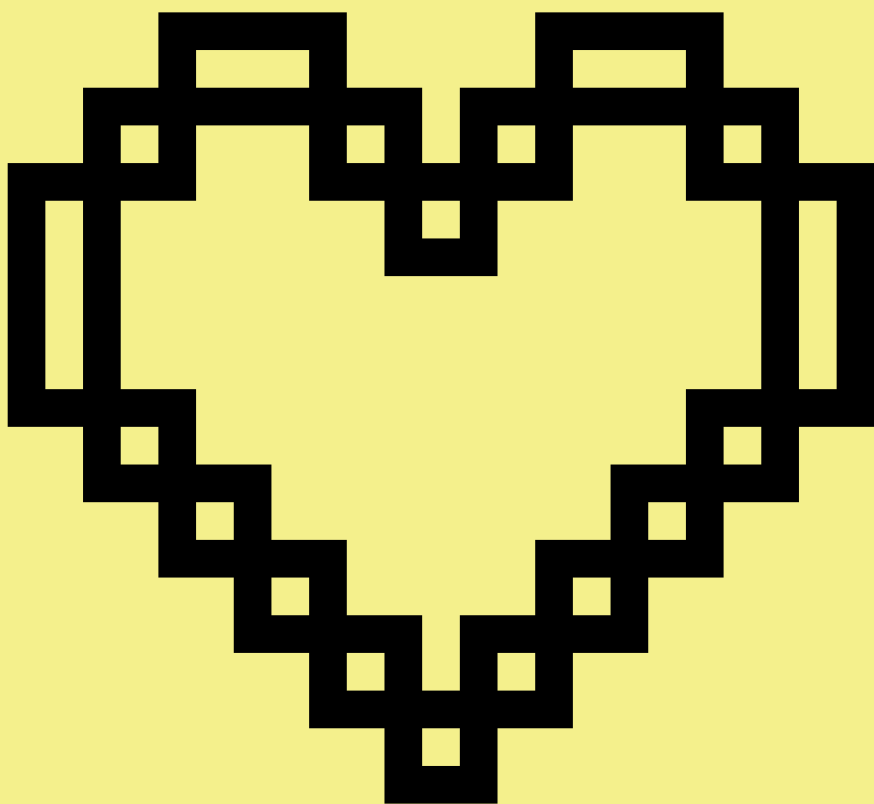


The Connection Between Art, Healing, and Public Health:

A REVIEW OF CURRENT LITERATURE



Volume 1: MUSIC ENGAGEMENT & VISUAL ARTS

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ABSTRACT

This review explores the relationship between engagement with the creative arts and health outcomes, specifically the health effects of music engagement, visual arts therapy, movement-based creative expression, and expressive writing. Although there is evidence that art-based interventions are effective in reducing adverse physiological and psychological outcomes, the extent to which these interventions enhance health status is largely unknown. Our hope is to establish a foundation for continued investigation into this subject and to generate further interest in researching the complexities of engagement with the arts and health.

*"There are many more things,
between heaven and earth, than
are dreamt of in your philosophy,
Horatio."*

—Shakespeare, *Hamlet*

The World Health Organization (WHO) defines holistic health as:

"viewing man in his totality within a wide ecological spectrum, and ... emphasizing the view that ill health or disease is brought about by an imbalance, or disequilibrium, of man in his total ecological system and not only by the causative agent and pathogenic evolution."^{11(p13)}

This important perspective is echoed in the organization's 1946 preamble, wherein health is defined as a state of complete physical, mental, and social well-being rather than merely the absence of disease or infirmity.

Implied in this definition is the tie to health outcomes or changes in health as a result of an action; in the present case, the connection between artistic engagement and the psychosocial and biological manifestations of that connection. More specifically, there is evidence that engagement with artistic activities, either as an observer of the creative efforts of others or as an initiator of one's own creative efforts, can enhance one's moods, emotions, and other psychological states as well as have a salient impact on important physiological parameters.²

Chronic diseases are a nationwide burden, with cardiovascular disease being the leading cause of death during the past century and the incidence of diabetes continuing to increase, now affecting more than 20 million Americans.^{3,4} These diseases are associated with psychosocial difficulties such as depression⁵ and chronic stress, contributing to negative cardiovascular outcomes.^{6,7} Engagement with creative activities has the potential to contribute toward reducing stress and depression and can serve as a vehicle for alleviating the burden of chronic disease.

