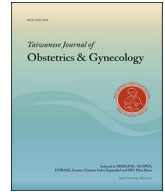




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## Original Article

## The effect of multimedia health education on pain and anxiety in women undergoing mammography in Taiwan

Ching-Pyng Kuo<sup>a, b, \*</sup>, Pei-Ching Li<sup>a</sup>, Hsiao-Ling Chuang<sup>a, b</sup>, Shu-Hsin Lee<sup>a, b</sup>, Wen-Chun Liao<sup>c, d</sup>, Maw-Sheng Lee<sup>e</sup><sup>a</sup> School of Nursing, Chung Shan Medical University, Taichung, Taiwan<sup>b</sup> Department of Nursing, Chung Shan Medical University Hospital, Taichung, Taiwan<sup>c</sup> School of Nursing and Graduate Institute of Nursing, China Medical University, Department of Nursing, China Medical University Hospital, Taichung, Taiwan<sup>d</sup> Department of Nursing, Asian University, Taichung, Taiwan<sup>e</sup> Institute of Medicine, Chung Shan Medical University, Department of Obstetrics and Gynecology, Chung Shan Medical University Hospital, Taichung, Taiwan

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## ABSTRACT

**Objective:** Breast cancer is the most common cancer among women in Taiwan. However, the discomfort of receiving mammograms reduces the willingness to screen.**Materials and methods:** This study using a quasi-experimental design and recruited 150 participants in a medical center, Taiwan. In the control group, only provided traditional health education sheets, the experimental group has joined the intervention of multimedia health education. State-Trait Anxiety Inventory and Visual Analogue Scale, respectively, were used to compare the differences in anxiety and pain between the two groups before and after receiving mammography.**Results:** After the intervention, the experimental group's state anxiety score was significantly lower than that of the control group ( $30.63 \pm 8.43$  vs.  $33.77 \pm 10.74$ ,  $p < .05$ ). However, there was no significant difference in pain scores ( $4.13 \pm 2.37$  vs.  $4.57 \pm 2.31$ ;  $p = .25$ ).**Conclusions:** Younger, prior experience with mammography, and high trait anxiety affect pain and state anxiety of women undergoing mammography. The multimedia health education intervention could reduce anxiety effectively, but it does not significantly relieve the pain undergoing mammography.© 2021 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

According to the global statistics for 2020, there were 2.26 million females diagnosed with breast cancer, 685,000 of which eventually succumbed to it [1]; breast cancer is currently a fatal cancer among women worldwide. The incidence and mortality rate of breast cancer in Taiwan remains high and has continued to increase [2]. Empirical studies have shown that mammography is the most effective screening tool to reduce breast cancer mortality effectively [3,4].

In Taiwan, the percentage of women aged 45–69 years who underwent mammography during the previous two years was 36% in 2013 [5], which is very low compared to the United States corresponding statistics. According to the 2013 statistics in the United States, 66.8% of women older than 40 underwent mammography within the previous two years [6]. Among the factors affecting women's breast cancer screening rate, it was found that the psychological barrier is the most significant factor [9] in addition to knowledge-related fear [2,7,8]. The studies pointed out that fear and anxiety due to lack of understanding of the procedure [9,10], pain during the execution of the examination [10], interactions with examiners at the test sites [8,10], and have no time to do screening [2,11] are the influencing factors.

Regarding reducing pain and anxiety in related interventions while performing medical examinations and treatments, previous studies have reported that the use of facial expressions, oral communication, written information, and emotional support can

\* Corresponding author. School of Nursing, Chung Shan Medical University, 110, Section 1, Chien Kuo North Road, Taichung, 402, Taiwan. Fax: +886 4 23248173.

E-mail addresses: [pyng@csmu.edu.tw](mailto:pyng@csmu.edu.tw) (C.-P. Kuo), [snoopy721021@gmail.com](mailto:snoopy721021@gmail.com) (P.-C. Li), [ling0911@csmu.edu.tw](mailto:ling0911@csmu.edu.tw) (H.-L. Chuang), [shl@csmu.edu.tw](mailto:shl@csmu.edu.tw) (S.-H. Lee), [wcl@mail.cmu.edu.tw](mailto:wcl@mail.cmu.edu.tw) (W.-C. Liao), [mslephd@gmail.com](mailto:mslephd@gmail.com) (M.-S. Lee).

