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Rewriting the Past: The Influence of Written Emotional Expression on Psychosocial Outcomes, Physical Symptoms, Medication Adherence, CD4 Cell Count, and Viral Load in HIV.

Courtney B. Kelsch
University of Miami, cbkelsch@gmx.com

UNIVERSITY OF MIAMI

REWRITING THE PAST: THE INFLUENCE OF WRITTEN EMOTIONAL EXPRESSION ON PSYCHOSOCIAL OUTCOMES, PHYSICAL SYMPTOMS, MEDICATION ADHERENCE, CD4 CELL COUNT, AND VIRAL LOAD IN HIV

By

Courtney Biondi Kelsch

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Courtney Biondi Kelsch

Approved:

_____
Gail H. Ironson, M.D., Ph.D.
Professor of Psychology

_____
Neil Schneiderman, Ph.D.
Professor of Psychology

_____
Robert J. Johnson, Ph.D.
Professor of Sociology

_____
Dean of the Graduate School

_____
Ray Winters, Ph.D.
Professor of Psychology

_____
Rick Stuetzle, Ph.D.
Lecturer in Psychology

KELSCH, COURTNEY BIONDI (Ph.D., Psychology)

Rewriting the Past: The Influence of Written Emotional Expression on Psychosocial Outcomes, Physical Symptoms, Medication Adherence, CD4 Cell Count, and Viral Load in HIV (August 2015)

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Psychosocial factors play a role in HIV progression. Expressive writing (EW) interventions have demonstrated positive effects on psychosocial and disease-related outcomes in HIV. Linguistic properties of written essays have been related to psychological outcomes, although such research is sparse in the HIV literature. This project examines the relationship of word usage to psychosocial and disease-related factors in HIV. As part of a larger randomized, controlled trial of EW, this project examined the subset of subjects (n = 121) randomized to write about trauma. Linguistic Inquiry and Word Count (LIWC) software was used to analyze word usage (pronouns, positive, negative, social, and religious words) in relationship to psychosocial (depression, PTSD, social support, and stress) and physical (ART adherence, physical HIV symptoms, CD4 count, viral load) outcomes over 6 months of follow-up. Negative word usage predicted increased physical HIV symptoms over 6 months, while positive word usage predicted decreased symptoms over the same period, controlling for baseline HIV symptoms, CD4, and viral load. There was a trend toward social word usage predicting decreased HIV symptoms over 6 months, controlling for baseline HIV symptoms. Word usage did not predict ART adherence, CD4 count, viral load, or any

psychosocial factors. There was a trend toward social word usage predicting lower stress levels at 6 months. In conclusion, positive word usage in EW essays predicted decreased HIV symptoms while negative word usage predicted greater HIV symptoms, over 6 months, controlling for baseline HIV symptoms. Future studies of written EW essay content are warranted in HIV.

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Chapter 1: Introduction

Despite advances in prevention and treatment, HIV/AIDS remains a worldwide epidemic with troubling costs to both individuals and society, affecting over 33.4 million people globally (WHO, 2009) and 1.1 million within the U. S. (CDC, 2008). Psychological factors play a role throughout the disease, from the initial diagnosis with HIV to the final stages of AIDS. Psychosocial factors such as depression and hopelessness (Ironson et al., 2005), and stressful life events (Leserman et al., 2009) have been found to accelerate HIV disease progression, while optimism (Ironson et al., 2005b; Milam, Richardson, Marks, Kemper, & McCutchan, 2004) and social support (Leserman et al., 2007) are associated with slower HIV progression. Given the potential impact of psychosocial factors on both physical and mental health within HIV, future studies must identify which psychosocial factors are most relevant, and how these factors affect mental and physical health in those with HIV/AIDS.

Individuals living with HIV must cope with a life-threatening, socially stigmatizing disease, and are more likely to develop posttraumatic stress disorder (PTSD) than those without HIV (Sherr et al., 2011). In a community-based sample of individuals living with HIV, a 34% prevalence rate of PTSD has been reported (Israelski et al., 2007). PTSD is associated with poorer antiretroviral medication adherence (Sherr et al., 2011), and represents an important target for intervention in those with HIV, along with reducing depressive symptoms and stress, which are also prevalent in those living with HIV (Israelski et al., 2007). In addition, enhancing social support may be beneficial as well. This project will examine the role of these psychosocial factors and their relationship to

physical and mental health outcomes by analyzing the written essays of individuals living with HIV.

Data for this project come from a randomized, controlled trial of a written emotional expression intervention (Ironson et al., 2013). In that study, 242 HIV-positive participants wrote about their deepest thoughts and feelings about their single most traumatic life experience, or wrote about trivial topics (control group) on 4 separate occasions. However, this project will use data exclusively derived from the experimental group participants (n = 121) who wrote about a traumatic life experience during each of the 4 writing sessions. Participants engaged in one 30-minute writing session per week over the 4-week duration of the intervention.

Expressive writing and health

Following the development of expressive writing (EW) interventions by Pennebaker and Beall in 1986, various studies have demonstrated that EW can positively impact health over time, through fewer health center visits, fewer absentee days, enhanced immunity, and reduced physical symptoms (Frisina, Borod, & Lepore, 2004). EW is also effective in reducing psychological symptoms (Frisina et al., 2004), particularly depression, anxiety and PTSD.

A recent meta-analysis of 146 randomized studies was performed to examine EW, and found a significant overall mean random (*r)* effect size (0.075) of written emotional disclosure on a variety of outcomes (Frattaroli, 2006), which indicates a small effect. Based on the widely-used criteria discussed by Cohen (1988), a small effect size is suggested by *r*-effect size values of approximately .10 or less, with medium and large effects being suggested by *r*-values of approximately .30 and .50, respectively. In

particular, the meta-analysis found that EW exerts significant effects on psychological health (r=0.056), as well as reported health (r=0.072), physiological functioning (r=0.059), and general functioning (r=0.046), but did not significantly affect health behaviors. Overall, this meta-analysis found that EW exerts relatively small effects on most outcomes. However, this analysis also found a significant, positive effect (r= 0.331) of EW on viral load in HIV, indicating that EW exerts moderate effects on viral load.

Expressive writing in HIV

However, more research is needed on the use of EW in medical populations, such as HIV patients, particularly given their increased psychosocial risk. EW interventions are brief, affordable, easy to implement in many settings, and have been well-tolerated by a variety of demographic groups ranging from college students to cancer patients (Frisina et al., 2004), thus the potential benefits of EW for those with HIV should be studied further. Ironson et al. (2013) found that EW significantly reduced HIV-related physical symptoms, as well as depression and PTSD, in women, but not men. These results indicate the need to study how EW works and how it can be tailored to enhance its benefits. Currently, the mechanisms through which EW can benefit physical and mental health in those with HIV are poorly understood, and the "active ingredients" in written essays which promote positive outcomes have not been fully characterized.

As there are only a few other studies of EW in HIV/AIDS, a brief review of the literature follows. One study investigated the relationship between EW and long-term AIDS survivorship (LTS), by comparing 46 long-term AIDS survivors with an HIV-positive, matched control group (N=89) on multiple outcomes following writing about a past trauma (O'Cleirigh et al., 2003). Cognitive/emotional depth of processing

(comprising experiential involvement, positive cognitive appraisal change, adaptive coping, and enhanced self-esteem) was examined as a potential mechanism through which EW exerts its beneficial effects. The study found that long-term survivors exhibited significantly greater emotional expression and depth processing, and that the effects of emotional expression on LTS status were mediated by depth processing. This study also found several effects of EW on health-related variables: emotional expression was related to higher CD4 count (in women) and lower viral load, and depth processing was positively related to CD4 count (in women) and medication adherence. Additionally, depth processing was inversely related to perceived stress. This study suggests that the content of EW essays and one's level of engagement while writing play an important role in EW outcomes.

Another study of EW randomized 37 HIV-positive men and women to an EW condition in which they wrote their deepest thoughts/feelings about a traumatic event, or a trivial topic (Petrie et al., 2004). This study followed participants over 6 months, and found that those in the EW condition had increased CD4 counts following the intervention. However, viral load was not measured, nor were psychosocial outcomes, which represents an important area of further investigation in EW.

Another EW intervention examined the relationship of finding meaning in being HIV-positive to antiretroviral therapy (ART) adherence, in 41 HIV-positive women, via four weekly EW sessions over one month (Westling, Garcia, & Mann, 2007). CD4 and viral load were not measured. The authors note that the discovery of meaning involves experiencing a shift in one's perspective and values, while reflecting thoughtfully on having HIV, and maintaining optimism. The authors found no main effect of EW on self-

reported adherence. However, further analysis of these data found that participants whose essays reflected the discovery of meaning did have significant increases in ART adherence over one month; while those who did not find meaning had significantly decreased adherence. Greater optimism at baseline, as well as greater use of cognitive processing in EW essays, was associated with discovery of meaning.

Another study examined EW in 44 HIV-positive individuals, who were randomized to write about a current/past trauma or a trivial subject for 20 minutes per week over one month (Wagner, Hilker, Hepworth, & Wallston, 2010). "Cognitive adaptability", an individual difference variable and coping resource, was examined as a potential moderator of EW on psychological and physical outcomes. Cognitive adaptability comprises a sense of personal control, competence, optimism and self-worth. Although no main effect of EW on psychological, physical pain/functioning outcomes was found at one month, higher cognitive adaptability at baseline predicted better outcomes for pain, physical functioning, and psychological outcomes (stress, positive/negative affect, sense of coherence, and optimism) in the EW group. These findings point toward the need to elucidate which HIV-positive individuals may benefit most from EW interventions, and which aspects of EW are most effective.

Expressive writing content

In addition to the effects of EW on mental and physical health, there has been an interest in examining the specific word content used in EW. Some reports indicate that analyzing the linguistic content used in EW can distinguish depression, suicidality, somatization, and schizophrenia, among other psychological diagnoses (for a review, see Pennebaker & King, 1999). There has been increased interest in examining potential

relationships between word content and physical/mental health outcomes, particularly after Pennebaker and colleagues reported that greater use of positive emotion words relative to negative words predicted better subsequent health, in an analysis of data from six studies of EW using diverse samples of college students, prisoners, and unemployed professionals (Pennebaker, 1997).

Several studies of EW have found linguistic correlates of depression and suicidality. In a study analyzing the work of 19th and 20th century poets, it was found that suicidal poets used more first-person singular words (*I*, *me, my*) and fewer words referencing the social collective (*we*, *us, our*) than poets who were not suicidal, indicating greater self-focus and social isolation in those who eventually committed suicide (Stirman & Pennebaker, 2001). This analysis also found that poets who eventually committed suicide used increasingly fewer communication words (*talk, listen, share*) over time. Similarly, in a study of EW in 124 college students, depressed participants were found to use more negatively-valenced words (*gloom, sad, inadequate, homesick*) and the word "I" more than never-depressed or formerly depressed individuals (Rude, Gortner, & Pennebaker, 2004). Formerly depressed participants increasingly used the word "I" across writing sessions and used "I" more than never-depressed participants in the final writing sessions.

In one study, 91 undergraduate students were prompted to write about their greatest weaknesses as part of a mock job interview, which was then analyzed for linguistic characteristics using LIWC software (Neff, Kirkpatrick, & Rude, 2007). The study found that lower use of first-person singular pronouns, and greater use of social references and first person plural pronouns, was associated with greater self-compassion.

Self-compassion is an adaptive form of relating to the self that is characterized by self-acceptance in the face of failure, connectedness with others, and mindfulness of negative affect without being overly-identified with it (Neff, 2003). This construct is inversely related to depression and anxiety, and associated with mastery and social connectedness. Interestingly, self-compassion is also related with greater willingness to seek medical care, engage in health-promoting behaviors, and adhere to treatment recommendations (Terry & Leary, 2011). In HIV, self-compassion correlates with less stress, shame, and negative affect, and greater coping and medication adherence (Brion, Leary, & Drabkin, 2013). Taken together, these results suggest that linguistic content of EW essays is relevant to physical and mental health, and further study in both general and medical populations, including HIV/AIDS, is warranted.

