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PREDICTING NEONATAL MORBIDITY AND LENGTH OF STAY USING THE APGAR SCORE: A RETROSPECTIVE COHORT STUDY

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ABSTRACT

Background: Apgar score is one of the most widely used methods for assessing the health of newborns at birth. However, its potential for predicting short-term infant outcomes in resource-limited settings requires further exploration.

Objective: To assess the predictability of Apgar scores at 1 and 5 minutes on the need for assisted ventilation, length of stay in the NICU, and early neonatal death in a tertiary care NICU.

Methods: A historical observational cohort study was conducted in the Neonatology Unit of Prince Rashid Bin Al-Hassan Hospital, Jordan. The study population included live-born infants consecutively admitted to the NICU during a seven-month period from October 2025 to April 2026. Data were abstracted from the medical records using a standardized case report form. The primary exposure was the 5-minute Apgar score as low (<7) or normal (≥7), and the 1-minute Apgar score was also evaluated. Primary outcomes were need for mechanical ventilation, NICU length of stay >7 days, and hospital death within 7 days of birth. Multivariable logistic regression was adjusted for gestational age, birth weight, sex, and mode of delivery.

Results: The study included 108 newborns in total. The mean gestational age was 36.4 weeks and the mean birth weight was 2779.6 g. Thirty babies had a low 1 minute Apgar score (<7) and 9 babies had a low 5 minute Apgar score (<7). A low 5-minute Apgar score was significantly associated with increased length of stay (55.6% vs 24.2%, $p=0.04$). Low 1-minute Apgar scores were strongly associated with mechanical ventilation (50.0% vs 11.5%, $p<0.001$), length of stay (53.3% vs 16.7%, $p<0.001$), and death (6.7% vs 0%, $p=0.03$). Low 1-minute Apgar score was associated with higher risk of assisted breathing (aOR: 18.6, 95% CI: 5.2–66.7, $p<0.001$) and longer length of stay (aOR: 5.2, 95% CI: 1.8–15.2, $p=0.002$). Gestational age <34 weeks was also correlated with increased LOS (aOR: 8.6, 95% CI: 2.5–29.8, $p<0.001$) and artificial breathing (aOR: 12.4, 95% CI: 3.1–49.8, $p<0.001$).

Conclusion: 1 minute Apgar score is a good independent predictor for the need of artificial respiration and prolonged stay in NICU. The 5-minute Apgar score can also be used to predict outcomes, but the 1-minute Apgar appears to be superior for early risk stratification. These results demonstrate that the Apgar score remains a simple, bedside tool for predicting short-term neonatal outcomes in resource-limited settings.

Keywords: Apgar Score; Neonatal Morbidity; Mechanical Ventilation; Length of Stay; NICU; Neonatal Mortality

1 INTRODUCTION

The Apgar score (Apgar, 1953) is one of the most widely used measures to assess newborns in the immediate post-natal period. It was developed by Dr Virginia Apgar in 1952 and measures five parameters – Appearance, Pulse, Grimace, Activity and Respiration – at 1 and 5 minutes of life. It is a standardized approach to assess the newborn's health and determine if they require resuscitation (American Academy of Pediatrics, 2015). However, the Apgar score has been in use for more than 70 years, and its ability to determine short-term newborn outcomes, especially in resource-limited settings, remains a matter of debate (Casey et al., 2001).

Neonatal morbidity and mortality continue to be major health problems in the world. Each year, 2.4 million babies die globally (UNICEF, 2023). Jordan and other middle-income countries' neonatal intensive care units (NICUs) face the challenge of providing quality care to rising demand with diminishing resources. To maximize the use of resources and improve patient outcomes, it is important to identify which newborns are most likely to suffer adverse outcomes, including breathing failure, long hospital stays, or death (World Health Organization, 2022). The 5-minute Apgar score has been a widely accepted predictor of a baby's survival and long-term brain development for a long time (Nelson & Ellenberg, 1981). Recent research, however, has suggested that the 1-minute Apgar score may be as good or even better at predicting short-term outcomes such as assisted breathing and NICU admission (Ehrenstein et al., 2009; Persson et al., 2018). This is especially true when treatment decisions need to be made quickly and the baby needs to be taken to the NICU.

