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# EVALUATING COMPLIANCE WITH THE HOUR-1 SEPSIS BUNDLE AND THE IMPACT OF A RAPID RESPONSE INTERVENTION IN SUSPECTED SEPSIS PATIENTS"- A PROSPECTIVE INTERVENTIONAL STUDY

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ABSTRACT

**Background:** Sepsis remains a leading cause of preventable mortality worldwide, particularly in resource-limited settings where delayed recognition and inconsistent adherence to evidence-based guidelines are common. The Surviving Sepsis Campaign recommends implementation of the Hour-1 Sepsis Bundle to improve outcomes. However, compliance remains suboptimal in many tertiary-care hospitals. **Objective:** To evaluate compliance with the Hour-1 Sepsis Bundle in suspected sepsis patients and to assess the impact of a simple Rapid Response Card intervention on improving bundle adherence.

**Materials and Methods:** This prospective interventional study was conducted over two months (October–December 2025) in the Department of General Medicine and ICUs of a tertiary-care teaching hospital in Visakhapatnam. Ninety-two adult patients with newly diagnosed sepsis (46 pre-intervention and 46 post-intervention) were included. Baseline compliance with individual Hour-1 bundle components—blood cultures, intravenous (IV) antibiotics, IV fluids, and vasopressors (when indicated)—was recorded. Serum lactate measurement was excluded due to non-availability. During the intervention phase, a bedside Sepsis Rapid Response Card was introduced to prompt timely action. Compliance rates and patient outcomes were compared using the Chi-square test, with $p < 0.05$ considered statistically significant.

**Results:** IV antibiotic compliance improved significantly from 34.8% pre-intervention to 84.8% post-intervention ($\chi^2=21.88$, $p<0.001$). Complete Hour-1 bundle compliance increased from 13% to 32.6% ($\chi^2=3.95$, $p=0.047$). Blood culture collection improved from 15.2% to 30.4%, and IV fluid administration increased from 63% to 73.9%, though these changes were not statistically significant. Mortality decreased from 21.7% in the pre-intervention group to 13% post-intervention, representing a clinically meaningful reduction. Discharge rates increased from 71.7% to 82.6%.

**Conclusion:** Implementation of a low-cost bedside Rapid Response Card significantly improved compliance with key components of the Hour-1 Sepsis Bundle, particularly timely IV antibiotic administration and overall bundle completion. Although full compliance remains suboptimal, structured, simple quality-improvement interventions can enhance early sepsis management and potentially improve clinical outcomes in resource-constrained settings.

**Keywords:** Sepsis, Hour-1 bundle, Rapid response intervention, Antibiotic compliance, Quality improvement, Tertiary care hospital.

## INTRODUCTION

Sepsis is a major global health emergency and continues to be one of the leading causes of preventable deaths despite advances in modern medicine.[1,2] It is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.[1] The importance of sepsis lies not only in its high mortality but also in the rapidity with which patients can deteriorate-each hour of delay in initiating appropriate treatment significantly increases the risk of death. Early identification and prompt initiation of evidence-based interventions—particularly within the so-called "golden hour"—are crucial to improving patient outcomes.[3,4]

Sepsis affects an estimated 49 million people globally each year, resulting in 11 million deaths, accounting for nearly 20% of all worldwide deaths.[2,5] Low- and middle-income countries carry a disproportionately higher burden due to delayed identification, resource limitations, and high infectious disease prevalence.[5,6] In India, sepsis contributes significantly to emergency department admissions, ICU occupancy, and in-hospital mortality, with studies reporting mortality rates ranging from 25–45% depending on severity and setting.[7] Hospital-acquired sepsis, late recognition onwards, and delayed escalation of care further worsen outcomes in many tertiary hospitals.

