

MULTIMEDIA-BASED PRESENTATIONS VERSUS DIDACTIC SESSIONS FOR PICC MANAGEMENT COMPREHENSION IMPROVEMENT IN CANCER PATIENTS: A META-ANALYSIS

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ABSTRACT

Background: It has always been a controversial issue to meet the educational needs of cancer patients living in peripherally inserted central catheter (PICC) by traditional didactic approach. In recent years, some scholars have proposed multimedia-based teaching approaches. However, the potential effectiveness of these approaches is still not reliable in the literature. **Objective:** This study evaluated the efficacy of multimedia-based presentations on improving the comprehension of PICC management in cancer patients. This study evaluated the efficacy of multimedia-based presentations on improving the comprehension of PICC management in cancer patients. **Methods:** Systematic searches of the PubMed, Cochrane Library, Embase Ovid, Medline, BioMed Central-cancer (BMC-cancer), ScienceDirect and Google Scholar databases without date constraints till May 31, 2020 were performed. The methodological quality of the eligible studies was appraised by using the Cochrane risk of bias tools. Meta-analysis methods were used to synthesize study results. **Results:** A total of 4 intervention studies met the inclusion criteria, including three randomized controlled trials and a quasi-experimental study. All studies included 314 subjects, including 151 in the multimedia group and 163 in the control group. The findings demonstrated that the overall comprehension score of the multimedia group was significantly improved after the intervention compared with the baseline data. However, compared with face-to-face interviews or face-to-face interviews plus brochures, multimedia-based presentations had no superiority in improving patients' comprehension. **Conclusion:** The findings suggest that multimedia-based presentations can be used as an alternative to face-face interviews or face-face interviews plus brochures to educate cancer patients about PICC management.

INTRODUCTION

Background

Peripherally inserted central catheter (PICC) is still the preferred vascular access device for long-term infusion therapy in cancer patients at home.^[1-3] PICC is a vascular access device that is inserted into the superficial or deep veins of the upper or lower extremities and advances the distal third of the superior vena cava or the proximal third of the inferior vena cava.^[1,2] They are commonly used in cancer patients, especially those requiring long-term infusion therapy.^[2] The catheters are reputable of greater safety for infusion of vesicant/irritant and hyperosmolar solutions, reduced risk of infection, cost-effective and reliability than centrally inserted venous catheters (CIVC).^[1] During treatment, a patient can live at home with a catheter for weeks to months.^[4,5] In order to maximize the clinical benefits of the services, PICC

management education for each patient before catheterization is vital.^[6-8]

Living with PICC is not only a stressful event, but it also increases the risk of catheter-related complications. Therefore, catheter management education should be carried out to improve patients' adaptation and catheter retention. Patients are taught how to flush the catheter, when to change the dressing, when to clean the catheter, how to identify signs and symptoms of catheter-related complications, identify high-risk behaviors, and check if the catheter is inserted correctly.^[9,10] Previous studies have shown that catheter management education before catheterization plays an important role not only in preventing catheter-related complications, but also in improving catheter retention.^[6-8,11] However, the main challenge remains is the lack of educational approach that could effectively meet the educational needs of

patients. The traditional didactic approach, commonly used in clinical settings around the world, is considered ineffective.^[1,3,12-16] Patients complain that they get too little or too much information, which is unhelpful, scary, technical and hard to understand.^[12-14,16,17] Patients whose educational needs are not met become distressed, dissatisfied with the care provided, and have a diminished quality of life.^[18-22] Sometimes they demand the catheter to be removed immediately after insertion.^[15] In addition, other studies have found an increased incidence of catheter-related complications, including infection, catheter obstruction, thrombosis, and catheter displacement.^[23] This situation is likely because the educational approach commonly used relies on patients passively acquiring knowledge through didactic sessions and brochures, whereas most patients actively request to learn at their own pace and view pictures related to the information presented. Patients, especially those diagnosed with cancer, are often intellectually challenged by the diagnosis of the disease and pay little attention to the verbal information provided by medical staff. Therefore, adopting flexible learning approaches, such as multimedia-based education approach, can help patients to resume learning more frequently when they are in a good mood.

