Review

Interventions to improve communication between nurses and physicians in the intensive care unit: An integrative literature review

Ya-Ya Wang [a,1], Qiao-Qin Wan [a,1], Frances Lin [b], Wei-Jiao Zhou [a], Shao-Mei Shang [a,*]

[a] School of Nursing, Peking University, Beijing, People's Republic of China
[b] School of Nursing and Midwifery, Menzies Health Institute Queensland, Griffith University, Queensland, Australia

ABSTRACT

Effective communication among healthcare professionals in the intensive care unit (ICU) is a particular imperative, with accurate and efficient interdisciplinary communication being a critical prerequisite for high-quality care. Nurses and physicians are highly important parts of the healthcare system workforce. Thus, identifying strategies that would improve communication between these two groups can provide evidence for practical improvement in the ICU, which will ultimately improve patient outcomes. This integrative literature review aimed to identify interventions that improve communication between nurses and physicians in ICUs. Three databases (Medline, CINAHL, and Science Direct) were searched between September 2014 and June 2016 using 11 search terms, namely, nurse, doctor, physician, resident, clinician, ICU, intensive care unit, communication, teamwork, collaboration, and relationship. A manual search of the reference lists of found papers was also conducted. Eleven articles met the inclusion criteria. These studies reported on the use of communication tools/checklists, team training, multidisciplinary structured work shift evaluation, and electronic situation–background–assessment–recommendation documentation templates to improve communication. Although which intervention strategies are most effective remains unclear, this review suggests that these strategies improve communication to some extent. Future studies should be rigorously designed and outcome measures should be specific and validated to capture and reflect the effects of effective communication.

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1. Introduction

Improving quality and safety has become a priority for hospitals worldwide in recent decades. Effective communication among healthcare team members is one of the hallmarks of safe and highly reliable patient care [1]. Improving the communication between healthcare team members under rapidly changing social and medical conditions is becoming increasingly important.

Nurses and physicians are among the most important healthcare professional groups in hospital settings. They undertake separate and distinct tasks in clinical practice, yet they are expected to communicate effectively to provide effective services for patients [2]. Effective nurse–physician communication is a two-way process

that involves sending the right message while being correctly received and understood by the other person [3].

Effective nurse–physician communication has positive effects on the quality of patient outcomes, such as increased patient satisfaction [4], shortened length of stay (LOS) [5], and decreased adverse events [6]. On the contrary, ineffective nurse–physician communication may compromise patient safety and increase healthcare costs [7–10]. The Joint Commission [11] reported that failure in communication causes two-thirds of sentinel events in healthcare. Sutcliffe et al. [12] identified that dysfunctional communication accounts for 91% of the medical errors reported by resident physicians, which are linked with increased costs in healthcare institutions [6]. Poor nurse–physician communication may also lead to work dissatisfaction and lack of autonomy [13,14] among nurses. Such working relationships have caused nurses to leave the profession [14], making retention and recruitment of nurses increasingly difficult [15–17]. Physicians are reported to be easily frustrated when orders are not carried out timely. Unclear communication contributes to significant work dissatisfaction among physicians [16,18]. These influences on nurses and

* Corresponding author. School of Nursing, Peking University, 38 Xueyuan Road, Haidian District, Beijing 100191, People's Republic of China.
E-mail address: mei916@263.net (S.-M. Shang).
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[1] Ya-Ya Wang and Qiao-Qin Wan are co-first authors.

physicians all in turn affect the quality and safety of patient care.

In the modern healthcare system, the intensive care unit (ICU), which provides critically ill patients with high-quality care, is an essential component of most large hospitals. ICU patients are often critically ill and unstable, their clinical conditions change frequently, and their care often involves a multidisciplinary approach [19,20]. In the complex environment of the ICU, the potential for adverse events is high [21]. Donchin [22] showed that 37% of all errors are due to some form of poor communication between nurses and physicians in the ICU, many of which are preventable [23].