Over the past decade, health psychologists have cautiously begun looking at how the arts might be used in a variety of ways to heal emotional injuries, increase understanding of oneself and others, develop a capacity for self-reflection, reduce symptoms, and alter behaviors and thinking patterns.⁸ Given the ubiquity of creative expression, as well as the relative ease of engagement, the extent to which psychological

others have found benefit in tying the intricacies of artistic meaning to the complexities of health and wellness. Our hope is to expand effective exploration of these concerns.

We further believe that certain social and environmental factors are converging to thrust the central questions related to better understanding the relationship between art and health into the spotlight of expanded and vigorous attention. Globalization, bringing with it the need to embrace the broad cultural diversity around how personal and societal philosophies interoperate, will put a premium on finding more effective ways to create and share meaning and meaningfulness. This need for meaning and relevance in daily experience has long been recognized as one of the fundamental driving forces in artistic creation and engagement.¹⁰

Similarly, expansion of individual and community health-enhancing efforts worldwide and an acceptance of the definition of health

ourselves struggling with the "fundamentals" of art and health and their meaning in society. We make no attempt to clarify or resolve these fundamental issues. Instead, our intent is to summarize current knowledge about the connection between art and health, identify the most compelling next steps for investigation, and generate further interest in researching the complexities of art and health. Legitimate research questions include whether certain art-based therapies are more or less effective than others, whether the impact of therapy can be tied to other important variables and preconditions, and whether health benefits are sustained or short term. These issues deserve vigorous continued attention.

We conducted a review of current research to determine what is known about art and healing. The goals of our review, primarily covering the period 1995 through 2007, were to assess the state of peer-reviewed research on arts and healing, to provide a brief summary of both qualitative and quantitative research methods and results, and to describe the principal categories of creative expression that have emerged as effective means of enhancing health and wellness.

METHODS

We focused on creative arts or expressive activities that were conducted primarily in North American and European countries and primarily with adults. We excluded studies focusing on complementary medicine practices. Although the literature in this review targeted adults (aged 18 years or older), many studies have focused on use of the arts with children in various contexts (e.g., sandplay,¹¹ dance-movement therapy,¹² dramatherapy,^{13,14} music,¹⁵ myth to facilitate storytelling and drawing activities,¹⁶ wheelchair dance experiences,¹⁷ mandalas,¹⁸ art therapy during painful cancer procedures,¹⁹ drama therapy,²⁰ and drawing.²¹), and other reviews have focused on art therapy and children.^{22,23} Also, we excluded articles about art education or art in professional career development. Finally, we did not evaluate the relationship of creative expression with major mental disorders such as schizophrenia or dementia, severe developmental disorders, end-of-life issues, the use of art with incarcerated populations, or the impact of religion on health outcomes.

We assessed how creative expression as a healing process has been used in both clinical and informal practice to promote



and physiological effects are sustainably health enhancing is an important area for public health investigation.

We reviewed research in the area of art and healing in an effort to determine the creative therapies most often employed. Four primary therapies emerged: music engagement, visual arts therapy, movement-based creative expression, and expressive writing. In these forms of expression, arts modalities and creative processes are used during intentional interventions to foster health.⁹ By assessing the use of these processes in clinical and qualitative trials, one can determine how

as being more than the absence of illness are spurring active investigation into the fundamentals of whole-person approaches to creating and sustaining health. Investigating the relationship between art and health offers some interesting ways to bridge these 2 important areas of inquiry and perhaps provide timely and important insights into each.

