

Meta-Analysis: Application of Theory of Planned Behavior on Acupuncture Therapy in Cancer Patients with Pain

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ABSTRACT

Background: Cancer is a health disorder caused by the formation of abnormal cells that grow past the normal cell cycle limit and can attack and spread to other parts of the body. In the Theory of Planned Behavior, one's behavior can be influenced by three main aspects, including attitudes, subjective norms, and behavioral control. The purpose of this study was to estimate perceived benefits, perceived barriers, and subjective norms regarding the use of acupuncture therapy in cancer patients with pain.

Subjects and Method: This was a systematic review and meta-analysis. This study uses the PICO model. The meta-analytic study was carried out by searching for articles from databases in electronic form using Google scholar, PubMed, and Elsevier. Article searches were conducted from 05 February to 10 March 2023. The keywords used were "Theory of Planned Behavior" OR "TPB" AND "Acupuncture" OR "Complementary Alternative Medicine" AND "Cancer" OR "Pain" AND "Cancer Pain" OR "Cross-Sectional". The inclusion criteria for this study were complete articles using cross-sectional research, published years from 2007-2022. Analysis of the articles in this study used RevMan 5.3 software.

Results: 8 cross sectional studies from North United States and Asia (Korea and Malaysia) were selected for meta-analysis. High perceived benefit (aOR= 1.20; 95% CI= 1.09 to 1.33; p<0.001) and strong subjective norm (aOR= 1.05; 95% CI= 1.01 to 1.08; p= 0.005) increased acupuncture utilization to reduce pain. High perceived barrier reduced acupuncture utilization (aOR= 0.94; 95% CI= 0.91 to 0.97; p < 0.001).

Conclusion: High perceived benefit and strong subjective norm increase the use of acupuncture. Strong perceived barrier reduces the use of acupuncture.

Keywords: Theory of Planned Behavior, cancer patients with pain, acupuncture therapy

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BACKGROUND

Cancer is a progressive disease and causes a poor quality of life for sufferers. Cancer is a

health problem due to the formation of abnormal cells that grow beyond the limits of the normal cell cycle and can attack and

spread to other parts of the body (WHO, 2018). Pain is one of the most common symptoms and feelings of discomfort in cancer patients. Untreated pain in cancer patients can affect quality of life, physical impairment, and overall survival (Liou et al., 2019).

According to Aman et al., (2021) around 1 in 3 people with cancer experience pain. The number of new cancer cases is also increasing, with an estimated 19.3 million new cases diagnosed globally in 2020. Cancer events are expected to increase from 18.1 million new cases to 29.5 million cases in 2040.

Pain management is an important aspect of cancer treatment including drugs, such as opioids and non-steroidal anti-inflammatory drugs (NSAIDs), as well as non-pharmacological interventions, one of which is acupuncture therapy. Acupuncture is a treatment technique that is performed by inserting fine needles in certain parts of the body (acupuncture meridian points) so that they can have an impact on the physiological functions of the body (Hwang et al., 2015). Cancer patients use acupuncture therapy for pain management, controlling nausea and vomiting, fatigue, anxiety, depression, and sleep disorders (Cahyadi et al., 2016).

Based on Theory of Planned Behavior (TPB), a person's behavior can be influenced by three main aspects including attitudes, subjective norms, and perceived behavioral control (Sulaeman et al., 2017). In this study TPB was used to analyze perceived benefits (reducing pain), perceived barriers (limited costs and health personnel), and subjective norms (determined by relatives, family, health facilitators).

Based on existing literature, this study aims to analyze previous primary studies and calculate estimates in assessing perceived benefits, perceived barriers, and subjective

norms regarding the use of acupuncture in cancer patients with pain.

CASE PRESENTATION

1. Study Design

Meta-analysis was carried out using the PRISMA flowchart using Google Scholar, PubMed, and Elsevier databases published from 2007 to 2022. The keywords used were "Theory of Planned Behavior" OR "TPB" AND "Acupuncture" OR "Complementary Alternative Medicine" AND "Cancer" OR "Pain" AND "Cancer Pain" OR "Cross-Sectional". There were 8 studies with a cross-sectional study design that met the inclusion criteria. Analysis was performed with RevMan 5.3 software.