Aims of the current project

In this project, the EW essays from the experimental group participants (n = 121) who wrote about a traumatic life experience over 4 writing sessions will be analyzed in order to characterize their psychological and social word content, and to determine whether this written content is related to and predicts psychological and health outcomes over time, as a preliminary step toward elucidating the mechanisms of EW. Specifically, the cross-sectional and longitudinal relationships between word valence (positive versus negative) and medication adherence, physical HIV symptoms, CD4 count, viral load and psychosocial factors (depression, PTSD, stress and social support) will be examined. Corresponding analyses of social word content will be performed separately.

This project will also examine positive psychological factors, which may buffer against negative physical and mental health outcomes, but have not been as widely

studied as the "traditional" factors of depression and stress. Specifically, the resource-related factors of resilience, religiosity, and positively-valenced words will be examined, to determine whether resilient individuals use different word content in their essays than those who are less resilient.

The construct of psychological resilience involves the ability to maintain a sense of mastery and perspective on one's situation, as well as one's sense of self-esteem, self-efficacy, and positive affect, when faced with adversity or stress (Bonanno, 2004; Simoni et al., 2006). Resilience has also been characterized as a dynamic, multifaceted process of positive adaptation to threatening, adverse, or severely stressful circumstances or life events (Luthar, Ciccetti, & Becker, 2007). There are diverse trajectories of functioning and coping which individuals may follow in the face of challenging events (Connor & Davidson, 2003). Resilient trajectories involve brief, mild disruptions in functioning, followed by stable periods of resilient functioning that surpasses simple recovery alone (Bonanno, 2005). The presence of resilience following stress or trauma has been found to be much more typical than previously assumed in the literature (Bonanno, 2005), although resilience has not been studied extensively within the context of HIV/AIDS.

Finally, first person singular pronouns (such as *I, me,* and *mine*) will be examined as indicators of self-focus (Rude, Gortner, & Pennebaker, 2004) and first person plural pronouns (such as *we*, *us, our* and *ours)* will be examined as indicators of social connectedness (Pennebaker & Graybeal, 2001; Stone & Pennebaker, 2002), and the relationships of these factors and their ability to predict depression and social support will be analyzed.

Chapter 2: Objectives

Hypotheses and statistical analyses

The specific aims of this project are: 1) to examine whether written essay content is correlated with and predicts physical health outcomes, 2) to determine whether essay content correlates with and predicts psychosocial outcomes, and 3) to examine differences in essay content depending on the individual difference factor of resilience. I hypothesize generally that essays with a higher proportion of negatively-valenced words (*angry, sad, wrong, gloom, inadequate, homesick, fight*) denoting anxiety, anger, and sadness, will be related to and predict negative outcomes, while a greater proportion of positively-valenced words (*happy, laugh, joyful, accept, play, best, share*) indicating positive emotion and social support will be related to and predict positive physical and mental health outcomes. The parent study for this project found a significant [$t(242) = 2.12$, $p = .035$] difference in age between participants in the EW and control writing groups (with control group being an average of 2.4 years younger), however, no other demographic (i.e. gender, ethnicity, or educational attainment) differed between groups, with all p-values > .2. Gender, ethnicity, education, and age were examined as potential covariates in this project. In a series of separate partial correlation analyses, none of these demographic covariates correlated with any of the health-related outcomes (adherence, physical HIV symptoms, CD4 cells, or viral load) at the 6 month follow-up period, which will be examined in this project. Therefore analyses will only control for the respective baseline values of each outcome variable. In the analyses with viral load as an outcome variable, adherence at baseline was examined as a covariate using a partial correlation analysis, controlling for baseline viral load levels, however baseline adherence was not related ($p > .2$) to viral load at 6 month follow-up.

Aim 1a: *Determine whether negative written essay content is correlated with and predicts medication adherence at the 6-month follow-up (F6) time point.* First, a correlation analysis will be conducted to determine whether negatively-valenced ("negative") words are cross-sectionally related to adherence at F6. Next, linear regression analysis will be run to determine whether negative word content predicts adherence at F6, while controlling for baseline adherence. I hypothesize that essays with a higher proportion of negative words (relative to total word count) will be associated with poorer adherence cross-sectionally and longitudinally.

Aim 1b: *Determine whether positive written essay content and social words are correlated with and predict medication adherence at the F6 time point.* Similarly to Aim 1a, a correlation analysis will be conducted to determine whether positively-valenced ("positive") words are cross-sectionally correlated with adherence at F6. Next, a regression analysis will be performed to determine whether the use of positive words predicts adherence, controlling for baseline adherence. I hypothesize that the percentage of positive words will be positively associated with adherence and will positively predict adherence over time. Parallel analyses will be run for social words, which I hypothesize will positively relate to and predict adherence at F6.

Aim 2a: *Determine whether negative written essay content is correlated with and predicts physical symptoms of HIV at F6.* Similarly to Aim 1, I will first determine whether negative word content is cross-sectionally related to physical HIV symptoms at F6, and then use linear regression to analyze whether negative word content predicts HIV-related physical symptoms at F6, controlling for baseline physical symptoms and

CD4 count. I hypothesize that a high proportion of negative words will predict high levels of physical symptoms at F6.

Aim 2b: *Determine whether positive written essay content and social words are correlated with and predict physical symptoms of HIV at F6.* I will first determine whether positive word content is cross-sectionally related to physical HIV symptoms at F6, and then use linear regression to analyze whether the proportion of positive word content predicts HIV-related physical symptoms at F6, controlling for baseline physical symptoms and CD4 count. Corresponding analyses will be conducted separately for social words. I hypothesize that a high proportion of positive word content and social words (as a percentage of total words) will each separately correlate with and predict lower levels of physical HIV symptoms.

Aims 3a & 3b: *Determine whether negative, positive, and social word content correlates with and predicts CD4 cell count at F6.* Similarly to the previous aims, a series of correlational and regression analyses will be run to determine whether negative, positive, and social word content each separately correlate with and predict CD4 cell count at F6, controlling for baseline CD4 cell count. I hypothesize that greater usage of negative words will be associated with and predict lower CD4 cell count at F6, and that greater usage of positive and social words will each predict greater CD4 cell count at F6.

Aims 4a & 4b: *Determine whether negative, positive, and social word content correlates with and predicts HIV viral load at F6.* In a similar manner as in the previous aims, a series of correlational and regression analyses will be run to determine whether negative, positive, and social word content each separately correlate with and predict HIV viral load at F6, controlling for baseline viral load. I hypothesize that greater usage of

negative words will be associated with and predict higher viral load at F6, and that greater usage of positive and social words will each predict lower viral load at F6.

Aims 5a & 5b: *Determine whether negative and positive written essay content correlates with and predicts psychosocial outcomes at F6.* Similarly, a series of correlational and regression analyses will be performed to determine whether the proportion of a) negative and/or b) positive words written about in the essays separately predict each of these psychosocial outcomes: 1) depression, 2) PTSD, 3) stress, and 4) social support, controlling for baseline values of depression, PTSD, stress, and social support, respectively. A follow-up analysis of depression as an outcome variable will be conducted, with words denoting sadness to be used as a control variable. A follow-up analysis of PTSD as an outcome variable will be conducted, with trauma severity to be used as a control variable. I hypothesize that negative essay content will correlate with and predict higher levels of depression, PTSD, and stress, and lower levels of social support. Conversely, I hypothesize that positive emotion words will correlate with and predict lower levels of depression, PTSD and stress, and higher levels of social support.

Aim 6: *Determine whether pronouns in written essays correlate with and predict psychosocial outcomes at F6.* Previous research has indicated that greater use of first person singular pronouns (such as *I*, *me, my* and *mine*) is associated with greater suicide rates, while greater use of first person plural pronouns (such as *we*, *us, our* and *ours*) is associated with lower depression and greater social support. Similarly to the previous aims, cross-sectional and longitudinal analyses will be conducted to determine whether the use of a) first person singular pronouns and b) first person plural pronouns separately correlate with and predict the depression and social support at F6, controlling for baseline

values of depression and social support, respectively. I hypothesize that greater use of first person singular pronouns (as a percentage of total words) will predict higher levels of depression and lower levels of social support, while greater use of first person plural pronouns (as a percentage of total words) will predict the opposite outcomes at F6.

Aim 7: *Determine whether individual differences in resilience are associated with differences in essay content.* Pearson's product-moment (*r*) correlation analyses will be used to determine whether resilience is related to differences in word content (i.e. the relative proportion of negative, positive, social, and religious words), provided that resilience and written word content variables are normally distributed. If these variables are not normally distributed, nonparametric statistics will be used and Spearman's rho (ρ) will be used to analyze the potential relationship between resilience and word content. I hypothesize that highly resilient participants will use a higher proportion of positive, social, and religious, indicating greater ability to cultivate and utilize these resource-related factors (as indicated by a significant, positive correlation), while less resilient participants will use more negative and fewer positive, religious, and social words, indicating a lower ability to recruit and utilize these sources of support (as indicated by a significant, negative correlation).

Chapter 3: Methods

Participants

In the parent study from which this project is derived, study participants were 242 HIV-positive men (57%) and women (43%) recruited from the Miami metropolitan area. Recruitment was conducted between February 2004 and February 2009, via community organizations, family medical clinics, physicians' offices, gay-related events and venues, and through fliers and newspaper advertisements. Enrolled participants were at the mid-range of HIV disease (100-600 cells/mm^3) upon entering the study, a time when psychological interventions are considered to have their greatest effects. The mid-range of disease is defined as a period of clinical latency in which HIV is reproducing slowly and symptoms may or may not be present. This phase is characterized by CD4 cell counts roughly between 200 cells/mm^3 and 600 cells/mm^3 (CDC, 2013).

Participants were excluded if they had used intravenous drugs within the last month, were currently dependent on alcohol or drugs, actively suicidal or psychotic, or had less than an eighth grade education. Participants were also excluded if they were under age 18, had undergone recent surgery, medication regimen changes, bereavement, or were suffering from a non-HIV related life-threatening illness.

Randomization and intervention procedures

During the baseline visit, participants signed an informed consent form, completed a variety of standardized questionnaires and interview measures, and then provided blood and saliva samples to be assayed for biological markers. During the next visit (Writing Session1), participants were randomized into either the expressive ("Trauma") writing condition or the control ('Daily") writing group, and were then

provided with a quiet, private office in which to write for 30 minutes. Participants visited the laboratory for a total of 4 writing sessions; each writing session lasted 30 minutes. All writing sessions occurred within 2 to 4 weeks of the baseline visit.

Consistent with the standard EW paradigm of writing for 15 to 20 minutes (Margola, Facchin, Molgora, & Revenson, 2010; Pennebaker & Beale, 1986), our participants completed a 20 minute writing session. Immediately following the initial 20 minutes of writing, all participants then completed an additional 10 minute writing session. This 10 minute session augmented the traditional EW paradigm: Trauma writing participants were given instructions to enhance processing, while Daily writing participants were instructed to write about mundane topics. For all linguistic analyses used in this project, the values for the 10 and 20 minute essays will averaged for each participant, to reflect mean word usage during each of the four study visits.

For the 20 minute essay, Trauma writing participants were given the following prompt: “During the four writing days, please write about your most traumatic or upsetting experiences of your entire life” and were asked to write about the same experience on all four days if possible, while letting go and exploring their deepest emotions and thoughts. The Daily participants were prompted to write for 20 minutes about a mundane topic such as their daily activities, while being as objective as possible. Verbatim instructions for Writing Session 1 can be found in Appendix B. Following each writing session, the essays were collected by study staff.

Assessment procedure

In addition to the assessment at the baseline visit, participants were also assessed at 1, 3, 6 and 12 months after completing the 4 writing sessions, via questionnaires,

interviews, and saliva and blood sample collection. A variety of psychosocial factors were assessed (PTSD, depression, stress, social support, resilience, etc.), as were HIV medication adherence and HIV-related physical symptoms. This project will assess outcomes through 6-month follow-up, as this is the period in which we anticipate the greatest effect of the EW intervention will occur.

