrals details	**Prehospital care group n (%)**	
	OP n=65	**IP n=27**
Reason for referral		
Not responded to treatment / Worsening of illness	65(100%)	23(85%)
DAMA	0	4(14.8%)
Referral letter		
Discharge summary /referral letter	11(17%)	23(85%)
With incomplete details	54 (83%)	4 (14%)

Distance travelled and nature of transport:

Our study population included all South Indian children, whose residing place varies from within 20 km from the hospital to the nearby states. Distance from hospital and time of travel is crucial in Emergency management.

More than 90% of Nil and OP group children travelled less than 60 kilometer, there by reaching tertiary center within an hour of period. In IP group 81.5% of children travelled less than 60 km while only 18.5% travelled more than 60 km. The association of distance and the type of care is not significant (p value =0.076)

Table 8: Distance travelled

Type of hospital care	**Distance travelled Km**	
	Less than 60 km	**More than 60 km**
Nil n=60	55 (91.7%)	5 (8.3%)
Op n=65	61 (93.8%)	4 (6.2%)
IP n=27	22 (81.5%)	5 (18.5%)

MODE OF TRANSPORT IN STUDY POPULATION:

Most common mode of transport in our study population was "Bus" followed by car and autorickshaw.

Ambulance was used only by 7% of study population.

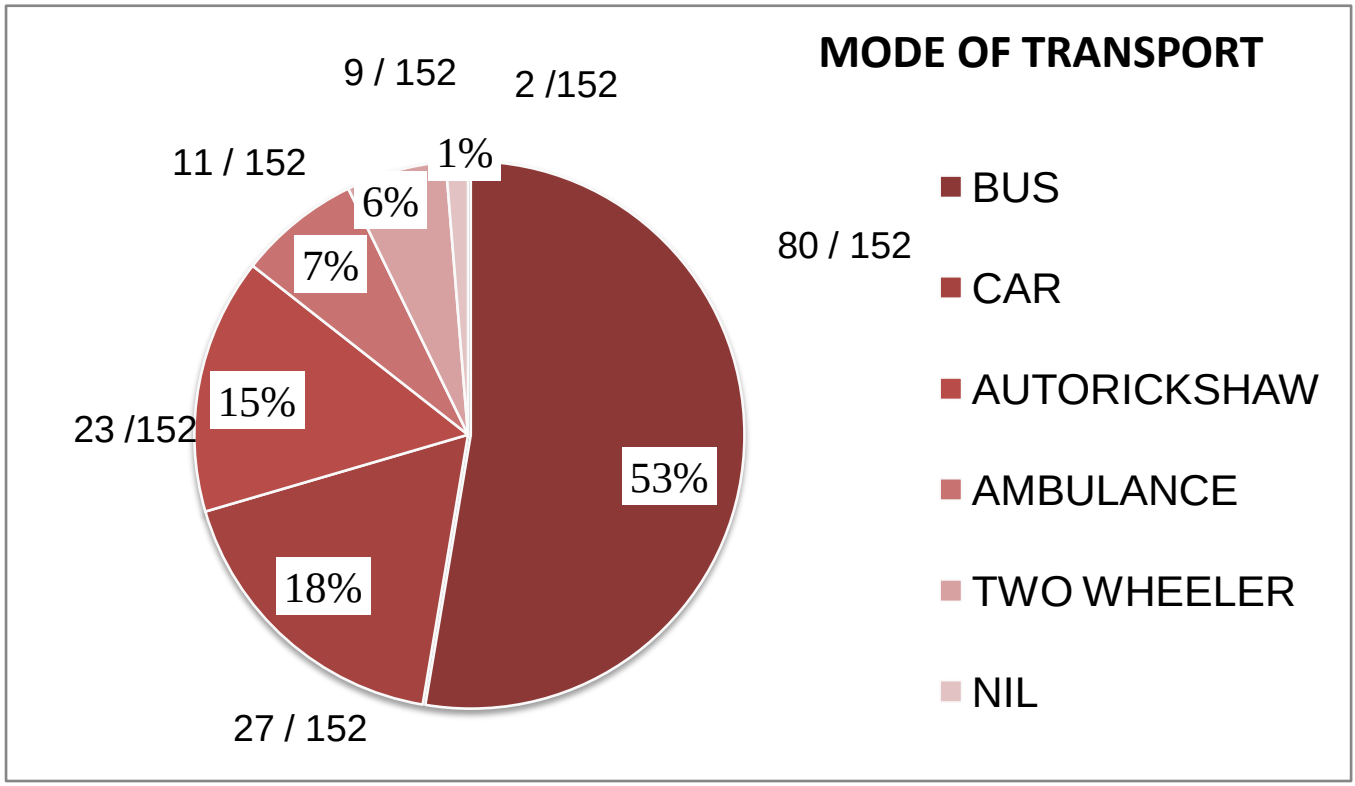


Figure 2: Mode of transport in study group

Transport details and association with type of prehospital care:

1. 67% of Nil group and 52% of Op group children have used “bus” as a mode of health transport followed by “auto”- (16%) in Nil group and 22% in Op group.

2. Ambulance was used only by IP care group children.

3. In IP care group, 44% of children were transported in ambulance, followed by bus (22%) and car (22%).

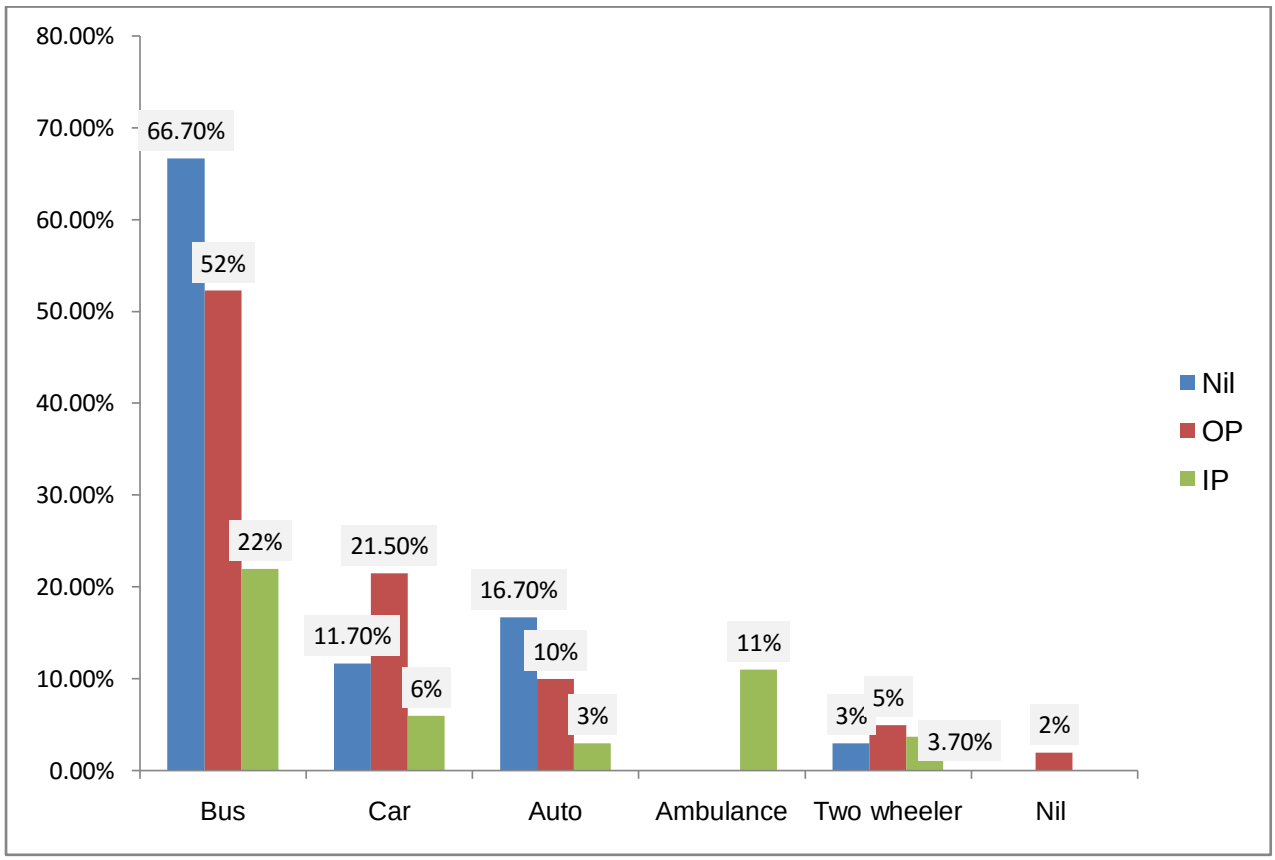


Figure 3: Transport details

DETAILS OF AMBULANCE SYSTEM:

Only 9/152 (5.9%) of children transported in ambulance had medical team and equIPment. And 2/152(1.3%) of children were transported in Ambulance service with equIPment without health personnel .There were no adverse events noted during the transport all the 11 children in the ambulance.

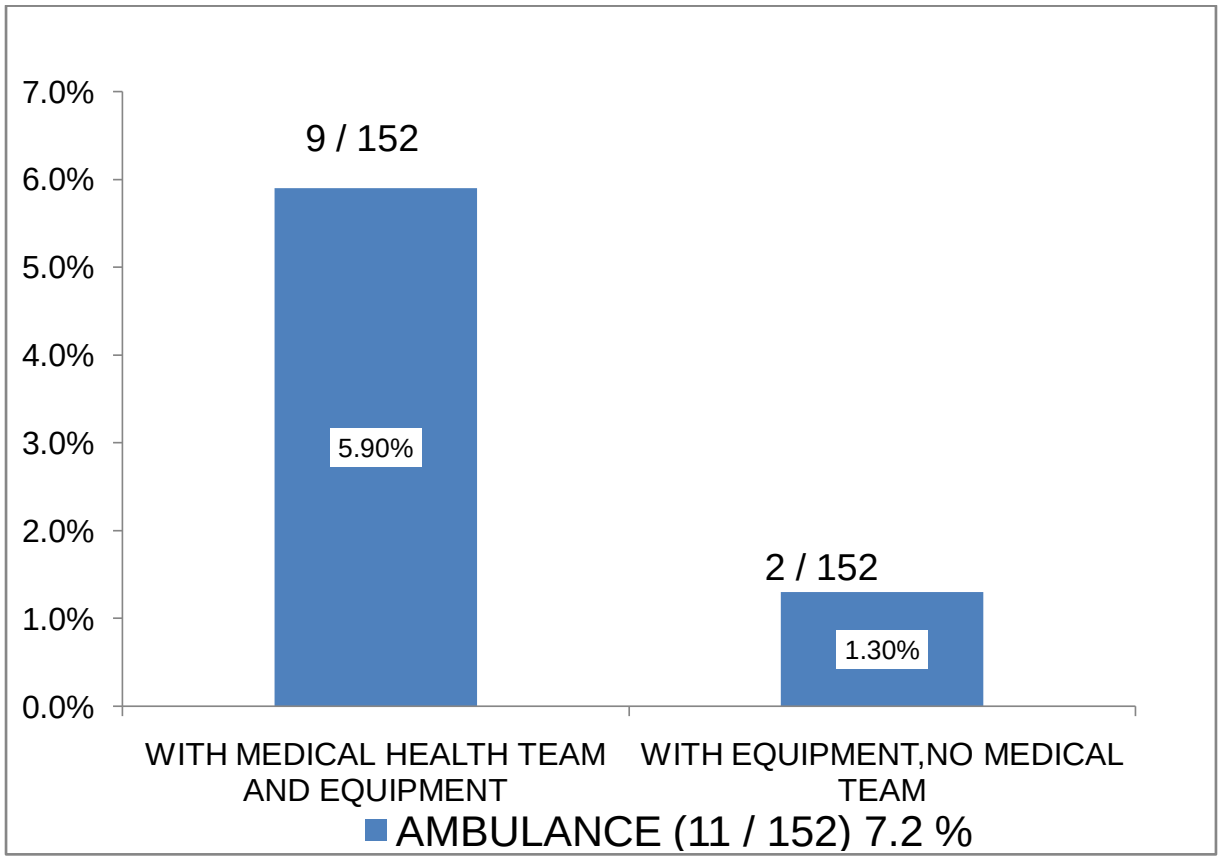


Figure 4 - Details of Ambulance

CLINICAL PRESENTATION

AIR AND BREATHING STATUS BASED ON PALS:

Airway:

About 1.7% of Nil group, 4.6% of Op group and 3.7% of IP group of children came with unclear airway maintained with positioning, suctioning/ nebulisation to maintain airway. Only 1.7% children in NIL group came with non-maintainable airway. None from Op or IP group came with non-maintainable airway.