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reduce pain and anxiety [12]. Using analgesic [13], controlling mammography pressure [14], and warming up limbs, and stretching [15] can reduce pain. Abdominal breathing, musical intervention, and providing psychoeducation can reduce anxiety [9,16,17]. Those found that some interventions reduce discomfort and anxiety. In recent years, multimedia has rapidly become one of the options for health education intervention. Many studies have explored the impact of multimedia health education intervention before cardiac catheterization [18] and colonoscopy [19], reducing pain and anxiety during the examination. However, few studies focus on the effect of multimedia interventions in reducing pain and anxiety in mammography. Therefore, this study explores the impact of multimedia health education intervention on the pain and anxiety of patients undergoing mammography.

## Methods

### Design

This study adopted a quasi-experimental design and recruited participants who underwent mammography in a medical center in Taiwan. Using the G POWER 3.1 software to estimate the sample size, conducted a two-tailed  $\alpha$  level of 0.05; set the power 0.80, the effect size 0.3 (medium), and analyzed independent t-test [20]. Calculated the required sample size for each group was 64. In consideration of the 15% sample loss rate, a total of 150 participants had recruited. State-Trait Anxiety Inventory and Visual Analogue Scale, respectively, were used to compare differences in anxiety and pain between groups before and after receiving mammography.

### Intervention

Designing multimedia health education has been used as the intervention. The content of the intervention was developed based on currently available health education handouts as the primary reference combined with the opinions and experiences of clinical experts. A total of 8 min of multimedia is divided into two parts. The first part, amount 3 min, includes “the benefits of mammography”, “why is it required to squeeze the breasts?”, “the notices of mammography” and “respiratory relaxation techniques”. The second part illustrates the actual procedure of mammography screening in the hospital. This 5-min part of the video begins with the check-in process and continues with relaxation techniques for cooperating with the screening.

Four experts scored the video content based on the necessity of the topic, the relevance of the content, suitability of the wording, mode and appeal of the presentation, and applicability for patients. The Content Validity Index (CVI) of those scoring is 0.9. We revised the contents of multimedia health education according to the suggestions from those experts.

### Instruments and measures

#### Participant characteristics

The participants' characteristics data used a structured questionnaire to collect. This study included age, body mass index, education, marital status, occupation, medical history and symptoms of breast disease, received mammography, and previous experience of pain when receiving mammography.

#### Pain

The pain assessment tool measured the degree of pain during mammography using the Visual Analogue Scale (VAS). This scale comprises a 10-cm line; the leftmost end (0 cm) indicates “no pain”, and the rightmost end (10 cm) indicates “severe pain”. The tool is

simple to use and is the most commonly used scale for assessing pain. The scale was confirmed that has good validity ( $r = 0.63$ ,  $p < .001$ ) and test-retest reliability ( $r = 0.83$ ,  $p < .001$ ) [21].

#### Anxiety

The “State-Trait Anxiety Inventory” (STAI) scale was a commonly used questionnaire designed to assess state anxiety and trait anxiety levels. It is a self-reported scale used to evaluate anxiety and emotional response. The state or trait subscale has 20 questions, and the total score ranges from 20 to 80 points. There are ten questions with reverse score measurement. A score of 20–39 points indicates mild anxiety, 40–59 points indicates moderate anxiety, and 60–80 points indicates severe anxiety [22]. This study has an excellent internal consistency, the Cronbach's alpha of the trait anxiety scale was 0.92, and that of the state anxiety scale was 0.93.

#### Data collection and ethical considerations

This study's ethical consideration has been approved by the Institutional Review Board (IRB No: 170902) and obtained informed consent from the participants. Using a structured questionnaire to collect data from October 2017 to March 2018, To avoid intervention interference bias, we recruited participants in odd weeks who were in the experimental group, and recruited in even weeks were under the control group; a total of 150 participants was recruited.

All participants completed the questionnaire of characteristics and the Trait Anxiety Scale before the mammography screening. After the screening, each participant filled the Visual Analogue Scale and State Anxiety Scale. The provided intervention in the experimental group was the multimedia health education before the screening, and the control group, in contrast, is offered with a “Handout form” for mammography instructions (see Fig. 1: Study flow diagram).