Biological and HIV-related measures

Adherence was measured using the Adult Clinical Trials Group (ACTG) Adherence Instrument, a 5-item, self-report questionnaire which assesses ART adherence, with scores ranging from 0-20 (Chesney et al., 2000). The ACTG primarily assesses recent adherence to minimize recall bias, beginning with questions on yesterday's adherence, and including two questions on distal adherence over the past weekend through the past few months. In addition, the ACTG assesses for 12 commonly-used reasons for missing medication doses and the frequency of these reasons for non-adherence, as well as 12 common side effects and how bothersome participants found these symptoms during the past two weeks. The ACTG questionnaire demonstrates good reliability and corresponds with plasma viral load measurements and adherence measured via electronic monitoring devices (Reynolds et al., 2007).

Physical symptoms of HIV were measured via interview using a 10-item symptom checklist based on the CDC's Category B symptom criteria. Category B includes such symptoms as: Oropharyngeal candidiasis (thrush), herpes zoster (shingles), peripheral neuropathy, pelvic inflammatory disease (PID), and fever (> 38.5ºC) or diarrhea lasting beyond one month. At the baseline and 1-month follow-up period, interviewers inquired about HIV-related symptoms during the past month, and at the 6-

and 12-month follow-up visits, symptoms during the past 6 months were assessed.

CD4 cell count was measured from blood samples which were collected and briefly stored in our laboratory during study visits, and then processed in another laboratory capable of conducting immunological assays. CD4 counts were determined by flow cytometry, with fluorochrome conjugated monoclonal antibodies in a four-color system.

HIV viral load was measured in plasma from blood samples that were collected in our laboratory, using the Roche Amplicor RT-PCR assay (Roche Molecular Diagnostics, Pleasanton, CA), which measures down to 400 copies of HIV-1 RNA in plasma.

Psychosocial Measures

PTSD was assessed via interview using the Davidson Trauma Scale (DTS), a 17-item self-report measure that assesses PTSD symptoms using the DSM-IV criteria (Davidson et al., 1997). Scores on the DTS range from 0 to 136; scores over 30 denote sub-threshold PTSD symptoms with impairment, and scores over 60 denote PTSD symptoms of clinical significance (Davidson, Tharwani, & Connor, 2002).

The Beck Depression Inventory (BDI), a widely-used self-report measure, was used to assess depression (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI comprises 21-items and assesses the cognitive, affective, and somatic symptoms of depression. Total scores on the BDI range from 0 to 63, with higher scores denoting greater symptom severity. Scores up to 9 indicate no or minimal depression, scores between 10 and 18 indicate mild to moderate depression, scores between 19 and 29 indicate moderate to severe depression, and scores 30 or greater indicate severe depression (Beck, Steer, & Carbin, 1988).

Stress was measured via the Perceived Stress Scale (PSS), a self-report which assesses the degree to which an individual perceives life events as being stressful. This 10-item measure demonstrates good reliability; PSS scores range from 0 to 40, with higher scores denoting greater global perceived stress (Cohen, Kamarck, & Mermelstein, 1983).

Resilience was measured using a composite variable of standardized scores on measures of self-efficacy, self-esteem, and positive affect (described below), averaged across all time points from Baseline through F6. The Pearlin Mastery Scale was used to measure self-efficacy; it is a 7-item self-report measure assessing the extent to which one feels in control of one's life circumstances. It assesses one's sense of empowerment, competence, and control. The Pearlin Mastery Scale correlates positively with self-esteem and negatively with depression (Pearlin et al., 1981). Scores range from 7 to 28, with higher scores indicating higher levels of self-efficacy. The Rosenberg Self Esteem Scale was used to assess self-esteem via self-report (Silber & Tippet, 1965). It is a10-item measure of global self-esteem which has demonstrated reliability and is widely used (Gray-Little, Williams, & Hancock, 1997). The measure assesses satisfaction with the self, positivity toward the self, and self-worth. Scores range from 10 to 40, with higher scores indicating higher self-esteem levels. Positive affect was measured using the positive subscale of the Positive and Negative Affect Schedule (PANAS), a widely-used, 20-item self-report measure of the general dimensions of positive and negative mood (Watson, Clark, & Tellegen, 1988). Each of the two subscales of the PANAS represents a distinct construct, and produces scores ranging from 0 to 50. Higher scores denote greater levels of positive or negative affect. The PANAS has demonstrated good reliability and

validity, with the negative affect scale being correlated to measures of depression (Watson et al., 1988).

Social Support was measured using the Medical Outcomes Study Social Support Survey (MOS), a 19-item self-report measure indicating the perceived degree of availability of social support to the individual (Sherborne & Stewart, 1991). The MOS assesses the following five dimensions of social support: emotional support, informational support, tangible support, positive social interactions, and affectionate support, with higher scores denoting greater social support. Scores on the MOS range from 0 to 25. The MOS demonstrates high reliability, and is inversely correlated with loneliness and directly correlated with one's emotional ties, as well as one's family and marital relationship functioning. As social support values were not collected at baseline, all analyses of social support will be conducted with the W1 session values of social support predicting social support at 6 month follow-up.

Trauma severity was scored for each of the 20-minutes essays, using a seven-point Likert scale, in which a score of seven represents the most serious traumas such as the death of child or spouse/partner, and a score of one represents the least serious traumas such as increased responsibility at work. This severity scale was borrowed from the Life Changes Scale (Miller & Rahe, 1997) with a few additional traumatic events added to the list that are relevant to the current study's population, such as the disclosure of a potentially stigmatizing disease (e.g. HIV). Traumatic events were assigned a severity value from one to seven based on group consensus among four graduate level research assistants. (Please see Appendix C for the rating scale).

Linguistic analysis

Each "Trauma" essay was later transcribed into electronic format and the written content was analyzed using specialized software (Linguistic Inquiry and Word Count-LIWC) which produces an output of 63 psychological, grammatical and linguistic word category variables (for a list of relevant categories, see Appendix A). Examples of these variables include: cognitive words, social words, emotion words, parts of speech, and words denoting relationships, perceptions, health, religion, and leisure activities. Each variable represents the percentage of words written in a given category (such as anxiety words), relative to total essay word count. For all analyses, word category data from the 4 writing sessions will be averaged to obtain 1 variable for each category (i.e. the average percentage of positive emotion words used across all 4 writing sessions), which is consistent with the methods used in recent studies (Neff, Kirkpatrick & Rude, 2007).

Chapter 4: Results

Sample characteristics

In the parent study from which this project is derived, participants (N = 242) were on average 42.8 (SD = 8.8) years of age, and were diverse with respect to ethnicity/race, with 56% identifying as African-American or Afro-Caribbean, 19.5% as Hispanic, and 17% as White. The sample was also diverse with respect to sexual orientation, with 42.6% of participants identifying as gay or bisexual. Educational attainment levels were also diverse among participants: approximately 30% had not graduated from high school, 43% reported some college or vocational education, and 5.4% reported having graduated from college.

At enrollment in the parent study, the mean CD4 cell count for all participants was 439 (SD = 235), indicating that the average participant fell within the mid-range of HIV disease (Ironson et al., 2013). The average number of physical HIV symptoms (out of 10 possible symptoms) reported at study entry was .25 (SD = .43) in the experimental writing group and .21 (SD = .41) in the control writing group, with no significant differences between groups, indicating relatively low symptom levels. Two-thirds of participants reported that they were currently taking ART medications. Table 1 presents descriptive statistics for physical and psychosocial factors at baseline and 6 month follow-up time points for those in the experimental, trauma-writing group.

Word types in written essays

Table 2 presents the descriptive statistics for the relevant word types which were analyzed in this project using LIWC software. Although population norms are not available for word usage in EW, the mean word usage (as a proportion of total words) for

these word types, as compiled by Pennebaker and colleagues (2007) from emotional writing samples involving 29 studies, 11 laboratories, and 1,104 participants (comprising individuals of diverse ages, including college students, psychiatric prisoners, the elderly, and elementary school-aged youth), in the United States, Canada, and New Zealand, provides a reference for interpreting the values in the current project. Our participants' mean usage of negative emotion words (2.68% of total words) was consistent with Pennebaker's (2007) average reported value of 2.67%. Our participants' mean usage of positive emotion words (3.14% of total words) was also consistent with Pennebaker's (2007) reported average value of 3.28%. Similarly, our participants' mean usage of social words (9.12% of total words) was consistent with Pennebaker's (2007) average value of 9.09%. Our participants' mean usage of first person plural pronouns (11.6% of total words) was consistent with Pennebaker's (2007) average value of 10.4%, as was our participants' mean usage of first person plural pronouns (less than 1% of total words) was also consistent with Pennebaker's (2007) average reported value of less than 1%. Finally, the average religious word usage of our participants (less than 1% of total words), was consistent with Pennebaker's (2007) mean reported values for religious words, which also comprised less than 1% of total words. Although average religious word usage in both samples was less than 1%, our participants' values (.6%) were 35 times higher than those reported by Pennebaker (.02%), which is consistent with findings that religion is highly important to many HIV-positive individuals (Cotton et al., 2006).

Trauma types in written essays

The Trauma essays were read by two undergraduate research assistants who tallied the type of trauma that participants wrote about in their first writing session. The

most common traumatic experience that participants wrote about was related to being HIV-positive (24.8% of all traumas reported). The second most common trauma involved "Other" traumas (22.7% of all traumas reported), of which sexual and/or physical abuse were most frequent (11.3% of all traumas). The "Other" category also included such traumas as homelessness, drug addiction, incarceration, automobile accidents, non-sexual assaults (being stabbed, mugged, or kidnapped), although each "Other" trauma type had at most two participants writing about it as their most traumatic event. The third most common trauma written about involved relationship stressors (21.3% of all traumas) and the fourth involved the death of loved one" (18.4% of all traumas).

Cross-sectional correlations between EW word content, psychosocial factors, and biological factors

Pearson's zero-order correlations were run to analyze the relationships between EW word content (negative, positive, and social word usage) and both psychological and biological factors at both the baseline and F6 time points. As indicated in Table 3, there was a significant correlation between negative words and baseline depression ($r = .226$, $p = .014$, $n = 117$), representing a moderate correlation. There were no significant correlations between EW content and PTSD, stress, or social support at baseline. There were no significant relationships between EW content and any biological factors at baseline. There were no significant correlations between EW content and any of the psychosocial factors (depression, PTSD, stress, or social support), with all p-values > .10. Similarly, no significant correlations were found between EW content and any of the biological factors except for physical symptoms of HIV. Physical symptoms at F6 were significantly and positively correlated with negative words ($r = .238$, $p = .020$, $n = 95$),

which represents a medium effect of negative word usage on physical symptoms, using Cohen's (1988) criteria for effect size. Physical symptoms were significantly and negatively correlated with positive words (r = -.257, p = .012, n = 95), exerting a moderate effect on physical symptoms. Physical symptoms were not correlated with social words (p > .10).

Word usage predicting biological factors at F6

A series of linear regression analyses were run, each controlling for the baseline value of the relevant outcome variable, to determine whether word content (negative, positive, or social word usage) predicted biological outcomes (ART adherence, physical HIV symptoms, CD4 cell count, and viral load) at the F6 time point. As noted in Table 4, the use of negative words did not predict adherence at F6 controlling for baseline adherence (β = -.090, p = .469), nor did the use of positive words (β = -.0229, p = .858), or social words (β = .034, p = .787).

