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Attachment anxiety is related to Epstein–Barr virus latency

Christopher P. Fagundes [a,*], Lisa M. Jaremka [b], Ronald Glaser [b], Catherine M. Alfano [c], Stephen P. Povoski [d], Adele M. Lipari [e], Doreen M. Agnese [d], Lisa D. Yee [d], William E. Carson III [d,f], William B. Farrar [d], William B. Malarkey [g,h,i], Min Chen [b], Janice K. Kiecolt-Glaser [b,i]

[a] Department of Health Disparities, University of Texas MD Anderson Cancer Center, United States
[b] The Institute for Behavioral Medicine Research, The Ohio State University College of Medicine, United States
[c] Office of Cancer Survivorship, National Cancer Institute, National Institute of Health, United States
[d] Department of Surgery, The Ohio State University College of Medicine, United States
[e] Department of Radiology, The Ohio State University College of Medicine, United States
[f] Department of Molecular Virology, Immunology, and Medical Genetics, The Ohio State University College of Medicine, United States
[g] Department of Internal Medicine, The Institute for Behavioral Medicine Research, The Ohio State University College of Medicine, United States
[h] Department of Molecular Virology, Immunology, and Medical Genetics, The Institute for Behavioral Medicine Research, The Ohio State University College of Medicine, United States
[i] The Institute for Behavioral Medicine Research, Comprehensive Cancer Center, and Department of Psychiatry, The Ohio State University College of Medicine, United States

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ABSTRACT

Attachment theory provides a framework for understanding individual differences in chronic interpersonal stress. Attachment anxiety, a type of relationship insecurity characterized by worry about rejection and abandonment, is a chronic interpersonal stressor. Stress impacts cellular immunity, including herpesvirus reactivation. We investigated whether attachment anxiety was related to the expression of a latent herpesvirus, Epstein–Barr virus (EBV), when individuals were being tested for breast or colon cancer and approximately 1 year later. Participants ($N = 183$) completed a standard attachment questionnaire and provided blood to assess EBV viral capsid antigen (VCA) IgG antibody titers. Individuals with more attachment anxiety had higher EBV VCA IgG antibody titers than those with less attachment anxiety. The strength of the association between attachment anxiety and antibody titers was the same at both assessments. This study is the first to show an association between latent herpesvirus reactivation and attachment anxiety. Because elevated herpesvirus antibody titers reflect poorer cellular immune system control over the latent virus, these data suggest that high attachment anxiety is associated with cellular immune dysregulation.

1. Introduction

There are well-documented links between close relationships and physical health. People who have supportive close relationships have lower rates of morbidity and mortality than those who have unsupportive and conflict-ridden relationships (Berkman and Syme, 1979; Brummett et al., 2001; Gilbert et al., 2009; House, 1988; Orth-Gomer and Johnson, 1987; Repetti et al., 2002; Tomaka et al., 2006; Uchino et al., 1996). Attachment theory provides a framework for understanding individual differences in chronic interpersonal stress and thus may offer insight into the associations between close relationships and health (Diamond and Hicks, 2004; Shaver and Mikulincer, 2007; Uchino, 2009).

Attachment theory suggests that people who have responsive and supportive parents during childhood develop a sense of emotional security that lasts into adulthood, while those who have unresponsive and unsupportive parents develop a sense of emotional insecurity (Mikulincer and Shaver, 2009; Thompson, 1999). Different academic and theoretical traditions conceptualize attachment insecurity in slightly different ways (Fraley and Waller, 1998); according to adult attachment theory, there are two patterns or dimensions of attachment insecurity: attachment anxiety and attachment avoidance (Mikulincer and Shaver, 2007). These patterns have the potential to change throughout one's lifespan but are thought to be relatively stable (Mikulincer and Shaver, 2007).

People with high attachment anxiety constantly worry about rejection and abandonment and use "hyperactivating" coping strategies, such as excessive rumination and preoccupation about

* Corresponding author. Address: UT MD Anderson Cancer Center, Dept. of Health Disparities Research, Unit 1440, Rm. FCT 9.5016, PO Box 301402, Houston, TX 77230, United States. Tel.: +1 713 794 523.
E-mail address: CPFagundes@mdanderson.org (C.P. Fagundes).

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stressful events (Brennan et al., 1998; Diamond and Fagundes, 2010; Diamond, 2001; Fraley and Shaver, 2000a). Indeed, people with higher attachment anxiety tend to have a more negative self-image and intense negative emotions than those with lower attachment anxiety (Mikulincer et al., 2006; Pietromonaco and Barrett, 1997).

