

Review paper

Effectiveness, experience, and usability of low-technology augmentative and alternative communication in intensive care: A mixed-methods systematic review



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ABSTRACT

Background: Patients in the intensive care unit (ICU) are commonly on mechanical ventilation, either through endotracheal intubation or tracheostomy, which usually leaves them nonverbal. Low-technology augmentative and alternative communication (AAC) strategies are simple and effective ways to enhance communication between patients and their communication partners but are underutilised.

Aim: The aim of this study was to systematically review current evidence regarding the effectiveness, experience of use, and usability of low-technology AAC with nonverbal patients and their communication partners in the ICU.

Methods: This review included quantitative, qualitative, and mixed-methods studies of adult ICU patients aged 18 or older who were nonverbal due to mechanical ventilation and their communication partners. Studies using low-technology AAC, such as communication boards and pen and paper, were included. Six databases were searched, and the review was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A convergent segregated approach was used for data synthesis.

Results: Thirty-two studies were included. Low-technology AAC improved patient satisfaction, facilitated communication, and met patients' physical and psychological needs. Communication boards with mixed content (e.g., pictures, words, and letters) were preferred but were used less frequently than unaided strategies due to patients' medical status, tool availability, and staff attitudes. Boards should be user-friendly, tailored, include pen/paper, and introduced preoperation to increase patient's comfort when using them postoperatively.

Conclusion: Existing evidence support low-technology AAC's efficacy in meeting patients' needs. Better usability hinges on proper implementation and addressing challenges. Further research is crucial for refining communication-board design, ensuring both user-friendliness and sophistication to cater to ICU patients' diverse needs.

Registration: The review protocol was registered in the International Prospective Register of Systematic Reviews, with registration number CRD42022331566.

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1. Background

Patient-centeredness and improved quality of care require an empowered communication process between patients and their care partners, including healthcare professionals (HCPs), family, and caregivers. This is difficult to achieve with mechanically ventilated (and often nonverbal) patients in the intensive care unit (ICU). The availability of communication resources greatly

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influences this process, and low-technology augmentative and alternative communication (AAC) is known to be an efficient and popular choice for nonverbal patients.¹ Low-technology AAC includes communication boards, symbol boards, picture boards, alphabet boards, letter boards, word boards, pen and paper, communication cards, and writing boards. These tools should be used in the ICU to help patients communicate their basic needs and emotions.² Recent reviews have focused on quantitative outcomes and examined the usability of AAC in the ICU.^{3–6} However, no review has specifically explored the effectiveness and usability of low-technology AAC in the ICU context or considered the experience of using such tools. This mixed-methods systematic review (MMSR) aims to examine the effectiveness, experience, and usability of low-technology AAC between nonverbal patients and their communication partners in the ICU using a mixed-methods approach.

2. Methods

2.1. Search strategy and study selection

The review protocol was registered in the International Prospective Register of Systematic Reviews with registration number CRD42022331566. Searches were conducted in July 2022 (updated in October 2023), using MEDLINE (Ovid), EMBASE (Ovid), CINAHL (EBSCO), PsycINFO (EBSCO), Cochrane Library, and Web of Science. Hand searches and reviews of reference lists were used to identify additional studies. Grey literature sources, Google Scholar, and [ClinicalTrials.gov](https://www.clinicaltrials.gov) were included in the search process. There were no restrictions on publication dates. The detailed search strategy is provided in [Supplementary Material Table 1](#). Based on the inclusion

Table 1
Inclusion criteria.

Study design
- Quantitative studies (experimental and observational)
- Qualitative studies
- Mixed-methods studies
Intervention
- Low-technology AAC, including, but not limited to, communication boards, symbol boards, picture boards, alphabet boards, letter boards, word boards, pen and paper, communication cards, and writing boards.
- In studies with a mix of AAC strategies, only the low-technology data were considered in this review.
Participants
- Adults (aged 18 or older)
- Admitted to the ICU
- Nonverbal due to medical intervention (e.g., mechanical ventilation, tracheostomy), and their communication partners (e.g., HCPs, family, caregivers).
Outcome measures
Any outcome measuring the impact of low-technology AAC was included. These outcomes include but are not limited to the following:
- Satisfaction with using the intervention
- Ease of communication
- Psychological status
- Frequency of use
- Barriers and facilitators of use
Language
All languages

Abbreviations: AAC, augmentative and alternative communication; HCP, healthcare professional; ICU, intensive care unit.

criteria shown in [Table 1](#), all included studies were exported into Endnote 9X and reviewed independently by two reviewers (HA, JA).

2.2. Data extraction and quality assessment

Two reviewers (HA, JA) extracted data into an Excel spreadsheet, consulting a third reviewer (AS, RH, or JC) to resolve any disagreements. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart (PRISMA) was used.⁷ Three appraisal tools were used: (i) The Joanna Briggs Institute Collaboration (JBI) tools for experimental quantitative and qualitative studies;⁸ (ii) the Crowe Critical Appraisal Tool⁹ for observational quantitative studies; and (iii) the Mixed Methods Appraisal Tool¹⁰ for mixed-methods studies.

2.3. Data synthesis and analysis

Data synthesis followed the JBI's methodological guidance for conducting a MMSR.¹¹ A convergent segregated approach was used (see [Supplementary Material Fig. 1](#)). Due to the heterogeneity of the quantitative data, meta-analysis was deemed inappropriate. Narrative synthesis was thus used to summarise the evidence for each category.¹² The meta-aggregative approach was used to synthesise qualitative data.¹³ Findings were characterised as themes, extracted from original studies, and supported by participant quotes or examples. In the categorisation process, findings were grouped based on linkages and shared meanings, with each category accompanied by a description of related findings and an explanatory statement. Through logical deduction, the categories generated were reviewed to allocate commonality in meaning and to create a comprehensive set of synthesis findings.

3. Results

Searching yielded 5466 studies, 32 of which were included. The PRISMA flowchart is shown in [Fig. 1](#). Detailed characteristics of the included studies are shown in [Tables 2 and 3](#). Studies that were read in full text and excluded are reported in [Supplementary Material Table 2](#).

3.1. Quality assessment

Qualitative and mixed-methods studies were generally of moderate to high quality, whereas the quality of quantitative studies ranged from moderate to poor (see [Supplementary Material Table 3](#)). All studies, regardless of methodological quality, were included in the synthesis.

3.2. Data synthesis

The included studies reported on the effect of low-technology AAC on satisfaction and frustration, difficulty and ease of communication, psychological status, appropriateness and success of communication, usability of strategies, prevalence of strategies used, and the perceived experience of using low-technology AAC.