Art and health have been at the center of human interest from the beginning of recorded history. Despite that fact, and despite the invested effort and growth of knowledge and understanding in each arena, it is interesting that we often still find

wellness and healing. We searched the following databases and Internet sites, covering the recent period of 1995 through 2007: Medline (PubMed) for general health care literature; Proquest, specifically PsycINFO for psychology journals and CINAHL for nursing and allied health literature; the Cochrane Library for health care reviews; and the Web of Science database including the Science Citation Index, the Social Sciences Index, and the Arts and Humanities Index. Primary keywords included the arts and medical outcomes, the creative arts and healing or wellness, creative expression and healing or wellness, the arts and health care, creative expression and illness, music therapy, art therapy, and creative expression and humanities.

In the Cochrane Library evidence-based literature, the only studies that included references to art or creative expression were those associated with the treatment of schizophrenia or schizophrenia-like illnesses^{24,25}; therefore, we did not include any Cochrane database studies in our review. In addition to the sources just mentioned, specific journals were also targeted because of their connection to art and health: Health Education Research, Health and Quality of Life Outcomes, Health Education and Behavior, The Arts in Psychotherapy, and the Journal of Music Therapy.

We also searched literature from 1970 to 1995 on PubMed (MeSH art therapy database) to determine whether there were further foundational research articles, but we did not find any abstracts matching our criteria. However, we found 1 randomized controlled trial in PubMed, and we included that study.²⁶ Because music therapy was observed to be a predominant source of research in the arts and healing, the Journal of Music Therapy was also reviewed for foundational articles. As mentioned, 4 major areas of arts and health care emerged from our review: music engagement, visual arts therapy, movement-based creative expression, and expressive writing. Therefore, we focused on the potential of these creative areas to promote healing.

RESULTS

The idea that creative expression can make a powerful contribution to the healing process has been embraced in many different cultures. Throughout recorded history, people have used pictures, stories, dances, and chants as healing rituals.²⁷ there has been much philosophical and anecdotal discussion

about the benefits of art and healing, but less empirical research exists in the literature. In fact, although arts therapy has been used clinically for more than a century²⁸ and has been recognized as a profession since 1991,²⁹ much of the published work is theoretical in nature, with little discussion of specific outcomes.^{13,30} Only in recent years have systematic and controlled studies examined the therapeutic effects and benefits of the arts and healing.³¹

Nevertheless, we have seen positive outcomes for the potential of using art to promote healing in our 4 primary areas of focus. This article is not meant to be a comprehensive review of all of the literature available (other authors have provided comprehensive overviews in areas such as music therapy³² and expressive writing³³). Instead, it represents a sampling of the many potential benefits of art in enhancing health and wellness.

MUSIC ENGAGEMENT

Music is the most accessible and most researched medium of art and healing, and there has been a principal emphasis on the soothing capacity of music and its ability to offset overly



Small test group from one of the music engagement studies.

technological approaches to care.³⁴ In particular, music therapy has been shown to decrease anxiety.^{35–37} The pleasure shared by participants in the healing process through a music therapy program can help to restore emotional balance as well.³⁸ There is also evidence of the effectiveness of auditory stimulation, together with a strong suggestion that such stimulation abolishes pain, as a strategy for achieving control over pain.³⁹

In addition, it has been shown that music can calm neural activity in the brain;⁴⁰ which may lead to reductions in anxiety, and that it may help to restore effective functioning in the immune system partly via the actions of the amygdala and hypothalamus. As the activity levels of neurons in the central nucleus of the amygdala decrease in

TABLE 1: DETAILS OF THE MUSIC ENGAGEMENT STUDIES REVIEWED

AUTHOR	YEAR OF STUDY	STUDY DESIGN	NO. OF PARTICIPANTS	STUDY POPULATION	VARIABLES MEASURED	FINDINGS
Guzzetta ²⁶	1989	Randomized controlled trial; relaxation, music therapy, and control groups	80	Coronary artery disease patients	Stress	More improvements in apical heart rates and peripheral temperatures in the relaxation and music therapy groups than in the control group
White ⁴¹	1999	Pretest–posttest	45	Coronary artery disease patients	Stress and psychological variables	Reductions in heart rate, respiratory rate, myocardial oxygen demand, and anxiety after 20 minutes of relaxing music
Burns et al. ⁴²	2001	Pretest–posttest	29	Cancer patients	Psychological variables and immune system response	Improvements in well-being and relaxation and reductions in tension and serum cortisol levels during music listening experience

response to calming effects of music, there may be corresponding reductions in the signals being sent to other parts of the brain. Table 1 outlines the results of key studies we reviewed that focused on music engagement.^{26,41,42}