## Results

### Distribution of participants' characteristic data

The average age of women in the experimental group was  $52.88 \pm 8.08$  years, whereas that of subjects in the control group was  $54.21 \pm 7.91$  years. Between the two groups, there were no significant differences in characteristic distribution (see Table 1). Before the screening, the average trait anxiety score was  $35.39 \pm 8.624$  for the experimental group and  $35.20 \pm 11.29$  for the control group ( $p = .91$ ). The above data indicated no significant difference in trait anxiety scores between the two groups before the test, and both groups were homogeneous in the attributes and trait anxiety scores.

### Effect of the multimedia mammography education intervention

The average pain score of the experiment group was  $4.13 \pm 2.37$ , and that of the control group was  $4.57 \pm 2.308$ , indicating that both groups experienced moderate pain. Although the pain score of the experimental group was lower than the control group, the difference between the two groups did not reach statistically significant ( $p = .25$ ). The average state anxiety score of the experimental group was  $30.63 \pm 8.43$  points, and that of the control group was  $33.77 \pm 10.74$  points, indicating that the experimental group had significantly lower anxiety than the control group ( $p < .05$ ) (see Table 2).

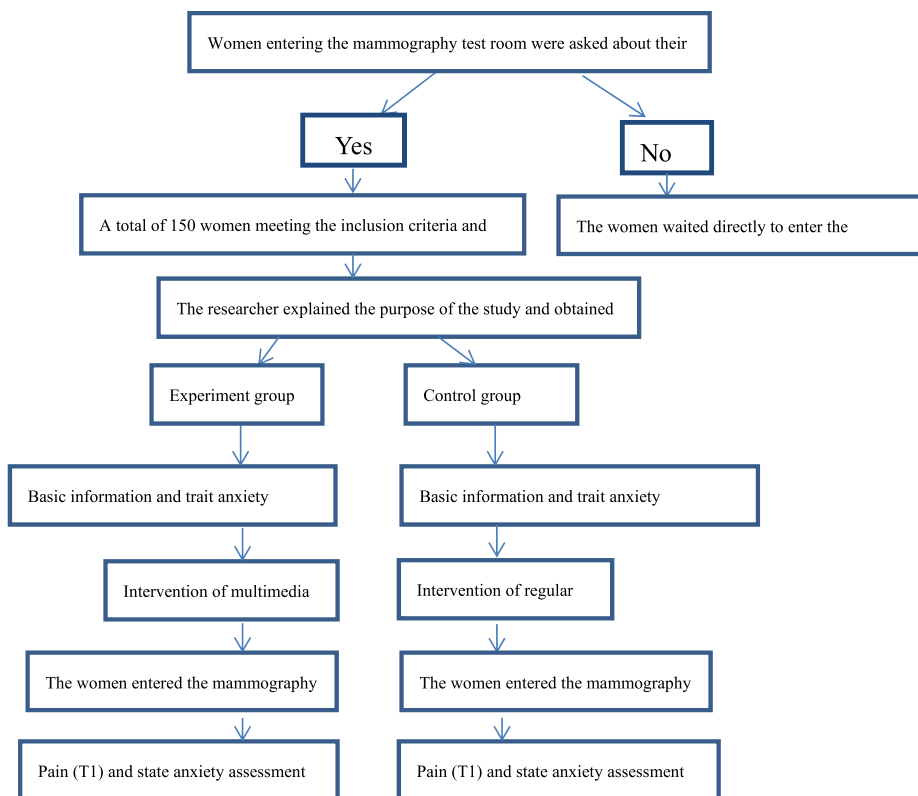


Fig. 1. Study flow diagram.