A variety of outcome measures were used, with some studies using one measure only, whereas others used multiple measures simultaneously. These measures were mainly related to satisfaction and frustration, difficulty and ease of communication,

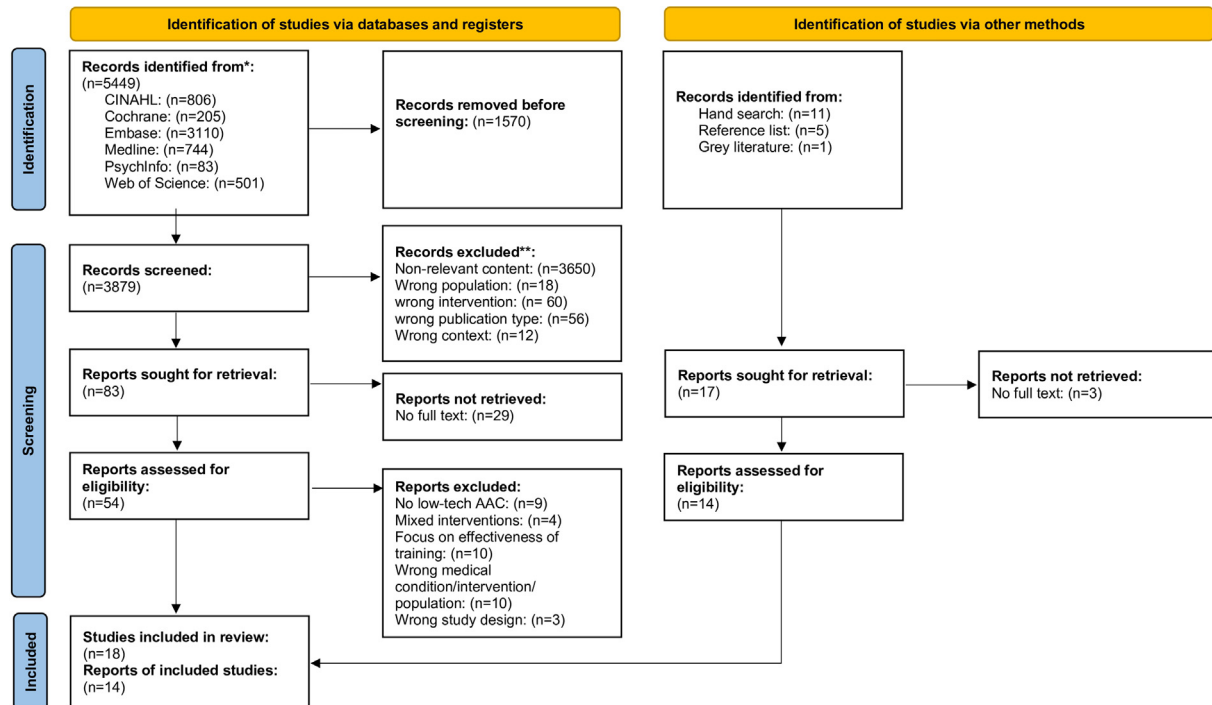


Fig. 1. PRISMA flowchart. Abbreviation:PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Table 2
Characteristics of included studies.

Methodological characteristics	Number of studies
Quantitative	24
Randomised control trials	8
Quasixperimental	11
Observational	7
Qualitative	5
Phenomenological	1
Qualitative descriptive	1
Not specified	3
Mixed methods	3
Publication year	
1980s	1
1990s	1
2000s	3
2010s	19
2020s	8
Low-tech AAC strategy	
Communication board and writing	19
Communication board only	11
Writing only	2
Content of communication board/cards	
Picture board	6
Letter board	4
Mixed	15
Not specified	5

Abbreviation: AAC, augmentative and alternative communication.

appropriateness and success of communication, and psychological status. Twelve studies assessed effectiveness in terms of satisfaction,^{17–19,23,26,33,34,36,38,41–43} one in terms of frustration,²⁷ and one assessed both satisfaction and frustration.²¹ Only two studies used predeveloped scales,^{23,36} with one³⁶ using the Quality of Nursing Care Questionnaire (Qualpacs) with a version adapted to the Iranian culture and reported on six dimensions and using only the communication dimension of the questionnaire for satisfaction about nursing care. Five studies assessed difficulty or ease of communication through study-specific measures

developed by the researchers^{28,38,40} and a predeveloped scale,^{16,29} Menzel's Ease of Communication scale.³¹ However, one study¹⁶ only mentioned the latter scale, reporting a different scoring structure, and the source of the scale was not reported and was not found elsewhere. Five studies assessed the appropriateness and success of communication using study-specific measures,^{19,23,27,40,41} and one²¹ used a partially developed tool²² in which patients rated the usefulness of communication methods. All three studies^{23,29,38} that reported on psychological status used predeveloped anxiety scales.^{24,30,39} Outcome measures were rated by the researchers,^{18,21,23,27,29,33,34,36,40} study participants,^{19,26,28,38,43} or not reported.^{16,17,41,42} Education was reported in one study,²³ in which the researchers provided around 5 min of education for the control group and 20 to 30 min for the intervention group before proceeding with the intervention phase.

3.3. Usability and effectiveness of low-technology AAC (quantitative data)

3.3.1. Frequency of use

Five studies reported the prevalence of use of low-technology AAC to facilitate communication.^{15,28,32,35,44} Three studies reported no usage of communication boards and limited use of writing with other unaided strategies.^{28,35,51} Only one study found higher usage of writing than unaided AAC.³² Comparing low-technology AAC strategies, patients and nurses used writing more frequently than communication boards,³² specifically letter boards.^{15,28,44} Notably, one study¹⁵ found that nurses used picture-based communication boards more frequently than letter-based boards, high-technology AAC, and writing. Two studies addressed patient-reported desires regarding the contents of communication.^{14,20} The first study¹⁴ reported that all patients (47) used communication cards, with additional unaided strategies. The main topics reported on cards were related to pain (89.4%), tube removal (59.6%), asking for water (48.9%), expressing inability to breathe

Table 3
Characteristics of individual sources of evidence.

Author	Study design	Study population	Medical intervention, setting	Low-technology AAC strategy	Measures	Main findings
Quantitative Albayaram & Yaka, 2020 ¹⁴ Turkey	Observational descriptive	47 patients	Oral intubation CICU	Communication cards (mix of pictures and words/sentences)	* Patient opinion—suggestion form to determine the topics to be included in the cards * Questionnaire to determine the patients' experiences in communication during intubation * Communication process evaluation form (<i>all author-developed</i>)	* All patients used the communication cards with additional unaided strategies. * 87.2% of the patients suggested that HCPs use coloured communication cards. * Characteristics of the visual communication cards, including the size of the cards, the number of shapes and their clarity, size, and colour of the shapes were rated by 51–55% of patients to be appropriate, 25–44% partially appropriate, and 6–19% not appropriate. * The main five contents reported from the communication cards were related to pain (89.4%), asking about tube removal (59.6%), asking for water (48.9%), expressing inability to breathe (34.0%), and asking to change position (29.8%).
Al-Yahyai et al., 2021 ¹⁵ Oman	Observational descriptive	194 nurses	Mechanical ventilation ICU, CICU, HDU	Unaided AAC, high-technology AAC, communication boards (pictures, letters), Writing	Questionnaire on methods used (<i>author-developed</i>)	* Low-technology AAC was used less than unaided strategies. * Picture boards were reported to be used more than letter boards, high-technology AAC and writing.
Aswini, 2016 ¹⁶ India	Randomised control trial Posttest	60 patients—control group	Mechanical ventilation NR ICU	* Intervention group: communication board (not specified) * Control group: NR	Menzel Ease of Communication scale	<u>Intervention group:</u> * 90% of the patients had little difficulty in communicating their needs, and 10% of the patients had no difficulty at all. <u>Control group:</u> * 93% of the patients had extreme difficulty in communicating their needs.
Chakraborty, 2021 ¹⁷ India	Quasiexperimental Posttest	60 patients—control group	Mechanical ventilation ICU	* Intervention group: communication board (pictures) * Control group: unaided AAC	Satisfaction scale: a 16-item, 5-point Likert scale (score range: 16–80), with higher scores indicating greater level of satisfaction (<i>author-developed</i>)	<u>Intervention group:</u> * 6.6% of the patients were highly satisfied, 36.6% moderately satisfied, 40% neutral, 10% moderately unsatisfied, and 6.6% unsatisfied. <u>Control group:</u> * 20% of the patients were moderately satisfied, 46.6% neutral, 23.3% moderately unsatisfied, and 10% unsatisfied.

