

UNIVERSITY OF BERGAMO

Ph.D. in Clinical Psychology (M-PSI/08)

XXIII Cycle

**THE WRITTEN-HEART STUDY**

A RANDOMIZED CONTROLLED CLINICAL TRIAL ON  
EXPRESSIVE WRITING FOR HEART HEALING

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ACCADEMIC YEAR 2009 / 2010

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## **Abstract**

**AIM:** Coronary heart disease (CHD) is typically associated with impaired quality of life, depression, anxiety and psychological stress. Expressive writing (EW) has shown beneficial effects on such variables in patients with a variety of chronic illnesses. We sought to determine for the first time whether EW benefits also patients with CHD. **METHODS:** A prospective, randomized, controlled trial was carried out in order to evaluate the psychological and physical effects of administering EW to patients with CHD (N=64) participating in a residential cardiac rehabilitation (CR) program. Patients were randomly assigned to write thoughts and emotions (EW group) or facts (control group) about heart disease and treatment. Depression, anxiety, health-related quality of life, post-traumatic growth and weight were recorded at baseline, at the end of the 4-week CR program, at 3 months and at 6 months after discharge. **RESULTS:** Physical health significantly improved in both groups at 3 months and no between-group effect was evident in longitudinal multilevel regression modeling. Post-traumatic growth showed a significant improvement only within EW group. **CONCLUSION:** EW showed additional psychological and physical benefits in patients with CHD when included as a component of residential cardiac rehabilitation.

## General introduction

Writing has been with us for centuries. Indeed, it is one of the defining characteristics of the mankind. Archaeologists have found written marks in stone that go back thousands of years. Originally, people developed writing in response to instrumental needs that progressively arose in public affairs and business. Indeed, writing was firstly used as a means of recording and fixing information but increasingly it has been used for communication and representation of life. Historically, it was through the sharing of oral and written accounts of their lives that individuals and communities began to identify themselves. Often these stories were about the exploits of great religious or military figures but increasingly they have been about everyday life (M. Murray, 2009).

Traditionally, psychologists have studied writing regardless of its uses in the real-world and have focused mainly on its structure, development and impairment from a cognitive perspective. However, writing is much more than a cognitive, cerebral or visual-motor function; like talking, writing serves a lot of human activities such as communication, representation, expression and processing of perceptual, cognitive and emotional information. Therefore, it is not surprising that psychologists, especially health and clinical psychologists, have become particularly interested in the expressive feature of writing. This interest is often traced back to the work of James Pennebaker who, although he was primarily a social psychologist, developed a research program that was initially inspired by the Freudian theory of inhibition and catharsis, suggesting that the inhibition of thoughts and feelings regarding an upsetting event is harmful and that, consequently, expression of those inhibited thoughts and feelings can reduce stress and improve health. For example, in a preliminary study on trauma and inhibition, Pennebaker and colleagues found that individuals who were victims of violence and who had kept this experience silent were significantly more likely to have adverse health effects than those who openly talked with others (J. W. Pennebaker & Susman, 1988). Then, they wondered if writing about negative experiences not previously disclosed would have been beneficial and began a series of studies in order to test this hypothesis. They developed a procedure that encouraged people to write about traumatic experiences they had not discussed with others or they felt guilty about, concurrent with the psychoanalytic notion that talking of events that are threatening or of memories that are at least partially hidden in unconscious is beneficial. This idea is further echoed in instructions to participants that ask them to really “let go” and “not worry about spelling, punctuation and grammar” as if the writing task was designed to be a type of free association exercise (Frattaroli, 2006). In the

first study, a sample of college students in psychology were asked to write about a trauma or about superficial topics for four days, 15 minutes per day. Pennebaker and colleagues found that confronting the emotions and thoughts surrounding deeply personal issues promoted physical health, as measured by reductions in physician visits in the months following the study, fewer reports of aspirin usage and overall more positive long-term evaluations of the effect of the experiment (J. W. Pennebaker & Beall, 1986). This initial work has been followed by literally hundreds of studies that have attempted to replicate and especially explain the health benefits of expressive writing. A number of theories has been proposed along the past twenty-five years in order to explain the mechanisms involved in the expressive writing process. Unfortunately, none of them has received sufficient empirical support as a stand-alone explanation and researchers have recently begun to develop integrated theoretical models. One promising candidate that has been proposed by Pennebaker and Chung (J.W. Pennebaker & Chung, 2007) concerns the effects of translating emotions into language format or, as they suggest, a metaphorical translation of an analog experience into a digital one.

Whereas the original writing studies asked people to write about traumatic experiences of choice, later studies expanded the writing topics to include general emotional events or specific experiences shared by other participants (e.g. losing job, coming to college, having a medical illness). Furthermore, although the greatest part of studies have examined physical health and biological markers as primary outcomes, an increasing number of studies has explored expressive writing's effects on psychological health, attitude change, stereotyping, creativity, working memory, motivation, life satisfaction, school performance and a variety of health-related behaviors (J.W. Pennebaker & Chung, 2007). Various meta-analyses of these studies have been conducted over the last decade. The most recent by Frattaroli (Frattaroli, 2006) has found the overall effect size to be disappointingly small. Although small, the fact that such a simple intervention can have any effect continues to attract attention. To date, well over 200 studies have been published in English language journals and many more will be published in future. A recent special issue of the *British Journal of Health Psychology* edited by Smyth and Pennebaker (J. M. Smyth & Pennebaker, 2008) confirms the breath of current interest in the topic and invites to look forward at the many remaining frontiers in Expressive Writing research. One of the boundary conditions to be explored concerns new outcome measures and previously unexamined populations.

The expressive writing procedure has never been used on patients with heart disease. This is surprising because many studies on the physiological effects of expressive writing have found

significant variations in many markers of the autonomic nervous system such as skin conductance, heart rate, heart rate variability and blood pressure. It is even more disappointing that the small but significant study of McGuire, Greenberg and Gevirtz (McGuire, Greenberg, & Gevirtz, 2005) on the autonomic effects of expressive writing in individuals with elevated blood pressure has been neither replicated nor expanded in the subsequent years. They showed that, one month after writing, the participants who were allocated in the expressive writing condition exhibited lower systolic and diastolic blood pressure (DBP) than before writing and that, four months after writing, DBP remained lower than baseline levels. As elevated blood pressure is a major cardiovascular risk factor that often affects patients with an established cardiovascular disease (CVD), an intriguing idea was to administer the expressive writing procedure to a sample of patients with CVD referred to a brief residential cardiac rehabilitation program and test the brief, mid and long-term effects of such an intervention on patients' health-related quality of life (HRQoL), anxiety symptoms, depressive symptoms, post-traumatic growth and medical consultations for new cardiovascular events.

Given the fact that most experimental studies of expressive writing have been more theory-oriented and not aimed at clinical application (J.W. Pennebaker & Chung, 2007), the study described in the last chapter was specifically intended to be a clinical trial based on a clearly identified sample of patients with CVD referred to cardiac rehabilitation. Furthermore, given the poor results of a recent systematic review evaluating the design and reporting quality of randomized expressive writing studies (Nazarian & Smyth, 2007) on the basis of the Consolidated Standards of Reporting Trials (CONSORT) checklist items (Schulz, Altman, & Moher, 2010) and the methodological and statistical reporting quality features suggested by the American Psychological Association Task Force on Statistical Inference (Wilkinson, 1999), this study was purposely designed in accordance to the above mentioned criteria and in response to the widespread limitations that were found in the systematic review. Primary aims of the study were thus to examine the feasibility, safety and clinical efficacy of expressive writing in patients with CVD. Therefore, a four-arm randomized controlled clinical trial was developed and used to compare four experimental conditions: 1) modified expressive writing task (writing about one's deepest thoughts and feelings regarding the experience with heart disease); 2) standard expressive writing procedure (writing about one's deepest thoughts and feelings about the most traumatic or negative event experienced in the life); 3) neutral writing (facts regarding the heart disease and its treatment) and 4) control condition not involving a

writing task (assessments only). All the active conditions consisted in four 20-minute writing sessions that occurred during the hospital stay within a 2-week period and that were scheduled twice a week for each participant. Secondary aim of the trial was to test the moderating effects of coping styles, type D personality, perceived emotional support and participants' evaluative ratings of the writing intervention on the main experimental effects in order to identify subgroups of patients showing different results. Given the longitudinal design of the study, main effects and interactions were evaluated with a multilevel longitudinal statistical approach which allows to model the random variability between and within subjects. The trial has been recently registered with ClinicalTrials.gov (NCT01253486).

The study is fully described in the last chapter, whereas the theoretical, methodological and empirical background of the expressive writing paradigm is laid out in the following chapters.



## **Brief introduction to the Expressive Writing Research**

As suggested by Bootzin (1997), the initial theory that motivated the first studies on expressive writing has numerous components: (a) not talking about important psychological phenomena is a form of inhibition; (b) inhibition increases stress; (c) increased stress leads to health problems; (d) disclosure reduces inhibition; (e) reduced inhibition reduces stress and (f) reduced stress leads to improved health outcomes. Although disclosure is a naturally occurring process that can be examined in observational and correlational designs, one can truly learn about the consequences of disclosure by manipulating this process using an experimental design (Frattaroli, 2006). Such an experimental manipulation was first conducted by Pennebaker and Beall (J. W. Pennebaker & Beall, 1986), who randomly assigned college students to write either about traumatic events or about neutral topics for several consecutive days. In this first study, Pennebaker and Beall (1986) assigned participants to one of four writing groups: a trauma-fact group, in which participants wrote only about the facts surrounding their trauma; a trauma-emotion group, in which participants wrote only about the emotions surrounding their trauma; a trauma-combo group, in which participants wrote about both the facts and emotions surrounding their trauma; and a control group, in which participants wrote in a non-emotional fashion about some neutral event (e.g., their plans for the day). The results of this study revealed that, several weeks after writing, the trauma-combo group (but not any of the other three) demonstrated a reduction in illness-related doctor's visits. This fascinating finding that disclosing one's thoughts and feelings concerning a traumatic event can lead to objectively measured health improvements was the beginning of a long tradition of research examining a wide range of effects elicited by experimentally induced disclosure.

Early research on experimental disclosure was conducted mainly with healthy college students (or university employees) and either asked them to disclose their most stressful or traumatic experiences or asked them to discuss their (presumably stressful) experience of having recently started a new life at college. The studies used a relatively uniform paradigm that consisted of having participants come to the lab for three to five sessions of 15–20 min each, during which participants were randomly assigned to either write expressively about an upsetting topic or write without emotion about a neutral topic. Researchers measured participants on a variety of health and well-being variables both before randomization and again several days or weeks (or sometimes months) after the disclosure sessions to assess long-term effects of writing (or, in some cases, talking). Some of the more striking benefits of

disclosure that were found included improvements in immune functioning (J. W. Pennebaker, Kiecolt-Glaser, & Glaser, 1988), a reduction in health center visits (J. W. Pennebaker, Colder, & Sharp, 1990), reduced absenteeism rates from work (Francis & Pennebaker, 1992), improved grade point average (J. W. Pennebaker & M. E. Francis, 1996) and decreased self-reported upper respiratory problems (Greenberg, Wortman, & Stone, 1996). After almost a decade of research on participants from a university sample, the effects of disclosure were examined in more varied samples, typically samples of people who were currently experiencing or had previously experienced an upsetting event. These field studies in the community revealed that experimental disclosure could help nonstudents as well. Interesting benefits of disclosure found in these studies included helping unemployed engineers find jobs faster (Spera, Buhrfeind, & Pennebaker, 1994), helping female caregivers reduce post-traumatic stress symptoms (Campbell, 2003) and helping incarcerated men take fewer trips to the infirmary (Richards, Beal, Seagal, & Pennebaker, 2000). It should be noted, however, that not all attempts to demonstrate the beneficial effects of disclosure were successful among nonstudent populations. For example, widowed community members who were assigned to write expressively about their loss did not show any improvement over controls on physical or psychological health outcomes (Stroebe, Stroebe, Schut, Zech, & van den Bout, 2002). Not long after distressed community members began to be used in studies of experimental disclosure, this paradigm was extended to include testing on people with medical ailments, including those with rheumatoid arthritis, asthma and migraine headaches. The first published study of this type was conducted by Kelley, Lumley and Leisen (Kelley, Lumley, & Leisen, 1997), who examined the effects of experimental disclosure on arthritis-related problems in rheumatoid arthritis patients. Patients who talked expressively about traumas (compared with a trivial topics condition) reported less physical and affective dysfunction in the weeks following writing. However, there were no group differences for arthritis-related pain or objectively measured joint condition. An even more recent study found that experimental disclosure was helpful for both rheumatoid arthritis and asthma patients (J. M. Smyth, Stone, Hurewitz, & Kaell, 1999), although some researchers have had trouble replicating the asthma finding (Harris, Thoresen, Humphreys, & Faul, 2005). Other recent findings with medical patients include a reduction in cancer-related doctor visits for breast cancer patients assigned to an experimental disclosure group (Stanton, Danoff-Burg, Sworowski, Collins, Branstetter, Rodriguez-Hanley, et al., 2002), a reduction in distress for migraine headache sufferers who wrote expressively (McKenna, 1997) and a reduction in depressive symptoms for community

members with Type I diabetes who disclosed thoughts and feelings about their illness (Bodor, 2002). The most recent sample of participants with whom expressive writing has begun to be tested is participants with psychiatric and psychological problems. Although only a handful of disclosure experiments have been conducted with these samples, the results thus far have been quite mixed. Some studies have found support for this intervention using samples of participants who suffered from psychological problems, such as Russ (1992), who found that disclosure improved psychological and physical health for college students with a history of anxiety. By contrast, other studies have found that disclosure may actually be harmful for certain clinical samples, such as Gidron et al. (Yori Gidron, Peri, Connolly, & Shalev, 1996), who found that disclosure increased illness-related doctor's visits in a small sample of men receiving treatment for post-traumatic stress disorder. In addition, a few studies have found null effects for disclosure, including studies using former psychological patients (Bird, 1992), participants with negative body image (Earnhardt, Martz, Ballard, & Curtin, 2002) and those with suicidal tendencies (Kovac & Range, 2002).

# **Putative Models and Mechanisms of Expressive Writing**

## ***Introduction***

Despite the beneficial effects of writing, it is not entirely clear why it is effective in bringing about such beneficial physical health and behavioral change. In a chapter in which she attempted to explain some of the mechanisms behind the benefits of experimental disclosure, Laura King wrote: “Two strong conclusions can be made with regard to the benefits of writing. First, expressive writing has health benefits. Second, no one really knows why” (L.A. King, 2002, p. 119). Beginning in 1989, a series of studies was designed to get a better understanding of writing outcomes. Several theoretical hypotheses were tested and none of them was sufficient to explain adequately and fully the mechanisms involved in the expressive writing procedure. In a recent paper (James W. Pennebaker, 2004), Pennebaker wrote that “No single theory appears to account for the effectiveness of the writing paradigm” (p. 138) and proposed a meta-theoretical model that offer a temporal and cumulative view of the overlapping, inter-agent and multilevel processes that work during the writing intervention and the days, weeks and sometimes months afterwards. As people start writing about a stressful event, they are immediately forced to label, structure and organize it in ways they probably have never had to do. They must also present the negative experience in a linguistic structure, often for the first time, to an ambiguous audience (perhaps the experimenter) and to themselves. According to Pennebaker, these immediate cognitive operations are the most difficult ones to understand and to determine whether they are associated with long-term health outcomes. Moreover, as people start writing about a stressful event, they immediately experience the negative emotions arising from the recall of the event. Based on the historically rich literature on flooding, implosive and exposure therapy, directly confronting an emotional upheaval is often linked to processes of habituation and extinction (Foa & Kozak, 1986). These short-term processes lead to some long-term changes that, in turn, determine the long-term health outcomes. Again, linking these long-term changes to health outcomes is problematic. For example, the early study of Klein and Boals (Klein & Boals, 2001) suggested that one of the long-term effects caused by expressive writing may be to free up working memory. The authors showed that, in the weeks after writing (but not immediately afterwards), participants were thinking less about their stressful events and could thus address their thoughts to other issues in their lives. On the emotional part, Lepore (S. J. Lepore, 1997) showed that the immediate emotional arousal associated with writing reduced

over time and, within weeks, participants reported a significant reduction of emotionally charged intrusive thoughts about the stressful event. A further long-term effect of expressive writing that is currently under empirical investigation is social (James W. Pennebaker & Graybeal, 2001). Such psychological, emotional and social process are also reflected in behavioral and biological ways. However, analyses of self-reports from several writing studies showed that people continued to smoke, exercise and sleep at rates comparable to control participants (J. W. Pennebaker, 1993) and the autonomic, immune and other biological markers of health are horrifyingly complex and difficult to study (Denise M. Sloan & Brian P. Marx, 2004). Perhaps, the best example of this temporal view is the groundbreaking study by Smyth and colleagues (J. M. Smyth, et al., 1999) in which people with asthma and arthritis were asked to write about emotional upheavals or control topics. Many effects that were not apparent in the month after writing emerged in the months afterwards. In other words, the effects of writing appeared to be gradual and cumulative, probably reflecting a host of psychological, emotional, social and biological processes (James W. Pennebaker, 2004). The writing intervention, then, is much more than three 15-minute writing periods. During and after writing, people report thinking, talking and even dreaming about their writing topic. Multiple psychological, emotional, social and biological processes are active in the days and weeks surrounding the writing intervention. Thus, it is difficult to determine exactly which mechanisms are at work and at what point in the process they become relevant (J.M. Smyth, Nazarian, & Arigo, 2008). That no one can agree on a single theory to explain these effects is not particularly surprising.

