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Review paper

Augmentative and alternative communication in ventilated patients in intensive care units: A scoping review

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ABSTRACT

Objectives: The aim of this study was to map the existing evidence on augmentative and alternative communication strategies for adult patients receiving mechanical ventilation in intensive care units.
Review methods: A scoping review was conducted following the Joanna Briggs Institute methodology and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines.
Data sources: Searches were performed in MEDLINE and CINAHL Complete databases (April 2025). Studies were included if they examined augmentative and alternative communication in adult mechanically ventilated patients in critical care units. Exclusion criteria included paediatric populations, noncritical care settings, letters, opinion papers, and single case reports. Articles published between June 2020 and February 2025 in English, Portuguese, Spanish, or French were eligible, with no restrictions on study design. A full-text review was conducted independently by two authors, and any disagreements were resolved through discussion with a third author. A table was developed to extract the essential information from the eligible studies.
Results: The evidence mapping identified 16 studies, highlighting a growing range of tools to improve communication among mechanically ventilated patients. The identified interventions were categorised into three dimensions: (i) unaided augmentative and alternative communication strategies; (ii) low-tech-assisted augmentative and alternative communication approaches; and (iii) high-tech-assisted augmentative and alternative communication solutions. Augmentative and alternative communication improved patient outcomes, including reduced anxiety, comfort, communication, and satisfaction. Key barriers included patient limitations, insufficient staff training, and device constraints, while facilitators comprised tailored tools, family involvement, and organisational support.
Conclusions: This review demonstrates that a wide range of augmentative and alternative communication strategies are available to support communication in mechanically ventilated adults in the intensive care units. Effective use requires individualised assessment, trained professionals, and integration into routine practice. Further research comparing the effectiveness of different approaches is needed to optimise their implementation and strengthen the evidence base for improving communication, safety, and outcomes in critical care.

1. Introduction

Communication is a basic human need and a fundamental component of patient-centred care. The value of effective communication is recognised in healthcare quality standards, improving safety and health outcomes.[1,2]

In intensive care units (ICUs), communication difficulties represent a significant problem for patients receiving invasive

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mechanical ventilation (IMV).[3] These patients have complex communication needs because temporary verbalisation impairment from an endotracheal tube or tracheostomy prevents them from communicating their needs, desires, or feelings.[4] This condition can be further impaired by the nature of the critical illness, associated with physical weakness, restrictions, use of sedation, and limited cognitive function.[5]

Evidence indicates that only approximately 5% of messages communicated by patients receiving IMV are accurately received and understood by healthcare professionals.[3] This inability to communicate can lead to negative emotional responses, such as anxiety, frustration, feelings of isolation, and fear, as well as hindering the accurate assessment of the patient's needs and the provision of appropriate care.[6] Ineffective communication also affects healthcare professionals, particularly within intensive care settings where timely and accurate exchanges are essential.[7–10] Communication barriers with mechanically ventilated patients heighten cognitive and emotional demands, contributing to stress, frustration, and reduced confidence during clinical interactions.[8,9,11] These challenges can hinder teamwork, create misunderstandings, and negatively influence workflow and collaboration.[12] Moreover, compromised communication may impair clinical decision-making, increase the likelihood of errors, and adversely affect patient safety.[13,14] Such conditions often lead professionals to report feelings of undervaluation, anxiety, and emotional strain.[9,11,15]

These communication constraints, particularly when interacting with mechanically ventilated patients in intensive care, highlight the critical importance of implementing effective Augmentative and Alternative Communication (AAC) to mitigate these challenges and enhance the quality and safety of care.

AAC refers to a range of strategies, techniques, and tools designed to support or replace natural speech in individuals with complex communication needs.[16–18] The term augmentative refers to methods that support or enhance existing speech, helping individuals communicate more clearly. Alternative refers to procedures that replace speech when verbal communication is absent or not functional, providing a different means for individuals to express themselves and communicate effectively.[18] AAC encompasses unaided systems, which rely on the individual's body (e.g., gestures, facial expressions, and eye-pointing) and aided systems that involve external supports. Aided systems are commonly categorised into low-technology approaches, such as communication boards and symbol charts, and high-technology approaches, including electronic speech-generating devices and software-based interfaces.[17–19] In the context of mechanically ventilated adult patients in the ICU, AAC tools represent a critical set of interventions to facilitate functional communication during temporary or prolonged speech impairment.[20]

A preliminary search of key databases (CINAHL Complete and MEDLINE) and registries (Open Science Framework and PROSPERO) revealed no ongoing reviews matching the scope of the present study. However, two completed reviews were found that are relevant to contextualising this work: a scoping review from 2023 that included studies from 2002 to 2021,[2] and a mixed-method systematic review (initial search in July 2022; updated in October 2023) focused exclusively on low-technology AAC in intensive care settings, therefore not addressing high-technology AAC interfaces nor capturing studies published after October 2023.[21] Although the effectiveness of AAC strategies is well documented, their use in the ICU remains inconsistent, partly due to limited training and knowledge among healthcare professionals.[7] Given the rapid development of technologies, changes in clinical practice, and the growing body of recent research, an updated scoping review encompassing both low- and high-technology AAC and extending the search timeframe is justified to map the most current evidence on AAC for mechanically ventilated adults in critical care units.

1.1. Objectives

This scoping review was designed to map the available scientific evidence on AAC in ventilated patients in ICUs.

1.2. Research question

The guiding question was formulated using the PCC mnemonic (Participants, Concept, and Context). In this context, the following were considered: (P) adult patients receiving invasive mechanical ventilation, (C) AAC strategies, and (C) ICUs. The primary objective of this scoping review was to answer the research question: "What AAC strategies are described for adult patients receiving invasive mechanical ventilation in intensive care units?" In addition to this main objective, two secondary and exploratory questions were formulated to guide data extraction and synthesis: (i) "What is the reported impact of AAC on effective communication, patient satisfaction, and overall comfort during invasive mechanical ventilation?" and (ii) "What barriers and facilitators are described in relation to the use of AAC in intensive care settings?"

2. Methods

A scoping review approach was considered the most appropriate method, which aims to systematically identify and map the available evidence on a given topic, domain, concept, or problem, regardless of source.[22] This review follows the Joanna Briggs Institute (JBI) methodology for scoping reviews and was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines.[23–27] A protocol review was registered on the Open Science Framework platform on the 8th of August 2025. Registration (DOI 10.17605/OSF.IO/NFPMB).

