

# Use of Modified Respiratory Distress Assessment Instrument (RDAI) Score to Determine Short-Term Morbidity in Children with Acute Lower Respiratory Tract Infections (ALRI)

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## ABSTRACT

**Objective:** To determine the clinical utility of modified Respiratory Distress Assessment Instrument (RDAI) score in predicting the short-term outcome of acute lower respiratory tract infections (ALRI) in children two months to two years of age.

**Study design:** Descriptive study.

**Setting:** Department of Pediatrics, Services Hospital, Lahore.

**Duration:** From August 2008 to March 2009.

**Subjects and methods:** One hundred and forty cases of ALRI, from 2 months to 2 years of age were selected. ALRI was diagnosed on the basis of fast breathing and lower chest indrawing. Modified RDAI scoring was applied at the time of admission or soon after, before instituting treatment.

**Results:** Mean age of the patients was observed  $7.94 \pm 6.4$  months. Total 99.3% patients were discharged and among those 77.8% were discharged in 72 hours of admission in hospital while remaining 22.1% patients were discharged after 72 hours of hospital stay and there was only one expiry amounting to 0.7% cases. 39.3% children with mild respiratory distress on modified RADI stayed in the hospital for < 24 hours, 0.7% for 25 to 72 hours and 4.3% for > 72 hours as compared to children with moderate respiratory distress among whom 19.3% stayed for > 24 hours, 17.9% for 25 to 72 hours and 15.7% for > 72 hours.

**Conclusion:** It is concluded that modified RDAI score may be used to determine the severity of ALRI and mild to moderate patients may be managed at out-patient-basis.

**Key words:** Acute respiratory infection, Modified Respiratory Distress Assessment Instrument score.

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## INTRODUCTION

Acute respiratory infections (ARI) are the leading cause of mortality in children under five years of age worldwide. It is estimated that 500 to 900 million ARI episodes occur per year in developing countries<sup>1</sup>. About 2 million under five children die of ARI annually, of which 90% deaths occur in developing countries<sup>1,2,3,4</sup>. Out of these pneumonia is primarily the main cause of mortality. Children with acute respiratory infections account for 20% to 40% of the children attending outpatient clinics and 12% to 35% of admissions into hospitals<sup>5</sup>.

The World Health Organization (WHO) has developed an ARI case management strategy that employs simple clinical signs to diagnose pneumonia, followed by empirical antimicrobial treatment<sup>6</sup>. WHO considers all acute lower respiratory tract infections (ALRI) including bronchiolitis, as pneumonia. The main objective of the ARI program is to reduce pneumonia related mortality in developing countries<sup>7</sup>. This needs administration of antibiotics to all children, including those with viral ALRI.

Besides WHO's case management strategy for ARI, 'Modified Respiratory Distress Assessment Instrument (RDAI) score' (table 1) has been used to determine its severity. In an attempt to target appropriate case for early intensive intervention a study was done in young Malaysian children in whom authors used this score to assess the respiratory distress at admission in children suffering from RSV infection<sup>8</sup>. It was concluded that assessment of respiratory distress may serve as a guide to clinicians in recognizing categories of patients who require general or intensive care<sup>8</sup>. Modified RDAI score employs four parameters (respiratory rate, color of the patient, use of accessory muscles of respiration and auscultatory findings in chest) which are given a particular score according to severity, to define respiratory distress as mild, moderate and severe.

The objective of the study was to determine the clinical utility of modified RDAI score in predicting the short-term outcome of ALRI in children two months to two years of age. If modified RDAI score is able to predict the outcome of ALRI then we can safely avoid un-necessary admissions and hospital management in mild respiratory distress, and these patients can be managed on the outdoor basis. In this study outcome

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of children in terms of discharge, death and length of hospital stay was correlated with the initial score.

Better management plan can be implemented on the basis of these results.

Table-1: Modified Respiratory Assessment Instrument (RADI) Score.