Technological innovation is not behind in responding to the education challenges of patients, especially patients with PICC.^[3,6,9,11,23] It is known for its flexibility in learning and opportunities for repetition. In recent years, some centers have experimented with technological innovations in the form of multimedia (such as text, audio, images, animation, video, and voiceover interactive PowerPoint) to educate patients.^[9-11,24] However, the efficacy of multimedia-based educational approach remain unclear. According to our understanding, the existing knowledge in the literature is bipolar, which confuses clinicians in choosing effective approach to meet patients' educational needs.^[9-11,25] Again, none was found of the systematic review and/or meta-analysis study that could synthesize the existing evidence.

Objective

The main objective of this study was to evaluate the efficacy of multimedia-based presentations on improving the comprehension of PICC management in cancer patients.

METHOD

Design

The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.^[26] A detailed protocol for the study was formulated prior to data collection.

Search strategy and selection criteria

The search strategy was conducted using MeSH key terms and their respective original words. Search

((("Patient Education as Topic"[Majr] OR "Patient Education" OR "Health Education"[Majr] OR "Health Education")) AND ("Catheterization, Peripheral"[Majr] OR "Peripherally Inserted Central Catheter" OR "PICC")). Electronic databases such as PubMed, Cochrane Library, Embase Ovid, Medline, BioMed Central-cancer (BMC-cancer), ScienceDirect and Google Scholar were searched without date constraints till May 31, 2020. The review was limited to published English written articles. Additional sources were identified by hand-searching reference lists of relevant study, using Google search. Two independent researchers conducted the search in accordance with the set criteria.

Studies were included based on the set inclusion criteria. (a) An interventional study with two or more comparative groups. (b) Involved subjects prescribed for or already installed with PICC (c) The educational approaches (interventions) employed are either didactic sessions (face-face interview with or without brochure) as a standard (control) or supplemented with multimedia either text, audio, image, animation, video or voiceover interactive PowerPoint (VOIPP) for the test group. (d) The study reports the outcome as either understanding, knowledge, or comprehension. Studies were excluded based on (a) included subjects aged <18 years (children), (b) unclear design or educational interventions, (c) subjects received interventions of similar kind prior the study or different interventions during follow up period. (d) Included critically ill patients. (See Table S1, Supplemental Content, which illustrates PubMed search results summary).

Quality appraisal

Cochrane risk assessment tools; for randomized controlled trials,^[27] and non-randomized studies (ROBIN-1),^[28] used to assess the risk of bias in individual studies. In RCTs, the risk of bias was judged to be low risk, high risk or unclear risk in each of the six aspects; random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), risk of attrition and reporting bias, and any other sources of bias.

In the non-randomized studies, the risk of bias in each study was judged to be low risk, moderate risk, serious risk, critical risk or no information in each of the seven aspects; bias due to confounding, bias in selection of participants into the study, bias in classification of interventions, bias due to deviations from intended interventions, bias due to missing data, bias in measurement of outcomes, and bias in selection of the reported results. Two independent evaluators assessed the methodological quality of each study. If the results conflict, a third evaluator was included. The strength of evidence was rated by using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) software.^[29]

Data abstraction and synthesis

Data were extracted by two independent data collectors as followed by a discussion of the conflicting results. Information pertaining to author name (s), year, country, study aim/outcomes, design, intervention type, sample size, and key findings in each study were extracted. The meta-analysis was used to synthesize the collected data, and the random effects model was chosen due to unexplained heterogeneity.