## ***Psychological, emotional and social theories***

### **Inhibition theory**

The early psychological explanations of the health benefits of expressive writing were based on the psychoanalytical theory of catharsis, suggesting that the inhibition of thoughts and feelings regarding an upsetting event is harmful and that, consequently, expression of those inhibited thoughts and feelings can reduce stress and improve a host of physical and psychological health outcomes (Frattaroli, 2006; J.W. Pennebaker & Chung, 2007). According to the inhibition theory (J. W. Pennebaker & Susman, 1988), actively avoiding or inhibiting a traumatic experience may be considered a stress response. It creates tension and necessitates a constant state of vigilance to prevent the unwanted material from entering awareness. The accumulation of such tension creates disease in the long term, for example

through immune suppression (Maier, Watkins, & Fleshner, 1994). Furthermore, investigators have found empirical evidence linking inhibited anger and hostility with hypertension and coronary heart disease (Chida & Steptoe, 2009; Smith, Glazer, Ruiz, & Gallo, 2004), and others have suggested that emotional inhibition may be linked to a wide variety of minor ailments (Pennebaker, 1990) and to cancer onset and progression (J. Gross, 1989). Research on emotion regulation has also shown that suppression of emotion increases sympathetic activation (James J. Gross, 1998; James J. Gross & Levenson, 1993; J. J. Gross & Levenson, 1997) and chronic sympathetic activation may result in adverse physical outcomes (Denise M. Sloan & Brian P. Marx, 2004).

Early tests of expressive writing encouraged participants to write about things they had not previously discussed with others or things they felt guilty about. The Freudian reminiscence is echoed in instructions to participants that ask them to really “let go” and “not worry about spelling, punctuation and grammar”, as if the written session was designed to be a type of free association exercise. As more studies were completed, however, evidence began to emerge that the Freudian inhibition-based explanation of the health benefits of expressive writing was not fully trustworthy. First, Francis and Pennebaker (Francis & Pennebaker, 1992) found that participants who had a low repressive disposition benefited most from an expressive writing intervention, whereas those who had a high repressive disposition benefited less (if disinhibition is the key to success, one would have expected that those who habitually hold back - those high in repressive style - would benefit more from expressive writing). Furthermore, researchers were obtaining mixed results regarding the need for a writing topic to be previously undisclosed. Some studies found that the benefit was stronger when participants reported writing about previously undisclosed topics, whereas others found no benefit. To address this issue experimentally, Greenberg and Stone (Greenberg & Stone, 1992) manipulated previous disclosure by assigning some participants to write about previously disclosed traumas, some participants to write about previously undisclosed traumas and some participants to write about a neutral topic (controls). This study found no benefit for writing about previously undisclosed (vs. previously disclosed) traumas. Greenberg et al. (Greenberg, et al., 1996) followed up this study with an even more challenging design: they assigned some participants to write about a trauma that had happened to them, assigned some participants to write about an imaginary trauma (a trauma - which they had not experienced - was briefly described to them and they were asked to write as if the trauma had been their own) and assigned some to a neutral writing condition. Surprisingly

they found that both real trauma participants and imaginary trauma participants demonstrated a reduction in illness-related doctor's visits over control participants. Participants benefited from writing about induced emotions surrounding a trauma that had not even happened to them.

Overall, the emotional inhibition theory has not received much support as an underlying mechanism of the written disclosure paradigm and this has led researchers to shift their attention away from the emotional inhibition theory and towards other theories (Denise M. Sloan & Brian P. Marx, 2004).

### **Cognitive theory**

In an early study based on the theory of inhibition, Pennebaker and colleagues (J. W. Pennebaker, Barger, & Tiebout, 1989) found that participants who wrote about past traumas spontaneously reported that writing forced them to think about the events differently (J. W. Pennebaker, et al., 1989). A year later, Pennebaker et al. (J. W. Pennebaker, et al., 1990) asked participants who had reported finding benefit in the expressive writing procedure to explain why they thought it was beneficial. An overwhelming majority of respondents did not talk of catharsis or a letting-go mechanism; instead, most participants reported that the writing was helpful because it allowed them to gain insight into what had happened to them. This anecdotal evidence led Pennebaker and other researchers to explore alternative avenues of explanation and to point to the critical role of cognitive processing in expressive writing. For example, in two studies by Murray and his colleagues (Donnelly & Murray, 1991; E. Murray, Lamnin, & Carver, 1989), students either wrote or talked to a therapist about a trauma or about superficial topics. In addition to greater emotional expression in the two trauma conditions, participants who wrote or talked about upheavals showed greater cognitive changes across the 4 days of the study. Cognitive change was measured by judges who evaluated transcripts on the degree to which they exhibited better understanding of the problem and the awareness of alternative explanations for the upheavals. To examine this idea further and more objectively, Pennebaker (J. W. Pennebaker, 1993) pooled the results of his first five experimental disclosure studies and developed a computerized text-analysis program called LIWC (Linguistic Inquiry and Word Count) to examine the words used during writing exercises. LIWC had been developed by having groups of judges evaluate the degree to which about 2,000 words or word stems were related to each of several dozen categories (J. W. Pennebaker & M. E. Francis, 1996). Categories include negative emotion words (sad, angry), positive emotion words (happy, laugh), causal words (because, reason) and insight words

(understand, realize). In line with the qualitative data provided by his own participants 3 years earlier, Pennebaker found that participants who had benefited most from expressive writing in previous studies demonstrated an increase in the use of causation words (e.g., because, cause, effect) and insight words (e.g., consider, know) during the course of their writing session. In comparison, those who did not benefit from the experimental disclosure did not show an increase in these types of words. Pennebaker (J. W. Pennebaker, 1993) concluded that the act of making sense of an event, of gaining insight about a trauma and of organizing and integrating an upsetting experience into one's inner schema is the mechanism by which expressive writing is helpful. However, in understanding the broad issue of cognitive processing, it is important to consider that a stressful or traumatic experience affects individuals on multiple levels, including cognitive attempts to understand the meaning and significance of the event itself as well as the emotional responses to it. For example, Pennebaker and Beall (J. W. Pennebaker & Beall, 1986) asked students to write about a traumatic event from one of three perspectives: 1) focus only on the facts surrounding the trauma; 2) focus only on the emotions or 3) focus on both. Participants who only wrote about the facts were not different from controls who wrote about superficial topics. The emotion-focus group reported the study to be valuable but showed no long-term health improvements. Only those people who wrote about both the facts of the trauma and their emotional responses exhibited long-term mental and physical health benefits.

The processing of a traumatic or stressful experience often requires also changing existing schemas when the integration of the upsetting experience in pre-existing models is impossible. For example, the theory of cognitive adaptation to traumatic or stressful experiences developed by Rena Janoff-Bulman (Arnie Cann, Calhoun, Tedeschi, Kilmer, Gil-Rivas, Vishnevsky, & Danhauer; Janoff-Bulman, 1992) suggests that all individuals hold three core assumptions: (a) we are invulnerable, (b) the world is meaningful and comprehensible and (c) we view ourselves in a positive light. Inherent in these assumptions are additional assumptions that others are trustworthy, moral and compassionate and that misfortunes occur infrequently. Janoff-Bulman noted that these core assumptions are often disrupted by a traumatic event, as such an experience is incompatible with these beliefs. Thus, coping with such an experience requires that the individual come to terms with these shattered assumptions. More specifically, such an individual must work to re-establish a conceptual system in which either the experience is assimilated into the old set of assumptions



(integrating the upsetting experience into pre-existing models) or the core assumptions are changed so that they can accommodate the traumatic experience.

However, despite the hypothetical high fitting of these cognitive-processing theories into the expressive writing box and the quite supporting findings from language analysis, the cognitive theory has proven difficult to evaluate empirically (Denise M. Sloan & Brian P. Marx, 2004). Indeed, as suggested by Sloan and Marx (2004), the evidence supporting the cognitive theory (i.e., changes in linguistic indicators) is correlational in nature and it is possible that the changes observed in the words used to describe traumatic and stressful events may be associated with some other mechanisms. Further, much of the correlational evidence supporting a cognitive model has been equivocal. For instance, linguistic changes have been observed in the absence of any physical or psychological improvements (Batten, Follette, Rasmussen Hall, & Palm, 2002; C.L. Park & Blumberg, 2002; Walker, Nail, & Croyle, 1999). In a study that directly examined the hypothesis that cognitive changes account for the beneficial outcome of expressive writing, Park and Blumberg (C.L. Park & Blumberg, 2002) tested the meaning-making hypothesis by examining cognitive appraisals of the traumatic/distressing event prior to the writing sessions, on the last day of writing and 4 months following the writing sessions. Findings indicated that appraisal of the traumatic/distressing event (uncontrollability, threat, stressfulness, intrusions, avoidance) improved from pre-writing to follow up for the disclosure participants. Unfortunately, the cognitive variables were examined for the disclosure participants only; thus, it is unclear if the appraisal changes occurred as a result of experimental condition. Further, analyses of the outcome measures indicated that the expressive writing group did not differ in self-reported emotional and physical health from pre-writing to follow-up, while the control group was significantly worse at follow-up relative to pre-writing scores. The authors discussed these findings as indicating that the expressive writing intervention exerted a protective effect for well-being; however, the results indicated that positive changes in appraisals of the traumatic/stressful event occurred in the absence of beneficial outcome (C.L. Park & Blumberg, 2002).

In general, there has not been consistent support for the good fitting of the cognitive-processing model into the expressive writing box. Part of the reason for the lack of support may be the difficulty in measuring cognitive changes during and across the writing sessions. Although linguistic indices may be informative, it is unclear if words are able to capture the nuances of cognitive restructuring thought to be important for positive change in health

outcomes (Denise M. Sloan & Brian P. Marx, 2004). Another confounding issue is that cognitive changes may be an outcome of exposure to the traumatic/stressful experience (Foa & Kozak, 1986); thus, any changes in cognitive process may also be explained by an exposure model.

### **Depth of disclosure**

Along with the exploration of the cognitive changes occurring during and across the expressive writing sessions, a related hypothesis suggested that it was the way participants approached the stressful topic that may have been the most predictive of the observed outcomes. For example, two people may write about the death of a grandparent; however, one could be deeply emotional and the other superficial in their exploration of the grief experience. The first strategy adopted to investigate this hypothesis was to have independent raters evaluate trauma essays from previous writing studies and to rate the essays' overall contents to see if it was possible to predict who benefitted most from expressive writing. Interestingly, judges noted that essays of people who gained from writing appeared to indicate that the people were smarter, more thoughtful and more emotional (J. W. Pennebaker, 1993). However, the relatively poor inter-judge reliability led Pennebaker and his colleagues to develop a computerized text analysis system called LIWC (Linguistic Inquiry and Word Count) that analyzed essays in text format. Exploring the participant's data from six writing studies, three linguistic factors reliably predicted improved physical health. First, the more individuals use positive emotion words, the better their subsequent health. Second, a moderate number of negative emotion words predicts health. Both very high and very low levels of negative emotion words correlate with poorer health. Third, and most important, an increase in both causal and insight words over the course of writing is strongly associated with improved health (J. W. Pennebaker, 1997; J. W. Pennebaker, Mayne, & Francis, 1997).

### **Narrative theory**

A cognitive mechanism relevant to writing about a trauma is that the mere act of writing may alter the way the event is represented and organized in memory. Indeed, a basic assumption of conversation is that, when ideas are communicated, they require coherence, self-reflection and use of multiple perspectives. Coherence subsumes several characteristics including structure, use of causal explanation, repetition of themes and an appreciation of the listener's perspective. Further, conveying of stories to others typically requires an ordered sequence of events (McAdams, 2001; Ramirez-Esparza & Pennebaker, 2006). Traumatic memories

typically remain chaotic and are stored as sensory perceptions leading to obsessional ruminations or behavioral re-enactments, as in the case of post-traumatic stress disorder. Writing, like talking, forces a narrative structure on these chaotic memories and it is therefore thought to be the process of forming narratives that has salutary effects in expressive writing (Kaufman & Sexton, 2006). Forming a coherent, meaningful narrative may adaptively transform and organize memory representations of stressful events, which may in turn reduce distress and improve health (J. W. Pennebaker & Seagal, 1999; Ramirez-Esparza & Pennebaker, 2006; J. Smyth, True, & Souto, 2001).

In the retrospective study on the essays from previous writing studies, Pennebaker and colleagues (J. W. Pennebaker, 1993) found that participants who showed an increase in use of insight and causal-cognitive words over several days had greater improvements in health than those who did not show such increase. However, there were no differences in the absolute number of causal or insight words between groups. It was the development of a narrative over the course of the experiment that was associated with increased improvements in health. That is, people who benefited from writing began with a poorly organized description and progressed to a coherent story by the last day of writing. These results suggested that participants who created a narrative across the writing sessions had the greatest improvements while subjects who differently wrote about a pre-fabricated understanding of the trauma did not show any health improvements.

Researchers have made a number of modifications to the standard expressive writing instructions in order to increase word use patterns associated with narrative formation (e.g., words indicating insight, causal relationships or a sense of meaning). In general, instructing participants to focus on cognitive restructuring of personal stress or trauma has produced increases in insight and/or causal words relative to control groups (Batten, et al., 2002; Kovac & Range, 2002; van Middendorp & Geenen, 2008). The effect of these manipulations on physical and psychological health, however, has been mixed. For example, writing about stressful life events in a chronological fashion resulted in reduced clinic visits and physical symptoms among frequent clinic attenders relative to controls (Y. Gidron, Duncan, Lazar, Biderman, Tandeter, & Shvartzman, 2002) and reduced traumatic stress symptoms among college students when compared to students assigned to unstructured, benefit-finding or control writing tasks (Guastella & Dadds, 2008). Other writing instructions designed to facilitate different aspects of narrative formation (e.g., meaning making or reinterpretation of the stressful life event) have not produced physical and mental health gains compared to

controls in both healthy and clinical populations (Batten, et al., 2002; Broderick, Stone, Smyth, & Kaell, 2004; Kovac & Range, 2002; Ullrich & Lutgendorf, 2002). Smyth and colleagues (J. Smyth, et al., 2001) directly tested whether narrative structure is necessary for writing to produce health benefits among college students. They examined one group of participants who was asked to write about stressful/traumatic events in a narrative fashion, as is typical in these writing studies, a second group of participants who were asked to write about stressful/traumatic experiences in a fragmented manner (e.g., lists of their thoughts, feelings and sensations related to the experience) and a third group who wrote about a trivial topic (control condition). Results indicated that the participants who wrote about traumatic events in a narrative manner reported less illness-related restriction of activity at follow-up compared to the other two groups.

These findings are consistent with current views on narrative and psychotherapy in suggesting that it is critical for the client to create and come to terms with a story to explain and understand behavioral or mental problems and their history. Inherent in this understanding is the ability to stand back and look at oneself from different perspectives. Using LSA and analyzing three previous expressive writing studies, Pennebaker and Campbell discovered that the more the people changed in their use of function words from day to day in their writing, the more their health improved (Campbell & Pennebaker, 2003). Closer analyses revealed that these effects were entirely due to changes in pronoun use. Specifically, the more that people oscillated in their use of 1st person singular pronouns (I, me, my) and all other personal pronouns (e.g., we, you, she, they), the more people's health improved. If individuals wrote about emotional upheavals across the 3-4 days of writing but they approached the topic in a consistent way - as measured by pronoun use - they were least likely to show health improvements. The findings suggest that the switching of pronouns reflect a change in perspective from one writing day to the next. Interestingly, it doesn't matter if people oscillate between an I-focus to a we- or them-focus or vice versa. Rather, health improvements merely reflect a change in the orientation and personal attention of the writer.

Finally, Pennebaker and Chung (2007) suggested that expressive writing is effective because it serves as a life course correction. They argued that occasionally most of us benefit from standing back and examining our lives. This requires a perspective shift and the ability to detach ourselves from our surroundings. The idea of expressive writing as a life course correction has not yet been tested empirically. The idea is certainly consistent with McAdam's (McAdams, 2001) life story approach. It is also relevant to work in

autobiographical memory (Singer & Bluck, 2001). There are times when we are forced to stop and look back at our lives and evaluate what issues and events have shaped who we are, what we are doing, and why (J.W. Pennebaker & Chung, 2007).

### **The exposure model**

The exposure theory of expressive writing argues that the expression of thoughts and feelings regarding an upsetting event is akin to exposure (or flooding) therapy, which is used to treat phobias and post-traumatic stress disorder. When a person repeatedly confronts, describes and, in essence, relives the thoughts and feelings about his or her negative experience (as researchers have accomplished by having participants disclose their event over and over throughout several days), this repetition and exposure should eventually lead to extinction of those thoughts and feelings. A number of investigators have suggested that the written disclosure paradigm may serve as a context that allows an individual to be exposed to aversive emotional material that had been previously avoided. This repeated exposure through several writing sessions may provide corrective information to the individual about the stimuli, responses and meanings (Bootzin, 1997; Kloss & Lisman, 2002; S.J. Lepore, Greenberg, Bruno, & Smyth, 2002; J. W. Pennebaker, 1997; D. M. Sloan & B. P. Marx, 2004).

If exposure underlies the written disclosure paradigm, then changes in post-traumatic symptoms should be observed (e.g., changes in intrusive thoughts and avoidance behaviors). Several studies have examined this hypothesis. However, findings have been mixed, with some studies indicating reductions in intrusive thoughts and images (Klein & Boals, 2001; Schoutrop, Lange, Hanewald, Davidovich, & Salomon, 2002) and some other studies finding no effect for intrusions (de Moor, Sterner, Hall, Warneke, Gilani, Amato, & Cohen, 2002; S. J. Lepore, 1997; Stroebe, et al., 2002; Walker, et al., 1999). Interestingly, the findings for avoidance-related symptoms have been even more mixed, with two studies reporting beneficial outcome (Klein & Boals, 2001; Schoutrop, et al., 2002), two studies reporting null effects (de Moor, et al., 2002; Stroebe, et al., 2002) and three studies finding significantly greater avoidance symptoms following the expressive writing sessions (Yori Gidron, et al., 1996; Greenberg, et al., 1996; J. Smyth, et al., 2001). According to Sloan and Marx (Denise M. Sloan & Brian P. Marx, 2004), several explanations might account for these mixed findings. First, some of these studies have used small sample sizes, which likely resulted in insufficient power to adequately examine outcome effects (Yori Gidron, et al., 1996; Walker, et al., 1999). Second, studies have varied widely on the follow-up period employed to assess

outcome. Length of follow-up period may account for the noted differences in efficacy. Indeed, Nishith and colleagues (Nishith, Resick, & Griffin, 2002) found that during the course of treatment female rape victims increased in trauma-related avoidance symptoms before they improved. Lastly, there is great variability in the samples used to examine these hypotheses. Some studies have examined treatment-seeking individuals (Yori Gidron, et al., 1996), while others have used college students who were either randomly selected or preselected based on a trauma history (Klein & Boals, 2001; Schoutrop, et al., 2002) and others used a medical illness sample (Walker, et al., 1999). Given the variability in these samples, the presence and severity of psychological symptomatology may have also varied considerably. It is feasible that the expressive writing intervention works best for those with low to moderate levels of symptomatology and may only serve to increase negative emotional associations for those with more severe levels of psychopathology. In such cases, more sessions may be needed in order to properly extinguish negative emotional associations (Denise M. Sloan & Brian P. Marx, 2004).