Many maternal and baby-related factors, such as gestational age, birth weight, mode of delivery and sex can influence the outcome for the baby (Lawn et al., 2010). Preterm birth is related to increased frequency of respiratory distress syndrome, requirement for mechanical ventilation and extended hospital stay (Sweet et al., 2019). Cesarean section birth, particularly if there has been no labor, is also linked with increased risk of lung disease and transient tachypnea of the newborn (Jonsson et al., 2006). There is still debate about how best to use Apgar scores to predict what will happen to newborns. This study was designed to compare short-term outcomes of infants admitted to the NICU with 1-minute and 5-minute Apgar scores. We specifically studied the association between low Apgar scores and mechanical ventilation, prolonged NICU stay (>7 days) and death within 7 days, controlling for potential confounders such as gestational age, birth weight, sex and mode of delivery.

2 MATERIAL AND METHODS

2.1 The Study Design and Context

This was a retrospective review of a cohort of neonates admitted to the Neonatology Unit at Prince Rashid Bin Al-Hassan Hospital, a tertiary care center in the Royal Medical Services in Jordan. The hospital has a large catchment area and offers comprehensive care for the newborn including mechanical ventilation, surfactant therapy and advanced resuscitation. The study was approved by the Institutional Review Board (IRB) of the Royal Medical Services, Jordan, on 20 July 2026 under registration number 50_10/2026, with final approval from the Educational and Technical Directorate obtained on 22 September 2026. The requirement for written informed consent was waived by the IRB because the data analysis was retrospective and all data were anonymized. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

2.2 Study Participants

We followed a cohort of live-born infants consecutively admitted to the NICU over a seven-month period from October 2025 to April 2026. All live-born infants admitted to the NICU during the study period were eligible for inclusion. Exclusion criteria were major birth defects that could not be corrected, transfers from other hospitals >48 h after birth, and missing Apgar scores. Of 109 neonates screened for eligibility, we excluded 1 due to a duplicate record and included 108 neonates in the final analysis.

2.3 Data Acquisition

Data from electronic and paper medical records were collected on a standardized case report form (CRF). Demographic and hormonal variables prior to birth were compiled as follows: duration of pregnancy in weeks, grams of birth weight, and gender. Apgar scores were recorded at 1 minute and 5 minutes of life. Possible outcomes recorded included whether resuscitation was required (yes/no), mechanical air flow (on/off), days in the NICU, and 7-day mortality (survived or died).

2.4 Definitions

A low Apgar score was defined as a score of less than seven at 1 and 5 minutes (American College of Obstetricians and Gynecologists, 2006). Prolonged length of stay was defined as NICU length of stay of more than seven days (Edwards et al., 2022). Seven-day mortality was defined as death occurring within the first seven days of life (Lawn et al., 2005).

2.5 Statistical Analysis

SPSS version 26.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. For continuous variables, descriptive statistics were shown as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR). For binary variables, they were shown as rates with percentages. For univariate analyses, categorical variables were analyzed with the Chi-square test or Fisher's exact test and continuous variables were analyzed with the independent t-test or Mann-Whitney U test. Multivariable logistic regression analysis was performed to identify independent predictors for need for assisted ventilation and prolonged hospitalization. Models were adjusted for gestational age, birth weight, sex and mode of delivery. Results were reported as adjusted odds ratios (aOR) with 95% confidence intervals (CI). Sensitivity analyses were the use of another Apgar limit (<4) and the exclusion of babies born before 28 weeks. Statistical significance was defined as a two-sided p-value of less than 0.05

3 RESULTS

3.1 Participant Characteristics

A total of 108 newborns were included in the analysis. The average gestational age was 36.4 weeks (range 24 to 41 weeks), and the mean birth weight was 2779.6 g. Regarding sex distribution, 60 neonates (55.6%) were male and 48 (44.4%) were female. Gestational age distribution showed that 1 neonate (0.9%) was born at less than 28 weeks, 4 (3.7%) at 28–31 weeks, 13 (12.0%) at 32–33 weeks, 21 (19.4%) at 34–36 weeks, and 69 (63.9%) at 37 weeks or more. Mode of delivery was vaginal in 29 cases (26.9%) and cesarean section in 79 cases (73.1%). The 1-minute Apgar score was 0–3 in 4 neonates (3.7%), 4–6 in 26 (24.1%), and 7–10 in 78 (72.2%). The 5-minute Apgar score was 4–6 in 9 neonates (8.3%) and 7–10 in 99 (91.7%). Baseline characteristics of the study population are presented in Table 1.