Effective communication between nurses and physicians is important for the safety and quality of patient care. Identifying strategies that would improve communication between these two groups could provide evidence for practical improvements in the ICU, which will ultimately improve patient outcomes. However, to our knowledge, no review conducted on interventions to improve communication between nurses and physicians in intensive care is available.

2. Aims and methods

2.1. Aims

This integrative review aimed to identify strategies that were used to improve communication between nurses and physicians in the ICU.

2.2. Design

We conducted an integrative literature review. Integrative reviews are considered as an appropriate approach because it encompasses empirical or theoretical literature, or both, depending on the review purpose [24]. Unlike meta-analyses and systematic reviews, which only include quantitative study of similar methodology, integrative reviews combine qualitative and quantitative studies and allow for the inclusion of diverse methodologies (i.e., experimental and nonexperimental study). The richness of the sampling frame can contribute to a comprehensive understanding of the phenomenon of interest, which can extend the generalizability of the results [25].

2.3. Search methods

We searched three databases (Medline, CINAHL, and Science Direct) between September 2014 and June 2016. Search terms that were included in various combinations were: nurse AND (doctor or physician or resident or clinician) AND (ICU or intensive care unit) AND (communication or teamwork or collaboration or relationship).

2.4. Study selection

Studies were included if they were original research, were peer reviewed, had ICU nurses and physicians as participants, explored communication between the two groups, were published in English, and had no year restriction.

Studies were excluded if they were not conducted in the ICU and/or did not focus on strategies to improve communication between nurses and physicians.

2.5. Search results

Our search for published literature yielded 734 original records for initial review. Following the removal of duplicates, 651 records were screened by examining titles and abstracts, which then excluded 582 papers. A further 58 papers did not meet the inclusion criteria after review of the full text, which left a final total of 11 studies to be included in this review. The reference lists of 11 retrieved articles were reviewed for additional relevant journals. Fig. 1 shows the flow chart of the literature search (Fig. 1).

2.6. Quality assessment

Quality assessment is not essential for integrative reviews and is not an inclusion criterion in integrative reviews [25]. Thus, all 11 studies were retained. Two evaluators (YYW and a research assistant) appraised the 11 retrieved publications independently using a quality assessment evaluation instrument developed by Kmet [26]. The instrument includes two evaluation checklists: one, with 10 criteria, for qualitative studies, and another, with 14 criteria, for quantitative studies. All 11 articles in this review were evaluated using the quantitative checklist (see Appendix A). This approach normally involves appraisal of 14 items (objective, design, method, subjects, random allocation, blinding of investigators, blinding of subjects, outcome, sample size, analytic methods, variance, confounding, result description, and conclusion). Studies were scored depending on how fully they met all criteria (yes = 2, partial = 1, no = 0). If a criterion was not applicable, then it was excluded from the score calculation. Summary score for each paper was calculated by dividing the total score by the total possible score (excluding nonapplicable criteria).

An intraclass correlation coefficient (ICC) was calculated as the indicator of agreement between the two evaluators with a two-way mixed model using SPSS version 18 [27]. No fixed limit to the interpretation of ICC was found in the existing literature; however, one suggestion was that the value should be interpreted as follows: values < 0.4 as poor, values 0.4–0.59 as fair, values 0.6–0.74 as good, and values 0.75–1 as excellent [28].

