

ALWAYS ON MY MIND: THE EFFECTS OF CANCER AND UNSUPPORTIVE  
RELATIONSHIPS ON COGNITIVE PERFORMANCE

by

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Submitted in partial fulfillment of the  
requirements for Departmental Honors in  
the Department of Psychology  
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December 6, 2013

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## INTRODUCTION

For several years, breast cancer patients have reported experiencing problems with memory, concentration, and other cognitive functioning following cancer treatment. For example, Jenkins and colleagues (2006) found that approximately eighty-three percent of women who are diagnosed with breast cancer experienced some form of cognitive impairment. Although research has focused on chemotherapy as the principal contributor (Rugo & Ahles, 2003; Tannock et al., 2004), several other studies have shown that patients experience a decline in cognition prior to undergoing chemotherapy (Cimprich, 1992; Cimprich et al., 2010; Reid-Arndt & Cox, 2012). In light of previous research showing that individuals with a history of unsupportive relationships develop deficits in working memory (Edelstein, 2006), the purpose of the present study was to use the attachment theory (Bowlby, 1969) as a theoretical framework to understand whether thoughts of cancer and unsupportive relationships decrease cognitive performance.

### **Cognitive Deficits in Breast Cancer Populations**

Breast cancer is the most common form of cancer among American women with about 1 in 8 women in the United States developing the disease during their lifetime (American Cancer Society, 2013). As a result of their diagnosis and treatment, many women with cancer often experience cognitive difficulties (e.g., Reid-Arndt, 2009; Reid-Arndt & Cox, 2012). This mental foggiess, called “chemo-brain,” is associated with an inability to recall information (e.g., memory lapses), short attention spans (e.g., concentration), an inability to multi-task, and problems with remembering details (e.g., names, dates) and common words (e.g., American Cancer Society; Cimprich et al., 2010). For instance, several meta-analyses have shown small to moderate effects across several

cognitive domains, with the highest detriments in executive functioning (i.e., planning, attention) and verbal memory (i.e., the interpretation of verbal information; Anderson-Hanley, Sherman, Riggs, Agocha, & Compas, 2003).

Although research on cognitive impairments among cancer patients has focused on chemotherapy and hormone therapies as principal contributors (e.g., Rugo & Ahles, 2003; Tannock et al., 2004), several other studies suggest that these are not the only cause (Cimprich, 1992; Cimprich et al., 2010; Reid-Arndt & Cox, 2012). For example, it appears that only 1/3 of breast cancer patients with a history of chemotherapy experience cognitive difficulties (Ahles & Saykin, 2001); further, some patients experience memory problems following surgery prior to the start of chemotherapy (Cimprich, 1992).

Research among breast cancer survivors has shown that cognitive deficits are associated with lower quality of life. For instance, Reid-Arndt, Yee, Perry, and Hsieh (2009) found that memory difficulties following chemotherapy were associated with decreased productivity, lower community involvement, decreased social functioning, and greater depression. Given that cognitive difficulties are associated with poorer physical and psychological health in breast cancer populations (e.g., Hess & Insel, 2007; Reid-Arndt, Yee, Perry, & Hsieh, 2009), it seems especially important to identify factors that contribute to this cognitive decline. Although several studies have examined cognitive declines in individuals with breast cancer, research has yet to examine how social factors, such as close relationships, influence these effects. The current research utilized attachment theory (Bowlby, 1969; Mikulincer & Shaver, 2007) to examine whether cognitive deficits following thoughts of cancer are explained, in part, by unsupportive relationships with close others.

## Attachment Theory

From the perspective of attachment theory (Bowlby, 1969), close relationships are important because they serve as a source of comfort and security following threat. Specifically, Bowlby observed that infants engage in a variety of behaviors, such as crying and searching the environment, to maintain or reestablish proximity to a caregiver. He hypothesized that such attachment behaviors were the result of a motivational system, which he called the *attachment behavioral system*, which functions to regulate proximity between infants and their primary caregivers. This system, according to Bowlby, was critical to the survival of species, especially ones who were born with limited capacities for feeding, exploration, and defense.

Although attachment theory was originally developed to explain infants' relationships with their parents, it has been extended to other close relationships across the lifespan, including romantic partners (see e.g., Mikulincer & Shaver 2007 for a review). Similar to children, adults who are distressed may seek out an attachment figure (e.g., boyfriend/girlfriend, spouse) in an attempt to restore emotional well-being following psychological (e.g., failing an exam) or physical (e.g., being in an accident) threat. In contrast to parent-child relationships, in adult relationships, both partners may rely on each other to fulfill attachment needs and both persons may act caregivers during times of stress or distress.

