

# Generative Artificial Intelligence (AI) to Uncover Insights From Breast Cancer Patients' Perceptions to Mindfulness-Based Stress Reduction (MBSR) Interventions

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The study's central objective is to harness the power of generative Artificial Intelligence (AI), in particular based on Large Language Models, as a valuable resource for delving deeper into the insights offered by patients with breast cancer (BC) who actively participated in a Mindfulness-Based Stress Reduction (MBSR) program. In a 6-week MBSR program, each session lasted 2 hours and encompassed a range of techniques, including sitting meditation, body scan, Hatha yoga, and walking meditation. A total of 25 participants were enrolled in the study. The majority of these participants reported a high level of satisfaction with the mindfulness course. The application of generative AI enabled a comprehensive analysis of the participants' responses, revealing distinct subgroups among them. The MBSR program was found to be beneficial for most participants, serving as a valuable tool in managing the psychological stresses associated with BC. **KEY WORDS:** *artificial intelligence, breast cancer, mindfulness* *Holist Nurs Pract* 2024;00(0):1–9

Breast cancer (BC) is the most common cancer disease in women<sup>1</sup>: The World Health Organization (WHO) globally assessed around 685 000 deaths in 2020 and about half of them was not associated with a specific risk factor. Only 0.5-1% of the total rate occurred among men.<sup>1</sup> However, survival incidence

has been ameliorated due to developments in the evaluation and treatment.<sup>1</sup>

Almost 60% of BC patients suffer from psychological disorders, specifically high rates in anxiety and

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depression,<sup>2,3</sup> even higher than other cancer typologies, with persistent tiredness and reduced social relationships.<sup>4,5</sup> Additionally, distress among BC patients negatively impacts their quality of life (QOL), also after treatments,<sup>6</sup> making them susceptible to psychological disorders for several years.<sup>7,8</sup> Literature mentions several pharmacologic and psychological treatments to face both physical and psychological BC related symptoms.<sup>9</sup> Among non-pharmacologic interventions, the Mindfulness-Based Stress Reduction (MBSR) intervention seems to be prominent among BC patients,<sup>10</sup> also among women with early-stage BC.<sup>11</sup> In fact, literature suggest MBSR as a successful intervention for decreasing individual levels in tiredness, mood depression and anxiety and fear of recurrence.<sup>12,13</sup> Mindfulness fosters a sense of focused attention and a more grounded perspective by encouraging an attitude of openness and acceptance toward our experiences. This is achieved through an interested, objective, and non-reactive approach. Essentially, this competence of acceptance toward experience is not one of passive acceptance to one's current occurrences but rather one of welcoming happenings, even if they are difficult to face. In the MBSR intervention, the meditation approach is adopted to develop responsive awareness without judgment and acceptance of their present conditions.<sup>14</sup> MBSR involves both training and life key factors addressing mindfulness-based meditative approaches. Typically, MBSR program spans a duration of 6 to 8 weeks, consisting of 2-2.5-hour group sessions per week. During these sessions, the patients receive systematic instructions aimed at enhancing stress reduction through the practice of mindfulness techniques, which include body awareness, sitting meditation, and yoga. The participants are also encouraged to engage in individual mindfulness practice at home for 15 to 30 minutes per day. It is worth noting that some studies suggested that MBSR programs may benefit from a longer duration, lasting approximately 8 to 12 weeks, to effectively deliver mindfulness training.<sup>14</sup> Other interventional studies elaborated programs from 3 days to 3 months in order to release intensive and well-scheduled portions of mindfulness interventions.<sup>15,16</sup> Fast mindfulness meditation interventions have also been developed holding from 2-3 weeks<sup>15,16</sup> in laboratory-based 3-4-day mindfulness interventions.<sup>15</sup> Further, the success of MBSR in decreasing stress has been assessed in several patients' groups.<sup>17,18</sup>

Among BC patients, limited data suggest that MBSR may decrease mood disturbances and stress<sup>19</sup> and significantly improve sleep quality.<sup>20</sup> However, there are no known published randomized trials on the use of MBSR among women with BC during the critical transition period from end of treatment to resuming normal daily life activities as a cancer survivor.<sup>21,22</sup>

By considering Evans' logic model<sup>20</sup> for psychosocial nursing research, the present study aims to assess deeper insights into the responses provided by BC patients who participated in a mindfulness-based course, by utilizing generative Artificial Intelligence (AI) to gain key information regarding perceived satisfaction definitions among users.