2. Steps of Meta-analysis

The meta-analysis was carried out through 5 steps as follows:

- 1) Formulate research questions using the PICO model. P = Cancer patient with pain; I = high perceived benefits, high perceived barriers, and high social norms; C = low perceived benefits, low perceived barriers, and low subjective norms; O = Use of Acupuncture.
- 2) Search for primary study research articles from 3 online databases namely Google Scholar, PubMed, and Elsevier.
- 3) Conduct screening and quality assessment of primary research articles
- 4) Extract and analyze data into RevMan 5.3 software.
- 5) Interpret the results and draw conclusions.

3. Inclusion Criteria

This research article is a full-text paper with a cross-sectional study design that analyzes perceived benefits, perceived barriers, and social norms towards the use of acupuncture. The influence measure used is the OR. Analysis used multivariate with Adjusted odds ratio (aOR) published articles in English

4. Exclusion Criteria

Article not in English, Randomized Control Trial and Cohort study design, animal subjects, and articles published before 2007.

5. Variable Operational Definitions

The use of acupuncture therapy in cancer cases with pain: is an acupuncture therapeutic intervention by inserting special acupuncture needles at certain points to prevent and reduce the side effects of cancer therapy and to overcome or relieve complaints arising from cancer.

Perceived benefit: The amount of benefit score increase in the use of acupuncture therapy in cancer patients with pain.

Perceptions of Obstacles: The amount of inhibition score reduction in the use of acupuncture therapy in cancer patients with pain.

Subjective norm: The number of increases in the subjective norm score on the use of acupuncture therapy in cancer patients with pain.

6. Study Instruments

The quality assessment of the main articles in this study used the critical assessment checklist for cross-sectional studies published by CEBM.

7. Data Analysis

The articles in this study were collected using the PRISMA diagram and analyzed using the Review Manager 5.3 application (RevMan 5.3) by calculating the effect size and heterogeneity (I²) to determine the combined research model and form the final results of the meta-analysis. The results of data analysis are presented in the form of forest plots and funnel plot.

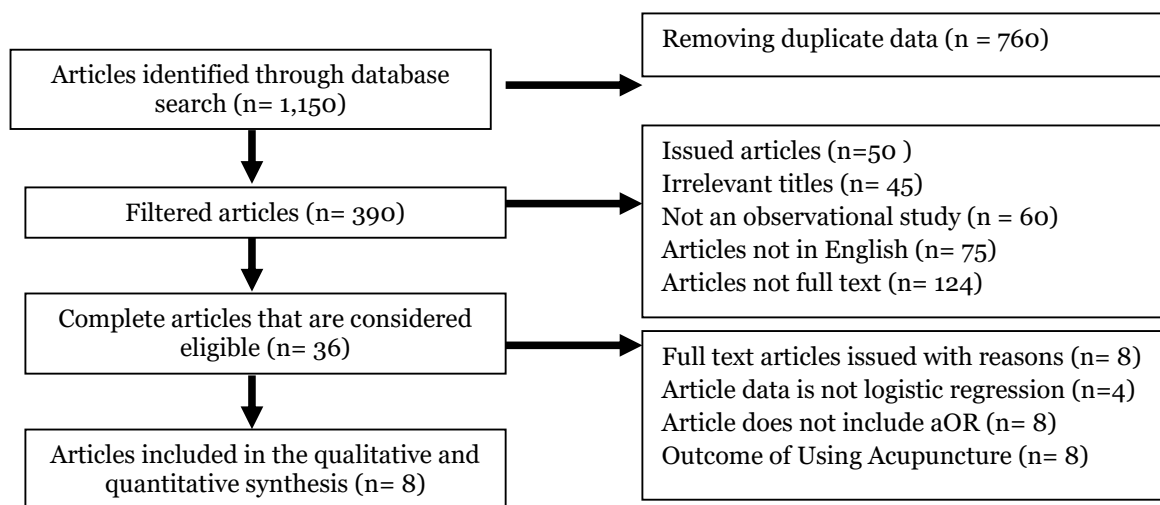


Figure 1. PRISMA flow diagram

RESULTS

The process of searching for articles is carried out through several journal databases which include Google Scholar, PubMed, and Elsevier. The article review process can be seen in the PRISMA flow diagram in Figure 1. The research related to perceived benefits, perceived barriers, and subjective norms towards the use of acupuncture consists of 8 articles. The initial search process yielded

56,244, after the deletion process 2,361 articles were obtained, of which 1,076 met the requirements for further full-text review, 8 articles that met the quality assessment were included in the meta-analysis.