The ICC for average measures between evaluators for absolute agreement was medium (ICC = 0.428, 95% CI −0.360 to 0.733, $P = 0.196$). Due to the evident variation between evaluator scores, the evaluators discussed their understanding of the evaluation guidelines. Consensus concerning the criteria was reached, and each evaluator revised their evaluation scores. A new ICC for average measures was calculated, with an excellent result (ICC = 0.984, 95% CI 0.891 to 0.992, $P < 0.001$). Quality of the studies
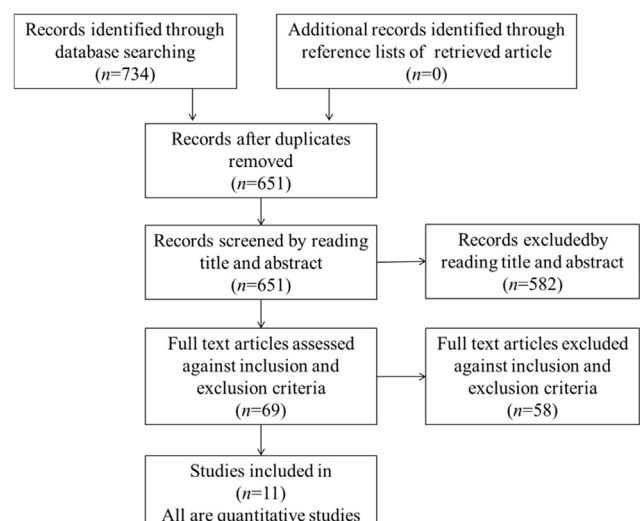

Fig. 1. Flow chart describing details of literature search.

varied from 0.60 to 1.00. According to the evaluation guidelines, a study can be included if it has a quality score ranging from 0.55 (relatively liberal) to 0.75 (relatively conservative) [26](Table 1).

Quality scores range from 0 (poor quality) to 1 (excellent quality).

2.7. Data extraction and analysis

Given the heterogeneity of the included literature, meta-analysis was not possible; therefore, thematic analysis was undertaken [29]. To facilitate analysis, data were extracted into an evidence table and categorized according to author/year, country, design, setting and sample, intervention strategy, outcome measure, and result (Table 2). Tabulation of quantitative findings within a single matrix supported the fusion of both narrative and statistical data [25]. Data analysis results were reviewed by all authors of the paper. The first author of this paper (YYW) screened all included papers and extracted data independently. Another author (FL) reviewed the extracted results. Discrepancies between two reviewers were resolved by discussing with the remaining authors (QQW, WJZ, and SMS) to reach a consensus. The remaining authors (QQW, WJZ, and SMS) reviewed the results after data extraction.

3. Results

The 11 reported studies were all quantitative studies that were published between 2003 and 2016. A total of 8 studies were undertaken in the USA, 1 in Japan, 1 in Sweden, and 1 in the Netherlands. A total of 10 studies were single site, and 1 study [30] was conducted in 2 hospitals. Sample sizes for studies were small and ranged from as low as 9 participants [31] to as high as 151 participants [32]. Of the 7 studies that reported sample size, 4 [30,31,33,34] had less than 60 participants (4/7, 57.1%) and the other 3 [32,35,36] ranged from 61 to 151 participants. The overwhelming majority of participants in the 6 studies that reported profession were nurses. Duration of intervention ranged from 1 month to 2 years. Of the 10 studies that reported duration, 2 lasted less than 3 months [37,38] and 7 lasted 3—12 months [30,31,34,36,39—41], and 1 study [32] had a 2-year project period.

3.1. Types of interventions

Interventions to improve nurse—physician communication were categorized into four: communication tools/checklists, team training, multidisciplinary structured work shift evaluation, and electronic situation—background—assessment—recommendation (SBAR) documentation template. Seven studies focused on using tools/checklists to improve communication between nurses and physicians [31,34,36—38,40,41], two on team training [30,32], one on multidisciplinary structured work shift evaluation [35], and one on electronic SBAR documentation template [42] (Table 2).