More recently, several studies have examined whether attachment influences an individual's ability to recall memories and how effectively they process information. For example, people who have a history of unsupportive relationships have more difficulty recalling emotional experiences from childhood and are less accurate about telling stories

about interpersonal loss (Fraley et al., 2000; Mikulincer & Orbach, 1995). Furthermore, Stanton and Campbell (2013) found that following thoughts of relationship threat, individuals with prior unsupportive relationships were more likely to process information holistically (versus being more detail-orientated) and exhibited poorer cognitive performance on a Stroop task compared to individuals with supportive relationships. Together, this work suggests that unsupportive relationships may contribute, in part, to impairments in memory. While research has looked at memory deficits from an attachment theory perspective, no work has examined whether unsupportive relationships increase memory difficulties among individuals diagnosed with cancer. Thus, one goal of the present research is to collect pilot data among college students to examine whether thoughts of cancer and unsupportive relationships lead to greater cognitive problems.

### **Present Research**

The purpose of the present research was to examine whether activating thoughts of a negative (vs. positive) relationship, after being primed with cancer, leads to lower cognitive functioning, specifically poorer math performance. In order to do this, participants were randomly assigned to write about their thoughts and feelings associated with cancer or dental pain (the control condition). Further, half of the participants were asked to recall a time when their romantic partner was supportive and positive, whereas the remaining participants were asked to recall a time when their partner was not supportive and negative (see Baldwin & Sinclair, 1996 for similar procedures). To measure cognitive performance, everyone was asked to complete 26 math problems taken from the quantitative section of the GRE (see McIntyre, Paulson, & Lord, 2003). Overall,

it was hypothesized that those who were primed with cancer, and asked to recall a negative close relationship, would exhibit poorer math performance.

## METHOD

### **Participants**

Eighty-one students (58 female;  $M_{age} = 20.08$ ,  $SD = 1.92$ ) were recruited from TCU psychology classes to participate in exchange for course credit.

### **Materials and Procedures**

The study was conducted in a classroom setting. Participants were told that they were taking part in an experiment on “Personality and Problem Solving.” After giving informed consent, participants completed several personality questionnaires, two writing primes, and then completed a 20 min timed math assessment. The content and order of materials are described below.

*Cancer prime.* Following a series of personality questionnaires (e.g., neuroticism, social desirability), participants completed the cancer prime manipulation. Consistent with previous research (Arndt, Goldenberg, Cook & Cox, 2009), cancer was manipulated by having participants answer two open-ended questions about their thoughts and feelings associated with cancer (e.g., “Briefly describe the emotions that the thought of cancer arouses in you” and “Jot down, as specifically as you can, what you think will happen to you as you physically get cancer and once you have physically gotten cancer”), versus parallel questions about experiencing dental pain (e.g., “Briefly describe the emotions that the thought of dental pain arouses in you” and “Jot down, as specifically as you can, what you think will happen to you as you physically feel dental pain and once you have physical dental pain”). This topic was chosen because it has been used as a



control condition in previous research (Peters et. al., 2005; Routledge et. al., 2008; Strachman & Schimel, 2006). Thus, by having control participants reflect on dental pain, the present study was able to examine whether an aversive event would engender similar effects as cancer.

*Relationship prime.* Following the cancer manipulation, participants were asked to visualize either a positive or negative interaction with a romantic partner (see Baldwin & Sinclair, 1996 for similar procedures). In the positive relationship condition participants were told, “Please write about a time when your romantic partner held a somewhat positive opinion of you” and “to hold this image and write your thoughts and feelings about your supportive partner.” In the negative condition, participants were instructed to “write about a time when your romantic partner held a somewhat negative opinion of you.” Everyone was instructed to imagine being in the presence of their partner (i.e., to imagine the person’s hair color, eye color, sound of his/her voice) and to write about their thoughts and feelings associated with the person for the length of a page.

*Math test.* Following McIntyre, Paulson, and Lord (2003), everyone was administered a mathematics test that included 26 different quantitative items. Participants were given 20 min to complete the test. Composite scores were calculated by summing the total number of correct problems and the total number of problems attempted (i.e., not left blank). Percentages were calculated by dividing the number of problems correct by the number of problems completed and multiplied 100. For example, if a participant completed 20 problems, 12 of which were correct, his/her score would be 60 ( $12/20 \times 100$ ; see McIntyre et al., for similar scoring procedures). Appendix A has a copy of the math problems that were used.

## RESULTS

The present study examined whether activating thoughts of cancer and recalling negative relational event would impair math ability. To test this, a 2 (cancer vs. dental pain) by 2 (positive vs. negative relationship) analysis of variance (ANOVA) was performed. The analysis revealed a significant main effect of relationship on the percent of math problems correct,  $F(1,77) = 9.23, p = .003, \eta^2 = .01$ . Specifically, those who recalled a positive relationship ( $M = 60.54, SD = 17.71$ ) performed better on the math assessment than those who recalled a negative relationship ( $M = 47.84, SD = 20.64$ ). However, this effect was qualified by a significant 2-way interaction between cancer prime and relationship,  $F(1,77) = 5.55, p = .021, \eta^2 = .01$ . Follow-up tests using simple main effect analyses showed that following thoughts of cancer, participants exhibited poorer math ability after recalling a negative relationship ( $M = 42.31, SD = 18.87$ ) compared to a positive one ( $M = 64.87, SD = 17.63$ ),  $F(1,77) = 14.40, p < .001$ . However, there was no significant difference between relationship conditions following thoughts of dental pain,  $F(1,77) = .235, p = .63$ . Looking at differently, participants primed with cancer exhibited poorer math ability ( $M = 42.31, SD = 18.87$ ) than those primed with dental pain ( $M = 53.95, SD = 21.27$ ) in the negative relationship condition,  $F(1,77) = 3.83, p = .05$ . There were no such differences in participants who recalled a positive relational event,  $F(1,77) = 1.88, p = .17$ .