As indicated in Table 5, the use of negative words significantly and positively predicted physical HIV symptoms at 6 months (β = .245, p = .016), controlling for baseline physical symptoms, indicating that greater use of negative words predicted a greater number of HIV symptoms at 6 months, beyond initial HIV symptom levels. Greater use of positive words significantly predicted fewer HIV symptoms at 6 months (β = -.203, p = .045), controlling for baseline physical symptoms. This indicates that both negative and positive word usage predicted changes in HIV symptoms over time. These findings are not accounted for by baseline levels of depression, as depression at baseline was not correlated with physical HIV symptoms at baseline (r = .107, p = .25, n = 117) or at 6 months (r = .102, p = .33, n = 117). There was a trend toward social word usage

negatively predicting physical HIV symptoms at 6 months (β = -.186, p = .072), controlling for baseline physical symptoms, indicating that greater use of social words might have the potential to predict a lower number of HIV symptoms at 6 months, beyond the level predicted by baseline HIV symptoms, perhaps in a subset of participants, or in the larger parent study sample of all participants (including experimental and control groups), which could be examined in future exploratory analyses, although participants in the control condition wrote about different topics. Table 6 provides the descriptive statistics for the mean number of physical HIV symptoms at baseline and 6 months, for participants within the upper and lower 50% of negative and positive word usage (as a proportion of total essay words). At baseline, there was no difference in mean physical symptom levels between those high or low in negative word usage. However, at 6 months, physical symptoms levels were 36.8% higher among those in the top half of negative word usage, compared with those in the bottom half of negative word usage. At baseline, mean physical HIV symptom levels were 28.6% lower for those in the top half of positive word usage, compared with those in the top half. At 6 months, physical symptoms levels were 36.4% higher among those in the bottom half of positive word usage, in comparison with participants in the top half of positive word usage. Figure 1 displays these results in a simplified visual format.

As shown in Table 7, the use of negative words did not predict CD4 count at F6, controlling for baseline CD4 count (β = -.091, p = .204), nor did the use of positive words (β = .097, p = .197), or social words (β = -.017, p = .823). These findings indicate that negative, positive, or social word usage does not predict CD4 cell count at F6 above and beyond CD4 cell counts predicted by those at baseline.

Similarly, as indicated in Table 8, the use of negative words did not predict viral load at F6 controlling for age and baseline viral load (β = .039, p = .718), nor did the use of positive words (β = -.065, p = .549), or social words (β = -.055, p = .621), which indicates that these types of word usage do not predict viral load at F6 above and beyond viral load levels predicted by baseline viral load values.

Word usage predicting psychosocial factors at F6

Another series of linear regression analyses were run to determine whether word content (negative, positive, or social word usage) predicted psychosocial outcomes (depression, PTSD, perceived stress, and social support) at the F6 time point. As noted in Table 9, negative word usage did not predict depression at F6, controlling for baseline depression (β = .055, p = .553), nor did positive word usage (β = -.062, p = .490), or social word usage (β = -.110, p = .220). Similarly, as noted in Table 10, negative word usage did not predict PTSD at F6, controlling for baseline PTSD (β = .028, p = .757), nor did positive word usage (β = -.024, p = .758), or social word usage (β = -.028, p = .753). Likewise, as noted in Table 11, negative word usage did not predict perceived stress levels at F6, controlling for baseline perceived stress (β = .017, p = .846), nor did positive word usage (β = .017, p = .845). There was a trend toward significance in social word usage (β = -.155, p = .071) inversely predicting perceived stress at F6. Finally, as noted in Table 12, negative word usage did not predict social support at F6, controlling for baseline social support (β = .035, p = .609), nor did positive word usage (β = -.020, p = .766) or social word usage (β = .064, p = .337).

Together, these results indicate that the usage of negative, positive, or social words does not predict a variety of psychosocial outcomes (depression, PTSD, perceived

stress, and social support) at F6 above and beyond the outcomes predicted by baseline values of these factors. The trend toward social words inversely predicting perceived stress suggest that it is possible that for subsets of the study population, or for the study population as a whole, the use of social words might predict lower levels of perceived stress, which could be assessed in future analyses of these data.

Follow-up analyses of word usage predicting depression and PTSD at F6

In order to determine whether a potential predictive effect of negative words on depression at F6 could be accounted for by words specifically denoting sadness, a follow-up analysis was performed using linear regression, which indicated that negative word usage does not predict depression at F6, controlling for baseline depression and sadness-denoting words (β = -.036, p = .730). However, this analysis indicated that sadness words predicted depression at F6, controlling for baseline depression (β = .175, p = .05). Positive words did not predict depression at F6, controlling for baseline depression and sadness words (β = -.058, p = .512).

Additional linear regression analyses were performed separately to assess whether trauma severity might account for a potential predictive effect of negative and/or positive words on PTSD at F6. Neither negative (β = .047, p = .610) nor positive word usage (β = -.037, p = .680) predicted PTSD at F6, controlling for baseline PTSD and trauma severity.

Relationships between pronoun type, depression, and social support

Pearson's bivariate correlations were run to analyze potential relationships between pronoun type (first person singular and plural pronouns), depression and social support at the F6 time point. The use of first person singular pronouns was not

significantly correlated with either depression (r = .057, p = .586, n = 95) or social support (r = -.133, p = .269, n = 97). The use of first person plural pronouns was not significantly correlated with depression (r = .080, p = .442, n = 95), and was marginally correlated with social support (r = .182, p = .070, n = 97).

Several linear regression analyses were conducted to determine whether type of pronoun usage (i.e. first person singular and first person plural pronouns) each separately predicted depression and social support at the F6 time point, controlling for baseline values of depression and social support, respectively. As noted in Table 13, first person singular pronouns did not predict depression at F6, controlling for baseline depression (β = .072, p = .426), nor did first person plural pronouns, controlling for baseline depression (β = .065, p = .496). Similarly, as noted in Table 14, first person singular pronoun usage did not predict social support at F6, controlling for social support at W1 (β = -.008, p = .907), nor did first person plural pronouns usage predict social support at F6, controlling for social support at W1 (β = .030, p = .660).

Relationships between resilience and word usage in EW essays

Several bivariate correlation analyses were conducted to determine whether the psychological resilience of participants is related to word usage in the EW essays. As indicated in Table 15, resilience was not significantly correlated with negative, positive, social, or religious word usage (all p-values > .20). As a follow-up analysis, baseline resilience was examined as a potential predictor of word usage in EW. Resilience at baseline did not predict the usage of negative, positive, or social words (all p-values > .20), however, there was a trend toward baseline resilience predicting greater use of religious words in EW (β = .162, SE = .081, t = 1.76, p = .081).

Chapter 5: Discussion

The principal findings of this study involve significant relationships between word valence (i.e. negative and positive) and physical HIV symptoms at 6 months following the EW intervention, in the subset of 121 participants who were randomized to write about traumatic events. Specifically, linear regression analyses indicated that the use of negative words predicted a moderate increase in physical HIV symptoms over 6 months, above and beyond initial HIV symptom levels. Conversely, positive word usage predicted a moderate decrease in physical HIV symptoms over 6 months, above and beyond initial HIV symptom levels. Negative word usage was slightly more strongly predictive of changes in HIV symptoms over time than positive word usage. There was a trend toward social word usage predicting a decrease in HIV symptoms, controlling for baseline physical symptoms. It is worth noting that these findings are not accounted for by baseline levels of depression, as depression at baseline was not correlated with physical HIV symptoms at baseline or at 6 months, and thus these findings reflect the ability of negative and positive word usage to predict changes in physical HIV symptoms independent of the presence of depressive symptoms.

These findings are consistent with studies of EW by Pennebaker and colleagues, which indicate that greater positive emotion word usage (relative to negative word usage) predicts better health over time, in a diverse sample of HIV-negative adults (Pennebaker, 1997). Although our findings do not indicate that emotional word valence predicts better health outcomes as measured by CD4 cells and viral load, we did find that word valence predicts changes in health as measured by HIV symptoms. Similarly to Pennebaker's results, we found that positive emotional word content predicts a decrease in physical HIV symptoms over 6 months, and we found that negative emotional content predicted

increased physical symptoms over the same period. Additionally, we found a trend toward social word usage predicting fewer HIV symptoms at 6 months. Although we examined the relationship of word valence to physical symptoms (and other HIV-related outcomes), we did not examine these effects in the same fashion as Pennebaker, using a ratio of positive/negative words, which would be suitable for a follow-up analysis.

Our findings contrast with those of Low and colleagues, who conducted a randomized, controlled trial of a 4-session EW intervention in a different medical population (early stage breast cancer patients), and found that greater use of negative words predicted fewer physical symptoms at 3 months (Low, Stanton, & Danoff-Burg, 2006). However, that study comprised exclusively female participants ($N = 60$) whereas our project included both genders ($N = 48$ women in the EW condition). As recent research has indicated that EW may be more effective in HIV-positive women than men (Ironson et al., 2013), it may be the case that gender also moderates the effect of emotional word valence on outcomes, which would be a worthwhile aim of follow-up analyses. Moreover, unlike Low and colleagues (2006), we examined outcomes at 6 months, and it is possible that our results would have been different at an earlier time point. The women studied by Low and colleagues were in the early stages of breast cancer, whereas our participants were at the mid-range of HIV disease, and it is possible that time since diagnosis might influence the mechanisms and outcomes of EW. It is likely that early-stage breast cancer patients would have had less time to come to terms with the stressor of receiving a breast cancer diagnosis than HIV-positive individuals who are at the mid-range of the disease process, and this difference could be reflected in the word usage within their essays. Future studies could examine changes in the relative

proportions of different types of word content (e. g. positive versus negative words, cognitive words, insight words) used over several EW sessions or over longer periods of time than the four writing sessions typically used in EW studies, to determine whether different cognitive or emotional processes may be enacted at different stages of disease. Lastly, different medical populations might respond differently to EW interventions, although it does not appear that this has been systematically examined in the literature.

Word usage and HIV-related factors

Regarding word valence and disease-related outcomes (i.e. adherence, CD4 cells, and viral load), contrary to what was hypothesized, the present study found that the use of negative words did not relate to or predict medication adherence at F6, nor did positive or social word usage. Similarly, negative word usage did not correlate with or predict CD4 count at F6, nor did the use of positive or social words. Lastly, the use of negative words was not related to or predictive of viral load at F6, nor was the use of positive or social words. These findings are somewhat surprising given the findings of the very few other studies of EW in HIV-positive individuals. However, as the body of research on EW in HIV is extremely small, future work will need to determine which findings are consistent between studies once a larger body of research has accumulated.

One of the few studies of EW in HIV, discussed previously, and from which the data for the current project are derived, Ironson et al. (2013), found that there was no main effect of EW on HIV-related outcomes, depression, or PTSD. However, gender was examined as a potential individual difference factor, and women in the EW condition experienced significant improvements in depression, PTSD, and physical HIV symptoms, while men in the EW condition did not. These effects were sustained through 1 year

following the intervention. As noted by the authors, gender moderates the effect of EW on biological and psychosocial outcomes in HIV, and further studies will be needed to determine how EW can be tailored to be most beneficial, and how gender may be exerting its effects on EW. As the parent study Ironson et al. (2013) examined the overall effects of EW, the current project has extended those findings by examining the specific word content in EW essays, and its potential relationships to physical and psychosocial outcomes in HIV.

One of the few other studies on EW in HIV was conducted by O'Cleirigh and colleagues (2003), who examined the effect of one session of EW in a group comprising 89 HIV-positive individuals and 46 long-term AIDS survivors (who were still alive at 4 or more years following the presence of a Category C AIDS-defining symptom). O'Cleirigh and colleagues found that emotionally expressive writing was related to higher CD4 cell count and lower viral load levels, in women only. In addition, the study found that it was the depth of emotional processing that was significantly related to greater medication adherence, rather than emotional expression, total emotion words, or word valence (i.e. positive or negative). However, O'Cleirigh and colleagues (2003) also found that positive word usage predicted both lower viral load levels and higher CD4 cell counts in women (but not in men), controlling for age and ART usage, whereas negative word usage did not predict viral load or CD4 count in either women or men.

Our present study did not examine gender as a moderator of the relationship between EW content and HIV-related factors, which may account for our non-significant findings pertaining to the relationship between word valence and the disease-related factors of adherence, CD4 cells, and viral load, but follow-up analyses of gender as a

potential moderator could be conducted with the data from our project. Further, unlike O'Cleirigh and colleagues, in the present study we did not examine how the depth of processing in EW may affect HIV-related factors, but rather we studied the effect of specific types of word usage within the EW intervention on HIV-related factors, which may also account for our null results. As the O'Cleirigh et al. (2003) study suggests, the effects of word valence and depth of processing on disease-related outcomes differ by gender, so future research should aim to investigate the effect of individual differences, such as gender, as well as potential cognitive, emotional, and behavioral mechanisms underlying these findings.