It can be seen in Figure 2 that research articles originating from 2 continents namely North America (USA) totaling 6 articles and 2 articles originating from Asia (Korea and Malaysia).



Figure 2. Map of the research area on perceived benefit, perceived barrier, and subjective norms on the use of acupuncture

Table 1. Critical appraisal checklist for cross-sectional studies in meta-analysis

Articles	Checklist Questions												Total	
	1	2	3	4	5	6	7	8	9	10	11	12		
Bao <i>et al.</i> (2017)	2	2	2	2	2	2	2	2	2	2	2	2	2	24
Bauml <i>et al.</i> (2015)	2	2	2	2	2	2	2	2	2	2	2	2	2	24
Goldstein <i>et al.</i> (2015)	2	2	2	2	1	2	2	2	2	2	2	2	2	23
Johny <i>et al.</i> (2017)	2	2	2	2	2	2	2	2	2	2	2	2	2	24
Kwon <i>et al.</i> (2019)	2	2	2	2	2	2	2	2	2	2	2	2	2	24
Liou <i>et al.</i> (2019)	2	2	2	2	2	1	2	2	2	2	2	2	2	23
Liou <i>et al.</i> (2020)	2	2	2	2	2	2	2	2	2	2	1	2	2	23
Mao <i>et al.</i> (2014)	2	2	2	2	2	2	2	2	2	2	2	2	2	24

Description of the question criteria:

1. Does the study address clearly focused questions/problems?
2. Are the research methods appropriate for answering the research questions?
3. Were there enough subjects (employees, team, division, organization) in the study to establish that the findings did not occur by chance?
4. Was the cohort/panel selection based on external, objective and validated criteria?
5. Does the cohort or panel represent a particular population?
6. Was the case/subject follow-up long enough?
7. Were objective and unbiased outcome criteria used?
8. Were objective and validated measurement methods used to measure outcomes?
9. Are effect sizes practically relevant?
10. How precise is the estimated effect? Are confidence intervals given?
11. Is it possible that there are disturbing factors that have not been taken into account?
12. Can the results be applied to your organization?

Description of the answer score:

- 0 = No
- 1 = Unclear
- 2 = Yes

Table 2. Table PICO Cross-Sectional study of perceptions of the perceived benefits of using acupuncture in cancer cases with pain (n=4,893)

Author (Year)	Country	Sample	P	I	C	O
Bao et al. (2018)	United States of America	529	Breast cancer with pain	High perceived benefit	Low perceived benefit	Use of Acupuncture
Bauml et al. (2015)	United States of America	696	Breast, thoracic and gastrointestinal cancer	High perceived benefits	Low perceived benefit	Use of Acupuncture
Goldstein et al. (2015)	United States of America	258	Cancer with pain	High perceived benefits	Low perceived benefit	Use of Acupuncture
Johny et al. (2017)	Malaysia	1,130	Cancer with pain	High perceived benefits	Low perceived benefit	Use of Acupuncture
Kwoon et al. (2019)	South Korea	310	Cancer patients and family members	High perceived benefits	Low perceived benefit	Use of Acupuncture
Liou et al. (2019)	United States of America	706	Breast cancer, lung, blood with pain	High perceived benefits	Low perceived benefit	Use of Acupuncture
Liou et al. (2020)	United States of America	628	Lung cancer, hematology with pain	High perceived benefits	Low perceived benefit	Use of Acupuncture
Mao et al. (2014)	United States of America	300	Cancer with joint pain	High perceived benefits	Low perceived benefit	Use of Acupuncture

Table 3. Data on the adjusted odds ratio (aOR) for the perceived benefits of using acupuncture

Author	aOR	95% CI	
		Upper Limit	Lower Limit
Bao <i>et al.</i> (2018)	1.10	1.00	1.20
Bauml <i>et al.</i> (2015)	1.22	1.13	1.35
Goldstein <i>et al.</i> (2015)	1.21	1.06	1.36
Johny <i>et al.</i> (2017)	3.99	1.85	8.64
Kwoon <i>et al.</i> (2019)	3.63	1.57	8.24
Liou <i>et al.</i> (2019)	1.23	1.16	1.31
Liou <i>et al.</i> (2020)	1.03	1.02	1.04
Mao <i>et al.</i> (2014)	1.17	1.08	1.26

Forest plot Figure 3 shows that cancer patients with pain at a high perceived benefit have a 1.20 times greater likelihood of using acupuncture than cancer patients with pain

at a low perceived benefit (aOR= 1.20; 95% CI= 1.09 to 1.33; p= 0.003). Forest plots show various effect estimates with heterogeneity (I²= 92%; p<0.001).

