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**THE ROLE OF EDUCATION USING THE TRANSTHEORETICAL STAGES OF CHANGE APPROACH IN DIGITAL SUBTRACTION ANGIOGRAPHY PATIENTS: A LITERATURE REVIEW**

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**ABSTRACT**

Effective health education is crucial to improving procedure outcomes and patient compliance. The Transtheoretical Stages of Change approach has been proven effective in changing health behaviour by tailoring interventions to the patient's psychological readiness. This literature review aims to analyse the role and effectiveness of health education integrated with the Transtheoretical Stages of Change approach in patients undergoing DSA procedures. Method: A literature review was conducted by searching electronic databases such as PubMed, Google Scholar, and ScienceDirect. The search was limited to publications from 2020 to 2025. Results: The review results indicate that the Stages of Change approach is effective in identifying patients' readiness levels. Patients in the precontemplation and contemplation stages require education to raise awareness, while patients in the preparation and action stages require practical information and support to maintain behaviour. Integration of TTM in pre-DSA education significantly reduces anxiety levels, improves compliance with pre-procedure instructions and increases patient satisfaction. Conclusion: Personalised health education using the Transtheoretical Stages of Change framework is a strategic and effective approach to preparing patients for DSA. This approach enables targeted education, thereby improving clinical outcomes and the overall patient experience.

Keywords: digital subtraction angiography; health education; knowledge; transtheoretical model; stages of change

**INTRODUCTION**

Digital Subtraction Angiography (DSA) is recognised as the gold standard in diagnosis and therapeutic intervention for various vascular diseases, including arterial stenosis, aneurysms, and arteriovenous malformations (AVMs). Although it provides highly accurate diagnostic information, this procedure is invasive and can cause significant psychological responses such as anxiety and fear in patients. This anxiety not only causes psychological discomfort but can also negatively impact physiological stability during the procedure, increasing the risk of complications and decreasing patient compliance with pre- and post-procedure instructions. DSA is a medical imaging technique that uses fluoroscopy and contrast media to clearly visualise blood vessels. As an invasive procedure, patients face various sources of stressors, including fear of pain, risk of complications (such as haematoma, contrast allergy, or stroke), uncertainty of diagnostic results, and the necessity to comply with strict instructions such as fasting and discontinuation of certain medications (Zhou et al., 2021). High anxiety can trigger autonomic responses such as tachycardia and hypertension, which can interfere with the smooth running of the procedure.

Conventional health education is often provided uniformly to all patients, without considering variations in each individual's psychological readiness, motivation, and prior knowledge. This can render the education ineffective, especially for patients who are not mentally prepared to receive

such information. The Transtheoretical Model (TTM) or Stages of Change is a behavioural change model that focuses on individual decision-making and views change as a process that occurs through six dynamic stages, namely 1) individuals have no intention of taking action in the near future. They may be unaware of or in denial about the problem (precontemplation), 2) individuals intend to change within the next six months. They recognise the benefits of change but also its obstacles (contemplation), 3) individuals intend to take action in the near future and have taken some small steps (preparation), 4) individuals have openly changed their behaviour in the last six months (action), 5) individuals are working to prevent relapse and consolidate their achievements (maintenance), and 6) individuals no longer have any temptations and are fully confident that they will not return to their old behaviour (termination). TTM was developed by Prochaska and DiClemente in the late 1970s. This model explains how individuals move through a series of stages when changing their behaviour. The main strength of this model is its ability to ‘meet patients where they are’ and provide interventions appropriate to their stage of readiness. The behaviours referred to in the context of Digital Subtraction Angiography (DSA) are mental readiness to undergo the procedure, compliance with pre-procedure instructions, and anxiety management.

This literature review aims to synthesise the latest evidence on the role of health education integrated with the application of the Transtheoretical Stages of Change approach in health education for patients undergoing DSA, as well as its impact on patients' psychological and clinical parameters

## **METHODS**

This study utilised narrative synthesis techniques with a literature review method to examine and summarise the results of research articles discussing the role of education using the Transtheoretical Stages of Change approach in patients undergoing Digital Subtraction Angiography. This literature review focused on the Transtheoretical Stages of Change approach in health education for patients undergoing Digital Subtraction Angiography (DSA). This literature review was conducted following the principles of narrative review. The literature search was conducted by searching the electronic databases PubMed, Google Scholar, and ScienceDirect published from January 2020 to May 2025. The inclusion criteria were: 1) research articles (quasi-experimental, RCT, cohort studies, case studies) and systematic reviews, 2) published in peer-reviewed journals in English or Indonesian, 3) focusing on the application of the Transtheoretical Stages of Change in health education, 5) the study population being adult patients undergoing diagnostic procedures or vascular interventions (including DSA, coronary angiography, etc.). The exclusion criteria for this literature review were articles that were not fully accessible or available in full text, and studies that did not specifically measure outcomes such as anxiety, compliance, or knowledge. The keywords used to search for articles were (‘Transtheoretical Model’ OR ‘Stages of Change’) AND (‘Digital Subtraction Angiography’ OR DSA OR angiography) AND (‘patient education’ OR ‘nursing education’) AND (anxiety OR adherence). A total of 102 articles were found in the PubMed, Google Scholar, and ScienceDirect electronic databases. These articles were then filtered according to the inclusion criteria, which can be seen in the following flow chart.