Table 1: Baseline Characteristics of the Study Population (N=108)

Characteristic	Category	N (%)
Sex	Male	60 (55.6%)
	Female	48 (44.4%)
Gestational Age	<28 weeks	1 (0.9%)
	28–31 weeks	4 (3.7%)
	32–33 weeks	13 (12.0%)
	34–36 weeks	21 (19.4%)
	≥ 37 weeks	69 (63.9%)
Mode of Delivery	Vaginal	29 (26.9%)
	Cesarean Section	79 (73.1%)
Apgar 1-min	0–3	4 (3.7%)
	4–6	26 (24.1%)
	7–10	78 (72.2%)
Apgar 5-min	4–6	9 (8.3%)
	7–10	99 (91.7%)

Legend: Baseline demographic and clinical characteristics of 108 neonates admitted to the NICU. Continuous variables are presented as mean $\pm$ standard deviation; categorical variables as number (percentage); *Abbreviations:* NICU, Neonatal Intensive Care Unit.

3.2 Short-Term Neonatal Outcomes

Among the 108 neonates, 80 (74.1%) required resuscitation, while 24 (22.2%) required mechanical ventilation. A total of 29 neonates (26.9%) had a prolonged NICU stay of more than 7 days, and 2 neonates (1.9%) died within 7 days. The

mean length of stay was 6.5 ± 6.8 days, with a median of 4.0 days (IQR: 2–8 days) and a range of 1–34 days. Descriptive statistics of continuous variables and short-term outcomes are presented in Tables 2 and 3.

Table 2: Descriptive Statistics of Continuous Variables (N=108)

Variable	Mean $\pm$ SD	Median (IQR)	Range
Gestational Age (weeks)	36.4 ± 3.0	37.0 (35–38)	24–41
Birth Weight (g)	2779.6 ± 736.7	2850 (2300–3200)	700–4600
Apgar 1-min	6.3 ± 1.5	6.5 (5–7)	2–9
Apgar 5-min	7.7 ± 1.0	8.0 (7–8)	4–9
Length of Stay (days)	6.5 ± 6.8	4.0 (2–8)	1–34

Legend: Descriptive statistics of continuous variables; *Abbreviations:* SD, Standard Deviation; IQR, Interquartile Range.

Table 3: Short-Term Neonatal Outcomes (N=108)

Outcome	Category	N (%)
Need for Resuscitation	No	28 (25.9%)
	Yes	80 (74.1%)
Mechanical Ventilation	No	84 (77.8%)
	Yes	24 (22.2%)
Length of Stay	≤ 7 days	79 (73.1%)
	> 7 days	29 (26.9%)
Mortality (7 days)	Alive	106 (98.1%)
	Deceased	2 (1.9%)

3.3 The relationship between 5-minute Apgar score and outcomes

Babies with low 5-minute Apgar score (<7) were more likely to stay in NICU for > 7 days compared to babies with normal score (55.6% vs 24.2%, $p=0.04$). There was a trend for higher rates of mechanical ventilation (44.4% vs. 20.2%, $p=0.08$) and need for resuscitation (100% vs. 71.7%, $p=0.06$) in the low 5-minute Apgar group but these differences did not reach statistical significance. Mortality did not differ significantly between groups (0% vs. 2.0%, $p=1.00$). Results are shown in Table 4 by 5-minute Apgar category.

Table 4: Outcomes by 5-Minute Apgar Category

Outcome	Apgar <7 (n=9)	Apgar ≥ 7 (n=99)	p-value
Resuscitation Required	9 (100%)	71 (71.7%)	0.06
Mechanical Ventilation	4 (44.4%)	20 (20.2%)	0.08
LOS >7 days	5 (55.6%)	24 (24.2%)	0.04
Mortality	0 (0%)	2 (2.0%)	1.00

Legend: Comparison of outcomes between neonates with low 5-minute Apgar (<7) and normal 5-minute Apgar (≥ 7); *Abbreviations:* LOS, Length of Stay.