2.1. Search strategy

The search strategy was developed based on the reviewers'' field expertise and in close collaboration with a health sciences librarian. An initial limited search was conducted in MEDLINE (via PubMed) and CINAHL (via EBSCOhost) using the key terms "critically ill", "critical care", "intensive care", "mechanical ventilation", "ventilator weaning", "respirator weaning", and "communication". The aim of this first search was to identify relevant articles and associated index terms. The titles, abstracts, and indexing terms of the retrieved records were then screened to extract additional keywords and controlled vocabulary (Medical Subject Headings terms and CINHAL headings). Variations, synonyms, and truncated forms of key search terms were intentionally incorporated to ensure comprehensive coverage of the core concepts. Although one of the secondary questions addressed barriers and facilitators to AAC use, search terms specifically related to "barriers" or "facilitators" were not included in the search strategy. This decision was intentional as the primary aim of the review was to map the overall evidence on AAC in mechanically ventilated ICU patients. Including such terms could have restricted the breadth of the search and increased the risk of missing relevant studies in which barriers and facilitators were reported as secondary findings. Information on barriers and facilitators was therefore identified during full-text screening and systematically extracted from all eligible studies.

The final search strategy, including all identified keywords and indexing terms, was tailored to each database and was conducted in April 2025. In CINAHL Complete, the following boolean phrase was applied: (TI ("critical ill*" OR "Critical Care" OR "Intensive Care") OR AB ("critical ill*" OR "Critical Care" OR "Intensive Care")) AND (TI ("mechanical ventilat*" OR "Respirator Weaning" OR "Ventilator Weaning") OR AB ("mechanical ventilat*" OR "Respirator Weaning" OR "Ventilator Weaning")) AND (TI (Communicati*) OR AB (Communicati*)). In MEDLINE Complete, an equivalent boolean strategy was used: ((("critical ill*"[Title/Abstract] OR "Critical Care"[Title/Abstract] OR "Intensive Care"[Title/Abstract])) AND (("mechanical ventilat*"[Title/Abstract] OR "Respirator Weaning"[Title/Abstract] OR "Ventilator Weaning"[Title/Abstract]))) AND ((Communicati*[Title/Abstract])).

2.2. Eligibility criteria

This scoping review was designed using the PCC (Population, Concept, and Context) mnemonic to define eligibility criteria. Regarding the population, studies involving adult mechanically ventilated patients were included, while studies on pediatric populations were excluded. For the concept, studies that clearly described the use of AAC were included. The review focused on patients in critical care units, excluding studies that did not belong in this setting. The search included articles published between June 2020 and February 2025 written in English, Portuguese, Spanish, or French. No restrictions were imposed based on study design. However, a few article types were excluded, such as letters to the editor, opinion articles, and single reports.

2.3. Selection of sources of evidence

The search data were transferred to Rayyan® (Rayyan Systems Inc., Cambridge, MA, USA) software to facilitate the selection process. Two reviewers independently screened each title and abstract against the inclusion criteria, with any conflict being resolved by a third reviewer. The full texts of potentially relevant papers were then independently assessed against eligibility criteria by two reviewers. Any discrepancy in the citation selection process between reviewers was resolved through discussion with a third author. The PRISMA flow diagram was employed to present the search results and document the literature selection process, thereby ensuring transparency and auditability of the search and screening procedures.

A quality appraisal of the selected citations was not undertaken as per the JBI scoping systematic review guidance. The decision not to critically appraise the retrieved literature is also consistent with the focus of this scoping review, which is to map the literature related to the searched topic, irrespective of citation quality.[28]

2.4. Data charting

In accordance with the JBI methodology for data extraction, a customised extraction table was developed to align with the study objective and research question. Two researchers independently tested the table before finalisation. The extracted information was categorised into specific fields: study, authors/year, study aim, study design, sample, and main findings.

2.5. Data synthesis

Data synthesis combined a descriptive summary with qualitative content analysis, consistent with current guidance for scoping review methodology.[23,24] A descriptive content analysis approach was applied following established methodological recommendations.[29] The process involved repeated readings of the extracted data to familiarise with the study findings and identify key elements related to AAC in mechanically ventilated ICU patients. Data were inductively coded and systematically compared across studies. Codes with conceptual similarities were grouped into broader categories reflecting AAC types and the specific issues reported in the included studies. This structured synthesis enabled the organisation of findings into coherent categories and allowed comparison across study designs and settings. Results were subsequently summarised and presented narratively.

3. Results

After identifying and selecting articles according to the established inclusion criteria, 16 articles were included in the review. The PRISMA flow diagram (Fig. 1) outlines the entire process of identifying and selecting studies.

3.1. General characteristics of included studies

The types of citations included primary research (one exploratory study, two qualitative studies, four observational studies, four clinical trials, one case study, and one cohort study), two literature reviews, one scoping review, and one umbrella review. The articles refer from 12 countries: the USA (n = 3), Germany (n = 2), Australia (n = 2), Belgium (n = 1), Japan (n = 1), Iran (n = 1), Cyprus (n = 1), Sir Lanka (n = 1), Turkey (n = 1), Israel (n = 1), the United Kingdom (n = 1), and Denmark (n = 1). The characteristics and main results of the studies are identified in Table 1.

3.2. Synthesis of results

The results were derived through a descriptive content analysis of the extracted findings. During the synthesis process, patterns were identified by comparing the characteristics and descriptive summaries of the included citations. The results are reported under three categories: (i) unaided AAC; (ii) AAC assisted by low-tech interfaces; and (iii) AAC assisted by high-tech interfaces.

3.2.1. Unaided AAC

Unaided communication strategies are methods that do not require external tools or devices, relying solely on everyone's physical abilities and natural resources to convey information.[21,30]

These use the patient's body as a means of communication, requiring no technological or material support, and consist mainly of gestures and mimics,[1–3,5,7,30,31] facial expressions,[1,3,7,30] body language,[1,3,7,30] lip reading,[1–3,5,7,32] use of hand signals such as pointing and winking,[2,7,30,32] head movements (nodding yes and no),[2,5,30,31] body movements of hands and legs,[7] and the use of touch.[7]

3.2.2. AAC assisted by low-tech interfaces

Communication strategies assisted by low-tech interfaces are methods that require the use of external tools or supports and do not depend on electricity or batteries to function.[1]

These serve to complement or replace speech when it is compromised, consisting of communication and writing boards.[4] Communication boards are low-cost tools that can contain symbols, letters, images, icons, or a combination of these to facilitate communication through patient or healthcare professional pointing.[1,4] Mixed charts are identified as the preferred choice for critically ill patients, demonstrating greater effectiveness, faster communication, and reduced negative feelings.[1,21,30]

Writing, i.e., the use of paper and pen, writing boards, or notebooks to communicate, can be used to complement other