RESULTS

Search results

A search turned up 2,923 studies; PubMed (222), Cochrane Library (10), Embase Ovid (23), Medline (10),

BMC-Cancer (1), ScienceDirect (281), and Google Scholar (2374). The other two studies come from the Google search engine. After removing duplicates and screening, nine studies were considered potentially eligible.^[6,7,9,11,17,24,25,30] After further evaluation, four studies finally met our inclusion criteria.^[10,11,24,25] Three studies were excluded because of unclear educational interventions,^[6,7,10] and the others is unrelated design.^[17,30] Two studies came from the United States.^[11,25] others from Canada.^[24] and Italy.^[10] In addition, three studies are RCTs.^[10,11,24] and the other is Quasi-experimental/case-control studies.^[25] (Figure 1 shows the PRISMA flow chart for screening and selecting studies).

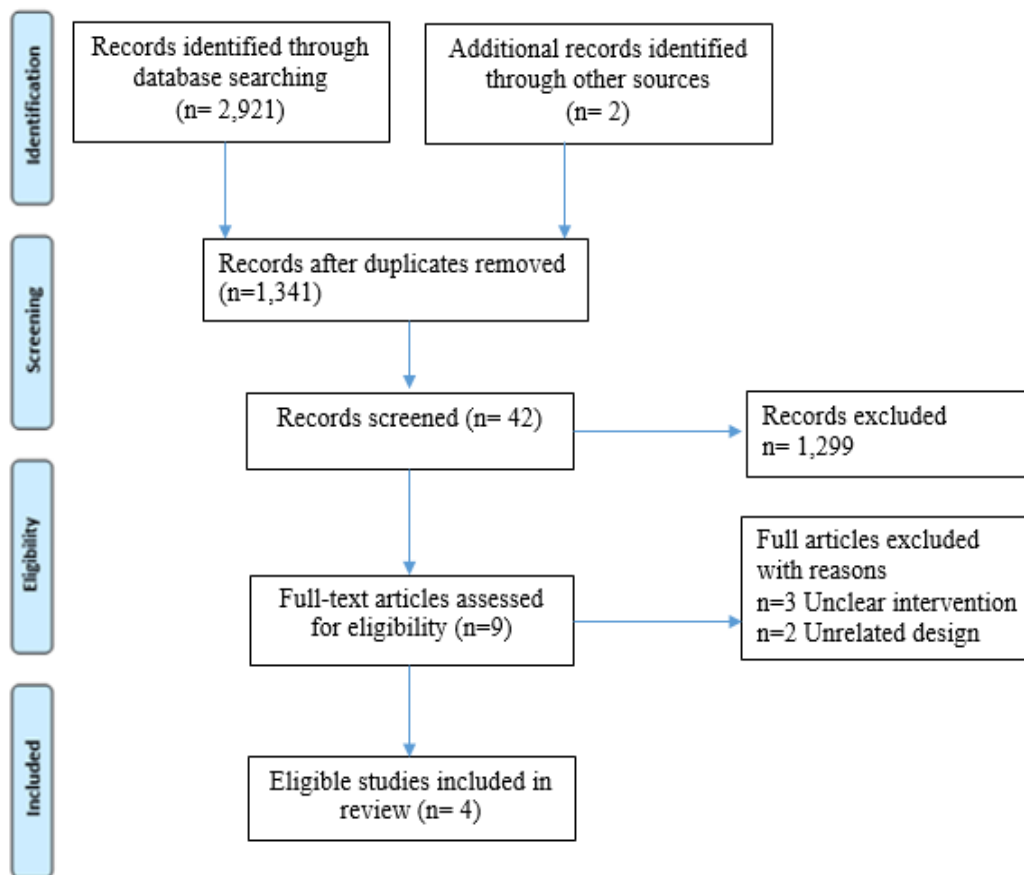


Figure 1: PRISMA flow chart showing the screening and selection of studies.

Study Characteristics

The main characteristics of the 4 eligible studies are shown in Table 1. These studies included a total of 314 subjects, including 151 (48.1%) in the multimedia group. The number of subjects in each study ranged from 27.^[10] to 130.^[25] Follow-up for each study ranged from one to ten days. Different types of multimedia were used across the studies. Two of the studies used multimedia in the form of video.^[10,24,25] and the other used Voiceover Interactive PowerPoint (VOIPP).^[11] Eligible studies reported outcome as patient understanding^[24] and patient knowledge.^[10,11,25] For the purposes of the current review, the terms "patient understanding" and "patient

knowledge" are merged into "patient comprehension". All the eligible studies employed questionnaires to measure the outcomes.