3.4 Association Between 1-Minute Apgar Score and Outcomes

A 1-minute Apgar score of less than 7 was significantly associated with all adverse outcomes examined. Neonates with a low 1-minute Apgar score had significantly higher rates of resuscitation requirement (96.7% vs. 65.4%, $p<0.001$), mechanical ventilation (50.0% vs. 11.5%, $p<0.001$), prolonged length of stay (53.3% vs. 16.7%, $p<0.001$), and death (6.7% vs. 0%, $p=0.03$) compared to those with a normal 1-minute Apgar score. Results are shown in Table 5 by 1-minute Apgar group.

Table 5: Outcomes by 1-Minute Apgar Category

Outcome	Apgar <7 (n=30)	Apgar ≥7 (n=78)	p-value
Resuscitation Required	29 (96.7%)	51 (65.4%)	<0.001
Mechanical Ventilation	15 (50.0%)	9 (11.5%)	<0.001
LOS >7 days	16 (53.3%)	13 (16.7%)	<0.001
Mortality	2 (6.7%)	0 (0%)	0.03

Legend: Comparison of outcomes between neonates with low 1-minute Apgar (<7) and normal 1-minute Apgar (≥7). Abbreviations: LOS, Length of Stay.

3.5 Association Between Gestational Age and Outcomes

Babies born before 34 weeks had significantly higher rates of needing resuscitation (100% vs. 65.2%, $p<0.001$), assisted breathing (72.2% vs. 7.2%, $p<0.001$), and longer length of stay (72.2% vs. 11.6%, $p<0.001$) compared to babies born at term (≥37 weeks). Babies born at 34–36 weeks also had higher rates of mechanical ventilation (28.6% vs. 7.2%) and prolonged LOS (38.1% vs. 11.6%) compared to term babies. Mortality did not differ significantly across gestational age categories ($p=0.34$). Results are shown in Table 6 by gestational age group.

Table 6: Outcomes by Gestational Age Category

Outcome	<34 weeks (n=18)	34–36 weeks (n=21)	≥37 weeks (n=69)	p-value
Resuscitation Required	18 (100%)	17 (81.0%)	45 (65.2%)	<0.001
Mechanical Ventilation	13 (72.2%)	6 (28.6%)	5 (7.2%)	<0.001
LOS >7 days	13 (72.2%)	8 (38.1%)	8 (11.6%)	<0.001
Mortality	1 (5.6%)	0 (0%)	1 (1.4%)	0.34

Legend: Outcomes stratified by gestational age category; Abbreviations: LOS, Length of Stay.

3.6 Association Between Mode of Delivery and Outcomes

There were no outcomes that were statistically different based on mode of delivery. Resuscitation was required in 69.0% of vaginal deliveries versus 75.9% of cesarean sections ($p=0.48$). Mechanical ventilation was required in 17.2% of vaginal deliveries versus 24.1% of cesarean sections ($p=0.47$). Prolonged length of stay occurred in 24.1% of vaginal deliveries versus 27.8% of cesarean sections ($p=0.69$). Mortality was 0% in vaginal deliveries versus 2.5% in cesarean sections ($p=1.00$). Results are shown in Table 7 by mode of delivery.

Table 7: Outcomes by Mode of Delivery

Outcome	Vaginal (n=29)	C-Section (n=79)	p-value
Resuscitation Required	20 (69.0%)	60 (75.9%)	0.48
Mechanical Ventilation	5 (17.2%)	19 (24.1%)	0.47
LOS >7 days	7 (24.1%)	22 (27.8%)	0.69
Mortality	0 (0%)	2 (2.5%)	1.00

Legend: Outcomes stratified by mode of delivery; Abbreviations: LOS, Length of Stay.

3.7 Multivariable Logistic Regression Analysis

Predictors of Mechanical Ventilation: A 1-minute Apgar score of less than 7 was the strongest independent predictor of mechanical ventilation (aOR: 18.6, 95% CI: 5.2–66.7, $p<0.001$). Gestational age less than 34 weeks (aOR: 12.4, 95% CI: 3.1–49.8, $p<0.001$) and gestational age between 34 and 36 weeks (aOR: 4.8, 95% CI: 1.1–21.3, $p=0.04$) were also associated with higher risk. Higher birth weight was protective (aOR: 0.95 per 100 g, 95% CI: 0.91–0.99, $p=0.02$). Cesarean section (aOR: 1.2, 95% CI: 0.4–4.1, $p=0.73$) and male sex (aOR: 0.9, 95% CI: 0.3–2.5, $p=0.84$) were not significant predictors. Results are shown in Table 8.