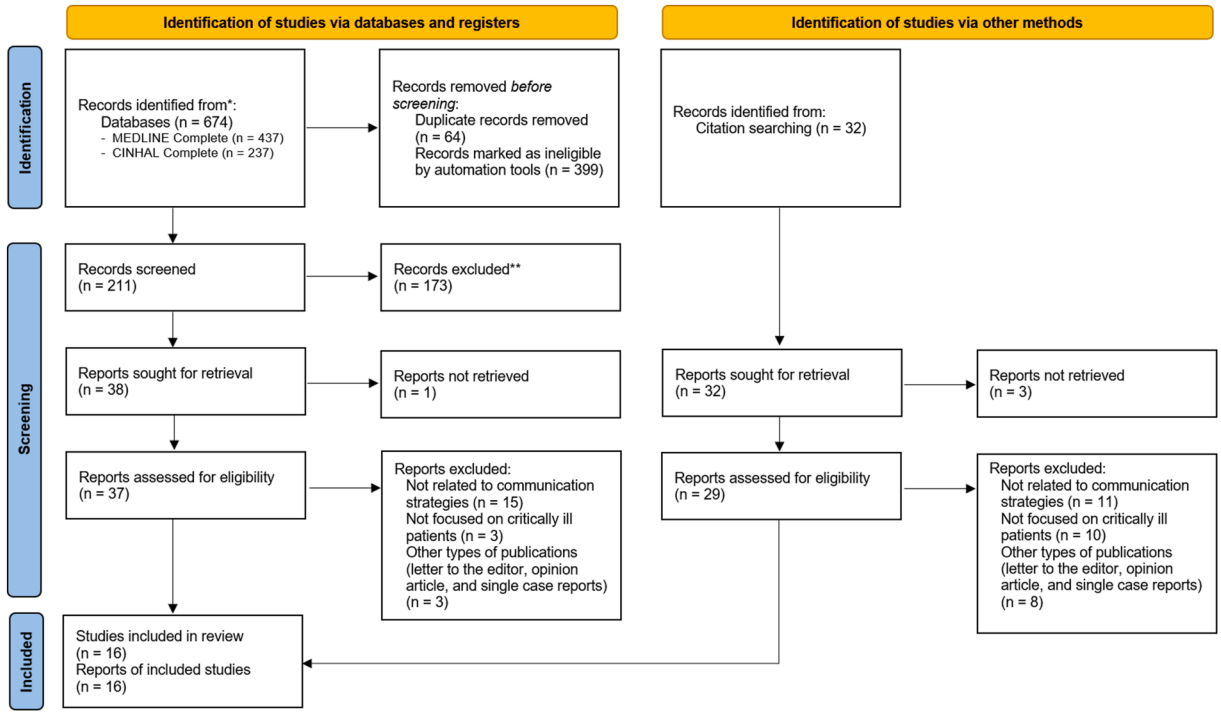

Fig. 1. PRISMA flow diagram. PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

unaided strategies. However, this approach can be challenging for patients with impaired fine motor skills, physical limitations, muscle weakness, vision problems, fears, and fatigue.[1,21,30]

These tools are generally considered a valuable method for communicating with ventilated patients, often more cost-effective and readily available than other options, making them highly recommended in resource-limited settings.[1,2]

3.2.3. AAC assisted by high-tech interfaces

High-tech interface-assisted communication strategies rely on electronic devices powered by a power source or batteries.[1] These advanced technologies are designed to facilitate communication for individuals with significant speech production difficulties.[3,33] These may consist mainly of voice-generation devices, communication software, and eye-tracking devices. Speech generation devices are electronic devices that produce sound when the user selects letters, words, phrases, or symbols.[1,33] The electrolarynx is an example of a device capable of producing artificial speech. To do this, the device must be pressed against the neck, and the electronic sound is produced by vibrations transmitted to the oropharynx.[2,30,34]

Communication applications are software programs specifically designed to run on tablets or other electronic devices, which can offer virtual keyboards, word banks, predefined phrases, visual representations, recording, and translation features. Some examples include VidaTalk Live Voice, Speak for Myself, ICUTalks, and OnScreen Communicator.[1,2,6,32]

Eye-tracking devices are gaze-controlled communication systems that allow users to select items on a screen by tracking and interpreting eye movements. These systems can be particularly beneficial for patients with significant motor limitations.[2,3,30,33]

High-tech interfaces offer advantages such as speech synthesis, database storage of phrases and images, easy message storage and retrieval, and customisable interfaces for each patient.[6,30] However, its use may be influenced by factors such as sedation, vision problems, fatigue, pain, physical restrictions, improper positioning, device complexity, and the availability of time and the intention of healthcare professionals.[2] In addition, to optimise effectiveness, patients must be alert and cognitively capable of interacting with the interface and demonstrate technical competence in the use and configuration of these devices.[1,2]

3.2.4. Patient-reported outcomes

The use of ACC during IMV significantly improves patient outcomes. In our findings, these benefits were measured using validated instruments and structured qualitative assessments, providing a robust understanding of the impact of AAC on patients' emotional well-being, comfort, communication effectiveness, and overall satisfaction with care.

Among the main effects observed in the included studies, we found reduced patient anxiety and increased comfort perception during the postprocedure period, contributing to greater overall satisfaction.[31] In this randomised controlled trial, anxiety was evaluated using the Faces Anxiety Scale, a validated visual tool enabling patients to indicate their perceived anxiety level. Thirty minutes after the communication intervention, patients who used illustrated communication materials showed a significantly greater reduction in Faces Anxiety Scale scores than with those who received routine communication.[31] AAC additionally enhanced patients' perceived comfort, a core dimension of patient experience in critical care settings. Comfort levels were assessed using the Perianesthesia Comfort Scale, which evaluates psychospiritual, physical, sociocultural, and environmental dimensions.[31] The authors reported significantly higher comfort scores in the intervention group than in the control group, indicating that communication efficacy positively influences overall comfort during ventilatory support.[31]

Similar improvements in communication ease were documented through the Ease of Communication Scale.[35] Among those who used AAC, Ease of Communication Scale scores improved markedly within 48–96 h, reflecting enhanced communicative capacity and reduced frustration associated with communication barriers. The authors also reported a concurrent reduction in

Table 1
Presentation of data extraction.