In a recent study that directly tested the exposure hypothesis, researchers investigated the emotional reactions of participants after each writing session. Kloss and Lisman (Kloss & Lisman, 2002) randomly assigned college undergraduates to one of three experimental conditions: (a) a traumatic/stressful experience written disclosure group, (b) a positive experience written disclosure group, and (c) a trivial topic, control writing group. Participants completed measures of psychological and physical health both prior to and 9 weeks following the writing sessions. They also completed a measure of state anxiety both immediately before and after the writing session in order to investigate whether activation associated with written disclosure initially increased and then gradually decreased over the course of the sessions. Unfortunately, the findings of this study did not support the exposure/emotional processing hypothesis as state anxiety, contrary to expectations, increased from pre- to post-writing. Further, the level of state anxiety did not decrease across the writing sessions and no significant changes in symptomatology were found from baseline to follow-up.

Even more recently, Sloan and Marx (Sloan, Marx, & Epstein, 2005) conducted a study on the expressive writing procedure with trauma survivors who reported high levels of psychological distress. In keeping with the standard writing protocol, participants were able to select the topic of their writing. In support of the exposure/emotional processing hypothesis, participants assigned to the expressive writing condition showed significantly greater emotional reactivity (via self-report and salivary cortisol, a biomarker of stress) to the first

writing session compared to the control participants, and the heightened reactivity was no longer observed at the last writing session. Further, outcome findings indicated that, compared to control participants, participants assigned to the expressive writing condition had self-reported significant reductions in PTSD and depressive symptomatology and reported significantly fewer physical health complaints at follow-up.

Some researchers have argued that exposure to the same traumatic experience is critical for extinction/habituation to occur and, as a result, critical for successful outcome. This may explain the mixed findings obtained across studies. Indeed, some individuals may choose to write about the same topic at each session, while other individuals may elect to write about different topics. An elegant strategy to test this hypothesis involved the use of Latent Semantic Analysis. LSA, a technique developed by experts in Artificial Intelligence, is able to mathematically evaluate the similarity of content of any sets of text, such as essays. Using LSA, Pennebaker and Campbell (Campbell & Pennebaker, 2003) attempted to learn if the content similarity of essays written by people in the experimental conditions in three previous writing studies was related to health improvements. Unfortunately, the finding was null. If anything, the more similar the writing content was from day to day, the less likely people's health was to improve.

Sloan and Marx (2004) further suggested that the extinction of negative associations may be achieved through the consistent elicitation of intense negative emotion, regardless of the eliciting stimulus. Once tolerance of negative emotion is achieved, it is possible that any stimulus that previously elicited high levels of negative feelings will no longer do so. The study by Greenberg, Wortman and Stone (1996) provided some support for speculation because writing about deep emotions related to imaginary traumas produced the same effects as writing about deep emotions related to experienced traumas.

## **Language theory**

In addition to using language to understand and explain events, translating emotions into language alters inchoate feeling states into conscious verbal labels. In fact, recent research suggests that mere labeling of an emotion may actually reduce its perceived intensity (J.W. Pennebaker & Chung, 2007). For example, Keltner, Locke and Audrain (Keltner, Locke, & Aurain, 1993) found that after reading a depressing story, participants who were given the opportunity to label their emotions subsequently reported higher life satisfaction than those who did not label them. Berkowitz and Troccoli (Berkowitz & Troccoli, 1990) found that after labeling their own emotions, participants were more magnanimous in evaluating others

than if not given the emotion labeling opportunity. Indeed, changing any sensory experience into language affects the experience. In an important study on language's effects on sensory experience, Schooler and Engstler-Schooler (Schooler & Engstler-Schooler, 1990) suggested that once an individual attempts to translate a picture into words, it changes the memory of the picture. Most experiences are like pictures.

As argued by Pennebaker and Chung (J.W. Pennebaker & Chung, 2007), the process of capturing an experience with language is comparable to the engineering work of defining an analog signal using digital technology. For signal to be computer analyzed, the analog line must be converted into numbers using an analog-to-digital (A-to-D) converter. To convert the line to numbers, however, one needs to decide how frequently the numbers should be sampled. Sampling at high frequency can be a tremendous waste of time and computer space since most of the adjacent readings will be redundant. Similarly, if the sampling rate is low, most of the information will be lost. Verbally labeling an emotion is much like applying a digital technology (language) to an analog signal (emotion and the emotional experience). It is hypothesized that if an emotion or experience remains in analog form, it cannot be understood or conceptually tied to the meaning of an event. The only way by which an emotion or experience in non-linguistic form can leave awareness is through habituation, extinction or the introduction of a new or competing emotion. Once an experience is translated into language, however, it can be processed in a conceptual manner. In language format, the individual can assign meaning, coherence and structure. However, if an experience and its emotions are described too briefly, the experience will not adequately capture or represent the event (verbal underrepresentation). In this case, it would be predicted that the many parts of the experience that were not represented in the brief linguistic description would continue to be processed until they gradually extinguished over time. If a moderate number of words are used to describe the experience (moderate representation), its representation should adequately mirror the event. This should reduce the degree to which the event takes up cognitive capacity and, at the same time, enhance self-regulation, coping and health (J.W. Pennebaker & Chung, 2007). Within the discourse literature, particular attention has been paid to the role of written language in demanding more integration and structure than spoken language (Brewin & Lennard, 1999; Redeker, 1984).

### **Self-Regulation Theory**

Although cognitive-processing theory has received much empirical support from many studies, it does not offer a clear explanation for the imaginary trauma study (Greenberg, et al.,



1996) or other studies that used a slightly different writing procedure but still found benefits. For example, King and Miner (L.A. King & Miner, 2000) found that writing about the benefits of a traumatic event was just as beneficial in reducing illness-related doctor's visits as the more traditional disclosure paradigm. Cameron and Nicholls (Cameron & Nicholls, 1998) demonstrated that a self-regulation writing exercise in which students described problems they encountered in college and came up with ways to fix the problems produced the same health benefits as typical expressive writing. King (Laura A. King, 2001) reported that writing about one's "best possible self" (writing about one's life as if all one's goals were met and everything went right) produced reductions in illness visits that were as strong as (if not stronger than) those produced from writing expressively about a trauma. Writing about the best possible self even improved psychological well-being (e.g., optimism), whereas the traditional expressive writing did not. This more recent flurry of writing tasks that produce the benefits of typical experimental disclosure without eliciting all the short-term negative affect that trauma writing often produces is currently being explained in the context of a self-regulation theory of expressive writing. Lepore, Greenberg, Bruno and Smyth (S.J. Lepore, et al., 2002) explained that experimental disclosure (in the traditional sense or in the recent, more positive variations) can be thought of as a mastery experience. It allows people to observe themselves expressing and controlling their emotions. This may give people a new or stronger sense of self efficacy for emotional regulation. They may feel that their traumas, stressors or challenges are more controllable, which should serve to reduce negative affect and lead to other well-being improvements. Evidence consistent with this theory has also been shown through the moderating effect of respiratory sinus arrhythmia (an indicator of emotion regulation ability) on the relationship between expressive writing and self-reported depression and physical health in college students (Sloan & Epstein, 2005). King (L.A. King, 2002) explained that traumatic/stressful experiences can disrupt the normal self-regulation process and defined self-regulation in terms of goal attainment - people experience emotion as a result of the status of their goals, as a feedback system that tells them whether they are on the right track or are staying away from the path that will lead them to goal attainment. The well-regulated individual experiences emotions that clearly inform him or her regarding the status of his or her goals. When a trauma occurs, it "might muddy the waters of affective feedback" (p. 120). Expressive writing tasks allow the participant to make sense of the event, explore sources of emotion, clarify goals and get the self-regulation feedback system back on track.

## **The social integration model**

The social integration model argues that expressive writing affects the way people interact with their social world, which, in turn, improves their health and wellbeing. Evidence for this model comes from studies that have found that participants assigned to expressive writing were more likely than controls to talk about their traumatic experience in the weeks or months following disclosure and were more likely to report having received socially supportive behaviors from friends and family. In addition, recent pilot studies have found that treatment participants make small changes in their friendship networks and even laugh more than control participants in the days and weeks following disclosure (James W. Pennebaker & Graybeal, 2001).

## **The assimilation of problematic experiences model**

Lara Honos-Webb, William Stiles and colleagues considered the assimilation of problematic experiences as one possible contributory mechanism to improvements in health in the expressive writing procedure (L. Honos-Webb, Harrick, Stiles, & Park, 2000). They hypothesized that expressive writing exercises may promote assimilation of previously unwanted problematic experiences. On the basis of the inhibition theory and the meaning-making/narrative theory, they assumed that actively avoiding or inhibiting a problematic experience may be considered a stress response. It creates tension and necessitates a constant state of vigilance to prevent the unwanted material from entering awareness. The accumulation of such tension creates disease in the long term. Relating this to the assimilation model (Lara Honos-Webb & Stiles, 1998), when clients move to the second level of the assimilation sequence, they become vaguely aware of previously unwanted material, reducing the inhibition of their problems. Thus, the assimilation of unwanted material to Level 2 should lead to a relaxation of the stress response entailed in defending against the unwanted material and a concomitant improvement in health outcomes. Meaning models (Crystal L. Park & Folkman, 1997) offer an additional explanation for the relationship between assimilation of problematic material and improvements in health. Park and Folkman (1997) suggested that the effects of stressors are mediated by meaning-making coping strategies. According to the meaning model, events are stressful when the affected person is not able to construct meaning out of them. In assimilation terms, when participants progress to the fourth level of the assimilation sequence (understanding/insight), they have made meaning of the traumatic

experience by creating an organized narrative over the course of the experiment and should experience relatively improved health (L. Honos-Webb, et al., 2000).

## ***Physiological mechanisms***

### **Autonomic activity**

Disclosure of deeply traumatic experiences has been found to be linked to drops in Skin Conductance relative to the same participant's discussing superficial topics (J. W. Pennebaker, Hughes, & O'Heeron, 1987). To address the association between word usage and autonomic activity, Hughes, Pennebaker and Uhlmann (Hughes, Uhlmann, & Pennebaker, 1994) recruited individuals who were instructed to type their thoughts and feelings for 15 min into a computer. This procedure allowed individuals to type their deepest thoughts and feelings on a computer keyboard and link each word to the participant's concurrent autonomic levels, such as Skin Conductance (SC) and Heart Rate (HR). Independent judges rated each phrase along multiple dimensions based on both word usage (e.g., positive or negative emotion words) and clinical judgment (e.g., use of psychological defenses), and the data were regressed against their SC and HR (Hughes, et al., 1994). In this study, SC was found to be much more closely linked to language than was heart rate. Expression of negative emotions was associated with increased SC, whereas expression of positive emotions was associated with drops in SC, suggesting that expressing something positive was safe and briefly relaxing. Causal and insight phrases were equally powerful in provoking both increased and decreased SC.

### **Immune Function**

Given that writing about emotions regarding a previous trauma was related to improved physical and psychological health and that it was mediated by changes in the autonomic nervous system, other studies have begun to examine the impact of writing on an important moderator of physical health, namely, the immune system. Changes in behavioral and emotional states that accompany perception of, and the effort to adapt to, environmental circumstances are accompanied by complex patterns of neuro-endocrine changes. Animal and human studies implicate psychosocial factors in the predisposition to, and initiation and progression of, various pathophysiological processes, including infectious, bacterial, allergic, autoimmune and neoplastic diseases that involve alterations in immunological defense mechanisms. The chain of psycho-physiological events has not yet been firmly established,

but changes in several components of antibody- and cell-mediated immunity have been associated with naturally occurring and experimentally induced behavioral and emotional states (Esterling, Antoni, Kumar, & Schneiderman, 1993). One marker of such changes was the immune system's control over reactivation of latent Epstein-Barr virus (EBV). EBV is widespread in the general population, which is at least 90% seropositive. Under certain conditions, the latent virus replicates, although the mechanisms of reactivation are unknown. This latent state can be established in the presence of high levels of circulating antibody, suggesting that the cellular immune response is primarily responsible for controlling the latent infection. In healthy individuals, EBV can reactivate spontaneously and often in the absence of clinical symptoms. EBV reactivation is usually accompanied by a significant increase in specific antibody as a consequence of antigen expression on the cell surface, even in the absence of infectious virus (Esterling, L'Abate, Murray, & Pennebaker, 1999).

In a recent study, healthy college students completed a personality inventory and were also asked to write once for 30 min describing a stressful event that had happened to them previously but which they had not yet fully disclosed to others. Participants with repressive personality styles (i.e., tend to deny negative feelings, attempt to appear content in the face of problems and commonly engage in self-sacrificing behaviors) had higher levels of antibody to EBV compared to those with sensitizer styles (i.e., present to others as being overbearing and aggressive, having a low frustration tolerance and who are quick to express their negative feelings). Similarly, those who used a smaller percentage of emotional words (low disclosers) in writing about their stressful events had higher antibody titers as compared to those with a higher percentage of emotional words. Interestingly, personality style interacted with the disclosure performance in the written task in predicting EBV antibody titers. Specifically, within the repressive personality group, the level of emotional disclosure evidenced through writing was not associated with differences in antibody titers to EBV, whereas within the sensitizer personality group those who engaged in a high degree of emotional disclosure through writing showed the greatest degree of immunological control (i.e., lowest EBV antibody titers). However, the low-disclosing sensitizers had antibody levels as high as those who were classified as repressors. These associations held even after controlling for medication use, recent sleep loss, physical activity levels, lean body mass, caloric intake and alcohol and recreational drug use (Esterling, Antoni, Kumar, & Schneiderman, 1990). These findings suggested that, for individuals dealing with major stressors, coping strategies such as

written emotional disclosure and confrontation (rather than denial) of the stressor may be associated with a normalization of immunologic control over herpes viruses such as EBV. To test the effects of experimentally manipulating emotional disclosure on antibody titers to EBV, a study was subsequently designed in which participants were asked to either write or talk about a stressful event in three separate emotional disclosure sessions occurring once per week over a 3-week period (Esterling, Antoni, Fletcher, Margulies, & Schneiderman, 1994). Participants were randomly assigned to one of the following conditions: written disclosure of stressful events, verbal disclosure of stressful events or a trivial writing condition. In each of the first two conditions, participants were asked to recall and focus on a stressful event that had happened to them and that they had not disclosed to many people. It was emphasized that they should choose a topic that they felt was highly stressful or traumatic or about which they felt very guilty. Participants in each intervention condition had the option to discuss the same stressful event as in the previous week or to choose a different stressful event that they had recently encountered. As in previous work, participants were classified into one of three personality groups and ratings of the percentages of total emotional words served as the index of emotional expressivity on the disclosure task. Specifically, all disclosures were scored for positive and negative emotional word use as well as for positive cognitive appraisal change (e.g., were alternative explanations discussed and to what degree, or was there evidence of better understanding of the problem and to what degree?), self-esteem improvements (e.g., was there evidence that the participants felt better about themselves or less down on themselves, and to what degree?), and degree to which adaptive coping strategies were discussed (e.g., was there evidence that the participants expressed feelings to people, became more assertive or took more interpersonal risks?). In addition, the seriousness of the event was rated on each participant's disclosure. Overall, participation in either the written or verbal emotional disclosure intervention significantly decreased EBV antibody titers over the 4-week observation period. Although equivalent at baseline, individuals assigned to the verbal disclosure group showed significantly lower EBV antibody titer values (i.e., better immune function) after the intervention compared to those in the written disclosure group, who had significantly lower values compared to controls. Further, it was found that participants assigned to the written disclosure group expressed significantly more total and negative emotional words than the verbal disclosure and control groups at each time point. However, the verbal disclosure group was rated higher in cognitive change, self-esteem improvements and adaptive coping strategies as compared with the other groups. Further, individuals

classified as having a repressive personality style had significantly higher EBV antibody titers compared to sensitizers but no significant interaction was found between personality and the experimental conditions. These results suggested to authors that expression of negative feelings may be the important mechanism in written disclosure, whereas cognitive reappraisal, self-esteem enhancement and generation of adaptive coping strategies may be the important processes in verbal expression. Moreover, finding suggested that both writing and speaking about stressful events may have beneficial physiological effects independent of personality factors related to emotional expressivity.

In addition to EBV, other studies have supported the use of expressive writing in improving the immune system using other immune outcome markers. For example, Pennebaker, Kiecolt-Glaser and Glaser (J. W. Pennebaker, et al., 1988) had participants write about either traumatic experiences or superficial topics for 15–20 min on 4 consecutive days and were followed up 6 weeks later. Immune function was assessed by stimulating lymphocytes with one of two nonspecific mitogens that provide a measure of global cellular immune functioning. Participants assigned to the trauma group evidenced significant improvements in two independent markers of cellular immune function across the study period. Consistent with previous studies (J. W. Pennebaker & Beall, 1986), these participants evidenced a drop in physician visits relative to control participants. Similarly, trauma participants reported being significantly happier than control participants at the 3-month follow-up. With respect to individual differences, these investigators found that, within the trauma writing group, those participants who could be classified as high disclosers wrote significantly more emotional words and evidenced greater cellular immune function compared to their low-disclosing counterparts. These outcomes are consistent with the previous studies by Esterling and collaborators, suggesting that expressive writing could be effective in improving cellular immune function and that those individuals who disclose a high degree of emotions through writing may receive the greatest immune benefit. Moreover, findings supported that the immune outcomes probably translated to clinical health in that those participants who wrote about traumatic events also reported greater physical health.

To date, there has been only one study that has investigated the role of expressive writing on the immunological response to a viral challenge (Petrie, Booth, Pennebaker, Davison, & Thomas, 1995). In this study, investigators studied whether written emotional expression of traumatic experiences influenced the immune response to a hepatitis B vaccination program. Compared to the control group, participants in the emotional disclosure group showed

significantly higher antibody levels against hepatitis B at the 4- and 6-month follow-up periods, suggesting greater immune responsiveness to the viral challenge.