Das, 2015 ¹⁸ India	Quasiexperimental Posttest	20 patients—control group	Mechanical ventilation ICU	* Intervention group: communication board (pictures) * Control group: unaided AAC	Satisfaction scale: a 7-item scale (score range: 17–68), with higher scores indicating greater level of satisfaction (<i>author developed</i>)	<u>Intervention group:</u> * Mean satisfaction score increased post intervention (46.4/68), with all patients showing moderate satisfaction. <u>Control group:</u> * Mean satisfaction score was 32.9/68, with 50% of the patients reporting dissatisfaction and 50% moderate satisfaction.
Das& Begum, 2015 ¹⁹ India	Quasi experimental Pretest/posttest	60 patients—no control group	Mechanical ventilation ICU	Communication board (not specified)	* Satisfaction scale: not reported scoring range or scoring criteria * Communication pattern scale: a 3-point Likert scale (score range: 52–156), with higher scores indicating better pattern of communication (<i>all author-developed</i>)	<u>Intervention group:</u> * Mean satisfaction score increased from 31.4 before intervention to 63.9 post intervention. * Mean communication pattern scores increased from 78.85 before intervention to 143.4 post intervention.
Duffy et al., 2018 ²⁰ USA	Pilot prospective study	12 patients	Endotracheal tube or tracheostomy TSICU	* Communication board (mix of pictures, letters, and words/sentences) * High-technology AAC	* Observation * Structured interview	* 11 patients demonstrated 100% accuracy in answering four basic needs questions (yes/no questions). * Patients desired to communicate additional information via the communication board, with 25% reporting a desire to go home, 25% asking for their lips to be moistened, and 16% requesting a chaplain/prayer, family, nurse, or doctor.
El-Soussi et al., 2014 ²¹ Egypt	Randomised control trial Posttest	60 patients—control group	Intubation CICU	* Intervention group: communication board (mix of pictures, letters, and words/sentences), writing * Control group: unaided AAC, writing	* Modified patient communication tool ²² (communication distress, helpfulness of methods): not reported scoring range or scoring criteria * Satisfaction scale: a 20-item, 5-point Likert scale (score range: 20–100), with higher scores indicating greater level of satisfaction (<i>author-developed</i>)	<u>Intervention group:</u> * All patients found communication methods extremely or mostly helpful, while reported varying levels of distress, from a little (36.7%) to very much distressed (13.3). * Varied levels of satisfaction, from very satisfied (40%) to very dissatisfied (10%). <u>Control group:</u> * Patients varied on how they found communication methods and their distress level, with 16.7% found them not helpful and 73.3% were very much distressed. * Varied levels of satisfaction from very satisfied (6.6%) to very dissatisfied (53%).
Erfan et al., 2018 ²³ Egypt	Quasi experimental Pretest/posttest	80 patients—control group	Mechanical ventilation CTICU	* Intervention group: communication board (mix of pictures and words/sentences) * Control group: unaided AAC, writing	* Hamilton Anxiety scale ²⁴ : a 14-item, 4-point Likert scale (score range: 0–56), with higher scores indicating greater level of anxiety * Modified Newcastle satisfaction scale ²⁵ (posttest only): a 16 item, 3-point Likert scale (score range 0–48), with higher scores indicating greater level of satisfaction * Patients' needs questionnaire (<i>author-developed</i> —posttest only)	<u>Intervention group:</u> * Mean score of anxiety decreased from before (3.4) to after (2.5) intervention and educational session. * 85% of patients were satisfied with their ability to communicate and express their needs. * Patients were able to express their basic needs and feelings using the communication board, with a mean

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Table 3 (continued)

Author	Study design	Study population	Medical intervention, setting	Low-technology AAC strategy	Measures	Main findings
Farahani et al., 2012 ²⁶ Iran	Randomised control trial Posttest	60 patients—control group	Tracheal intubation ICU	* Intervention group: communication board (letters and words), Communication boards (pictures, letters, words) * Control group: unaided AAC	Satisfaction scale: a 10-cm VAS (score range: 1–10), with higher number indicating greater level of satisfaction (<i>author developed</i>)	percentage of 89.3%. <u>Control group:</u> * Mean score of anxiety decreased from before (3.2) and after (2.9) intervention and educational session. * 15% of patients were satisfied in their ability to communicate and express their needs. * Patients were able to express their basic needs and feelings using the communication board with a mean percentage of 26.7%. <u>Intervention group (letters and words communication board):</u> * Mean satisfaction score of patients post intervention was 3.83/10. <u>Intervention group (pictures and letters communication board):</u> * Mean satisfaction score of patients post intervention was 4.10/10. <u>Control group:</u> * Mean satisfaction score of patients post intervention was 2.58/10.
Gaudel & Bai, 2017 ²⁷ India	Randomised control trial Posttest	60 patients—control group	Mechanical ventilation NR ICU	* Intervention group: communication board (mix of pictures and words/ sentences) * Control group: NR	* Level of communication questionnaire: a 10-item, 4-point Likert scale (score range: 10–50), with higher scores indicating for better communication level * Frustration level questionnaire: a 10-item, 4-point Likert (score range: 10–50), with higher scores indicating for greater level of frustration (<i>all author-developed</i>)	<u>Intervention group:</u> * Mean communication score: 34.23/50, with varied levels, from very good (16.7) to average (26.7%). * Mean score of frustration: 25.90/ 50, with varied levels of frustration, from no frustration (13.3%) to moderate (10%). <u>Control group:</u> * Mean communication score: 22.80/50, with varied levels, from good (10%) to poor (26.7%). * Mean score of frustration: 25.90/ 50, with varied levels of frustration, from mild (13.3%) to severe (33.3%).
Happ et al., 2011 ²⁸ USA	Observational descriptive	30 patients 44 nurses	Oral endotracheal tube or tracheostomy MICU, CTICU	Writing, communication board (letters)	* Observation of 4 (3-min) video recording of sessions of nurse –patient interaction * Ease of Communication scale (<i>author-developed</i>)	* Patients performed 1693 communication acts, of which writing was observed in 20 acts with no observation of letter board. * About 40% of patients reported difficulties in communication.
Hosseini et al., 2017 ²⁹ Iran	Quasiexperimental Pretest/posttest	30 patients—control group	Mechanical ventilation GICU, NICU	* Intervention group: communication board (mix of pictures and words/ sentences), Writing * Control group: NR	* Hospital Anxiety and Depression Scale ³⁰ : a 7-item, 4-point Likert scale (score range: 0–21), with higher scores indicating greater anxiety * Ease of Communication Scale	<u>Intervention group:</u> * Mean anxiety score of patients decreased from 18.06/21 to 3/21 post intervention. * Mean difficulty of communication score decreased from 22.26/24 to

