A Study to Assess the Effectiveness of Communication Board on Level of Satisfaction Among Mechanically Ventilated Patients at Intensive Care Unit at NMCH Jamuhar

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***Abstract*—Mechanically ventilated patients in intensive care units (ICUs) are unable to communicate verbally due to endotracheal intubation, resulting in significant distress, anxiety, and unmet needs. Communication boards—simple, low-cost pictorial tools depicting basic needs, emotions, and pain scales—have emerged as practical aids to bridge this communication gap. Despite growing global evidence documenting satisfaction improvements of 20–30% following board use, localized validation in rural Indian ICU settings remains scarce, creating an urgent evidence-practice gap.**

Aim: To assess the effectiveness of a communication board on the level of satisfaction among mechanically ventilated patients at the ICU of Narayan Medical College and Hospital (NMCH), Jamuhar, Bihar.

I. BACKGROUND OF THE STUDY

Patient communication is a fundamental human right and a cornerstone of patient-centered nursing care. Mechanically ventilated patients admitted to intensive care units (ICUs) experience profound communication disruption due to the presence of an endotracheal or tracheostomy tube, rendering them unable to express basic needs, pain, discomfort, or emotional distress verbally. This enforced voicelessness generates helplessness, anxiety, frustration, and a deep sense of dehumanization, with up to 80% of conscious ventilated patients reporting significant psychological distress from communication failure. Effective nurse–patient communication is foundational to patient-centered critical care. Conventional alternatives—lip-reading, gesturing, and handwriting—prove unreliable under ICU constraints of equipment noise, physical immobility, and sedation, with up to 62% of ventilated patients reporting despair from unsuccessful expression. Patient satisfaction, a key quality metric in critical care, suffers markedly without structured communication aids, directly affecting therapy adherence and clinical outcomes including prolonged ventilation duration and elevated stress hormones.

Communication boards—structured visual aids incorporating pictures, symbols, alphabets, numbers, and basic need expressions—have emerged as practical, low-cost solutions that allow patients to point to predefined icons to convey needs, responses, and emotions. Studies worldwide confirm satisfaction improvements of 20–30% following board use, with pictorial boards achieving superior nurse comprehension rates (92%) compared to gestures (41%), significantly reduced response times, and decreased agitation episodes. Despite this global evidence, adoption of communication aids remains inconsistent in Indian ICUs, where nurse shortages, resource constraints, and linguistic diversity further compound the problem.

The ICU at Narayan Medical College and Hospital

(NMCH), Jamuhar—a tertiary care facility serving the predominantly rural Rohtas district of Bihar—faces compounding challenges including high nurse-to-patient ratios (1:4), Hindi/Bhojpuri linguistic diversity, and resource constraints that limit standardized communication protocol implementation. Local audits reveal pre-intervention satisfaction scores below 50%, underscoring an urgent need for low-cost, culturally adapted communication interventions. This study addresses this gap by evaluating a locally designed communication board as a practical nursing intervention to improve the satisfaction of mechanically ventilated patients at NMCH, Jamuhar.

II. OBJECTIVES

- To assess the pre-test level of satisfaction among mechanically ventilated patients in the study group and control group.
- To assess the post-test level of satisfaction among mechanically ventilated patients in the study group and control group.
- To evaluate the effectiveness of the communication board on the level of satisfaction among mechanically ventilated patients in the study group.
- To find out the association between the level of satisfaction and selected demographic variables of mechanically ventilated patients in the study group and control group.

III. RESEARCH METHODOLOGY

A quasi-experimental pre-test post-test control group design was used to evaluate the effectiveness of a communication board on the level of satisfaction among mechanically ventilated patients. The study group received the communication board intervention in addition to routine ICU care, while the control group received routine care only. The independent variable was the communication board, and the dependent variable was the level of satisfaction among mechanically ventilated patients. Sociodemographic variables including age, gender, religion, educational status, diagnosis, and duration of mechanical ventilation were also assessed.

The study was conducted in the Intensive Care Unit of Narayan Medical College and Hospital (NMCH), Jamuhar, Rohtas district, Bihar, India—a tertiary care facility admitting diverse critical illnesses including ARDS, respiratory failure, post-surgical cases, and sepsis. The setting was selected for accessibility to the target population and availability of required facilities. The study population comprised all mechanically ventilated adult patients admitted to the ICU during the data collection period. A non-probability purposive sampling technique was used, and the sample consisted of 30 mechanically ventilated patients (15 in the study group and 15 in the control group).

Inclusion criteria were: adult patients (≥18 years) receiving invasive mechanical ventilation via endotracheal tube, fully conscious and oriented, able to visualize and comprehend pictures and symbols, and willing to participate. Exclusion criteria included unconscious or deeply sedated patients, those with severe neurological or cognitive impairment, and hemodynamically unstable patients.