In another study of EW in HIV by Petrie and colleagues (2004), 37 HIV-positive individuals (2 women) were randomized to either a control writing condition or an EW condition focusing on their most traumatic life event(s), and wrote for 30 minutes over 4 consecutive days. Viral load and CD4 counts were assessed through 6 months. Viral load levels decreased in the EW group in the 2 weeks following the intervention, but this change was not sustained at 6 months. CD4 counts increased in both groups in the 2 weeks following the intervention, but only the EW group sustained this increase through 6 months. This study indicates that EW can exert beneficial effects in HIV however, this study did not examine the specific nature of the EW word content and whether this was related to disease outcomes, which is a new area of inquiry within the literature. The authors note that an EW intervention may be more effective in some patients than others, and suggest that those who are socially isolated and lack a close confidante may derive greater benefit. Taken together, the Ironson et al. (2013), O'Cleirigh et al. (2003), and

Petrie et al. (2004) studies point to the need to assess the potential role of individual difference factors in EW outcomes.

Word usage and psychosocial factors

In an effort to elucidate which aspects of EW may predict positive outcomes in HIV, our current study has examined specific components of EW such as word valence, social words, and pronoun usage. We examined whether the use of negative, positive, and social words each separately predicts psychosocial outcomes at 6 months. Word usage, whether negative, positive, or social, did not predict symptoms of depression or PTSD at 6 months, controlling for baseline depression and PTSD symptoms, respectively. Neither negative nor positive word usage predicted perceived stress levels at 6 months, controlling for baseline perceived stress, however, there was a trend toward social words predicting lower perceived stress at 6 months. Finally, negative, positive, or social word usage each did not predict social support at 6 months, controlling for baseline social support.

What could account for these findings indicating that emotional and social words in EW essays do not predict psychosocial outcomes? As noted in Frisina's (2004) meta-analysis of 5 studies of EW involving populations with diverse physical and mental health diagnoses, EW reduces psychological symptoms, albeit to a modest extent (d = .07). Our findings indicate that word usage alone does not predict psychosocial outcomes above and beyond initial levels of these factors. If word usage did exert an effect, however, it was overshadowed by psychosocial (or other unmeasured) factors. It is possible that for participants with very high initial levels of depression, PTSD, or stress, the effect of word usage (i.e. negative, positive, or social) would need to be quite

pronounced to exert an additional effect on these psychological symptoms at 6 months. It is possible that for participants low in stress and/or with sub-clinical depression or PTSD symptoms, perhaps word usage would account for psychological outcomes to a greater extent, beyond levels explained by initial psychological symptoms. Therefore, follow-up analyses could examine whether symptom severity moderates these relationships, as word usage may play a different role in predicting psychosocial outcomes for individuals with especially high or low levels of depression, PSTD, and/or stress at baseline. Given that there was a trend toward social words predicting lower perceived stress at 6 months, social support levels could also be examined separately as a potential moderator, as it is likely that the level of one's social support would influence one's usage of social words, which could, in turn, affect social support levels at 6 months.

The mechanisms underlying the effects of EW have not yet been elucidated, although studies point to depth of cognitive processing (O'Cleirigh et al., 2003) and the combined use of both emotional expression and cognitive processing (Ullrich & Lutgendorf, 2002) as potential mechanisms. It is possible that our null findings in regard to word content and psychosocial outcomes could be due to participants not experiencing a sufficient degree of cognitive and emotional processing to promote changes in depression, PTSD, stress, and social support over 6 months. It is likely that participants who are especially high or especially low in cognitive and/or emotional processing would experience different outcomes from EW, and would use different proportions of negative, positive, and social words, which could be another individual difference factor to be investigated in future studies. Future analyses of this data could determine whether the proportion of cognitive to emotional words used in EW essays predicts psychosocial

outcomes. Finally, although participants may have experienced emotional and cognitive changes via the EW intervention, this would not necessarily translate into behavioral changes, such as recruiting increased social support or engaging in stress-reducing practices. One study of EW (Kim, 2008) tested whether prompting 89 bilingual college students to use either their native language, learned language, or to switch between both while writing would affect the frequency of conversations over 2 days before and 2 days after the EW intervention. Only those in the EW condition who switched between languages while writing had an increased frequency of conversations with others over the study period. These findings suggest that as participants changed the type of language they used during writing, they may also have experienced an emotional and/or cognitive change which impacted their conversational behaviors. This study indicates that certain manipulations of the EW paradigm have the potential to promote greater engagement in conversations with others, however it remains to be seen whether EW can promote greater social engagement in medical populations, and whether this would benefit mental and physical health in clinically significant ways.

Word usage and psychosocial factors: Additional analyses

Follow-up analyses were run to examine the potential role of sadness words in predicting depression at 6 months. Negative words did not predict depression at 6 months, controlling for sadness words and baseline depression, however sadness words predicted higher levels of depression at 6 months, controlling for baseline depression. These findings suggest that certain types of negative emotion expressed in EW, such as sadness, might be more influential in predicting depression, whereas others might not be as deleterious. Our findings indicate that negative emotion words as a whole do not

predict depression (or other psychosocial outcomes), however, it would be instructive to examine whether other specific negative emotion words indicating anger, or anxiety, predict depression (or other psychosocial factors). Within the psychoanalytic tradition, depression is conceptualized as the result of angry feelings and aggressive impulses being turned inward and directed at the self, which has some empirical support (Newman, 1983). Consistent with the psychoanalytic theory of depression, future studies of EW could examine whether the use of high proportions of anger words and words referring to the self (i.e. first-person pronouns), in combination with few words referring to others, might predict depression. More recent theories of depression, which also have empirical support, posit that rumination on the antecedents, consequences, and experience of depressive symptoms promotes depression (Nolen-Hoeksema, 2000). As individuals who are high in the individual difference factor of rumination engage in repetitive and passive thinking about negative emotions, future studies could examine whether rumination correlates with characteristics of written essays (such as consistently high usage of negative emotion words with no changes over the 4 writing sessions), and whether tailoring the EW instructions to combat ruminative thinking could ameliorate depressive symptoms. One study of 69 college students found that EW reduced depressive symptoms at 6 months only in those who were high in the tendency to ruminate, while those low in ruminative tendencies did not experience improvement in depressive symptoms (Sloan et al., 2008). However, the Sloan et al. (2008) study did not analyze the relationship of negative or positive word content to rumination or to changes in depression, which is an area where more research appears warranted.

Similarly, our follow-up analysis examining whether positive or negative word usage predicted PTSD at 6 months, controlling for baseline PTSD and trauma severity, produced null results. Interestingly, there was no correlation between the severity of the traumas that participants wrote about in their essays and PTSD symptoms (at either baseline or 6 months), and trauma severity did not predict PTSD at 6 months, controlling for baseline PTSD (all p's > 0.2). This is somewhat surprising given that more severe traumas would be expected to predict high levels of PTSD symptoms, and because certain types of traumas (such as interpersonal violence) are associated with particularly high rates of PTSD, depression, and physical problems (Koopman et al., 2005). It is likely that one's perception and experience of trauma is influenced by a variety of factors, and EW may have the potential to elucidate some of these factors, particularly in relation to specific emotional, social, and cognitive processes which may be indicated by word usage during EW. Koopman and colleagues (2005) suggest that future studies should examine the specific word content used by individuals with trauma histories, to assist in determining whether writing about certain types of trauma predicts who benefits from EW interventions. In their study of 47 women exposed to diverse forms of interpersonal violence, there was no main effect of EW on PTSD symptoms, however, trauma type and severity were not examined separately, thus it is unknown whether specific trauma types might influence EW interventions (Koopman et al., 2005). Additional research is needed to determine which moderating factors may impact EW outcomes, and which mediating factors may be driving EW outcomes, and analyzing specific emotional word content is an effort in that direction.

Interestingly, one study assessed the emotional content in daily diary entries of 50

college students over 2 weeks and found that those who made greater distinctions between different types of negative emotions (i.e. they were higher in emotion differentiation) employed greater use of emotion regulation strategies (Barrett, Gross, Christensen, & Benvenuto, 2001). Positive emotion differentiation was not related to the use of emotion regulation. The authors note that individuals who can precisely describe, categorize, and distinguish between discrete types of negative emotions are also likely to use a variety of emotion regulation strategies, particularly when emotional intensity is high. As negative emotions are inherent in the experiences of PTSD, depression, and stress, it would be worthwhile for future studies to analyze whether variety in the types of negative emotional words used in EW predicts lower levels of these psychosocial outcomes, in addition to analyzing proportions of specific negative emotion word types as predictors.

Pronoun types and psychosocial factors

Regarding the potential relationship between pronoun type (i.e. first person singular and first person plural) used during the four writing sessions and depression at F6, bivariate correlation analyses indicated no significant relationship between either type of pronoun and depression at F6. There was no significant bivariate correlation between first person singular pronouns and social support at F6. There was a trend toward first person plural pronouns being positively correlated with social support at F6. (Bivariate correlation analyses indicated no significant relationships between either first person singular or first person plural pronouns and initial social support at W1). Following those analyses, separate linear regression analyses indicated that neither first person singular nor first person plural pronouns predicted depression at F6, controlling for baseline

depression. Similarly, pronoun usage (first person singular or plural) did not predict social support at F6, controlling for initial social support at W1.

In the present study, although we found a trend toward a positive bivariate correlation between first person plural pronoun usage (e.g. *we, us, our*) and social support, however, first person plural pronoun usage did not predict social support at F6, beyond initial social support levels. Although first person plural pronouns are considered to indicate one's level of social connectedness and support (Pennebaker & Graybeal, 2001; Stone & Pennebaker, 2002), without also accounting for the emotional valence and qualitative nature of the relationships indicated by these pronouns, it is unclear whether it is one's level of social support or one's hopes, concerns, or intentions regarding social support are being measured. These findings indicate that, regardless of the process which is indicated by the usage of first person plural pronouns, it does not account for social support at F6, beyond initial levels of social support. Future studies may consider examining potential changes in pronoun usage and social support over time, to see whether these two factors change together, and whether a change in pronoun usage predicts future social support beyond changes predicted by baseline self-reports. Future studies could also examine whether pronoun usage relates to and predicts different types of social support (e.g. tangible, emotional, informational), in order to determine which aspects of social connectedness LIWC may be indicating.

Our analyses indicated that neither first person singular nor plural pronoun usage predicted depression at F6, controlling for baseline depression. High usage of first person singular pronouns is considered to indicate self-focused attention, and has been associated with depression (Rude, Gortner, & Pennebaker, 2004), preoccupation with the

self and with how one is perceived by others, and with possessing lower rank/power status in the social hierarchy (Kacewicz, Pennebaker, Davis, Jeon, & Graesser, 2014). As cognitive biases have been implicated in depression (Matthews & MacLeod, 2005), such that depressed individuals (or those who are vulnerable to depression) are more likely to use negative interpretive styles, to attend to negative stimuli, and to utilize ruminative thinking, it stands to reason that different word usage patterns could emerge in depressed individuals.

In a small study by Stirman and Pennebaker (2001), LIWC software was used to analyze the poetry of 18 poets, half of whom had committed suicide, and were matched by age, sex, nationality, education, and era to the poets who did not take their own lives. A total of 291 poems (spanning each poet's career) were analyzed, and results indicated that poets who had committed suicide used a significantly greater proportion of first person singular pronouns and a lower proportion of first person plural pronouns throughout their career (relative to total words). In poets who had committed suicide, there was a trend toward decreased first person singular pronouns and increased death-related words in the time leading up to the suicides. Surprisingly, there were no differences in positive or negative word usage between the two groups, which indicates that perhaps other factors may have been more relevant than written emotional valence. Although our study did not find that pronoun usage predicted depression in our sample as a whole, a follow-up analysis could examine whether pronoun usage predicts depression or other mental health outcomes in the subset of participants who are currently depressed, or who were formerly depressed (and therefore are at risk of future depressive episodes). Additionally, in a similar fashion to Stirman and Pennebaker's (2001) LIWC analysis of

poets, examining words denoting "death" within in an HIV-positive population would be interesting, both in relationship to depression and disease-related outcomes.