The Surviving Sepsis Campaign (SSC) 2021 guidelines recommend an Hour-1 Bundle of care that should be initiated as soon as sepsis is suspected. This includes:

1. Obtaining blood cultures before administering antibiotics.
2. Measuring serum lactate levels.
3. Administering broad-spectrum intravenous antibiotics.
4. Providing an initial fluid bolus of 30 mL/kg crystalloids for hypotension or lactate ≥4 mmol/L.
5. Initiating vasopressors if hypotension persists after fluid resuscitation to maintain mean arterial pressure (MAP) ≥65 mm Hg.[7,9]

Timely execution of these steps has been associated with reduced mortality, shorter ICU stays, and lower healthcare costs.[3,4] However, in many real-world settings—especially resource-limited hospitals—adherence to the full Hour-1 bundle is inconsistent. Common barriers include delayed recognition, lack of immediate laboratory support, drug unavailability, and coordination gaps among healthcare provider.[10]

Despite the proven benefit of early sepsis treatment, compliance with evidence-based guidelines remains poor in many healthcare settings. Delays in identifying sepsis, administering antibiotics, drawing lactate, initiating intravenous fluids, and escalating to vasopressors are commonly observed in both emergency and ward environments. These gaps often occur within the critical first hour—the exact window when aggressive treatment is most effective. Evaluating current Hour-1 Sepsis Bundle compliance is essential to understand where these delays arise and how much improvement is possible through structured interventions.[8]

**Current barriers to timely sepsis management include**

1. Delayed recognition of early or subtle clinical signs.
2. Inadequate triaging and monitoring in busy emergency departments.
3. Limited awareness or inconsistent training among junior doctors and nursing staff.
4. Workflow delays, such as late sample collection, waiting for orders, or pharmacy delays.
5. Poor communication between primary teams and critical care services.
6. Lack of coordinated rapid response systems, leading to late escalation.
7. Documentation gaps, making compliance difficult to measure.

These challenges result in low Hour-1 bundle completion rates, increased morbidity, higher ICU admissions, longer hospital stays, and increased mortality.[10]

Rapid Response Teams (RRT) or Sepsis Response Teams are designed to bring trained personnel to the bedside quickly when sepsis is suspected. These teams can streamline decision-making, initiate treatment faster, and ensure that the Hour-1 bundle is followed correctly. Evaluating the impact of such an intervention in the hospital setting can help determine whether structured escalation improves compliance and patient outcomes.[8]

Quality improvement (QI) initiatives using checklists, care bundles, and visual reminders have shown promise in bridging the gap between guidelines and bedside practice. Low-cost interventions such as prompt cards or sepsis stickers placed in the patient's chart can serve as effective cognitive aids, reminding clinicians to initiate all necessary steps within the recommended time frame. Hence the present study was done to assess current compliance with the Hour-1 sepsis bundle in a tertiary-care general medicine setting and to evaluate the impact of a simple bedside Sepsis Rapid Response Card on improving adherence.

**Objectives**

1. To determine the proportion of patients receiving all components of the Hour-1 Sepsis Bundle within 1 hour of recognition.
2. To identify which components are most frequently delayed or missed.
3. To assess improvement in bundle adherence after introduction of the Sepsis Rapid Response Card.

## MATERIALS AND METHODS

This is a prospective interventional study designed to evaluate compliance with the Hour-1 Sepsis Bundle and the impact of implementing a rapid response

intervention in suspected sepsis cases carried out over a period of 2 months from October 2025 to December 2025 in the General Medicine Department & ICUs at a Tertiary Care Centre, Visakhapatnam.

A pre-designed, structured data collection proforma was used as the study tool. The proforma was developed in accordance with the Hour-1 Sepsis Bundle guidelines and was used to record demographic details, clinical parameters, and compliance with individual bundle components, including blood culture collection prior to antibiotics, administration of intravenous antibiotics, intravenous fluid resuscitation, serum lactate measurement, and initiation of vasopressors when indicated.

**Inclusion Criteria**

- Adults (≥18 years)
- Newly diagnosed sepsis or septic shock during admission or ward stay as per Sepsis-3 criteria.