3.1.1. Communication tools/checklists

Tools used to improve communication included a daily goal sheet or form, bedside whiteboard, and door communication card. Majority of the studies involved a daily goal sheet or form. Despite a variety of formats, the sheets and forms were all innately oriented to patient treatment and needs. Pronovost et al. [31] explored the effectiveness of a daily goal form consisting of three sections: tasks to be completed, care plan, and communication plan. Findings showed that after 6 weeks of implementation, the percentage of physicians and nurses who understood the daily goals increased. Moreover, this study found a significant decrease in patient ICU LOS. Narasimhan et al. Phipps and Thomas, and Agarwal et al. [33,34,36] took Pronovost's model to develop specific daily goal sheet interventions (see Table 2) and obtained similar results with Pronovost. Justice et al. [41] conducted a quality improvement program in a pediatric hospital to test the effectiveness of visual display of patient daily goals through a write-down and read-back process; the percentage of agreement of patients' goals among team members and family satisfaction improved. Rehder et al. [38] designed sequential interventions that were timed 8—12 weeks apart: (1) implementing a new resident daily progress note format, (2) creating a performance improvement dashboard, and (3) documenting patients' daily goals on bedside whiteboards, in a 9 month period. Shared agreement of patients' daily goals among key healthcare providers increased with each intervention.

A door communication card is one of the modalities of a daily goal sheet or form. Ainsworth et al. [37] developed a door communication card that recorded the major priority goals for the patient, with the cards placed on patients' doors. However, communication between the healthcare team members did not change significantly after one month of implementation. According to the authors [37], the reasons were as follows: (1) no specific training was provided about how to use these goal cards; (2) no scheduled review of the goals was listed as Pronovost did [31]; it was difficult for all team members to be kept familiar with the planned goals; (3) the short study period was not enough to achieve increases in goal alignment.

3.1.2. Team training

Boyle and Kochinda [30] conducted an interventional study in Japan whereas Meurling et al. [32] did one in Sweden; both of them aimed at exploring the effectiveness of team training. Boyle and Kochinda [30] provided evidence on the effectiveness of team training in improving the communication skills of ICU nurse and physician leaders. They found that ICU nurse—physician communication improved significantly when both professions interacted with great respect and trust and gained deep insight into each other's roles and responsibilities. Meurling et al. [32] conducted systematic simulation-based team training on safe teamwork during times of stress, in which the main learning objectives were to improve the participants' knowledge and understanding of safety in complex organizations. Nurse assistants perceived an increased quality of collaboration and communication with physician specialists.

Table 1
Results of quality assessment showing degree of agreement between evaluators.

Evaluator	Study										
	Pronovost P et al. (2003)	Boyle DK and Kochinda C (2004)	Sluiter JK et al. (2005)	Narasimhan M et al. (2006)	Phipps LM and Thomas NJ (2007)	Agarwal S et al. (2008)	Rehder KJ et al. (2012)	Ainsworth CR et al. (2013)	Meurling L et al. (2013)	Panesar RS et al. (2014)	Justice LB et al. (2016)
Evaluator1	0.65	0.90	0.80	0.68	0.85	1.00	0.82	0.68	0.82	0.70	0.60
Evaluator2	0.65	0.82	0.80	0.68	0.85	1.00	0.82	0.68	0.86	0.70	0.60

Table 2
Summary of reviewed studies.