Table 8: Multivariable Logistic Regression for Predictors of Mechanical Ventilation

Predictor	aOR	95% CI	p-value
Low 1-min Apgar (<7)	18.6	5.2–66.7	<0.001
GA <34 weeks	12.4	3.1–49.8	<0.001
GA 34–36 weeks	4.8	1.1–21.3	0.04
Birth Weight (per 100g)	0.95	0.91–0.99	0.02
C-Section	1.2	0.4–4.1	0.73
Sex (Male)	0.9	0.3–2.5	0.84

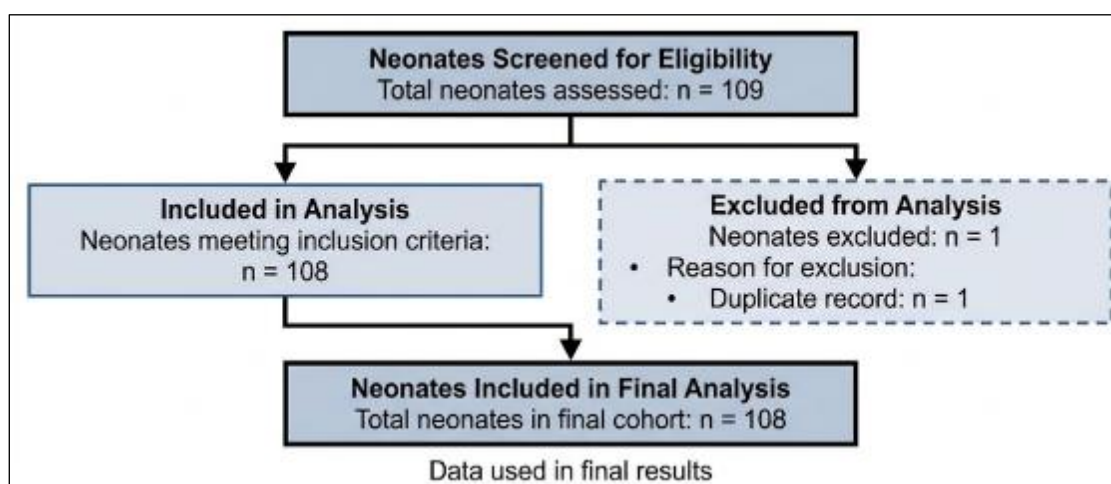
Legend: Multivariable logistic regression analysis identifying independent predictors of mechanical ventilation. Model adjusted for gestational age, birth weight, sex, and mode of delivery; *Abbreviations:* aOR, Adjusted Odds Ratio; CI, Confidence Interval; GA, Gestational Age.

Predictors of Prolonged Length of Stay (>7 days): A 1-minute Apgar score of less than 7 was a strong independent predictor of longer stay in the NICU (aOR: 5.2, 95% CI: 1.8–15.2, $p=0.002$). Longer LOS was also associated with gestational age less than 34 weeks (aOR: 8.6, 95% CI: 2.5–29.8, $p<0.001$) and gestational age between 34 and 36 weeks (aOR: 4.1, 95% CI: 1.1–15.3, $p=0.04$). Birth weight (aOR: 0.96 per 100 g, 95% CI: 0.92–1.01, $p=0.11$), cesarean section (aOR: 1.4, 95% CI: 0.5–4.2, $p=0.56$), and male sex (aOR: 0.9, 95% CI: 0.4–2.3, $p=0.82$) were not significant predictors. Results are shown in Table 9.