In a lengthy review of the music therapy literature from 1983 to 1990, Aldridge noted that most of the research was concerned with passive music therapy and the playing of prerecorded music to patients to reduce stress and enhance well-being.³² Overall, he concluded that although there is a broad literature covering applications of music therapy, there is a general absence of valid clinical research from which substantive conclusions can be drawn. In a later review, Gregory examined the Journal of Music Therapy from 1964 through 1999 to determine whether study methodologies included behavioral research designs (e.g., reversal, multiple baseline).⁴³ Of the 607 articles published in that journal during the study time period, 96 (15.8%) included a behavioral research design.

A widely researched phenomenon is the use of music in the control of chronic cancer pain.³² Five benefits of using music therapy with cancer patients have been reported in the literature: increases in hospital patients' sense of control, promotion of wellness and the healthy aspects of patients' lives, reductions in pain⁴⁴ and increases in immunity, decreases in anxiety, and reductions in psychological and physical symptoms.⁴⁵ In

several clinical studies examining the effects of music and music therapy on healing and wellness, music has been found to be a form of relaxation and anxiety reduction.^{41,42,46–50}

In a study of patients admitted to a coronary care unit with acute myocardial infarction, Guzzetta found that relaxation and music therapy were effective in reducing stress.²⁶ In that investigation, 80 patients were randomly assigned to a relaxation, music therapy, or control group. The relaxation and music therapy groups participated in 3 sessions over a 2-day period. Stress was evaluated via apical heart rates, peripheral temperatures, cardiac complications, and qualitative patient evaluative data. Results demonstrated that apical heart rates were lower and peripheral temperatures were higher in the relaxation and music therapy groups than in the control group.

Another area of research is the relationship between coronary heart disease and reductions in anxiety states.^{51–53} In 1 study, music was introduced into the private hospital rooms of 45 patients with myocardial infarction.⁴¹ A Holter monitor was attached to each participant, baseline physiological values were obtained, and participants were asked to complete the State Trait Anxiety Inventory. After listening to relaxing music for 20 minutes, participants exhibited significant reductions in heart rate, respiratory rate, myocardial oxygen

demand, and, in particular, anxiety, both immediately after and 1 hour after the intervention.

In their study, Burns et al.⁴² investigated the relationship of music therapy with positive emotions and immune system responses. They assessed the therapeutic effects on patients of listening to music, both live and recorded, while in a relaxed state, as well as the effects of active involvement in music improvisation. Twenty-nine patients participating in a residential 1-week course completed the University of Wales Institute of Science and Technology (UWIST) Mood Adjective Checklist, and data were collected on cortisol levels.

Results showed increases in well-being and relaxation and decreases in tension during the listening experience, increases in well-being and decreases in tension during the improvisation experience, and decreases in serum cortisol levels during both experiences.

An additional anxiety study⁵⁴ sought to investigate the effects of group music therapy combined with other creative art methods on self-reported levels of anxiety, depression, and self-esteem among women who had experienced intimate partner violence. The group met for 6 sessions, each 1 to 1.5 hours in duration, over a period of 3 months. Visual analog scales

were used to assess anxiety, depression, and self-esteem; the goals of the group were to increase self-esteem and self-expression, decrease anxiety and depression, and increase social support. Significant decreases in depression and marginally significant decreases in anxiety were observed among the study's 7 participants. No significant effects were found for self-esteem. Most participants reported that all of interventions were helpful and rated the group therapy as a positive experience. These findings suggest that active music therapy in a group context may be effective in improving mood among women recovering from intimate partner violence.