				(ECS) ³¹ : a 6-item, 5-point Likert scale (score range: 0–24), with higher scores indicating greater difficulty with communication	5.73/24 post intervention. <u>Control group:</u> * Mean anxiety score of patients decreased from 16.93/21 to 12/21 post intervention. * Mean difficulty of communication score decreased from 21.40/24 to 14.80/24 post intervention. * Nurse–patient communication mainly involved the use of pen and paper, facial expressions, and gestures to obtain information relating to patients' needs and their health history.
Johnson et al., 2020 ³² South Africa	Observational descriptive	210 nurses	Mechanical ventilation ICU	Unaided AAC, high-technology AAC, communication board (not specified), writing	Communication aspects questionnaire (<i>author-developed</i>)
Kaur et al., 2018 ³³ India	Randomised control trial Pretest/posttest	60 patients—control group	Intubation ICU	* Intervention group: communication chart (pictures) * Control group: NR	Satisfaction scale: a 26-item, 5-point Likert scale: not reported scoring range or scoring criteria (<i>author-developed</i>)
Metilda & Jaganath, 2020 ³⁴ India	Quasiexperimental Posttest	30 patients—control group	Mechanical ventilation ICU	* Intervention group: communication board (not specified) * Control group: NR	Satisfaction scale: a 15-item, 4-point Likert scale (score range: 15–60), with higher scores indicating greater level of satisfaction (<i>author-developed</i>)
Momennasab, 2019 ³⁵ Iran	Observational descriptive	35 patients 10 Nurses	Endotracheal tube CSICU	Unaided AAC, writing, communication board (mix of pictures and words)	* Observation
Navidhamidi et al., 2021 ³⁶ Iran	Randomised control trial Posttest	60 patients—control group	Nasal/oral tube, tracheostomy ICU	* Intervention group: communication board (mix of pictures, letters, and words/sentences) * Control group: unaided AAC	* Qualpacs Quality of Nursing questionnaire—communication dimension ³⁷ : an 11-item, 4-point Likert scale (score range: 0–33), with higher scores indicating greater quality of communication
Neelavathi et al., 2021 ³⁸ India	Quasiexperimental Pretest/multiple posttest	20 patients—control group	Mechanical ventilation ICU	* Intervention group: communication board (mix of pictures and words/sentences) * Control group: unaided AAC, writing, communication board (letters)	* Modified face anxiety scale ³⁹ : five face types representing five levels of anxiety, with higher scores indicating greater level of anxiety. * Communication difficulties questionnaire: not reported scoring range or scoring criteria (<i>author-developed</i>) * Satisfaction scale: not reported scoring range or scoring criteria (<i>author-developed</i>)

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Table 3 (continued)

Author	Study design	Study population	Medical intervention, setting	Low-technology AAC strategy	Measures	Main findings
Otuzoğlu & Karahan, 2014 ⁴⁰ Turkey	Quasiexperimental Posttest	90 patients—control group	Intubation and mechanically ventilated CVICU	* Intervention group: communication board (mix of pictures, letters, and words/sentences) * Control group: unaided AAC, writing	* Patient opinion form (control group only—predevelopment of communication board) * Communication experiences form (communication difficulties, quality, and appropriateness of methods): not reported scoring range or scoring criteria * Communication process form (for bedside nurses) (all author-developed)	Intervention group: * More than half of the patients (51%) reported no difficulties in communication post intervention. * Nurses comprehension of patients' needs was adequate to 37.8% of the patients. * Communication methods were appropriate for 42.2% of patients and not appropriate for 57.8%. * 77.8% of the patients found the communication board beneficial and 22.2% found it partially beneficial. Control group: * 80% of participants reported difficulties post intervention. * Nurses comprehension of patients' needs was adequate to 15.6% of the patients. * Communication methods were appropriate for 20% of the patients and not appropriate for 80%.
Pakhide, 2019 ⁴¹ India	Quasiexperimental Pretest/posttest	60 patients—control group	Mechanical ventilation NR	* Intervention group: communication board (pictures) * Control group: NR	* Communication ability checklist: a 30-item scale (score range: 1–30), with higher scores indicating greater ability * Satisfaction scale: a 10-item scale (score range: 21–50), with higher scores indicating greater level of satisfaction (intervention group posttest) (all author-developed)	Intervention group: * Mean communication abilities score for patients increased from 7.26/30 to 18.2/30 post intervention. * All patients were satisfied with communication post intervention. Control group: * Mean communication abilities score for patients increased from 8.2/30 to 9.03/30 post intervention.
Rathi & Baskaran, 2015 ⁴² India	Quasiexperimental Posttest	30 patients—control group	Mechanical ventilation MICU	* Intervention group: communication board (pictures) * Control group: writing	Satisfaction scale: a 20-item, 5-point Likert scale (score range: 20–100) on physiological, psychological, and social, with higher scores indicating greater level of satisfaction (author-developed)	Intervention group: * Mean satisfaction score was 83.5/100 post intervention. Control group: * Mean satisfaction score was 65/100 post intervention.
Stovsky & Dragonette, 1988 ⁴³ USA	Quasiexperimental Posttest	40 patients—control group 22 nurses	Endotracheal tube CSICU	* Intervention group: communication board (mix of pictures and words/sentences) * Control group: unaided AAC, writing	* Patient interviews (open-ended questions) * Nurse bedside assessment tool * Patient satisfaction questionnaire: a 9-item, 5-point Likert scale (score range: 9–45), with higher scores indicating greater level of satisfaction * Satisfaction scale: a 10-cm VAS (score range: 1–10) with higher number indicating greater level of satisfaction (all author-developed)	* Both intervention and control groups stated that education on communication methods before surgery is helpful. Intervention group: * Mean satisfaction score was 36 post intervention (16 patients). Control group: * Mean satisfaction score was 28 post intervention (19 patients).
Thomas & Rodriguez, 2011 ⁴⁴ USA	Observational descriptive	162 patients	Voiceless MICU, CICU, SICU		Communication methods used: questionnaire (author-developed)	