## MATERIALS AND METHODS

### Study design

A survey was administered to BC patients through Google Forms as a component of a post-intervention research study. The study seeks to investigate the experiences of women undergoing MBSR programs as a part of their BC treatment.

### Sampling and eligibility criteria

This study employed purposive sampling, with a primary focus on capturing the firsthand experiences of individuals dealing with BC. Participant recruitment was conducted through the posting of advertisements on the website of a BC peer support group and within the breast surgery clinic of the research hospital. Eligible participants encompassed individuals diagnosed with BC within the past 5 years, spanning from stage 0 to IV, and aged 18 years or older. Exclusion criteria were applied to individuals diagnosed with psychosis who were actively undergoing medication treatment for their condition.

### The MBSR intervention

The intervention in our study was strictly referred to as a MBSR intervention, without any additional interventions. The standard MBSR curriculum inherently included practices like sitting meditation, body scan, Hatha yoga, and walking meditation.<sup>14</sup> Particularly, patients with BC attended 6 consecutive weeks of 2-hour sessions, ensuring uninterrupted time and space for practice in order to enhance mindfulness training

techniques, such as seated meditation, body scanning, Hatha yoga, and walking meditation. Each session incorporated 3 to 4 of these techniques.<sup>23</sup> Informal practices included participants practicing meditation at home with the aid of an instructional CD.<sup>24</sup> A standard MBSR program typically lasted from 6 to 8 weeks, with weekly group sessions lasting 2 to 2.5 hours each. During these sessions, patients received structured guidance to enhance stress reduction through mindfulness techniques, including body awareness, sitting meditation, and yoga. Specifically, participants engaged in home-based practices for at least 10-15 minutes daily, 5 to 6 times per week, and documented their personal experiences on paper. Informal exercises, in essence, refer to activities that could be practiced at any time, by underlining the flexibility in the scheduling of informal or home-based practices, within the program's overall duration and fostering self-awareness, communication, learning, and attentive listening. This approach allowed participants to engage in these practices at times that best suit their individual schedules and needs, ensuring the program in a more adaptable and accessible way.

In the described context, the MBSR protocol lasted 6 consecutive weeks. During this period, the patients with BC attended weekly sessions, each for 2 hours. These sessions were dedicated to practicing various mindfulness techniques above mentioned. In addition to these structured sessions, the participants were also engaged in informal practices. This involved home-based practice using a meditation instruction CD, with a recommendation to practice for at least 10-15 minutes daily, 5 to 6 times per week. The informal exercises were designed to be flexible, allowing participants to practice at their convenience, thereby fostering skills like self-awareness, communication, learning, and attentive listening.

Therefore, the overall duration for learning and practicing the MBSR protocol in this study was 6 weeks of structured group sessions supplemented by daily individual practice at home.

At the end of the MBSR training, an interview with an open-ended questionnaire was performed for each participant in order to better underline their experiences with the MBSR program.

### Data analysis

Data saturation was achieved with 25 participants. Interview documents were processed through

ChatGPT 3.5 version, a sophisticated AI model trained on extensive textual data across various languages, enabling it to produce responses that closely resemble human communication (OpenAI. OpenAI: Models GPT-3).<sup>25</sup> This model was crafted by OpenAI, a company based in San Francisco, CA, USA. The name combines the concept of a chatbot (software designed to comprehend and produce text-based interactions) with the underlying technology called the generative pre-trained transformer (GPT).<sup>26</sup> This GPT framework employs a neural network to interpret natural language, generating replies based on the given input context. What sets ChatGPT apart from earlier GPT versions is its enhanced capability to cater to multiple languages, producing polished and intricate responses due to its advanced modeling techniques (Table 1).