Breathing:

1.7% of NIL group, 3.7% of both Op and IP group children arrived with respiratory failure.

Table 9: Airway and Breathing Status of study population:

Components of ABCD	**Prehospital care group n (%)**		
	Nil n=60	**OP n=65**	**IP n=27**
Airway			
Clear	58(97%)	62(95%)	26(96%)
Maintainable	1(1.7%)	3(4.6%)	1(3.7%)
Not maintainable	1(1.7%)	0	0
Breathing			
Respiratory distress	59(98.4%)	64(98.5%)	26(96.3%)
Respiratory failure	1(1.7%)	1(3.7%)	1(3.7%)

CIRCULATORY STATUS AND DISABILITY ASSESSMENT OF STUDY POPULATION: (BASED ON PALS)

Circulation: Study shows 1.7% of NIL group and 3.7% of IP group children came with hypotensive shock, and 3.1% of Op group came with compensated shock Remaining children in all the three groups came with stable circulatory status.

Disability: Quick assessment of disability by AVPU showed none came with unresponsiveness, 18.5% of IP group and 6.7% of NIL group responded to voice. While about 3 % in all the three groups came with response to pain.

Table 10 : Circulatory status and disability assessment of study population:

Components of ABCD	**Prehospital care group n (%)**		
	Nil n=60	**OP n=65**	**IP n=27**
Circulation			
Normotensive	59(98.3%)	63(96.9%)	26(97.2%)
Compensated shock	0	2(3.1%)	0
Hypotensive shock	1(1.7%)	0	1(3.7%)
Disability			
Alert	54(90%)	62(95.4%)	21(77.8%)
Responds to Voice	4(6.7%)	1(1.5%)	5(18.5%)
Responds to pain	2(3.3%)	2(3.1%)	1(3.7%)
Unresponsiveness	0	0	0

TREATMENT BASED ON PALS IN PES:

Among the study group, 2 children (7.4%) in IP group , 1 child (1.5%) in OP group and 1 child (1.7%) in Nil group came in respiratory failure and required ventilation (invasive and non-invasive) .

7 children (26%) in IP group, 13 children (20%) in OP group and 7 children (11.7%) in NIL group required high flow oxygen.

Table 11: Management of Airway and breathing:

Prehospital care (n)	**Management of airway and breathing**							
	Nebulisation			**Low flow Oxygen**	**High flow Oxygen**	**Oral Airway**	**Ventilation (invasive +non-invasive)**	**ICD**
	3% saline	**salb**	**adrenaline**					
NIL(60)	20(33.3%)	31(52%)	2(3.3%)	21(35.0%)	7(11.7%)	0	1(1.7%)	1(1.7%)
OP(65)	21(36%)	28(40%)	1(1.5%)	10(15.4%)	13(20.0%)	2(3.1%)	1(1.5%)	3(4.6%)
IP (27)	15(56%)	8(29.6%)	1(3.7%)	11(40.7%)	**7(25.9%)**	0	**2(7.4%)**	2(7.4%)

MANAGEMENT OF CIRCULATION:

The percentage of children requiring fluid inotropes were found to nearly same 3% in all groups. Whereas the percentage of children requiring fluid resuscitation was found to be relatively high in OP and NIL group compared to IP group (statistically not significant).

Table 12: Management of Circulation

Prehospital care	**Management of circulation**	
	Fluid resuscitation	**Inotropes**
Nil	3(5.0%)	2(3.3%)
OP	4(6.2%)	2(3.1%)
IP	1(3.7%)	1(3.7%)

NATURE OF ADMISSION

In our study the “nature of admission” is taken as outcome, since it indirectly shows the severity of illness along with assessment of respiratory illness based on PALS and PRESS scoring at admission. The morbidity/ hospital discharge and mortality was not taken as outcome since it depends on many other factors such as sepsis related complications after 3-4 days of initial illness and occasionally hospital acquired infections.

Type of PHC and nature of admission

7.4% of IP group, 3.3% of NIL group and 1.5% of OP group required PICU admission where as about 11 percent of children in all the 3 groups were admitted in PHDU. The remaining children were admitted in short stay PES for less than 2 days or in ward for more than 2 days.

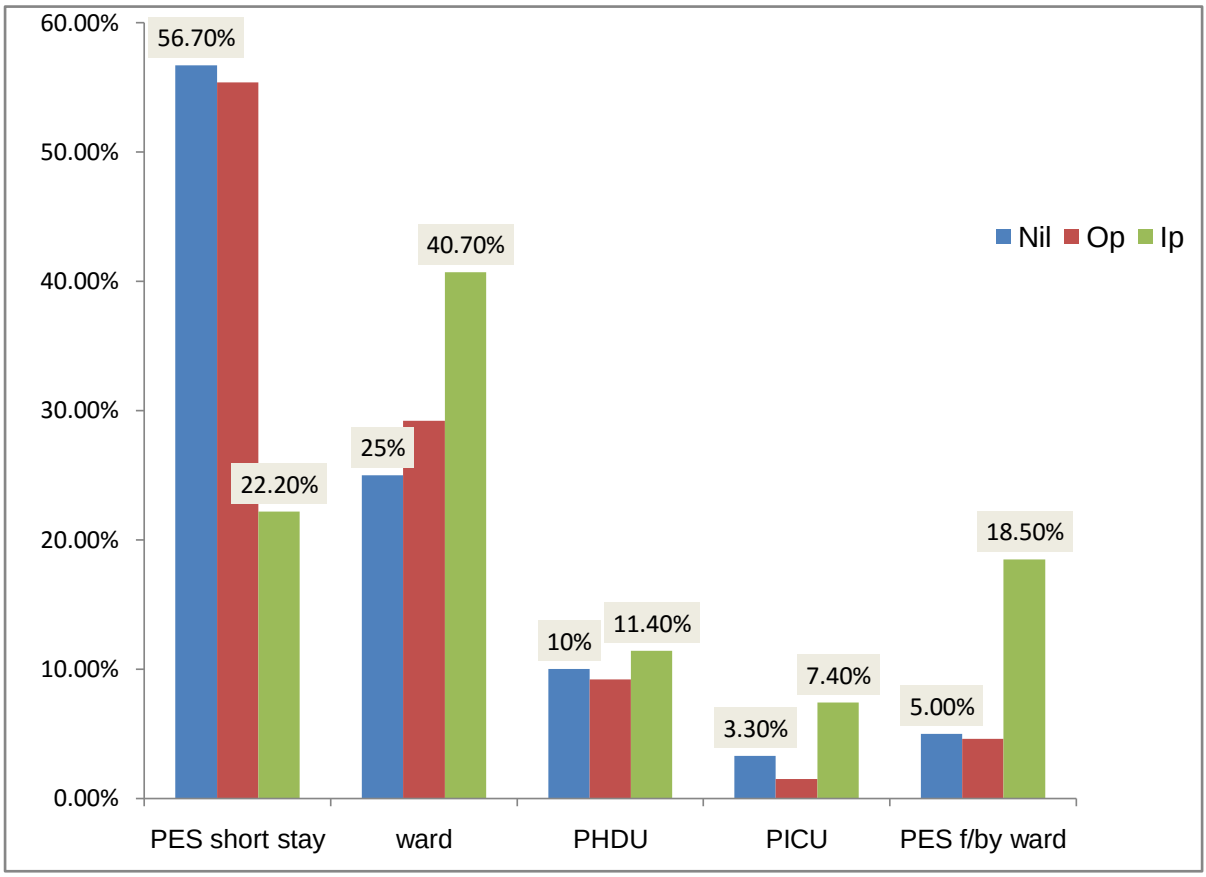


Figure 5: Type of PHC and nature of admission

Reason for referral and nature of admission:

Of the children who came with referral reason as "Not responding to treatment/worsening" 87.5% were admitted in ward, 9% in PHDU and 3.4% in PICU. Those children who were discharged against medical advice were 11, of whom 75% were admitted in ward, 25% in PHDU and none in PICU.(p value not significant)

Table 13: Reason for referral and nature of admission

Reason for referral	**Nature of admission**		
	Ward	**PHDU**	**PICU**
Not responding	**77 (87.5%)**	**8(9.1%)**	**3(3.4%)**
DAMA	**3(75%)**	**9(25%)**	**0**

DIAGNOSIS AND ITS RELATION WITH OTHER FACTORS:

Diagnosis among the study group

Pneumonia (31.5%) and LRI with wheeze (26.3%) were the most common diagnosis among the children in study.About 80 % of children with pneumonia reached tertiary care center after receiving Op and IP care.

28% of children with acute exacerbation of RAD/asthma came directly to receive tertiary care. Upper air way problems like ALTB constituted 4.6%.

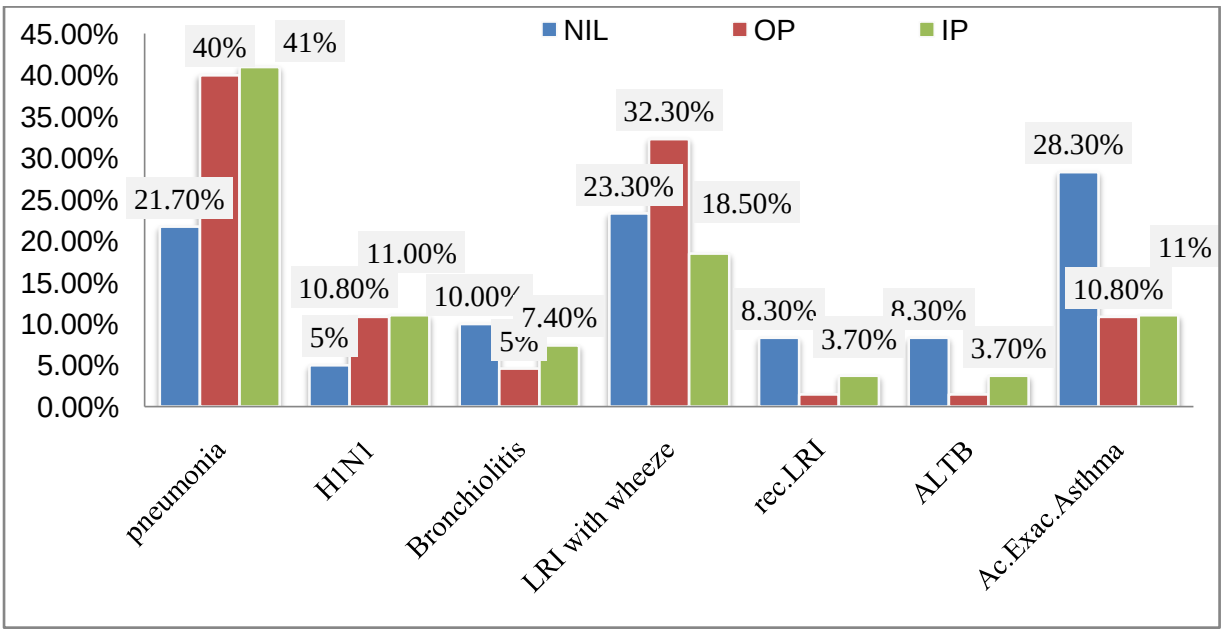


Figure 6: Diagnosis among the study group

Age wise distribution of diagnosis

In this study pneumonia contributed around 44 % of the children who are less than two months and 35% of children of six months to one year of age group. LRI with wheeze was found more common among 2 to12 months of age group.