Clinical Parameter	Score 0	Score 1	Score 2	Score 3
Respiratory Rate (per minute)	<40	40 –60	60 – 70	>70
Use of Accessory Muscles	None	1 accessory muscle used	2 accessory muscles used	≥3 accessory muscles used
Color/Cyanosis	Pink in room air/no cyanosis	Cyanosed when crying	Pink with oxygen or cyanosed in room air	Cyanosed with oxygen or cardio-respiratory arrest
Auscultatory findings	Normal	Decreased air entry, no Rhonchi heard	Decreased air entry, Rhonchi heard	Silent chest

**MATERIAL AND METHODS**

This study was carried out in the Department of Pediatrics, Services Hospital, Lahore from August 2008 to March 2009. The calculated sample size with 95% confidence level with 7% margin of error and 80% magnitude of success of modified RDAI score to predict the short term outcome in ALRI was 140 cases. These children were recruited through emergency or out-patient’s department (OPD). Sampling technique employed was non-probability and purposive. Children aged 2-24 months of both genders with clinically proven ALRI (based on WHO’s criteria of fast breathing and lower chest indrawing) were included in the study. The cut-off point for fast breathing for infants 2 – 12 months of age was 50/minute and that for older children was 40/minute. Children having bronchial asthma, foreign body inhalation or congenital heart disease (all assessed on history and clinical examination) were excluded from the study.

After taking an informed consent from the parents or guardian of the child demographic information and a detailed history was obtained and a thorough physical examination was done with special attention given to respiratory system. ALRI was diagnosed on the basis of fast breathing and lower chest indrawing. Modified RDAI scoring (table 1) was applied at the time of admission or soon after, before instituting treatment. Patient was classified as having mild (score 0-4), moderate (score 5-8) and severe (score 9-12) respiratory distress on the basis of modified RDAI score. Progress of the patients was noted during their stay in the ward while management was carried out according to the hospital, protocol. Outcome was assessed on the basis of discharge or death and length of stay in the hospital. All of this information was recorded.

Data were entered and analyzed through computer software SPSS version 10.0. The variables

were analyzed using simple descriptive statistics as mean, standard deviation, proportions and percentages. Logistic regression analysis was used for predicting the short-term outcome (length of hospital stay, discharge/death) of ALRIs using modified RDAI score (mild, moderate or severe respiratory distress).  $P \leq 0.05$  was considered significant. Data was stratified for age, mode of admission (emergency/OPD) and mild, moderate and severe categories of respiratory distress on modified RDAI score.

**RESULTS**

Ninety-nine (70.7%) patients were between 2-11 months and 41 (29.3%) between 12-24 months with mean age of  $7.94 \pm 6.4$  months (Table-2). Gender distribution showed 85 males (60.7%) with male to female ratio of 1.5:1 (Table-2). Fifty-four 54 patients (38.6%) were admitted through outpatient’s department and 86 (61.4%) through emergency (Table-2).

Modified RDAI score labeled respiratory distress as mild in 62 patients (44.3%), moderate in 74 patients (52.9%) and severe in 4 patients (2.9%) (Table-2). Prediction of Modified RDAI score showed that 62 patients (44.6%) with mild, 73 patients (52.5%) with moderate and 4 patients (2.9%) with severe respiratory distress were discharged and 1(0.71%) patient of moderate respiratory distress expired. (Table-3). As regards overall short-term outcome, 139 patients (99.3%) discharged and only 1 patient (0.07%) expired. Mean length of stay was  $37.7 \pm 36.6$  hours and respiratory rate  $54.4 \pm 11.0$ /minute.

Stratification of age according to RDAI score outcome was mild in 41 patients (29.3%), moderate in 54 (38.6%) and severe in 4 (2.8%) in children between 2-11 months while in patients between 12-24 months of age mild respiratory distress was seen

in 21 (15.0%), moderate in 20 (14.3%) cases. Stratification of sex according to RDAI score outcome showed that male patients were labeled as mild in 43 (30.7%) cases, moderate in 39 (27.9%) and severe in 03 (2.1%) and female patients had mild respiratory distress in 19 (13.6%) cases, moderate in 35 (25.0%) and severe in 01 (0.7%) (Table-4). Severity of respiratory distress in patients admitted through OPD was mild in 21 (15.0%), moderate in 32 (22.9%) and severe in 01 (0.7%) and patients admitted through emergency had mild respiratory distress in 41 (29.3%), moderate in 42 (30.0%) and severe in 03 (2.1%) cases.