Factors affecting pain and state anxiety during mammography

The results of related factors affecting pain showed that the difference in pain reached a significant level ( $p < .05$ ) among women in different age groups. Further analysis revealed that the average pain score of women aged <44 years old was significantly higher than those aged >60. The average pain score of those who knew someone who had undergone mammography was higher than that of those who did not know someone (friends or families) who had undergone mammography ( $p < .05$ ). The average pain score was higher in cases with experience of mammography pain ( $p < .001$ ), indicating that patients who had previously experienced pain during mammography had significantly higher pain scores than those who had not previously experienced pain during mammography. And the higher the trait anxiety, the higher was the pain score ( $p < .01$ ). The results showed that age was a significant factor affecting the state anxiety ( $p < .05$ ). Further analysis found that the average pain score of women under 44 years was significantly higher than that of women 45–59 years old and those who were  $\geq 60$  years old. In terms of marital status, the unmarried group had the highest average score ( $p < .001$ ). Participants with perceptual breast abnormalities had a higher average score of state anxiety ( $p < .05$ ). Women with a family history of breast cancer had higher state anxiety scores than those without ( $p < .01$ ). For women who had experienced pain during mammography, the average state anxiety was higher ( $p < .01$ ), indicating that women who had previously experienced pain during mammography had significantly higher state anxiety than those who had not previously experienced pain during mammography (Table 3).

Discussion

A randomized clinical trial study had suggested analgesic administration can reduce mild pain for women undergoing mammography [13]. But in Taiwan, during the screening, analgesics were not be used. In my study, most participants thought that mammography was painful and uncomfortable. This study primarily explored the effect of different modes of health education on pain and anxiety experienced during mammography. The results showed no significant differences between the pain scores of the two groups, but the experimental group lower than the control Group 0.44 points. This intervention could alleviate the anxiety of mammography screening, maybe due to the content of multimedia health education intervention, the screening process, relaxation techniques, and how to protect the privacy that has been provided in advance of the screening. However, the pain regarding breast compression still existed during the mammography. A study has reported that non-drug pain management methods before mammography include emotional support, verbal and written health education, and relaxation technique instructions [23]. Those methods can alleviate pain caused by emotional support and give patients a sense of control. Therefore, pain relief can be achieved. Similarly, some studies on music and abdominal breathing did not significantly reduce pain scores but reported that anxiety was decreased effectively [9,16,17]. Helping the patient be psychologically prepared for the examination can achieve relaxation, consistent with the study findings of this multimedia health education intervention.

Some studies have demonstrated that individualizing compression [14], the radiologist's attitude friendly, and increasing

**Table 1**  
Distribution of participants' characteristic (N = 150).

Variable	Experiment Group (n = 75) N(%) / Mean ± SD	Control Group (n = 75) N(%) / Mean ± SD	χ <sup>2</sup> /t	p
<b>Average age</b>	52.88 ± 8.08	54.21 ± 7.91	0.029	0.309
<b>Age</b>			2.500 <sup>a</sup>	0.287
≤44	15(20.0)	9(12.0)		
45–59	45(60.0)	45(60.0)		
60–74	15(20.0)	21(28.0)		
<b>Average BMI</b>	23.923 ± 4.59	23.875 ± 4.16	0.067	0.947
<b>BMI</b>			0.874 <sup>a</sup>	0.645
<18.5	6(8.0)	4(5.3)		
18.5–23.9	34(45.3)	39(52.0)		
≥24	35(46.7)	32(42.7)		
<b>Education</b>			2.774 <sup>a</sup>	0.250
Primary or below	10(13.3)	17(22.7)		
Middle/High school	38(50.7)	30(40.0)		
College or above	27(36.0)	28(37.3)		
<b>Marital status</b>			0.894 <sup>a</sup>	0.640
Unmarried	6(8.0)	8(10.7)		
Married or cohabiting	60(80.0)	61(81.3)		
Divorced or other	9(12.0)	6(8.0)		
<b>Employment status</b>			1.369 <sup>a</sup>	0.242
Unemployed	26(34.7)	33(44.0)		
Employed	49(65.3)	42(56.0)		
<b>Breast disease and symptoms</b>			0.775 <sup>a</sup>	0.379
Without	54(72.0)	49(65.3)		
With	21(28.0)	26(34.7)		
<b>Perceptual breast abnormality</b>			0.323 <sup>a</sup>	0.570
Without	58(77.3)	55(73.3)		
With	17(22.7)	20(26.7)		
<b>Family history of breast cancer</b>			1.675 <sup>a</sup>	0.196
Without	65(86.7)	59(78.7)		
With	10(13.3)	16(21.3)		
<b>Knowing someone who has taken mammography</b>			0.000 <sup>a</sup>	1.000
No	18(24.0)	18(24.0)		
Yes	57(76.0)	57(76.0)		
<b>Having taken mammography</b>			0.000 <sup>a</sup>	1.000
No	14(18.7)	14(18.7)		
Yes	61(81.3)	61(81.3)		
<b>Having experienced mammography pain</b>			1.847 <sup>a</sup>	0.174
No	45(73.8)	38(62.3)		
Yes	16(26.2)	23(37.7)		
<b>Average trait anxiety</b>	35.39 ± 8.624	35.20 ± 11.289	0.114	0.910
<b>Trait anxiety</b>			1.120 <sup>a</sup>	0.729
Mild	51(68.0)	49(65.3)		
Moderate	24(32.0)	26(34.7)		