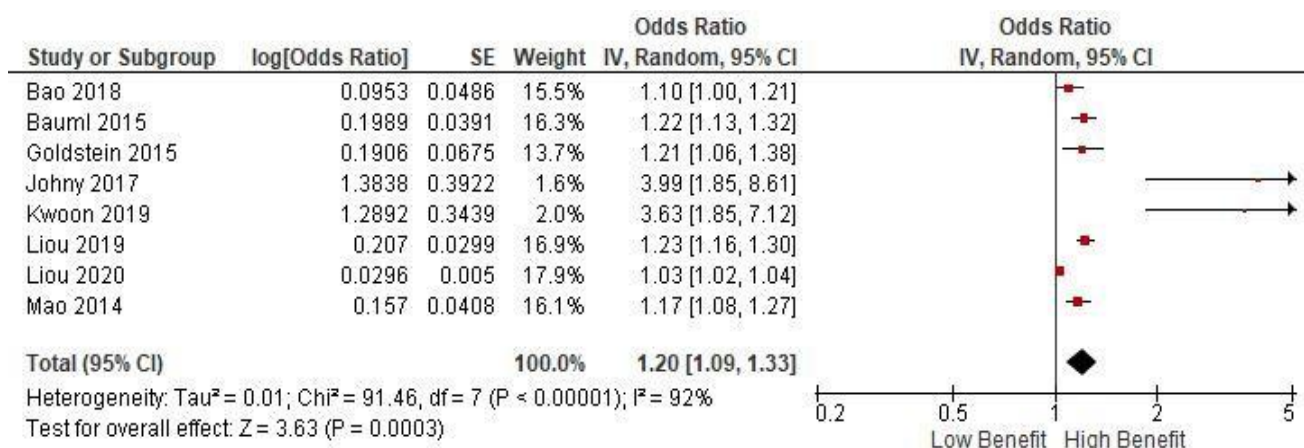


Figure 3. Forest plot of perceived benefits on acupuncture use in cancer patients with pain

The funnel plot in Figure 4 shows an asymmetrical effect assessment. The assessment of the results of multiple effects is in the position of the right perpendicular line of the average rating, thus indicating that there is a publication bias. Because most of the results are

judged to the right of the average perpendicular line of estimates in the funnel plot which is the same as the average estimated effect in the forest plot which is located on the left, the publication bias tends to overestimate the true effect.