authors/year	Study aim	Study design	Sample	Main results
Alodan, H. A., Sutt, A., Hill, R., Alsadhan, J., Cross, J. L. 2024.	Aimed to review current evidence regarding the effectiveness, user experience, and usability of low-tech AAC with nonverbal patients in the ICU.	Systematic review	Thirty-two studies	Low-tech 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' clinical condition, availability of tools, and staff attitudes.
Choi, J., Tate, J. A. 2021.	Overview of evidence-based strategies for improving communication during critical illness with adults with communication disorders.	Literature review	–	Adopting AAC strategies can improve patient satisfaction with communication. Strategies include interventions that do not require assistance (gestures, facial expressions, words), low-tech strategies (writing, posters), and high-tech strategies (computer-assisted devices, applications, speech-generating devices).
Holm, A., Viftrup, A., Karlsson, V., Nikolajsen, L. 2020	Conducted a review summarising the evidence regarding communication with patients receiving IMV in the ICU.	Umbrella review	Seven studies	Three different approaches can be used in the ICU: unaided AAC, low-tech AAC, and high-tech AAC.
Kuruppu, N. R., Chaboyer, W., Abayadeera, A., Ranse, K. 2023.	Aimed to understand the extent and type of evidence on AAC strategies for mechanically ventilated patients in the ICU.	Scoping review	Twenty-three studies	Three types of low-tech communication strategies were identified (communication boards, visual communication cards, and illustrated communication material). Four types of high-tech tools were identified (tablets, eye-tracking devices, electronic voice output communication aids, and electrolarynxes).
Bendavid, I., Assi, S., Sasson, N., Statlender, L., Hellerman, M., Fishman, G., Singer, P., Kagan, I. 2023.	Assessed communication abilities and the incidence of delirium using the EyeControl-Med device in critically ill patients who were unable to communicate.	Perspective cohort study	Fifteen adult patients receiving IMV	EyeControl-Med is a safe communication strategy for use in patients receiving IMV as it improves their communication skills, enabling them to operate it independently after the third supervised session. In the last session, a reduction in delirium symptoms was observed. The use of personalised content improved communication skills and awareness, with highly significant and consistent results across the entire study population.
Gajic, S., Jacobs, L., Gellentien, C., Dubin, R. M., Ma, K. 2024.	Evaluated the feasibility of implementing a cuff-side vocalisation (CSV) protocol at the hospital level, using tracheostomy tubes with CSV capability, and its impact on the speech of patients in the ICU.	Observational study	A total of 323 critically ill adult tracheostomy patients	Immediate implementation of above-cuff vocalization (ACV) after tracheostomy is feasible, safe, and associated with earlier communication. ACV is a crucial method for facilitating communication in patients who require mechanical ventilation with tracheostomy cuff inflation.
Kolcak, B., Ayhan, H., Tastan, S. 2023.	Assessed the effect of using illustrated communication materials on patients' anxiety and comfort levels receiving mechanical ventilation support.	Randomised clinical trial	Sixty adult patients receiving IMV	The use of illustrated communication materials in the intervention group proved more effective in reducing patients' anxiety levels, increasing satisfaction rates, and improving perceptions of comfort, allowing their needs and desires to be more easily understood.
Kuruppu, N. R., Tobiano, G., Ranse, K., Abayadeera, A., Chaboyer, W. 2024.	Explored patients' and nurses' perspectives on the potential facilitators, barriers, and acceptability of implementing a communication framework in the ICU in Sri Lanka.	Descriptive qualitative study	Eight adult patients receiving IMV and nine nurses	Communication boards are a globally accepted, valuable tool that can improve communication between nurses and mechanically ventilated patients, acting as a facilitator for understanding their needs. Both patients and nurses expressed great interest and positive attitudes towards the use of communication boards.
Kyranou, M., Cheta, C., Pampoulou, E. 2022.	Explored the strategies nurses use by nurses when caring for conscious patients receiving IMV in the ICU, as well as the communication barriers they encountered.	Qualitative study	Fourteen intensive care nurses	Several communication strategies were identified, both unaided (lip movements, hands, legs, facial expressions, gestures, touch) and assisted (pen and paper, communication boards, cell phones), used by nurses to communicate with patients. However, nurses reported barriers to communication, mainly related to patient and nurse characteristics and the ICU environment.

(*continued on next page*)

Table 1 (*continued*)

authors/year	Study aim	Study design	Sample	Main results
Poursadeghi, Z., Miri, K., Hajiabadi, F., Mazloum, S. R., Malekzadeh, J., Niazi, F. 2024.	Assessed the impact of patient communication software on facilitating communication with mechanically ventilated patients in the ICU patients.	Randomised clinical trial	A total of 120 adult patients receiving IMV	Software designed to aid communication for patients receiving IMV can improve their ability to communicate their needs more effectively, offering an alternative to methods such as lip reading, writing, alphabet boards, and communication boards.
Sato, k., Genda, J., Deguchi, S., Taniguchi, T. 2025	Presented the feasibility and intelligibility of speech using a portable hands-free electrolarynx in tracheostomised and mechanically ventilated patients.	Case study	Seven tracheostomised patients receiving IMV	The use of a portable, hands-free electrolarynx has proven feasible, safe, and potentially more helpful than the conventional device for autonomous communication in critically ill tracheostomised patients.
Shin, J. W., Happ, M. B., Tate, J. A. 2021.	Explored family members' perceptions of the electronic communication application, VidaTalk, their communication experiences, and emotional reactions when communicating with mechanically ventilated patients in the ICU.	Randomised clinical trial	Seven family members of adult patients receiving IMV	The VidaTalk application promoted communication with people on IMV, enabling clearer communication, with greater content, and a better understanding of the messages and needs felt by patients. This electronic tool helped families fulfil their role as caregivers, making them happy and grateful to be able to communicate with the patient and express feelings of relief, reduced frustration, and reduced stress.
Sutt, A., Cornwell, P. L., Hay, K., Fraser, J. F., Rose, L. 2022.	Measured the success of communication before and during the use of the voice valve in patients receiving ventilatory weaning in intensive care, from the perspective of nurses and patients.	Prospective cohort study	Twenty-five patients receiving IMV and 52 nurses	Both patients and nurses reported greater communication success when using the voice valve. The use of the valve should be considered in patients with tracheostomy as early as possible.
Szymkowicz, E., Bodet-Contenin, L., Marechal, Y., Ehrmann, S. 2024	Compared the use of a conventional low-tech communication board and a high-tech eye-tracking device to improve the communication effectiveness for mechanically ventilated patients in intensive care.	Randomised clinical trial	Forty-four adult patients receiving IMV	The use of communication interfaces (communication board vs. eye-tracking device) has been shown to significantly affect the number of messages transmitted, the communication success rate, and patient satisfaction. The eye-tracking device can further improve communication effectiveness for mechanically ventilated patients compared to the conventional communication board, both quantitatively and qualitatively.
Ull, C., Hamsen, U., Weckwerth, C., Schildhauer, T. A., Gaschler, R., Jansen, O., Waydhas, C. 2021.	Assessed pain levels, mood, general health, quality of life, and self-esteem using eye-tracking devices in mechanically ventilated patients.	Prospective observational study	Seventy-five adult patients receiving IMV	The use of eye-tracking devices enables mechanically ventilated patients with limited fine motor skills to express their pain, mood, quality of life, and self-esteem using predefined scales and scores. Eye tracking is a helpful tool for identifying symptoms and, as a result, may improve interaction between the patient and the healthcare team and patient satisfaction.
Ull, C., Weckwerth, C., Schildhauer, T. A., Hamsen, U., Gaschler, R., Waydhas, C., Jasen, O. 2023.	Investigated the application of eye-tracking technology in patients receiving mechanical ventilation in a surgical ICU and surgical intermediate care unit.	Prospective, single-centre, observational study	Eleven patients receiving IMV	Eye-tracking technology is suitable for patients receiving IMV and is a promising, effective technique for improving nonverbal communication. Through this AAC strategy, it was possible to observe an improvement in technology-supported communication, a reduction in anxiety and dysphoric thoughts, as well as positive effects on patients' ability to adapt, their level of competence, and self-esteem.