Although the present study examined the mean percent usage of pronouns across the four writing sessions, it may be worthwhile to examine whether there is a shift in pronoun usage over time. Campbell and Pennebaker (2003) analyzed data from three studies of EW to examine potential relationships between pronoun usage patterns and changes in the frequency of physician visits at two to four months following the EW intervention. Participants comprised 60 college students and 33 psychiatric prisoners who wrote about traumatic experiences for 20 minutes over three to five writing sessions. Latent Semantic Analysis (LSA) methods were used to assess potential correlations among the similarity of many linguistic features of the essays over the series of writing sessions, and physician visits. LSA uses an iterative process used to distill groups of linguistically similar word categories from thousands of separate linguistic dimensions into hundreds, which can be analyzed in relationship to other variables. The authors found the more that pronoun usage varied (among 19 pronouns) between each writing session, the less likely participants were to visit a physician for illness in the months following the EW intervention. The authors found similar patterns when other word categories were examined, such that greater dissimilarity between each participant's individual essays over time was associated with fewer physician visits, which indicates that change in linguistic content across the EW process is associated with an indicator of health status. However, a limitation of that study is that the specific types of pronouns were not examined individually (e.g. first person singular versus plural), and the specific ways in which pronoun usage changed was not examined. The study did not examine

whether increases or decreases in specific pronoun types are most strongly associated with health outcomes, or whether greater overall variability in pronoun usage (regardless of pronoun type) is more strongly related to health outcomes. This study only examined one measure of health, physician visits, and utilized a relatively short follow-up period of 2 to 4 months, but it does indicate that the degree of change in linguistic features of essays is related to health, which could inform future research within the field.

A study by North, Meyerson, Brown, and Holahan (2012), used LIWC to examine linguistic changes in the expressive writing of 269 undergraduates, after writing about their biggest stressor for 20 minutes over four consecutive days, and being taught to utilize various emotion regulation strategies. Participants who used acceptance and positive reappraisal of the stressor used higher proportions of future- and insight-oriented words, and used decreasing proportions of first person singular pronouns, along with increasing proportions of first person plural pronouns over the four writing sessions. The study by North and colleagues (2012) points to two additional linguistic variables, insight and future words, that may be fruitful to examine in EW interventions with HIV-positive individuals. Both of the previously-mentioned studies (Campbell and Pennebaker, 2003; North et al., 2012) also indicate that it may be worthwhile to examine shifts in the relative proportions of pronouns over time, as this may reflect cognitive and emotional shifts. These studies did not examine whether these shifts are related to social support or other psychosocial factors, which could be examined in future research, and it also remains to be seen whether these results would replicate in clinical populations such as those with HIV.

Word usage and resilience

The final and most minor aim of this project was to examine the relationship between resilience and several different word types (i.e. negative, positive, social, and religious words). There were no significant bivariate correlations between the average level of resilience (from baseline through 6 months) and any of these word types (at 6 month follow-up), however, when these analyses were restricted to baseline resilience, there was a trend toward resilience being correlated with higher religious word usage at 6 month follow-up. The presence of a trend indicates that there may be a relationship between baseline resilience and religious word usage for a subset of participants. It is possible that resilience may be associated with religious words only in individuals who identify themselves as being religious or spiritual, which could be examined in a follow-up study. If the trend was due to insufficient statistical power in these analyses of the trauma writing group, these analyses could be conducted with the parent study's larger sample of all participants in both experimental and control writing groups, however, the groups are not comparable due to being randomized to different writing conditions.

One of the limitations of the LIWC software that is relevant to this aim of the project is that LIWC groups together both religious places and objects (e.g. bible, church, temple) along with religious/spiritual states and experiences (e.g. sacred, sin, faith, mercy). Therefore it is possible that components of the religious word category are correlated with resilience, although this limitation inherent in the LIWC software does not permit for further analysis of this possibility. Future studies might consider investigating these relationships by using raters to analyze different religious word types in these EW essays, as an association has been found between resilience and religiosity

(Kasen, Wickramaratne, Gameroff, & Weissman, 2012), and as increased religiousness/spirituality is common following an HIV diagnosis (Ironson, Stuetzle, & Fletcher, 2006). In our sample, religious words were used more frequently, on average, than in the values complied by Pennebaker et al. (2007) from other emotional writing samples, which is consistent with the finding that religion is important to many HIV-positive individuals (Cotton et al., 2006). Given the apparent salience of religion for our participants, and given that that increased religiosity/spirituality predicts slower HIV progression (Ironson, Stuetzle, & Fletcher, 2006), future analyses of these data using religious words as a potential predictor of HIV-related outcomes and psychosocial factors, would be worthwhile.

Clinical Implications

The primary findings of the present study indicate that negative and positive word usage in EW predict increases or decreases in HIV symptoms, respectively, over 6 months, while accounting for initial HIV symptom levels. This information indicates which individuals are likely to be at risk for experiencing increased HIV symptom levels, and who may be in need of additional clinical intervention. In addition, these findings provide information about which individuals may be less likely to experience worsening HIV symptoms, and who may be somewhat protected against a worsening in this HIV-related outcome over six months. This information could have clinical utility as an indicator identifying who is at greatest risk, and who may benefit most from additional clinical care. However, it remains to be seen whether these findings will be replicated with other studies of EW in HIV/AIDS, thus these results should be interpreted and applied with great caution.

The present findings indicate that LIWC analyses can predict changes in physical HIV symptoms at levels beyond those predicted by baseline symptom self-reports. It is possible that LIWC analyses of written essays could provide additional information beyond that which is provided by self-reports in other domains as well. Although certain individuals may be hesitant to endorse certain psychosocial symptoms or experiences on self-report questionnaires, these individuals may indirectly be providing important psychosocial information in their essays, which is something that might be fruitful for the fields of behavioral medicine and health psychology to explore further. For instance, as previously discussed, a prior study (Stirman & Pennebaker, 2001) found that greater use of first-person singular pronouns along with lower use of first person plural pronouns was associated with committing suicide. If individuals who are at risk for suicide verbally deny symptoms of suicidality, or deny it on written questionnaires, but they are depressed or there is reason to suspect that they may be suicidal, LIWC analysis could be conducted to analyze pronoun usage as a potential indicator that further clinical assessment is needed. As some studies have reported that HIV-positive individuals are at elevated suicide risk (Cooperman & Simoni, 2005), future studies could examine whether suicidality can be detected at higher rates beyond those indicated verbally or on questionnaires by self-report, and whether a single writing sample would be sufficient to detect suicidality, as this would be much more clinically feasible than collecting four separate writing samples.

Beyond detecting which HIV-positive individuals may be at risk of negative outcomes using LIWC analyses of emotional word valence, it might also be worthwhile to examine whether deliberately prompting participants to alter their proportionate use of

negative and positive words while engaging in EW could promote beneficial outcomes in HIV. Future studies could prompt EW participants to use fewer negative and more positive words, and compare symptom levels with those who were provided the standard EW instructions. To our knowledge, this has not been done with an HIV-positive sample, and the literature is quite sparse in this area. One study randomized 60 breast cancer survivors to either standard EW, EW focusing on positive emotions, or a control writing condition (Stanton et al., 2002). The authors found that those in both types of EW groups had fewer physical symptoms and physician visits at three months versus controls, yet those in standard EW had the fewest symptoms and physician visits of the three conditions. Therefore, future studies should attempt to replicate these findings with larger studies and with a variety of medical populations, such as those living with HIV/AIDS, to determine whether it may be harmful, beneficial, or ineffective to prompt EW participants to alter their emotional word usage.

Lastly, as the field of psychology in general has become increasingly aware of the limitations inherent in the exclusive use of self-report questionnaires to measure psychological variables, and there has been a call to utilize more ecologically valid measurements within study protocols (Shiffman, Stone, & Hufford, 2008), LIWC analysis could potentially have a place in this shift within the field, as this may enable researchers to tap into the emotions and cognitions of an individual, in his or her own words. Whether LIWC analyses are feasible, and add incremental validity to self-report measures, must be determined by future research. Although expressive writing interventions and methods for linguistic analysis of written text have been developed and

studied during the past few decades, there is much more work which can be done to further develop and expand the field, as well as to integrate it into health psychology.

Limitations

This study was limited in that it drew on the rather sparse literature which has examined specific components of EW essays and how these components relate to mental and physical health outcomes. Although a fairly substantial body of work exists on the role of EW in mental and physical health, there are only a very few studies examining EW within the context of HIV, and to our knowledge, this represents the first examination of specific word types used by an HIV-positive sample during EW using LIWC software. Therefore, the choice of relevant predictor variables was guided by the literature to the extent possible, although it is likely that other relevant emotional, cognitive, and linguistic factors were not accounted for by the current study, which was limited in scope. Even though a limited number of linguistic variables were examined, relative to the many variables which LIWC categorizes from written essays, the present study did examine a relatively large number of predictor (5 LIWC categories) and outcome variables (4 psychosocial and 4 biological factors), through many correlational and regression analyses. This has the potential to increase the risk of making Type I errors, in which no difference in outcomes exists, yet a difference is wrongly inferred from the statistical analyses. For this reason a more stringent level of statistical significance than $p < .05$ could be set in order to consider that the changes in physical HIV symptoms are due to differences in word usage, for example. However, this would simultaneously increase the risk of Type II error, in which an actual difference in HIV symptoms would be incorrectly overlooked. Ideally, future EW studies with HIV-positive

individuals would examine the relationship of word usage to physical and psychosocial outcomes, and once the results of several similar studies are available, then the present findings will either be supported or fail to be supported within the broader context of the literature.

Another potential limitation of this study is that it analyzed the four writing sessions together, which is consistent with some previous studies of EW. However, other studies have analyzed change in word usage over time, which could be worthwhile for future investigation. This study was also limited in that it was a preliminary examination of several word categories and their potential relationships to a variety of psychosocial and HIV-related outcomes at 6 months of follow-up, which is when the maximum intervention effect was expected, and therefore it is possible that these findings would not hold at earlier or later periods of follow-up, or that different relationships would emerge. The most comprehensive analysis of these data would involve analyzing change in multiple variables across all follow-up periods of the study through one year, to determine whether various linguistic factors change over time, and whether these potential changes relate to any changes in the outcome variables.

As this study was a preliminary examination of relationships between word content and psychosocial and disease-related factors in HIV, it examined relationships between these various factors, but it did not examine potential mechanisms of these relationships, which could be investigated in future analyses. It is possible that LIWC is measuring mechanisms of change (perhaps emotional or cognitive in nature) which could lead to reduced physical symptoms, or that there are other intervening factors, such as behavioral changes, which were not accounted for by this study. Although medication

adherence was accounted for in several analyses as appropriate, it is possible that engaging in EW prompted increased coping behaviors, or efforts to seek social support, or may have led to changes in mood, emotion regulation, or cognitions, which could have influenced the outcome variables. Although several studies indicate that depth of cognitive and emotional processing may account for the effects of EW, exactly how EW works has not been fully elucidated at this time. Similarly, previous research suggests that individual difference factors such as gender and emotion regulation abilities, as well as the presence and/or severity of mental health symptoms can affect outcomes in EW, and this study was limited in that it did not examine potential moderating factors, which could be examined in future analyses of data from this project. As the parent study for this project found that gender moderated the effect of EW on physical and psychosocial outcomes in HIV, it is a limitation of the present study that we did not examine gender as a moderator as well, which would be appropriate for follow-up analyses of these data.

Finally, this study relied heavily upon the LIWC software, which, although it has been utilized with diverse adult clinical and non-clinical populations, and validated against judges ratings of word content (Pennebaker et al., 2007), it possesses inherent limitations. For instance, although LIWC draws from an extensive dictionary of thousands of words, and computes 63 different categories as variables from written essay data, there is limited differentiation between emotional word categories, which are the categories of primary interest within psychological research. For instance, the "positive emotion" category has no sub-categories, which is incongruent with the many variants of positive emotional constructs which have been identified by the field of positive psychology, such as optimism, gratitude, and compassion. Similarly, LIWC does not

distinguish between religious word sub-categories, which is problematic, as religious behaviors and subjective spiritual experiences and feelings may not always overlap.