## DISCUSSION

Women with breast cancer often report cognitive difficulties as a result of their cancer diagnosis and treatment (e.g., Reid-Arndt, 2009; Reid-Arndt & Cox, 2012). Although it was once believed that memory deficits were the result of hormone and

chemotherapy treatments, (e.g., Rugo & Ahles, 2003; Tannock et al., 2004), several studies have shown that reduced cognitive functioning is often present before cancer treatment begins (Cimprich, 1992; Cimprich et al., 2010; Reid-Arndt & Cox, 2012). The current study was interested in the role of close relationships and how activating thoughts of a negative relationship results in poorer cognitive performance among individuals primed with cancer. In support of this hypothesis, the results revealed that participants performed worse on math problems following thoughts of cancer and an unsupportive relationship. These results suggest that close relationships play an important role in the cognitive functioning of individuals as they cope with cancer.

The present findings have important implications for research on cancer populations. Specifically, although previous research has found a relationship between self-reported stress and cognitive difficulties in breast cancer populations (Reid-Arndt & Cox, 2012), studies have yet to look at the impact that social factors have on cancer populations. This is important given that the diagnosis and treatment of breast cancer is often a severe, potentially life threatening event (American Cancer Society, 2013). Treatment for the disease almost always involves surgical removal of the tumor, postoperative chemotherapy and/or radiation therapy, and the potential for disease reoccurrence. Not surprisingly, many women with breast cancer typically exhibit higher levels of psychological distress (Hess & Insel, 2007) and often turn to close relationships for comfort and support (Lichtman, Taylor & Wood, 1987). The current study found that participants exhibited poorer cognitive performance following thoughts of cancer and an unsupportive relationship. These results suggest that although the diagnosis of breast cancer can place a strain on people's relationships with close others (e.g., Lichtman,

Taylor, & Wood, 1987; Wellisch, Gritz, Schain, Wang, & Siau, 1991), close relationships play an important role in the cognitive well-being of breast cancer survivors.

The present findings also have important implications for research on attachment theory. According to Bowlby (1969), the attachment system is most prevalent when an individual undergoes a stressful or threatening event, and his/her attachment figure offers comfort and security to foster coping and adjustment for the individual. In support of this reasoning, researchers have found that individuals with unsupportive relationships often have difficulties disengaging from negative thoughts and memories about their close relationships (e.g., Mikulincer & Orbach, 1995; also see Mikulincer & Shaver, 2007 for a review). With respect to the current work, participants had a more difficult time disengaging from thoughts of an unsupportive relationship following a threatening event (i.e., thoughts of cancer). These results are consistent with other work showing that people with a history of unsupportive relationships are less able to recall emotional experiences (Fraleley et al., 2000; Mikulincer & Orbach, 1995) and perform poorer on cognitive tasks (Stanton & Campbell, 2013).

Although this research provides initial support for the relationship between cancer, close relationships, and cognitive functioning, this study is not without its limitations. First, the sample of participants in this study was college-age students, which limits the generalizability of these findings. Future research should recruit participants of all ages, both educated and uneducated. Second, in the current study, individuals were asked to express their thoughts and feelings associated with being diagnosed with cancer. The use of a fictional cancer scenario may have very different results compared to actually being diagnosed with the disease. Future research should extend these findings to

real cancer populations to determine the impact that negative relationships have on their cognitive abilities. It would also be interesting assess whether poorer memory functioning after thoughts of an unsupportive relationship leads to lower physical and psychological well-being among cancer patients. Third, this study is limited in the cognitive task that was performed: math performance. It has been found that cancer populations have cognitive deficits in memory, attention and verbal memory (e.g., Reid-Arndt, 2009; Reid-Arndt & Cox, 2012), which should also be examined with unsupportive relationships.

Finally, this study is limited because it did not look at how attachment style differences influenced the current effects. Contemporary research on individual differences suggests that attachment should be understood with respect two dimensions: attachment anxiety (i.e., the extent to which people worry about close relationships) and attachment avoidance (i.e., the extent to which people are emotionally distant from close others; Brennan, Clark, & Shaver, 1998). In the current research, securely attached (i.e., low anxiety/low avoidance) and anxious individuals (i.e., high anxiety/low avoidance) may have reacted more negatively to an unsupportive relationship compared to avoidant persons (i.e., low anxiety/high avoidance). This is consistent with previous research showing that secure and anxious individuals are more distressed by relationship problems whereas avoidant individuals are not (Mikulincer & Shaver, 2007). Additionally, individual differences in attachment have been proposed to influence attention and memory (e.g., Main, Kaplan, & Cassidy, 1985), with anxious individuals performing worse memory tasks because of their constant rumination about close others (e.g., Stanton & Campbell, 2013). Future research should take into account individual

differences with breast cancer populations to see whether certain attachment styles are more or less vulnerable to cognitive impairments than others.