Authors	Country	Design	Setting and sample	Interventions	Outcome measures/statistical significance	Result
(1) Pronovost P et al. [31] 2003	United States	Prospective cohort study	A 16-bed surgical ICU, academic hospital Physicians: 6 Nurse practitioners: 3	Daily goal form: Tasks to be completed, care plan, and communication plan (discussions with patient/family or other caregivers) Duration: 1 year	1. Understanding of patient goals 2. ICU LOS	1. During the first 2 weeks, less than 10% of residents and nurses understood the daily goals of therapy and the daily tasks. After 6 weeks the percentage of residents and nurses who understood the daily goals increased to over 95% 2. ICU LOS decreased significantly from a mean of 2.2 days−1.1 days
(2) Boyle DK and Kochinda C [30] 2004	Japan	Pre−post study design	1. Highly specialized 4-bed unit, state-owned academic medical center 2. 22-bed medical −surgical ICU, church-affiliated hospital Physician leaders: 3 Nurse leaders: 7	Team training Training for 6 modules: leadership, trust, helping others adapt to change, guiding conflict resolution, core skills for communication, core skills for teams (team culture, team communication, and team coordination) Duration: 6 months	1. Leader group measures: Collaborative communication simulation vignette; leader self-report of collaborative communication 2. Unit staff measures: ICU nurse−physician questionnaire (nurse leadership, physician leadership, openness between groups, problem solving between groups, and satisfaction with communication) 3. Attendance at and usefulness of the collaborative communication intervention	1. Nurse and physician leaders' communication skills improved: Collaborative communication simulation vignette scores increased, leader self-report of collaborative communication scores increased 2. Staff's perception of communication improved but not significantly; perception of problem solving between groups, nurse leadership, and physician leadership improved significantly 3. Mean attendance was 20.5 h of 23.5 total hours of the intervention. Attendance rate for each leader was above 91%; Participants rated the usefulness of the modules above 4 of 5 total score
(3) Sluiter JK et al. [35] 2005	Netherlands	Prospective repeated measurement design	PICU, university-affiliated medical center 61 staff members (physicians, nurses, department assistants)	Multidisciplinary structured work shift evaluation: 30 min at the end of day shift, evaluate how well the working day went and what had happened during work Duration: 6 months	1. Level of team communication: a subscale in the test battery "Experience and Assessment of Work" to assess their satisfaction regarding communications with colleagues within their discipline and those in other disciplines 2. Staff health: "Need for Recovery after working time scale" to assess work-related fatigue; subscale of "Maslach Burnout Inventory" to assess emotional exhaustion 3. Quality and process of the intervention: (a) staff attendance, (b) planned time span, (c) type of interaction between the shift evaluation leader and team members, (d) subjects of evaluation, and (e) shift evaluation leader's satisfaction.	1. 38% of the staff reported seeing their colleagues' skills improve at communicating with them; 62% of the PICU staff reported the intervention had a positive effect on the perceived level of team communication 2. Communication satisfaction with colleagues improved from 76% to 92% 3. Work-related fatigue dropped; mean level of problems with emotional exhaustion decreased significantly
(4) Narasimhan M et al. [33] 2006	United States	Pre−post study design	A 16-bed medical ICU, medical center Physicians: 8 Nurses: 8 Fellow: 1	Daily goal worksheet: Take Pronovost's as a model Tests or procedures, medications, sedation, analgesia, catheters, consultations, nutrition, mobilization, family discussions, consents, and transfer Duration: 9 months	1. Understanding of the goals 2. Physicians' (nurses') satisfaction of communication with their partners 3. LOS 4. Desire to use the worksheet	1. Understanding of the goals improved 2. Physicians and nurses both reported significant improvement in communication with each other. (Communication scores remained high 9 months after the worksheet was implemented) 3. Mean LOS in the ICU declined 4. Nurses were more likely to want to continue to use the sheet, whereas physicians were less likely to want to continue
(5) Phipps LM and Thomas NJ [34] 2007	United States	Pre−post study design	A 12-bed medical −surgical PICU Nurses: first survey 40 second survey 42	Daily goal sheet: Take Pronovost's as a model Safety risk and main goal, pain and sedation, respiratory, cardiac, GI, nutrition, electrolytes, hematology, tests or procedures, medications, discharge planning Duration: 1 year	Nurses' perception of team communication using a self-design four-item survey	1. 85% of nurses reported the daily goals sheet led to improved communication between physicians and nurses in the PICU 2. A positive influence on all questions related to communication