Although the findings of these studies are limited to young, physically healthy students and have no pathophysiological link to any disease, they point to the possible importance of the use of written disclosure as an intervention in medical populations, where receipt of a life-threatening diagnosis can be extremely traumatic and disruptive and may itself have pathological consequences. Indeed, the literature suggests that immune function and health are differentially modulated depending on whether individuals are subjected to emotionally arousing situations or have also an appropriate outlet for the expression of those feelings. For example, anxiety-provoking events have all been associated with increased reactivation of latent EBV. This means that the experience of an emotion (e.g., anxiety) does not by itself have a beneficial effect on the immune response against latent viruses such as EBV; in fact, the opposite seems to be the case. If with heightened emotion there is an easily accessible and comfortable route of expression (e.g., writing or talking about the stressful event), disclosure may have beneficial effects in controlling EBV reactivation.

## ***Conclusions***

Several theories have been proposed to explain the frequently observed physical and psychosocial benefits of expressive writing and, although there are some data to support each of these theories, there is also contradictory evidence for each of them. Perhaps, theories offered to date have not been investigated adequately. Furthermore, it is also possible that an alternative theory not yet explored underlies the effects of the expressive writing procedure. A further probability that has not yet been entertained fully is that a single theory may not fully account for the effects of expressive writing. Instead, it may be the case that a combination of these previously theorized mechanisms underlies the beneficial effects observed. For example, as suggested by James Pennebaker in a recent commentary (2004), it is possible that one mechanism accounts for the initial changes while another mechanism accounts for the maintenance of these and other changes. Stated another way, it is likely that the mechanism of action that accounts for the benefits of the expressive writing procedure may be quite complex and not accounted for by any single theory. However, no study to date has simultaneously investigated more than one model.

# Methods of Expressive Writing

## *Introduction*

As suggested by Sloan and Marx (Denise M. Sloan & Brian P. Marx, 2004), part of the reason that empirical support for each of the purported explicative theories of the benefits of expressive writing has been so equivocal and research findings have been mixed relates to the varying methodologies used across the studies.

## **Outcome variables**

Researchers have relied on a variety of physical and psychological measures to evaluate the effect of expressive writing. Across multiple studies in laboratories around the world, writing about emotional experiences relative to writing about superficial control topics has been found to be associated with significant drops in physician visits from before to after writing among relatively healthy samples. However, this outcome variable has been considered problematic because many individuals do not visit a physician even when they are sick and some other individuals visit a physician when they are healthy simply because of an help-seeking behavior. Thus, sensitivity of visits to a physician or campus infirmary as an outcome measure has been often questioned.

Writing about emotional topics has also been found to influence immune function in beneficial ways, including t-helper cell growth, antibody response to Epstein-Barr virus and antibody response to hepatitis B vaccinations (J.W. Pennebaker & Chung, 2007). Activity of the autonomic nervous system is also influenced by expressive writing. Among those participants who disclose their thoughts and emotions to a particularly high degree, skin conductance levels are significantly lower during the trauma disclosures than when describing superficial topics. Systolic blood pressure and heart rate drops to levels below baseline following the disclosure of traumatic topics but not superficial ones (J. W. Pennebaker, et al., 1987). McGuire, Greenberg and Gevirtz (McGuire, et al., 2005) have shown that these effects can carry over to the long-term in participants with elevated blood pressure. One month after writing, those who participated in the emotional disclosure condition exhibited lower systolic and diastolic blood pressure (DBP) than before writing. Four months after writing, DBP remained lower than baseline levels. Similarly, Sloan and Marx (D. M. Sloan & B. P. Marx, 2004) found that participants in a disclosure condition exhibited greater physiological activation, as indexed by elevated cortisol levels, during their first writing session, relative to



controls. Physiological activation then decreased and was similar to that of controls in subsequent writing sessions. Behavioral changes have also been found. Students who write about emotional topics evidence improvements in grades in the months following the study (Mark A. Lumley & Provenzano, 2003). Senior professionals who have been laid off from their jobs get new jobs more quickly after writing (Spera, et al., 1994). Consistent with the direct health measures, university staff members who write about emotional topics are subsequently absent from their work at lower rates than controls. Surprisingly, relatively few reliable changes emerge using self-reports of health-related behaviors. That is, in the weeks after writing, experimental participants do not exercise more or smoke less. The one exception is that the study with laid off professionals found that writing reduced self-reported alcohol intake (Spera, et al., 1994). Self reports also suggest that writing about upsetting experiences, although painful in the days of writing, produces long-term improvements in mood and indicators of well-being compared to controls. Although some studies have failed to find clear mood or self-reported distress effects, Smyth's (J. M. Smyth, 1998) meta-analysis on written disclosure studies indicates that, in general, writing about emotional topics is associated with significant reductions in distress (J.W. Pennebaker & Chung, 2007)

## **Samples**

The greatest part of studies have examined the efficacy and the features of the expressive writing procedure using samples of randomly selected healthy college students, whereas relatively few other studies have used samples of individuals with a PTSD diagnosis, a history of traumatic experiences and a medical illness. Although expressive writing is a decidedly psychological intervention, it rarely has been applied to psychiatric populations. As suggested by Stroebe and colleagues (Stroebe, et al., 2002), one reason for the hesitancy was a brief report by Gidron et al. (Yori Gidron, et al., 1996) that indicated that Israeli PTSD individuals who wrote about their traumas reported increases in symptoms five weeks later. The Gidron procedure, however, required participants to read and openly discuss their writing with others in the group. Anyway, no expressive writing studies has included clinically depressed samples. However, several studies have found drops in self-reported depression or distress among people who have been classified as formerly depressed, who initially reported elevated depression symptoms among mixed psychiatric, medical and community samples (Stroebe, et al., 2002).

## **Writing topic**

A fundamental aspect of the expressive writing procedure that has varied across the studies and that has shown to alter outcomes in important ways is the writing topic. In their early study, Pennebaker and Beal (1986) allowed the participants to freely choose the most traumatic experience they have had in their life. Many studies used the original writing instructions and, although one study found that health effects only occurred among individuals who wrote about particularly traumatic experiences (Greenberg & Stone, 1992), most of them showed broader benefits (J.W. Pennebaker & Chung, 2007). However, in a lot of other studies free of choice was variously constrained and participants were directed to write about particular topics, such as adjusting to college (J. W. Pennebaker, et al., 1990; James W. Pennebaker & Martha E. Francis, 1996), an upcoming graduate entrance exam (S. J. Lepore, 1997), job loss (Spera, et al., 1994), past childhood sexual abuse (Batten, et al., 2002), recent death of a spouse (Stroebe, et al., 2002) or current physical illnesses (de Moor, et al., 2002; Mann, 2001; Petrie, Fontanilla, Thomas, Booth, & Pennebaker, 2004; J. M. Smyth, et al., 1999; Stanton, Danoff-Burg, Sworowski, et al., 2002; Walker, et al., 1999). In each case, however, participants were asked to write about the topic in a very broad way and were encouraged to write about other topics that may have been only remotely related. For example, in the job layoff project, participants in the experimental conditions were asked to explore their thoughts and feeling about losing their jobs. Fewer than half of the essays dealt directly with the layoff. Others dealt with marital problems, issues with children, money and health (Spera, et al., 1994). Indeed, as argued by Pennebaker and Chung (J.W. Pennebaker & Chung, 2007), even if the diagnosis of a life-threatening disease may be considered as the most important issue for a person to write about in a cancer-related study, this can be secondary to a cheating husband, an abusive parent or some other trauma that may have occurred years earlier. In this regard, Smyth's (J. M. Smyth, 1998) meta-analysis of the available literature indicated that instructions to write about current traumas resulted in a higher mean effect size for outcome than instructions to write about past traumas. However, Schoutrop and colleagues (Schoutrop, et al., 2002) and Sloan and Marx (D. M. Sloan & B. P. Marx, 2004) allowed participants who endorsed a trauma history to write about either current or past traumas/distressing events. Results indicated beneficial effects for expressive writing regardless of the two conditions. Differently, findings from studies on healthy college students showed that writing about current or past topics may selectively influence outcomes. For example, in a sample of beginning college students who were asked to write specifically

about emotional issues related to coming to college, both health and college grades improved. However, when other students were asked to write about emotional issues related to traumatic experiences in general, only health improvements and not academic performance were found (J.W. Pennebaker & Chung, 2007).

Several investigators varied the original writing instructions in other important ways. For example, in one study examining adjustment to college, Cameron and Nicholls (Cameron & Nicholls, 1998) had participants previously classified as dispositional optimists or pessimists write in one of three conditions: a self-regulation condition (writing about thoughts and feelings towards coming to college and then formulating coping strategies), a disclosure condition (writing about thoughts and feelings only) or a control task (writing about trivial topics). Overall, participants in the disclosure task had higher grade scores at follow-up, but only those in the self-regulation task experienced less negative affect and better adjustment to college over the control participants. Optimists visited their doctors less in the following month if they had participated in either of the experimental writing conditions. On the other hand, only pessimists in the self-regulation condition had significantly fewer visits to the doctor after the study. Particularly interesting has been also a series of studies by Laura King and her colleagues. When asked to write about intensely positive experiences (IPE) or control topics, participants who wrote about IPEs reported significantly better mood and fewer illness-related health center visits than did those who wrote about trivial topics (Burton & King, 2004). In another study, students were asked to write about traumas in the standard way (L.A. King & Miner, 2000). In the benefit-finding condition, participants were encouraged to focus on the benefits that have come from the trauma. Finally, in the mixed condition, participants were first asked to write about the trauma and then to switch to the perceived benefits arising from the trauma experience. Counter to predictions, the trauma only and benefits only participants evidenced health improvements whereas the mixed group did not. In an unpublished project by Lori Stone (2002), students were asked to write about their thoughts and feelings about the September 11 attacks. In one condition, they received the standard unconstrained instructions. In a second condition, participants were asked to focus on their own feelings on one day and on other perspectives on alternating days. The perspective-switching instructions proved to be less beneficial than the unconstrained methods. Although several variations on the expressive writing method have been tested, none have been found to be consistently superior to the original trauma writing or other methods that encourage the participants' freely choosing their writing topic. As suggested by

Pennebaker and Chung (2007), forcing individuals to write about a particular topic or in a particular way may cause them to focus on the writing itself rather than the topic and the role of their emotions in the overall story.

### **Number of Writing Sessions**

The number of writing sessions and duration of the sessions has varied across studies. Typically, studies included three writing sessions (e.g., Batten, et al., 2002; Esterling, et al., 1994; Richards, et al., 2000; D. M. Sloan & B. P. Marx, 2004; J. M. Smyth, et al., 1999), though some studies used one session (e.g., Greenberg, et al., 1996; S. J. Lepore, 1997), four sessions (e.g., Greenberg & Stone, 1992; C.L. Park & Blumberg, 2002; J. W. Pennebaker & Beall, 1986; Petrie, et al., 1995), five sessions (e.g., Klein & Boals, 2001; Schoutrop, et al., 2002; Spera, et al., 1994) and seven sessions (Stroebe, et al., 2002). The duration of the writing sessions has also varied. Most studies have used 20-min sessions, though the original study by Pennebaker and Beal (1986) used 15-min sessions and some studies have used 30-min sessions (Greenberg, et al., 1996) and 45-min sessions (Schoutrop, et al., 2002). Finally, Stroebe and colleagues (Stroebe, et al., 2002) directed participants to write between 10 to 30 min during each session. Smyth's (J. M. Smyth, 1998) meta-analysis of the available literature indicated that number of sessions and duration of sessions did not affect the overall effect size. However, the meta-analysis was conducted using studies that employed physically and psychologically healthy participants. Consistent with both the cognitive and exposure models, the number and duration of the sessions may be important for individuals with PTSD-related symptoms, as only a few sessions short in duration may not be adequate for cognitive reframing and/or extinction of negative emotional associations.

### **Time Between Sessions**

The time period between writing sessions has also varied. The majority of studies have conducted the writing sessions on consecutive days. Although a few studies have spaced out the sessions over a 1-week period (de Moor, et al., 2002; Esterling, et al., 1994), two studies have spaced five sessions out over a 2-week period (Schoutrop, et al., 2002) and one study spaced out four sessions over 3-week period (Stanton, Danoff-Burg, Sworowski, et al., 2002). Interestingly, Smyth's (1998) meta-analysis indicated that studies that used a longer period of time between sessions were associated with a higher effect size. However, two following studies that actually manipulated the times between writing failed to support Smyth's findings. The first, by Sheese, Brown and Graziano (Sheese, Brown, & Graziano, 2004),

asked students to write either once per week for three weeks or for three continuous days about traumatic experiences or superficial topics. No trend emerged concerning the relative benefits of once a week versus daily writing. More recently, Pennebaker and Chung (J.W. Pennebaker & Chung, 2007) randomly assigned 100 students to write either about major life transitions or about superficial topics. Participants wrote three times, 15 minutes each time, either once a day for three days, once an hour for three hours or three times in a little more than an hour. Immediately after the last writing session and again at one month follow-up, no differences were found between the daily versus 3-times-in-one-hour condition. Indeed, at follow-up, the three experimental groups evidenced lower symptom reports than the controls after controlling for the pre-writing symptom levels.

### **Follow-up Visit**

The final variable that would seem important to outcome, yet that varies widely across studies, is the time until follow-up assessment. Investigators have varied the follow-up period such that they range from immediately following the last writing session to 6 months after the writing sessions. Most investigators have not provided a rationale for the follow-up period employed. The variation of the follow-up period may also explain some null findings as it may be the case that any beneficial effects obtained through expressive writing may dissipate after several weeks. While some psychological and physical health changes may be immediately apparent, they may be fleeting. On the other hand, some effects may take days, weeks, months or even years to emerge as significant changes on various health measures. The timing of improvements may also vary as a function of sampling characteristics. In an expressive writing study examining those suffering from asthma or rheumatoid arthritis (RA), health benefits were seen in asthmatics in the experimental writing condition as early as 2 weeks after writing. However, the health profile of RA patients in the experimental writing condition did not differ from those in the control condition until the 4-month assessment period (J. M. Smyth, et al., 1999).

Ideally it would be useful for studies to include multiple follow-up periods and several studies have already done this. However, all of these studies collapsed the multiple follow-up visits in order to compute a single follow-up visit score used in subsequent analyses. Such an approach does not allow for an examination of whether the beneficial effects of the paradigm are fleeting.

## **Statistical Significance Versus Clinical Significance**

In reporting the efficacy of the expressive writing procedure, investigators use a statistical significance approach, typically comparing participants in the written disclosure condition to participants assigned to a control condition. In addition to using statistical significance tests, investigators should also employ tests of clinical significance. Clinical significance analyses would allow for an examination of the clinical relevance of any reductions in physical and psychological health and these tests also take into account the test-retest reliability of the outcome measures. At this point, only Sloan and Marx (D. M. Sloan & B. P. Marx, 2004) have examined clinical significance and the findings indicated clinical significance for only one out of three outcome variables included in the study. (Denise M. Sloan & Brian P. Marx, 2004).

## ***Conclusions***

Many variations to the original writing instructions have been made during the past twenty-five years. Some of them were theory-driven and served the exploration/validation of the theoretical models that have been proposed to explain the health benefits of expressive writing. Some other variations were probably suggested by plausible assumptions on the salience of the experience. For example, some investigators directed participants to write about a current physical illness probably because they assumed it was the most stressful for them in that time. Again, some variations were simply curiosity-driven and served the exploration of features that were merely arbitrary, such as the number of writing sessions, their duration, the time between them and the mode of writing. Although no studies have compared ways of writing on health outcomes, a few have explored if mode of writing can influence people's ratings of the expressive writing procedure itself. Brewin and Lennard (Brewin & Lennard, 1999), for example, reported that writing by hand produced more negative affect and led to more self-rated disclosure than did typing. One possibility is that writing by hand is slower and encourages individuals to process their thoughts and feelings more deeply. Recently, Pennebaker has tested the idea of finger writing (J.W. Pennebaker & Chung, 2007). In finger writing exercises, people are asked to use their finger and to "write" about a trauma as if they were holding a pen. Over the last years, workshop participants have been asked to write for 5-10 minutes about an emotional topic on three occasions. For two of the three times, people are asked to write using a pen and one time with their finger. At the conclusion of the 4-6 hour workshop, individuals are asked to rate "how valuable and

meaningful” each of the writing exercises had been. Along a 7-point unipolar scale, where 7 = a great deal, the mean rating for the finger writing has been 5.81 (SD=2.30) and the mean for the two pen-writing occasions has been 5.84. Interestingly, women significantly prefer the finger writing with respect to men. When queried about their preference for finger writing, many women reported that finger writing allowed them to freely express some of their most secret thoughts. Indeed, in every workshop, several people reported that they used more swear words when finger writing compared to writing with a pen (J.W. Pennebaker & Chung, 2007).

# **Expressive writing and Psychotherapy**

## ***Introduction***

The expressive writing procedure has early been viewed as similar to psychotherapy or psychological counseling in that people confront a distressing memory, label it and discuss its causes and consequences (J. W. Pennebaker, 1997). As the expressive writing procedure has become more popular, a number of comparisons with psychotherapy have been drawn (James W. Pennebaker, 2004). Given the emphasis on objective outcome measures, it was natural that researchers who study cognitive-behavioral therapy (CBT) became interested in expressive writing. Both expressive writing and CBT offer relatively brief interventions that appear to help a wide range of individuals. Both strategies have been shown to affect both cognitive and behavioral measures. In a recent commentary, Pennebaker (2004) stated that many of his CBT-true-believer friends have helpfully pointed out that expressive writing is nothing but a glorified CBT intervention. However, even before the expressive writing paradigm became so popular, many other clinical researchers explored the use of writing as a therapeutic strategy (L'Abate, 1991). Indeed, writing is both cost-effective and mass-oriented, and can be used in parallel or as an adjunct to preventive and therapeutic interventions requiring face-to-face patient-therapist relationships (Esterling, et al., 1999). Therapeutic writing is a more global term with respect to expressive writing and it is used throughout the literature to describe any writing exercise that is undertaken to support therapeutic work. Therapeutic writing can be described along a continuum from least to most structured. On the lower end there is open-ended writing where the patient writes about whatever comes to his or her mind. Programmed writing represents the most structured type of writing, with focused and guided writing falling in between (Kerner & Fitzpatrick, 2007). For example, in programmed writing, a topic (e.g., depression) is broken down into its major components, each represented by a lesson or homework assignment. A series of lessons, also referred to as homework assignments, constitutes a workbook. The level of abstraction may vary from abstract to concrete. Patients complete written homework assignments or lessons devoted to one specific clinical topic. In focused writing, the patient is asked to write about his or her thoughts and feelings regarding general topics (e.g., personal anxieties) (Esterling, et al., 1999).