Despite these limitations, this study offers important insight into how close relationships play a role in the cognitive functioning of individuals with cancer. This year it is estimated that 230,000 new cases of invasive breast cancer will be diagnosed among women, with nearly 40,000 women expected to die from the disease (American Cancer Society, 2013). Although the current study utilized college students, the eventual goal is to extend these results to actual breast cancer survivors, with a hope to find a strategy to improve their cognitive functioning. The current results establish the possibility that relationship factors contribute, in part, to the apparent cognitive decline in breast cancer populations. Findings from this work can be used to develop interventions focused on providing social support for patients and their families coping with the cancer.

APPENDIX A

**Texas Christian University  
Fort Worth, Texas**

**CONSENT TO PARTICIPATE IN RESEARCH**

**Title of Research:** Personality and Problem Solving

**Funding Agency/Sponsor:** Not Applicable (N/A)

**Study Investigators:** Katrina Fazelimanesh (principle investigator), Erin VanEnkevort (principle investigator), & Cathy Cox, Ph.D. (faculty advisor)

**What is the purpose of the research?**

The study is interested in understanding how personality relates to mathematic ability.

**How many people will participate in this study?**

There will be approximately 160 participants in this study.

**What is my involvement for participating in this study?**

Your participation will involve filling out a variety of questionnaire and evaluation forms.

**How long am I expected to be in this study for and how much of my time is required?**

The study will take about 40 minutes.

**What are the risks of participating in this study?**

Your participation in this research may expose you to potentially higher amounts of awareness about different personality characteristics that you may or may not possess and how these characteristics relate to different judgments, but is otherwise no more risky than your everyday activity. During the study you may also be asked questions about emotionally evocative topics. You are free to not answer any particular question if you choose, and to stop participating at any time during the experiment without any penalty or loss of credits to which you are entitled. The experimenter will inform you if any new information surfaces that may affect your willingness to participate.

**What are the benefits for participating in this study?**

You will receive credit towards your psychology course, plus first-hand experience of how psychology research is conducted.

**What is an alternate procedure(s) that I can choose instead of participating in this study?**

Alternatives to participation in experiments are made available upon request from Dr. Sarah E. Hill and/or Dr. Cathy R. Cox by the last experimental day of the semester.

**How will my confidentiality be protected?**

To insure confidentiality, you will complete all materials in a private environment and will place all materials in a blank confidential envelope. Data, along with consent forms, will be kept in a locked file cabinet. Only the investigators will have access to participant data.

**Is my participation voluntary?** Yes

**Can I stop taking part in this research?** Yes

**What are the procedures for withdrawal?**

A participant can withdraw at any time from the experiment. However, it is preferred that you get up quietly and tell the experimenter that you need to be excused from the experiment. Please do not disturb the other participants. You will be asked to talk with the experimenter about the nature of the study before leaving the experimental session.

**Will I be given a copy of the consent document to keep?**

Yes, if a copy of the consent form is specifically requested.

**Who should I contact if I have questions regarding the study?**

Katrina Fazelimanesh, Principle Investigator, Department of Psychology, 817-257-4231 (k.d.fazelimanesh@tcu.edu)

Erin A. VanEnkevort, Principle Investigator, Department of Psychology, 817-257-4231 (e.vanenkevort@tcu.edu)

Dr. Cathy R. Cox, Faculty Advisor, Department of Psychology, 817-257-6418 (c.cox@tcu.edu)

**Who should I contact if I have concerns regarding my rights as a study participant?**

Dr. Sarah E. Hill, Chair, Departmental Review Board, [s.e.hill@tcu.edu](mailto:s.e.hill@tcu.edu), 817-257-6424

Dr. David Cross, Chair, TCU Institutional Review Board, [d.cross@tcu.edu](mailto:d.cross@tcu.edu), 817-257-6416

Dr. Timothy Barth, Associate Dean, Research and Graduate Studies, [t.barth@tcu.edu](mailto:t.barth@tcu.edu), 817-257-6427

Your agreement below indicates that you have read the information provided above, you have received answers to all of your questions and have been told who to call if you have any more questions, you have freely decided to participate in this research, and you understand that you are not giving up any of your legal rights.