Furthermore, LIWC is a proxy for measuring psychological processes or states, and may serve as an indicator of either emotional, cognitive, and/or behavioral factors. LIWC is considered to indicate emotional and cognitive states, as well as where the writer has placed his or her attention, although it is not capable of assessing or reflecting the nuances of the writer's message. For instance, a high proportion of social words relative to total essay words indicates that a person is using a lot of social words, and is placing a lot of attention on social factors while writing, but does this indicate social connectedness, as is typically assumed, or could it indicate dissatisfaction with social relationships, or preoccupation with a lack of social relationships, or with the search for higher quality social relationships, or some other factor? Unfortunately, LIWC software cannot tease apart these different processes, or shed light on their qualitative nature. Perhaps by examining the combination of both social and negative emotion words, or social and positive emotion words, one could approximately determine the qualitative nature of the social connectedness, but it would be much more practical and likely valid to administer a self-report survey of perceived social support and satisfaction. Thus, although LIWC software can analyze huge amounts of written text quickly, and does not require the resources needed to train raters, it has limitations which must be acknowledged.

Summary, Conclusion, and Future Directions

This study found that the usage of negative words in EW predicted a moderate increase in HIV symptoms at 6 months of follow-up, while positive words in EW essays

predicted a moderate decrease in physical HIV symptoms during this period. It is striking that these relationships were found in HIV-positive individuals who had, on average, relatively low symptom levels at study entry, which indicates that word usage can predict a change in physical symptoms, even when relatively low levels of symptoms are present. Moreover, these findings are not accounted for by baseline levels of depression, as baseline depressive symptoms are not correlated with physical HIV symptoms either at baseline or 6 months of follow-up.

However, no significant relationships emerged between these word types (or social words, or first person singular and plural pronouns) and other HIV-related outcomes which were examined (i.e. ART adherence, CD4 cell count, or viral load), and neither did significant relationships emerge for psychosocial outcomes which were examined (i.e. depression, PTSD, stress, and social support). These results are consistent with prior studies, which indicate that EW tends to exert a greater effect on physical health outcomes that on psychosocial outcomes. To our knowledge, this is the first study using LIWC to examine the relationship of specific types of EW word content to psychosocial and HIV-related outcomes in a potentially vulnerable clinical population. This study represents a preliminary step toward examining specific psychological and linguistic elements of EW in an HIV-positive sample, and how those factors influence a variety of physical and mental health outcomes which are relevant in HIV disease.

Future studies could examine whether these relationships hold for those in earlier or later stages of the HIV disease process. It would also be important for future research to determine whether it is beneficial to modify EW interventions to deliberately alter the proportionate usage of negative and positive word types, in order to improve HIV

symptom levels. However, the field must proceed with caution, as one previously-mentioned study has reported that negative word usage predicted fewer physical symptoms in cancer populations (Stanton et al., 2002), and it remains unknown whether negative and positive emotional word usage might be beneficial at different times and in different proportions, following a medical diagnosis or other traumatic experience. Future studies could examine whether a change in word usage over time is also predictive of changes in HIV symptoms, and could also examine potential mediating factors such as changes in mood, coping, and health behaviors, which may account for these findings. As this study examined only a small fraction of the many types of words that LIWC software is capable of analyzing, future studies could examine which other word types may be related to psychosocial and disease-related outcomes in HIV. These results suggest that further investigation of the specific types of word content used in EW essays is warranted within HIV research.

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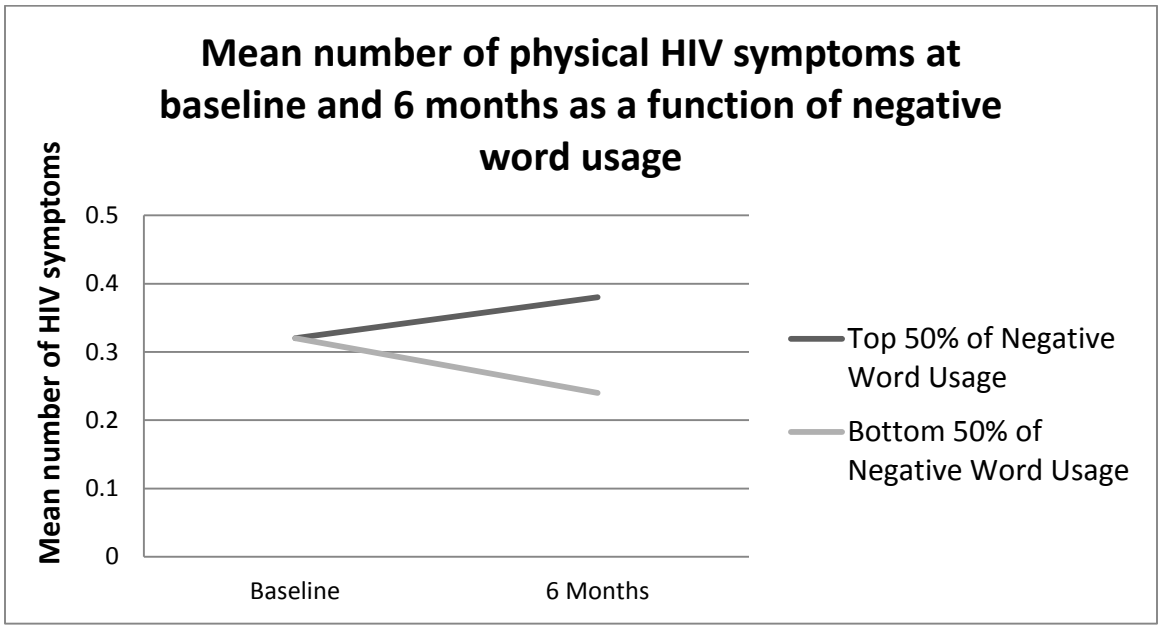
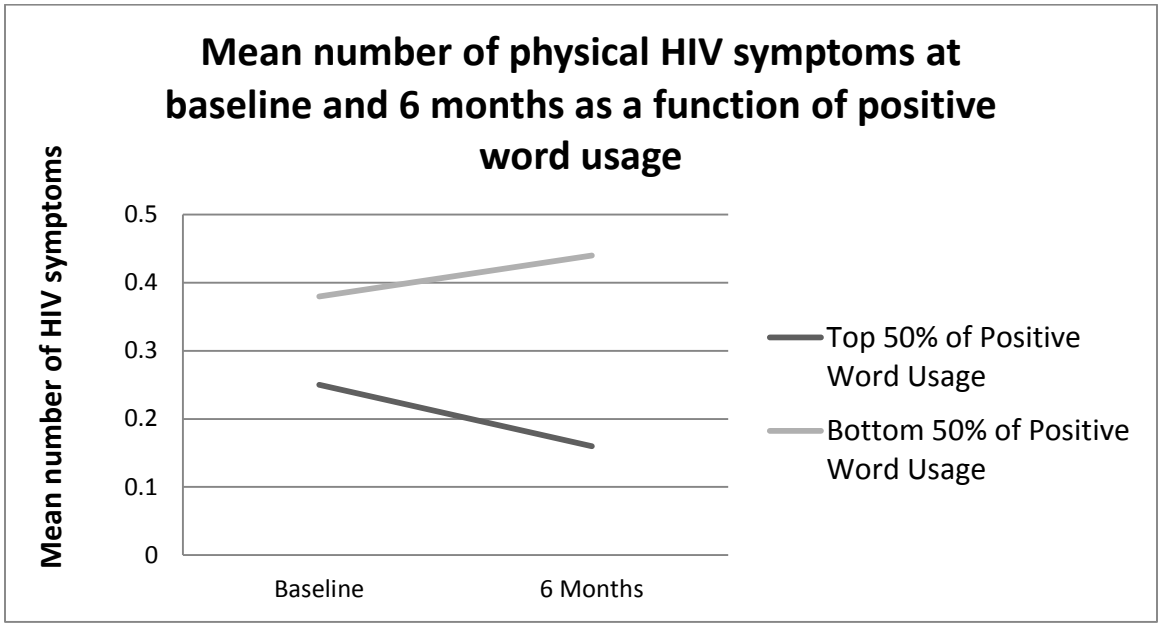
Figures and Tables

Figure 1. Mean number of physical HIV symptoms reported at baseline and 6 month follow-up, as a function of the proportion of negative and positive word usage (relative to total words).





For each chart above, the mean number of HIV symptoms is presented as a function of negative or positive word usage (as a percentage of total words) for participants within the top and bottom halves of negative and positive word usage, respectively.

Median negative words: 2.62% of total words; Median positive words: 2.95% of total words

Table 1. Descriptive statistics for physical and psychosocial factors at baseline and 6 month follow-up for the Trauma writing group.

Baseline:

	Mean	*Median*	*SD*	*Range*
Adherence*	.33	.00	.88	0 - 4
Physical symptoms past mo	.32	.00	.60	0 - 2
CD4 count	410	390	207	23 - 1,071
Viral load	4.8×10^4	693	1.3×10^5	0 - 7.5×10^5
Depression	9.7	9.0	7.7	0 - 33
PTSD	27.5	22.0	24.0	0 - 106
Stress	16.5	17.0	6.9	1 - 32
Social Support	3.7	3.8	.99	1.4 - 5

6 month follow-up:

	Mean	*Median*	*SD*	*Range*
Adherence*	.26	.00	.67	0 - 4
Physical symptoms past mo	.31	.00	.73	0 - 4
CD4 count	417	385	244	13 - 1,687
Viral load	4.6×10^4	697	1.2×10^5	10 - 7.5×10^5
Depression	8.6	6.0	8.1	0 - 35
PTSD	17.7	10.0	20.1	0 - 92
Stress	16.0	17.0	7.4	0 - 33
Social Support	3.6	3.8	1.0	1.1 - 5

*Adherence denotes days in which at least one dose was missed in the past four days.

Table 2. Descriptive statistics for usage of word types utilized by participants in expressive writing essays.

	Negative words	Positive words	Social words	Religious words	FPS Pronouns	FPP Pronouns
Mean percent	2.68	3.14	9.12	.595	11.6	.415
Median	2.62	2.95	8.71	.395	11.6	.282
Standard deviation	1.00	1.06	3.09	.673	2.22	.430
Minimum	.76	1.06	3.44	.00	5.40	.00
Maximum	6.47	7.52	17.7	4.53	18.4	2.04

Values for each word type were averaged across the four writing sessions. Values above represent percentages of words in each category, as a proportion of total words per essay.
FPS = first person singular pronouns; FPP = first person plural pronouns.
N = 122

Table 3. Pearson's zero-order correlations (*r*) between physical and psychosocial factors and word usage at baseline and 6 month follow-up.

Baseline:

	Negative words	Positive words	Social words	*N*
Adherence	.000	.146	-.189†	84
Physical symptoms past mo	.161†	-.038	.048	119
CD4 count	-.073	-.079	.168	117
Viral load	.040	-.010	-.020	117
Depression	.226*	-.055	-.042	117
PTSD	.105	.001	-.027	116
Stress	.024	-.026	-.044	117
Social Support	-.149	-.027	.078	118

6 month follow-up:

	Negative words	Positive words	Social words	*N*
Adherence	-.086	.019	-.004	73
Physical symptoms past mo	.238*	-.257*	-.086	95
CD4 count	-.062	.053	.139	98
Viral load	.138	-.044	-.049	99
Depression	.174†	-.082	-.145	95
PTSD	.100	-.002	-.044	94
Stress	.028	.031	-.165	97
Social Support	-.112	.000	.166	97

*Correlation is significant at $p < .05$

† Correlation is marginally significant at $.05 < p < .10$

All other *p*-values > .10

Table 4. Linear regression analyses with word usage predicting adherence at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline adherence	.144	.090	1.17	.246
Negative words	-.090	.089	-.728	.469

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline adherence	.146	.091	1.17	.247
Positive words	-.022	.071	-.180	.858

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline adherence	.150	.092	1.19	.240
Social Words	.034	.027	.271	.787

Table 5. Linear regression analyses with word usage predicting physical HIV symptoms at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline symptoms	.268	.122	2.68	.009
Baseline CD4 count	.040	.000	.409	.683
Negative words	.245	.066	2.46	.016*

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline symptoms	.314	.122	3.11	.003
Baseline CD4 count	.037	.000	.369	.713
Positive words	-.203	.057	-2.04	.045*

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline symptoms	.297	.123	2.96	.004
Baseline CD4 count	.088	.000	.854	.395
Social words	-.186	.021	-1.82	.072*

*Significant at $p < .05$
†Marginally significant at $p < .10$

Table 6. Mean number of physical HIV symptoms reported at baseline and 6 month follow-up, by proportion of negative and positive word usage (relative to total words).