Table 1: Eligible study characteristics.

| Reference and country | Outcomes | Design | Multimedia Group | | Control Group | | Follow-up (day) | Evaluation tool |
|-----------------------|------------------|--------------------------|------------------|-------|---------------|-----------------------------------|-----------------|-----------------|
| | | | n | Type | n | Type | | |
| 10 ITALY | Knowledge | Single-centre RCT | 13 | Video | 14 | Face-face interview | 1 | Questionnaire |
| | | | | | 13 | Face-face interview plus brochure | | |
| 11 USA | Knowledge | RCT | 24 | VOIPP | 27 | Face-face interview plus brochure | 7-10 | Questionnaire |
| 24 CANADA | Understanding | RCT | 49 | Video | 44 | Face-face interview | 1 | Questionnaire |
| 25 USA | Knowledge recall | Quasi-experimental study | 65 | video | 65 | Face-face interview | 1-2 | Questionnaire |

n=sample size, PICC=Peripherally inserted central catheter, RCT=Randomized-controlled trial, VOIPP= Voiceover Interactive PowerPoint.

Methodological quality of eligible studies

In the three RCTs, the risk of random sequence generation (selection bias) was considered low in two studies.^[10,24] and unclear in one.^[11] Only one study,^[24] involved allocation concealment (selection bias), and the risk of bias due to the blinding of participants and personnel (performance bias) was not known in all of the studies. Blinding of outcome assessment (detection bias) was considered high-risk in two studies.^[10,11] while the other study was unclear. All studies had a low risk of attrition and reporting bias. Other sources of bias were

also considered low-risk in all studies. (Figure 2 shows Risk of bias summary for RCTs).

In non-randomized study, there was a moderate risk of bias due to confounding and participant selection, and a low risk bias in the classification of interventions, missing data, measurement of outcomes, and selection of reported outcomes.^[25] The overall risk of bias was considered moderate in the study.^[25] (Table 2 shows Risk of bias summary for non-RCTs).

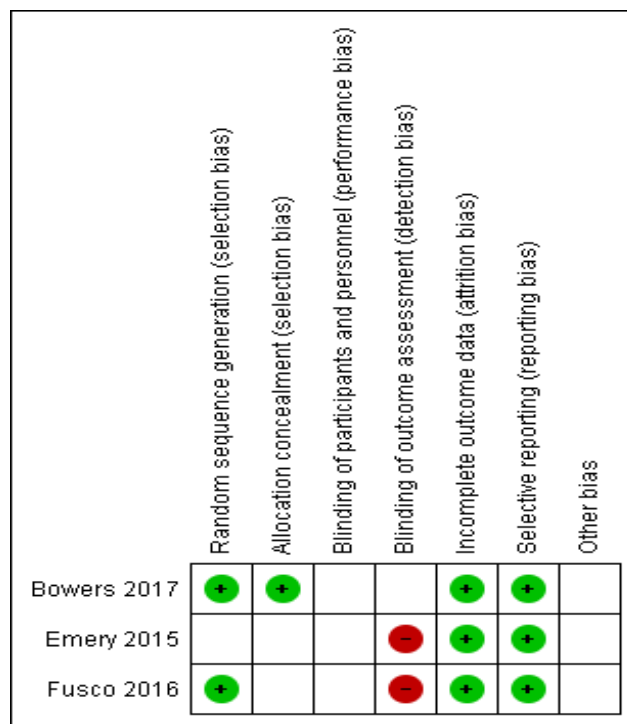


Figure 2: Risk of bias summary for RCTs.