### Ethical concerns

This study was approved by the research ethics committee, China Medical University & Hospital, Taichung, Taiwan on September 7, 2021, with approval number CMUH110-REC2-156. The study was conducted in accordance with the Declaration of Helsinki. All participants firstly gave their consents to participate, after carefully reading and understanding all the explanation of the study and its relating purpose.

## RESULTS

By considering all the open answers received, it was highlighted that the majority of participants reported a high level of satisfaction with the mindfulness course, with many noting improvements in stress management, self-awareness, emotion regulation, and sleep quality (Table 2).

The application of generative AI allowed for a comprehensive analysis of the responses, revealing distinct subgroups among the participants. Some found the course particularly beneficial for managing negative emotions and stress, others appreciated the practical, hands-on nature of the course and some groups, highlighted the importance of daily practice (Table 3).

The generative AI analysis provided valuable insights into the nuanced experiences of the participants (Table 4).

**TABLE 1.** The Arrangement of Text Analyzed through Generative AI Model for Qualitative Interview Data Typically Involves Several Key Steps and Processes

Step	Description
1. Importing Data	Import qualitative interview data into the generative AI model, including transcripts or relevant documents.
2. Data Preprocessing	Clean and format the text data, removing irrelevant characters and standardizing the text.
3. Segmentation	Divide the data into meaningful units, such as individual interview responses or thematic sections.
4. Coding	Utilize NLP algorithms to automatically code or categorize text segments based on predefined criteria or recurring themes.
5. Sentiment Analysis	Determine the emotional tone of the text using sentiment analysis techniques.
6. Topic Modeling	Identify prevalent topics or themes within the data using methods like LDA (Latent Dirichlet Allocation).
7. Visualization	Create visual representations such as charts, graphs, or word clouds to explore data distribution and relationships.
8. Keyword Extraction	Extract frequently occurring keywords or phrases to identify important terms and concepts.
9. Text Search and Retrieval	Implement search and retrieval functions to quickly locate specific sections of text or responses related to themes or keywords.
10. Report Generation	Generate reports or summaries of findings, often including visual representations, to facilitate interpretation and communication of results.

## DISCUSSION

The present study aims to assess deeper insights into the responses provided by BC patients attending a MBSR course, by utilizing generative AI as a tool to gain more key-information regarding perceived satisfaction definitions among users' patients.

From the data obtained, different key points emerged thanks to the generative AI approach in elaborating open answers given by BC patients. In fact, BC patients defined their attended MBSR course as an experience which improved their satisfaction levels with positive benefits in emotional well-being, self-understanding and self-acceptance, and motivation to continue to practice also after the course. Then, thanks to the perception of the mindfulness approach, recognizing challenges as opportunities for development, emphasizing the importance of participating in this course in order to feel in connection with participants and reflecting on life, health and illness, increasing awareness of one's own health, and integration of mindfulness into daily life in several conditions, while also reducing stress.

Therefore, the MBSR course seems to decrease distress effects to both diagnosis and medical treatments in BC patients. In this regard, several studies assessed the impact of mindfulness treatments by adopting several psychological approaches both in group and in

person intervention by ameliorating individual skills in emotional health.<sup>27</sup> Literature supports several extensive strategies to improve QOL among BC patients by considering several dimensions and perceived levels and varying from physical activity, yoga, and psychoeducational interventions.<sup>28,29</sup> For example, Huang et al<sup>30</sup> introduced the MBRS program which significantly and positively influenced psychological patients' conditions. Kang et al<sup>31</sup> demonstrated how the training in nurse-led psychological approach significantly decreased anxiety and depression and, at the same time, increased global health condition. Henderson et al<sup>32</sup> assessed the success of the MBSR schedule in parallel with a nutrition training intervention in early-stage BC patients, by underlining its efficacy in women's well-being improvements. Witek-Janusek et al<sup>33</sup> reported that an MBSR program improved immune function, QOL, and coping attitudes in early-stage BC patients.