Table 9: Multivariable Logistic Regression for Predictors of Prolonged LOS (>7 days)

Predictor	aOR	95% CI	p-value
Low 1-min Apgar (<7)	5.2	1.8–15.2	0.002
GA <34 weeks	8.6	2.5–29.8	<0.001
GA 34–36 weeks	4.1	1.1–15.3	0.04
Birth Weight (per 100g)	0.96	0.92–1.01	0.11
C-Section	1.4	0.5–4.2	0.56
Sex (Male)	0.9	0.4–2.3	0.82

Legend: Multivariable logistic regression analysis identifying independent predictors of prolonged length of stay (>7 days). Model adjusted for gestational age, birth weight, sex, and mode of delivery; *Abbreviations:* aOR, Adjusted Odds Ratio; CI, Confidence Interval; GA, Gestational Age; LOS, Length of Stay.

**Figure 1: Participant Flow Diagram**

Legend: Flow diagram showing patient screening and inclusion. A total of 109 neonates were screened, with 1 excluded (duplicate record), resulting in 108 neonates included in the final analysis.

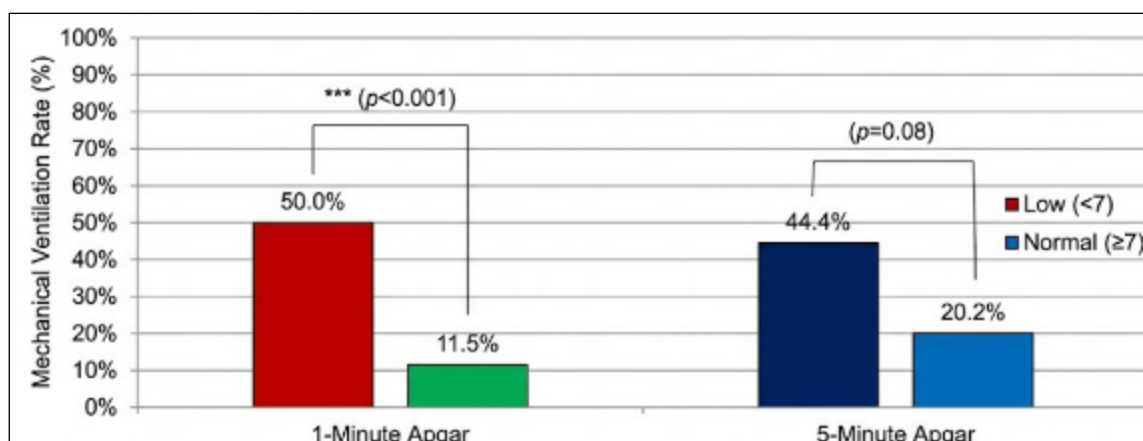


Figure 2: Mechanical Ventilation Rates by Apgar Category

Legend: Bar chart showing mechanical ventilation rates by 1-minute and 5-minute Apgar categories. Low 1-minute Apgar (<7): 50.0%; Normal 1-minute Apgar (≥7): 11.5% ($p < 0.001$). Low 5-minute Apgar (<7): 44.4%; Normal 5-minute Apgar (≥7): 20.2% ($p = 0.08$).