Qualitative Broyles et al., 2012 ⁴⁵ USA	NR Secondary analysis	41 patients NR nurses NR families	Intubation ICU, CICU, HDU	Unaided AAC, communication board (letters), writing	Unaided AAC, high- technology AAC, communication board (letters), writing	* Observation with video recording * Field notes * Interviews with nurses * Intervention log	* Letter-based communication board was used by 7.4%, and writing was used by 23.5% of the patients. * Five main themes emerged to describe the communication between patients and their family: 'Families are unprepared and unaware', 'Families' perceptions of communication effectiveness', 'Nurses deferring to or guiding patients-family communication', 'Patients' communication characteristics', 'Families' experience with and interest in AAC'. * Writing enabled patients to communicate and express their feelings and needs, helped them to cope with the situation, and created a strong bond with the environment. * Some patients were unable to use writing as a communication method because of their limited physical abilities. * Communication board and writing helped nurses to communicate with patients. * Barriers to use AAC strategies included patients' variables, nurses' variables, ICU environment, assistive technology, and Covid-19 related barriers.
Henao Castaño, 2008 ⁴⁶ Spain	Phenomenological	9 patients	Mechanical ventilation ICU	writing	Interview		
Kyranou et al., 2022 ⁴⁷	Qualitative descriptive	14 nurses	Mechanical ventilation ICUs	Unaided AAC, communication board (not specified), writing, high- technology AAC	Interview		
Leathart, 1994 ⁴⁸ USA	NR Participant observation and interview	NR patients 8 nurses	Intubated ICU	Communication board (pictures), writing	* Observations * Interviews		<u>From observations:</u> * Writing as a strategy was the least used compared to unaided AAC. <u>From interviews:</u> * Half of the nurses exclusively identified communication aids such as picture boards and writing as effective strategies. * A minority of patients used low- technology AAC compared to unaided AAC. * Patients perceived communication boards as useful for basic needs but said that they were not offered and that they needed bigger words. Writing was perceived as not effective because no one could understand their handwriting, and they felt too weak to write. * HCPs perceived communication boards to be basic but that they can be complicated and varied in their opinions. Writing was perceived as unsuitable for delirious patients but
Zhen et al., 2015 ⁴⁹ UK	NR Semistructured interview	13 patients 18 HCPs	Mechanical ventilation ICU	Unaided AAC, communication boards (pictures, letters), writing	Interview		

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Table 3 (continued)

Author	Study design	Study population	Medical intervention, setting	Low-technology AAC strategy	Measures	Main findings
Mixed methods Guttormson et al., 2014 ⁵⁰ USA	NR	31 patients	Mechanical ventilation MSICU	Unaided AAC, communication boards (pictures, letters), writing	* Interviews * Questionnaires (author-developed)	that it can be the most efficient if patients can write. * Main themes that emerged were failed communication and receipt of information communication methods. * Although patients perceived communication methods to be useful, they described challenges related to their physical abilities and the attitude of HCPs. * Participants suggested adaptation for better use of writing as a strategy of communication. * Writing was noted in 26 of 649 communication records, with no records of communication boards. * Communication records identified 812 codes of content data, with 30 codes were of no content because of patients illegible handwriting. * 86% of patients reported that communication board while receiving mechanical ventilation would have lessened their frustration levels. * 69% reported that a communication board would have been extremely/very helpful.
Happ et al., 2004 ⁵¹ USA	NR	50 patients	Mechanical ventilation MICU, CTICU, Coronary care, liver transplant ICU, intermediate MICU, TSICU, NICU	Unaided AAC, writing	Observation records on communication content and methods	* Three themes emerged regarding content of communication board: 'A preprinted communication board is more efficient and faster than writing', 'A preprinted communication board facilitates patients' communication of their emotional needs and conveyance of their individuality', 'A preprinted communication board meets the visual and literal needs of patients'.
Patak et al., 2006 ⁵² USA	Cross-sectional, NR qualitative	29 Patients	Mechanical ventilation ICU	Communication board (mix of pictures, letters, and words/sentences), writing	Structured interviews (author-developed)	

* NR: Not reported.

* Settings: CICU, cardiac intensive care unit; ICU, intensive care unit; HDU, high-dependency unit; TSICU, trauma surgical intensive care unit; CTICU, cardiothoracic intensive care unit; MICU, medical intensive care unit; GICU, general intensive care unit; NICU, neurological intensive care unit; CSICU, cardiac surgery intensive care unit; CVICU, cardiovascular intensive care unit; SICU, surgical intensive care unit; MSICU, medical surgical intensive care unit.

* Unaided strategies: strategies that does not require external tools and based on body parts such as gestures, eye blinking, and mouthing.

* High-technology AAC: aids that require power to function such as speech generating devices.

Abbreviations: AAC, augmentative and alternative communication; HCP, healthcare professional; ICU, intensive care unit; Qualpacs, Quality of Nursing Care Questionnaire, VAS: visual analogue scale.

Table 4

Synthesis of qualitative data on experience of nonverbal patients and their communication partners in using low-technology AAC in the ICU.