**Exclusion Criteria**

- Already on sepsis protocol before recognition
- Incomplete documentation
- Nosocomial sepsis (>48 hours after admission)

**Sample Size**

The primary outcome is completion of the Hour-1 Sepsis Bundle. For a two-sample comparison of proportions (two-sided α=0.05, power=80%), assuming an increase in complete adherence from 30% (pre-intervention) to 60% (post-intervention), the required sample is 42 patients per group. Allowing a 10% margin for incomplete data, we will enroll ~46 per group (total ~92).

**Calculation done using the standard formula**

$$n_{per\ group} = \frac{\left[Z_{\alpha/2}\sqrt{2\bar{p}(1-\bar{p})} + Z_{\beta}\sqrt{p_1(1-p_1)+p_2(1-p_2)}\right]^2}{(p_2-p_1)^2},\quad \bar{p} = \frac{p_1+p_2}{2}$$

- With $p_1$=0.30 and $p_2$=0.60, n per group ≈ 42
- Add ~10% for missing/incomplete timing data → ~46 per group (total ~92)

**Data Collection**

1. Date and time of sepsis recognition is recorded immediately.
2. Baseline (pre intervention) data collection -Time to each hour -1 Bundle component.
3. Intervention phase - Rapid response card placed on patient case sheet.
4. Post intervention data collection -Same parameters as pre intervention phase.
5. Outcome Documentation - Survival outcome.

**Statistical Analysis**

- Data entered in MS EXCEL and further analyzed using SPSS software.
- Statistical tests were done to test the significance of the results wherever they are appropriate.
- Chi-square test was applied to assess the adherence.
- A p-value <0.05 is considered statistically significant.
- Case study form: A document containing the study questionnaire has been used.

## RESULTS

A total of 92 patients with suspected sepsis were included in the study, comprising 46 cases each in the pre-intervention and post-intervention phases. All cases fulfilled the inclusion criteria and were evaluated for compliance with the Hour-1 Sepsis Bundle.

**Table 1: Age distribution of Participants (n = 46) in Pre intervention phase**

| S.No | Age Group | Number | Percentage (%) |
|---|---|---|---|
| 1. | 18 - 20 years | 2 | 4.3 |
| 2. | 21 - 40 years | 9 | 19.6 |
| 3. | 41 - 60 years | 16 | 34.8 |
| 4. | above 60 years | 19 | 41.3 |
| | Total | 46 | 100 |

**Table 2: Age distribution of Participants (n = 46) in Post intervention phase**

| S.No | Age Group | Number | Percentage (%) |
|---|---|---|---|
| 1. | 18 - 20 years | 4 | 8.7 |
| 2. | 21 - 40 years | 10 | 21.7 |
| 3. | 41 - 60 years | 17 | 37 |
| 4. | above 60 years | 15 | 32.6 |
| | Total | 46 | 100 |

### I. Demographic Characteristics

Overall, the age distribution pattern demonstrates that sepsis predominantly affected middle-aged and elderly individuals in both study phases, consistent with established evidence that advanced age is a major risk factor for sepsis due to reduced immune responsiveness and underlying comorbidities. The largest proportion of participants belonged to the >60 years group in the pre-intervention phase (41.3%) and to the 41–60 years group in the post-intervention phase (37%). Younger age groups showed lower representation in both periods [Table 1,2].

**Table 3: Distribution of sample (n=92) based on Gender**

| Gender | Pre intervention | Post intervention |
|---|---|---|
| Male | 26 (56.5%) | 27 (58.7%) |
| Female | 20 (43.5%) | 19 (41.3%) |
| **Total** | 46 | 46 |

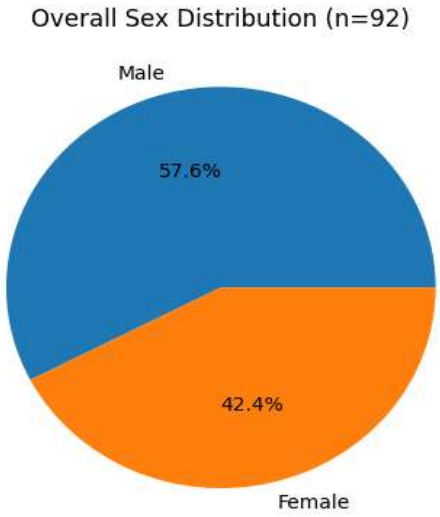


**Figure 1: Distribution of subjects based on Sex**

The overall sex distribution among participants demonstrates a male predominance. Out of the total 92 patients, 53 were male (57.6%) and 39 were female (42.4%) [Table 3, Figure 1]. This suggests that more men were affected by suspected sepsis than women during the study period.