Acute exacerbation of RAD was found to be the cause of respiratory distress in 79% of children among the age group >5 yrs. There was a significant correlation with age and Diagnosis ($p<0.00$)

Table 14: Age and diagnosis

Diagnosis	**Age (%) in months**				
	1-2 (n=45)	2-6 (n=15)	6-12 (n=20)	12-60 (n=58)	>60 (n=14)
Pneumonia	20(44.%)	4(26.7%)	7(35%)	17(29%)	0
H1N1	2(4.4%)	1(6.7%)	1(5%)	9(15.5%)	0
Bronchiolitis	9(20%)	2(13.3%)	0	0	0
LRI with wheeze	8(17.8%)	6(40%)	9(45%)	14(24%)	3(7.5%)
Rec.LRI	3(6.7%)	1(6.7%)	1(5%)	2(3.4%0	0
ALTB	0	1(5%)	1(5%)	1(1.7%)	0
Ac.Exacerbation .RAD/asthma	0	0	1(5%)	14(24%)	11(78.6%)
Others	3(6.6%)	0	0	1.7%	0

SEVERITY OF ILLNESS (BASED ON PRESS SCORE) AND ITS CORRELATION WITH OTHER FACTORS:

Duration of illness and Severity of illness:

Against the expectation, our study showed that the severity does not vary with duration of illness.

It shows, 48% of children whose duration of illness less than 48hrs and 50% of children with duration of illness more than 48 hrs had severity score –"severe" according to PRESS score

Table 15: Duration of illness and Severity of illness

Duration of illness	Severity at admission	
	Moderate	Severe
<48 hrs	16 (52%)	15(48.4%)
>48 hrs	60 (49.6%)	61(50.4%)

Level of Care center and severity

Of the total 92 children who received prehospital care, only 2 were referred from tertiary care center and they had severe illness at admission. There was no difference in severity among the children referred from primary and secondary care center.

Table 16: Level of Care center and severity

Level of care center	**Severity at admission**	
	Moderate	**Severe**
Primary	**30(52.6%)**	**2(47.3%)**
Secondary	**12(36.4%)**	**21(63.6%)**
Tertiary	**0**	**2(100%)**

Reason for referral and severity of illness

Of 92 children who received prehospital care, 88 were referred for worsening/not responded and their pattern of severity at admission was both moderate and severe in equal proportion. Among the children came discharge against medical advice 75% were with severe illness. The difference was not statistically significant.

Table 17: Reason for referral and severity of illness

Reason for referral	**Severity at admission**	
	Moderate	**Severe**
Worsening/not responded to treatment	**41(46.6%)**	**47(53.4%)**
DAMA	**1(25%)**	**3(75%)**

Referral letter and severity of illness

Of the children who came with proper referral letter 32.4% and 67.6% had moderate and severe score respectively. (Statistically significant with p value =0.037)

Table 18: Referral letter and severity of illness

Referral status	**Severity at admission**	
	Moderate	**Severe**
Incomplete referral details	30(54.5%)	25(45.5%)
With referral letter	12(32.4%)	25(67.6%)

Nature of Admission and severity of illness

About 93% of children admitted in PHDU and 100% of children admitted in PICU had severe score at admission. Severity at admission correlates well with nature of admission. (p value =0.000)

Table 19: Nature of Admission and severity of illness:

Nature of admission	Severity at admission		P value
	Moderate	Severe	
Ward	75(56.8%)	57(43.2%)	0.000
PHDU	1(6.7%)	14(93.3%)	
PICU	0	5(100%)	

Type of prehospital care and severity (PRESS) over time with treatment:

Total number of children hospitalized who presented with ARI (acute respiratory illness) included in our study was 152. They were grouped as 3 groups 1. NIL group (Not received prehospital care) 2. OP group (received Out-patient treatment) 3. IP group (received In-patient treatment). They were further categorized during analysis of Outcome as 1.Adequately treated which include Inpatient group and 2.Inadequately treated which include NIL and OP group

Scoring of respiratory illness was done at arrival, which indirectly implies the influence of prehospital care.

The severity score at 0 hrs was 3.5 and 4 (out of 5) which slowly dropped at 48 hrs to 1.7 and 2.1, in the inadequately treated and Inpatient group respectively .The rate of fall of severity showed no difference among the groups.

Table 20 Severity of illness over 48 hrs

TIME	PRESS SEVERITY SCORE (max-5)		P-VALUE
	Inadequately treated group	Adequately treated group	
0HR	3.6±0.82	4±0.83	0.83
12HR	3.3±0.94	3.81±1	
24HR	2.64±1	3.07±1.17	
48HR	1.71±1.34	2.19±1.78	

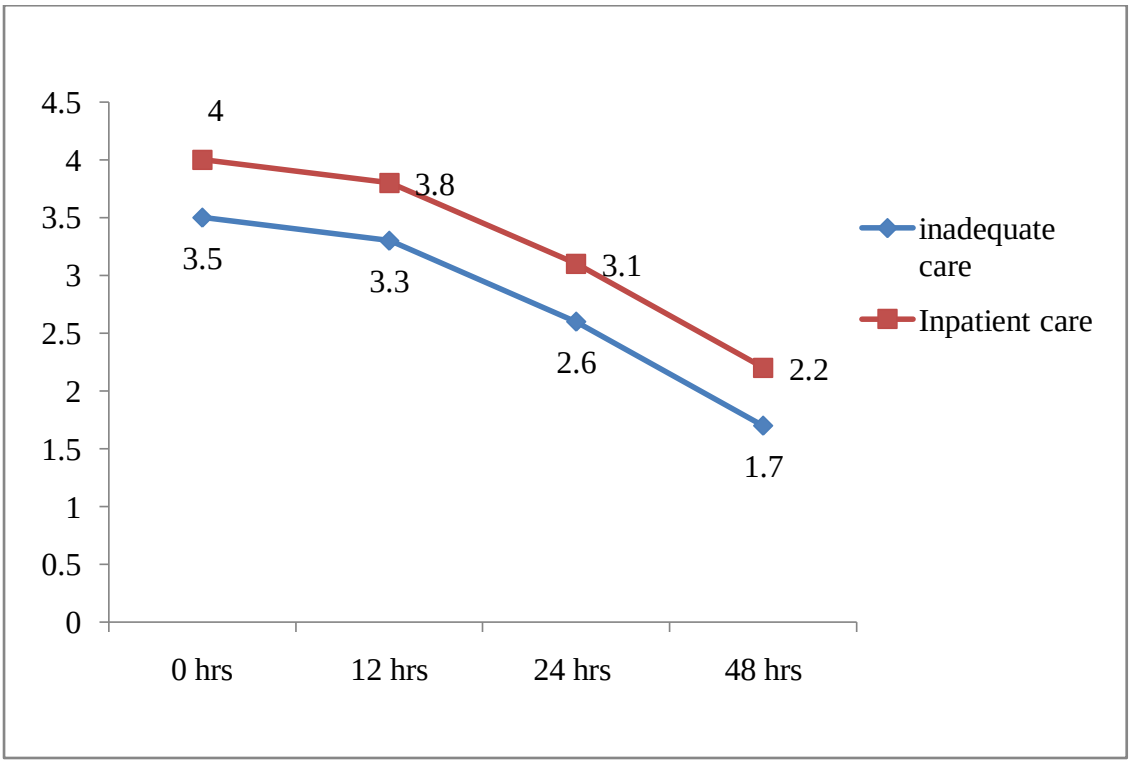


Figure7: Severity score among "Adequately treated and inadequately treated" group.

IMPACT OF PREHOSPITAL CARE:

IMPACT ON SEVERITY OF ILLNESS AT ADMISSION:

66.7% of children who were adequately treated admitted with severe score. There was no significant difference in severity, found among adequately and Inadequately treated groups.

Table 21: Impact of Prehospital care and severity of illness at admission

Prehospital care	**Severity at admission**		**P value**
	Moderate	**Severe**	
Inadequate group	67(53.6%)	58(46.4%)	0.05
Adequate group	9(33.3%)	18(66.7%)	

PREHOSPITAL CARE AND LEVEL OF RESPIRATORY SUPPORT AT ADMISSION

Respiratory support was given according to PALS guidelines .i.e. for respiratory distress –high flow oxygen; for impending respiratory failure-Non-invasive support; for respiratory failure - invasive ventilation.

a. Prehospital care and Status of Oxygen requirement at admission

In our study it was found that, both high and low flow oxygen requirement was comparatively high among adequately group (p value =0.042).One of the reason was these children were referred for the treatment either due to worsening of symptoms or not responding.

Table 22: Prehospital care and Status of Oxygen requirement at admission

Prehospital care	**Oxygen requirement**			**P value**
	Not required	**Low flow**	**High flow**	
Inadequately treated	74(59.2%)	31(24.8%)	20(16%)	0.042
Adequately treated	9(33.3%)	11(40.4%)	7(26%)	

b. Impact of prehospital care on advanced airway requirement

In our study group, 2 children (7.4%) in adequately treated group and 2 children (1.6%) in inappropriately treated group required advanced airway. (p value 0.145)

Table 23: Impact of prehospital care on advanced airway requirement

Prehospital care	**Advanced airway requirement**		**P value**
	Yes	**No**	
Inadequately treated	2(1.6%)	123(98.4%)	0.145
Adequately treated	2(7.4%)	25(92.6%)	

Prehospital care and nature of admission:

Of the adequately treated children 7.4% were admitted PICU where as 2.4% of inadequately treated children. There was no statistical significant difference in nature of admission among the children inadequately treated and adequately treated. (p value 0.396).

Table 24: Prehospital care and nature of admission

Prehospital care	**Nature of admission**			**P value**
	Ward	**PHDU**	**PICU**	
Inadequately treated	110 (88%)	12(9.6%)	3(2.4%)	0.396
Adequately treated	22 (81.5%)	3 (11.1%)	2(7.4%)	

STATUS OF PREHOSPITAL TRANSPORT:

1. Status of prehospital transport among the hospitalized based on severity:

Only 10.6% of children hospitalized with severe respiratory score were transported in ambulance which shows the underutilization of ambulance.