VISUAL ARTS

Art helps people express experiences that are too difficult to put into words, such as a diagnosis of cancer. Some people with cancer explore the meanings of past, present, and future during art therapy, thereby integrating cancer into their life story and giving it meaning.⁵⁵

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Case studies are a typical methodology

focusing on the use of the arts in meaning making. For example, McMurray and Schwartz-Mirman⁵⁶ and Reynolds and Prior⁵⁷ conducted case studies in an attempt to understand why some people turn to making visual art after a cancer diagnosis and how artistic self-expression might contribute to maintenance or reconstruction of a positive identity. Table 2 summarizes the use of art therapies in the healing process.⁵⁷⁻⁶³

TABLE 2: DETAILS OF THE VISUAL ARTS STUDIES REVIEWED

AUTHOR(S)	YEAR OF STUDY	STUDY DESIGN	NO. OF PARTICIPANTS	STUDY POPULATION	VARIABLES MEASURED	FINDINGS
Reynolds and Prior ⁵⁷	2003	Phenomenological	30	Chronic illness patients	Health and well-being	Art filled occupational voids, distracted thoughts of illness; improvements in flow and spontaneity, expression of grief, positive identity, social networks
Puig et al. ⁵⁹	2006	Randomized controlled trial (creative arts)	39	Breast cancer patients	Psychological variables	Improved well-being by decreasing negative emotions and increasing positive ones
Ross et al. ⁵⁹	2006	Pre-test-posttest (arts in medicine program)	46	Hemodialysis patients	Medical outcomes, depression, dialysis times, weight gain, laboratory data	Improved medical outcomes, trends toward reduced depression and hemodialysis parameters
Walsh et al. ⁶⁰	2004	Pre-test-posttest quasi-experimental	40	Cancer patients	Stress, anxiety, emotions	Reductions in stress and anxiety; increases in positive emotions
Nainis et al. ⁶¹	2006	Pre-test-posttest	50	Cancer patients	Pain and psychological variables	Reductions in distress and negative emotions
Samoray ⁶²	2006	Semi-structured interviews	11	Trauma patients	Stress and fatigue	Reductions in stress and symptoms of compassion fatigue; increases in healing, well-being, and sense of purpose
Reynolds and Lim ⁶³	2007	Interviews and art	12	Cancer patients	Well-being	Improved focus on positive life experiences, self-worth, and social identity

Guillemin, one of the first to use drawings in an effort to understand experiences of health and illness, examined how 32 middle-aged women with heart disease understood their condition.⁶⁴ After an individual interview, each participant was asked to "draw" her heart disease. The drawings were grouped into 3 themes: the heart at the center, the heart in the lived body, and heart disease as a social illness. Use of color, spatial organization,

and composition were explored. The drawings were considered as both visual products of the women's knowledge about heart disease and processes of embodied knowledge production. It was concluded that having individuals draw how they visualized their condition was an insightful method with which to explore understandings of illness.

"Art can be a refuge..." from the

intense emotions associated with illness.⁶⁵ There are no limits to the imagination in finding creative ways of expressing grief. In particular, molding clay can be a powerful way to help people express these feelings through tactile involvement at a somatic level, as well as to facilitate verbal communication and cathartic release and reveal unconscious materials and symbols that cannot be expressed through words.⁶⁶

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Women taking part in a qualitative study focusing on cancer described ongoing cancer-related difficulties such as fear for the future, pain, sleeplessness, role loss, activity restriction, reduced self-confidence, and altered social relationships.⁶³ Engaging in different types of visual art (textiles, card making, collage, pottery, watercolor, acrylics) helped these women in 4 major ways. First, it helped them focus on positive life experiences, relieving their ongoing preoccupation with cancer. Second, it enhanced their self-worth and identity by providing them with opportunities to demonstrate continuity, challenge, and achievement. Third, it enabled them to maintain a social identity that resisted being defined by cancer. Finally, it allowed them to express their feelings in a symbolic manner, especially during chemotherapy.