Table 2: Risk of bias summary for non-RCTs.

| Study | Bias due to confounding | Bias in selection of participants | Bias in classification of intervention | Bias due to missing data | Bias in measurement of outcome | Bias in selection of the reported results | Overall results |
|------------|-------------------------|-----------------------------------|--|--------------------------|--------------------------------|---|-----------------|
| Sowan 2018 | moderate | moderate | low | low | low | low | moderate |

Results of meta-analysis

Three comparisons were performed in our review: multimedia-based presentations versus no interventions, multimedia-based presentations versus face-face interviews, and multimedia-based presentations versus face-face interviews plus brochure.

cancer patients both immediately post-intervention and after 7-10 days post-intervention compared with the control group (no intervention) (Figure 3; IV 11.64[95%CI, 1.89, 21.40]; $P= 0.02$). Utilizing the GRADE tool, this evidence was considered of moderate quality (see Table S2, Supplemental Content, which illustrates the quality of this outcome and the strength of the evidence).

Multimedia-based presentations versus no intervention

The use of multimedia-based presentations significantly improved the comprehension of PICC management in

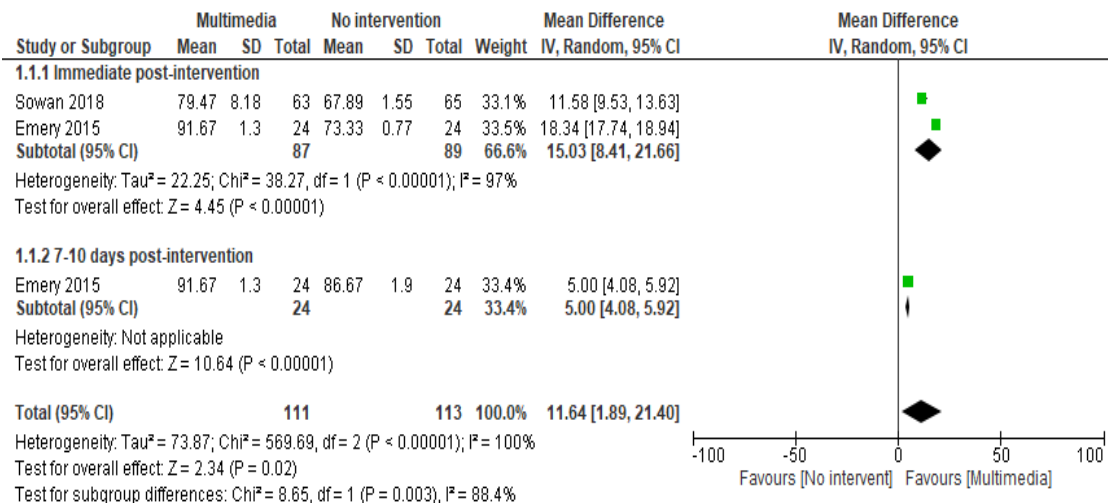


Figure 3: Forest plot of comparing multimedia-based presentations versus no interventions on the patients' comprehension score of PICC management. SD=standard deviation, IV=weighted mean difference, CI=confidence interval, df=degrees of freedom, Chi2=chi-square statistic, p=p value, I²=I-square heterogeneity statistic, Z=Z statistic.

Multimedia-based presentations versus face-face interviews

Compared with face-to-face interview, multimedia-based presentation has no superiority in improving patients' comprehension of PICC management in both informative and non-informative video formats (Figure 4; IV 7.25 [95%CI, -13.51-21.04]; $P= 0.44$). Utilizing the GRADE tool, this evidence was considered of very low quality (see Table S3, Supplemental Content, which illustrates the quality of this outcome and the strength of the evidence).