AAC: Augmentative and Alternative Communication; ICU: intensive care unit; IMV: invasive mechanical ventilation.

patient agitation, particularly when individuals were able to communicate their fundamental needs more effectively, such as suctioning, repositioning, or pain management.[35]

Patient satisfaction with AAC was another prominent outcome. In one study, satisfaction was measured using a numerical rating scale, with 90% of patients in the intervention group reporting high satisfaction, compared with only 30% in the control group.[31] Other authors also reported that patients expressed high levels of satisfaction, describing feelings of relief, stress reduction, joy, and happiness associated with the ability to communicate effectively.[5]

Although the literature reports that the use of AAC generally improves communication effectiveness, different types of AAC may yield varying results when compared with one another. A separate study compared the efficacy of a conventional low-tech communication board with a high-tech device employing eye-tracking technology. The findings indicated that communication was substantially improved with the eye-tracking device as the

number of transmitted messages, the success rate, and patient satisfaction were all significantly higher than with the conventional communication board.[3] This underscores that high-tech AAC may support more continuous, autonomous, and nuanced exchanges. This is particularly crucial in critical care, where communication extends beyond the transmission of isolated messages to sustaining ongoing dialogue, allowing patients to express complex needs and alleviating the emotional distress frequently experienced in such settings.

Overall, these findings indicate that AAC provides multidimensional improvements in patient-reported outcomes, including anxiety, comfort, ease of communication, emotional well-being, and satisfaction. The use of validated measurement tools across studies strengthens the evidence base for AAC implementation and underscores its relevance as a critical component of patient-centred care in mechanical ventilation.

3.2.5. Barriers and facilitators connected with the use of AAC

Despite their benefits, AAC presents several challenges that can hinder their practical use and, in some cases, create additional communication barriers.

Patient-related barriers consistently emerge as the most frequently reported obstacles to effective AAC use. Impaired cognition, delirium, reduced consciousness, and sedation,[1,2,30,32,33,35] physical limitations such as muscle weakness and fatigue,[1,2,6,32,34] sensory deficits,[1] and language barriers[1,30] are characteristics that limit its applicability in the critical care patient.

Clinician-related barriers, such as limited training, confidence, or inconsistent implementation,[1,3,30,33,35] unfamiliarity with AAC tools,[2,3,36] and a lack of communication skills[3] are frequently cited as significant obstacles to effective AAC use.

The literature also identifies barriers related to the AAC devices themselves, particularly with high-tech tools that demand greater alertness, motor skills, and cognitive capacity.[1,34] In addition, these devices require training,[34] are more costly,[1,3] may encounter technical issues,[2,6] and are not always readily available in the ICU.[1,3]

To address these challenges, the healthcare team plays a crucial role in overcoming barriers and identifying facilitators to mitigate the communication difficulties associated with AAC. This involves recognising each patient's specific needs, adapting our strategies accordingly, and ensuring that the chosen AAC methods truly enhance, rather than hinder, communication. Across the reviewed studies, several key facilitators emerged that support the successful implementation of AAC. Access to appropriate, intuitive, and user-friendly technology tailored to each patient's specific needs and limitations was shown to significantly enhance communication effectiveness.[3,6,31,33,34] Family engagement and support also represent a critical facilitator of AAC, offering both emotional and practical benefits. As primary communication partners, family members' attitudes, involvement, and skills play a significant role in shaping the effectiveness and overall outcomes of AAC interventions.[7,33] Organisational support, along with structured implementation such as targeted training and multidisciplinary collaboration, was key to facilitating AAC adoption within the multidisciplinary team.[35]

4. Discussion

The objective of this scoping review was to provide a comprehensive overview of approaches to facilitate interaction with critically ill patients experiencing communication difficulties during IMV. The review identified a range of strategies, which were categorised into three main categories: unaided AAC, AAC assisted by low-tech interfaces, and AAC assisted by high-tech interfaces, consistent with recommendations from professional organisations such as the International Society for AAC, the American Speech-Language-Hearing Association, and the Royal College of Speech and Language Therapists.[16–18] Notably, this review enabled a clearer understanding of the patient-related outcomes reported across the included studies, particularly improvements in ease of communication, reductions in anxiety, enhanced comfort, and greater satisfaction, as well as the key barriers and facilitators influencing the implementation of these interventions in intensive care settings.

Unaided communication, which involves using the body as a means of expression, has proven widely used due to their accessibility and simplicity, as inferred in a previous study evaluating their use by healthcare professionals.[37] The use of gestures, facial expressions, body language, lip reading, and hand signals were identified as fundamental tools for interacting with patients who are unable to speak. However, our findings confirm that effectiveness may be limited by individual barriers, such as fluctuations in consciousness, motor or cognitive difficulties, and language barriers, as well as by healthcare professionals' familiarity with these techniques. This perspective is supported by prior research examining the barriers and facilitators to the use of AAC strategies.[38] Grounded in the recognition that unaided communication methods provide a simple, readily accessible means of interaction in the ICU, several modifiable antecedents can be addressed to optimise the effective use of AAC. These antecedents include optimising the care environment (e.g., regulating light and noise levels), supporting the emotional well-being of both patients and clinicians, facilitating family presence at the bedside, providing targeted communication training for healthcare professionals, and ensuring access to evidence-based communication tools tailored to each patient's abilities and preferences.[38] Adopting these strategies may help reframe communication as a collaborative process, mitigate individual barriers, and ultimately enhance patient comfort, safety, and communication effectiveness.

Communication strategies assisted by low-tech interfaces, such as communication boards and writing, remain simple, accessible, and effective methods for facilitating communication between nonverbal patients and healthcare professionals. These stand out for their feasibility and ease of implementation, especially in resource-limited settings. The included studies indicate that the use of communication boards can significantly improve the ease of communication pattern, reduce the level of anxiety, and increase patient satisfaction and comfort, meeting their physical and psychological needs. Although patients often prefer communication boards that combine images, words, and letters, these tools are used less frequently than unaided communication strategies due to factors such as patients' clinical condition, limited availability, and healthcare professionals' attitudes. These barriers can be mitigated by the early introduction of easy-to-use and easy-to-read communication boards tailored to individual needs. One study found that 90% of patients in the intervention group, who used illustrated materials, were satisfied with the communication method and believed the materials were beneficial.[31] These findings are consistent with evidence from previous studies on low-technology AAC.[39–41]

One study went a bit further and compared the use of a conventional low-tech communication board and a high-tech eye-tracking technology-based device to improve communication effectiveness.[3] The authors found a better improvement of communication when using the eye-tracking device, given that the quantity of transmitted messages, success rate, and patient satisfaction were significantly higher than with the communication board.[3]

These results show us that high-tech interfaces have the potential to improve communication effectiveness both quantitatively and qualitatively, since they demonstrate significant advantages, including message personalisation, speech synthesis, and expanded options. Also, voice-generation devices, communication applications, and eye-tracking systems have emerged as advanced alternatives for patients with severe motor limitations. This idea is supported by quasi-experimental research in which the researchers developed and tested the effectiveness of the Needs Communicative Digital Technology Program, focusing on communication strategies that rely solely on digital technology. They implemented the program over 48 h and found that it effectively addressed the communication needs of intubated, critically ill patients. They also reported that the advanced technology and communication strategies were easy to use, convenient, and rapid, facilitating communication across visual, textual, and auditory modalities.[42]

The evidence gathered from this review can also be cautiously related to studies conducted in different populations, such as individuals with cerebral palsy, aphasia, and autism spectrum disorders, where AAC strategies also play a key role in promoting communication and social interaction.