(6) Agarwal S et al. [36] 2008	United States	Pre—post study design	A 12-bed PICU, children's hospital Physicians: 59 Nurses: 68 Fellows: 5	Daily patient goal sheet: Take Pronovost's as a model Fluid, nutrition, cardiac, respiratory, hematology, infectious disease, endocrine, neurologic, studies for today, consults, tests, risk, discharge plan, catheters, family communication Duration: 4 months	1. Understanding of patient care goals for the day 2. PICU LOS 3. The comfort in explaining patient care goals. 4. The number of goals that subjects were able to list for each patient under their care. 5. The helpfulness of the goal sheets 6. Nurses' knowledge of the attending physician and fellow responsible for the patient during their shift	1. Both nurses and physicians showed improved understanding of patient care and became comfortable in their ability to explain patient care goals to parents and to list more patient care goals 2. Nonsignificant reduction trend in LOS 3. Nurses' identification of PICU attending physicians and fellows improved significantly
(7) Rehder KJ et al. [38] 2012	United States	Prospective cohort study	PICU, tertiary hospital	1. A new resident daily progress note format: 1 month 2. A performance improvement dashboard: 1 month 3. Use of a bedside whiteboard to document daily goals: 1 month	1. Shared goal agreement. 2. Prevalence of communication barriers and facilitators during rounds. 3. Assessment of team culture and satisfaction with rounds	1. Overall and each provider group's mean score on team agreement increased with each intervention. 2. Multiple barriers to communication were reduced and the use of communication facilities increased. 3. Providers' satisfaction increased
(8) Ainsworth CR et al. [37] 2013	United States	Pre—post study design	A 20-bed surgical ICU, academic military medical center	Door communication card: Major goals for the patient and the priority of the goals The cards were placed on patients' doors Duration: 1 month	Alignment rates of goals between healthcare team members	Goal alignment among healthcare team members was low before and did not improve after intervention
(9) Meurling L et al. [32] 2013	Sweden	Pre—post study design	A general ICU, tertiary hospital Physicians: 51 Nurses: 75 Nurse assistants: 25	Systematic simulation-based team training: Safe teamwork during times of stress, in which the main learning objectives were knowledge and understanding of safety in complex organizations Duration: 2 year project period	1. Self-efficacy 2. Safety attitudes questionnaire 3. Experienced quality of collaboration and communication between professionals 4. Staff turnover and sick leave	1. Nurses' and physicians' mean self-efficacy scores improved 2. Nurse assistants' perception of the SAQ as well as nurses' perception of safety climate were more positive after the project 3. Nurse assistants' perceived quality of collaboration and communication with physician specialists improved 4. Nurses quitting their job and nurse assistants' time on sick leave were reduced
(10) Panesar RS et al. [42] 2014	United States	Pre—post study design	A 12-bed PICU, tertiary hospital	Electronic SBAR documentation template Duration: -	1. Frequency of documentation 2. Completeness of documentation 3. Multidisciplinary communication: notification of the nurse and attending physician	1. Completeness of documentation improved 2. Multidisciplinary communication: notification of the nurse and attending physician improved
(11) Justice LB et al. [41] 2016	United States	Pre—post study design	A 25-bed cardiac ICU, academic freestanding pediatric hospital	Visual display of patient daily goals through a write-down and read-back process Duration: 3 months	1. Agreement for patient goals 2. Family survey for their satisfaction of whether the team was working together to accomplish the stated goals	1. The percentage of agreement improved from 62% to 87.6% 2. Family survey results improved from a mean score of 4.6—5.7

3.1.3. Multidisciplinary structured work shift evaluation

Using a quantitative study design, Sluiter et al. [35] conducted a multidisciplinary structured work shift evaluation program in a tertiary pediatric ICU. All staff members received training before the implementation, and eight staff members were trained to act as shift evaluation leaders. Multidisciplinary structured work shift evaluation was implemented on two predetermined days per week at the last 30 min of the day shift. All staff members working on that shift gathered and evaluated the events of the working day and how well they went. The study revealed that implementation of multidisciplinary shift evaluations had a positive effect on the perceived level of team communication and mean amount of problems relating to emotional exhaustion decreased significantly.

3.1.4. Electronic SBAR documentation template

SBAR is an abbreviation for situation–background–assessment–recommendation. Situation refers to the current condition of the patient and working diagnosis. Background refers to the history of presenting illness, past medical history, and patient medication. Assessment refers to the examiner's evaluation and assessment of the disease or condition. Recommendation refers to the plan of care and anticipated changes in condition or treatment [42]. Panesar et al. [42] implemented an electronic SBAR documentation template for organizing information in a clear and concise format in the electronic medical record system. The effectiveness of the program was evaluated by the frequency and completeness of documentation and the documentation of attending physician and bedside nurse notification. The increase in frequency of documentation was not statistically significant, but the completeness of documentation and notification of the nurses and attending physicians improved.