Fifty-five (39.3%) children with mild respiratory distress on modified RADI stayed in the hospital for < 24 hours, 01 (0.7%) for 25 to 72 hours and 06 (4.3%) for > 72 hours as compared to children with moderated respiratory distress among whom 27 (19.3%) stayed for > 24 hours, 25 (17.9%) for 25 to 72 hours and 22 (15.7%) for > 72 hours. Regarding children having severe respiratory distress (04 in number), one (0.7%) stayed for 25 – 72 hours and 3 (2.1%) for > 72 hours.

Table-2: Distribution of cases various variables.

Variables		=n	%age
Age (months)	2-11	99	70.7
	12-24	41	29.3
Sex	Male	85	60.7
	Female	55	39.3
Mode of admission	Outpatient	54	38.6
	Emergency	86	61.4
Respiratory distress (Modified RDAI score)	Mild	62	44.3
	Moderate	74	52.9
	Severe	04	02.9
Short term outcome	Discharged	139	99.3
	Expired	01	00.7

Table-3: Prediction of Modified RDAI score

Modified RDAI	OUTCOME			
	Discharged		Expired	
	=n	%age	=n	%age
Mild	62	44.6	-	-
Moderate	73	52.5	01	0.71
Severe	04	02.9	-	-

P = 0.638

Table-4: Stratification of age, sex, mode of admission and length of stay according to RDAI score outcome

Variables		Modified RDAI Score			Total
		Mild	Moderate	Severe	
Age (months)	2-11	41 (29.3%)	54 (38.6%)	04 (2.8%)	99 (70.7%)
	12-24	21 (15.0%)	20 (14.3%)	-	41 (29.3%)
Sex	Male	43 (30.7%)	39 (27.9%)	03 (2.1%)	85 (60.7%)
	Female	19 (13.6%)	35 (25.0%)	01 (0.7%)	55 (39.3%)
Mode of admission	OPD	21 (15.0%)	32 (22.9%)	01 (0.7%)	54 (38.5%)
	Emergency	41 (29.3%)	42 (30.0%)	03 (2.1%)	86 (61.5%)
Length of stay (hrs)	≤ 24	55 (39.3%)	27 (19.3%)	-	82 (58.6%)
	25-72	01 (0.7%)	25 (17.9%)	01 (0.7%)	27 (19.3%)
	> 72	06 (4.3%)	22 (15.7%)	03 (2.1%)	31 (22.1%)

## DISCUSSION

Acute lower respiratory tract infections (ALRI) are the main cause of morbidity and mortality in younger children. These accounts for 33-50% mortality in children below 5 years of age, most of them in underdeveloped countries<sup>9</sup>. Pneumonia is primarily the main cause of mortality in children under five year in most developing countries and is responsible for about 2 million deaths each year<sup>2,10</sup>.

Studies reveal that the application of standardized case management protocols can produce up to 50% reduction in mortality due to childhood ALRI in the developing countries. The success of the program depends upon detection of high risk cases and timely referral to hospitals with secondary and tertiary level care<sup>11</sup>.

In an attempt to target appropriate cases for early intensive intervention, several workers have

evaluated simple predictors of adverse outcome in ALRI. However, many of these reports have several lacunae<sup>12,13</sup>. Most studies have evaluated limited factors. The study design have been non-uniform precluding a ready inter study comparison.

It is observed that respiratory distress may serve as a guide to clinician in recognizing categories of patients who require general or intensive care<sup>8</sup>. It is presumed that modified RDAI score is able to predict the outcome of ALRI and unnecessary admission and hospital management can be avoided in cases of mild respiratory distress, and most of the patients can be managed on the outdoor basis.