Studies on poststroke aphasia indicate that speech-generating devices and personalised communication software increase patient autonomy and facilitate language rehabilitation.[43,44] In individuals with cerebral palsy, eye-tracking and touch-selection systems have been identified as effective strategies for compensating for severe motor limitations and enabling more efficient communication.[45,46]

Thus, it can be inferred that the use of AAC strategies is widely supported in the literature, in various contexts, demonstrating significant benefits in promoting effective communication, reducing discomfort, and improving the patient experience, and can therefore be safely implemented in healthcare provision.

The selection of the most appropriate communication strategy should consider the patient's clinical condition, the available resources, and the healthcare team's experience in using these tools effectively. Despite the diversity of tools described in the literature, they should be approached holistically. Thus, a systematic assessment of the individual's communication needs and each situation is essential to ensure the selection and application of the most appropriate strategies. The review further indicates that using a single communication tool is often insufficient to meet the complex needs of mechanically ventilated patients. Instead, the evidence supports combining multiple communication methods and instruments, integrating both unaided and assisted approaches. Such personalisation should be guided by each patient's individual characteristics, considering their cognitive, psychological, and physical conditions. This idea is highlighted by a 2025 review, which emphasises that simply using AAC tools is insufficient for effective communication and concludes that comprehensive communication assessments are essential to ensure strategies are tailored to each patient's needs.[14]

Optimising effective communication in the ICU through environmental modifications and multiprofessional support are key strategies for enhancing patient interaction.[14] We emphasise the importance of continuous training for healthcare teams as it plays a crucial role in improving communication with critically ill patients and promoting a more humanised, person-centred approach to clinical practice. Additionally, the finding that some professionals do not recognise the use of these communication tools as a constant necessity[47] highlights the importance of raising awareness of the value of effective communication as a fundamental right and an essential pillar of care, capable of enhancing patient well-being and accelerating recovery, an idea well supported in the literature.[37] Implementing standardised training in evidence-based AAC strategies further underscores the potential of education to improve care quality and increase the satisfaction of critically ill, ventilated patients, supporting the need for research and training in this area.

4.1. Implications for practice, education, and research

The findings of this scoping review underscore the critical need for more rigorous, implementation-oriented research on the use of AAC in adult patients receiving IMV in intensive care settings. Although a growing range of AAC has been described, the evidence base remains fragmented and translation into routine ICU practice is inconsistent. Future research should therefore prioritise evaluating the effectiveness, feasibility, and acceptability of the identified approaches, with particular attention to their capacity to enhance interaction between patients and healthcare teams, increase comfort, and reduce communication-related distress.

Implementing standardised training in evidence-based AAC strategies not only has the potential to enhance the quality of care and patient outcomes but also encourages a culture of proactive communication within the healthcare team. By equipping professionals with practical skills and confidence, such training can foster more meaningful interactions with critically ill, ventilated patients, ultimately contributing to better clinical outcomes and a more humanised care environment.

There is also a call for comparative research to assess the advantages and limitations of the communication methods that rely solely on the patient versus those enhanced by low- or high-interface devices. Examining the factors that influence the practical application of these communication strategies—including the level of training among healthcare professionals, the availability of institutional resources, and patient-specific needs—could yield valuable insights to optimise clinical practice.

To narrow the persistent evidence-to-implementation gap, future research must also examine the determinants of successful adoption, sustained use, and scalability of AAC in critical care. These findings would inform the development of evidence-based guidelines and protocols, supporting a more systematic and effective integration of communication tools.

4.2. Limitations

This review has several limitations that should be registered. Restricting the search to studies published between 2020 and 2025 may have excluded earlier relevant evidence.

Although the review protocol was registered retrospectively, it had been fully defined before data extraction, and no methodological changes were made thereafter, minimising the impact of delayed registration.

The search was conducted in only two major databases, which, despite their broad coverage of nursing and health literature, may have limited the overall scope of retrieved studies. Additionally, no formal quality appraisal was performed, which restricts the ability to evaluate the robustness of the evidence.

Finally, the search was limited to publications in English, Portuguese, Spanish, and French, potentially missing relevant studies in other languages.

5. Conclusion

This review identified a broad range of AAC strategies available for adult patients receiving IMV in the ICU, encompassing unaided, low-tech-assisted, and high-tech-assisted approaches. However,

successful AAC implementation depends not only on the availability of tools but also on supportive attitudes, adequate training, accessibility, and integration into everyday ICU practice. AAC effectiveness should be evaluated not merely by whether communication occurs but also by the extent, frequency, and richness of patient expression when appropriate tools are provided. Beyond consolidating existing knowledge, this review adds value to the current literature by incorporating evidence published between 2020 and 2025, thereby capturing emerging high-tech AAC technologies that were under-represented in earlier reviews. By synthesising findings across all AAC modalities and including patient-reported outcomes alongside context-specific barriers and facilitators, this review offers a comprehensive, up-to-date, and multidimensional understanding of AAC implementation. This expanded perspective clarifies not only what AAC strategies are available but also which organisational, clinician, and patient-level conditions support successful adoption, thereby strengthening the foundation for evidence-informed clinical practice and guiding future comparative and implementation-focused research in critical care.

The results underscore the growing importance of implementing AAC strategies in clinical practice as these strategies mitigate the inability to communicate verbally caused by IMV, thereby promoting communication between critically ill patients and healthcare professionals.

The literature highlights the importance of a holistic approach to communication, with individualised assessment of each person's needs and context. It is recommended to combine different strategies, both assisted and unaided, tailored to the patient's cognitive, psychological, and physical characteristics, as a single tool may not be sufficient. Although there is a wide range of AAC strategies for adult patients with IMV in the ICU, their practical and patient-centred implementation requires an individualised assessment of each patient's needs. Healthcare professionals play a crucial role as facilitators of this process, promoting effective communication and contributing to improved safety and quality of care, as well as better health outcomes and patient satisfaction. Their ability to fulfil this role effectively depends on targeted training that equips them with the skills, confidence, and knowledge to meet the complex needs of critically ill and ventilated patients.

Despite the relevant findings, further research is needed in this area to strengthen the scientific evidence. For future research, we suggest analysing and comparing the effectiveness of the identified communication strategies for promoting patient interaction while accounting for existing communication barriers, thereby optimising their application in clinical practice.

CRediT authorship contribution statement

Ana Fonseca: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualisation, Writing – original draft, Writing – review & editing.

Maria Amaral: Conceptualisation, Data curation, Formal analysis, Visualisation, Writing – review & editing.

Maria Ribeiro: Conceptualisation, Data curation, Formal analysis, Visualisation, Writing – review & editing.

Rúben Encarnação: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Supervision, Visualisation, Writing – review & editing.

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Data availability statement

All data relevant to the study are included in the article. The datasets used in this study are available from the corresponding author on reasonable request.