## ***Similarities and differences between expressive writing and psychotherapy***

Use of writing in clinical settings relies on a therapeutic process that works without the interpersonal aspects that are entailed in traditional psychotherapy. The processes of support, empathy, interpretation, and so on that are believed crucial to therapeutic change are lacking in writing. Therefore, it seemed improbable that simply writing about traumatic events could produce results comparable to psychotherapy. To investigate this issue and to explore in what ways the processes in writing therapy and psychotherapy are similar and different, a series of studies was conducted to compare writing about traumatic events to brief psychotherapy (Donnelly & Murray, 1991; E. Murray, et al., 1989). Undergraduate participants were asked to write about a very traumatic event, write about trivial events or talk to a therapist about a traumatic event for 20 minutes over two successive days (E. Murray, et al., 1989). In the psychotherapy condition, participants were asked to recall a traumatic event that had occurred to them and to discuss that event, recalling the facts and the emotions associated with the trauma. Therapy focused on reflections of feelings and content, use of empathy, clarification and prompting for the participants to explore deeper understandings of their specific event. Findings showed that both expressive writing and psychotherapy showed evidence of positive changes in cognitions, self-esteem and adaptive behavior in the study content analyses. In a follow-up study involving a larger number of participants and four sessions, both writing and psychotherapy were again equally effective in dealing with traumatic experiences (Donnelly & Murray, 1991). Specifically, both groups reported feeling more positive about their topic in comparison to the control group. Furthermore, the content analysis of the essays showed that, over the course of the four sessions, both groups reduced negative emotion and exhibited increased self-esteem as well as adaptive changes in cognition and behavior. In contrast to other measures, dramatic differences in positive and negative mood were found between writing therapy and psychotherapy groups. Mood was measured immediately before and after each session. Following each writing session, an upsurge of negative and a decline in positive mood was observed. In contrast, the mood after the psychotherapy sessions was generally positive. In spite of the upsurge in negative mood after each session, however, the writing group felt more positive overall by the end of the study. Taken together, these studies indicated that, with participants suffering from minor psychological complaints, expressive writing may produce changes comparable to those produced by short-term psychotherapy. Although there may be a slight initial advantage of psychotherapy, this advantage disappeared

over a four-session period. Therefore, expressive writing and psychotherapy provide evidence of significant cognitive and emotional processing of the traumatic experience. However, dramatic differences in mood produced by the two interventions suggested that different mechanisms may have been involved. Specifically, the therapist may have played a role in the more positive mood observed after the psychotherapy sessions. However, studies with clinical populations are still needed to address the clinical relevance of these findings.

In comparing expressive writing and psychotherapy, three important factors emerge as fundamentally distinctive. First, psychotherapy involves an interpersonal interaction whereas expressive writing is often a solitary work. In the previous studies, the therapist may have ameliorated the residual negative mood experienced in the writing condition in keeping a person dealing with the emotional negative experience until processing was complete. Second, psychotherapy provides continuous and personal feedbacks to clients/patients, while in the expressive writing procedure participants are assured of anonymity but are also aware that their writings may be viewed by the researcher. This aspect of the expressive writing procedure can imply an imaginary audience for the participant, possibly exerting an influence on the way that person expresses himself or herself. Indeed, some evidence suggests that a greater presumed audience will result in increased censorship of disclosure (J.M. Smyth, et al., 2008). Although writing interventions are successful in the absence of feedback from therapists, the potential benefit of receiving this feedback has not yet been ruled out (L. Honos-Webb, et al., 2000). Second, psychotherapy differs from expressive writing and other forms of therapeutic writing in that it involves vocal expression. To test the hypothesis that the differential effects of psychotherapy and expressive writing on residual negative mood after each session were due to the vocal expression inherent in psychotherapy, participants were asked to either speak into a tape recorder with no one present or to write for the same time period focusing on both the descriptive and emotional aspects of the event (E. J. Murray & Segal, 1994). Half of each group was asked to deal with traumatic experiences and the other half was asked to deal with trivial topics. Each group spent 20 min performing the task. Consistent with previous studies, both writing and talking about the traumatic experiences had positive therapeutic effects and were equally effective, with both groups showing positive changes on the content analyses. Further, after both writing and vocal expression sessions, participants showed an upsurge in negative mood and a decrease in positive mood. These results suggest that differences between expression and psychotherapy are due to interpersonal factors. Together, these studies support the hypothesis that expressive writing is

as effective, or nearly as effective, as short-term psychotherapy. The major drawback to these expressive methods is that they resulted in an upsurge in negative mood after each session. This effect could produce an avoidance of expressive methods over time. Because a therapist seems to ameliorate the upsurge in negative mood, use of a combination of expressive sessions and regular therapy sessions might be therapeutically optimal, as well as cost effective. Clearly, more research is needed before one may equate writing with traditional psychotherapy. However, research to date does suggest that writing therapy is effective and may approach the efficacy of traditional psychotherapy in enhancing cognitions, behavior and self-esteem (Esterling, et al., 1999)

### ***Conclusions and alternative applications***

There are clear disadvantages as well as advantages to writing versus talking with a psychotherapist about traumas. Writing about intensely personal experiences does not allow for an objective outside opinion, support from others or objective coping information. Alternately, writing is tremendously cost-effective, allows people to confront traumas at their own rates and encourages them to devise their own meaning and solutions to their problems. Above all, writing may provide an alternative form of preventive therapy that can be valuable for individuals who otherwise would not enter therapy (Esterling, et al., 1999).

Several studies have tested the effects of the expressive writing intervention in modified ways, expanding its utility and broadening its range of application. A recent study examined the use of expressive writing through letters, as applied within treatment for couples who had experienced an extra-marital affair (Gordon, Baucom, & Snyder, 2004). The couple's therapist read drafts of the written narratives and provided feedback on the letters before they were shared between partners. This relational model uses letters for different purposes as treatment progresses, emphasizing different content at each stage. The results of this study support the effectiveness of this type of extension of the expressive writing procedure; however, as these findings were based on case studies, experimental trials of this modified intervention are necessary in order to draw strong conclusions about its benefits. Lastly, the Internet provides an area for future research on the implementation of expressive writing. Writing naturally occurs in great frequency over the Internet, through mechanisms such as e-mail, blogs (online journals) and instant messaging. Structured writing has been applied on the Internet through a program called Interapy (or Internet therapy), which provides a combination of structured expressive writing with therapist feedback and instructions (Lange,

Rietdijk, Hudcovicova, van de Ven, Schrieken, & Emmelkamp, 2003; Lange, van de Ven, & Schrieken, 2003)

## **Expressive writing in clinical settings**

### ***Introduction***

In their review on the putative theories underlying the expressive writing paradigm, Sloan and Marx concluded that it was too early to say definitively whether expressive writing is a trustworthy technique that should be adopted by the therapeutic community (Denise M. Sloan & Brian P. Marx, 2004). However, the expressive writing procedure is tremendously cost-effective, easy to administrate and feasible, does not need highly trained clinicians to work, has a great accessibility and, despite its brief duration, has shown promising objective and subjective health benefits in many studies.

Such appealing features made it very attractive for clinicians and clinical researchers who, beginning in the 90s, started to use the expressive writing procedure with their patients and to examine its effects empirically in many randomized clinical trials involving individuals with physical as well as psychological disorders.

### ***Physical illnesses***

One of the first studies to report significant benefits from expressive writing for medically ill patients was conducted by Smyth, Stone, Hurewitz & Kaell (J. M. Smyth, et al., 1999). Community samples of patients with chronic asthma or rheumatoid arthritis (RA) were randomly assigned to write about either stressful life events or a neutral topic (time management). Outcome was measured both through self-report as well as objective health assessments (collected at baseline, 2 weeks, 2 months and 4 months after writing). Health assessments included spirometry (pulmonary function in asthma patients) and clinical examinations conducted by a rheumatologist (RA patients). Four months after treatment, asthma patients in the experimental group showed improvements in lung function, whereas control group patients showed no change. Rheumatoid arthritis patients in the experimental group showed improvements in overall disease activity, whereas control group patients did not change. In fact, across both disease groups, 47% of experimental patients had clinically relevant improvement, whereas 24% of control patients had improvement. Expressive writing interventions have been tested for other medically ill populations as well, including patients with breast cancer (Stanton, Danoff-Burg, Sworowski, et al., 2002; Walker, et al., 1999), rheumatoid arthritis (Kelley, et al., 1997), fibromyalgia (Gillis, Lumley, Mosley-Williams, Leisen, & Roehrs, 2006), HIV (Mann, 2001; Petrie, et al., 2004), renal cell carcinoma (de

Moor, et al., 2002), men diagnosed with prostate cancer (Rosenberg, Rosenberg, Ernstoff, Wolford, Amdur, Elshamy, et al., 2002), women with chronic pelvic pain (Norman, Lumley, Dooley, & Diamond, 2004), men with elevated blood pressure (McGuire, et al., 2005), patients undergoing bladder papilloma resection (Solano, Donati, Pecci, Persichetti, & Colaci, 2003) and transurethral prostate resection (Solano, Pepe, Donati, Persichetti, Laudani, & Colaci, 2007). Several of these studies have found significant improvements as results of expressive writing; however, many have reported either few or no significant findings.

### ***Psychological disorders***

According to Smith, Nazarian and Arigo (J.M. Smyth, et al., 2008), the expressive writing procedure has a great clinical potential as a stand-alone treatment for psychological disorders and may also improve both the process and outcomes of psychotherapy. Yet, despite the feasibility and the demonstrated psychological benefits of using expressive writing as a treatment tool, certain issues warrant consideration. Assigning expressive writing as between-session “homework” activities can maximize privacy and client control, which has been shown to relate to improved outcome (Frattaroli, 2006). However, engagement in expressive writing typically results in immediate distress and discomfort (J. M. Smyth, 1998). As such, clients who experience unpleasant emotions may choose to stop writing in un-monitored settings, thus reducing the effectiveness of the writing activity and even increasing the risk for harm. For this reason, it is very important to determine how to help clients address their distress when writing on their own. Some evidence also suggests that situations of great actual distress do not provide optimal conditions for gaining benefits from expressive writing. This effect has been demonstrated in a clinical study involving Israeli patients with PTSD who, after writing about their traumas, reported increases in symptoms five weeks later (Yori Gidron, et al., 1996). The Gidron procedure, however, required participants to read and openly discuss their writing with others in the group. In addition, some clients may not see the value in writing about upsetting experiences. In such instances, it may be useful for practitioners to emphasize the findings of expressive writing studies and refer patients to lay publications on the benefits of this activity (J.M. Smyth, et al., 2008).

Although expressive writing is a decidedly psychological intervention, it rarely has been applied to psychopathological populations (Stroebe, et al., 2002). Given the theoretical strength of the exposure model, some clinical studies have included individuals with a PTSD (Post-Traumatic Stress Disorder) diagnosis or with general stress disorders such as grief and

caregiving burden but, for example, no clinical trial on the expressive writing procedure has to date included clinically depressed samples. However, several studies have found drops in self-reported depression or distress among people who have been classified as formerly depressed, who initially reported elevated depression symptoms among mixed psychiatric, medical and community samples (Stroebe, et al., 2002).

### ***Clinical suggestions for proper use of expressive writing in clinical settings***

As suggested by Smith and colleagues (J.M. Smyth, et al., 2008), clinicians should keep a few factors in mind. First, there is no magical number of sessions required for clients to experience the positive effects of expressive writing: some individuals benefit from a single session, whereas others may require more. Second, optimal session spacing has been inconsistent in the literature, but the most recent research synthesis did not find spacing to moderate the effects of the writing intervention (Frattaroli, 2006). Third, the solitary nature of the expressive writing procedure may be advantageous because it provides participants/patients with privacy, confidentiality and control over their own intervention dosage (J. W. Pennebaker, 2002). Forth, clinicians should also consider the “audience” to which the client is directing his or her writings. Brody and Park (Brody & Park, 2004) have suggested that some participants in expressive writing studies begin their writing with an implicit audience in mind, which may contribute to the effectiveness of this activity. This audience is made explicit only when writing is shared with the client’s therapist, but it is unclear if and how this sharing might influence the process and outcomes of the writing intervention. At least, participants are aware that their writings may be viewed by the researcher. This aspect of the expressive writing procedure can imply an imaginary audience for the participant, possibly exerting an influence on the way that person expresses himself or herself. Indeed, some evidence suggests that a greater presumed audience will result in increased censorship of disclosure (J.M. Smyth, et al., 2008). Although writing interventions are successful in the absence of feedback from therapists, the potential benefit of receiving this feedback has not yet been ruled out (L. Honos-Webb, et al., 2000). Therefore, when this intervention is used in clinical settings, therapists and clients/patients should decide on whether or not to share or discuss writing samples before writing begins (J. Smyth & Helm, 2003). Individual client and therapist dyads may determine the level of involvement and feedback from a therapist based on the individual case. Many factors may make feedback

from a therapist undesirable, such as client self-motivation to improve or a therapist-client mismatch of goals/approaches to treatment. Conversely, some individuals may require more involvement and/or guidance from the therapist. In such cases, “self” administered writing may not always be beneficial, and some evidence suggests there are identifiable subgroups that would benefit from assistance. Therapist involvement can focus on clarifying the process and goals of writing, providing appropriate feedback and regulating the writing “dose,” which may increase benefit for certain clients. Therapists may also want to check in with clients after the first writing session is completed in order to address any resulting questions or concerns (J.M. Smyth, et al., 2008). Therapist feedback can take several forms, each of which may prove to be effective with individual clients. Suggested feedback strategies include (a) therapists responding after clients read their writing out loud (particularly parts that are of increased emotional importance to them), (b) therapists reading written narratives during a session and subsequently discussing the writing with the client, and (c) therapists reading the writing samples between sessions and providing feedback during the following session (J.M. Smyth, et al., 2008). Deciding on which of these options to use will in part depend on a client’s individual desire for therapist feedback and comfort level with sharing his or her writing. Fifth, although the traditional expressive writing instructions ask participants to focus on negative events, physical and psychological improvements have also been associated with topics that direct participants to focus on the positive aspects of such events (see chapter ?). For example, Stanton and colleagues (Stanton, Danoff-Burg, Sworowski, et al., 2002) found that asking patients with breast cancer to explore the potential benefits in their stressful medical experiences through writing led to reductions in both physical symptoms and symptom-related medical visits. Sixth, efforts to “improve” the expressive writing intervention have added guidelines (such as narrative structure, processing, word use, etc.) to the writing instructions, but results have been mixed. Specificity of writing instructions has been associated with better outcome (Frattaroli, 2006), but the imposition of too much structure may restrict the client’s potential range of emotional expression or willingness to engage in the intervention at all. As suggested by Pennebaker and Chung (2007), forcing individuals to write about a particular topic or in a particular way may cause them to focus on the writing itself rather than the topic and the role of their emotions in the overall story. Seventh, clients/patients may present with disabilities that prevent them from engaging in the traditional expressive writing task. Physical disabilities, learning disabilities and literacy issues may influence clients/patients’ willingness and ability to write. One alternative for



individuals who are unable to write might be the private disclosure of their experiences into a tape recorder (J.M. Smyth, et al., 2008).

## ***Conclusions***

Although the transfer of the expressive writing procedure to the clinical setting is feasible and promising, there are some cautions to take into account because the expressive writing procedure is not a panacea. Few years ago, from a psychotherapeutic perspective James Pennebaker urged a research agenda: find out when it does and does not work and with whom. In the real world, a large number of people need inexpensive, fast and effective treatments in their dealing with traumas, emotional upheavals and daily stressors. He further wrote: “Why expressive writing works is certainly an interesting and important question. But for the general populace, we also need to know when and how well it works” (James W. Pennebaker, 2004, p. 141)

The following questions remain matters of deliberation for clinicians who wish to successfully implement a personalized writing intervention. First, how should writing be introduced to the client? Will writing be approached as a primary treatment technique or as a supplement to more traditional methods? Should it be used on an inpatient or outpatient basis? How and how much should the instructions be structured, as opposed to allowing the client to guide the writing? Will this intervention be as effective at home as it has been in the laboratory? These questions continue to require purposeful clinical and empirical attention, but the potential for the integration of expressive writing interventions into clinical practice in a wide array of settings remains high (J.M. Smyth, et al., 2008)

# **A randomized controlled clinical trial on expressive writing for heart healing. The WRITTEN-HEART study**

## ***Study rationale***

A recent special issue of the British Journal of Health Psychology edited by Joshua Smyth and James Pennebaker (J. M. Smyth & Pennebaker, 2008) confirms the breath of current interest in the expressive writing paradigm and invites to look forward at the many remaining frontiers in Expressive Writing research. One of the boundary conditions that was identified in their commentary paper concerns new outcome measures and previously unexamined populations.

Surprisingly, the expressive writing procedure has never been used on patients with heart disease. Perhaps, clinical researchers have been negatively impressed by some negative results (Yori Gidron, et al., 1996). Furthermore, in a review on the putative theories underlying the expressive writing procedure, Sloan and Marx concluded that it was too early to say definitively whether expressive writing is a trustworthy technique that should be adopted by the therapeutic community (Denise M. Sloan & Brian P. Marx, 2004). However, the meta-analysis by Frisina, Borod and Lepore (Frisina, Borod, & Lepore, 2004) on 9 writings studies using clinical populations showed that expressive writing significantly improved health outcomes ( $d=.19$ ) and the strongest effect was found for physical health outcomes ( $d=.21$ ). Moreover, the expressive writing procedure is tremendously cost-effective, easy to administrate, feasible and brief, does not need highly trained clinicians to work, has a great accessibility and has shown an amount of promising objective and subjective health benefits in many studies on students and individuals from the community. Such appealing features have made it very attractive for some clinicians and clinical researchers who, beginning in the 90s and going on until nowadays, have started to use the expressive writing procedure with their patients and to examine its effects empirically in many randomized clinical trials involving individuals with physical disorders such as breast cancer (Low, Stanton, Bower, & Gyllenhammer, 2010; Low, Stanton, & Danoff-Burg, 2006; Stanton, Danoff-Burg, Sworowski, et al., 2002; Walker, et al., 1999), rheumatoid arthritis (Kelley, et al., 1997), fibromyalgia (Gillis, et al., 2006), HIV (Mann, 2001; Petrie, et al., 2004), renal cell carcinoma (de Moor, et al., 2002), men diagnosed with prostate cancer (Rosenberg, et al., 2002), women with chronic pelvic pain (Norman, et al., 2004), men with elevated blood pressure (McGuire,

et al., 2005), patients undergoing bladder papilloma resection (Solano, et al., 2003) and transurethral prostate resection (Solano, et al., 2007).