Note: Age and BMI use Mean ± SD; other items use percentage; a: Chi-Squared Test.

**Table 2**  
Comparison of pain and anxiety between the experiment group and the control group (N = 150).

	Experiment Group Mean ± SD	Control Group Mean ± SD	t	p
Pain	4.13 ± 2.373	4.57 ± 2.308	-1.151	0.252
State Anxiety	30.63 ± 8.427	33.77 ± 10.740	-1.996	0.048*

Note: \*p < .05.

verbal information [10] can significantly improve pain. Many studies have found that women who have previously experienced pain during mammography anticipated the same pain and uncomfortable feeling; therefore, their pain level during the screening will be significantly higher than that of women without prior experiences [8,10]. This finding is similar to the results of this study.

This study used a strategy of multimedia health education to instruct the screening process and inform the subjects about possible feelings or discomfort felt during the screening and the purpose and reasons for the screening, so that the women can psychologically prepare themselves for the examination, and then taught relaxation techniques to the women. The results showed that the multimedia intervention could significantly reduce the

anxiety experienced during mammography. Fernández-Feito et al. (2015) also provided complete information and emotional support for mammography before the mammography screening, which is consistent with this study and has all been shown to reduce anxiety scores significantly [12]. Lungulescu et al. (2018) used abdominal breathing as a pre-mammography intervention and found that it significantly reduced anxiety [9]. The results from our intervention are similar to that of the deep breathing relaxation techniques taught in the screening procedure. Overall, it was found that younger age, unmarried as marital status, perceptual breast abnormalities, family history of breast cancer, previous experience of pain during mammography, and high trait anxiety are factors that significantly affect state anxiety during mammography. The

**Table 3**  
Relevant factors affecting pain and state anxiety (N = 150).

Variables	Pain			State Anxiety		
	Mean	SD	<i>p</i>	Mean	SD	<i>p</i>
<b>Age</b>			0.031*			0.034*
1.<44	4.96	2.331	1 > 3	36.83	11.150	1 > 2/3
2.45–59	4.53	2.347		31.60	8.963	
3.60–74	3.50	2.171		30.61	10.021	
<b>BMI</b>			0.407			0.206
1.<18.5	4.20	2.098		36.60	8.720	
2.18.5–23.9	4.62	2.481		32.67	9.277	
3.≥24	4.09	2.221		31.03	10.284	
<b>Education</b>			0.059			0.310
1.Primary or below	3.52	2.173		29.59	8.907	
2.Middle/High school	4.31	2.254		32.75	9.572	
3.College or above	4.82	2.450		32.80	10.307	
<b>Marital status</b>			0.692			0.000***
1.Unmarried	4.86	1.834		44.07	8.775	1 > 2/3
2.Married or cohabiting	4.31	2.415		30.78	9.215	
3.Divorced or other	4.20	2.242		32.60	7.327	
<b>Employment status</b>			0.840			0.307
1.Unemployed	4.31	2.647		31.19	9.350	
2.Employed	4.38	2.138		32.86	9.995	
<b>Breast disease and symptoms</b>			0.056			0.075
1.Without	4.11	2.392		31.24	8.431	
2.With	4.89	2.159		34.30	11.987	
<b>Perceptual breast abnormality</b>			0.569			0.011*
1.Without	4.42	2.267		31.04	8.600	
2.With	4.16	2.588		35.73	12.096	
<b>Family history of breast cancer</b>			0.068			0.002**
1.Without	4.19	2.319		31.06	9.287	
2.With	5.12	2.355		37.62	10.261	
<b>Knowing someone who has taken mammography</b>			0.035*			0.925
1.No	3.64	2.232		32.33	9.731	
2.Yes	4.58	2.342		32.16	9.798	
<b>Having taken mammography</b>			0.922			0.462
1.No	4.39	2.424		33.43	9.082	
2.Yes	4.34	2.335		31.92	9.910	
<b>Having experienced mammography pain</b>			0.000***			0.006**
1.No	3.70	2.128		30.24	9.623	
2.Yes	5.72	2.176		35.49	9.679	
<b>Trait anxiety</b>			0.003**			0.000***
1.Mild	3.96	2.108		28.85	7.567	
2.Moderate	5.14	2.603		38.90	10.229	