There was no statistically significant difference in utilization among the children with moderate and severe score (p value =0.077),which shows the overall underutilization of ambulance.

Table 25:Prehospital transport and severity of illness

Respiratory severity based on PRESS score	**PREHOSPITAL TRANSPORT**		**P value**
	AMBULANCE	**NON-AMBULANCE**	
Moderate	3 (4%)	73(96%)	0.077
severe	8(10.6%)	68 (89.4%)	

2. Distance travelled and prehospital transport

Only 21.4% of children who travelled more than 60 km were transported in ambulance and 78.6% of Children who stay >60 km away from the tertiary care center did not utilize ambulance.

There was no statistically significant difference in use of ambulance based on distance travelled (p value -0.056)

Table 26: Distance travelled and prehospital transport

Distance travelled by study group n=152	**PREHOSPITAL TRANSPORT**	
	AMBULANCE	**NON-AMBULANCE**
</=60 km	8 (5.8%)	130 (94.2%)
>60 km	3(21.4%)	11 (78.6%)

3.Level of Respiratory support and prehospital care transport:

Only 25% of children who required ventilation and 18.5% of children requiring high flow oxygen were transported by ambulance which shows the underutilization of ambulance even in the severe illness (respiratory failure) requiring ventilation (invasive and Non-invasive) and also in severe respiratory distress requiring high flow oxygen.

There was statistically significant difference in use of ambulance among the children requiring and not requiring high flow oxygen (p value=0.004)

Table 27: Level of Respiratory support and prehospital care transport:

Management	**PREHOSPITAL TRANSPORT**		**P value**
	AMBULANCE	**NON-AMBULANCE**	
ventilation	1(25%)	3(75%)	0.274
High flow oxygen	5(18.5%)	22(81.4%)	0.004

4.Nature of admission and prehospital transport care:

Among the children admitted in PICU and PHDU, only 40% and 7.1% respectively were transported in ambulance which implies the majotiry of children requiring critical care were not transported in ambulance appropriately.

Table 28: Nature of admission and prehospital transport care

Nature of admission	**PREHOSPITAL TRANSPORT**		**P value**
	AMBULANCE	**NON-AMBULANCE**	
Ward	8(6%)	125(94%)	0.03
PHDU	1(7.14%)	13(92.8%)	
PICU	2 (40%)	3(60%)	

DISCUSSION:

Pre-hospital care is an important link in management of acutely ill children which is not established in developing countries.Many studies showed that there was significant reduction in mortality following prehospital care.[31], [32,]

This study was done to analyze the impact of pre-hospital care among the children presenting to PES with acute respiratory illness measured by severity of illness using PRESS score, level of respiratory support, and nature of admission (outcome).

The study population (152 children) are the children who were admitted with ARI-Acute Respiratory Illness i.e. respiratory distress or failures (study group) were grouped based on Pre-hospital care status during **data collection**, as 3 groups namely those received 1.Nil treatment 2.OP treatment 3.IP treatment.

Demographic details were studied , the clinical details,assessment of illness at arrival based on PRESS score as well as PALS was done and managed .These details were noted in Proforma and children were followed till 48 hrs of admission and assessed during the period. Status of prehospital transport was also studied. Details of treatment was noted as with referral letter and incomplete details (prescription and medications).

Analysis was done by grouping them as 1) adequately treated 2) inadequately treated group. "**Adequately treated group**" included the Inpatient group because child who needs hospitalization has received Inpatient care, hence taken as adequate. (not by assessing the treatment received in another hospital).

"**Inadequately treated group**" included the "NIL group" as well as Outpatient group" because the child requiring admission and monitoring, was not treated as needed.

Outcome of the study was assessing the impact of prehospital care by comparing among the adequately treated and inadequately treated groups in 1.Severity scoring at admission, 2.Level of respiratory support. (Low flow Oxygen,High flow Oxygen and advanced airway – Invasive or Non-invasive based on PALS guidelines)

3. Nature of admission (i.e Ward, PHDU or PICU).

All these clinical and demographic details were noted in proforma . Data was analysed by SPSS, using independent t-test or Mann Whitney U test .

Age group:

In our study, Children more than 1 month were included.Children less than one month were not included because clinical presentation and management of respiratory illness in age group less than 1 month differs. Age group 1-12 months constituted 64 % of the study group , 12-60 months was 49%, >60 months was 9.2%.

In a cohort study [47] done in South India in a population of under 3 years (92) over a period of 11.3 months of follow up, it was found that pneumonia was same among both the sex and there was no significant difference in incidence of ARI among various age groups. (Table-1)

Gender distribution:

Among the study group -152 children, 73% were male and 27% were female. (figure 1,Table-2)

Similar high proportion of male was shown a study done in Japan for 1 year period by Miyaji et al ([30]) on the severity of respiratory illness using PRESS score in which 202 children with acute respiratory illness were enrolled , of which 60.9% and 39.1% were male and female respectively.

Duration of Illness at arrival:

Among the children who arrived after 48 hrs of illness, 47% of children were from OP group , 34% from NIL group,and 19% from IP group. There was significant difference in number of children arriving before and after 48 hrs of illness (p value = 0.02) (Table 3)

Past illness:

Among the study group, 70 % children had no similar illness in the past which was statistically significant (p value =0.000). 46.7% of children with previous similar illness receive tertiary care without receiving any prehospital care. (Table 4)

Prehospital care center :

In our study group, 81% IP group received care in secondary care center, 7.4% from tertiary care center and referred ,where as 83% and 11% of OP group received prehospital care from primary health center and secondary health center respectively which is statistically significant (p value 0.000) (Table 5,6)

In our study group, 90 % of prehospital care was received from private sector which was also showed in study done in national health service [14].

The care giver were pediatrician in 95% of OP group and 100% IP group which was not statistically significant.

Referral details: Among the children who received prehospital care (92 children) ,100 % of OP children and 85% of IP group children were referred for worsening or not responded, and only 4 % of IP group came with discharge against medical advice, which is found statistically significant(p value 0.006)

85% of IP group and 17 % of OP group came with referral letter or discharge summary which is statistically significant.(p value 0.000) . **(**Table 7)

Distance travelled:

Statistically there is no significant difference in the type of care based on distance travelled. (p value =0.076). **(**Table 8)

The median time was found to be 20 min in all the three groups with median distance of 40 kilometers

Similar study on prehospital transport done by Shankar et al [6] showed median time to reach a hospital was 22 min. The patient who reach and receive the treatment within the critical period will have good survival.

Status of ABC on arrival and their management:

1.7 % of NIL group, 3.7% of OP and IP group came with respiratory failure and 7.4% of IP group, 1.5% of OP group and 1.7% of NIL group required ventilation either as invasive or non-invasive.(Table 9,11)

1.7% of NIL group,3.7% of IP group came with Hypotensive shock where as 3.1% of OP group came with compensated shock.(Table 10).

There was no statistically significant difference in number of children requiring fluid boluses and inotropes among the three groups. (Table 12)

Nature of admission

7.4% of IP group, 3.3% of NIL group and 1.5% of OP group required PICU admission where as about 11 % of children in all the 3 groups were admitted in PHDU (Figure 5)

Reason of referral and nature of admission:

87.5% of children who came with worsening/not responded to treatment after prehospital care were admitted in ward. Only 9% and 3.4% of children of this group were admitted in PHDU and PICU respectively. (Table 13)

There was no significant relation (p value 0.4) in between nature of admission and reason for referral

Diagnosis:

In our study, Pneumonia contributed about 41% of IP group, 40% of Op group and 21.7% of NIL group. Pneumonia was found to common cause of hospitalization (31.5%) among our study group, followed by LRI-lower respiratory infection with wheeze (26.3%) and acute exacerbation of RAD/ asthma (28%) (figure 6 and Table 14)

A cohort study done by acharya et al in South India on ARI (community based study), showed higher incidence of Pneumonia ($p<0.0002$) compared to all the cause of ARI. In this study, 8.2% of children developed pneumonia [47] in the follow up period of ARI.

In our study, there was significant correlation among age wise distribution of diagnosis ($p < 0.001$). It was shown that pneumonia contributes 44% and 35% among the children hospitalized with ARI in age group < 2 and 6 months to 1 year group respectively.

Similarly Acute exacerbation of RAD/asthma contributes 78.6 % of children hospitalized with ARI among the age group > 5years.

There was significant correlation among age wise distribution of diagnosis.($p < 0.001$) It was shown that pneumonia contributes 44% and 35% among the children hospitalized with ARI in age group < 2 and 6 months to 1 year group respectively.

Similarly Acute exacerbation of RAD/asthma contributes 78.6 % of children hospitalized with ARI among the age group > 5years. (Table14).

Status of prehospital transport

A study done on trauma patients [59] showed that only 7.5% of patients were transported in ambulance of which 96% of children were referred from another hospital , similarly in our study among the Children hospitalized with ARI only 7% of children were transported by ambulance of which only 40% was equipped and with health personnel.

Similar to our study, Shankar et al [6] showed there was underutilization of ambulance in children reaching pediatric medical emergencies in a tertiary care center. In this study, 26 children were referred and out of which 25 were transported by ambulance without any accompanying person.

a.Severity of illness and Prehospital transport:

Of 76 children with severe PRESS score, only 8 (10.6%) were transported in ambulance.(pvalue=0.07) (Table 25) highlighting the underutilization of ambulance.

b.Level of respiratory support and Prehospital transport:

Only 25% of children who required ventilation (p value=0.27) and only 18.5% of children requiring high flow oxygen were transported by ambulance (p value=0.004).(Table 27)

78.6% of Children who stay >60 km away from the tertiary care center did not utilize ambulance in spite of severe illness (p value =0.056)

This implies the severe underutilization of ambulance even in children requiring immediate advanced airway management.

c.Nature of admission and prehospital transport:

Among the children admitted in PICU and PHDU, only 40% and 7.1% respectively were transported in ambulance which implies the underutilization of ambulance even in children requiring intensive care and high dependency unit care(p value=0.03) (Table 28)

Impact of Prehospital care

The outcome of our study is assessing the impact of prehospital care by comparing the following among the adequately treated and inadequately treated groups:

1.Severity scoring (PRESS score-given below and PALS) at admission,

2.Level of respiratory support (Low flow Oxygen,High flow Oxygen and advanced airway – Invasive or Non-invasive based on PALS guidelines)

3. Nature of admission (i.e Ward, PHDU or PICU)

. Outcome at discharge was not taken in order to exclude the disease complication and iatrogenic causes contributing morbidity.

1. Impact on severity of illness at admission based on PRESS score

Of 76 children presented with severe PRESS score, 66.7% were adequately treated and 46.4% were inadequately treated (18/27 Vs 58/125,P value=0.05)(Table 21).

2. Impact on level of respiratory support at admission:

Based on PALS assessment, there is a significant difference (26% Vs 16% ,pvalue=0.042) in requirement of high flow and low flow oxygen among the two groups. It was noted that requirement was higher among the adequately treated group. (Table 22)

Ventilation requirement was 7 times more among the adequately treated group than the inadequately treated children (p value 0.145) (Table 23)

It was noticed that the children who were referred with reason for referral as worsening or not responding. These children (in majority in adequately treated group) presented with severe PRESS score and hence therefore the requirement of highflow oxygen, advanced airway.

3. Impact on Nature of admission:

Study showed no difference in (outcome) nature of admission among the children who are adequately treated and inadequately treated.(p value 0.396) (table 24).