Top 50% of negative word usage:

Baseline	*6 month follow-up*
Mean: .32	Mean: .38
SD: .57	*SD*: .75
n: 59	*n*: 45

Bottom 50% of negative word usage:

Baseline	*6 month follow-up*
Mean: .32	Mean: .24
SD: .62	*SD*: .72
n: 60	*n*: 50

Top 50% of positive word usage:

Baseline	*6 month follow-up*
Mean: .25	Mean: .16
SD: .51	*SD*: .42
n: 56	*n*: 45

Bottom 50% of positive word usage:

Baseline	*6 month follow-up*
Mean: .38	Mean: .44
SD: .67	*SD*: .91
n: 60	*n*: 50

Median negative words: 2.62% of total words; Median positive words: 2.95% of total words

Table 7. Linear regression analyses with word usage predicting CD4 count at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline CD4 count	.724	.083	10.2	.000
Negative words	-.091	18.6	-1.27	.204

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline CD4 count	.727	.084	10.2	.000
Positive words	.097	16.0	1.30	.197

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline CD4 count	.726	.086	9.89	.000
Social Words	-.017	5.81	-.225	.823

Table 8. Linear regression analyses with word usage predicting viral load at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline viral load	.492	.117	4.43	.000
Baseline adherence	-.099	.211	-.896	.374
Negative words	.039	.213	.363	.718

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline viral load	.488	.117	4.40	.000
Baseline adherence	-.089	.212	-.797	.428
Positive words	-.065	.162	-.602	.549

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline viral load	.497	.117	4.45	.000
Baseline adherence	-.110	.215	-.970	.336
Social words	-.055	.059	-.497	.621

Table 9. Linear regression analyses with word usage predicting depression at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline depression	.494	.093	5.39	.000
Negative words	.055	.774	.596	.553

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline depression	.505	.090	5.63	.000
Positive words	-.062	.655	-.692	.490

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline depression	.500	.090	5.59	.000
Social Words	-.110	.236	-1.24	.220

Table 10. Linear regression analyses with word usage predicting PTSD at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline PTSD	.543	.076	6.10	.000
Negative words	.028	1.86	.311	.757

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline PTSD	.547	.075	6.20	.000
Positive words	-.024	1.60	-.273	.785

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline PTSD	.545	.075	6.17	.000
Social Words	-.028	.584	-.316	.753

Table 11. Linear regression analyses with word usage predicting perceived stress at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline stress	.556	.092	6.43	.000
Negative words	.017	.667	.195	.846

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline stress	.556	.092	6.42	.000
Positive words	.017	.582	.195	.845

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline stress	.554	.091	6.51	.000
Social Words	-.155	.206	-1.83	.071[†]

[†]Marginally significant at $p < .10$

Table 12. Linear regression analyses with word usage predicting social support at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline social support	.777	.069	11.5	.000
Negative words	.035	.073	.514	.609

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline social support	.771	.068	11.6	.000
Positive words	-.020	.062	-.299	.766

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline social support	.762	.068	11.4	.000
Social Words	.064	.023	.966	.337

Table 13. Linear regression analyses with pronoun usage predicting depression at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline depression	.509	.090	5.69	.000
First-person singular pronouns	.072	.326	.799	.426

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline depression	.505	.090	5.64	.000
First-person plural pronouns	.065	1.65	.727	.496

Table 14. Linear regression analyses with pronoun usage predicting social support at 6 month follow-up.

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline social support (at W1)	.770	.069	11.5	.000
First-person singular pronouns	-.008	.031	-.117	.907

Variable	Parameter Estimate (β)	Standard Error	*t*	*p*
Baseline social support (at W1)	.764	.069	11.3	.000
First-person plural pronouns	.030	.160	.441	.660

Table 15. Pearson's zero-order correlations between resilience and word usage at 6 month follow-up.

	Negative words	Positive words	Social words	Religious words	*N*
Resilience	.112	-.080	-.009	-.085	117

All values non-significant at $p > .10$

Appendix A

Selected LIWC word categories with numbers/examples of words in each category:

Negative Emotion (category comprises 346 words)

- Hurt, ugly, nasty, crying, sad, grief, hate, annoyed, worried, fearful, nervous, abandon, abuse, alarm, alone, regret, reject, stress, stupid, terrifying, victim

Positive Emotion (category comprises 266 words)

- Love, nice, sweet, relaxing, satisfied, rich, romantic, security, content, good, enthusiastic, sentimental, smiling, vital, strong, fond, supportive, thankful, terrific

Social Words (category comprises 326 words)

- Express, companion, involve, ex-girlfriend, celebrate, discuss, e-mail, lover, everybody, inform, insult, let's, meeting, participate, mother, talking, spoke, y'all

Religious Words (category comprises 57 words)

- Faith, angel, bible, God, hell, bless, holy, sinned, worship, spirit, divine, souls, priest, Jewish, Methodist, pray, testament, sacred, temple, meditate, heavenly

First person singular pronouns (category comprises 9 words)

- I, I'll, I've, I'd, I'm, me, mine, my, myself

First person plural pronouns (category comprises 11 words)

- Let's, our, ours, ourselves, us, we, we're, we've, we'll

Appendix B

For the 20 minute essay, participants in the experimental "Trauma" writing condition

were provided with the following written prompt and several sheets of lined paper:

"During the four writing days, **please write about your most traumatic or upsetting experiences of your entire life**. In your writing I want you to really let go and **explore your very deepest emotions and thoughts**.

- Although I prefer that you write about a major trauma in your life, instead you may choose to write about major conflicts or problems that you have experienced or are experiencing right now.
- It is best if you write about the same experience on all four days. But if you decide to write about a different experience that's okay too.
- I prefer that you write about significant trauma or conflicts that you have not discussed in great detail with others.

Try to make your memories of the event as real as possible, remembering what you were thinking and feeling at the time and what you were experiencing physically.

In your writing you may relate your personal experience to other parts of your life. For example, how is it related to your childhood, your parents, people who love you, who you are or who you want to be? Be sure to examine your deepest emotions and thoughts.

Whatever you decide to write about please write continuously for 20 minutes. It is very important that you write for the whole 20 minutes. If you run out of things to write you can repeat what you have already written.

Remember I want you to really let go and explore your very deepest emotions and thoughts. Please begin writing now. I will tell you when the time is up."

For the 20 minute essay, participants in the control "Daily" writing condition were

provided with the following written prompt and several sheets of lined paper:

"**In today's writing, I want you to describe what you did <u>yesterday</u> from the time you got up until the time you went to bed.** Avoid writing about emotions or opinions. Rather try to be as objective as possible. For example, you might start when your alarm went off and you got out of bed. You could include the things you ate, where you went, which buildings or objects you passed by as you walked from place to place. The most important thing in your writing, however, is for you to describe your day as accurately and objectively as possible. I would like you to begin writing when I leave the room. **Please write for 20 minutes on what you did yesterday.**"

For the 10 minute essay, participants in the experimental "Trauma" writing condition were provided with the following written prompt and several sheets of lined paper:

- Session 1: How you have tried to understand and make sense of the traumatic experience(s)?
- Session 2: How does the traumatic experience affect your feelings about yourself, your self-worth, and your self-esteem?
- Session 3: How does the traumatic experience affect your ability to solve problems, to meet future challenges, or to deal with day-to-day stress?
- Session 4: How have you tried to understand the trauma and make sense of it?

For the 10 minute essay, participants in the control "Daily" writing condition were provided with the following written prompt and several sheets of lined paper:

"**I want you to describe what you did <u>today</u> from the time you woke up this morning. The most important thing in your writing, however, is for you to describe what you did as accurately and with as much detail as possible. I will tell you when the time is up.**"

For the following three writing sessions, prompts were varied slightly to reflect descriptions of what participants did on different days or what they planned to do on future days.

Appendix C

Trauma/Stressor Severity Rating Scale

How serious was the event discussed? How do you think the patient saw it?

1	2	3	4	5	6	7
Not at all Serious			**Moderately Serious**			**Very Serious**

Score = 7

- Death of child
- Death of spouse/partner

Score = 6

- Death of sibling
- Death of parent
- Divorce
- Childhood sexual abuse
- Childhood physical abuse
- Kidnapping/hostage situation
- Homicide of family member or close friend

Score = 5

- Loss of job-fired from work
- Adult physical abuse (e.g. domestic violence, physical assault)
- Adult sexual abuse (e.g. rape, sexual assault)
- Military/combat trauma
- Attempted suicide of family member or close friend
- Abandonment by parent/adoption/foster care (minor child)
- Diagnosis or ongoing status of life-threatening/chronic terminal illness (e.g., HIV, cancer)

Score = 4

- Separation from spouse due to marital problems
- Being held in jail
- Injury or illness (kept you in bed for 1 week or more or sent you to the hospital)
- Death of close friend
- Loss of job-laid off from work
- Pregnancy
- Birth or adoption of a child
- Miscarriage/stillbirth/abortion
- Act of violence on close family member or friend
- Child custody issues (e.g. regaining or losing custody)

- Victim of crime with threat to life (e.g. robbed at gunpoint w/out physical harm sustained)
- Prostitution

Score = 3

- Decreased income
- Major business adjustment
- A relative moving in with you
- Divorce of your parents
- Foreclosure on mortgage or loan
- Investment and/or credit difficulties
- Major change in health or behavior of a family member (including family member drug addiction)
- Separation from spouse due to work
- Retirement
- Change to a new type of work
- Major decision regarding your immediate future
- Change in arguments with spouse
- Parents remarriage
- Your own marriage
- An accident
- Drug abuse/dependence treatment or rehab
- Natural disaster (e.g. hurricane)
- Witnessing act of violence on a stranger
- Sexual identity crisis/disclosure
- Disclosure of potentially stigmatizing disease (e.g. HIV)
- Incarceration of family member or close friend
- Victim of non-violent crime (e.g. robbery or mugging without weapon, vandalism)

Score = 2

- Move to a different town, city, or state
- "Falling out" of a close personal relationship
- Spouse beginning or ending work
- Engagement to marry
- Child leaving home for other reasons
- Sexual difficulties
- An injury or illness which was less serious than "74"
- Birth of grandchild
- Loss or damage of personal property
- Major change in living conditions (including homelessness)
- Demotion at work
- Child leaving home to attend college
- Child leaving home due to marriage
- Girlfriend or boyfriend problems (including break-up of relationship)

- Increased income
- In-law problems
- Beginning or ending school or college
- New, close, personal relationship (including new romantic relationship)
- Major purchase
- Major personal achievement
- Troubles at work with co-workers
- Troubles at work with persons under your supervision
- Change of school or college
- Change in your work hours or conditions
- Arrest of family member or close friend
- Being bullied as a child
- Loss of pet
- Discrimination (e.g. racial, sexual orientation, HIV status, gender, etc.)

Score = 1

- Work transfer
- Promotion at work
- Change in religious beliefs
- More responsibilities at work
- Troubles with your boss
- Major change in your usual type/amount recreation
- Other work troubles
- Major change in eating habits
- Change in social activities
- Change in personal habits
- Major dental work
- Major change in sleeping habits
- Move within the same city or town
- Change in family get-togethers
- Change in political beliefs
- Vacation
- Fewer responsibilities at work
- Moderate purchase
- Minor violation of the law
- Correspondence course to help you in your work