The data collection tool comprised two sections: Section A—a structured demographic data sheet capturing age, gender, religion, educational status, diagnosis, and duration of mechanical ventilation; and Section B—a validated 10-item observer-rated satisfaction scale (score range 10–50; Cronbach $\alpha = 0.87$, test-retest $r = 0.82$). Each item was rated on a three-point Likert scale (Strongly Satisfied = 5, Satisfied = 4, Dissatisfied = 3). Scoring categories: Highly Satisfied (41–50), Satisfied (31–40), Moderately Satisfied (21–30), Dissatisfied (≤20). Content validity was established through an expert panel review from Medical-Surgical Nursing, Critical Care Nursing, and Nursing Research.

The communication board was a laminated pictorial tool (10 × 15 inches) designed in Hindi and Bhojpuri, comprising 48 icons organized into domains: basic physiological needs (thirst, hunger, urination, defecation, repositioning), pain scale (numeric 0–10 with facial expression analogues), emotions (anxiety, fear, reassurance request), family-related requests (visitor wish, spiritual care), and yes/no response indicators. The board was introduced to study group patients with a 15-minute demonstration by the investigator and used during nursing interactions for 4–6 days (minimum 4 hours daily). Data were collected in four phases: Phase I (pre-test), Phase II (board introduction), Phase III (implementation), and

Phase IV (post-test). Ethical clearance was obtained from the Institutional Ethics Committee of NMCH, Jamuhar. The collected data were analyzed using descriptive statistics (frequency, percentage, mean, standard deviation), paired t-test, independent samples t-test, and chi-square test.

IV. RESULTS

Section I: Demographic Characteristics

The majority of patients (33.3%) were in the 41–50-year age group; males constituted 63.3%. Hindu patients comprised 80.0% of the sample. High school certificate holders formed the largest educational subgroup (26.7%); 16.7% were illiterate. The most common diagnosis was ARDS (30.0%), and 40.0% of patients had been mechanically ventilated for 4–6 days.

Table 1: Frequency and percentage distribution of demographic variables (N = 30)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	30–40	8	26.7
	41–50	10	33.3
	51–60	7	23.3
	61–70	5	16.7
Gender	Male	19	63.3
	Female	11	36.7
Religion	Hindu	24	80.0
	Muslim	5	16.7
	Christian	1	3.3
Educational status	Illiterate	5	16.7
	Primary school certificate	7	23.3
	Middle school certificate	6	20.0
	High school certificate	8	26.7
	Graduate and above	4	13.3
Diagnosis	ARDS	9	30.0
	Respiratory failure	8	26.7
	Post-operative ventilation	7	23.3
	Sepsis	4	13.3
	Others	2	6.7
Duration of ventilation	1–3 days	9	30.0
	4–6 days	12	40.0
	7–9 days	6	20.0
	≥10 days	3	10.0

Section II: Pre-test Level of Satisfaction

Table 2 shows comparably low baseline satisfaction in both groups. In the study group, 53.3% were dissatisfied and 40.0% moderately satisfied at pre-test. The control group showed a similar distribution (46.7% dissatisfied, 46.7% moderately satisfied). Neither group had any patient in the highly satisfied category at baseline, confirming universal communication-related dissatisfaction.

Table 2: Pre-test level of satisfaction among mechanically ventilated patients in study group and control group (n = 15 each)

Level of Satisfaction	Study Group f (%)	Control Group f (%)
Dissatisfied (≤20)	8 (53.3%)	7 (46.7%)
Moderately satisfied (21–30)	6 (40.0%)	7 (46.7%)
Satisfied (31–40)	1 (6.7%)	1 (6.7%)
Highly satisfied (41–50)	0 (0%)	0 (0%)
Total	15 (100%)	15 (100%)

Section III: Post-test Level of Satisfaction

Table 3 demonstrates a marked improvement in the study group following the communication board intervention. A combined 86.6% of study group patients achieved satisfied (53.3%) or highly satisfied (33.3%) status. In contrast, 33.3% of control group patients remained dissatisfied and 46.7% moderately satisfied, with only 20.0% satisfied and none highly satisfied, confirming the effectiveness of the communication board.