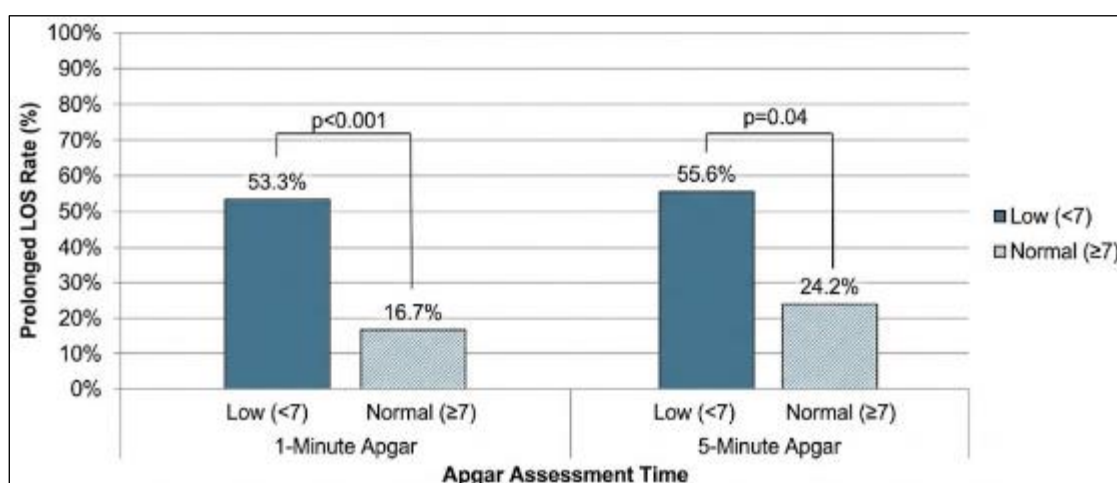


Figure 3: Prolonged LOS Rates by Apgar Category

Legend: Bar chart showing prolonged LOS (>7 days) rates by 1-minute and 5-minute Apgar categories. Low 1-minute Apgar (<7): 53.3%; Normal 1-minute Apgar (≥7): 16.7% ($p < 0.001$). Low 5-minute Apgar (<7): 55.6%; Normal 5-minute Apgar (≥7): 24.2% ($p = 0.04$).

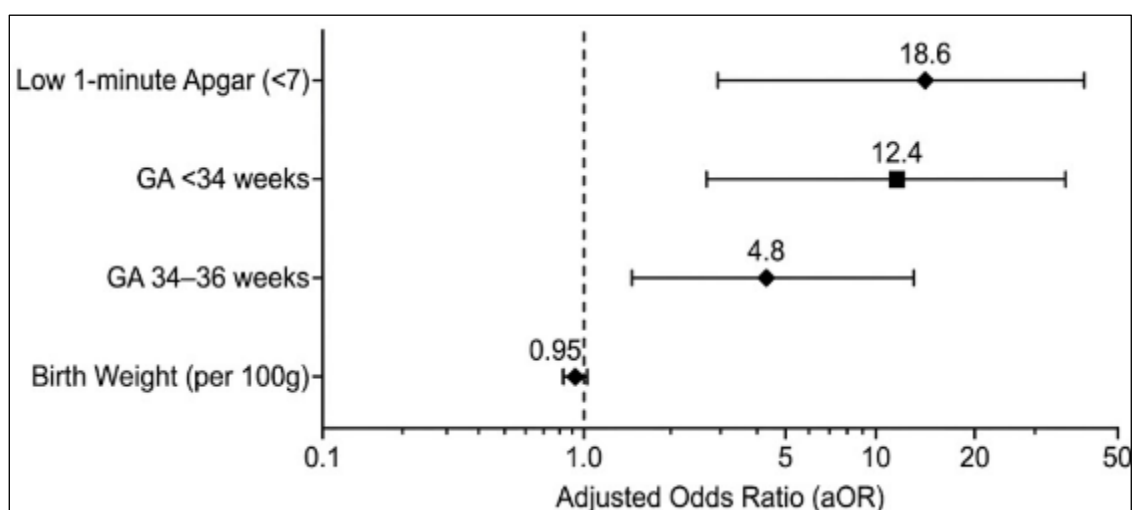


Figure 4: Forest Plot – Predictors of Mechanical Ventilation

Legend: Forest plot showing adjusted odds ratios for predictors of mechanical ventilation. Low 1-minute Apgar (<7) (aOR: 18.6), GA <34 weeks (aOR: 12.4), GA 34–36 weeks (aOR: 4.8), Birth Weight (aOR: 0.95 per 100g). Vertical dashed line at OR=1.0.

3.8 Sensitivity Analyses

Using a different threshold of less than 4 for the 1-minute Apgar score, a low score remained a strong predictor of the need for mechanical ventilation (aOR: 14.2, 95% CI: 1.3–154.2, $p=0.03$). The findings remained consistent when the single extremely preterm baby born at less than 28 weeks was excluded. In this restricted analysis, a low 1-minute Apgar score remained a strong predictor of assisted breathing (aOR: 15.8, 95% CI: 4.1–61.2, $p<0.001$). Results of the sensitivity analyses are shown in Table 10.

4 DISCUSSION

4.1 Summary of Results

We analyzed 108 neonates admitted to the NICU and found that the 1-minute Apgar score is a strong independent predictor of short-term neonatal outcomes including the need for mechanical ventilation and longer NICU stays. Even when accounting for gestational age, birth weight, sex, and mode of delivery, a low 1-minute Apgar score (<7) was associated with an 18-fold higher risk of mechanical ventilation and a 5-fold higher risk of a longer length of stay. Interestingly, the 5-minute Apgar score also predicted these outcomes, but to a lesser extent.