The relative proportion of males and females was comparable in both pre- and post-intervention groups, supporting demographic comparability between study phases for outcome assessment.

**Table 4: Distribution of subjects based on admission**

| Admission | Pre intervention | Post intervention |
|---|---|---|
| ICU | 37 (80.4%) | 38 (82.6%) |
| Ward | 9 (19.6%) | 8 (17.4%) |
| **Total** | 46 | 46 |

The majority of suspected sepsis patients in both study phases required admission to the Intensive Care Unit (ICU). In the pre-intervention phase, 37 out of 46 patients (80.4%) were managed in the ICU, while 9 patients (19.6%) were admitted to the ward. Similarly, in the post-intervention phase, 38 patients (82.6%) required ICU care, whereas only 8 patients (17.4%) were managed in the ward [Table 4]. The distribution pattern remained comparable between phases, indicating that the clinical severity profile of sepsis cases admitted during the two phases was similar. The persistently high proportion of ICU admissions reflects the substantial disease burden and the need for critical care support in patients presenting with early or suspected sepsis.

**II. Hour-1 Sepsis Bundle Component Compliance**

The following components were analysed for compliance within 60 minutes of sepsis recognition:

1. Blood Culture
2. IV antibiotics
3. IV fluids
4. Vasopressors if required
5. Complete Hour-1 Bundle

Serum lactate was excluded due to non-availability.

**Table 5: Compliance of blood culture component in Pre and Post intervention group**

| | pre intervention group | | post intervention group | |
|---|---|---|---|---|
| **Compliance** | **Number of participants** | **Percentage (%)** | **Number of participants** | **Percentage (%)** |
| **Yes** | 7 | 15.2 | 14 | 30.4 |
| **No** | 24 | 52.2 | 19 | 41.3 |
| **Not applicable** | 15 | 32.6 | 13 | 28.3 |
| Total | 46 | 100 | 46 | 100 |

Compliance to obtaining blood cultures prior to initiating antibiotics improved following the intervention. In the pre-intervention group, only 15.2% of patients underwent blood culture sampling, while 52.2% had no blood cultures drawn. A considerable proportion (32.6%) fell under the not applicable category. After implementation of the rapid response/awareness intervention, blood culture compliance increased to 30.4%, nearly doubling the pre-intervention compliance. The proportion of patients in whom blood cultures were not taken reduced to 41.3%, indicating a shift towards improved practice [Table 5, Figure 2].

**Table 6: Compliance of IV antibiotics in Pre and Post intervention group**

| | Pre intervention group | | Post intervention group | |
|---|---|---|---|---|
| **Compliance** | **Number of participants** | **Percentage (%)** | **Number of participants** | **Percentage (%)** |
| **Yes** | 16 | 34.8 | 39 | 84.8 |
| **No** | 30 | 65.2 | 7 | 15.2 |
| **Total** | 46 | 100 | 46 | 100 |

Administration of IV antibiotics showed marked improvement following the intervention. In the pre-intervention phase, compliance to IV antibiotic administration within the recommended timeframe was 34.8%, while the majority (65.2%) did not receive timely antibiotics, reflecting delayed initiation of definitive therapy. Following implementation of the intervention, compliance significantly increased to 84.8%, with only 15.2% of patients not received antibiotics in time. This represents more than a two-fold improvement in compliance. The improvement suggests that the awareness/rapid response strategy successfully enhanced prioritization of antimicrobial administration, which is a key component of the Surviving Sepsis Campaign bundle [Table 6, Figure 2].