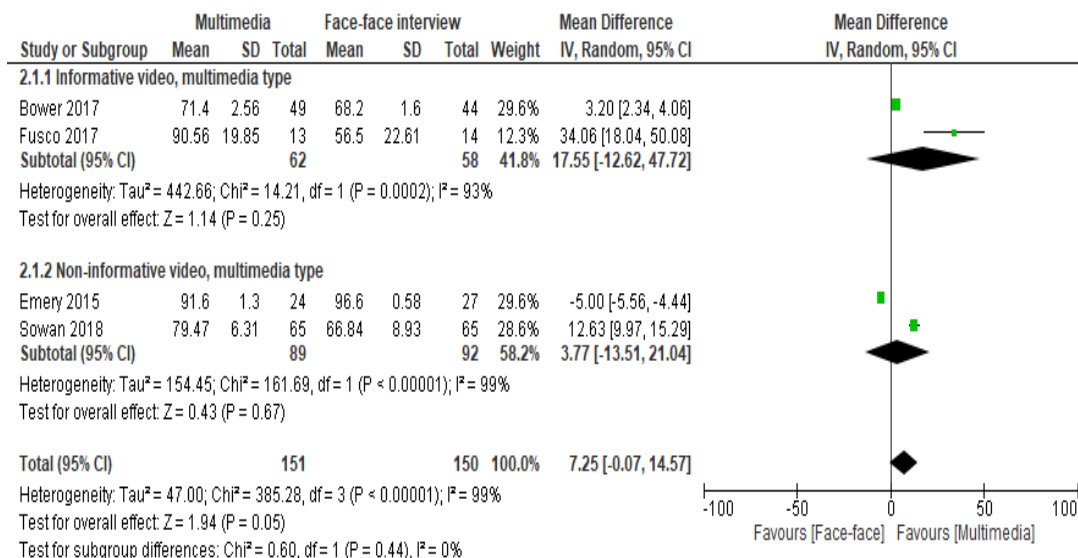


Figure 4: Forest plot of comparing multimedia-based presentations versus face-face interviews on the patients' comprehension score of PICC management. SD=standard deviation, IV=weighted mean difference, CI=confidence interval, df=degrees of freedom, Chi2=chi-square statistic, p=p value, I²=I-square heterogeneity statistic, Z=Z statistic.

Multimedia-based presentations versus face-face interviews plus brochures

When compared with face-face interview plus brochure, multimedia failed to demonstrate superiority in improving PICC management comprehension scores (Figure 5, IV -4.02 [95%CI, -8.95-0.90]); P= 0.11). Surprisingly, compared with face-to-face interviews plus

brochures, the informative video multimedia format significantly improved the comprehension of cancer patients on the management of PICC (IV -5.00[95%CI, -5.56-(-4.44)]; P<0.01). Utilizing the GRADE tool, this evidence was considered of moderate quality (see Table S4, Supplemental Content, which illustrates the quality of this outcome and the strength of the evidence).

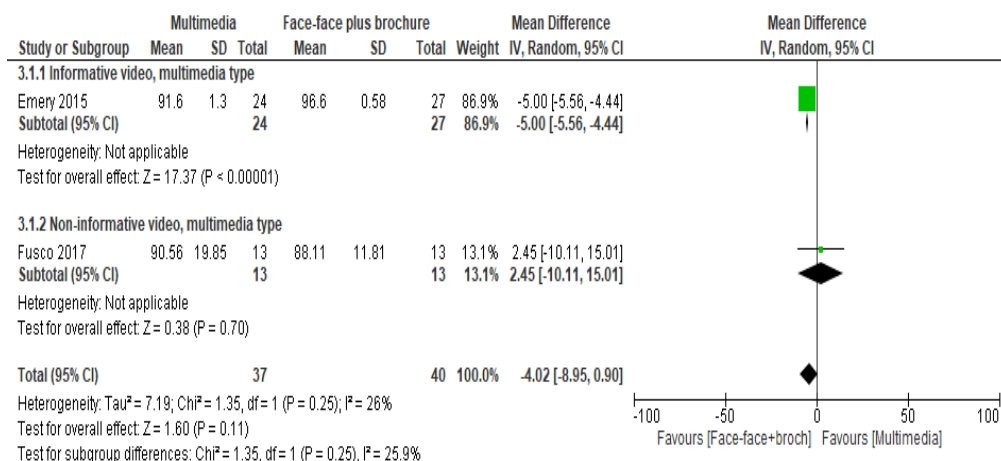


Figure 5: Forest plot of comparing multimedia-based presentations versus face-face interviews plus brochures on the patients' comprehension score of PICC management. SD=standard deviation, IV=weighted mean difference, CI=confidence interval, df=degrees of freedom, Chi2=chi-square statistic, p=p value, I²=I-square heterogeneity statistic, Z=Z statistic.