LIMITATIONS:

1. Estimated sample size was not reached due to short study period and also due to the seasonal variation of acute respiratory illness.
2. The reason for not utilizing the ambulance was not considered in the analysis.

SUMMARY:

This study was initiated with the hope that this will be a basement for the future studies on Prehospital care in pediatric medical emergencies to increase the the availability of facilities and trained personnel along with development of protocols for the same. Our aim was to analyze the impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service (PES) with acute respiratory illness (ARI) in a tertiary care center in South India and to analyze the prehospital transport among them.

This is a prospective observational study which included children of age >1 month to <16 years admitted in PES with ARI between January and June 2017. The effect of pre-hospital care among the “adequately treated” and “inadequately treated” was measured using PRESS score, level of respiratory support given and the nature of admission.

Of 152 children included, 80(64%) were infants. Majority (79.7%) reached PES after 48 hrs of illness. Among the study population, 125 (82%) were” inadequately treated”, 27(18%) were “adequately treated”.

Majority of children in the “adequately treated” group had PRESS-severe score as compared to the inadequately treated group (18/27 Vs 58/125, p = 0.05). A significantly higher number of patients in the adequately treated group required high flow oxygen (HFO) (26% Vs 16%, p =0.042). No difference was found in the rates of advanced airway placement between the two groups (7.5% Vs 1.6%, p= 0.145). PHDU and PICU admission rates were not significantly different (11.1% Vs 9.6%&7.4% Vs 2.4%, p=0.396).

Ambulance was the mode of transport in 11(7%) children. Of the 76 with severe PRESS score, 10% used ambulance (8/76 Vs 68/79,p=0.07). 18.5% of children requiring HFO and 25% needing advanced airway were transported by ambulance (1/4vs 3/4, p value = 0.042).

Our study concluded that severe PRESS score and High flow oxygen requirement were significantly high among the adequately treated group. Ambulance utilization was significantly less even among those with severe PRESS score and requiring advanced airway.

CONCLUSION:

1. Our study showed that significantly higher number of children in “adequately treated” group had severe PRESS score and high flow oxygen requirement compared to “inadequately treated” children
2. .In our study, there was no difference in the requirement of advanced air way placement and no difference in the nature of admission between the children who were adequately treated and inadequately treated
3. Ambulance utilization was significantly less even among those with Severe PRESS score and those requiring immediate advanced airway.

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ANNEXURES

ANNEXURE 1 –IRB DOCUMENTS

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Anna Benjamin Pulimood, M.B.B.S., MD., Ph.D.,
Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

January 13, 2017

Dr. S. Nithya,
PG Registrar,
Department of Paediatrics,
Christian Medical College,
Vellore - 632 004.

Sub: **Fluid Research Grant NEW PROPOSAL:**
Impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service(PES) with acute respiratory illness in a tertiary care center in South India.
Dr. S. Nithya, Employment Number: 33451, PG registrar, Paediatrics, Dr. Debasis Das Adhikari, Employment Number: 50132, Paediatrics, Dr. Kala Ebenezer, Employment Number: 20049, Dr. Ebor Jacob, Employment Number : 20175, Paediatrics, Dr.Pragathesh, Paediatrics, Dr. Koshy Alan, Employment Number: 33958, Paediatrics.

Ref: IRB Min No: 10353 [OBSERVE] dated 03.11.2016

Dear Dr. S. Nithya,

I enclose the following documents:-

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Biju George, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS, M.D., D.M.
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

Cc: Dr. Debasis Das Adhikari, Dept. of Paediatrics, CMC, Vellore

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284202 Fax: 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

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Department of Paediatrics,
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Vellore - 632 004.

Sub: **Fluid Research Grant NEW PROPOSAL:**
Impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service(PES) with acute respiratory illness in a tertiary care center in South India.
Dr. S. Nithya, Employment Number: 33451, PG registrar, Paediatrics, Dr. Debasis Das Adhikari, Employment Number: 50132, Paediatrics, Dr. Kala Ebenezer, Employment Number: 20049, Dr. Ebor Jacob, Employment Number : 20175, Paediatrics, Dr.Pragathesh, Paediatrics, Dr. Koshy Alan, Employment Number: 33958, Paediatrics.

Ref: IRB Min No: 10353 [OBSERVE] dated 03.11.2016

Dear Dr. S. Nithya,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "Impact of Pre-hospital care and transporton the outcome of Acutely ill children presenting to Pediatric Emergency Service in a Tertiary care center from South India" on November 03rd 2016.

The Committee reviewed the following documents:

1. IRB Application format
2. Proforma
3. Information Sheet and Informed Consent Form (English , Tamil)
4. CVS of Drs. S. Nithya,Debasis Das Adhikari, Kala Ebenezer, Ebor Jacob, Pragathesh, Koshy Alan.
5. No. of documents 1 – 4

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on November 03rd 2016 in the BRTC Conference Room, Christian Medical College, Bagayam, Vellore 632002.

2 of 4

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Anna Benjamin Pulimood, M.B.B.S., MD., Ph.D.,
Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Name	Qualification	Designation	Affiliation
Dr. Biju George	MBBS, MD, DM	Professor, Haematology, Research), Additional Vice Principal , Deputy Chairperson (Research Committee), Member Secretary (Ethics Committee), IRB, CMC,Vellore	Internal, Clinician
Dr. B. J. Prashantham	MA(Counseling Psychology), MA (Theology), Dr. Min (Clinical Counselling)	Chairperson, Ethics Committee, IRB. Director, Christian Counseling Centre, Vellore	External, Social Scientist
Dr. Ratna Prabha	MBBS, MD (Pharma)	Associate Professor, Clinical Pharmacology, CMC, Vellore	Internal, Pharmacologist
Dr. Rekha Pai	BSc, MSc, PhD	Associate Professor, Pathology, CMC, Vellore	Internal,Basic Medical Scientist
Rev. Joseph Devaraj	BSc, BD	Chaplaincy Department, CMC, Vellore	Internal, Social Scientist
Mr. C. Sampath	BSc, BL	Advocate, Vellore	External, Legal Expert
Dr. Ranjith K Moorthy	MBBS, MCh	Professor, Neurological Sciences, CMC, Vellore	Internal, Clinician
Mrs. Sheela Durai	MSc Nursing	Professor, Medical Surgical Nursing, CMC, Vellore	Internal, Nurse
Ms. Grace Rebekha	M.Sc., (Biostatistics)	Lecturer, Biostatistics, CMC, Vellore	Internal, Statistician
Mrs. Pattabiraman	BSc, DSSA	Social Worker, Vellore	External, Lay Person
Dr. Anand Zachariah	MBBS, PhD	Professor, Medicine, CMC, Vellore	Internal, Clinician
Dr. Balamugesh	MBBS, MD(Int Med), DM, FCCP (USA)	Professor, Pulmonary Medicine, CMC, Vellore	Internal, Clinician

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294. 2284202 Fax: 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Anna Benjamin Pulimood, M.B.B.S., MD., Ph.D.,
Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Dr. SnehaVarkki	MBBS, DCH, DNB	Professor, Paediatrics, CMC, Vellore	Internal, Clinician
Mrs. Emily Daniel	MSc Nursing	Professor, Medical Surgical Nursing, CMC, Vellore	Internal, Nurse
Dr. Sathish Kumar	MBBS, MD, DCH	Professor, Child Health, CMC, Vellore	Internal, Clinician
Dr. Visalakshi. J	MPH, PhD	Lecturer, Biostatistics, CMC, Vellore	Internal, Statistician
Dr. Mathew Joseph	MBBS, MCH	Professor, Neurosurgery, CMC, Vellore	Internal, Clinician

We approve the project to be conducted as presented.

Kindly provide the total number of patients enrolled in your study and the total number of withdrawals for the study entitled: "Impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service(PES) with acute respiratory illness in a tertiary care center in South India"on a monthly basis. Please send copies of this to the Research Office (research@cmcvellore.ac.in).

Fluid Grant Allocation:

A sum of 14,800/- INR (Rupees Fourteen ThousandEight hundred Only) will be granted for 8Months.

Yours sincerely,

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
M.D., D.M.
SECR. (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

IRB Min No: 10353 [OBSERVE] dated 03.11.2016 4 of 4

ANNEXURE 2 – INFORMATION SHEET AND INFORMED CONSENT

Information sheet for parents

This is to inform you that I need your informed consent for A study on Impact of Pre-hospital care on the outcome of the children presenting to Pediatric Emergency with acute respiratory illness in a Tertiary care center from South India. "

1.What is a study?

A study or research is a scientific exercise of finding out an answer to a particular question. Many problems that our world has faced have been solved by similar exercises as this. A study is a planned, thorough, fact-finding mission backed up by certain scientific princIPles that ensure that the final results are truthful, useful and reproducible.

2. What is this particular study?

Pre-Hospital care is the emergency care given by a physician and health care persons in a primary/community health center and during transport. where the parents seek medical care for their children. Pre-hospital care ,if given at appropriate time will save a child from life-threatening events .

My study is to find whether such Pre-hospital care has a influence on the well being of the children with acute respiratory illness who present to pediatric emergency .

3. How is this study done?

If you are willing for your child to particIPate in the study, I will need to take some details about the child problems and the treatment if taken already for the same illness. Your child will be investigated and treated as any other children. Your child will be followed up after admission, till discharge.

4. What will my child gain from this study?

This study will make the parents to gain knowledge about the importance of pre-hospital care

5. What all blood tests will be done and what will be the treatment?

Your child will tested and treated according to Standard protocols according to the disease condition as needed

6. Will my child be harmed by the study?

No. The blood tests, procedures and the treatment which are being done on your child as

part of this study is the standard of care protocol for all children , whether they are in the study or not. Hence no harm will come to your child by consenting to be part of this study.

7. Can my child not particIPate if I don't like it? now or later sometime?

Definitely yes, at any point, if you feel like withdrawing your child from the study, you can do so by contacting me. (My contact details are given at the bottom of the page)The treatment of the child will not be affected following withdrawal.

8. Will my child's data be revealed to anyone else?

The personal data of the child will be noted for the identity and not included in the study.

9. What will you gain from this study?

I will know the availability and effectiveness of Pre-Hospital care given by primary / community health care physician and health care persons before the child reaches a tertiary hospital.

10. What will anybody else gain from this study?

The Outcome of the study will help to know availability and effectiveness of Pre-Hospital care given to the children presenting with acute respiratory illness before reaching the tertiary care center. This study can help to increase the availability of trained pediatric emergency team in the out-reach areas in the future .