Declaration of competing interests

There are none to declare.

References

[1] Choi JY, Tate JA. Evidence-based communication with critically ill older adults. Crit Care Clin 2021 Jan 1;37(1):233–49. https://doi.org/10.1016/j.ccc.2020.09.002. W.B. Saunders.

[2] Kuruppu NR, Chaboyer W, Abayadeera A, Ranse K. Augmentative and alternative communication tools for mechanically ventilated patients in intensive care units: a scoping review. Aust Crit Care 2023 Nov 1;36(6):1095–109. https://doi.org/10.1016/j.aucc.2022.12.009. Elsevier Ireland Ltd.

[3] Szymkowicz E, Bodet-Contentin L, Marechal Y, Ehrmann S. Comparison of communication interfaces for mechanically ventilated patients in intensive care. Intensive Crit Care Nurs 2024 Feb 1:80. https://doi.org/10.1016/j.iccn.2023.103562. Churchill Livingstone.

[4] Kuruppu NR, Tobiano G, Ranse K, Abayadeera A, Chaboyer W. Facilitators, barriers and acceptability of implementing a communication board in Sri Lankan intensive care units: a qualitative descriptive study. Intensive Crit Care Nurs 2024 Aug 1:83. https://doi.org/10.1016/j.iccn.2024.103708. Churchill Livingstone.

[5] Shin JW, Happ MB, Tate JA. VidaTalk™ patient communication application "opened up" communication between nonvocal ICU patients and their family. Intensive Crit Care Nurs 2021 Oct 1:66. https://doi.org/10.1016/j.iccn.2021.103075. Churchill Livingstone.

[6] Poursadeghi Z, Miri K, Hajiabadi F, Mazloum SR, Malekzadeh J, Niazi F. The impact of patient communication software app on facilitating communication with mechanically ventilated patients: a randomized clinical trial. Digit Health 2024 Jan 1;10. https://doi.org/10.1177/20552076241299639. SAGE Publications Inc.

[7] Kyranou M, Cheta C, Pampoulou E. Communicating with mechanically ventilated patients who are awake. A qualitative study on the experience of critical care nurses in Cyprus during the COVID-19 pandemic. PLoS One 2022;17(12). https://doi.org/10.1371/journal.pone.0278195. Public Library of Science.

[8] Perelló-Campaner C, González-Trujillo A, Alorda-Terrassa C, González-Gascúe M, Pérez-Castelló JA, Morales-Asencio JM, et al. Determinants of communication failure in intubated critically ill patients: a qualitative phenomenological study from the perspective of critical care nurses. Healthcare (Switzerland) 2023 Oct 1;11(19). https://doi.org/10.3390/healthcare11192645. Multidisciplinary Digital Publishing Institute (MDPI).

[9] Kuyler A, Heyns T, Johnson E. Critical care nurses' experiences of communication-vulnerable patients in the intensive care unit and the influence on rendering compassionate care. South Afr J Crit Care 2024 Apr 1;40(1):23–30. https://doi.org/10.7196/SAJCC.2024.v40i1.750. South African Medical Association.

[10] Zaga CJ, Freeman-Sanderson A, Happ MB, Hoit JD, McGrath BA, Pandian V, et al. Defining effective communication for critically ill patients with an artificial airway: an international multi-professional consensus. Intensive Crit Care Nurs 2023 Jun 1:76. https://doi.org/10.1016/j.iccn.2023.103393. Churchill Livingstone.

[11] Yoo HJ, Lim OB, Shim JL. Critical care nurses' communication experiences with patients and families in an intensive care unit: a qualitative study. PLoS One 2020 Jul 1;15(7 July). https://doi.org/10.1371/journal.pone.0235694. Public Library of Science.

[12] Chen Y, Gong Y. Teamwork and patient safety in intensive care units: challenges and opportunities. Stud Health Technol Inform 2022:469–73. https://doi.org/10.3233/SHTI220120. IOS Press BV.

[13] Keshtkar L, Bennett-Weston A, Khan AS, Mohan S, Jones M, Nockels K, et al. Impacts of communication type and quality on patient safety incidents: a systematic review. Ann Intern Med 2025;178(5). https://doi.org/10.7326/ANNALS-24-02904.

[14] Freeman-Sanderson A, Istanboulian L, Rose L. Communication with the critically ill patient: a nexus between patient needs, communication partner skills and the ICU environment. Intens Crit Care Nurs 2025 Jun 1:88. https://doi.org/10.1016/j.iccn.2025.103962. Churchill Livingstone.

[15] Seo HS, Tsao AJ, Kim MI, Luan-Erfe BM. Providers' perspectives on communication barriers with language-discordant patients in the critical care