On the other hand, Bissling et al,<sup>34</sup> Cramer et al,<sup>35</sup> and Piet et al<sup>36</sup> suggested an insignificant amelioration in the QOL among BC patients after MBSR intervention. However, the literature recognized mindfulness interventions as applicable in several approaches.<sup>36,37</sup> Additionally, Reich et al<sup>38</sup> suggested that an effective mindfulness training should sustain at least 12 weeks with a positive effect on the improvement in BC patients in their psychological fatigue disorders. This trend was explained since the end of the 6 weeks;

**TABLE 2.** Answers Received from the Interviewed Patients

**Question:** “How do you feel after your participation in the MBSR interventional course?”

**Answers:**

- *Thank you for teaching me stress reduction techniques. I think I need to practice more to make these techniques a daily habit.*
- *Great, I learned a good way to exercise my mind and remind myself to get back on track as soon as possible when I encounter any depression in the future!*
- *Be kind to yourself, live in the moment, understand yourself, change your mind and change yourself.*
- *Learn how to not be anxious and live in the present moment*
- *When I am angry, sad, or crying, I learn to use mindfulness to deal with it. I can calm down and not be immersed in sadness like before. I also accept my imperfections and learn to treat myself gently. I feel happier than before.*
- *Very good, you can talk to yourself about what you need!*
- *Very practical, you can remind yourself often.*
- *Very helpful! Break through many blind spots and myths!*
- *I know very clearly that my heart is fragile and I often feel like crying.*
- *Seize the moment and don't be attached ~*
- *It's great. I think I can use it more often.*
- *I can detect the ups and downs of my mood and reduce the number of times I get angry through breathing regulation. It's a great course and I've benefited a lot.*
- *Thumbs up!*
- *Participating in this mindfulness course allows you to be more aware of yourself, understand yourself, and control your emotions, so that you can better grasp the present moment, not deny yourself, and make yourself more comfortable. It's great!*
- *Learn to experience everything around you with your heart*
- *Great! Being able to be aware of the current feelings and focus on it and practice relaxation is very useful. It is what I need to practice now that I am impatient. Accustomed*
- *Very good. Having a teacher lead and explain is much more effective than reading a book on my own. I will want to find similar groups on a regular basis to continue mindfulness training.*
- *When I feel down, I will be used to opening the recording files shared in class to calm myself down.*
- *Very positive, able to understand my own emotions and needs, very pleasant*
- *Thanks*
- *Feeling good, the concept of mindfulness is clearer, and there are practice methods available*
- *Learn how to slow down your thoughts and focus on the present moment*
- *Very relaxing*
- *Happy relaxation and stress relief*
- *This course helps me examine my emotions and stress, and relieves my current sad emotions when I feel unwell.*
- *Very relaxing and learned a lot*
- *I saw breathing techniques and body scanning taught in books many years ago, but I couldn't fully understand them. Through this course, the teacher explained and led the exercises, and I benefited a lot. grateful!*
- *It helps me a lot to be aware of my feelings.*
- *It is very good to strengthen mindfulness and feel that life has energy.*
- *It makes me feel that being sick is no big deal.*
- *Understand the working mechanism of your own brain, find ways to reverse it through practice, and not let bad thoughts continue to spread.*
- *I learned some meditation methods, thank you.*
- *There's not much difference in my mood, I'm still figuring it out.*
- *I am a very anxious person, but after learning mindfulness, I will use five sticks to taste and chew them slowly when eating. With a grateful and blessing heart, it becomes a beautiful condiment?? ~*
- *I arrived at school early and was looking forward to starting the class. However, due to my late registration, I did not receive the pre-class notice. After asking many people, I was able to find the class room. I was already late when I entered the class, disturbing those who were already in class and making me panic. When I went through the re-registration procedure, I felt uneasy and sorry. I felt that it had disrupted the flow of the class, and I was very sorry.*
- *I feel that I should slow down a little more and feel everything in life calmly, but I need to keep practicing and practice often! I came into contact with mindfulness courses for the first time because I wanted to know myself better, listen to my inner voice, and face my inner fears. This will be of great help to me during the treatment after I have cancer.*

(continues)

**TABLE 2.** Answers Received from the Interviewed Patients (*Continued*)**Question:** “How do you feel after your participation in the MBSR interventional course?”