In another study, supportive care providers responding to a survey described the healing benefits of music and art therapy in hospital settings, and these benefits seemed to be clustered around notions of exploration, expression, release, and the healing process.⁶⁷ In an additional study conducted at the Chelsea and Westminster Hospital, Staricoff compared the use and nonuse of an art intervention in different units of the hospital.⁶⁸ The groups that received the intervention were significantly more likely than were those that did not to have improved clinical outcomes, including better vital signs, diminished cortisol related to stress, and less medication needed to induce sleep.

There is also evidence that use of art and music reduces hospital stays, with studies showing earlier discharges among patients taking part in visual and performing arts interventions than among those not doing so.^{69,70} In 1 study, surgery or critical care patients who participated in guided imagery or had a picture of a landscape on their wall had a decreased need of narcotic pain medication relative to their counterparts and left the hospital earlier.^{71,72} Evaluations of art projects can link the benefits of creative expression to healing and greater wellness.

Two other visual arts studies have focused on the experience of women with cancer.^{58,73} In a quantitative trial of mindfulness art therapy targeted toward women with cancer, Monti et al.⁷³ found that those who engaged in art making demonstrated statistically significant decreases in symptoms of physical and emotional distress during treatment. In addition to the introduction

8 of self-care through guided imagery, the art-making therapy involved the women

drawing complete pictures of themselves and engaging in yoga and meditation. The relaxation and symptom reduction produced by creative expression opened pathways to emotional healing.

The psychological effects of breast cancer, in particular, may include adjustment disorders, depression, and anxiety, and these symptoms in turn may generate feelings of fear, anger, guilt, and emotional repression. In their study, Puig et al.⁵⁸ explored the efficacy of a complementary creative arts therapy intervention with respect to enhancing emotional expression, spirituality, and psychological well-being among newly diagnosed breast cancer patients. This pretest–posttest study included 4 individual therapy sessions conducted over a 4-week period, with each hour-long session comprising guided, semistructured, creative arts therapy exercises involving drawing implements. Thirty-nine women with stage 1 or stage 2 breast cancer were randomly assigned to an experimental group that took part in an individual creative arts therapy intervention or to a delayed treatment control group.

Analyses of covariance were used to analyze the results, which indicated that the creative arts therapy intervention was not effective in enhancing the expression of emotions or the participants' level of spirituality.⁵⁸ However, participation in the intervention enhanced experimental group participants' psychological well-being by decreasing their negative emotions and enhancing their positive emotions.

Medical professionals are beginning to recognize the role that creative arts play in the healing process; increasingly, arts in medicine programs are emerging throughout the United States and worldwide.⁷⁴ With the success of the University of Florida's general arts in medicine program, a similar set of activities was launched in the long-term dialysis unit with the goal of assessing their effects.⁵⁹ Long-term hemodialysis is associated with impaired quality of life and depression, which are thought to worsen compliance with treatment regimens. At baseline and 6 months, the study authors administered the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) and Beck Anxiety Inventory to 46 patients and assessed dialysis times, interdialytic weight gain, and predialysis laboratory results.⁷⁵

They also examined relationships between these variables and participation in the arts in medicine program. The intervention, led by artists, included artwork, crocheting, crafts,

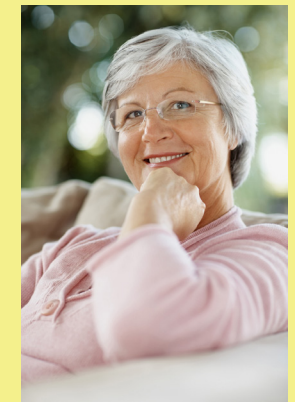
seasonal displays, poetry, and playing of musical instruments. At 6 months, the participating patients, nurses, technicians, and physicians reported that the program had a positive impact on the unit. Paired comparisons with baseline data showed significant improvements in SF-36 symptom scores (e.g., weight gain, serum carbon dioxide content, phosphate levels) and a trend toward reduced levels of depression.

In addition, regression analyses showed that high levels of program participation correlated with improved SF-36 social functioning, bodily pain, and physical role functioning scores, as well as a trend toward greater albumin levels, but also higher phosphate

and lower calcium levels. In conclusion, participation in an arts-in-medicine program was related to improved quality-of-life measures, and there were encouraging trends in terms of improvements in depression and certain laboratory and hemodialysis parameters.