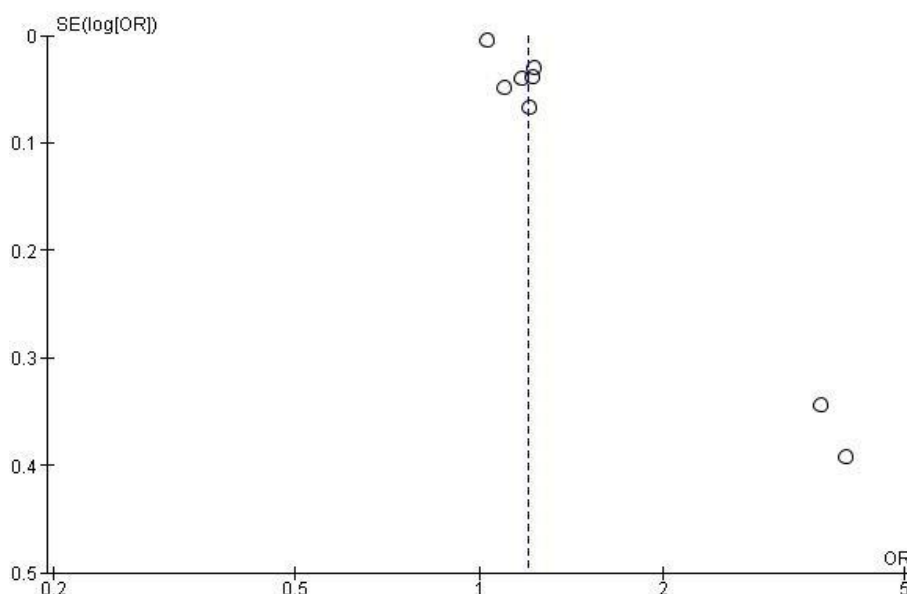


Figure 4. Funnel plot of the perceived benefit on acupuncture use

Table 4 shows the five primary study articles from 2 countries, namely the United States and Malaysia. The largest population is found in a study

conducted by Johny et al. (2017), namely 1,130 research subjects and the least population, namely the study conducted

by Bao et al. (2018) with a total of 592 research subjects.

Table 4. Table PICO Cross-Sectional Study of perceived barriers to the use of acupuncture in cancer cases with pain (n=4,025)

Author (Year)	Country	Sample	P	I	C	O
Bao <i>et al.</i> (2018)	USA	592	Breast cancer	High perceived barrier	Low perceived barrier	Use of Acupuncture
Bauml <i>et al.</i> (2015)	USA	696	Breast, thoracic, digestive cancer	High perceived barrier	Low perceived barrier	Use of Acupuncture
Johny <i>et al.</i> (2017)	Malaysia	1130	Cancer with pain	High perceived barrier	Low perceived barrier	Use of Acupuncture
Liou <i>et al.</i> (2019)	USA	706	Breast cancer, lung, hematology	High perceived barrier	Low perceived barrier	Use of Acupuncture
Liou <i>et al.</i> (2020)	USA	628	Lung cancer, hematology	High perceived barrier	Low perceived barrier	Use of Acupuncture

Table 5. Data on adjusted odds ratio (aOR) on perceived barriers to the use of acupuncture

Author	aOR	95% CI	
		Upper Limit	Lower Limit
Bao <i>et al.</i> (2018)	0.89	0.80	0.90
Bauml <i>et al.</i> (2015)	0.83	0.74	0.93
Johny <i>et al.</i> (2017)	0.53	0.30	0.91
Liou <i>et al.</i> (2019)	0.95	0.93	0.97
Liou <i>et al.</i> (2020)	0.95	0.94	0.97

The forest plot in Figure 5 shows that there is no perceived barrier to the use of acupuncture and the effect is statistically significant. Cancer patients with pain at low perceived barriers were more likely to use acupuncture 0.94 times than cancer patients with pain

at high perceived barriers (aOR= 0.94; 95% CI= 0.91 to 0.97; p<0.001). The forest plot in Figure 5 shows the effect estimation with high heterogeneity (I²= 63%, p= 0.030), thus the calculation of the average effect estimate is carried out using a random effect model approach.

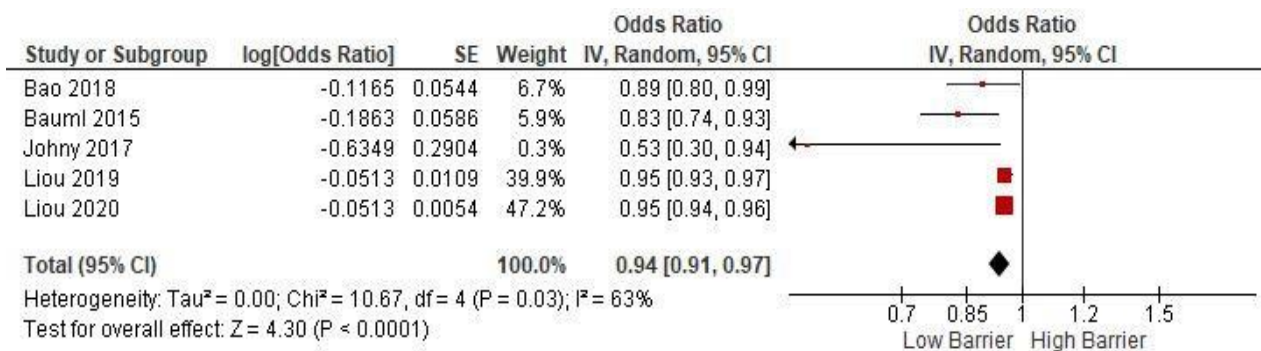


Figure 5. Forest Plot of perceived barriers to the use of acupuncture in cancer patients with pain