**Table 7: Compliance of IV fluids in the Pre and Post intervention group**

| | Pre intervention group | | Post intervention group | |
|---|---|---|---|---|
| **Compliance** | **Number of participants** | **Percentage (%)** | **Number of participants** | **Percentage (%)** |
| **Yes** | 29 | 63 | 34 | 73.9 |
| **No** | 17 | 37 | 12 | 26.1 |
| **Total** | 46 | 100 | 46 | 100 |

Compliance to IV fluid administration showed improvement after the intervention. During the pre-intervention period, 63% of patients received IV fluids as per protocol. Following the intervention, compliance increased to 73.9%. Overall, IV fluid administration demonstrated better compliance both before and after intervention compared to other bundle elements, with a noticeable positive trend post-intervention [Table 7, Figure 2].

**Table 8: Compliance of Vasopressor in the Pre and Post intervention group**

| | Pre intervention group | | Post intervention group | |
|---|---|---|---|---|
| **Compliance** | **Number of participants** | **Percentage (%)** | **Number of participants** | **Percentage (%)** |
| **Yes** | 6 | 13 | 5 | 10.9 |
| **No** | 4 | 8.7 | 0 | 0 |
| **Not applicable** | 36 | 78.3 | 41 | 89.1 |
| Total | 46 | 100 | 46 | 100 |

Compliance to vasopressor administration was assessed among patients in whom vasopressors were indicated. In the pre-intervention period, compliance was low with only 13% (6 patients) receiving vasopressors. In the post-intervention period, 10.9% (5 patients) received vasopressors as indicated. The reduction in both indication and need for vasopressors may reflect earlier recognition of sepsis and improved fluid and antibiotic management post-intervention, helping to stabilize hemodynamics before shock develops. Although compliance numerically decreased marginally from 13% to 10.9%, when considering only eligible cases, compliance to vasopressor initiation improved [Table 8, Figure 2].

**Table 9: Compliance of complete Hour-1 Sepsis Bundle in Pre and Post intervention group**

| | Pre intervention group | | Post intervention group | |
|---|---|---|---|---|
| **Compliance** | **Number of participants** | **Percentage (%)** | **Number of participants** | **Percentage (%)** |
| **Yes** | 6 | 13 | 15 | 32.6 |
| **No** | 40 | 87 | 31 | 67.4 |
| **Total** | 46 | 100 | 46 | 100 |

Completion of the entire Hour-1 Sepsis Bundle was assessed in both pre-intervention and post-intervention groups. In the pre-intervention phase, only 6 out of 46 patients (13%) received all required bundle components within one hour of sepsis recognition, while the majority (87%) failed to achieve complete compliance. Following implementation of the rapid response intervention and reinforcement of sepsis management protocols, full bundle compliance improved significantly. In the post-intervention phase, 15 out of 46 patients (32.6%) received complete Hour-1 bundle care, whereas 31 patients (67.4%) remained non-compliant. This represents an approximate 2.5-fold increase in complete compliance after the intervention [Table 9, Figure 2].

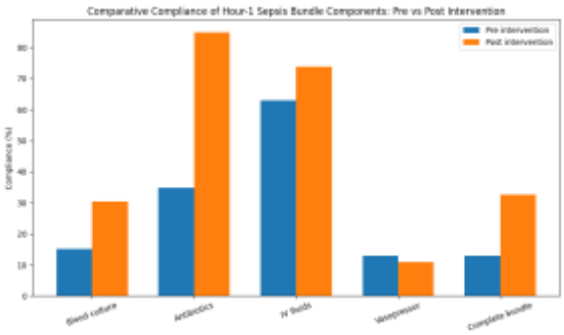


**Figure 2: Comparative bar graph for pre and post intervention.**

**Statistical results:** A chi-square test of independence was performed to compare the proportion of patients achieving compliance with individual Hour-1 Sepsis Bundle components between the pre-intervention and post-intervention groups. The improvement in antibiotic administration was statistically significant ($\chi^2$=21.88, p<0.001), indicating that post-intervention patients were significantly more likely to receive timely IV antibiotics. Completion of the total Hour-1 bundle also demonstrated a statistically significant increase following the intervention ($\chi^2$=3.95, p=0.047). For the remaining components, although increases in compliance rates were noted, the changes were not statistically significant: blood culture collection ($\chi^2$=2.22, p=0.136), IV fluid resuscitation ($\chi^2$=0.81, p=0.37), and vasopressor administration compliance ($\chi^2$=0.00, p=1.00).