Majority of our patients were less than one year of age. 70.7% of patients belonged to 2-11 months age group and these included 29.3% patients of mild respiratory distress, 38.6% patients of moderate respiratory distress and 2.8% patients of severe respiratory distress. Patients who belonged to age group 12-24 months were 29.3% and included 15%

patients of mild respiratory distress and 14.3% patients of moderate respiratory distress with no patient of severe respiratory distress in this age group. This is comparable with study done by Mansbach et al, they concluded that most of their patients i.e 73% were less than 12 months old<sup>14</sup>. There was a preponderance of male patients which is comparable to previously published study<sup>15</sup>.

In current study, males were 60.7% and included 30.7% patients of mild respiratory distress, 27.9% patients of moderate respiratory distress and 2.1% patients of severe respiratory distress. Females were 39.3% patients and included 13.6% patients of mild respiratory distress, 25% patients of moderate respiratory distress and 0.7% patients of severe respiratory distress. This is also comparable to a study of Mansbach et al in which it was observed that overall males were 58% who predominate in patients with ALRI under 2 years of age<sup>14</sup>.

Most of the patients (61.4%) were admitted through emergency department of which 29.3% patients were of mild, 30% patients of moderate and 2.1% patients of severe respiratory distress. The patients admitted through outpatient department were 38.6% of which 15% patients were of mild, 22.9% were of moderate and 0.7% were of severe respiratory distress.

In current study, when examined for respiratory distress with modified RDAI score it was found that only 2.9% of patients belonged to severe respiratory distress group while most of the patients 97.1% belonged to mild and moderate respiratory distress, collectively, including 44.3% patients of mild respiratory distress and 52.9% patients of moderate respiratory distress. These results are supported by studies of Kristjansson et al,<sup>16</sup> Dobson et al<sup>17</sup>, Reijonen et al<sup>18</sup> and Schuh et al<sup>19</sup>.

Mean length of stay was 37.7±36.6 hours while mean respiratory rate was 54.4±11 minutes which is not much different from the results of a study done by Cherian et al<sup>20</sup>. They concluded that among children with ALRI the mean respiratory rate in those with normal nutrition (61.5±16.1) was not significantly different from those who were stunted (57.5±16.5), wasted (61.3±14.0), or stunted and wasted (55.4±12.8).

While comparing length of stay in hospital with modified RDAI score, it was observed that 58.6% of patients were discharged within 24 hours, and of these 39.3% patients were of mild and 19.3% patients were of moderate respiratory distress. Those patients who remained admitted from 25-72 hours were 19.3% and of these 0.7% were of mild respiratory distress, 17.9% were of moderate and 0.7% were of severe respiratory distress. The patients who were discharged after 72 hours of stay

were 22.1% and included 4.3% patients with mild, 15.5% patients with moderate and 2.1% patients with severe respiratory distress. On the basis of this we can draw the inference that if modified RDAI score is less the duration of stay in hospital will also be less and vice versa.

When short term outcome was compared with modified RDAI score, it was observed that there was only one (0.71%) out of 140 patients expired. This patient had moderate respiratory distress. 99.3% patients were discharged out of which 44.6% were suffering from mild, 52.5% from moderate and 2.9% from severe respiratory distress. The results are different from previous study of Sehgal et al<sup>21</sup> in which mortality rate was high 10-20% as compared to <1% in current study and age was generally < 1 year as compared to this study in which there is only one expiry and that too in 2<sup>nd</sup> year of life.

It was also observed that overall 97.1% patients belonged to mild and moderate respiratory distress. Patients having mild respiratory distress stayed for short period in the hospital and these can be managed conservatively at home with proper treatment. While only 2.9% patients belonged to severe respiratory distress group needing hospital admission and treatment.

## CONCLUSION

It is concluded that most of the patient with mild respiratory distress according to modified RDAI score can be managed adequately on the outpatient basis and in this way extra burden and unnecessary hospital admission can be avoided. This approach is also cost effective.

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