**Have you read the consent information above, and do you agree to participate?\***

- Yes, I have read the information above and would like to participate.
- No, I would not like to participate in this research

**Participant Name:** \_\_\_\_\_ **TCU Student ID:** \_\_\_\_\_

### Experiences in Close Relationships Inventory

The following statements concern how you generally feel in close relationships (e.g., with romantic partners, close friends, or family members). Respond to each statement by indicating how much you agree or disagree with it. Write the number in the space provided, using the following rating scale:

| 1                            | 2     | 3     | 4                         | 5     | 6     | 7                         |
|------------------------------|-------|-------|---------------------------|-------|-------|---------------------------|
| <i>Disagree<br/>Strongly</i> | ..... | ..... | <i>Neutral/<br/>Mixed</i> | ..... | ..... | <i>Agree<br/>Strongly</i> |

- \_\_\_ 1. I prefer not to show others how I feel deep down.
- \_\_\_ 2. I worry about being rejected or abandoned.
- \_\_\_ 3. I am very comfortable being close to other people.
- \_\_\_ 4. I worry a lot about my relationships.
- \_\_\_ 5. Just when someone starts to get close to me I find myself pulling away.
- \_\_\_ 6. I worry that others won't care about me as much as I care about them.
- \_\_\_ 7. I get uncomfortable when someone wants to be very close to me.
- \_\_\_ 8. I worry a fair amount about losing my close relationship partners.
- \_\_\_ 9. I don't feel comfortable opening up to others.
- \_\_\_ 10. I often wish that close relationship partners' feelings for me were as strong as my feelings for them.
- \_\_\_ 11. I want to get close to others, but I keep pulling back.
- \_\_\_ 12. I want to get very close to others, and this sometimes scares them away.
- \_\_\_ 13. I am nervous when another person gets too close to me.
- \_\_\_ 14. I worry about being alone.
- \_\_\_ 15. I feel comfortable sharing my private thoughts and feelings with others.
- \_\_\_ 16. My desire to be very close sometimes scares people away.
- \_\_\_ 17. I try to avoid getting too close to others.
- \_\_\_ 18. I need a lot of reassurance that close relationship partners really care about me.
- \_\_\_ 19. I find it relatively easy to get close to others.
- \_\_\_ 20. Sometimes I feel that I try to force others to show more feeling, more commitment to our relationship than they otherwise would.
- \_\_\_ 21. I find it difficult to allow myself to depend on close relationship partners.
- \_\_\_ 22. I do not often worry about being abandoned.
- \_\_\_ 23. I prefer not to be too close to others.
- \_\_\_ 24. If I can't get a relationship partner to show interest in me, I get upset or angry.

- \_\_\_ 25. I tell my close relationship partners just about everything.
- \_\_\_ 26. I find that my partners don't want to get as close as I would like.
- \_\_\_ 27. I usually discuss my problems and concerns with close others.
- \_\_\_ 28. When I don't have close others around, I feel somewhat anxious and insecure.
- \_\_\_ 29. I feel comfortable depending on others.
- \_\_\_ 30. I get frustrated when my close relationship partners are not around as much as I would like.
- \_\_\_ 31. I don't mind asking close others for comfort, advice, or help.
- \_\_\_ 32. I get frustrated if relationship partners are not available when I need them.
- \_\_\_ 33. It helps to turn to close others in times of need.
- \_\_\_ 34. When other people disapprove of me, I feel really bad about myself.
- \_\_\_ 35. I turn to close relationship partners for many things, including comfort and reassurance.
- \_\_\_ 36. I resent it when my relationship partners spend time away from me.

For each of the following statements, please indicate the extent to which you agree on the following scale:

1      2      3      4      5      6      7  
 strongly      strongly  
 disagree      agree

- \_\_\_\_\_ 1. It really bothers me when people sneeze without covering their mouths.
- \_\_\_\_\_ 2. If an illness is 'going around', I will get it.
- \_\_\_\_\_ 3. I am comfortable sharing a water bottle with a friend.
- \_\_\_\_\_ 4. I do not like to write with a pencil someone else has obviously chewed on.
- \_\_\_\_\_ 5. My past experiences make me believe I am not likely to get sick even with my friends are sick.
- \_\_\_\_\_ 6. I have a history of susceptibility to infectious diseases.
- \_\_\_\_\_ 7. I prefer to wash my hands pretty soon after shaking someone's hand.
- \_\_\_\_\_ 8. In general, I am very susceptible to colds, flu, and other infectious diseases.
- \_\_\_\_\_ 9. I dislike wearing used clothes because you do not know what the past person who wore it was like.
- \_\_\_\_\_ 10. I am more likely than the people around me to catch an infectious disease.
- \_\_\_\_\_ 11. My hands do not feel dirty after touching money
- \_\_\_\_\_ 12. I am unlikely to catch cold, flu, or other illnesses, even if it is 'going around.'
- \_\_\_\_\_ 13. It does not make me anxious to be around sick people.
- \_\_\_\_\_ 14. My immune system protects me from most illnesses that other people get.
- \_\_\_\_\_ 15. I avoid using public telephones because of the risk that I may catch something from the previous user.

### Personality Inventory

Please answer each question by circling either “Y” for yes or “N” for no, following the question. There are not right or wrong answers and no trick questions. Work quickly and do not think too long about the exact meaning of the question.