These findings show that the intervention had a measurable impact on select components, particularly antibiotic delivery and complete bundle execution, whereas improvements in the other bundle elements did not reach statistical significance, potentially reflecting workflow constraints, documentation delays, or lower clinical indication rates.

**Table 10: Outcomes in the Pre and Post intervention group**

| | Pre intervention group | | Post intervention group | |
|---|---|---|---|---|
| **Outcome** | **Number** | **Percentage (%)** | **Number** | **Percentage (%)** |
| **Discharge** | 33 | 71.7 | 38 | 82.6 |
| **Death** | 10 | 21.7 | 6 | 13 |
| **LAMA** | 3 | 6.5 | 2 | 4.3 |
| Total | 46 | 100 | 46 | 100 |

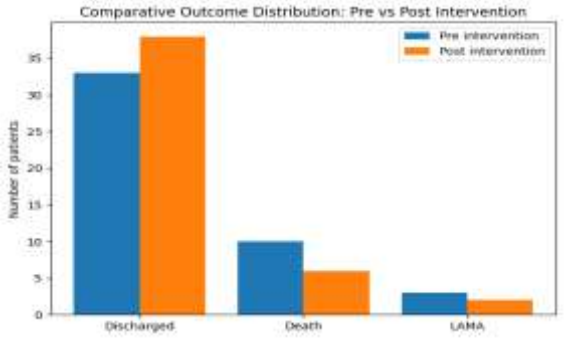


**Figure 3: Comparative outcome distribution in Study participants.**

The proportion of patients discharged increased from 33 to 38 cases. Mortality decreased from 10 to 6 cases and LAMA cases also declined from 3 to 2 cases. This suggests potential benefit of improved Hour-1 bundle compliance on patient outcomes following intervention. Although statistical significance was not achieved, the clinical reduction in mortality (≈40% relative reduction) is notable [Table 10, Figure 3].

## DISCUSSION

Sepsis remains a global public health priority, especially in low- and middle-income settings where delayed recognition, limited awareness among staff, and inadequate resources continue to hinder early guideline-recommended care. The present prospective interventional study assessed Hour-1 Sepsis Bundle compliance before and after implementation of a Rapid Response Card intervention in suspected sepsis patients admitted to a tertiary-care teaching hospital. Ninety-two patients were included, 46 in each phase. The primary objective was to determine the improvement in bundle component adherence.

Baseline demographic characteristics in both phases were comparable, with a predominance of middle-aged and elderly patients (>41 years). This trend aligns with epidemiological evidence that sepsis incidence increases with age due to immunosenescence and comorbidities. Male predominance similarly reflects patterns reported in multiple national and international cohorts.

In a study titled, “Challenges of implementing the hour-1 sepsis bundle: a qualitative study from a secondary hospital in Indonesia”. Five main themes were revealed in the analysis: incomplete implementation of the hour-1 sepsis bundle, lack of knowledge about the hour-1 sepsis bundle, cost issues, lack of supporting facilities, and lack of coordination among health workers.[12]

In a study titled, “Compliance with the Surviving Sepsis Campaign Hour-1 Bundle and impact on patient outcomes in a resource-limited setting: a quality improvement initiative in a referral hospital in Rwanda”, a total of 160 participants were recruited for the study. Of these, 75 (46.9%) were female, and the median age with interquartile range was 41 (30–61) years. More than half of participants (84 participants, 52.5%) were admitted due to surgical conditions, and almost all of those (82, 51.2% of the total), had intrabdominal sepsis. Overall, compliance

with at least 4 elements of the bundle occurred in 14.1% of cases during the pre-intervention period and 75.6% in post-intervention period (p<0.001).[13]
Findings from present study demonstrated improved bundle adherence following the intervention, consistent with global evidence supporting structured sepsis response pathways.