Synthesised findings	Categories	Findings	Illustration
Synthesised finding 1 The usability and benefits of low-technology AAC strategies	Category 1: both writing and communication boards (including pictures, letters, and words) are efficient and could help HCPs to deliver support and patients to express their feelings and explain their needs, which could preserve their right to communicate	Low-technology AAC helps HCPs to deliver support and patients to express their emotions and needs to others. Patients' use of low-technology AAC preserves their right to be heard by HCPs.	"Yes, I wrote to them ... many times I asked for paper, as I could not express myself, so I made pencil signs and they passed it to me ... Then I realised everything, and I could communicate by writing, I expressed what I felt to everyone". ⁴⁶ (p. 240) "What I wrote to them the most was to aspirate me so that they could take my secretions out ... There, I left some writing and even a note for them to read". ⁴⁶ (p. 240) "[We had] a board with a marker and there was a glass window in front of him, but we could see him and he could see us. We would write messages for him like 'Everything will be ok' or draw a smiley face". ⁴⁷ (p. 8) "[Picture board] most helpful to pinpoint important needs" [patient's quote]. ⁴⁹ (p. 7) "It [mixed-content communication board] would create an interface between the patient and the staff that would, in a way, formalise the requirement that they pay attention to what the patient is trying to say. It would be like a passport. The person, even if he didn't use it, could wave it, say, I matter. I can be heard. I have a stake in this. It's not just about you acting on me. It's about my being able to tell you what I want, what I'm doing I believe; the concept itself is very strong because it would obligate the staff to both stop and listen with a fresh ear, instead of saying—Oh well, they're intubated. They can't talk. Let's just write them off—It could inspire, that is to say, install hope and empower those who are not as strong-willed as I am". ⁵² (p. 187) "[writing]Best method if patient is able to write". [HCP's quote] ⁴⁹ (p. 7)
	Category 2: Patients and HCPs have different perspectives about which method is more helpful	HCPs perceive writing as the best method of communication if the patient has the ability to do so. Patients perceive the mixed-content communication board as helpful and more efficient than relying on writing alone.	"It would allow me to indicate things without having to draw them. The idea of pointing at a figure and then completing the sentence with catch phrases is a good idea". ⁵² (p. 187)
	Category 3: Low-tech AAC strategies tend to be used less frequently than unaided AAC strategies or as an alternative to other strategies	Families use writing to complement other unaided communication strategies. Low-technology AAC is of less use than unaided AAC.	"Her husband stated... that when he was unable to comprehend the message she mouthed, he would offer her a tablet and pen to write. He was able to understand those messages for the most part [enrolment note]". ⁴⁵ (p. 26) "I also asked [patient's family member] if he had personally used any of the AAC devices such as the letter board, which is in the patient's room. He said he had not but just tended to rely on the patient's mouth". [observation note] ⁴⁵ (p. 28)
Synthesised finding 2 The usability of low-technology AAC strategies is challenged by Patients' abilities and communication partners' attitudes	Category 1 Patients' medical status and literacy levels restrict them from using low-technology AAC strategies	Patients' physical status and levels of consciousness restrict them from using low-technology AAC Patients with limited literacy skills struggle to read, and communication partners might not understand their messages.	"The patient had been printing notes but found it difficult to hold a pen. His hands were oedematous and stiff" [enrolment note]. ⁴⁵ (p. 27) "Because when intubated, they cannot hold the board properly; they don't have the strength to do so". ⁴⁷ (p. 8) "[writing] Not suitable for delirious and sedated" [nurse's quote]. ⁴⁹ (p. 7) "No one can understand my writing as I am dyslexic" [patient quote]. ⁴⁹ (p. 7) "The husband says [a bit defensively] that the patient has difficulty with longer words in reading, but can read" [observation note]. ⁴⁵ (p. 28)
	Category 2 Patients struggle to use low-technology AAC strategies because they are not available or they are not allowed to make full use of them	Patients are interrupted before they can fully express their needs and communication partner tend to wrongly assume their needs. Limited availability of low-technology AAC prevents patients and their	"The one thing that was frustrating is that I'd start a word, and they'd jump the gun and say, oh, a different word ... And that was both nursing staff and family ... I'd start in to a question or I want something or, you know, whatever, and they'd kind of presume where I was going". ⁵⁰ (p. 183) "He [the husband] said that there had been a [communication] board in the room at one point and that he used it. He didn't know where it was now so he relied on

(continued on next page)

Table 4 (continued)

Synthesised findings	Categories	Findings	Illustration
Synthesised finding 3 Low-technology AAC strategies should be adapted to fit patients' needs and to be well implemented	Category 1 Communication boards (including pictures, letters, and words) need to be adapted with convenient designs for the patients	communication partners from using them.	either mouthing or writing" [observation note]. ⁴⁵ (p. 28)
		The contents of communication boards need to be easy to read and concise and should include writing sections.	"I wasn't offered to use one" [patient's quote]. ⁴⁹ (p. 7) "I wouldn't be able to write, but I could be able to, you know, put a ... just do a dot or a line". ⁵² (p. 187) "I'm not sure that this isn't overkill. Conciseness. How would you know the difference between anxious and afraid with varying degrees of the same emotion?" ⁵² (p. 187) "I mean, just with my glasses, in this dim lighting, you're getting a reflection here that's hard to ... you can't read". ⁵² (p. 188) "Some of the colours of the lettering, I'm not able to see it". ⁵² (p. 188) "[picture board] Should have bigger words" [patient's quote]. ⁴⁹ (p. 7)
	The design of communication boards, including the size and colouring, must be clear to read.	"They had just a piece of typing paper on clipboard, and the clip ... as I recall, didn't clip. And so what you really had was just a loose piece of paper on a board. And are you ready for this? A ball point pen ... You know ... if I'm doing something like that, I want a fricking [sic] felt tip Sharpie ... I want the big one, you know ... Something larger handled, you know, where you could write". ⁵⁰ (p. 184) "Maybe it could be part of the preoperative package. It's a lot of information, but if they had a photocopy on paper of this and said, this is your message board, familiarise yourself with it, that could be very helpful, so that somebody isn't trying to cope with discomfort and trying to interpolate". ⁵² (p. 188)	
	Category 2 Extra materials should be attached, with a pen for better writing, and education on how to use the communication board should be provided to patients.	Writing as a strategy should be supported with a pen that is adapted and safe for patients' use. Patients who are due to undergo surgery should be introduced to the communication board beforehand to allow them to absorb the content and feel comfortable when using it postoperatively.	

Abbreviations: AAC, augmentative and alternative communication; HCP, healthcare professional; ICU, intensive care unit.

(34.0%), and asking to change position (29.8%).¹⁴ In the other study,²⁰ 83.3% of patients expressed different needs via the communication board, including a desire to go home (25%), requests for lip moistening (25%), and seeking a chaplain/prayer, family, nurse, or doctor (16%).

3.3.2. Content of low-technology AAC

Six studies used communication boards partially derived from existed ones (i.e., Vidatak EZ).^{20,21,23,29,38,52} Modifications and translations of the content were undertaken in Arabic^{21,23} and Tamil.³⁸ Seven studies specifically reported the content of boards and showed pictorial samples.^{14,20,21,27,40,43,52} The content covered basic needs, expression of emotions and feelings, and common questions. Basic needs included the following: change positions, painkillers, hygiene, suction, hunger, thirst, sleep, comfort, privacy, family, HCPs, sleep, and spiritual support. Expressions included the following: breathing difficulty, dizziness, pain, nausea, cold, hot, fear, nervousness, frustration, sadness, and happiness. Questions were about time, date, surgery progress, discharge from ICU, medical status, and tube removal. The wording, design, and overall layout differed between studies from different countries. For example, the words "chaplain" and "prayers" were used in two studies to represent religious needs,^{20,27} whereas one²¹ only used the word "pray".

3.3.3. Increased level of satisfaction and decreased frustration

Four pretest and posttest studies with mixed-content and picture-based communication boards reported increased satisfaction compared to control.^{23,33,38,41} In studies assessing posttest scores only, six studies using different types of communication boards^{17,18,21,34,36,42} showed considerable improvement in satisfaction compared to the control using unaided AAC or writing only. Two studies^{21,27} reported decreased frustration and distress in their intervention groups compared to control groups when using a mixed-content communication board. One study²⁶ used two

different communication boards (A: pictures and letters; B: letters and words) compared to unaided AAC (control) and showed that board A had the highest satisfaction. One mixed-methods study reported the perceived level of frustration for most patients would have been decreased if communication board was used.⁵²

3.3.4. Ease of communication

Findings from included studies indicate a reduction in communication difficulties following the use of low-technology AAC. Two studies^{29,38} showed a significantly greater decrease in mean scores for communication difficulties in patients in the intervention group compared to control group. Another study¹⁶ reported that all 30 patients in their intervention group had little to no difficulty with communication, whereas the majority of the control group experienced extreme difficulty. Moreover, one study⁴⁰ reported that only 2.2% of the intervention group using a mixed-content communication board had difficulties in communication, compared to 35.6% of the control group using unaided AAC and writing. A mixed-methods study⁵¹ recorded 649 communication instances between patients and HCPs, outlining 812 communication codes and indicating communication content. However, 525 of these codes lacked specified content, with 30 attributed to challenges in interpreting patient messages, including illegible handwriting.⁵¹