Table 3: Post-test level of satisfaction among mechanically ventilated patients in study group and control group (n = 15 each)

Level of Satisfaction	Study Group f (%)	Control Group f (%)
Dissatisfied (≤20)	0 (0%)	5 (33.3%)
Moderately satisfied (21–30)	2 (13.3%)	7 (46.7%)
Satisfied (31–40)	8 (53.3%)	3 (20.0%)
Highly satisfied (41–50)	5 (33.3%)	0 (0%)
Total	15 (100%)	15 (100%)

Section IV: Effectiveness of Communication Board — Comparison of Satisfaction Scores

A paired t-test demonstrated a statistically significant improvement in the study group. Mean satisfaction scores increased from 22.4 (SD = 4.12) at pre-test to 34.6 (SD = 4.85) at post-test, yielding a mean difference of 12.2 (t = 9.86, df = 14, p = 0.001). The control group showed a non-significant gain of 2.1 points (t = 1.72, df = 14, p = 0.107), confirming that the observed improvement was attributable to the communication board intervention.

Table 4: Comparison of mean pre-test and post-test satisfaction scores among mechanically ventilated patients in study group and control group

Group	Test	Mean	SD	Mean Diff.	df	t value	p value
Study group	Pre-test	22.4	4.12	12.2	14	9.86	0.001*
	Post-test	34.6	4.85				
Control group	Pre-test	23.1	4.34	2.1	14	1.72	0.107
	Post-test	25.2	4.91				

* Statistically significant at $p < 0.05$.

Between-group comparison of post-test scores further confirmed superiority of the study group (mean 34.6 ± 4.85 vs. 25.2 ± 4.91; mean difference 9.4; unpaired t = 5.38, df = 28, p = 0.001).

Table 5: Comparison of post-test mean satisfaction scores between study group and control group

Group	Mean	SD	Mean Diff.	df	aired t	p value
Study group	34.6	4.85	9.4	28	5.38	0.001*
Control group	25.2	4.91				

* Statistically significant at $p < 0.05$.

Section V: Association Between Satisfaction and Selected Demographic Variables

Chi-square analysis revealed no statistically significant associations between post-test satisfaction level and any selected demographic variable in the study group (age: $\chi^2 = 0.84$, p = 0.839; gender: $\chi^2 = 0.13$, p = 0.718; educational status: $\chi^2 = 4.21$, p = 0.122; diagnosis: $\chi^2 = 1.92$, p = 0.750; duration of ventilation: $\chi^2 = 1.37$, p = 0.712), indicating uniform board efficacy across all patient subgroups.

Table 6: Association between post-test level of satisfaction and selected demographic variables in study group (n = 15)

Variable	Moderately S a t i s f i e d n	Satisfied / Highly Satisfied n	χ^2	df	p value
Age (years)			0.84	3	0.839
30–40	1	3			
41–50	1	4			
51–60	0	4			
61–70	0	2			
Gender			0.13	1	0.718
Male	1	8			
Female	1	5			
Educational status			4.21	2	0.122
Up to middle school	2	5			
High school	0	5			
Graduate and above	0	3			
Diagnosis			1.92	4	0.750
ARDS	1	3			
Respiratory failure	0	4			
Post-operative	1	2			
Sepsis	0	2			
Others	0	2			
Duration of ventilation			1.37	3	0.712
1–3 days	0	4			
4–6 days	1	5			
7–9 days	1	3			
≥10 days	0	1			

V. DISCUSSION

The study demonstrated that the communication board effectively improved the level of satisfaction among mechanically ventilated patients at NMCH, Jamuhar. Baseline pre-test satisfaction was

comparably low in both groups, ensuring internal validity. Post-test scores showed a statistically significant improvement in the study group ($t = 9.86$, $p = 0.001$) while the control group showed no significant change ($p = 0.107$), confirming the communication board as the causal factor for improvement.

Pre-test baseline scores (study group mean 22.4 ± 4.12; control 23.1 ± 4.34) confirmed universal communication-related dissatisfaction, consistent with Khalaila and Zbidat (2018) who reported that 62% of ventilated patients scored below 30% satisfaction without communication aids. Specific unmet needs at baseline—pain expression, thirst, positioning—mirror findings by Happ et al. (2011), who demonstrated that unstructured communication attempts frequently led to patient frustration and delayed care.

Post-test transformation in the study group (86.6% satisfied or highly satisfied versus 20.0% in the control group) substantially exceeded gains documented in earlier Indian quasi-experimental studies. Sidhu et al. (2024) reported 20–30% satisfaction improvements following board use in a tertiary ICU, while Rathi and Baskaran (2014) documented a satisfaction shift from moderate to high levels (paired $t = 4.5$, $p < 0.001$) without a control group. The larger effect size observed here is attributed to the culturally localized board design incorporating Hindi/Bhojpuri icons relevant to Bihar patients, including family visit requests and spiritual care indicators.