1. Does your mood often go up or down? Y or N
2. Do you ever feel “just miserable” for no reason? Y or N
3. Do you often worry about things you should not have done or said? Y or N
4. Are you an irritable person? Y or N
5. Are your feelings easily hurt? Y or N
6. Do you often feel fed-up? Y or N
7. Are you often troubled about feelings of guilt? Y or N
8. Would you call yourself a nervous person? Y or N
9. Are you a worrier? Y or N
10. Do you worry about awful things that might happen? Y or N
11. Would you call yourself tense or “highly strung”? Y or N
12. Do you worry about your health? Y or N
13. Do you suffer from sleeplessness? Y or N
14. Have you ever felt listless and tired for no reason? Y or N
15. Do you often feel life is very dull? Y or N
16. Do you worry a lot about your looks? Y or N
17. Do you worry too long after an embarrassing experience? Y or N
18. Do you suffer from “nerves?” Y or N
19. Do you often feel lonely? Y or N
20. Are you easily hurt when people find fault with you or the work you do? Y or N
21. Are you sometimes bubbly with energy and sometimes very sluggish? Y or N
22. Are you touchy about some things? Y or N

### Personal Attitudes Questionnaire

Listed below are a number of statements concerning personal attitudes and traits. Read each statement and decide whether it is true or false as it pertains to you personally. If the statement is true as it pertains to you, circle the letter T; if the statement is false as it pertains to you, circle the letter F.

- |   |   |  |
|---|---|--|
| T | F | 1. Before voting I thoroughly investigate the qualifications of all candidates.                                      |
| T | F | 2. I never hesitate to go out of my way to help someone in trouble.  |
| T | F | 3. It is sometimes hard for me to go on with my work if I am not encouraged.   |
| T | F | 4. I have never intensely disliked anyone.   |
| T | F | 5. On occasion, I have had doubts about my ability to succeed in life.   |
| T | F | 6. I sometimes feel resentful when I don't get my way.   |
| T | F | 7. I am always careful about the manner of my dress.   |
| T | F | 8. My table manners at home are as good as when I eat out in a restaurant.   |
| T | F | 9. If I could get into a movie without paying for it and be sure I was not seen, I would probably do it.             |
| T | F | 10. On a few occasions, I have given up doing something because I thought too little of my ability.                  |
| T | F | 11. I like to gossip at times.   |
| T | F | 12. There have been times when I felt like rebelling against people in authority even though I knew they were right. |
| T | F | 13. No matter who I'm talking to, I'm always a good listener.  |
| T | F | 14. I can remember 'playing sick' to get out of something.   |
| T | F | 15. There have been occasions when I took advantage of someone.  |
| T | F | 16. I'm always willing to admit when I've made a mistake.  |
| T | F | 17. I always try to practice what I preach.  |
| T | F | 18. I don't find it particularly difficult to get along with loud-mouthed, obnoxious people.                         |
| T | F | 19. I sometimes try to get even, rather than forgive and forget.   |
| T | F | 20. When I don't know something, I don't at all mind admitting it.   |
| T | F | 21. I'm always courteous, even to people who are disagreeable.   |
| T | F | 22. At times I have really insisted on having things my own way.   |
| T | F | 23. There have been occasions when I felt like smashing things.  |
| T | F | 24. I would never think of letting someone else get punished for my wrong doings.                                    |
| T | F | 25. I never resent being asked to return a favor.  |
| T | F | 26. I have never been irked when people express ideas different from my own.   |
| T | F | 27. I never take a long trip without checking the safety of my car.  |
| T | F | 28. There have been times when I was quite jealous of the good fortune of others.                                    |
| T | F | 29. I have almost never felt the urge to tell someone off.   |
| T | F | 30. I am sometimes irritated by people who ask favors of me.   |
| T | F | 31. I have never felt that I was punished without cause.   |
| T | F | 32. I sometimes think when people have a misfortune they only got what they deserved.                                |
| T | F | 33. I have never deliberately said something that hurt someone's feelings.   |

**Cancer manipulation:**The Projective Life Attitudes Assessment

This assessment is a recently developed, innovative personality assessment. Recent research suggests that feelings and attitudes about significant aspects of life tell us a considerable amount about the individual's personality. Your responses to this survey will be content-analyzed in order to assess certain dimensions of your personality. Your honest responses to the following questions will be appreciated.

1. PLEASE BRIEFLY DESCRIBE THE EMOTIONS THAT THE THOUGHT OF CANCER AROUSES IN YOU.

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2. JOT DOWN, AS SPECIFICALLY AS YOU CAN, WHAT YOU THINK WILL HAPPEN TO YOU AS YOU PHYSICALLY GET CANCER AND ONCE YOU HAVE PHYSICALLY GOTTEN CANCER.

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**Dental Pain manipulation:**The Projective Life Attitudes Assessment

This assessment is a recently developed, innovative personality assessment. Recent research suggests that feelings and attitudes about significant aspects of life tell us a considerable amount about the individual's personality. Your responses to this survey will be content-analyzed in order to assess certain dimensions of your personality. Your honest responses to the following questions will be appreciated.