- *Practice mindful breathing repeatedly. Sometimes when you feel anxious or troubled, you will open the recording file and listen to it to calm yourself down.*
- *Haven't taken class yet*
- *The teacher explained it very clearly, but I may not be ready yet and feel that I have been unable to enter the situation.*
- *Have an experience different from ordinary life*
- *The mood is relatively stable and not impatient*
- *very good*
- *During class, I find that I am easily distracted, distracted, and impatient. During the food practice, I couldn't wait to feel it and ate it before it was even halfway through! I thought about practicing after class, but I couldn't bring myself to open the recording file to practice. I wonder if it was affected by physical exertion?*
- *Not much mood change*
- *feel relaxed*
- *Stress relief, happy sharing among sisters*
- *This is my first time taking a class, and I'm still trying to figure out how to use mindfulness to reduce stress.*
- *Learn more about the methods and uses of mindfulness-based stress reduction, so that you can relax more*
- *Ok*
- *These exercises can really help me relax and ease my emotions in the moment, which is really great*
- *Although I still don't feel as deeply as other students did after walking mindfully, my chaotic mind before class has gradually calmed down. I think this is also a gain! Thanks!*
- *Understand your own feelings*
- *The body is a little tired but the soul is rewarding.*
- *The teacher mentioned that when inexplicable emotions come, the first step is to focus on your breathing, observe your thoughts and feelings, and first understand why you are like this before making a choice and action. After practicing this week, I really discovered a lot. Emotions do not come out of nowhere, but because your inner self feels that you are not confident enough or brave enough, so you are unhappy. So now, practice talking to yourself and tell yourself that all those reactions are OK, and those negative ones are just you. It is an idea rather than a fact. You can also be a little sun, giving warmth to yourself and others. Keep working hard. I believe you can do it. Come on!*
- *Very happy*
- *Seize the moment, be aware of yourself, don't judge, experience everything slowly, and feel calmer*
- *Relax*
- *Understand what mindfulness is*
- *Deal with emotions*
- *Mindful breathing to aid sleep*
- *Comfortable*
- *The last exercise today is to say goodbye properly. I think this part is a little difficult for me and makes me a little sentimental.*
- *Feeling of gratitude*
- *Happy*
- *The mood is very relaxed! Already feel comfortable! There's energy!*
- *I have become accustomed to practicing breathing before going to bed to calm my mood and improve the original difficulty in falling asleep.*
- *Thinking about it feels to the brain like having done it*
- *I feel like I have learned a lot about relaxation, meditation, and awareness.*

participants did not record high levels in symptoms with reduced ranges of potential implementation that could probably be reported after 12-weeks. At present, there are no further studies exploring the consequences of MBSR in BC patients.<sup>38</sup>

The present findings are in agreement with other studies: MBSR intervention reports prominent and positive effects for self-management in

several co-occurring adverse symptoms experienced by BC patients. However, other studies suggest that positive effects on the MBSR intervention vary according to cancer type,<sup>22,39</sup> disease stage and therapeutic intervention.<sup>39</sup> The MBSR intervention seems to be an effective non-pharmacologic intervention in psychological and fatigue improvements also after 6-week training consolidating after 12 weeks.