The fact that no trial to date has yet evaluated the effects of expressive writing on patients with heart disease is surprising because many studies on the physiological effects of expressive writing have found significant and beneficial variations in many markers of the autonomic nervous system such as skin conductance, heart rate, heart rate variability and blood pressure (e.g., Low, et al., 2006). It is even more disappointing that the small but significant study of McGuire, Greenberg and Gevirtz (McGuire, et al., 2005) on the autonomic effects of expressive writing in individuals with elevated blood pressure has been neither replicated nor expanded in the subsequent years. In their paper, McGuire, Greenberg and Gevirtz argued that, given the high costs and potential risks of elevated blood pressure and the lack of demonstrated effective non-pharmacological treatments for this population, a low-cost and easily administered psychological intervention as expressive writing, if shown to be effective, has the potential for widespread clinical use. Although they showed that, one month after writing, the participants who were allocated in the expressive writing condition exhibited lower systolic and diastolic blood pressure than before writing and that, four months after writing, diastolic blood pressure remained lower than baseline levels, their argument felt on deaf ears. As elevated blood pressure is a major neuro-cardiovascular risk factor that often affects patients with an established cardiovascular disease (CVD), an intriguing idea was to administer the expressive writing procedure to a sample of patients with CVD referred to a brief residential cardiac rehabilitation program and test the brief, mid and long-term effects of such an intervention on patients' health-related quality of life (HRQoL), anxiety symptoms, depressive symptoms, medical consultations for cardiovascular morbidity, post-traumatic growth and benefit finding. With respect to the latter outcomes, some evidence suggests that expressive writing is effective in enhancing positive growth from trauma over time (Ullrich & Lutgendorf, 2002) and a body of research has shown that awareness of the benefits of adverse events and circumstances is an important predictor of successful adjustment (Affleck, Tennen, Croog, & Levine, 1987; Davis, Nolen-Hoeksema, & Larson, 1998; Mendola, Tennen, Affleck, McCann, & Fitzgerald, 1990).

Further empirical support to the rationale of this study comes from the results of a recent clinical trial on potential physiological, emotional and cognitive mechanisms underlying the positive health effects produced by disease-related expressive writing in a sample of women with early stage breast cancers (Low, et al., 2006). Findings supported the hypothesis that

autonomic activity (heart rate) mediates the effect of the expressive writing condition on self-reported physical symptoms. Findings suggested that the prolonged and repeated exposure and concomitant cognitive processing might contribute to improved regulation of physiological responses, presumably leading to less stress on bodily systems and ultimately enhanced physical health (Low, et al., 2006).

A second goal of the study was to determine whether the effects of the expressive writing intervention varied as a function of four potential moderating variables: coping styles, negative affectivity and social constraint (type D personality factors), perceived social support and evaluative ratings of the writing intervention. In fact, some evidence suggests that expressive writing may be most effective for individuals who use more approach-oriented, expressive coping strategies than for those who are more non-expressive or have deficits in identifying and processing emotion (M.A. Lumley, Tojek, & Macklem, 2002; Stanton, Danoff-Burg, Cameron, Bishop, Collins, Kirk, et al., 2000; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). Further, same evidence suggests that perceived emotional support is a moderator of the expressive writing effects. This hypothesis was guided by social constraint theory, which suggests that the absence of social outlets for emotional expression and processing has a negative effect on adjustment to stressful situations and that expressive writing may represent a useful intervention for individuals who lack opportunities for emotional expression in their social environments (Zakowski, Ramati, Morton, Johnson, & Flanigan, 2004).

## ***Methods and participants***

### **Study design and hypotheses/outcomes**

A four-arm randomized controlled clinical trial with three follow-up assessments (immediately before discharge from hospital, 3 months and again 6 months after discharge) was planned in order to test the following primary hypotheses/outcomes: 1) a modified disease-related expressive writing intervention is effective in enhancing physical and psychological health outcomes (HRQoL, anxiety and depression symptoms, medical visits for CVD-related morbidities) relative to a sham condition in which patients write solely about the facts of their experience with CVD and relative to a control empty condition; 2) the modified disease-related expressive writing intervention is more effective in enhancing physical and psychological health outcomes than a standard expressive writing condition in which patients write about their deepest thoughts and feelings about the most traumatic or negative event

they have experienced in their life. Secondary explorative hypotheses/outcomes were: 1) the modified disease-related expressive writing intervention is effective in enhancing post-traumatic growth and benefit finding relative to sham and control conditions; 2) the modified disease-related expressive writing intervention is more effective in enhancing post-traumatic growth and benefit finding than the standard expressive writing condition.

Sub-group analysis were also planned in order to examine the relative effectiveness of the writing conditions as a function of patients' gender, age, coping styles, negative affectivity and social constraint (type D personality factors), perceived social support and evaluative ratings of the writing intervention by patients. Accordingly, significant interactions between the experimental conditions and the moderator variables mentioned above were postulated such that, for example, patients low on avoidance would benefit more from expressive writing than would avoidant patients and that patients perceiving low social support would benefit more than patients perceiving high social support.

## **Participants**

One-hundred and fifty individuals who were consecutively referred to in-patient cardiac rehabilitation (CR) from May 2009 to May 2010 and who met inclusion criteria of having had a medical diagnosis of Coronary Heart Disease (CHD) and being affected by major cardiovascular risk factors were asked and screened for admission in the study. CHD was defined as a history of at least one of the following: myocardial infarction, coronary artery bypass grafting (CABG) and coronary angioplasty (PTCA). Patients were not selected if they had been diagnosed with recent (less than four weeks) myocardial infarction, CABG or PTCA, if they were unable to read and write in Italian and if they had an age  $\geq 70$  years. Screening for exclusion criteria reduced the initial pool to ninety-five patients, who reduced again to seventy-two after twenty-three patients declined participation and did not consent on study recruitment. Appropriate sample size of 64 participants was determined on the basis of statistical comparisons across treatment arms in the HRQoL measure (SF-12) (statistical power = 0.80;  $f^2 = 0.35$ ;  $p < 0.05$ ).

Attrition occurred during data collection and writing sessions such that of the 72 patients who consented to participate, eight were recruited for the study but did not complete it for reasons as follows (Table 1): two did not complete the baseline questionnaires and eight declined further participation after completing one, two or three writing sessions (four in total). Thus, 67% of the patients introduced to the research completed it. Those who declined or terminated participation most often reported lack of interest, motivation loss and writing difficulties.

Non-participants (n=8) completing the baseline questionnaires did not differ significantly on any baseline variable from study participants.

## **Experimental Procedure**

Patients were recruited from a residential cardiovascular rehabilitation unit in the northwestern of Italy. The cardiac rehabilitation (CR) program lasted 1 month for each patients in accordance with the Italian Health Institute's guidelines. Along this period, patients lived in the S. Giuseppe hospital, which is located on a mountain highland and far away from towns and cities. Few days after entry in the CR unit and immediately after the initial medical evaluation and treatment planning (first week), patients were approached by the research investigator for initial screening in accordance to inclusion and exclusion criteria. Patients who went through the screening were informed orally by the research investigator that a scientific study was ongoing and that its purpose was "to learn more about how individuals adjust to having heart disease". They were also told that they could have been asked to write about their experiences with heart disease and, if they unofficially consented, they were scheduled for the following day when they received the informed consent form and were asked to sign it after having fully understood the procedure. The informed consent form included no mention of expected benefits from the writing sessions and no mention of the randomization to one of four conditions. Once the patients had signed the informed consent form, they were administered the baseline questionnaires and returned them immediately after completion. With the exception of the control participants, they received a schedule relative to the four writing sessions to be completed within the following two weeks. The randomization plan was created by the research investigator using the Web site [www.randomization.com](http://www.randomization.com). Only participants were blinded to condition assignment, whereas the research investigator and a trained research assistant were not. Once randomization was performed, no change in treatment allocation took place. Participants completed the individual writing sessions in a peaceful laboratory close to the CR unit. Writing instructions were written on the first of the sheets on which patients had to write and were presented to them at the beginning of each writing session. The research assistant met each participant just before writing, gave him the writing sheets and let him alone in the laboratory for twenty minutes, then returned to stop the session and to pick up the sheets. The research assistant was not aware of research hypotheses.

**Table 1. Summary of Trial Participation Rates**

Trial phase	DR-EW	S-EW	Sham	CTL	Total
Introduced to trial	–	–	–		95
Consented to trial	–	–	–		72
Completed baseline questionnaires	–	–	–		70
Randomized	22	21	20		70
Began and completed writing sessions	21	21	18		64
Completed follow-up assessments	21	21	18		64

Abbreviations: DR-EW, disease-related expressive writing condition; S-EW, standard expressive writing condition; sham, disease-related facts; CTL, empty control condition

Participants were randomized to one of the following four conditions: 1) disease-related expressive writing (DS-EW); 2) standard expressive writing (S-EW); 3) unemotional writing (Sham) and 4) an empty condition not involving a writing task (assessments only). All the active conditions (1, 2 and 3) consisted in four 20-minute writing sessions that occurred during the hospital stay within a 2-week period and that were scheduled twice a week for each participant.

Writing instructions for the three active groups were as follows:

1. Disease-related expressive writing (DS-EW)

“What I would like you to write about for these four sessions are your deepest thoughts and feelings about your experience with heart disease. I realize that individuals with heart disease experience a full range of emotions and I want you to focus on any and all of them. In your writing, I want you to really let go and explore your very deepest emotions and thoughts. You might think about all the various feelings and changes that you experienced before being diagnosed, after diagnosis, during treatment, and now. Whatever you choose to write, it is critical that you really focus on your deepest thoughts and feelings. Ideally, I would like you to focus on feelings, thoughts or changes that you have not discussed in great detail with others. You might also tie your thoughts and feelings about your experiences with heart disease to other parts of your life - your childhood, people you love, who you are or who you want to be. Again, the most important part of your writing is that you really focus on your deepest emotions and thoughts. The only rule we have is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written. Don't worry about grammar, spelling or sentence structure. Don't worry about erasing or crossing things out. Just write.”

## 2. Standard expressive writing (S-EW)

“What I would like you to write about for these four sessions are your deepest thoughts and feelings about the most traumatic or negative experiences you had in your life. I realize that individuals who live a traumatic experience have a full range of emotions and I want you to focus on any and all of them. In your writing, I want you to really let go and explore your very deepest emotions and thoughts. Whatever you choose to write, it is critical that you really focus on your deepest thoughts and feelings. Ideally, I would like you to focus on feelings, thoughts or changes that you have not discussed in great detail with others. You might also tie your thoughts and feelings about your negative experiences to other parts of your life - your childhood, people you love, who you are or who you want to be. Again, the most important part of your writing is that you really focus on your deepest emotions and thoughts. The only rule we have is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written. Don't worry about grammar, spelling or sentence structure. Don't worry about erasing or crossing things out. Just write.”

## 3. Unemotional writing (Sham)

“What I would like you to write about for these four sessions is a detailed account of facts regarding your heart disease and its treatment. I am interested in how the specifics of detection, diagnosis and treatment differ among individuals with heart disease; therefore, it is critical that you provide an extremely detailed account of all that happened to you with regard to having heart disease. I realize that individuals with heart disease experience many emotions, but in your writing I want you to focus only on the facts, not on your emotions. No fact is too big or too small. You might write about when your heart disease was discovered and who discovered it, appointments that you had with doctors or other people about your heart disease, information you were given and what treatment was chosen. You might recount your experience from beginning to present day, including all the factual details you can think of. Again the most important part of your writing is that you focus on the facts and try to reconstruct what happened in as great factual detail as possible. The only other rule . . . [Instructions continue as above]

At the end of the CR program and before discharge, all participants, including those assigned to the empty control condition, were re-administered the outcome questionnaires and were told that they would have received other follow-up questionnaires by mail at 3, 6, 9 and 12 months after discharge from hospital. They were also given the phone numbers of the research



investigator and the research assistant, and they were instructed to talk to them if they had any concerns. A form on which to record any medical visits over the previous 3 months was also sent at each participant at the follow-up points. All participants received and returned questionnaires and the form regularly.

## **Outcome Measures**

### **SF-12**

The SF-12 Health Survey is a measure of physical and mental health. It is the short form of the most popular SF-36 and consists of the 12 items that were found to be the best predictors of the two SF-36 physical and mental summary scores (referred to as PCS-36 and MCS-36, respectively) in the US validation study (Ware, Kosinski, & Keller, 1996). Selected items and weights derived from the general US population were then used to score the physical and mental summary scores (referred to as PCS-12 and MCS-12, respectively). The PCS-12 and MCS-12 were very highly correlated with PCS-36 and MCS-36 ( $r = 0.951$  and  $0.969$ , respectively) and were very weakly correlated ( $r = 0.06$ ) with each other in the US sample. In the present study, the Italian version of the SF-12 was used (Apolone, Mosconi, Quattrocioni, Gianicolo, Groth, & Ware, 2005) and the two summary scores (PSC-12 and MCS-12) were computed with weights derived from the Italian validation sample.

### **Beck Depression Inventory – II**

The Beck Depression Inventory – Second Edition (BDI-II) is a measure of depressive symptoms. It was developed by revising the BDI in response to the American Psychiatric Association's publication of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, which changed many of the diagnostic criteria for Major Depressive Disorder. Indeed, the BDI items involving changes in body image, hypochondria and difficulty working were replaced. Also, sleep loss and appetite loss items were revised to assess both increases and decreases in sleep and appetite. All but three of the items were reworded; only the items dealing with feelings of being punished, thoughts about suicide and interest in sex remained the same. Finally, respondents rate how they have been feeling for the past two weeks, as opposed to the past week as in the original BDI. Like the BDI, the BDI-II also contains 21 items and each answer is scored on a scale that ranges from 0 to 3. A total score is computed by summing all the ratings and higher total scores indicate more and more acute depressive symptoms. The Italian study to establish the validity and reliability of the measure indicated

that the BDI-II is positively correlated with the Hamilton Depression Rating Scale. The test was also shown to have a high one-week test–retest reliability (Pearson  $r = 0.93$ ), suggesting that it was not overly sensitive to daily variations in mood. The test also has high internal consistency ( $\alpha = .91$ ).

### **Beck Anxiety Inventory**

The Beck Anxiety Inventory (BAI) is a measure of anxiety symptoms. It consists of 21 items that represent 21 psychological or somatic symptoms of anxiety (such as numbness, hot and cold sweats or feelings of dread). The respondent is asked to rate on a scale which ranges from 0 (*Not at all*) to 4 (*SEVERELY: I could barely stand it*) how each symptom has caused him distress in the previous week. A total score is computed by summing all the ratings and higher total scores indicate more and more severe anxiety symptoms.

### **Post-Traumatic Growth Inventory – Short Form**

The Post-Traumatic Growth Inventory – Short Form (PTGY-SF) was derived analytically from the 21-item PTGY (Tedeschi & Calhoun, 1996) and consists of the 10 items that loaded most on each of the five underlying factors (A. Cann, Calhoun, Tedeschi, Taku, Vishnevsky, Triplett, & Danhauer, 2009). In particular, the items with the highest loadings on each factor were examined and the two with the highest loadings were selected for three (Spiritual Change, Appreciation of Life and Personal Strength) of the five factors. For the remaining two factors (Relating to Others and New Possibilities) the two items with the highest loadings were not selected because they were too redundant in content; instead items were selected in order to improve the breadth of coverage. In the US validation study, the 10-item PTGI-SF had internal reliability only very slightly lower than the full form PTGI, and the reliability of the total score was generally in the range of .90 across a variety of samples (A. Cann, et al., 2009). In the present study, the Italian translation of the PTGY-SF 10 items were used (Prati & Pietrantonio, 2006) and a total score for each participant was computed by averaging the responses to all the items.

### **Frequency of medical visits for cardiovascular morbidity**

A form on which to record any medical visits over the previous 3 months was also sent at each participant at the three follow-up time points. Patients had to retrospectively record all medical visits during the previous 3 months. They had to record also the medical provider and

the reason for each visit (e.g., check-up with medical cardiologist). These medical appointments were coded as a function of reason for the visit (i.e., routine and non-routine CVD-related and non-CVD-related appointments) by the research investigator who was aware of participants' condition assignment. Medical appointments for CVD-related problems were of interest, excluding scheduled check-ups, as an indicator of morbidity associated with CVD and its treatment. The other categories of medical appointments (i.e., CVD-related scheduled medical check-ups, other scheduled medical check-ups or non-routine medical appointments for other problems, such as flu symptoms) were combined for analysis.

## **Covariates**

### **CVD-related past and actual perceived stress**

Along with the collection of demographic and clinical data and before the questionnaires' administration, patients were asked to rate how much stressful was the CVD onset and how much stressful was currently the CVD on seven-point scales from (1) not at all to (7) extremely.

### **Essay ratings**

Immediately following the last writing session, participants were asked to rate sixteen items reflecting some aspects of the essays and of the whole writing experience on seven-point scales from (1) not at all to (7) extremely. For example, participants were asked to rate how emotional and how personally meaningful the essays were (the full questionnaire is in Appendix 1).

### **Self-reported mood**

Immediately prior to and after each writing period, participants completed a restricted and "right now" version of the Profile of Mood States (POMS). The scale has 65 affect adjectives rated on a 7-point scale (0 not at all, 7 extremely). As in other studies (Low, et al., 2006; Stanton, Danoff-Burg, et al., 2000; Stanton, Danoff-Burg, & Huggins, 2002), we constructed a distress index (Distress) by adding items (e.g., tense, sad) on the Anger, Depression, Tension, Fatigue and Confusion subscales, and we used the Vigor subscale (e.g., energetic, cheerful) to indicate positive mood. In this study, internal consistency estimates of reliability ranged from .89 to .94 for POMS Vigor and .81 to .88 for POMS Distress.