Note: \**p* < .05 ; \*\**p* < .01 ; \*\*\**p* < .001.

research found that the younger subjects with an increased risk of cancer and who had previously experienced painful mammography had higher anxiety scores when undergoing mammography [24], consistent with our results. If women are the high-risk breast cancer population, they may be concerned about the screening results, which increases their anxiety during the screening [25]. Women with the inevitable breast compression of pain during the previous mammography may feel a lack of control and get expecting pain, thereby becoming anxious. For unmarried women, not having a spouse or family member to support them is the primary source of anxiety [10,26]. In this study, the unmarried women had significantly higher anxiety levels, which is similar to the previous study results.

Spielberger et al. (1970) reported a significant correlation between trait anxiety and state anxiety. Those with higher trait anxiety have higher state anxiety [22]. State anxiety is positively correlated with pain, and trait anxiety is also positively associated with pain, indicating that women with high trait anxiety would also have high pain levels. The results of this study also showed that a significant positive correlation exists between pain and trait anxiety. After excluding the effects of trait anxiety on state anxiety and pain, this study found no significant difference in alleviating pain between multimedia education and traditional intervention. Still, the pain score of the experimental group was lower than the

control group. This result is consistent with the findings of studies that have reported reduced anxiety but no significant effect in reducing pain via relaxation breathing [9] and music therapy [17]. Many studies that have assessed the use of multimedia care instructions before examination or surgery have reported that digitalization of information is beneficial to most patients and can reduce anxiety and improve satisfaction regarding the treatments [7,18]. These results indicated use of multimedia could reduce anxiety are also consistent with the results of this study.

In summary, most researchers believe that much of the pain and unnecessary anxiety experienced during a mammography is because of the lack of information. The inexplicable fear and anxiety generated due to lack of correct information can convert to affect the feeling of pain. The multimedia health education intervention could reduce anxiety effectively, but it does not significantly relieve mammography pain.

#### Research limitations

The results of this study are limited by the lower levels of anxiety degree of the subjects, who mostly had below moderate or mild anxiety levels; therefore, it is impossible to generalize the conclusions to the mammography cases with higher anxiety degrees. Besides, only outpatient mammography cases from a medical

center in central Taiwan were selected as research subjects, thus affecting the generalization of the findings of this study. Before the screening, only completed the Trait Anxiety Scale, the State Anxiety assessment was not performed; if performed, the comparison between pre-test and post-test state anxiety can help further understand the improvement accomplished by the multimedia education intervention. Radiologists' attitudes and verbal information, among other factors, could not be kept consistent, which may interfere with the effects of the intervention. If these factors could have been consistently standardized, the efficacy of the intervention in improving pain and anxiety would be better measured.

## Conclusion

The results showed that multimedia health education could significantly reduce the degree of anxiety in women facing mammography screening. Younger women (aged <44 years), previous experience of pain during mammography, and high trait anxiety affect post-test pain and anxiety. Medical staff should identify cases with these factors as soon as possible and provide appropriate and individualized measures to improve the acceptance of mammography of women. In the future, individualized pain reduction methods may be considered to improve the quality of care effectively. It is suggested that the experimental research can include some physiological indicators, such as heart rate variability, electro-dermal activity, blood pressure, respiration, and heartbeat, designed for objective monitoring of pain, rather than only subjective assessment.

## Author contributions

W.C. Liao and S.H. Lee contributed to the conception and design of this study; P.C. Li and H.L. Chuang performed the statistical analysis and drafted the manuscript; C.P. Kuo critically reviewed the manuscript and supervised the whole study process. All authors read and approved the final manuscript.

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## Declaration of competing interest

The authors have declared no conflict of interest.

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