1. PLEASE BRIEFLY DESCRIBE THE EMOTIONS THAT THE THOUGHT OF DENTAL PAIN AROUSES IN YOU.

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2. JOT DOWN, AS SPECIFICALLY AS YOU CAN, WHAT YOU THINK WILL HAPPEN TO YOU AS YOU PHYSICALLY FEEL DENTAL PAIN AND ONCE YOU HAVE PHYSICAL DENTAL PAIN.

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## PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate number next to that word. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale provided to record your answers.

1 = very slightly or not at all

2 = a little

3 = moderately

4 = quite a bit

5 = extremely

|                  |   |   |   |   |   |
|------------------|---|---|---|---|---|
| 1. Interested    | 1 | 2 | 3 | 4 | 5 |
| 2. Disinterested | 1 | 2 | 3 | 4 | 5 |
| 3. Excited       | 1 | 2 | 3 | 4 | 5 |
| 4. Upset         | 1 | 2 | 3 | 4 | 5 |
| 5. Strong        | 1 | 2 | 3 | 4 | 5 |
| 6. Guilty        | 1 | 2 | 3 | 4 | 5 |
| 7. Scared        | 1 | 2 | 3 | 4 | 5 |
| 8. Hostile       | 1 | 2 | 3 | 4 | 5 |
| 9. Enthusiastic  | 1 | 2 | 3 | 4 | 5 |
| 10. Proud        | 1 | 2 | 3 | 4 | 5 |
| 11. Irritable    | 1 | 2 | 3 | 4 | 5 |
| 12. Alert        | 1 | 2 | 3 | 4 | 5 |
| 13. Ashamed      | 1 | 2 | 3 | 4 | 5 |
| 14. Inspired     | 1 | 2 | 3 | 4 | 5 |
| 15. Nervous      | 1 | 2 | 3 | 4 | 5 |
| 16. Determined   | 1 | 2 | 3 | 4 | 5 |
| 17. Attentive    | 1 | 2 | 3 | 4 | 5 |
| 18. Jittery      | 1 | 2 | 3 | 4 | 5 |
| 19. Active       | 1 | 2 | 3 | 4 | 5 |
| 20. Afraid       | 1 | 2 | 3 | 4 | 5 |





## Quantitative Section GR 91-18

Please circle the answer you feel is most correct.

1. If  $3^n < 500$ , which of the following is the greatest possible value of  $n$ ?

- A. 2
- B. 4
- C. 5
- D. 6
- E. 7

2.  $\frac{m+m}{m} - n =$

- A.  $\frac{mn}{m-n}$
- B.  $\frac{m}{m(m-n)}$
- C.  $\frac{m-n}{m}$
- D. 1
- E. -1

3. In deciding the asking price for a piece of property, a real estate broker determines that the market value of the lot is  $\frac{1}{7}$  the market value of the building on it. If the total value of the property is set at \$140,000, then what is the total value of the lot?

- A. \$10,000
- B. \$17,500
- C. \$20,000
- D. \$120,000
- E. \$122,500

4. Company A manufactures paper plates at a rate of 1,000K per hour, while company B manufactures plates at a rate of 1,000L per hour. If both companies work simultaneously, how many hours will it take them to manufacture 100,000 plates?

- A.  $\frac{100}{K+L}$
- B.  $\frac{1}{K+L}$
- C.  $\frac{K+L}{100}$
- D.  $100(K+L)$
- E.  $1000(K+L)$

5. John has 4 ties, 12 shirts, and 3 belts. If each day he wears exactly one tie, one shirt and one belt, what is the maximum number of days he can go without repeating a particular combination?

- A. 12
- B. 21
- C. 84
- D. 108
- E. 144

6. If  $y = 2x - 1$ , what is the value of  $x$  in terms of  $y$ ?

- A.  $\frac{y - 1}{2}$
- B.  $\frac{y - 1}{2} - \frac{1}{2}$
- C.  $\frac{y + 1}{2} - \frac{1}{2}$
- D.  $\frac{y}{2} + 1$
- E.  $y + \frac{1}{2}$

7. If  $a = 2$ ,  $b = 4$ , and  $c = 5$ , then

$$\frac{a + b}{c} - \frac{c}{a - b} =$$

- A. 1
- B.  $\frac{11}{30}$
- C.  $\frac{37}{10}$
- D.  $-\frac{11}{30}$
- E. -1

8. If  $\frac{(p - q)}{p} = \frac{2}{7}$ , then  $\frac{q}{p} =$

- A.  $\frac{2}{5}$
- B.  $\frac{5}{7}$
- C. 1
- D.  $\frac{7}{5}$
- E.  $\frac{7}{2}$

9. If integer  $x$  were divided by 7, the quotient would be 12 with a remainder of 1. Therefore,  $x$  equals

- A. 91
- B. 90
- C. 88
- D. 85
- E. 83

10. If  $y \neq 0$  and  $2x + y = 12$ , then which of the following is NOT a possible value of  $x$ ?

- A. 12
- B. 10
- C. 8
- D. 6
- E. 4

11. If  $4x + 3y = 8$  and  $\frac{x}{2} = \frac{1}{4}$ , what is the value of  $y$ ?

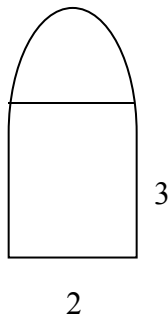
- A.  $\frac{4}{3}$
- B. 2
- C.  $\frac{7}{3}$
- D. 3
- E.  $\frac{10}{3}$

12. Two people were hired to mow a lawn for a total of \$45. They completed the job with one person working for 1 hour and 20 minutes and the other working 40 minutes. If they split the \$45 in proportion to the amount of time each spent working on the job, how much did the person who worked longer receive?