3.2. Evaluation of interventions

Evaluation of interventions across these studies was categorized into efficacy and feasibility. Efficacy evaluation consisted of patient and staff outcomes. The most commonly used patient outcome identified in this review was LOS (3/11, 27.3%) [31,36,40]. The most common staff outcome was the understanding of daily patient goals (6/11, 54.5%); however, measurement varied considerably across the studies. Three studies [31,36,40] used self-designed surveys to compare the pre–post scores of goal understanding for nurses or physicians. Three studies [37,38,41] used a relatively objective method through questionnaires to evaluate goal alignment between nurses and physicians pre- and post-intervention. Another major staff outcome measure was communication quality experienced and scored by staff (4/11, 36.4%) [30,32,39,40]. Other staff outcome measures included self-reported communication skills, staff satisfaction, self-efficacy, job stress, and intention to leave. Only three (3/11, 27.3%) studies reported feasibility of intervention [30,39,40]. Staff attendance, planned time span, usefulness experienced by staff, staff's desire to use the intervention, and leaders' satisfaction were used as feasibility evidence for these interventions.

4. Discussion

Considerable variation in strategies to improve communication was observed, making comparison among findings difficult; therefore, this review did not find an intervention that is highly effective for improving nurse–physician communication. However, majority of the reviewed studies strongly supported the implementation of strategies to improve nurse–physician communication. These strategies included four categories: communication tools/checklists, team training, multidisciplinary structured work shift evaluation, and electronic SBAR documentation template.

Communication is defined as the verbal and nonverbal exchange of ideas, feelings, beliefs, and attitudes that enable a common understanding between the sender and receiver of a message. These communication tools (daily goal sheet, bedside whiteboard, or door communication card) are designed to share information to achieve collaboration and may use the same mechanism. As types of common reference points about goals [2], concerns, and plans for ICU patients, these tools allow nurses and physicians to be aware of and have access to the information about the same patients effectively and to improve communication between the staff professional groups [43].

A daily goal sheet could help the exchange of ideas and information; however, team training may improve communication and foster a collaborative working environment. ICU outcomes depend on the ability of the individual staff to function collectively as a team, because quality and safety of patient care require high-functioning multidisciplinary teams. A team can efficiently realize its shared goals if the team members have relevant teamwork skills. Nevertheless, staff in healthcare settings are rarely trained to work as teams in current education systems [1,44]. Traditional training for health professionals has focused on technical ability and individual competence in patient care. Individuals are assumed to acquire adequate competency in teamwork [45]. Team training involves behaviors that professionals must acquire to function effectively as part of an interdependent team [46] and may improve trust, thereby improving conflict resolution and communication skills.

Multidisciplinary structured work shift evaluation could provide open communication opportunities for the healthcare team and simultaneously foster a collaborative working environment by cultivating an atmosphere for staff to talk freely about emotional events, teamwork, work roles, and organizational aspects in predefined models [39]. This method may help team members have improved understanding of each member's roles and responsibilities and respect each other. Moreover, this method may provide ways for collaborative problem solving and learning among the interdisciplinary team [47]. Ultimately, communication among team members would improve.

For communication to be effective, it must be complete (including all relevant information), clear (in a manner that is easily understood), brief (given in a concise manner), and timely (offered within an appropriate time frame for effective clinical actions) [48,49]. The SBAR tool was designed as a documentation template for organizing information in a clear and concise format within the electronic medical record system. This tool provides a data entry structure that prompts the resident to document each of the four components of SBAR and serves as a reminder to the resident to provide detailed and complete records of the changes in the patient's condition accurately. An additional data field is included in the SBAR template to document the nurse caring for the patient, to prompt closed-loop communication among the residents and the bedside nurse in the electronic medical record system [42]. SBAR could also be used as a communication model. After formal patient assessment to establish the situation and background, nurses give recommendations to the physicians using the SBAR model. When nurses structure their communication following this model, physicians may obtain improved understanding of the situation, prioritize effectively, give effective orders, and make correct decisions [50], and vice versa. The SBAR communication model has demonstrated its positive influence on the effectiveness of communication

in general wards [50,51].