**TABLE 3.** Participant Feedback on a MBSR Course: Themes and AI-Powered Analysis

Themes	Description
Satisfaction and Positive Benefits	Responses expressing gratitude, satisfaction, and appreciation for the benefits gained from the mindfulness course. Participants appear to have derived significant advantages from the experience and are content with the results.
Improvement in Emotional Well-being and Stress	Many participants note an improvement in emotion management, particularly in handling negative emotions such as anger, sadness, and anxiety. This is often associated with an enhanced ability to calm these emotions through mindfulness.
Self-Understanding and Self-Acceptance	Some participants recognize that they have learned to accept themselves with greater kindness and have become more aware of who they are. This may indicate increased self-confidence and self-compassion.
Motivation to Continue Practice	Several participants express their intention to continue practicing mindfulness even after completing the course, indicating that they have found value in the approach and technique.
Challenges and Difficulties	Some participants acknowledge challenges in mindfulness practice, such as distraction or impatience. This suggests an awareness of areas where further work may be needed.
Sharing and Community	Some participants highlight the importance of sharing and participating in mindfulness groups or communities, possibly reflecting a desire for connection and support among participants.
Reflection on Life and Health	Several participants reflect on their life, health, and illness, indicating a heightened awareness of how mindfulness can influence their perspective on health.
Practical Application of Mindfulness	Some participants share how they have integrated mindfulness into their daily lives, using it to address specific situations or improve sleep quality, for example.

## STRENGTH AND LIMITATIONS

The current study had certain strengths worth noting. First, the innovative approach: this study stands out for its innovative use of generative AI to analyze open responses from BC patients. This approach offered a unique perspective on enhancing the effectiveness of MBSR training for mental health and treatment compliance among BC patients. Second, the focus on post-intervention: the study emphasized follow-up assessments conducted after the completion of the MBSR intervention, shedding light on the potential longer-term impacts of this approach. However, it was important to underline that the present study had some limitations, like sample size: a significant limitation was the relatively small sample size used in the study which negatively influenced the generalizability of the findings. Expanding the participant pool to include a larger and more diverse group could provide a more comprehensive understanding of the intervention effects. Secondly, there was a lack of long-term follow-up. Another limitation was the absence of extended follow-up assessments

beyond the conclusion of the MBSR training, also including stress assessment. Investigating the sustainability of the observed benefits over an extended period could yield valuable insights into the lasting impact of the intervention. Thirdly, the present study adopted the unique AI approach by analyzing participant responses. In this regard, it was important to note that, to our knowledge, no prior studies adopted generative AI in this context. This uniqueness could be both a strength and a limitation, as it may require careful consideration of the AI's capabilities and potential biases in interpreting the results.

## CONCLUSIONS

Interesting answers from patients' highlight improvements in self-management in psychological and physical wellbeing, as key-dimensions in self-thoughts. The finding that MBSR improves depression, anxiety, anger, confusion, fatigue, and vigor in patients with BC extended findings from MBSR found in outpatients with general cancer.<sup>40</sup>

**TABLE 4.** Detailed Analysis of Participant Feedback on a Mindfulness Care Course from Generative Artificial Intelligence (AI)**Categories and Key points****Satisfaction and Positive Benefits**

- Participants express gratitude for stress reduction techniques.
- Emphasis on the need for ongoing practice to make techniques a daily habit.

**Improvement in Emotional Well-being and Stress**

- Feedback highlights improved emotion management, especially with negative emotions.
- Association with enhanced ability to calm emotions through mindfulness.

**Self-Understanding and Self-Acceptance**

- Recognition of progress in self-acceptance with kindness.
- Increased self-awareness as a result of the course.

**Motivation to Continue Practice**

- Intent to continue mindfulness practice after the course.
- Perception of value in the mindfulness approach and technique.

**Challenges and Difficulties**

- Acknowledgment of challenges, including distractions and impatience.
- Viewing challenges as opportunities for growth and improvement.

**Sharing and Community**

- Importance placed on sharing and participating in mindfulness groups or communities.
- Desire for connection and support among participants.

**Reflection on Life and Health**

- Reflecting on life, health, and illness as a result of the course.
- Increased awareness of how mindfulness can influence the perspective on health.

**Practical Application of Mindfulness**

- Integration of mindfulness into daily life, such as using it to address specific situations or improve sleep quality.
- Practical use of mindfulness in various situations.

**DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS**

The OpenAI (OpenAI. OpenAI: Models GPT-3) adopted in the present study model was crafted by OpenAI, a company based in San Francisco, CA, USA. The name combines the concept of a chatbot (software designed to comprehend and produce text-based interactions) with the underlying technology called the generative pre-trained transformer (GPT). This GPT framework employs a neural network to interpret natural language, generating replies based on the given input's context.

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