setting: a systematic review. Anesth Res 2025 Mar 2;2(1):7. https://doi.org/10.3390/anesthres2010007. MDPI AG.
[16] International Society for Augmentative and Alternative Communication. About AAC [Internet]. 2011 [cited 2025 Dec 8]. Available from: https://isaac-online.org/english/about-aac/.
[17] American Speech-Language-Hearing Association. Augmentative and alternative communication (AAC) [Internet]. 2025 [cited 2025 Dec 8]. Available from: https://www.asha.org/practice-portal/professional-issues/augmentative-and-alternative-communication/.
[18] Royal College of Speech and Language Therapists. Augmentative and alternative communication (AAC) overview [Internet]. 2024 [cited 2025 Dec 8]. Available from: https://www.rcslt.org/speech-and-language-therapy/clinical-information/augmentative-and-alternative-communication/#section-3.
[19] Communication Matters. About AAC systems [Internet]. 2025 [cited 2025 Dec 8]. Available from: https://www.communicationmatters.org.uk/about-aac-systems/.
[20] Karlsen MMW, Holm A, Kvande ME, Dreyer P, Tate JA, Heyn LG, et al. Communication with mechanically ventilated patients in intensive care units: a concept analysis. J Adv Nurs 2023:563–80. https://doi.org/10.1111/jan.15501. John Wiley and Sons Inc.
[21] Alodan HA, Sutt AL, Hill R, Alsadhan J, Cross JL. Effectiveness, experience, and usability of low-technology augmentative and alternative communication in intensive care: a mixed-methods systematic review. Aust Crit Care 2025 Jan 1;38(1). https://doi.org/10.1016/j.aucc.2024.04.006. Elsevier Ireland Ltd.
[22] Munn Z, Pollock D, Khalil H, Alexander L, McLnerney P, Godfrey CM, et al. What are scoping reviews? Providing a formal definition of scoping reviews as a type of evidence synthesis. JBI Evid Synth 2022:950–2. https://doi.org/10.11124/JBIES-21-00483.
[23] Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, et al. Updated methodological guidance for the conduct of scoping reviews. JBI Evid Synth 2020 Oct 1;18(10):2119–26. https://doi.org/10.11124/JBIES-20-00167. Lippincott Williams and Wilkins.
[24] Pollock D, Peters MDJ, Khalil H, McInerney P, Alexander L, Tricco AC, et al. Recommendations for the extraction, analysis, and presentation of results in scoping reviews. JBI Evid Synth 2022:520–32. https://doi.org/10.11124/JBIES-22-00123. Lippincott Williams and Wilkins.
[25] Peters MDJ, Godfrey C, McInerney P, Khalil H, Larsen P, Marnie C, et al. Best practice guidance and reporting items for the development of scoping review protocols. JBI Evid Synth 2022 Apr 9;20(4):953–68. https://doi.org/10.11124/JBIES-21-00242. Lippincott Williams and Wilkins.
[26] Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med 2018;169(7). https://doi.org/10.7326/M18-0850.
[27] Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil H. JBI manual for evidence synthesis [Internet]. 2024 [cited 2025 Dec 8]. Available from: https://jbi-global-wiki.refined.site/space/MANUAL/355862497/10.+Scoping+reviews.
[28] Mattos SM, Cestari VRF, Moreira TMM. Scoping protocol review: prisma-scr guide refinement. Rev Enferm UFPI Univ Fed Piaui 2023;12(1). https://doi.org/10.26694/reufpi.v12i1.3062.
[29] Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs 2008 Apr;62(1):107–15. https://doi.org/10.1111/j.1365-2648.2007.04569.x.
[30] Holm A, Viftrup A, Karlsson V, Nikolajsen L, Dreyer P. Nurses' communication with mechanically ventilated patients in the intensive care unit: umbrella review. J Adv Nurs 2020 Nov 1;76(11):2909–20. https://doi.org/10.1111/jan.14524. Blackwell Publishing Ltd.
[31] Kolcak B, Ayhan H, Tastan S. The effect of using illustrated materials for communication on the anxiety and comfort of cardiac surgery patients receiving mechanical ventilator support: a randomized controlled trial. Heart Lung 2023 May;59:157–64. https://doi.org/10.1016/j.hrtlng.2023.02.005. Elsevier Inc.
[32] Ull C, Hamsen U, Weckwerth C, Schildhauer TA, Gaschler R, Jansen O, et al. The use of predefined scales and scores with eye-tracking devices for symptom identification in critically ill nonverbal patients. J Trauma Acute Care Surg 2022;92(4):640–7. https://doi.org/10.1097/TA.0000000000003494. Lippincott Williams and Wilkins.
[33] Bendavid II, Assi S, Sasson N, Statlender L, Hellerman M, Fishman G, et al. The EyeControl-Med device, an alternative tool for communication in ventilated critically ill patients: a pilot study examining communication capabilities and delirium. J Crit Care 2023;78. https://doi.org/10.1016/j.jcrc.2023.154351. W.B. Saunders.
[34] Sato K, Genda J, Deguchi S, Taniguchi T. A hands-free wearable electrolarynx for communication in tracheostomised mechanically ventilated critically ill patients: a case series. J Anesth 2025. https://doi.org/10.1007/s00540-025-03481-2. Springer.
[35] Gajic S, Jacobs L, Gellentien C, Dubin RM, Maa K. Implementation of above-cuff vocalization after tracheostomy is feasible and associated with earlier speech. Am J Speech Lang Pathol 2024;33(1):51–6. https://doi.org/10.1044/2023_AJSLP-23-00184. American Speech-Language-Hearing Association.
[36] Sutt AL, Cornwell PL, Hay K, Fraser JF, Rose L. Communication success and speaking valve use in intensive care patients receiving mechanical ventilation. Am J Crit Care 2022 Sep 1;31(5):411–5. https://doi.org/10.4037/ajcc2022516. American Association of Critical-Care Nurses.
[37] Al-Yahyai ANS, Arulappan J, Matua GA, Al-Ghafri SM, Al-Sarakhi SH, Al-Rahbi KKS, et al. Communicating to non-speaking critically ill patients: augmentative and alternative communication technique as an essential strategy. SAGE Open Nurs 2021;7. https://doi.org/10.1177/23779608211015234. SAGE Publications Inc.
[38] Istanboulian L, Rose L, Gorospe F, Yunusova Y, Dale CM. Barriers to and facilitators for the use of augmentative and alternative communication and voice restorative strategies for adults with an advanced airway in the intensive care unit: a scoping review. J Crit Care 2020 Jun 1;57:168–76. https://doi.org/10.1016/j.jcrc.2020.02.015. W.B. Saunders.
[39] Huang L, Yan J, Chen SHK. Combining low-technology augmentative and alternative communication with regular aphasia treatment: interim findings of a hospital-based RCT in post-stroke patients. Aphasiology 2025;39(8):1144–63. https://doi.org/10.1080/02687038.2024.2406592. Routledge.
[40] Hosseini SR, Valizad-Hasanloei MA, Feizi A. The effect of using communication boards on ease of communication and anxiety in mechanically ventilated conscious patients admitted to intensive care units. Iran J Nurs Midwifery Res 2018;23(5):358–62. https://doi.org/10.4103/ijnmr.IJNMR_68_17. Wolters Kluwer Medknow Publications.
[41] Titus TKS, Manimozhi R, Ba RR. The effectiveness of communication board on ease of communication and anxiety among patients on mechanical ventilator. Int J Nurs Res 2022;8(2):19–24. https://doi.org/10.31690/ijnmi.2022.v07i02.002. Innovational Publishers.
[42] Chaihan N, Bunthan W. Needs communicative digital technology program for intubated patients with critical illnesses: a quasi-experimental study. Nuttapol Chaihan, RN, MNS, lecturer. Pacific Rim Int J Nurs Res 2023. https://doi.org/10.60099/prijnr.2023.262313.
[43] Balandin S, Hemsley B, Sigafoos J, Green V. Communicating with nurses: the experiences of 10 adults with cerebral palsy and complex communication needs. Appl Nurs Res 2007 May;20(2):56–62. https://doi.org/10.1016/j.apnr.2006.03.001.
[44] Palmer R, Enderby P, Paterson G. Using computers to enable self-management of aphasia therapy exercises for word finding: the patient and carer perspective. Int J Lang Commun Disord 2013 Sep;48(5):508–21. https://doi.org/10.1111/1460-6984.12024.
[45] Borgestig M, Sandqvist J, Parsons R, Falkmer T, Hemmingsson H. Eye gaze performance for children with severe physical impairments using gaze-based assistive technology—A longitudinal study. Assist Technol 2016 Apr 2;28(2):93–102. https://doi.org/10.1080/10400435.2015.1092182. Taylor and Francis Inc.
[46] Crowe B, Machalicek W, Wei Q, Drew C, Ganz J. Augmentative and alternative communication for children with intellectual and developmental disability: a mega-review of the literature. J Dev Phys Disabil 2022 Feb 1;34(1). https://doi.org/10.1007/s10882-021-09790-0. Springer.
[47] Johnson E, Heyns T, Nilsson S. Nurses' perspectives on alternative communication strategies use in critical care units. Nurs Crit Care 2022 Jan 1;27(1):120–9. https://doi.org/10.1111/nicc.12612. John Wiley and Sons Inc.