The funnel plot in Figure 6 shows an asymmetrical assessment of the effect results. The assessment of the effect results is mostly in the position to the left of the line perpendicular to the average assessment, thus indicating that there is publication bias. Because many effect assess-

ments are positioned on the left of the line perpendicular to the average assessment in the funnel plot which is the same as the average effect estimate in the forest plot which is located on the right, the publication bias tends to exaggerate the same effect. Actually (over estimate).

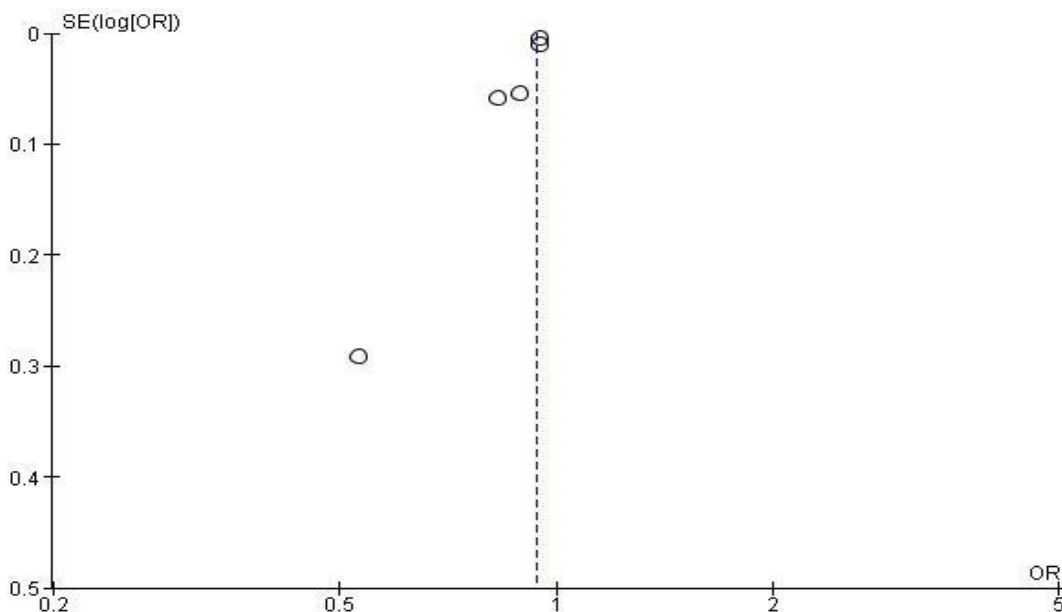


Figure 6. Funnel plot of perceived barriers to the use of acupuncture in cancer patients with pain

Table 6. PICO table of cross-sectional studies: effect of subjective norm on the use of acupuncture in cancer patients with pain (n=2,895)

Author (Year)	Country	Sample	P	I	C	O
Bao et al. 2018	USA	592	Cancer with pain	High subjective norm	Low subjective norm	Acupuncture Use
Bauml et al. 2015	USA	696	Cancer with pain	High subjective norm	Low subjective norm	Acupuncture Use
Liou et al. 2019	USA	706	Cancer with pain	High subjective norm	Low subjective norm	Acupuncture Use
Liou et al. 2020	USA	628	Cancer with pain	High subjective norm	Low subjective norm	Acupuncture Use

Table 7. Pooled of aOR's of subjective norm on acupuncture use

Author	aOR	95% CI	
		Upper Limit	Lower Limit
Bao et al. 2018	1.10	1.00	1.20
Bauml et al. 2015	1.10	1.07	1.34
Liou et al. 2019	1.02	1.01	1.04
Liou et al. 2020	1.02	1.04	1.03

Forest plot of Figure 7 shows there is a high subjective norm for the use of acupuncture and the effect is statistically significant. Cancer patients with pain at a high subjective norm were 1.05 times more likely to use acupuncture than cancer patients with pain at a low subjective norm (aOR=

1.05; 95% CI= 1.01 to 1.08; p= 0.005). The forest plot in Figure 7 shows the estimated effect with high heterogeneity ($I^2= 89\%$, $p<0.001$). Thus the calculation of the average effect estimate is carried out using the random effect model approach.