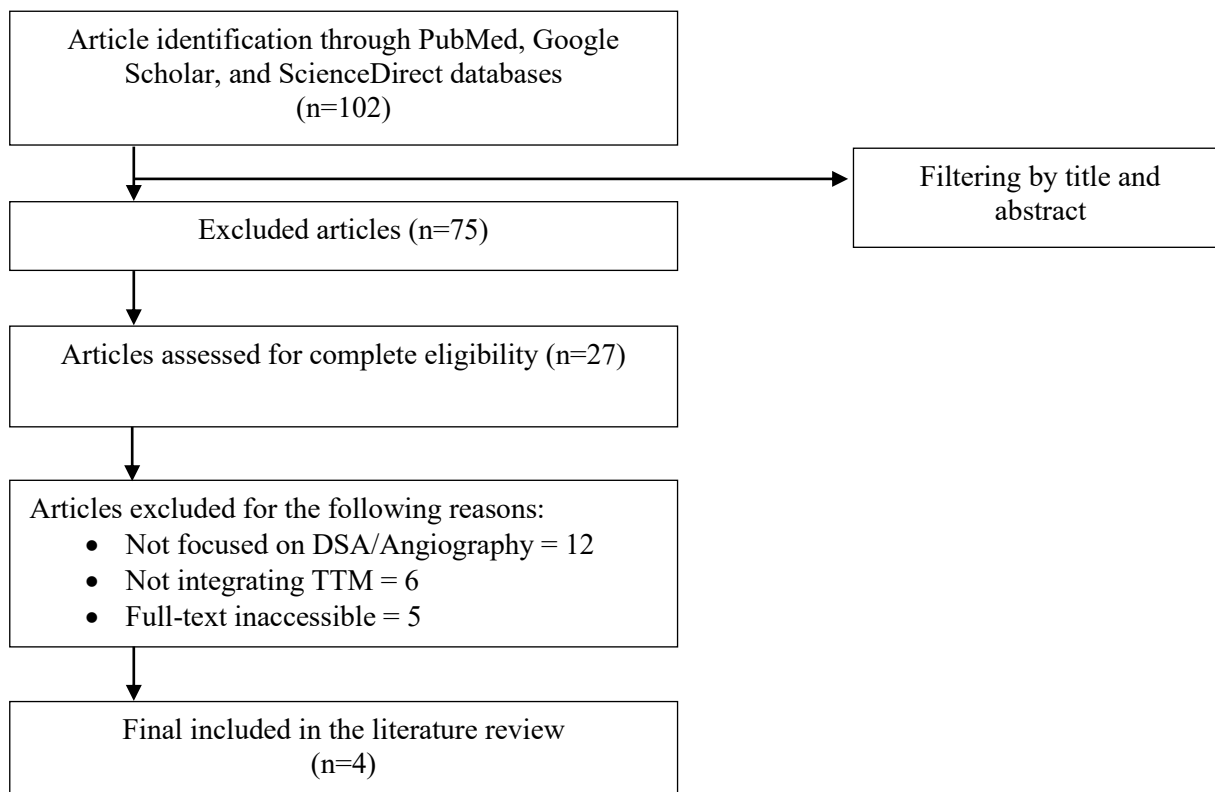


Figure 1. PRISMA Flow chart of study selection

## RESULT

Table 1.  
Literature Synthesis Results

Author	Title	Year	Study Design	Result
Sonia Josefa Fernandes, Suhariadi Atmanta, Kusmas	Prosedur Pemeriksaan Digital Subtraction Angiography (DSA) Vena Cerebral Dengan Akses Transradial Pada Kasus Venous Thrombosis (CVT)	2023	Pre-experiment	The results of the study explain that the Digital Subtraction Angiography (DSA) procedure of the cerebral veins with transradial access in cases of cerebral venous thrombosis (CVT) is a safe initial diagnostic procedure for patients with chronic diseases.
Shirin Shaban, Bella Huasen, Abilash Harida, Murray, John Wornington, Pascal Jabbour	Digital subtraction angiography in cerebrovascular disease: current practice and perspectives on diagnosis, acute treatment and prognosis	2022	Pre-experiment	The results of the study explain that DSA is used to assess cerebral vascular patency. Preclinical and clinical studies explain that there are various aspects that can be seen in cerebrovascular morphology in acute ischaemic stroke through the DSA therapy process.
Living Yang, Xing Gao, Chao Gao, Shichuan Xu, Shaodong Cao	Dynamic evaluation of unruptured intracranial aneurysms by 4D-CT angiography: comparison with digital subtraction angiography (DSA) and surgical findings	2023	Pre-experiment	The results of the study explain that 4D-CTA provides non-invasive, real-time preoperative assessment of UIA comparable to that of post-DSA patients.
Su Jin Lee, Belinda Liu, Neil Rane, Peter Mitchell, Richard Dowling, Bernard Yan	Correlation between CT angiography and digital subtraction angiography in acute ischemic strokes	2023	Pre-experiment	The results of the study indicate that CTA is sufficiently accurate in identifying large vessel occlusion in acute ischaemic stroke. We propose that current regional guidelines include CTA for all acute ischaemic strokes.

## **DISCUSSION**

### **Patient Anxiety and Knowledge Prior to DSA Procedures**

Patients undergoing DSA often experience significant levels of anxiety. A study by Chen et al. (2021) found that more than 60% of patients reported moderate to severe anxiety prior to the procedure, mainly stemming from ignorance about the procedure, fear of pain, and concerns about complications. This anxiety not only causes psychological distress but can also affect haemodynamic stability during the procedure and slow down recovery. Generic health education, without assessing patient readiness, is often ineffective in addressing the root causes of this anxiety. Research by Li et al. (2020) shows that individually tailored interventions are superior to standard education in reducing anxiety.

**The Effectiveness of the Transtheoretical Model (TTM) Approach in Health Education** TTM has been successfully applied in various health education contexts, such as chronic disease management, smoking cessation, and physical activity promotion. Its main principle is ‘process matching,’ which is matching intervention strategies to the patient's stage of change. For example, in the precontemplation stage, education focuses on raising awareness about the benefits of DSA and the risks of not doing it. In the contemplation and preparation stages, the information provided is more technical about