Pictorial icons achieved high nurse comprehension and reduced response times, consistent with Otuzoglu and Karahan's (2014) finding that 77.8% of intubated patients preferred pictorial boards over other communication modalities ($\chi^2 = 18.7$, $p < 0.001$). Anxiety reduction aligns with the RCT by Hoseini-Esfidarjani et al. (2018), which demonstrated significant anxiety decreases ($z = -2.98$, $p = 0.003$) alongside improved communication ease ($z = -4.69$, $p < 0.001$) in a Persian ICU population. The absence of significant demographic associations (all $p > 0.05$) confirms demographic-agnostic efficacy, with illiterate patients gaining equivalently to graduates, validating pictorial design superiority over literacy-dependent alternatives.

VI. CONCLUSION

This quasi-experimental study evaluated the effectiveness of a communication board on the level of satisfaction among mechanically ventilated patients at NMCH, Jamuhar. Thirty patients were purposively selected and divided into a study group (n = 15, communication board + routine care) and a control group (n = 15, routine care only). Satisfaction was measured using a validated 10-item scale before and after a 4–6-day intervention period. Results showed no baseline difference between groups; however, post-intervention, the study group demonstrated a significant improvement in mean satisfaction score (22.4 → 34.6, mean gain 12.2, $t = 9.86$, $p = 0.001$), with 86.6% achieving satisfied or highly satisfied status. The control group showed no significant change. Between-group comparison confirmed superior study group outcomes (unpaired $t = 5.38$, $p = 0.001$). No significant demographic associations were found. The communication board was found to be an effective, low-cost (approximately INR 200), and culturally adaptable nursing intervention for improving satisfaction among voiceless ICU patients.

Nursing Practice

- Promote communication boards as a routine, evidence-based intervention for conscious mechanically ventilated patients in ICU settings.
- Integrate culturally adapted pictorial boards into holistic ICU nursing care protocols, targeting the first 72 hours of conscious ventilation.
- Use boards as a non-pharmacological strategy to reduce inappropriate sedation driven by unmet communication needs.
- Include board-facilitated communication as a standard item in nursing handoff documentation.
- Advocate for zero communication-related patient complaints as a quality metric linked to hospital accreditation.

Nursing Education

- Add augmentative and alternative communication (AAC) modules—including simulation laboratory sessions and OSCE stations—to B.Sc. Nursing and Post-Basic ICU curricula.

- Enhance cultural sensitivity training to address multilingual ICU patient populations such as Hindi/Bhojpuri speakers in Bihar.
- Organize 4-hour in-service education programs for nursing staff on communication board use, targeting 90% competency.
- Prepare nurses for community and critical care settings through interdisciplinary learning involving physicians, physiotherapists, and speech therapists.

Nursing Administration

- Procure laminated communication boards in bulk (approximately INR 200 per board) for all mechanically ventilated patient bedsides.
- Develop and implement a formal Standard Operating Procedure (SOP) for "Ventilator Communication Bundle" at NMCH.
- Submit findings to the Bihar Nursing Council and INC for inclusion of communication board use as a mandatory ICU nursing standard.
- Allocate resources for quarterly satisfaction audits targeting greater than 80% highly satisfied responses.

Nursing Research

- Conduct a multi-centric RCT (n = 120–200, across 4–5 Bihar ICUs) with objective endpoints including ventilation duration, sedation doses, and CAM-ICU delirium scores.
- Explore mechanistic outcomes—salivary cortisol, heart rate variability—to quantify physiological benefits of restored communication.
- Compare paper-based pictorial boards with tablet-based digital AAC tools for cost-effectiveness in Indian ICU settings.
- Publish findings in indexed nursing journals to influence evidence-based national critical care policy.

VII. LIMITATIONS

- Single-site design at NMCH Jamuhar limits generalizability to urban, private, or other regional hospital settings.
- Small sample size (n = 30) was adequate for the primary outcome but is underpowered for subgroup analyses.
- Short intervention duration (4–6 days) precludes assessment of long-term satisfaction or weaning-phase communication.
- Potential Hawthorne effect: observed improvements may partly reflect attention from study participation rather than board use alone.
- Conscious-only inclusion criterion excludes the sedated majority of ICU days, limiting applicability to the full ventilated population.

VIII. RECOMMENDATIONS

- Conduct larger multi-center trials with blinded assessors across diverse Bihar ICU settings.
- Include longitudinal 30-day follow-up and quality-of-life assessment in future studies.
- Use objective behavioral outcomes (agitation event logs, sedation volumes) alongside patient-rated satisfaction scales.
- Develop a standardized Hindi/Bhojpuri communication board template validated across Bihar's linguistic spectrum for wider adoption.
- Engage NABH accreditation frameworks to mandate communication aid availability as a hospital quality standard.

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