## **Type D Personality Inventory**

The Type D Personality Scale (DS14) is a 14-item scale comprising of two subscales (Denollet, 2005): a seven-item subscale which measures negative affectivity (NA) (e.g., “I often feel unhappy”) and a 7-item subscale measuring social inhibition (SI) (e.g., “I often feel inhibited in social interactions”). Respondents rate their personality on a five-point Likert-type scale which ranges from 0=false to 4=true (Items 1 and 3 were reverse scored). The NA and SI scales can be scored as continuous variables (range, 0–28) to assess these personality traits independently. Participants who score highly on both NA and SI using a cutoff point of  $\geq 10$  on both scales are classified as having a Type D personality. Cronbach’s  $\alpha=0.88$  and  $0.86$ , respectively, for NA and SI indicating excellent internal consistency in the current sample.

## **Brief COPE**

The Brief COPE is a self-completed questionnaire measuring coping strategies (Carver, 1997). It is the short form of the most famous 60-item COPE inventory (15 scales with 4 items per scale) and consists of 28 items that compose 14 scales of two items each. Two scales from the full measure were omitted from the brief form because they did not proven useful in previous work or had proven redundant with another scale (Restraint Coping and Suppression of Competing Activities). Three other scales were refocused slightly because they had proven to be problematic in previous work. Positive Reinterpretation and Growth became Positive Reframing (omitting any mention of growth), Focus on and Venting of Emotions became Venting (omitting items that had appeared to relate too closely to experiencing distress) and Mental Disengagement became Self-Distraction. A new scale (self-blame) – not part of the original COPE – was added because of evidence of its importance (Carver, 1997). Respondents rate each item on a four-point Likert scale which ranges from 1 (*I usually do not this at all*) to 4 (*I usually do right like this*). Items and response options can be converted to a dispositional “coping style” format (the one I used for the present study) and to a situational concurrent format. The first study to establish the validity and reliability of the measure indicated that the a priori scales had adequate internal reliability (from  $\alpha=0.82$  for Religion to  $\alpha=0.54$  for Denial) and that the factor structure was generally consistent with that reported for the full COPE (Carver, 1997). In the present study, the Italian version of the Brief COPE was used (Conti, 1999) and the 14 scale scores were computed by averaging the responses to the two composing items.

## **Experimental manipulation check**

An independent rater (a clinical psychologist) not involved in the study and unaware of condition membership, judged whether each transcribed essay, ordered randomly, conformed to condition instructions.

## **Statistical analysis**

Data entry was conducted by a trained research assistant who was aware of participants' condition assignment and but was unaware of the research hypotheses. In all analyses, experimental conditions (DR-EW condition, n=17; S-EW condition, n=15; Sham condition, n=17 and empty condition n=15) was a categorical independent variable as well as gender, and all the other moderator variables were continuous independent variables.

Preliminary analyses were conducted to examine assumptions for parametric statistical analysis. For hypothesis testing, given the nature of the data with repeated measurements, mixed linear models (MLM) analysis in MLwiN 2.21 (Centre for Multilevel Modeling-CMM, University of Bristol), known variously as multilevel modeling (Willett, Singer, & Martin, 1998) or hierarchical linear modeling (Bryk & Raudenbush, 1992), was firstly used to study health outcomes as functions of time and experimental conditions. This allowed testing of primary and secondary hypothesis (see experimental hypothesis above) as interactions between longitudinal change and dummy variables representing comparisons between pair of conditions. Furthermore, MLM analysis was used to study health outcomes as functions of time, experimental conditions and some covariates as gender, age, coping styles, negative affectivity and social inhibition, perceived social support and essays ratings.

MLM has many advantages over conventional multivariate repeated measures methods because it allows to handle missing data and to model random variability between and within-subjects. On the contrary, repeated-measures ANOVA assumes a constant treatment effect for all individuals, an assumption that is often violated in clinical trials. We first examined the error covariance structure of the multilevel models and then tested individual growth in the outcomes across three follow-ups.

## ***Results***

### **Baseline Characteristics**

Demographic and clinical characteristics of participants who completed the study are summarized in Table 1. Average time from CVD onset was 8.6 years (SD, 6.1 years; range, 1

to 28 years) and mean weight was 105.3 kg (SD, 21; range, 64.3-167). Most (32.8%) had a class II obesity (BMI 35-39.9). Conservative baseline comparisons ( $p=0.01$ ) across experimental groups showed no significant difference in the outcome measures and covariates, whereas conservative baseline comparisons across sub-groups (males vs. females, BMI classes) showed only that males had a significantly higher mean weight than females (113 kg vs. 90.6 kg,  $p<0.000$ ) and reported significantly higher school levels ( $p<0.000$ ).

**Table 2. Demographic and medical characteristics**

Entry data	Total (N=64)
Females	22 (34.2%)
Age (years)	57.9±7.2 (range 37-70)
Weight (kg)	105.3±21 (range 64.3-167)
BMI (kg/m <sup>2</sup> )	36.3±5.6 (range 26.1-58.5)
BMI Class (WHO classification of obesity)	
Overweight	7 (10.9%)
Class I	20 (31.3%)
Class II	21 (32.8%)
Class III (Morbid obesity)	16 (25%)
Civil status	
Unmarried	10 (15.6%)
Married	41 (64.1%)
separated/divorced	6 (9.4%)
Widowed	7 (10.9%)
Education level	
Primary school	9 (14.1%)
Middle school	23 (35.9%)
High school	27 (42.2)
University	5 (7.8)
Work status	
Housewife	11 (17.2%)
Employed	24 (37.5%)
Unemployed	17 (26.6%)
Retired	12 (18.8%)
Hypertension	51 (79.7%)
Diabetes	31 (48.4%)
Smoking	
Current smoker	8 (12.5%)
Ex-smoker	36 (56.2%)

## Manipulation Check

The independent judge's determination of the experimental condition assignment corresponding to each essay was correct for 95% of the 256 individual essays, indicating excellent adherence to experimental instructions by participants.

## Essay Ratings

Multiple ANOVAs ( $p=0.01$ ) including experimental conditions as independent variable and not controlling for any covariates was conducted on the participants' ratings of their essays and of the writing task. As shown in table 3, the effect of experimental conditions was statistically significant for item 4 ("Overall, how much did you reveal your emotions in what you wrote?"), item 8 ("In general, how sad or depressed have you felt over the writing days?"), item 9 ("In general, how happy have you felt over the writing days?") and item 10 ("Since the beginning of the study, during the hours that you were not involved in the writing task, to what degree have you thought about the topics that you wrote about?"). Bonferroni post-hoc analysis showed that, as expected, DR-EW and S-EW participants revealed significantly more emotions in the essays than Sham participants ( $p=0.002$  and  $p=0.001$  respectively), that S-EW participants felt significantly more sad/depressed during writing days than Sham participants ( $p=0.002$ ), that DR-EW and Sham participants felt significantly happier than S-EW during writing days ( $p=0.005$  and  $p=0.003$ ) and, finally, that DR-EW and S-EW participants, since the beginning of the study, during the hours that they were not involved in the writing task, thought about the topics that they wrote about significantly more than Sham participants ( $p=0.001$  and  $p=0.002$  respectively).

**Table 3. ANOVAs on Essay Ratings**

<b>Essays were personal</b>	<b>DR-EW</b>	<b>S-EW</b>	<b>Sham</b>	<b>F</b>	<b>Sig.</b>
Mean	6,12	6,13	6,12	0,001	0,999
SD	0,93	0,92	1,05		
<b>Revealed written contents to others before study</b>					
Mean	2,06	2,60	1,88	1,226	0,303
SD	0,97	1,55	1,45		
<b>Wrote contents in diary or letter before study</b>					
Mean	2,00	2,53	2,41	0,415	0,663
SD	1,41	2,10	1,73		
<b>Revealed emotions in essays</b>					
Mean	4,88	5,00	3,06	9,345	<b>0,000</b>
SD	1,27	1,69	1,39		

<b>Constrained telling others written contents</b>	<b>DR-EW</b>	<b>S-EW</b>	<b>Sham</b>	<b>F</b>	<b>Sig.</b>
Mean	3,76	3,13	2,29	2,793	0,072
SD	1,89	1,96	1,61		
<b>Wanted talking to others about contents before study</b>					
Mean	3,65	3,00	3,71	0,558	0,576
SD	2,00	1,93	2,26		
<b>Had difficulties in writing</b>					
Mean	2,65	2,47	2,76	0,163	0,850
SD	1,27	1,41	1,71		
<b>Felt sad and/or depressed during writing days</b>					
Mean	2,76	4,13	2,00	6,797	<b>0,003</b>
SD	1,95	1,51	1,41		
<b>Felt happy during writing days</b>					
Mean	4,18	2,27	4,24	7,605	<b>0,001</b>
SD	1,24	1,28	2,11		
<b>Thought of themes cited in the essays during free days</b>					
Mean	5,12	5,00	3,29	9,854	<b>0,000</b>
SD	1,62	1,07	1,21		
<b>Importance that essays were anonymous</b>					
Mean	3,35	3,00	2,47	0,962	0,390
SD	1,87	1,65	2,03		
<b>Like unknown people to read your anonymous essays</b>					
Mean	3,18	3,40	3,76	0,468	0,629
SD	1,70	1,50	2,08		
<b>Like to have essays thrown away</b>					
Mean	2,82	2,80	2,35	0,328	0,722
SD	1,98	1,52	2,09		
<b>Writin task had positive effects</b>					
Mean	4,41	4,27	4,53	0,101	0,904
SD	1,54	1,79	1,62		
<b>Writing task had negative effects</b>					
Mean	1,65	1,53	1,47	0,209	0,812
SD	0,86	0,74	0,80		
<b>Writing task valuable/meaningful</b>					
Mean	4,94	5,60	5,47	1,264	0,292
SD	1,30	1,06	1,37		

Note: Response scales for these items were 1=not at all to 7=a great deal/extremely.

## Psychological Health Outcomes

Unadjusted descriptive statistics (means and SDs) of psychological outcome variables (anxiety and depressive symptoms, SF-12 mental health summary score and post-traumatic growth) as functions of time (repeated measurements) and experimental conditions are listed in Table 4.

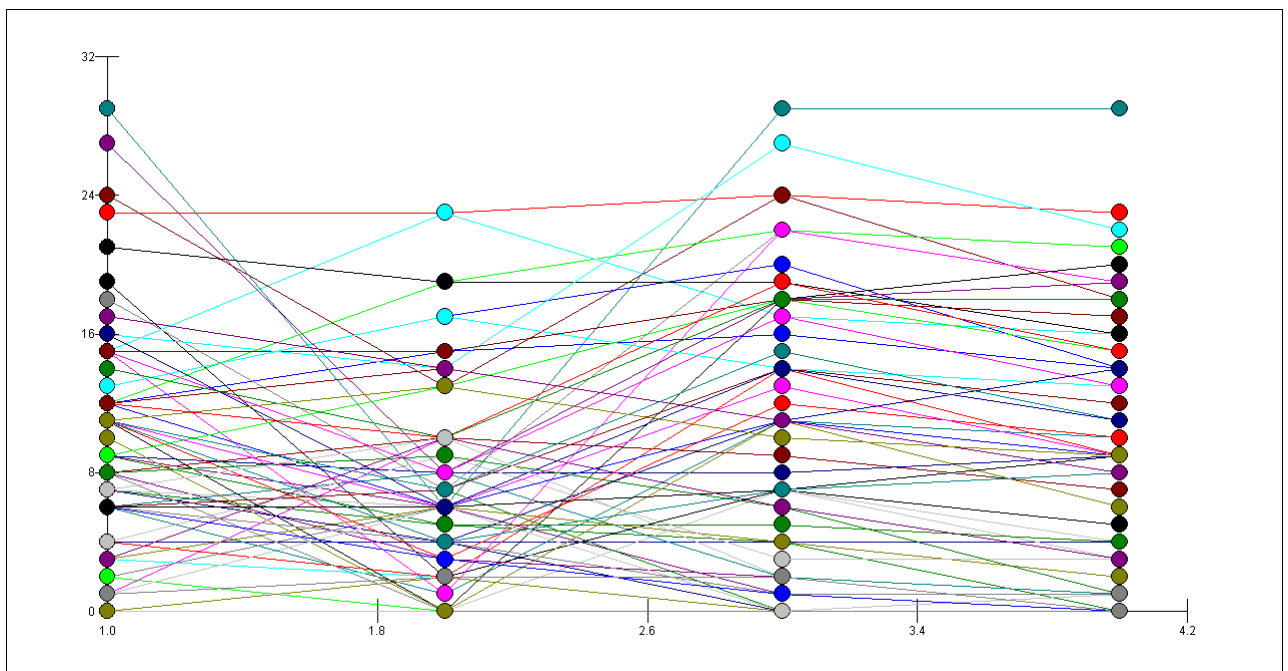


**Table 4. Descriptive statistics on psychological health variables for the Total Sample**

Dependent Variables	DR_EW (n=17)		S-EW (n=15)		Sham (n=17)		Empty (n=15)	
	Mean	DS	Mean	DS	Mean	DS	Mean	DS
BAI_baseline	8,24	7,60	9,33	4,13	11,35	7,80	11,27	4,93
BAI_discharge	7,06	6,12	9,53	5,93	6,18	4,99	8,60	5,37
BAI_3 months	7,82	7,55	10,07	6,54	11,65	9,14	12,00	7,69
BAI_6 months	6,53	7,05	9,07	6,03	9,35	8,95	9,67	7,45
BDI_baseline	11,18	10,88	10,20	7,56	8,35	6,44	11,47	7,54
BDI_discharge	8,18	9,71	11,27	6,92	7,24	5,03	7,80	4,74
BDI_3 months	8,47	5,68	12,60	6,95	9,47	7,45	10,67	5,49
BDI_6 months	8,76	10,66	8,07	7,20	8,06	6,66	10,67	7,99
MCS_baseline	48,54	9,93	48,20	7,34	47,06	9,71	48,65	7,72
MCS_3 months	53,41	10,17	54,64	7,37	45,75	5,74	44,51	4,80
MCS_6 months	55,79	11,69	51,74	9,25	49,21	6,45	40,39	6,83
PTGY_baseline	18,76	10,82	10,40	11,24	19,53	12,82	18,67	10,93
PTGY_3 months	23,12	7,24	12,73	7,73	19,76	9,23	17,13	8,33
PTGY_6 months	23,59	7,32	13,27	8,35	19,29	8,47	17,53	8,31

Abbreviations: DR-EW, disease-related expressive writing condition; S-EW, standard expressive writing condition; sham, disease-related facts condition; CTL, empty control condition; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; MCS, SF-12 Mental Component Summary; PTGY, Post-traumatic Inventory.

**Fig.1 Spaghetti plot of observed individual curves in anxiety symptomatology (BAI)**



## **Anxiety symptoms**

In Fig. 1 a spaghetti plot of observed individual curves in BAI scores is displayed. MLM analyses showed that interactions between time effects (linear, quadratic and cubic) and the dummy variable representing the comparison between DR-EW and the empty condition were not statistically significant as well as the interactions between time effects and the dummy variable representing the comparison between DR-EW and S-EW. Explorative analyses comparing each pair of experimental conditions revealed significant interactions between time effects (both linear and cubic) and both a dummy comparing DR-EW with Sham condition and another dummy comparing S-EW and Sham condition. This means that participants in the DR-EW and S-EW conditions had different change patterns in BAI scores with respect to participants in the Sham conditions.

## **Depression symptoms**

In Fig. 2 a spaghetti plot of observed individual curves in BDI scores is displayed. MLM analysis showed that interactions between time effects and the dummy variable representing the comparison between DR-EW and the empty condition were not statistically significant, whereas the interaction term between the quadratic time effect and the dummy variable comparing DR-EW and S-EW was significant, indicating that participants in the DR-EW condition reported a slightly quadratic increase in depression scores along time with respect to the S-EW group, which showed a decrease. Explorative analyses comparing each pair of experimental conditions revealed no significant interactions.

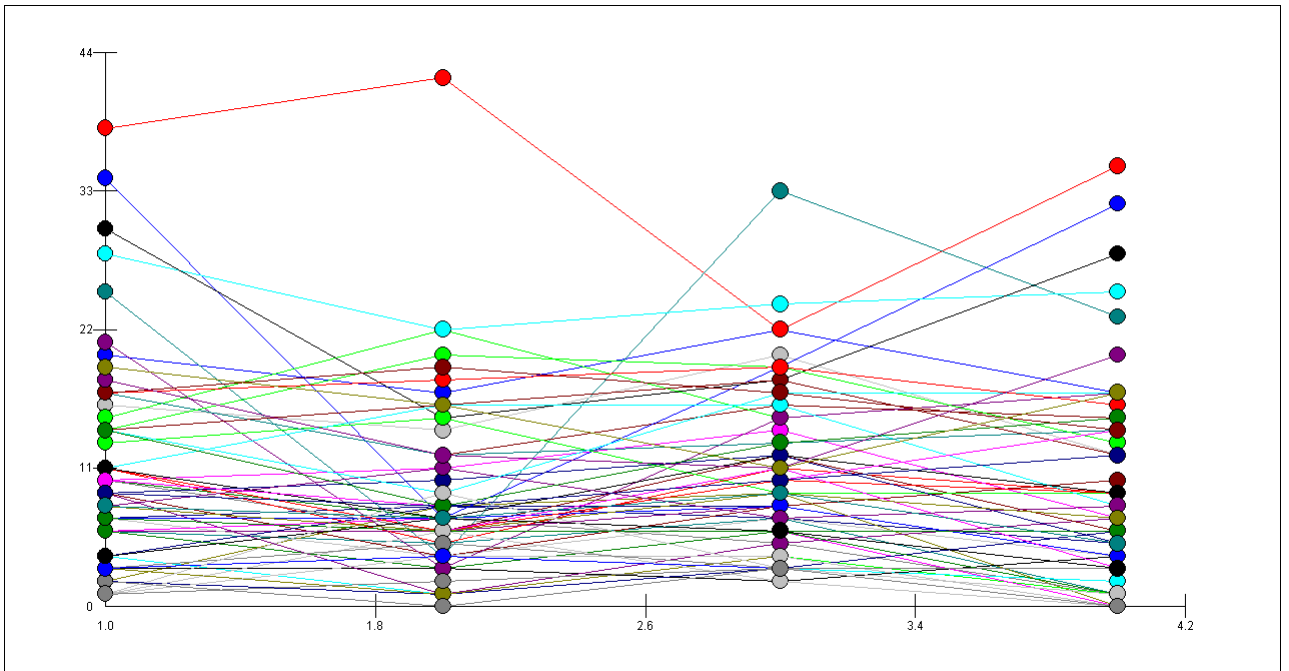
## **Mental health (SF-12)**

In Fig. 3 a spaghetti plot of observed individual curves in the SF-12 mental health summary scores is displayed. MLM analysis showed a statistically significant interaction between the linear time effect and the dummy variable comparing DR-EW and the empty condition such that participants in the DR-EW condition improved along time while control patients deteriorated. No significant interaction effects were found either with the dummy comparing DR-EW and S-EW or the other pairs.