In case of any doubts or clarifications, Please contact me

Name: Dr .S.Nithya

Phone no : +91 -9842198033 Email :drnithiarun11@gmail.com

Informed Consent Form for Parents to particIPate in the study titled

" Impact of Pre-hospital care on the outcome of the children presenting to Pediatric Emergency with acute respiratory illness in a Tertiary care center from South India. "

Parent's name:
Age:
Sex:

I, _____ (father / mother) of , _____
Declare that I have read the information sheet provide to me regarding this study and have
clarified any doubts that I had. [ ]

I also understand that my child's particIPation in this study is entirely voluntary and that I am free to withdraw permission to continue to particIPate at any time without affecting my child's usual treatment or his/her legal rights [ ]

I understand that the study staff and institutional ethics committee members will not need my permission to look at my child'shealth records even if I withdraw from the trial. I agree to this access [ ]

I understand that my child's identity will not be revealed in any information released to third
parties or published [ ]

I voluntarily agree for my child to take part in this study [ ].I hereby give permission for blood tests and clinical examination

Name:
Signature/Thumb impression:
Date:

Name of witness:
Relation to particIPant:
Signature/Thumb impression:
Date:

Informed Consent Form for Parents to particIPate in the study titled " Impact of Pre-hospital care on the outcome of the children presenting to Pediatric Emergency with acute respiratory illness in a Tertiary care center from South India. "

Parent's name:
Age:
Sex:

I, _____ (father / mother) of , _____
Declare that I have read the information sheet provide to me regarding this study and have
clarified any doubts that I had. [ ]

I also understand that my child's particIPation in this study is entirely voluntary and that I am free to withdraw permission to continue to participate at any time without affecting my child's usual treatment or his/her legal rights [ ]

I understand that the study staff and institutional ethics committee members will not need my permission to look at my child'shealth records even if I withdraw from the trial. I agree to this access [ ]

I understand that my child's identity will not be revealed in any information released to third
parties or published [ ]

I voluntarily agree for my child to take part in this study [ ].I hereby give permission for blood tests and clinical examination

Name:
Signature/Thumb impression:
Date:

Name of witness:
Relation to particIPant:
Signature/Thumb impression:
Date:

பெற்றோர்களுக்கான தகவல் அறிக்கை

இதன் மூலம் தெரிவிப்பது என்னவென்றால் கிறிஸ்துவ மருத்துவ கல்லூரியில் எனது மேற்படிப்பிற்கு தேவையான ஆய்வினை மேற்கொள்வதற்காக உங்கள் ஒத்துழைப்பு அனுமதி வேண்டுகிறேன்.

என்னுடைய ஆய்வின் தலைப்பு :

தென்னிந்தியாவில் ஆரம்ப சுகாதார நிலையம் மற்றும் தனியார் மருத்துவ மனைகளில் முதற்கட்ட அவசர சிசிக்சை அளித்த பின் மேற்சிகிச்சைக்காக மூன்றாம் நிலை மருத்துவமனை அவசர சிகிச்சைக்கு மூச்சு திணறலுடன் வரும் குழந்தைகளின் தாக்கம் பற்றிய ஆய்வு.

1. **ஆய்வு என்பது என்ன?**

ஆய்வு அல்லது ஆராய்ச்சி என்பது ஒரு குறிப்பிட்ட கேள்விக்கு ஒரு பதில் கண்டுபிடிப்பதற்கான ஒரு அறிவியல் பயிற்சி ஆகும். உலகம் எதிர்கொண்ட பல பிரச்சனைகளுக்கு இதே போன்று பயிற்சிகள் மூலம் தீர்க்கப்பட்டுள்ளது. ஒரு ஆய்வு என்பது திட்டமிட்ட முழுமையான உண்மை கண்டறியும் இறுதி முடிவு. இதனை மீண்டும் உருவாக்கக்கூடிய உண்மையான பயனுள்ள முடிவு என்று சில அறிவியல் கோட்பாடு ஆதரவுடன் நிரூபிக்கப்படுகிறது.

2. **திட்ட ஆய்வு என்பது என்ன?**

ஆரம்ப சுகாதார நிலையம், தனியார் மருத்துவ மனைகள் மற்றும் அவசர சிகிச்சை வாகனத்தில் அளிக்கப்படும் முதற்கட்ட சிகிச்சையின் பலனை அறிவதற்கான ஆய்வு. இந்த முதற்கட்ட சிகிச்சை அச்சுறுத்தும் நிகழ்விலிருந்து காப்பாற்றுமா? இல்லையா? என்பது எனது ஆய்வு.

3. **இந்த ஆய்வு எப்படி செய்யப்படுகிறது?**

நீங்கள் பங்கேற்க தயாராக உள்ளீர்கள் என்றால் உங்கள் குழந்தையின் நோய் மற்றும் முதற்கட்ட அவசர சிகிச்சைகளின் விவரங்களை தரவேண்டும். அதன் பிறகு அந்த விவரங்களை நான் ஆய்வு செய்வேன்.

4. **என் குழந்தை இந்த ஆய்விலிருந்து என்ன பயன் பெறும்?**

இந்த ஆய்வின் மூலம் முதற்கட்ட அவசரகால சிகிச்சை மற்றும் அவசர சிகிச்சை ஊர்திகளில் அளிக்கப்படும் சிகிச்சையின் முக்கியத்துவம் பற்றி அறிவீர்கள்.

5. **இந்த ஆய்விற்காக என் குழந்தைக்கு ஏதேனும் இரத்த பரிசோதனையோ தனிப்பட்ட சிகிச்சையோ அளிக்கப்படுமா?**

இந்த ஆய்விற்காக தனிப்பட்ட இரத்த பரிசோதனையோ அல்லது சிகிச்சையோ தரப்படாது. தங்கள் குழந்தையின் நோய் நிலைக்கு ஏற்ப இரத்த பரிசோதனை மற்றும் சிகிச்சை அளிக்கப்படும்.

6. **இந்த ஆய்வினால் எனது குழந்தைக்கு பாதிப்பு உண்டா?**

இல்லை. உங்கள் குழந்தை ஆய்வில் இருந்தாலும், இல்லாவிட்டாலும் இரத்தப்பிரிசோதனைகளும் சிகிச்சைகளும் மாறாது.

7. **இந்த ஆய்வில் பங்கேற்க விருப்பம் இல்லை என்றால் விலகிக் கொள்ளலாமா?**

ஆம். நிச்சயமாக விலகிக்கொள்ளலாம். கீழே குறிப்பிட்டுள்ள கைபேசி எண் அல்லது மின் அஞ்சல் மூலம் தகவல் தெரிவித்துவிட்டு விலகிக் கொள்ளலாம். இதனால் தங்கள் குழந்தைகளின் சிகிச்சை பாதிக்கப்படாது.

8. **என் குழந்தையின் விபரங்கள் வேறு யாரிடமும் வெளிப்படுத்துவீர்களா?**

தங்கள் குழந்தையின் பெயர் விபரங்களை வெளிப்படுத்தப்பட மாட்டாது

9. **இந்த ஆய்வின் மூலம் மருத்துவர் ஆன எனக்கு என்ன பயன்?**

உயர் சிகிச்சைக்காக மூன்றாம் நிலை மருத்துவ மனைக்கு வரும் முன் அளிக்கப்பட்ட முதற்கட்ட அவசர சிகிச்சை மற்றும் அவசர சிகிச்சை ஊர்தியில் அளிக்கப்பட்ட சிகிச்சையின் திறனை அறிய இந்த ஆய்வு உதவும்.

10. **இந்த ஆய்வின் மூலம் மற்றவர்களுக்கு கிடைக்கும் ஆதாயம் என்ன?**

எதிர்காலத்தில் இந்த ஆய்வின் மூலம் ஆரம்ப சுகாதார நிலையம், இரண்டாம் நிலை மருத்துவமனைகள் மற்றும் அவசர சிகிச்சை ஊர்தியில் மேற்கொள்ள வேண்டிய சிகிச்சைகளின் மாற்றங்கள் மற்றும் முன்னேற்றங்களுக்கு தேவையான யோசனைகள் பெறாலம்.

தங்கள் சந்தேகங்கள் மற்றும் விபரங்களை தெரிந்துகொள்ள என்னை தொடர்பு கொள்ளவும்

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ஒப்புதல் படிவம்

தென்னிந்தியாவில் ஆரம்ப சுகாதார நிலையம் மற்றும் தனியார் மருத்துவ மனைகளில் முதற்கட்ட அவசர சிசிக்சை அளித்த பின் மேற்சிகிச்சைக்காக மூன்றாம் நிலை மருத்துவமனை அவசர சிகிச்சைக்கு மூச்சு திணறலுடன் வரும் குழந்தைகளின் தாக்கம் பற்றிய ஆய்வில் பங்கேற்பதற்கான ஒப்புதல் படிவம்.

பெற்றோர் பெயர் :
குழந்தையின் வயது :
ஆண்/பெண் :

- _____ என்ற குழந்தையின் (தாய்/தந்தை) யாகிய நான் _____ இந்த ஆய்வின் தகவல் தாளினை படித்துள்ளேன். எந்த சந்தேகமும் எனக்கு இல்லை [ ]
- இந்த ஆய்வு எனது குழந்தையின் பங்களிப்பு முற்றிலும் தன்னார்வமுடையது மற்றும் எனது குழந்தையின் வழக்கமான சிகிச்சை பாதிக்காமல் இந்த ஆய்விலிருந்து விலக எனக்கு உரிமைகள் உள்ளது.
- குழந்தையின் நோய் பதிவுகளை ஆய்வு ஊழியர்கள் மற்றும் நெறிமுறைகள் குழு உறுப்பினர்கள் பார்க்க என் அனுமதி தேவையில்லை என்பதை புரிந்து கொண்டேன்.
- எனது குழந்தையின் பெயர்/ அடையாள விபரங்கள் மூன்றாவது அணிக்கு வெளிப்படுத்தமாட்டாது என்று புரிந்து கொண்டேன்.
- நான் தன்னார்வத்துடன் எனது குழந்தையின் இரத்தப்பரிசோதனை மற்றும் மருத்துவப்பரிசோதனைகளையும் மேற்கொள்ள சம்மதிக்கிறேன்.

பெற்றோரின் பெயர் :

கையொப்பம்/ பெருவிரல்ரேகை :

தேதி :

சாட்சியின் பெயர் :
கையொப்பம்/பெருவிரல்ரேகை

குழந்தையின் குடும்பத்தார்:

நாள் :

ANNEXURE 3- PROFORMA

Impact of Pre-hospital care on the outcome of the children presenting to the Pediatric Emergency Service (PES) with acute respiratory illness in a Tertiary care center in South India

Study No: Date:
Name: Hospital number:
Age: Sex : Phone number:
Address /town : Distance from CMC:
Return within 72 hrs Travel time:

Presenting complaints :

Signs & Symptoms		
Duration	<24hr	
	24-48 hrs	
	48-72 hrs	
	>72 hrs	
Allergy:	Yes	No
Prior treatment <72hrs	Yes	No
Chronic illness		
Details of the Event (reason for ER visit)		

Pre-hospital care given (Encircle): 1.Nil 2.OP 3.IP

Type of hospital:	Government	primary health center	secondary health center	medical college
	Private	Rural	Urban	CMC-PerIPheral
Care given by :	Quack	Ayuvedic	General Physician	Paediatrician
Reason for referral :	Not responding	worsening	DAMA	
Referral letter :	with details	without details	No referral letter	

Details of the transport of the sick child:

Ambulance	With medical health team and equIPment	With medical health team but nil equIPment
	With equIPment but no medical health team	without equIPment and medical health team
Transport other than Ambulance (give details)		
Adverse event during transport if by Ambulances		Worsening:1.yes 2.no

If yes 1.airway,2. Hypoxia, 3.shock, 4 . arrest 5.GCS/AVPU, 6.seizures	

Intervention by the Physician (as pre-hospital care)

Approach	**Problems if any**	**Intervention if any**		
A-Airway				
B-Breathing		Oxygen	Yes	No
		Neblisation	Yes	No
		Antibiotics	Yes	No
C-Circulation				
D-Disability				
Pre-hospital care diagnosis:		Diagnosis:	Yes	No

Assessment at arrival in PES: (Visual Assessment)

Consciousness	Breathing	Color

Primary assessment:

Airway	Clear	Maintainable		Not maintainable
Breathing	RR	Sat without oxygen		Sat with oxygen
	Respiratory Distress	Yes		No
	Grunting:	Yes		No
	Cyanosis	Yes		No
	Irregular breathing/gasping	Yes		No
Circulation	HR:	CRT: < 2sec/>2sec	BP:	Pale: Yes/No
	PerIPhery: warm/cold	Hydration: Adequate/Dehydrated	Skin turgor: N/D/L	Urine with in 6 hrs: Yes/No
Circulation	Normotensive	Compensatory shock		Hypotensive shock
Disability	AVPU:		GCS:	
	Features of raised ICP: Yes/No	Anisocoria/ not reacting to light: Yes/No		Focal neurological deficits: Yes/No

Status of acute respiratory illness

Nil	**Respiratory distress/failure**

Included In study	**Excluded from study:**

Reason for exclusion:

PRESS –Respiratory scoring system

PRESS Score	Operational definition	Scoring

Component								
Respiratory rate	Respiratory rate at rest, on room air*						0	1
Wheezing	High-pitch expiratory sound heard by auscultation						0	1
Accessory muscle use	Any visible use of accessory muscles						0	1
SpO_2	Oxygen saturation <95% on room air						0	1
Feeding difficulties	Refusing feedings						0	1
Sum of five components							**Interpretation**	
PRESS score	0	1	2	3	4	5	0-1: mild 2-3: moderate 4-5: severe	

Treatment in pediatric Emergency Service at CMC Vellore at arrival:

Approach	Problems	Intervention
A: Air way	Identification of obstructed airway	Positioning/suctioning/air way (oral or nasopharyngeal)/ adrenaline nebulisation /Drugs/Intubation
B:Breathing	Identification of respiratory distress/failure	Oxygen(high flow)/ CPAP /Intubation/ICD/Antibiotics
C: Circulation	Identification of shock	High flow Oxygen/fluid boluses / /soda bicarbonate/ Ianotropes /antibiotics/ blood product
D: Disability	Identification of abnormal GCS/AVPU Or raised ICP, Seizures	ABC intervention, anti-epileptics, anti-cerebral oedema / neuro protective measures/Antibiotics
E: Exposure	Hypothermia/ hyperthermia	Warmth / tepid sponging as neededAttention to ABCD

Respiratory PRESS scoring at: 0/12/24/48 hrs

Pre hospital care status	Respiratory PRESS scoring at			
	0 hours	12 hours	24 hours	48 hours
1.nil				
2.OP				
3.IP				

Details of treatment after admission

Admission	Short stay in PES	ward	Semi-icu	HDU	PICU	DAMA	Discharge

Final diagnosis :

ANNEXURE 4 "PRESS" -SEVERITY SCORING for severity assessment :

The severity respiratory illness was assessed based on a Paediatric simple respiratory severity scoring(PRESS) which was done at 0, 12,24 and 48 hours among all 3 groups and will be entered in Proforma.

PRESS Score Component	Operational definition	Scoring	
Respiratory rate	Respiratory rate at rest, on room air*	0	1
Wheezing/added sounds	High-pitch expiratory sound /crepts heard by auscultation	0	1
Accessory muscle use	Any visible use of accessory muscles	0	1
SpO_2	Oxygen saturation <95% on room air	0	1
Feeding difficulties	Refusing feedings	0	1

*Respiratory rate at rest, on room air- as per AHA- PALS (Annexure)

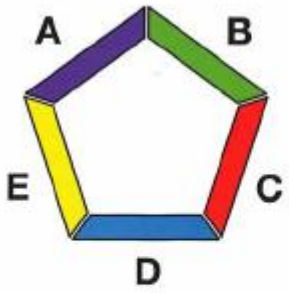
- Accessory muscle use was defined as visible retraction of one or more of the sternomastoid/ suprasternal, intercostal, and subcostal muscles.
- Wheezing/crepts was defined by auscultation performed by pediatrician (investigator or co-investigators).
- SpO2 was evaluated as - above or below 95%.
- Feeding difficulties were assessed using information provided by the parents.

Sum of five components							Interpretation
PRESS score	0	1	2	3	4	5	0-1: mild 2-3: moderate 4-5: severe

Interpretation: Severity was graded as mild, moderate, and severe based on the scores.

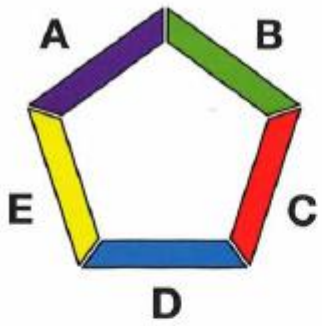
ANNEXURE 5 : PALS ANNEXURE

Primary Assessment



A	**Airway** ***Assessment*** • Is the airway maintainable? • Is the airway clear? • If no to any of these, below are the interventions* ***Interventions*** • Maintain airway patency by positioning, using OPA • Suction as indicated • Advanced airway (eg, supraglottic airway or endotracheal tube) • If inserting an advanced airway, verify correct placement with waveform capnography
B	**Breathing** ***Assessment*** • Adequate depth and rate of respirations • Chest rise • Noisy breathing (eg, grunting, stridor, wheezing) • Use of accessory muscles, nasal flaring • Pulse oximetry* ***Interventions*** • Provide high-flow O_2 • Bag-mask device with or without OPA • Advanced airway • Avoid excessive ventilation
C	**Circulation** ***Assessment*** • Adequate peripheral and/or central pulse • Heart rate • Blood pressure* • Capillary refill—peripheral and/or central • Skin color and temperature • Level of consciousness ***Interventions*** • Obtain IV/IO access • Consider fluid resuscitation

(continued)



D	**Disability** ***Assessment*** • Quickly assess for responsiveness, level of consciousness, and pupillary response to light • AVPU: Alert, Voice, Pain, and Unresponsive • Check point-of-care glucose ***Interventions*** • Spinal motion restrictions • Correct hypoglycemia • Consider naloxone for acute opioid toxicity
E	**Exposure** ***Assessment*** • Remove clothing to perform a physical examination (anterior and posterior), looking for obvious signs of trauma, bleeding, burns, unusual markings, rashes, or medical alert bracelets • Temperature ***Interventions*** • Ensure normothermia • Control bleeding • Decontamination

*If at any part of this sequence you find that a patient has a life-threatening condition, correction of that condition takes precedence over establishing baseline vital sign measures, such as blood pressure or pulse oximetry. When the primary assessment is completed and after life-threatening problems have been addressed, the healthcare provider proceeds to the secondary assessment (Consensus Statement: Emergency Medical Services for Children—Definitions and Pediatric Assessment Approaches. April 2005. Updated July 2015).

Table 31. Signs of Respiratory Distress*

Mild Respiratory Distress	Severe Respiratory Distress or Possible Respiratory Failure
• Mild tachypnea • Mild increase in respiratory effort (eg, nasal flaring, retractions) • Abnormal airway sounds (eg, stridor, wheezing, grunting) • Mottling	• Marked tachypnea and apnea • Significant or inadequate respiratory effort (eg, hypoventilation or bradypnea) • Abnormal airway sounds • Low oxygen saturation (hypoxemia) despite high-flow supplementary oxygen • Pale, cool skin; cyanosis • Decreased level of consciousness (eg, less responsive or unresponsive)

*These indicators may vary in severity.

Table 32. Signs of Severe Respiratory Distress and Probable Respiratory Failure

Signs of Severe Respiratory Distress	Signs of Probable Respiratory Failure
• Marked tachypnea • Increased or decreased respiratory effort • Poor distal air movement • Tachycardia • Low oxygen saturation (hypoxemia) despite high-flow oxygen administration • Cyanosis	• Very rapid or inadequate respiratory rate or possible apnea • Significant, inadequate, or absent respiratory effort • Absent distal air movement • Extreme tachycardia; bradycardia often indicates life-threatening deterioration • Low oxygen saturation (hypoxemia) despite high-flow supplementary oxygen • Decreased level of consciousness • Cyanosis

Respiratory failure can result from upper or lower airway obstruction, lung tissue disease, and disordered control of breathing (eg, apnea or shallow, slow respirations). *When respiratory effort is inadequate, respiratory failure can occur without typical signs of respiratory distress*. Respiratory failure is a clinical state that *requires intervention* to prevent deterioration to cardiac arrest.

Pediatric Advanced Life Support
Signs of Respiratory Problems

	Clinical Signs	Upper Airway Obstruction	Lower Airway Obstruction	Lung Tissue Disease	Disordered Control of Breathing
A	Patency	Airway open and maintainable/not maintainable			
B	Respiratory Rate/Effort	Increased			Variable
B	Breath Sounds	Stridor (typically inspiratory) Barking cough Hoarseness	Wheezing (typically expiratory) Prolonged expiratory phase	Grunting Crackles Decreased breath sounds	Normal
B	Air Movement	Decreased			Variable
C	Heart Rate	Tachycardia (early) Bradycardia (late)			
C	Skin	Pallor, cool skin (early) Cyanosis (late)			
D	Level of Consciousness	Anxiety, agitation (early) Lethargy, unresponsiveness (late)			
E	Temperature	Variable			

Pediatric Advanced Life Support
Identification of Respiratory Problems by Severity

	Respiratory Distress → Respiratory Failure
A	Open and maintainable → Not maintainable
B	Tachypnea → Bradypnea to apnea
B	Work of breathing (nasal flaring/retractions) Increased effort → Decreased effort → Apnea
B	Good air movement → Poor to absent air movement
C	Tachycardia → Bradycardia
C	Pallor → Cyanosis
D	Anxiety, agitation → Lethargy to unresponsiveness
E	Variable temperature

Figure 24. Recognition of Respiratory Problems Flowchart.

Table 33. Initial Management of Respiratory Distress or Failure

Evaluate	Interventions (as Indicated)
Airway	• Support an open airway (allow child to assume position of comfort) or, if necessary, open the airway with – Head tilt–chin lift – Jaw thrust without head tilt if cervical spine injury is suspected. If this maneuver does not open the airway, use the head tilt–chin lift or jaw thrust with gentle head extension • Clear the airway if indicated (eg, suction nose and mouth, remove visualized foreign body). • Consider an oropharyngeal airway or nasopharyngeal airway to improve airway openness/patency.
Breathing	• Monitor O_2 saturation by pulse oximetry. • Provide O_2 (humidified if available). Use a high-concentration delivery device such as a nonrebreathing mask for treatment of severe respiratory distress or possible respiratory failure. • Administer inhaled medication (eg, albuterol, epinephrine) as needed. • Assist ventilation with bag-mask device and supplementary O_2 if needed. • Prepare for insertion of an advanced airway if indicated.
Circulation	• Monitor heart rate, heart rhythm, and blood pressure. • Establish vascular access (for fluid therapy and medications) as indicated.