Table S1: PubMed search results summary.

| S/N | Key word/MeSH term | Search Results |
|-----|--|----------------|
| A | "Patient Education"[Majr] | 39,273 |
| B | "Patient Education" | 100,645 |
| C | "Health Education"[Majr] | 142,662 |
| D | "Health Education" | 704,804 |
| E | "A" OR "B" OR "C" | 713,212 |
| F | "Catheterization, Peripheral"[Majr] | 7,985 |
| G | "Peripherally Inserted Central Catheter" | 2,301 |

| | | |
|---|-------------------|-------|
| H | “PICC” | 1,209 |
| I | “F” OR “G” OR “H” | 9,613 |
| J | “E” AND “I” | 222 |

Table S2: Multimedia-based presentations versus no intervention on Cancer patients’ comprehension of PICC management.

| <p>Patient or population: Cancer patients living with PICC Settings: Oncology settings Intervention: Multimedia-based presentations Comparison: No intervention</p> | | | | | | |
|--|---|--|--------------------------|------------------------------|---------------------------------|----------|
| Outcomes | Illustrative comparative risks* (95% CI) | | Relative effect (95% CI) | No of Participants (studies) | Quality of the evidence (GRADE) | Comments |
| | Assumed risk | Corresponding risk | | | | |
| | Didactic session | Multimedia-based presentation | | | | |
| <p>Improving Comprehension Percentage. Scale from: 0 to 100. Follow-up: mean 1-10 days</p> | The mean improving comprehension in the control groups was 77.28 % | The mean improving comprehension in the intervention groups was 11.64 higher (1.89 to 21.40 higher) | | 224 (2 studies) | ⊕⊕⊕⊖ moderate | |
| <p>*The basis for the assumed risk (e.g. the median control group risk across studies) is provided in footnotes. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). CI: Confidence interval;</p> | | | | | | |

Table S3: Multimedia-based presentations versus face-face interviews on Cancer patients’ comprehension of PICC management.

| <p>Patient or population: Cancer patients receiving PICC management education Settings: Oncology settings Intervention: Multimedia-based presentations Comparison: Face-face interviews</p> | | | | | | |
|--|---|--|--------------------------|------------------------------|---------------------------------|----------|
| Outcomes | Illustrative comparative risks* (95% CI) | | Relative effect (95% CI) | No of Participants (studies) | Quality of the evidence (GRADE) | Comments |
| | Assumed risk | Corresponding risk | | | | |
| | Face-face interviews | Multimedia-based presentations | | | | |
| <p>Improving PICC management comprehension Scale from: 0 to 100. Follow-up: 1-10 days</p> | The mean improving picc management comprehension in the control groups was 72.03 % | The mean improving picc management comprehension in the intervention groups was -7.25 higher (0.07 lower to 14.57 higher) | | 301 (4 studies) | ⊕⊖⊖⊖ very low | |
| <p>*The basis for the assumed risk (e.g. the median control group risk across studies) is provided in footnotes. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). CI: Confidence interval;</p> | | | | | | |

Table S4: Multimedia-based presentations versus face-face interviews plus brochure on Cancer patients’ comprehension of PICC management.