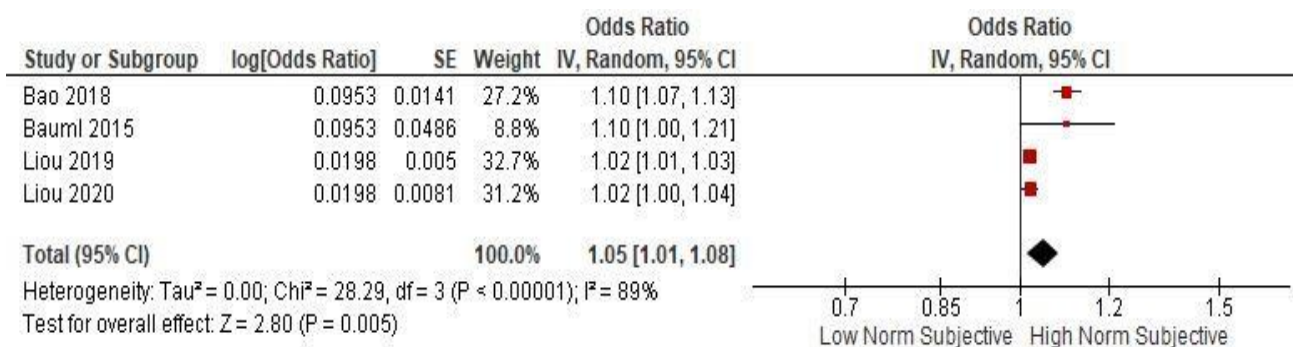


Figure 7. Forest plot of subjective norms for the use of acupuncture

The funnel plot in Figure 8 shows a symmetrical distribution of outcome ratings. The distribution of outcome ratings is more or less balanced between the right

and left of the plumb line of the assessment means, so that the funnel plot indicates there is no publication bias.

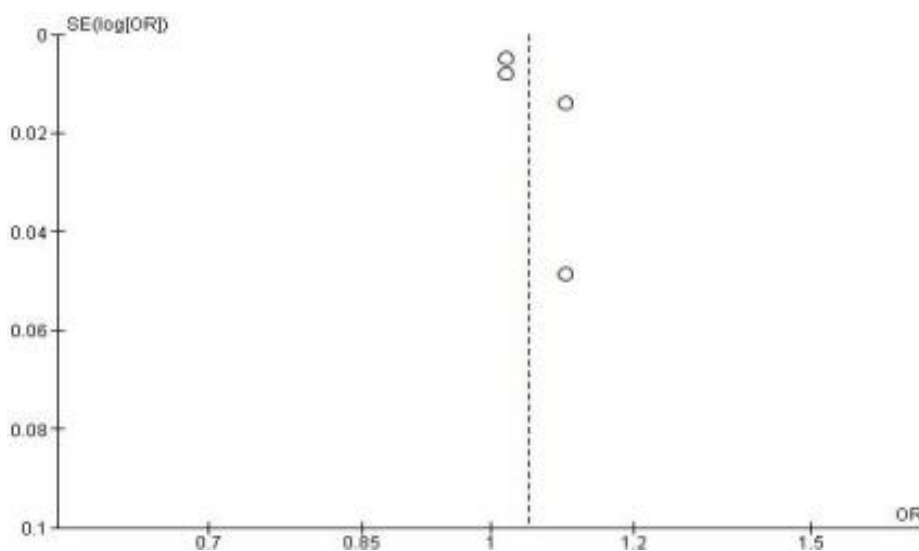


Figure 8. Funnel plot of subjective norms for the use of acupuncture

DISCUSSION

Cancer is a health problem due to the formation of abnormal cells that grow beyond the limits of the normal cell cycle and can attack and spread to other parts of

the body (WHO, 2018). Pain is one of the most common symptoms and feelings of discomfort in cancer patients. Untreated pain is common among patients with cancer and affects poor quality of life,

physical impairment, and overall survival (Liou et al., 2019).