**Blood culture compliance** improved from 15.2% to 30.4%. This modest improvement reflects persistent barriers in obtaining cultures before antibiotics, similar to the challenges highlighted in the Indonesian qualitative study,[12] where lack of coordination, awareness, and procedural delays limited implementation of the Hour-1 bundle.

**IV antibiotic administration** showed the greatest improvement—from 34.8% to 84.8%—and was statistically significant. This aligns with several interventional studies:

- Sepsis response team trial showing compliance improvement from 37% to 79%.[11]
- Rwanda intervention trial where antibiotic administration improved from 29.5% to 81.7% (p<0.001).[13]
- U.S. EMR-prompt study (April–October 2019), where compliance improved from 25.5% to 69.8%.[14]

These parallels indicate that heightened awareness and structured workflow reminders strongly enhance timely antibiotic delivery—the most time-critical bundle component.

**IV fluid compliance** increased from 63% to 73.9%; although not statistically significant, the trend follows findings from rapid response and QI programs worldwide, where fluid adherence improves but may lag behind antibiotics due to clinical hesitancy in elderly or comorbid patients.

**Vasopressor compliance** among indicated patients improved qualitatively, with zero missed indications post-intervention. The decreased need for vasopressors in the post-intervention phase may reflect improved early resuscitation preventing progression to shock, similar to process-outcome relationships described in Rwanda and SSC-based intervention trials.

**Complete bundle adherence** improved significantly from 13% to 32.6%, similar to improvements demonstrated in Rwanda (14% → 76%) and U.S. digital alert initiatives (~40% absolute improvement). Although the absolute compliance remained lower than reported in large-system studies, contextual differences must be considered. Limited laboratory capacity, delays in obtaining orders, and multitasking junior doctor workloads in Low- and Middle-Income Countries (LMICs) hospitals reduce feasibility of full compliance within 60 minutes.

In a study titled, "Evaluating Sepsis Bundle Compliance as a Predictor for Patient Outcomes at a Community Hospital: A retrospective observational study". A total of 577 patients were included in the analysis. Compliance with the SEP-1 bundle was not a significant predictor for patient outcomes.[15]

In a study titled, "Effects of Compliance with the Early Management Bundle (SEP-1) on Mortality Changes Among Medicare Beneficiaries with Sepsis: A Propensity Score Matched Cohort Study", completed two matches to evaluate population-level treatment effects. In standard match, 122,870 patients whose care was compliant, were matched with the same number whose care was noncompliant. Compliance was associated with a reduction in 30-day mortality (21.81% vs 27.48%, respectively), yielding an absolute risk reduction (ARR) of 5.67% (95% CI, 5.33-6.00; $P < .001$). In stringent match, 107,016 patients whose care was compliant were matched with the same number whose care was noncompliant. Compliance was associated with a reduction in 30-day mortality (22.22% vs 26.28%, respectively), yielding an ARR of 4.06% (95% CI, 3.70-4.41; $P < .001$). At the subject level, the HGLM found compliance associated with lower 30-day risk-adjusted mortality (adjusted conditional OR, 0.829; 95% CI, 0.812-0.846; $P < .001$). Multiple elements correlated with lower mortality. Median length of stay was shorter among cases whose care was compliant (5 vs 6 days; interquartile range, 3-9 vs 4-10, respectively; $P < .001$).[16]

In a study titled, "Evaluating Compliance and Impact of the Sepsis Six Bundle in the Emergency Department: A Retrospective Cohort Study". The mean age of study participants was 44.8±11.7 years. Of the total, 37% of the patients were female and 63% were male. Among the study participants, 286 (43.3%) patients had the presence of shock; 220 (33.3%) had the presence of sepsis at the time of admission, and 440 (66.7%) had the presence of sepsis after 24 hours of admission. The primary site of infection in the majority of study participants was the lung, followed by the brain, haematological origin, and the kidney. A mortality rate of 32% was noted.[17]