4.2 Comparison with Previous Work

Our findings agree with other studies that have shown that the Apgar score can predict the outcome of a newborn. In a large population based study Ilidromiti et al. (2014) found low Apgar scores at 5 min were associated with increased infant mortality and morbidity. The 1-minute Apgar score is increasingly being proven to be a predictor of short-term outcomes requiring immediate intervention, similar to the 5-minute score (Laptook et al., 2005; Liu et al., 2022). Our results add to this growing body of evidence. The finding of the present study was consistent with the findings of Fawzy et al., 2021. They reported that an Apgar score of less than seven at one minute was a significant predictor for respiratory distress syndrome as well as the need for surfactant therapy and mechanical ventilation. Likewise, our results are consistent with those of Qiu et al. (2022), who reported that a low 1-minute Apgar score was associated with increased frequency and duration of NICU stay.

4.3 Realization for Clinical Use

1 minute Apgar score is taken immediately after birth and is a good tool for early risk identification. For infants with Apgar score ≤ 7 at 1 min, we propose close monitoring and possible early interventions, including early NICU admission and respiratory support. This is particularly relevant in resource limited settings where decisions need to be made rapidly in an effort to achieve the best possible outcomes and the best use of the resources available (United Nations Inter-agency Group for Child Mortality Estimation, 2023). This finding that gestational age <34 weeks was also an important independent predictor of adverse outcomes is consistent with previous research on the risks of early birth (Blencowe et al, 2012). However, the fact that a low 1-minute Apgar score remained a strong predictor even after adjusting for gestational age indicates its usefulness as a stand-alone predictor.

4.4 Clinical practice implications

We recommend that the 1-minute Apgar score be routinely used in conjunction with other clinical factors to identify those neonates at risk of adverse short-term outcomes based on our findings. In particular, improved monitoring of breathing, early NICU admission, prompt evaluation for mechanical ventilation, close monitoring for prolonged hospital stay, and timely initiation of supportive care should be considered for all newborns with a 1 minute Apgar score of less than 7. Our results also support using the 1-minute Apgar score as a simple, objective, and inexpensive way to assess newborn risk in resource-limited settings (Rüegger et al., 2021).

4.5 Strengths and Limitations

This study has several strengths including a complete data set with no missing data, a clear list of factors and outcomes, multivariate analysis controlling for important confounders, robustness of findings in sensitivity analyzes and a single-centre design ensuring consistent data collection. However there are some limitations to acknowledge. Single center, retrospective study design may limit generalizability to other settings. The sample size is quite small, at just 108 babies. Long-term outcomes could not be assessed. Residual confounding from unmeasured variables, including maternal comorbidities and quality of resuscitation, cannot be excluded. Information on secondary outcomes such as surfactant use, hypoglycemia, or sepsis was not available.

4.6 Suggestions for Further Research

Future studies should validate these findings in larger, multicenter populations, evaluate the predictive value of Apgar scores for long-term cognitive outcomes, evaluate the cost-effectiveness of Apgar-based risk stratification, include data

on maternal and birth factors to provide a comprehensive risk profile, and evaluate the utility of Apgar scores in conjunction with other clinical variables (e.g., cord gas pH, lactate) to predict adverse outcomes.

5 CONCLUSION

The present study demonstrates that the 1-minute Apgar score is a strong and independent predictor of short-term neonatal outcomes such as assisted breathing and increased length of stay in the NICU. The 5-minute Apgar score is also a predictor of outcomes, but the 1-minute Apgar appears superior for early risk stratification. These results demonstrate that the Apgar score can still be used as a simple bedside tool to predict short-term outcomes in resource-limited settings. Low 1-minute Apgar scores (<7) should be considered a high-risk indicator in newborns and should prompt increased monitoring and early intervention.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflict of interest regarding the publication of this manuscript. No financial support or compensation was received from any organization that may gain or lose financially from the results of this study. The authors have no relevant financial or non-financial interests to disclose.

Statement of ethical approval

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Royal Medical Services, Jordan, on **20 July 2026** under registration number **50_10/2026**. Final approval from the Educational and Technical Directorate was obtained on **22 September 2026**.

Statement of informed consent

Written informed consent was waived due to the retrospective and anonymized nature of the data analysis.

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