DATA SHEET

sno	age	sex	pla	dis	tim	dur	chrn	phc	day	type	cent	crgv	reas	rflet
1	4	2	pallikonda	20	0.3	72	1	1						
2	0.04	2	pallikonda	20	0.3	24	7	1						
3	14	1	vellore tow	10	0.15	48	2	1						
4	1.06	1	virunchipu	20	0.3	48	7	1						
5	0.11	1	pachur	90	3	48	7	1						
6	0.08	1	chitoor	40	1.3	48	1	1						
7	1.06	1	chitoor	40	1.3	48	1	1						
8	0.07	1	chitoor	40	1.3	72	7	1						
9	11	2	katpadi	10	0.15	72	2	1						
10	1	1	bhagayam	6	0.1	48	7	1						
11	0.03	1	vaniyamba	50	2	48	7	1						
12	3	1	thiruvanam	60	2	48	7	1						
13	1.06	2	thiruvanam	60	2	48	1	1						
14	3	1	solingar	4	3	1	7	1						
15	0.03	2	pallikonda	20	0.3	24	7	1						
16	1.02	2	gudiyatham	30	1	24	1	1						
17	2	1	bhagayam	6	0.1	72	1	1						
18	1	1	thimiri	30	1	72	1	1						
19	0.02	1	polur	30	1	72	7	1						
20	0.07	1	arani	60	2	24	1	1						
21	0.07	2	minoor	40	1.3	72	7	1						
22	3	2	chitoor	40	1.3	72	7	1						
23	3	1	chitoor	40	1.3	72	7	1						
24	4	2	krishnagiri	90	3	48	1	1						
25	1.06	1	Lallapet	40	2	72	7	1						
26	1	2	tirupattur	90	3	48	1	1						
27	4	1	kaveripaak	5	0.15	72	1	1						
28	4	1	katpadi	5	0.15	24	7	1						
29	3	2	tirupattur	90	3	72	1	1						
30	3	1	vallimalai	45	1.3	24	1	1						
31	0.09	2	katpadi	5	0.15	72	7	1						
32	2	2	kaavalur	40	1.3	72	7	1						
33	1	1	pallikonda	20	0.3	24	7	1						
34	0.03	1	walaja	20	0.3	24	1	1						
35	0.06	1	vellore	4	0.1	48	7	1						
36	0.08	2	virunhcipu	20	1.3	72	1	1						
37	8	1	tirupati	90	2.3	48	2	1						
38	14	1	arani	40	1.3	48	1	1						
39	1.06	1	chitoor	40	1.3	48	1	1						
40	1.06	1	ambur	40	1	24	3	1						
41	5	1	vellore	20	0.3	24	7	1						
42	0.5	1	walaja	20	0.3	72	7	1						
43	0.03	1	kadapa	40	1.3	72	1	1						
44	0.1	1	vellore	10	0.15	72	1	1						
45	0.7	1	chitoor	40	1.3	24	1	1						
46	1	2	chitoor	40	1.3	72	7	1						
47	1.06	1	chitoor	40	1.3	24	7	1						
48	0.04	2	saidapet	2	0.1	72	7	1						
49	0.03	1	kadapa	120	4	72	7	3	1	2	1	4	2	3
50	0.11	1	salem	80	3	48	7	3	1	2	2	4	1	3
51	0.05	2	new arcot	30	1	48	7	3	1	1	3	4	3	3
52	0.01	1	walajapet	20	0.2	48	7	3	1	2	6	4	2	3
53	8	1	arani	30	1	48	7	3	1	2	2	4	2	3
54	2.06	2	thoothuku	120	4	96	7	3	1	2	2	4	2	3
55	1	2	villapakkam	30	0.3	48	3	3	1	2	2	4	2	3
56	3	2	chitoor	40	1.3	72	7	3	2	2	2	4	1	3
57	1.06	1	chitoor	40	1.3	96	7	3	3	2	2	4	2	3
58	1.09	1	pangarapal	40	1.3	72	7	3	3	2	2	4	1	3
59	0.03	1	chitoor	40	1.3	72	7	3	1	2	2	4	1	3
60	0.1	2	arani	40	1	48	7	3	1	1	2	4	3	3
61	1.03	1	chitoor	40	1.3	48	7	3	1	2	1	4	2	3
62	0.02	2	dharmapur	90	3.3	72	7	3	2	2	1	4	2	3
63	1	1	thiruvanam	60	2	72	7	3	2	2	3	4	3	3
64	2	1	sripuram	15	0.2	72	1	3	1	2	2	4	1	3
65	1.05	1	kallavi	90	3	96	7	3	3	2	6	4	1	3
66	0.05	1	chitoor	40	1	72	7	3	1	2	2	4	2	1
67	1	1	mittur	40	1.3	72	7	3	1	1	2	4	3	3
68	0.11	1	vellore	10	20	72	7	3	2	2	6	4	2	3
69	13	1	thuthipet	50	1	1	2	3	1	2	6	4	1	3
70	3.06	1	vellore	10	0.15	72	7	3	1	2	2	4	2	1
71	1.06	1	vellore	10	0.15	72	7	3	2	2	6	4	1	3
72	0.05	1	chitoor	40	1.3	2	7	3	2	2	2	4	2	3
73	0.09	1	polur	70	2	48	7	2	1	2	1	4	1	1

74	0.11	1	vellore	2	0.1	2	7	2	1	2	1	4	1	1
75	0.4	1	pollur	60	2	48	1	2	1	2	1	4	1	3
76	0.05	1	poigai	30	1	72	7	2	1	2	2	4	1	1
77	0.5	1	tirupathi	60	2.3	72	7	2	3	2	1	4	1	1
78	2.06	1	vellore	1	0.05	48	1	2	2	2	1	4	1	1

79	1.02	2	katpadi	6	0.15	72	7	2	2	2	1	4	1	1
80	0.07	1	walaja	20	0.3	72	7	2	3	2	1	4	1	1
81	0.11	2	solingar	60	2	72	7	2	2	2	1	4	1	1
82	1	1	solinger	60	2	72	7	2	2	2	1	4	1	1
83	0.07	1	chitoor	40	1.3	72	1	2	2	2	1	4	1	1
84	0.06	2	chitoor	40	1.3	72	7	2	3	2	1	4	1	1
85	5	1	chitoor	40	1.3	72	7	2	3	2	1	4	2	1
86	1.06	1	chitoor	40	1.3	72	1	2	2	2	1	4	2	1
87	1.3	1	gudiyatham	60	2	72	7	2	2	2	1	4	2	1
88	0.06	1	vellore	1	5	72	7	2	3	2	1	4	2	1
89	0.08	1	arcot	30	1	72	1	2	3	2	1	4	2	1
90	0.1	2	gudiyatham	30	1	72	7	2	3	1	2	4	1	1
91	1.02	1	polur	30	1	72	7	2	3	2	1	3	1	1
92	0.08	1	ambur	30	1	72	7	2	2	2	1	4	1	1
93	3	2	katpadi	5	0.15	72	7	2	2	2	1	4	1	1
94	3	2	thiruthani	60	2.3	96	7	2	3	2	1	4	1	1
95	0.03	1	melvishara	3	0.15	72	7	2	1	2	1	4	2	1
96	3.06	1	vellore	1	0.1	72	7	2	2	2	1	4	1	1
97	6.06	1	chitoor	40	1.3	48	7	2	2	2	1	4	1	3
98	0.02	1	vellore	1	0.1	48	7	2	1	2	6	4	1	3
99	2	1	ambur	30	1	72	7	2	2	2	1	4	1	1
100	1.11	2	annaikattu	10	0.2	48	7	2	1	2	1	4	2	1
101	2.06	2	chitoor	40	1.3	48	7	2	1	2	4	4	2	3
102	1.03	1	tirupattur	80	2.3	2	1	2	1	2	5	4	1	3
103	0.07	1	polur	40	1.3	96	7	2	3	2	5	4	1	3
104	0.04	1	katpadi	5	0.15	72	7	2	2	2	6	4	1	3
105	0.11	1	arcot	30	1	48	7	2	1	2	6	4	1	3
106	3	1	chennai	90	3	72	1	2	2	2	1	4	1	1
107	6	1	arni	40	2	24	1	1						
108	2	1	cheyyar	30	2	72	7	2	2	2	1	4	2	1
109	1	1	arani	30	1	48	7	2	1	2	1	3	1	1
110	0.6	1	chottapala	1	0.05	120	7	2	3	2	1	4	1	1
111	0.08	1	arcot	30	0.4	72	7	2	2	1	1	4	1	1
112	1.08	1	chitoor	40	2	36	7	2	1	2	1	4	2	1
113	4	1	chitoor	40	2	24	7	2	3	2	1	4	1	1
114	6	2	katpadi	2	0.1	72	1	2	2	2	1	4	1	1
115	0.08	2	peranampa	50	1.3	48	7	2	1	2	1	4	1	1
116	6	1	arani	45	2	72	1	2	1	2	1	4	1	1
117	0.02	2	katpadi	2	0.1	48	7	2	1	2	1	4	1	1
118	1.01	2	arani	30	1	72	7	2	2	2	1	4	1	3
119	0.08	1	chitoor	45	1.3	48	7	2	2	2	1	4	2	1
120	2	1	jolarpet	60	2	1	7	2	1	1	2	4	2	1
121	3	2	araakonam	45	1.3	48	7	2	2	2	1	4	1	1
122	0.03	2	visharam	30	1	72	7	2	2	2	1	4	1	1
123	0.02	2	chitoor	45	1.3	96	7	2	2	2	1	4	1	3
124	1	1	senji	60	2	72	7	2	2	2	1	4	2	1
125	0.02	1	tirupathi	60	2	72	7	2	2	2	1	4	1	1
126	2	1	chitoor	45	10.56	72	1	2	1	2	1	4	1	1
127	0.11	1	vaniyamba	45	1.3	72	7	2	1	1	1	4	2	3
128	4	1	kumbakon	300	6	3	7	2	2	1	2	4	1	3
129	0.02	1	virudhamp	2	0.1	48	7	1						
130	2.06	1	polur	40	1.3	72	1	2	2	1	1	4	1	1
131	0.06	2	arcot	30	1	36	7	3	1	2	6	4	1	3
132	8	1	walaja	10	0.2	2	7	2	1	2	1	4	1	1
133	2	2	walaja	20	30	2	1	1						
134	6	1	chitoor	45	1.3	36	1	1						
135	0.03	1	tiruvannam	60	2	3	7	1						
136	0.08	1	arakkonam	30	1	72	7	1						
137	1	1	chitoor	45	1.3	72	1	2	1	2	1	4	1	1
138	1	1	Arakonam	30	1	72	7	1						
139	0.6	1	chitoor	45	1.3	72	1	2	2	2	1	4	1	3
140	0.09	1	vellore	1	0.1	2	7	1						
141	3	2	vaniyamba	50	2	96	7	2	3	1	1	4	2	1
142	6	2	ranipet	20	0.3	1	1	1						
143	2.06	1	walaja	20	0.3	3	7	2	2	2	6	4	2	3
144	0.03	1	chitoor	45	1.3	48	7	3	1	2	2	4	2	1
145	0.1	1	chitoor	45	1.3	3	7	3	2	2	2	4	2	1
146	0.09	1	chitoor	45	1.3	48	7	2	1	2	1	4	2	1
147	9	1	vellore	2	0.05	72	1	2	2	2	1	3	1	1
148	1.06	1	poigai	30	0.2	72	1	2	2	2	1	4	2	1
149	2	1	arani	45	1.3	72	1	1						
150	0.04	1	aarani	40	1.15	72	7	2	3	2	5	4	2	1
151	0.03	1	odugathoo	40	1.3	48	7	1						
152	0.7	1	chitoor	40	1.3	72	7	1						

oxy	neb	ab	trns	amb	adv	eve	air	bre	cir	dis1	p0	p12	p24	p48
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ps0	ps12	ps24	ps48	away	intu	cpap	flo	icd	neb1	flu	ino	admss	diag
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