Walsh et al. conducted a pretest–posttest quasi-experimental study to test the efficacy of a creative arts intervention with 40 family caregivers of patients with cancer.⁶⁰ Participation in the creative arts intervention was the independent variable, and stress, anxiety, and emotions were the dependent variables. The 6-month study was implemented at a regional cancer treatment center. The

creative arts intervention consisted of several creative arts activities designed for bedside delivery. Participants completed the Mini-Profile of Mood States (Mini-POMS), the Beck Anxiety Inventory, and the Derogatis Affects Balance Scale (as a measure of negative and positive affect). The creative arts intervention promoted short-term well-being in this sample of family caregivers. Caregivers reported significantly reduced stress, decreased anxiety, and increased positive emotions after taking part in the intervention. They also reported increases in positive communications with cancer patients and health care providers.



“Caregivers reported significantly reduced stress, decreased anxiety, and increased positive emotions after taking part in the intervention. They also reported increases in positive communications with cancer patients and health care providers.”

In another study,⁶¹ the specific aim was to determine the effects of a 1-hour art therapy session on pain and other symptoms common to adult cancer inpatients. The Edmonton Symptom Assessment Scale and the Spielberger State-Trait Anxiety Index were used to quantify symptoms, and the 50 patients taking part were asked open-ended questions to evaluate their perceptions of the experience. There were statistically significant reductions in 8 of the 9 symptoms measured by

the Edmonton scale, including the global distress score, as well as significant improvements in most of the domains measured by the Spielberger State-Trait Anxiety Index. Patients overwhelmingly expressed comfort with the process and a desire to continue with therapy. This study provides initial evidence of the efficacy of art therapy in reducing a broad spectrum of symptoms among cancer inpatients.

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This series explores the relationship between engagement with the creative arts and health outcomes, specifically the health effects of music engagement, visual arts therapy, movement-based creative expression, and expressive writing. Although there is evidence that art-based interventions are effective in reducing adverse physiological and psychological outcomes, the extent to which these interventions enhance health status is largely unknown. Our hope is to establish a foundation for continued investigation into this subject and to generate further interest in researching the complexities of engagement with the arts and health.



Dr. Heather L. Stuckey's research focuses on improving the education, self-management support and psychological distress of people with diabetes and other chronic disease. Using medical humanities-based models and problem-solving techniques, she works with qualitative methods (narrative, video, arts-based inquiry, observations, interviews, focus groups) to determine how adults make meaning of their illness and how the medical community can respond to support patients and their families. She has been the leader in developing website interventions that are built to help people problem-solve by looking at strategies that have worked in real-life scenarios. Using her adult education background and creativity, she takes a systems approach in not only improving knowledge, but

providing social and emotional support as part of her interventions. She has also co-edited a book on transformation and the arts, and has written several NIH grants to become an expert in mixed methods research applied to behavioral science.



Dr. Jeremy Nobel's practice as a general internist for many years allowed him to experience "the front lines" of health care and its delivery. Currently, through his faculty appointments at the Harvard School of Public Health and the Harvard Medical School, Dr. Nobel's teaching, research, and community based projects address the design of healthcare delivery systems that improve quality, cost-effectiveness and access. His work has been the basis of significant improvements in preventative, acute, chronic, rehabilitative, and end of life medical care that focus on understanding what quality healthcare means from a patient perspective, and how best to deliver it.

Dr. Nobel is also a recognized leader in the field of medical humanities, an interdisciplinary endeavor that draws on a diverse range of fields, including the creative arts, to inform medical education and practice. He is the founder and president of the Foundation for Art and Healing whose signature initiative, the UnLonely Project, addressing the personal and public health challenges of loneliness and social isolation, has gained national visibility. His work is dedicated to exploring the important relationship between creative expression and health and well-being, bringing those benefits to individuals and communities through innovative programs and an active research agenda. Also a published poet, Dr. Nobel has received several awards for his poetry including the Bain-Swiggett Prize from Princeton University, and the American Academy of Poets Prize from the University of Pennsylvania.

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