Theory of Planned Behavior states that a person can decide on certain behaviors due to the expected impact of these behaviors as a method for dealing with cancer symptoms including pain, subjective norms can be determined by relatives, family, or health service facilitators as well as perceived behavioral control including cost limitations, availability of acupuncture and individual health personnel. Some literature states that the use of acupuncture therapy in cancer patients with pain is related to perceived benefits, perceived obstacles, and subjective norms (Bao et al., 2018).

This systematic review and meta-analysis research presents the title of application of the theory of planned behavior to the use of acupuncture therapy in cancer patients with pain. The dependent variable analyzed was the use of acupuncture therapy in cancer patients with pain. The independent variables analyzed were perceived benefits, perceived obstacles, and subjective norms.

1. Effect of perceived benefit on acupuncture use in cancer patients with pain

A total of 8 observational research articles with a cross-sectional study design as a source of meta-analysis of the effect of perceived benefits on the use of acupuncture therapy in cancer patients with pain. This study shows the results of the analysis that there is an effect of perceived benefits on the use of acupuncture therapy and the effect is statistically significant. Cancer patients with high perceived benefit pain were 1.20 times more likely to use acupuncture than cancer patients with low perceived benefit pain.

This study is in line with the high perceived benefits of using acupuncture

therapy 4 times compared to the low perceived benefits. This condition means that the high perceived benefits of using acupuncture therapy in cancer patients can reduce pain. High expectations and encouragement for the use of acupuncture therapy in cancer patients have the belief that it can reduce chronic pain, prevent disease severity, improve and maintain their health status. There is a positive relationship in the use of acupuncture therapy to reduce concerns about drug toxicity, improve overall quality of life, and reduce drug side effects (Johny et al., 2017).

Therefore the use of acupuncture therapy requires guidance from doctors to help direct patients to their preferred therapy, provide a sense of control, increase satisfaction, and the results of pain management in cancer patients (Bao et al., 2018).

2. Effect of perceived barrier on acupuncture use in cancer patients with pain

A total of 5 observational research articles with a cross-sectional study design as a source of meta-analysis of perceived barrier to the use of acupuncture in cancer patients with pain. This study showed that there were no perceived barriers to the use of acupuncture and these perceptions were statistically significant. Cancer patients with pain at low perceived barriers were more likely to use acupuncture 0.94 times compared to cancer patients with pain at high perceived barrier.

According to Liou et al., (2019) perceived resistance is low 0.95 times compared to high perceived resistance to the use of acupuncture in cancer patients with pain.

Perceived control explains one's beliefs about inhibiting factors for carrying out a certain behavior (Setiowati et al., 2019). Barriers that are felt in cancer

patients in the use of acupuncture lack of knowledge about it. patient's right to use acupuncture therapy will increase if there are fewer perceived obstacles such as costs and the provision of good quality health workers and health services (Bao et al., 2018).

3. Effect of subjective norm on acupuncture use in cancer patients with pain

A total of 4 observational research articles with a cross-sectional study design as a source of subjective norm meta-analysis of the use of acupuncture in cancer patients with pain. This study shows that there is a high subjective norm for the use of acupuncture and the effect is statistically significant. Cancer patients with pain at a high subjective norm were 1.05 times more likely to use acupuncture than cancer patients with pain at a low subjective norm (aOR= 1.05; 95% CI= 1.01 to 1.08; p= 0.005). The high heterogeneity of the research data shows $I^2= 89\%$ so that the spread of the data is stated to be heterogeneous (random effect model).

This study is also in accordance with Bauml et al. (2015), which stated that high subjective norms for the use of acupuncture have a one-time probability compared to low subjective norms for the use of acupuncture. Social norms regarding behavior such as cultural attitudes towards acupuncture and advice from the treating oncology team or people who have influence on individuals have an important role for cancer patients with pain in using acupuncture therapy to improve their health status (Setiowati et al., 2019).

Meanwhile, high subjective norms such as research conducted by Bao et al., (2018) state that high subjective norms for the use of acupuncture have a possibility of 1.10 times compared to low subjective norms for the use of acupuncture. Sub-

jective norms in this study strongly support the use of acupuncture by the support of family or care providers, peers, and other patients who have benefited from acupuncture therapy.

AUTHORS CONTRIBUTION

Fatimah Rahmawati as a researcher who selects topics, searches for and collects research data. Argyo Demartoto and Hanung Prasetya analyzed the data and reviewed research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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