3.3.5. Appropriateness and success

One study²⁷ demonstrated that 73.3% of their intervention group, using a mixed-content communication board, rated communication level as "good" or "very good", whereas 90% of those in the control group rated it as "average" or "poor". Using communication board with pictures,⁴¹ no significant difference was reported between the intervention (7.26/30) and the control group (8.2/30) in pretest communication ability scores. However, in the posttest, the intervention group showed a significant increase in communication ability (18.2/30), while the control group showed

only a marginal increase (9.03/30). Similarly, another study²³ found that patients in the intervention group using a mixed-content communication board were better at expressing their needs, except for the feeling of hunger. With no control group, one study¹⁹ reported increase of communication pattern post using the communication board.

One study²¹ reported that all respondents in the intervention group rated the communication methods as “extremely” (63.3%) or “mostly” (36.7%) helpful, whereas 16.7% of the control group found them “not helpful”. The intervention group in this study had a significantly lower total duration of ICU stay (13.63 ± 2.25 days) than the control group (16.77 ± 2.82 days).²¹ Another study⁴⁰ reported that 20% of patients in the control group, compared to 42.2% in the intervention group, felt that the medical staff’s communication methods were appropriate. They also found that 37.8% of patients in the intervention group, compared to 15.6% in the control group, rated nurses’ ability to comprehend their needs as adequate. Furthermore, the majority of patients in the intervention group (77.8%) found the communication board beneficial. However, most patients in both groups perceived this ability as inadequate (62.2% in the intervention group, 84.4% in the control group).⁴⁰ An observational study¹⁴ reported on patients’ ratings of the appropriateness of certain characteristics of the visual communication cards, including the size of the cards and the number, size, colour, and clarity of the shapes used. They found that 51–55% of patients found them to be appropriate, 25–44% partially appropriate, and 6–19% not appropriate.¹⁴

3.3.6. Psychological distress

Three studies^{23,29,38} found a decrease in anxiety among intervention groups using mixed-content communication boards compared to the control. In one study,²³ the mean score of anxiety decreased from 3.4 to 2.5 in the intervention group and from 3.2 to 2.9 in the control. Another study²⁹ found a decrease in anxiety between their intervention and control groups, where the mean anxiety score of the intervention groups fell from 18.06/21 at pretest to 3/21 at posttest, compared to the control group, in which the mean score was 16.93/21 at pretest and 12/21 at posttest. Using face anxiety scale,³⁸ the mean anxiety score decreased from 4.30 to 1.50 in the intervention group posttest compared to that in control, which increased from 4.20 to 4.30 posttest.

3.4. Experience of nonverbal patients and communication partners in using low-technology AAC (qualitative data)

Eight studies, including five qualitative studies^{45–49} and three mixed-methods studies,^{50–52} explored the experience of nonverbal patients and communication partners using low-technology AAC. A total of sixty findings were identified in relation to the experience of using low-technology AAC, including authors’ statements that were not supported by participants’ quotes. However, to avoid redundancy in reporting evidence on the same concept or idea, some findings supported with quotes and are presented in [Table 4](#). The remaining findings are presented in [Supplementary Material Table 4](#).

3.5. Integration of data synthesis from quantitative and qualitative evidence

Quantitative and qualitative findings from the included studies were generally complementary, especially regarding the usability of different low-technology AAC strategies or in comparison with unaided AAC. However, some aspects were solely reported in one research design and had no parallel findings from the other design.

3.5.1. Low-technology AAC facilitates communication, addresses psychological and physical needs, and may reduce ICU stay

Quantitative evidence showed that using communication boards, with or without writing strategies, decreased communication difficulty for patients^{16,29,38,40} and enhanced the quality of their communication with HCPs.^{19,21,23,27,36,40,41} Similarly, qualitative evidence^{43,45,46,49,50,52} showed that patients view communication boards and writing as helpful strategies that facilitate their communication. Quantitative findings showed reduced anxiety^{23,29,38} and increased ability to express basic needs, such as asking for suction or a change in position and expressing pain using mixed-content communication boards.²³ Qualitative findings supported these benefits, emphasising the preservation of patients’ communication rights, motivation, and sense of identity.⁵² One quantitative study²¹ showed a shorter duration of ventilation and ICU stay in patients who used low-technology AAC than those who used unaided communication strategies. Although there is no parallel qualitative evidence, one study⁵² showed that improved communication abilities would motivate patients, instil hope, and contribute to their strength, thereby potentially shortening their length of stay.

3.5.2. Mixed-content communication boards are the preferable communication strategy

Quantitative findings showed that patients were more satisfied with using mixed-content or picture-based communication boards than with using writing or unaided AAC.^{17,18,21,23,26,27,33,38,41–43} One randomised control trial further showed that patients who used picture/letter boards were more satisfied than those who used letter/word boards.²⁶ Qualitative findings did not compare low-technology AAC with other strategies in terms of patient satisfaction but explained the different perspectives of patients and HCPs. HCPs perceived writing as the best method of communication, but only if patients could write,⁴⁹ whereas patients perceived that using mixed-content communication boards was better than relying solely on writing because it was faster and more efficient in delivering their messages.⁵²

3.5.3. Usability of low-technology AAC in general, and in comparison, with other strategies

Quantitative evidence from observational studies showed higher utilisation of unaided strategies for communication between nonverbal patients and HCPs than low-technology AAC.^{15,28,35,44,51} One quantitative finding revealed that most patients used unaided strategies alongside the picture-based communication cards.¹⁴ Qualitative findings supported these results and highlighted family members’ reliance on using unaided AAC despite the availability of low-technology AAC.⁴⁵ They considered unaided AAC the primary method of communication, using writing as a complementary method for comprehension. Regarding low-technology AAC, only quantitative evidence showed that writing was used more frequently than letter-based communication boards^{15,28,44} and less frequently than picture based boards,¹⁵ with no parallel qualitative evidence.

3.5.4. Factors hindering the use of low-technology AAC

Qualitative studies largely described reasons restricting patients’ use of low-technology AAC for communication. Firstly, patients might not use communication boards because they are not available or are not offered.^{45,49} Secondly, patients explained that HCPs tended to interrupt their communication efforts and assume their needs without letting them make full use of the communication board.⁵⁰ Two quantitative studies presented variations in this regard: one reported overall satisfaction with nurses’ communication quality,³⁶ whereas the other showed

dissatisfaction among both intervention and control groups.⁴⁰ Thirdly, patient-related factors such as physical health, level of consciousness, and limited literacy skills restricted the use of low-technology AAC, particularly writing, resulting in messages being misunderstood by communication partners.^{43,45–47,49} There is no quantitative evidence to support these factors, but one mixed-methods study⁵¹ reported several unsuccessful communication episodes because nurses could not understand patients' messages due to illegible handwriting.