- A. \$33.75
- B. \$30.00
- C. \$27.50
- D. \$25.00
- E. \$22.50

**GO ON TO THE NEXT PAGE.**

13.



A rectangular window with dimensions 2 meters by 3 meters is to be enlarged by cutting out a semicircular region in the wall as shown above. What is the area, in square meters, of this semicircular region?

- A.  $\pi/4$
- B.  $\pi/2$
- C.  $\pi$
- D.  $2\pi$
- E.  $4\pi$

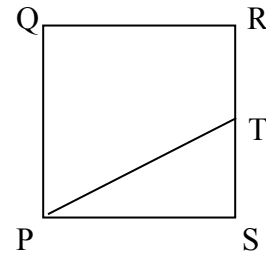
14.  $\frac{10^2 (10^8 + 10^8)}{10^4} =$

- A.  $2(10^4)$
- B.  $2(10^6)$
- C.  $10^8$
- D.  $2(10^8)$
- E.  $10^{10}$

15. If  $n = 15 \times 28 \times 26$ , which of the following is NOT an integer?

- A.  $n/15$
- B.  $n/21$
- C.  $n/32$
- D.  $n/35$
- E.  $n/39$

16.



In square PQRS above, T is the midpoint of side RS. If  $PT = 8\sqrt{5}$ , what is the length of a side of the square?

- A. 16
- B.  $6\sqrt{5}$
- C.  $4\sqrt{5}$
- D. 8
- E.  $2\sqrt{6}$

17. If  $q \neq 0$  and  $k = qr/2 - s$ , then what is  $r$  in terms of  $k$ ,  $q$ , and  $s$ ?

- A.  $\frac{2k + s}{q}$
- B.  $\frac{2sk}{q}$
- C.  $\frac{2(k - s)}{q}$
- D.  $\frac{2k + sq}{q}$
- E.  $\frac{2(k + s)}{q}$

18.  $|3| + |-4| + |3-4|$

- A. 14
- B. 8
- C. 7
- D. 2
- E. 0

**GO ON TO THE NEXT PAGE.**

19. A computer can perform 30 identical tasks in 6 hours. At that rate, what is the minimum number of computers that should be assigned to complete 80 of the tasks within 3 hours?

- A. 6
- B. 7
- C. 8
- D. 12
- E. 16

20. Which of the following is 850 percent greater than  $8 \times 10^3$ ?

- A.  $8.5 \times 10^3$
- B.  $6.4 \times 10^4$
- C.  $6.8 \times 10^4$
- D.  $7.6 \times 10^4$
- E.  $1.6 \times 10^5$

21.  $9^2 - 6^2 = 3$

- A. 1
- B.  $15/9$
- C. 5
- D. 8
- E. 15

22. What is 0.423658 rounded to the nearest thousandth?

- A. 0.42
- B. 0.423
- C. 0.424
- D. 0.4236
- E. 0.4237

23. If  $3(x+2) = x-4$ , then  $x =$

- A. -5
- B. -3
- C. 1
- D. 3
- E. 5

24. If  $x^2 + 2xy + y^2 = 9$ , then  $(x + y)^4 =$

- A. 3
- B. 18
- C. 27
- D. 36
- E. 81

25. If the sum of two numbers is 14 and their difference is 2, what is the product of the two numbers?

- A. 24
- B. 28
- C. 40
- D. 45
- E. 48

26. A secretary typed 6 letters, each of which had either 1 or 2 pages. If the secretary typed 10 pages in all, how many of the letters had 2 pages?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

**STOP TEST IS COMPLETE**

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## ABSTRACT

For several years, breast cancer patients have reported experiencing problems with memory, concentration, and other cognitive functioning following cancer treatment. In light of previous research showing that individuals with a history of unsupportive relationships develop deficits in working memory, the purpose of the present study was to use the attachment theory as a theoretical framework to understand whether thoughts of cancer and unsupportive relationships decrease cognitive performance. In a pilot study, 81 students from TCU psychology courses were randomly assigned to one of two conditions (dental pain v. cancer) and asked to ruminate about their current/past relationship (negative v. positive). Following this, everyone was given 20-min to complete 26 math problems, which served as a measure of cognitive functioning. Results revealed that those who were presented with the negative relationship and cancer prime performed at a lower cognitive level on the math test than those who did not. These results suggest that social factors, such as close relationships, have the potential to contribute to cognitive difficulties in breast cancer populations.