| | | | | | | |
|---|--|--|--|--|--|--|
| <p>Patient or population: Cancer patients receiving PICC management education Settings: Oncology settings Intervention: Multimedia-based presentations</p> | | | | | | |
|---|--|--|--|--|--|--|

| Comparison: Face-face interviews plus brochures | | | | | | |
|---|---|---|--------------------------|------------------------------|---------------------------------|----------|
| Outcomes | Illustrative comparative risks* (95% CI) | | Relative effect (95% CI) | No of Participants (studies) | Quality of the evidence (GRADE) | Comments |
| | Assumed risk | Corresponding risk | | | | |
| | Face-face interview plus brochure | Multimedia-based presentations | | | | |
| Improving PICC management comprehension Scale from: 0 to 100. Follow-up: 1-2 days | The mean improving picc management comprehension in the control groups was 92.35 % | The mean improving picc management comprehension in the intervention groups was 4.02 lower (8.95 lower to 0.90 higher) | | 77 (2 studies) | ⊕⊕⊕⊖ moderate | |
| *The basis for the assumed risk (e.g. the median control group risk across studies) is provided in footnotes. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). CI: Confidence interval; | | | | | | |

DISCUSSION

The present review evaluated the effectiveness of multimedia-based education approach in improving the comprehension of PICC management in cancer patients. The findings of this review demonstrated that the use of multimedia-based presentations could improve the comprehension of PICC management in cancer patients. However, compared with face-to-face interviews or face-to-face interviews plus brochures, multimedia-based presentations had no superiority in improving patients' comprehension of PICC management.

PICC management education to cancer patients remains a hallmark of catheter retention, patient adaptation, and catheter-related complication prevention.^[6-8,11] The education provided helps patients not only in the adaptation but also ability on how to flush the catheter, when to change the dressing, when to clean the catheter, how to identify signs and symptoms of catheter-related complications, identify high-risk behaviors, and check if the catheter is inserted correctly.^[9,10] In recent years, with the continuous advancement of Science and Technology, there has been a growing demand for multimedia-based education for PICC patients.^[9-11,24] The traditional didactic approach, commonly used in clinical settings around the world, is considered ineffective in improving comprehension of PICC management in cancer patients.^[1,3,12-16] Patients complain that they get too little or too much information, which is unhelpful, scary, technical and hard to understand.^[12-14,16,17] Although there is insufficient evidence to support this decision, other institutions have tried multimedia-based education approach to ensure that cancer patients receiving PICC devices are fully informed about catheter management.^[9-11,24]

The findings of this review demonstrated that the use of multimedia could improve the comprehension of PICC management in cancer patients after the intervention. The multimedia-group showed significant improvement

in comprehension scores immediately after intervention and 7-10 days after intervention, compared with baseline data or no intervention. However, Compared with face-to-face interviews or face-to-face interviews plus brochures, multimedia-based presentations did not show a superiority in improving patients' comprehension. In the sub-group analysis, it was further shown that neither informative video nor non-informative video multimedia format was superior to the control group (face-face interviews plus brochures) in improving the comprehension. To our own understanding, this is the first meta-analysis study evaluating the efficacy of multimedia-based presentation in improving the comprehension of PICC management in cancer patients. Since then, technological innovation has changed the way of life of human beings, which is evident that many people own digital mobile phones, computers, ipads and other portable electronic products. Therefore, the findings of this review may indicate that multimedia-based approach can be used as an alternative to the traditional didactic education approach.

Our study has its strengths and limitations. The main strength of our study include the use of a systematic approach to search for studies, the use of well-known electronic databases, comprehensive analysis of eligible study results, and extensive discussion of current study findings. However, the generalizability of current study findings is limited by several factors, including the small number of eligible studies, small sample size in some of the eligible studies, high heterogeneity across studies, and the lack of long-term follow-up studies in the similar outcome. Although the quality of evidence found according to the GRADE tool is moderate, the generalizability of the findings of this review may be limited.

CONCLUSION

In this review, the efficacy of multimedia-based education approach in improving the comprehension of

PICC management in cancer patients was evaluated. The findings demonstrated that, as with other instructional approaches, multimedia-based presentations improves cancer patients' comprehension of PICC management, but they have no superiority over face-to-face interviews or face-to-face interviews plus brochures. The findings suggest that multimedia-based presentations can be used as an alternative to face-face interviews or face-face interviews plus brochures to educate cancer patients about PICC management. Further review, including original studies of high methodological quality, is needed to confirm the current findings.

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Conflict of interest

The authors have no conflicts of interest to declare.

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