the procedure, what to prepare, and pain management. In the action and maintenance stages, education shifts to post-DSA wound care, monitoring for signs of complications, and lifestyle modifications to prevent recurrence. A study by Wang et al. (2022) on coronary heart disease patients undergoing angiography showed that TTM-based nursing interventions significantly improved patient compliance in controlling risk factors and quality of life compared to routine care. This proves the relevance of TTM in the context of invasive vascular procedures.

### **Integration of TTM in DSA Patient Education**

Based on a synthesis of the literature, TTM-based health education for DSA patients shows several potential benefits

**More Effective Anxiety Reduction:** By conveying the right information at the right stage, patients feel more prepared and in control, which ultimately reduces fear of the unknown (Chen et al., 2021).

**Improved Compliance and Cooperation:** Patients who understand the reasons behind each instruction (e.g., bed rest after the procedure) are more likely to comply. TTM helps build this commitment from within the patient (Miller & Rollnick, 2023).

**Improved Self-Efficacy and Long-Term Outcomes:** Personalised education builds patients' confidence in their ability to get through the procedure and care for themselves afterwards. This contributes to faster recovery and better long-term health behaviours, such as medication adherence and regular check-ups (Li et al., 2020; Wang et al., 2022).

Based on a review of the literature, there is consistent evidence that the Transtheoretical Stages of Change approach provides an excellent framework for DSA patient education. Its main advantage lies in its personalised and patient-centered nature. Rather than providing the same information to everyone, healthcare professionals can allocate resources and time more efficiently by providing the type of support that each patient needs most. Findings from various studies (Zhang et al., 2020; Garcia et al., 2024) reinforce that this approach not only improves psychological outcomes (reduced anxiety) but also behavioural outcomes (increased compliance) and procedural outcomes (reduced procedure duration and vasovagal complications).

## **CONCLUSION**

Health education delivered using the Transtheoretical Stages of Change approach offers a more dynamic and patient-centred paradigm for preparing patients undergoing DSA. Rather than providing the same information to all patients, this approach allows healthcare professionals to ‘meet patients where they are’ in their behavioural change journey. Preliminary evidence from recent studies suggests that integrating TTM can be an effective strategy for reducing anxiety, improving compliance, and ultimately improving clinical outcomes and patient experience. Further research with robust controlled clinical trial designs is still needed

to further validate its effectiveness and determine standard protocols for its application in the DSA setting. Health education integrated with the Transtheoretical Stages of Change approach has been proven effective in improving mental readiness, reducing anxiety, and increasing compliance among patients undergoing Digital Subtraction Angiography procedures.

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