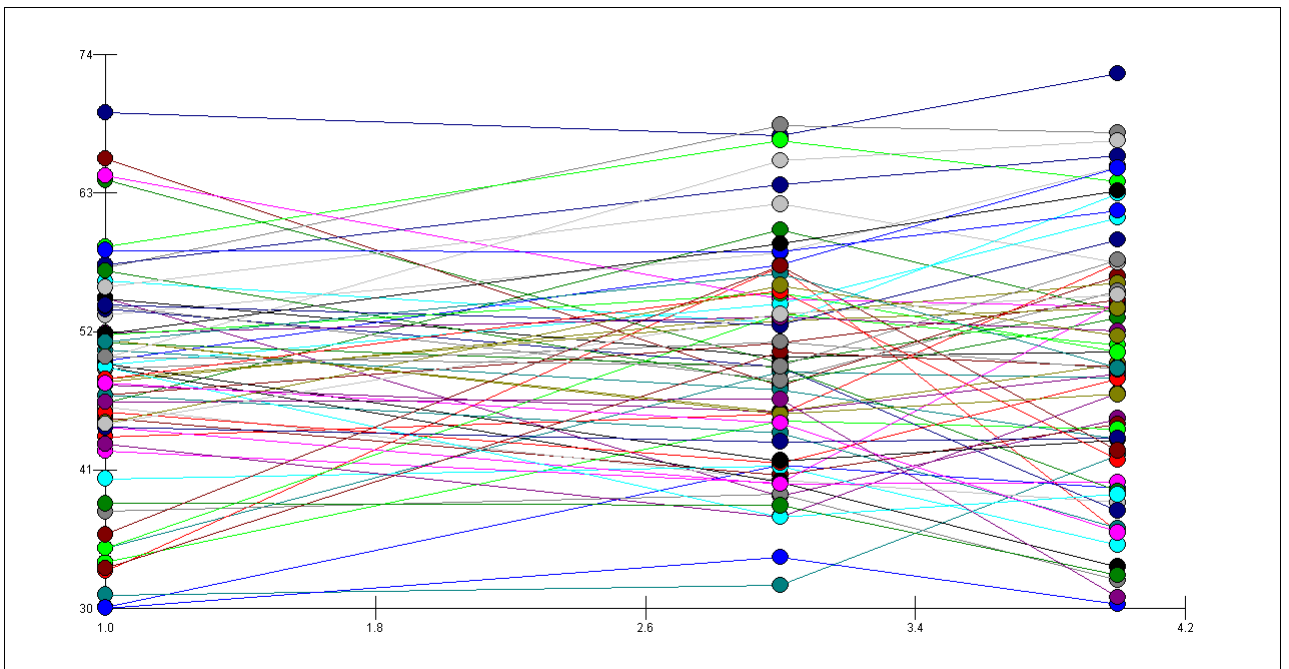
## **Post-traumatic growth**

In Fig. 4 a spaghetti plot of observed individual curves in the Post-Traumatic Growth Inventory scores is displayed. MLM analysis showed a statistically significant interaction

**Fig.2 Spaghetti plot of observed individual curves in depression symptomatology (BDI)**

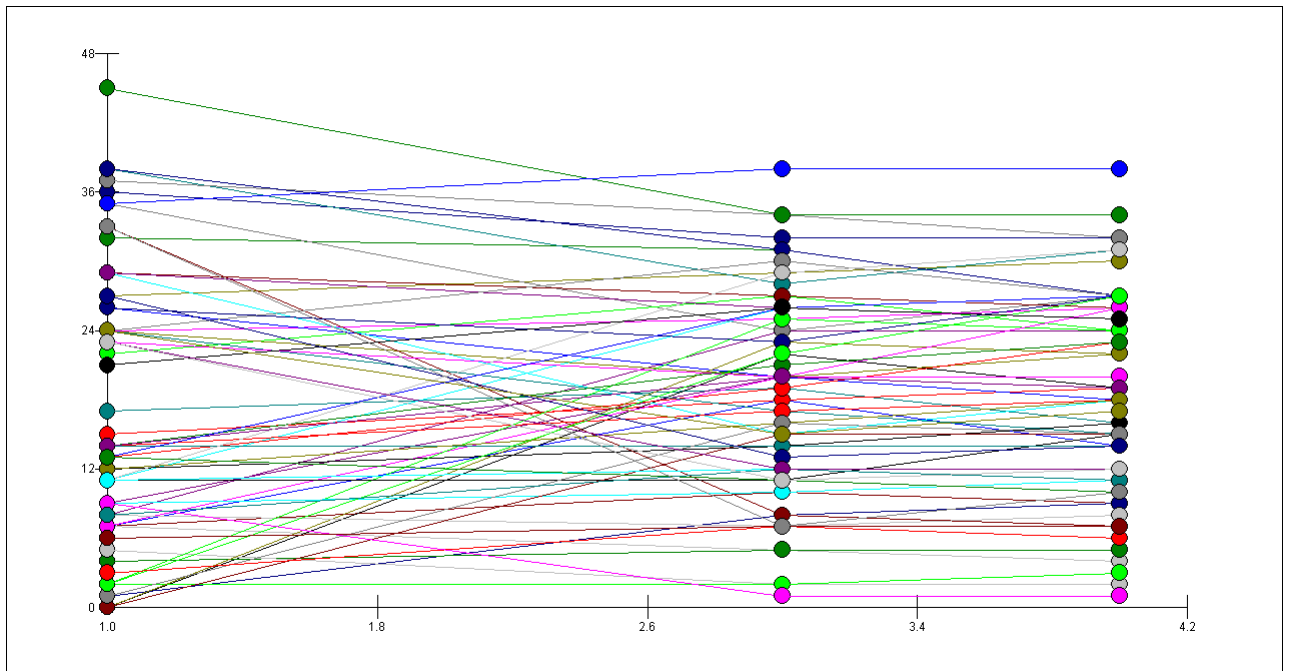


**Fig.3 Spaghetti plot of observed individual curves in the SF-12 Mental Health Component**



between the linear time effect and the dummy variable comparing DR-EW and the empty condition such that participants in the DR-EW condition grew along time, while control patients showed no change. No significant interaction effects were found either with the dummy comparing DR-EW and S-EW or the other pairs.

**Fig.4 Spaghetti plot of observed individual curves in the Post-traumatic Growth Inventory**



### **Physical Health Outcomes**

Unadjusted descriptive statistics (means and SDs) of physical outcome variables (SF-12 physical health summary and weight) as functions of time (repeated measurements) and experimental conditions are listed in Table 5.

### **Physical health (SF-12)**

In Fig. 5 a spaghetti plot of observed individual curves in the SF-12 physical health summary scores is displayed. MLM analysis showed statistically significant interactions between the linear and quadratic time effects and the dummy variable comparing DR-EW and the empty condition such that MLM analysis showed statistically significant interactions between the linear and quadratic time effects and the dummy variable comparing DR-EW and the empty condition such that participants in the DR-EW condition improved in physical health along

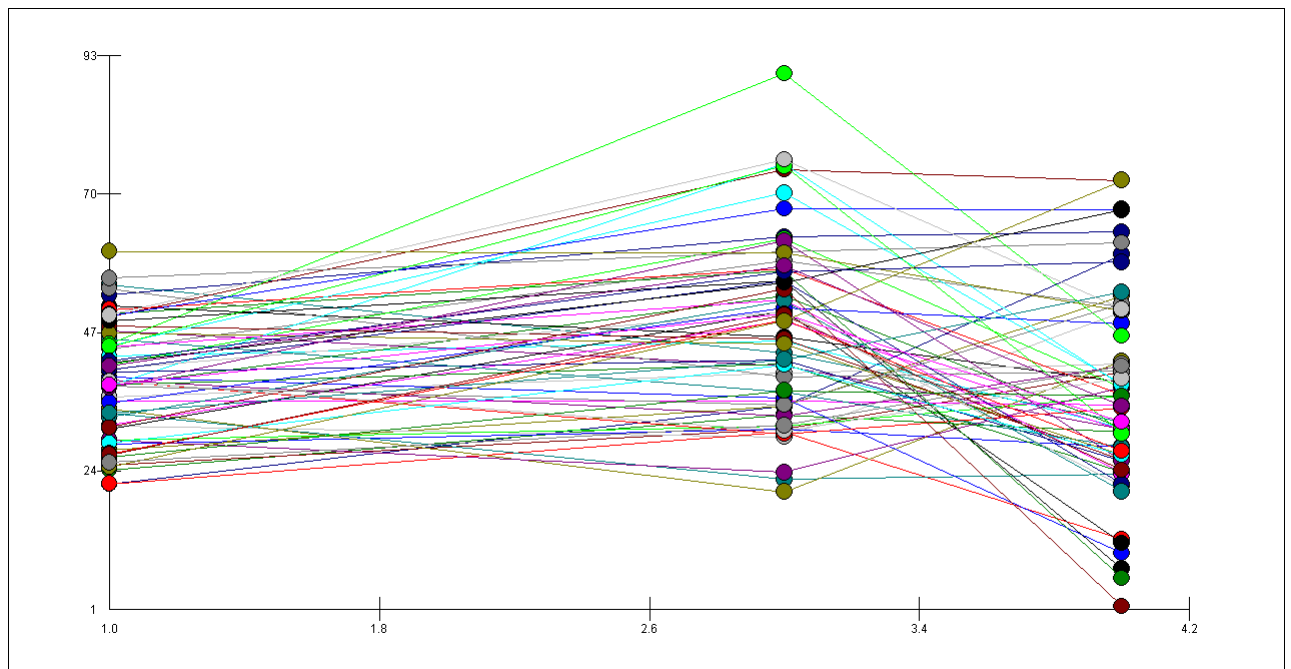
time and had a slightly decrease at 6 months, while control patients deteriorated and reported a higher decrease at 6 months. A significant interaction was found also between the quadratic time effect and the dummy comparing DR-EW and S-EW such that participants in the DR-EW condition reported a significantly lesser deterioration at 6 months than patients assigned to the S-EW group. The same pattern emerged for the interaction between linear and quadratic

**Table 5. Descriptive statistics on physical health variables for the Total Sample**

Dependent Variables	DR_EW (n=17)		S-EW (n=15)		Sham (n=17)		Empty (n=15)	
	Mean	DS	Mean	DS	Mean	DS	Mean	DS
PCS_baseline	37,56	9,22	38,62	8,06	40,13	11,09	39,45	9,48
PCS_3 months	44,45	17,81	53,35	12,64	46,41	16,26	46,88	9,30
PCS_6 months	43,91	17,39	32,16	14,56	42,62	13,54	26,09	11,60
Weight_baseline	104,12	23,57	105,37	23,26	108,31	18,84	103,25	19,86
Weight_discharge	99,95	22,63	101,15	22,33	103,97	18,09	99,12	19,07
Weight_3 months	99,10	22,28	98,69	21,46	103,09	17,63	98,15	18,85
Weight_6 months	92,07	20,52	110,68	24,75	94,67	16,44	110,48	20,79

Abbreviations: DR-EW, disease-related expressive writing condition; S-EW, standard expressive writing condition; sham, disease-related facts condition; CTL, empty control condition; PCS, SF-12 Physical Component Summary; PTGY, Post-traumatic Inventory.

**Fig.5 Spaghetti plot of observed individual curves in the SF-12 Physical Health Component**

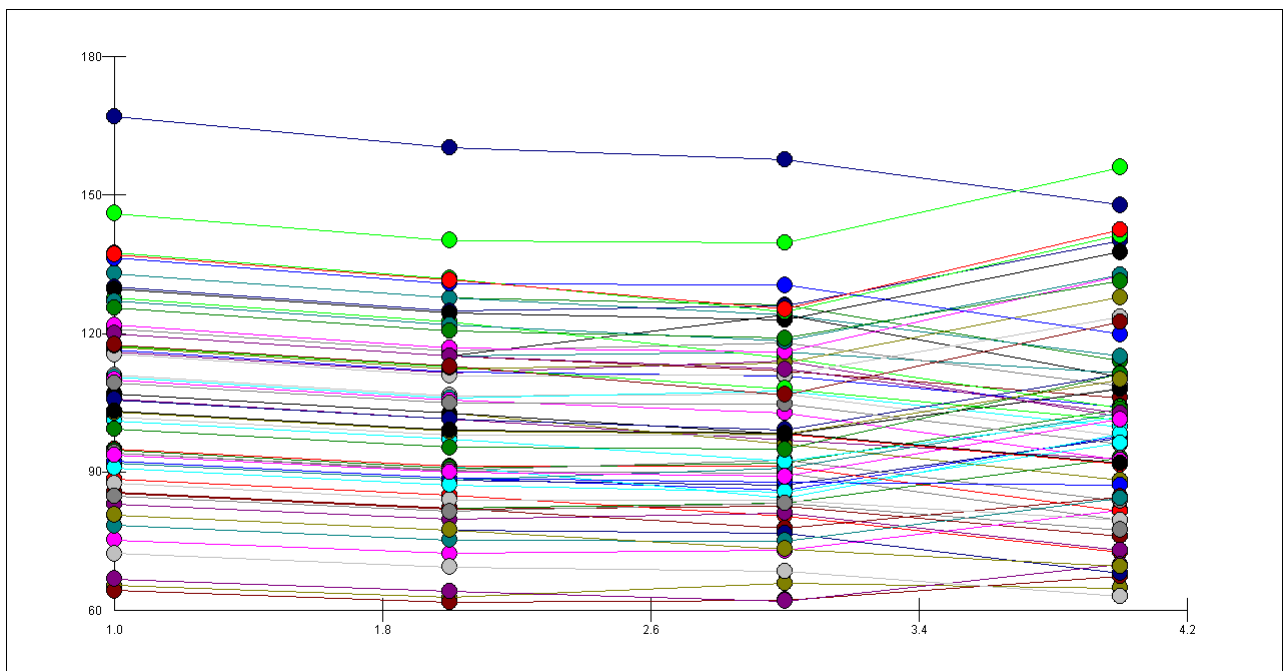


time effects and the dummy comparing the Sham condition and the control group. No significant interaction effects were found either with the dummy comparing S-EW and the empty condition or the other pairs.

## Weight

In Fig. 6 a spaghetti plot of observed individual curves for weight is displayed. MLM analysis showed statistically significant interactions between the linear and quadratic time effects and the dummy variable comparing DR-EW and the empty condition such that participants in the DR-EW condition lost weight along time and did not regain it at 6 months, while control patients showed a slightly increasing linear trend and reported a higher weight increase at 6 months. A similar pattern emerged also for the interaction between the linear and quadratic time effects and the dummy comparing DR-EW and S-EW.

**Fig.6 Spaghetti plot of observed individual curves for weight (kg)**



## Discussion

Findings support the primary and secondary hypotheses that promoting written expression of thoughts and emotions concerning the experience with heart disease in patients with CVD produces long-term benefits with regard to the dependent variables of psychological and physical health-related outcomes. Patients who wrote about the most traumatic or negative

experience they had in their life fell between the group who wrote about the thoughts and the emotions of having a heart disease and the group who wrote about the facts concerning heart disease and its treatment. The narrow advantage of the disease-related expressive writing over the standard expressive writing procedure and a disease-related sham condition on health-related outcomes requires replication in a larger sample to assess its reliability and potency.

No previous study has evaluated the effects of expressive writing on patients with CVD referred to a brief cardiac rehabilitation program and no reliable comparison can be made with the results of similar trials on patients affected by cancer or other medical diseases.

How did the induction of emotional expression and cognitive processing about the experience with heart disease confer health benefits? Among the multiple theories that offer an explanation of the emotional, cognitive and social mechanisms that are initiated by expressive writing, the self-regulation model appear to be the best suited for clarifying the health benefits reported by a small sample of patients with CVD. Indeed, one of the health outcomes that significantly improved in patients assigned to the disease-related expressive writing condition is weight loss and no other theoretical model can explain such a kind of benefit.

Limitations of this trial deserve mention. A first potential limitation includes a primary reliance on participants' self-report of psychological and physical outcomes. However, questionnaire measures were psychometrically sound and empirically validated. A second limitation regards generalizability of the findings to cardiac patients referred to home rehabilitation. Inpatient treatment allowed perfect adherence to writing sessions and patients received also multi-disciplinary interventions from physicians, nutritionists and clinical psychologists. A third limitation involves the relatively small sample size. Although power was greater than 0.80 to detect high effects, it was not adequate to detect small to medium effects. Further, outcomes differed on dependent variables relevant to physical versus psychological status, with the former revealing main effects of experimental condition and the latter yielding moderated effects. Stability and clinical import of these effects require study with larger samples. Given these limitations, applied implications of the results must be advanced judiciously. Findings suggest that the expressive writing procedure, especially a modified form that focuses on the experience with heart disease, may be among the effective ingredients in multi-modal interventions delivered in various formats and argue for their inclusion in intervention packages. Results also allow the tentative suggestion that specific writing interventions can be implemented productively with patients treated for CVD. Although adherence cannot be guaranteed without oversight by a clinician, such interventions

carry the advantages of being relatively brief, easily administered and beneficial with regard to psychological and physical health outcomes.

Finally, the utility of integrating writing interventions into a clinical situation that promotes subsequent therapeutic discussion of the written material requires study, as does when and for whom particular writing interventions are most effective.



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