Evaluation of interventions generally includes both efficacy and feasibility [52]. This review found that outcome measures for intervention efficacy varied considerably, especially the staff outcomes. Understanding daily patient goals has been widely used to reflect the effectiveness of nurse–physician communication in the ICU. However, no standard method exists to evaluate understanding of daily patient goals. Additionally, no specific instrument or measurement has been presented for the communication between nurses and physicians. Communication quality is scored by staff using various self-designed items. Therefore, comparing the intervention efficacy among studies was difficult. Outcome measures for intervention feasibility need to be focused on, because only a small part of studies reported feasibility of intervention [30,39,40].

5. Limitations

Results of this review provide improved understanding on strategies used for improving the communication between ICU nurses and physicians; however, some limitations should be considered. First, relevant studies may have been missed because we only included papers published in English. Second, none of these studies were randomized controlled trials (RCTs) and all of them used convenience nonprobability sampling. None of the studies included a sample that was both randomly selected and representative of the studies' local/national contexts. Third, the majority of included studies were single site, which potentially affected the generalizability of findings beyond the samples. Finally, the lack of consistency in study design complicated the comparison among studies. Moreover, outcome measures varied considerably and did not have specific instruments or measurements for communication between nurses and physicians.

6. Implications for future research

Multiple strategies are needed to improve communication between nurses and physicians to ensure best possible patient outcomes. The daily goal sheet is the most commonly used intervention in the ICU with positive effects. Our findings indicated that although various interventions are effective in improving communication in ICU populations, the intervention strategy that is most effective remains unclear. Rigorously designed intervention studies using RCTs are required, with increased sample sizes with sufficient power to detect group mean differences, sampling plans that allow recruitment of large-enough sample sizes, and strategies to minimize attrition. Development of instruments that precisely capture and reflect the impact of good communication will facilitate the accurate evaluation of communication-related interventions and decrease outcome measure variation. Moreover, intervention feasibility should be considered.

7. Conclusion

This integrative review uniquely contributes to current knowledge of the strategies used to improve nurse–physician communication in the ICU, which includes communication tools (daily goal sheet or form, bedside whiteboard, and door communication card), team training, multidisciplinary structured work shift evaluation, and electronic SBAR documentation template. The heterogeneity of study designs and outcome measures prevented the meta-analytic approach; therefore, this review did not find an intervention that is most effective for improving nurse–physician communication. However, results suggested that these strategies improve communication to some extent. Future rigorously designed studies are needed to investigate the effectiveness of the strategies.

Conflict of interest

No conflict of interest has been declared by the authors.

Appendix A. Checklist for assessing the quality of quantitative studies

Question	Criteria	Yes (2)	Partial (1)	No (0)	N/A
1	Question/objective sufficiently described?				
2	Study design evident and appropriate?				
3	Method of subject/comparison group selection or source of information/input variables described and appropriate?				
4	Subject (and comparison group, if applicable) characteristics sufficiently described?				
5	If interventional and random allocation was possible, was it described?				
6	If interventional and blinding of investigators was possible, was it reported?				
7	If interventional and blinding of subjects was possible, was it reported?				
8	Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias? means of assessment reported?				
9	Sample size appropriate?				
10	Analytic methods described/justified and appropriate?				
11	Some estimate of variance is reported for the main results?				
12	Controlled for confounding?				
13	Results reported in sufficient detail?				
14	Conclusions supported by the results				

Appendix A displays checklist for assessing the quality of quantitative studies from Kmet et al. [26].

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