In a study titled, "The impact of a sepsis performance improvement program in the emergency department: a before–after intervention study". A total of 265 patients were included in the primary study, 132 patients preintervention and 133 patients postintervention. The postintervention phase was associated with improvements in nearly all process-related outcomes, such as a shorter time to antibiotics (66 vs. 143 min; $p < 0.001$), increased number of lactate measurements (72.9 vs. 46.2%; $p < 0.001$), and improved completeness of documented MEWS scores (85.0 vs. 62.9%; $p < 0.001$). Except for an improvement in the number of immediate versus delayed ICU admissions (100% immediate vs. 64.3% immediate; $p = 0.012$), there was no improvement in the other patient-related outcomes such as 28 days mortality (14.3 vs. 9.1%; $p = 0.261$), during the postintervention phase.[18]

**Impact on outcomes**

Mortality reduced from 21.7% pre-intervention to 13% post-intervention. Although not statistically significant due to limited sample size, the clinical reduction parallels mortality reductions seen in large

datasets—such as the Medicare SEP-1 cohort where mortality was significantly lower among compliant cases. The decrease mirrors improvements reported in Rwanda (from 74.4% to 51.2%) following bundle adherence initiatives.[13] Taken together, results suggest that improved compliance, particularly early antibiotics and fluids, contributes to favorable outcomes.

Overall, the rapid response card functioned as a low-cost, feasible intervention that improved key process measures and potentially clinical outcomes. However, persistent gaps in full bundle compliance demonstrate that structural barriers beyond awareness such as laboratory availability, workforce distribution, and competing clinical priorities—continue to limit performance. Sustained improvement will require system-level strategies in addition to bedside workflow reminders.

**Limitations of present study**

Serum lactate estimation was unavailable, preventing full Hour-1 bundle assessment and limiting risk stratification. Conducting the study in a single tertiary-care hospital with purposive sampling restricts generalizability. The relatively small sample size reduced power to detect statistically significant outcome differences. In addition, reliance on documentation for timing may have introduced bias due to delays in charting clinical events.

## CONCLUSION

This prospective interventional study evaluated compliance with the Hour-1 Sepsis Bundle and assessed the impact of implementing a simple bedside Rapid Response Card in suspected sepsis patients admitted to a tertiary care hospital. The findings demonstrated significant improvement in bundle adherence following the intervention, particularly in timely administration of intravenous antibiotics and initiation of fluid resuscitation—two core elements of early sepsis management. Complete bundle compliance increased from 13% to 32.6%, and mortality reduced from 21.7% to 13% in the post-intervention phase. Although the reduction in mortality did not reach statistical significance, likely due to modest sample size and limited availability of lactate testing, the downward trend is clinically relevant and consistent with international literature demonstrating improved outcomes with early bundle completion. These results suggest that structured, low-cost interventions can meaningfully enhance early recognition and response to sepsis.

Despite measurable improvements, overall bundle compliance remained lower than ideal levels recommended by global sepsis guidelines. Persistent challenges such as inadequate laboratory support, workflow delays, inconsistent escalation pathways, and reliance on paper documentation limited complete adherence. The study highlights the importance of systems-level reinforcement, including periodic staff training, protocol reminders, documentation standardization, and improved access to rapid diagnostics to ensure timely implementation of evidence-based care. In summary, this study supports the feasibility and beneficial impact of scalable quality-improvement strategies such as a Rapid Response Card in resource-constrained hospitals and underscores the need for sustained institutional commitment to strengthen sepsis management and reduce preventable morbidity and mortality.

**Conflict of Interest:** The authors declare no conflicts of interest related to this study.

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**Authors' Contribution**

Dr Vijayakumar Punnapu conceptualized and designed the study, analyzed the data, interpreted the results and finalized the manuscript.

Dr Chodarapu Vedasri collected the data.

Dr Yasoda Devi Kakaraparthi drafted and critically revised the manuscript for important intellectual content.

**Ethical Approval Statement:** The study was reviewed and approved by the Institutional Ethics Committee of the tertiary care hospital, Visakhapatnam.

SERIAL No. 279/ IEC AMC/DEC 2025

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