3.5.5. Adaptations/adjustments required for better use of low-technology AAC

Qualitative evidence emphasised the importance of designing communication boards to be concise, easy to read, and visually appealing, including a section for writing.^{49,52} Writing as a strategy should be supported with the provision of pens that are adapted and safe for patients' use.⁵⁰ No quantitative evidence reported on these suggestions, but one observational study¹⁴ showed that patient perceptions varied regarding the appropriateness of communication cards, with just under half of the respondents considering the size, clarity, and characteristics of the shapes used to be appropriate, whereas over half of the respondents rated them as partially or not appropriate. Qualitative findings showed that education could facilitate the use of low-technology AAC.⁵² Although this was not explicitly identified in the quantitative findings, one study²³ indicated that the intervention group, which received a longer duration of education on communication strategies than the control group, reported higher levels of satisfaction and lower levels of anxiety.

4. Discussion

This review is the first to explore effectiveness, usability, and experience of using low-technology AAC between nonverbal patients and HCPs in ICU settings and shows that low-technology AAC improved patients' ability to communicate with their communication partners. This review adds to previous systematic reviews^{3–6} by expanding the scope to include all study designs and languages and providing insights into the effectiveness and usability of low-technology AAC for nonverbal patients from clinical trials, as well as the perspectives of both patients and their communication partner. A more recent scoping review⁵³ summarises different AAC strategies from different study designs but limits the breadth of knowledge about low-technology strategies, which is the aim for this review. For example, some of the studies in previous reviews used mix of strategies, and as a result, their findings were mixed, making it impossible to synthesise results exclusively, focussing on low-technology AAC.

Although inconclusive, there appears to be preliminary evidence that low-technology AAC strategies increase patients' satisfaction, facilitate communication between patients and HCPs, enhance patients' psychological status, and increase the quality and success of communication. Almost half of patients in the ICU could benefit from low-technology AAC,⁵⁴ particularly through the use of communication boards, which are the most straightforward strategy⁵ and are more cost-effective than high-technology AAC.³ Patients in the included studies and from previous literature^{2,5,55} preferred low-technology AAC, but there was a reliance on unaided AAC strategies. Gropp et al.⁵⁶ found that nurses initially increased their usage of communication boards after training but gradually returned to unaided strategies. Patient messages and needs might not be well interpreted or understood using such strategies, and HCPs might struggle to understand or perform lip

reading.⁵⁵ Future iterations should explore why these methods are frequently used and address their effectiveness between patients and HCPs in ICU settings.

The implementation of low-technology AAC in the ICU context poses challenges, particularly considering patients' health conditions. Writing can be difficult for patients with impaired fine motor skills, leading to illegible handwriting. Ten Hoorn et al.⁵ proposed an algorithm for selecting low- or high-technology AAC, which, although not validated, suggests that writing is suitable for patients with intact fine motor skills but that otherwise, communication boards are a better option. The issue of availability of AAC strategies also limits their use, consistent with findings from previous literature.^{55,57} The quality of HCPs' communication with patients is suboptimal, with nurses' attitudes playing a role in interrupting patients using communication boards and assuming their needs, confirming the findings of previous reviews.⁵⁷ Nurses' attitudes place a significant challenge on effective patient–nurse communication in ICU settings.⁵⁸ When nurses assume patients' needs and interrupt their communication, it hinders addressing patient needs and increases workload.

This review covers the use of several types of communication boards or cards in the ICU to achieve communication between nonverbal patients and HCPs; some studies included both pictures and words/letters, whereas others used either boards with only words/letters or only pictures. The preferred content of communication boards was mixed content. However, specific content requirements are often overlooked, and there is variability in the design and content of communication boards across studies. Some studies adapted existing communication boards to different languages and local contexts. This development of the communication boards involved translating them into different languages and included a combination of letters and words, depicted using pictures.

It is essential to consider language and cultural diversity when supporting individuals with communication impairments, with some functional words specifically designed for a particular context, as direct translation might not convey the exact meaning or usage.⁵⁹ Within the South African context, for example, patients suggested adding or modifying words and phrases in the Vidatak EZ communication board to align with their culture (e.g., 'I appreciate you' instead of 'I love you').⁶⁰ Further exploration is needed on how communication boards should be designed for diverse cultures. A comprehensive understanding of the specific needs of patients and HCPs in the ICU is crucial for future development of such boards. The reviewed studies suggest that with proper implementation, communication boards can effectively meet patients' needs, and their usability can be enhanced. To increase patient participation and improve healthcare outcomes, it is crucial to involve patients in selecting and assessing the quality of AAC tools. Kuruppu et al.⁵³ emphasised that it is necessary to understand the experiences of patients who have undergone mechanical ventilation in order to develop tools that effectively address such patients' needs.

5. Study limitations

There are limitations to this review. The majority of the included studies were assessed as being of poor to moderate quality, which weakens the overall evidence base supporting the review's objective. Some studies had missing or misreported data,^{26,32} and attempts to contact the authors through email for clarification were unsuccessful. The outcome measures used in experimental studies were mostly unvalidated, with unknown psychometric properties.

Despite this, even minor improvements in the ability of vulnerable patients in the ICU to use low-technology AAC may contribute to their wellbeing and support their healthcare decisions.

Although some of the interpreted findings from qualitative evidence lacked direct quotes or citations, they were appended as additions to preserve substantive depth and enhance the trustworthiness of the findings. However, they should be read and interpreted with caution as they may have weakened the quality of evidence. This type of review inevitably involves a degree of complexity. Specifically, there is no clear consensus on the typology of synthesis designs, and reported methodologies are largely theoretical. Nonetheless, the data synthesis in this review adhered to guidelines provided by the JBIC, which offer a systematic approach for conducting MMSRs, emphasising the conduct of reviews rather than their reporting.¹¹

Strengths of this review include its focus on low-technology AAC for nonverbal patients and HCPs in ICU settings, the inclusion of diverse study designs, a comprehensive search strategy, quality appraisal using validated assessment tools, and the inclusion of studies from multiple languages and publication periods.

6. Conclusion

The limited existing evidence suggests that low-technology AAC strategies satisfy patients' needs. Better usability could be achieved if the tools were properly implemented and challenges addressed. Further research is needed to establish a more thorough understanding of the design and presentation fundamentals of a communication board that would be easy to use yet sophisticated enough to cover ICU patients' needs.

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Credit authorship contribution statement

Hissah A Alodan: Conceptualisation; Methodology; Formal analysis; Investigation; Resources; Writing—original draft; Writing—review and editing; Project administration; Funding acquisition. **Anna-Liisa Sutt:** Supervision; Writing—review and editing. **Rebekah Hill:** Supervision; Writing—review and editing. **Joud Alsadhan:** Investigation. **Jane L. Cross:** Supervision; Writing—review and editing.

Conflict of interest

The authors declare they have no conflict of interest.

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Supplementary data

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