People with high attachment avoidance are uncomfortable depending on others for support and use "deactivating" coping strategies that inhibit, exclude, or suppress distressing relational experiences (Brennan et al., 1998; Fraley and Shaver, 2000b). Individuals with higher attachment avoidance tend to denigrate and distrust support providers more than those with lower attachment avoidance (Mikulincer and Shaver, 2003; Shaver and Mikulincer, 2005). Furthermore, they keep negative emotions alive internally, while attempting not to express them externally (Mikulincer and Shaver, 2003; Shaver and Mikulincer, 2005).

Attachment anxiety has been reliably linked to many age-related health problems, while attachment avoidance has not (McWilliams and Bailey, 2010; Puig et al., 2012). The chronic social stress that is a feature of attachment anxiety may be an important mechanism underlying this link; chronic stress can impair vaccine responses, slow wound healing, promote inflammation, and dysregulate cellular immunity (Glaser and Kiecolt-Glaser, 2005a). Consistent with this argument, recent work in the field of psychoneuroimmunology demonstrated that people who had higher attachment anxiety had fewer numbers of $CD3^+$ T-cells, $CD45^+$ T-cells, $CD3^+CD4^+$ helper T-cells, and $CD3^+CD8^+$ cytotoxic T-cells compared with those who had lower attachment anxiety (Jaremka et al., 2013).

Chronic interpersonal stress can drive herpesvirus reactivation and replication by impairing cellular immune system control over viral latency through both autonomic and glucocorticoid pathways (Cacioppo et al., 2002; Glaser and Kiecolt-Glaser, 1994; Yang et al., 2010). Maladaptive alterations in cellular immune function can enhance herpesvirus reactivation and replication, resulting in elevated herpesvirus antibody titers (Glaser and Kiecolt-Glaser, 1994, 2005b; Glaser et al., 2005; Steptoe et al., 2007). For example, organ transplant patients have dysregulated cellular immunity and elevated herpesvirus antibody titers (Gray et al., 1995). Although usually asymptomatic, elevated herpesvirus antibody titers reflect poorer cellular immune system control over viral latency (Glaser and Kiecolt-Glaser, 1994). Accordingly, people who are anxiously attached may be vulnerable to latent herpesvirus reactivation and replication due to their chronic interpersonal stress and corresponding cellular immune dysregulation.

Based on the argument that attachment anxiety is a chronic interpersonal stressor, we hypothesized that those who were more anxiously attached would have higher EBV VCA IgG antibody titers than those who were less anxiously attached. Because most studies have not shown a consistent association between attachment avoidance and health or stress sensitivity, we made no a priori hypothesis about attachment avoidance (Dewitte et al., 2010; Jaremka et al., 2013). However, we examined the possibility that those who were more avoidantly attached would have higher EBV VCA IgG antibody titers than those who were less avoidantly attached. We also explored whether the association between attachment anxiety/avoidance and herpesvirus reactivation differed over time.

2. Methods

2.1. Participants and procedure overview

Study participants ($N = 183$) were recruited from oncology clinics as they were being tested for breast or colon cancer as part of an ongoing longitudinal observational study investigating potential links between fatigue and immune dysregulation. Participants were being tested for breast or colon cancer because of a suspicious initial test; all participants completed their first visit after this initial suspicious test. Participants eventually received a benign diagnosis as the result of one or more follow-up tests. On average, participants received a benign diagnosis from their final test 9.8 days ($SD = 15.08$) after their first study visit. Approximately one year later, participants completed a follow-up assessment. We did not have data for 12% of participants at the second assessment. Participants who did not complete the second visit were contacted by phone and email multiple times and (a) stated they did not want to continue due to lack of time or interest, or (b) never returned our messages. Screening exclusions included a prior history of cancer except basal or squamous cell skin cancers and severe cognitive impairment (e.g., Alzheimer's disease). Out of the 183 participants enrolled at the first visit, eight were EBV seronegative (i.e., they never contracted EBV); therefore, they were not included in the analyses. All participants who were EBV seropositive at the first visit were also seropositive at the second visit; once contracted, herpesvirus seropositivity does not change. The average time between study visits was 365 days ($SD = 124$ days). The Institutional Review Board approved the project; all subjects gave written informed consent prior to participation.

2.2. Determination of EBV VCA IgG antibody titers in plasma

EBV VCA IgG represents the antibody response to the combination of multiple viral proteins that make up the virus coat. We assessed antibody against EBV VCA IgG in plasma to assess control over viral latency. Plasma was stored at $-80\ ^\circ C$ until assayed with Euroimmun EBV ELISA plates (Boonton Township, NJ). This ELISA's antigen, a cell lysate of human B-cells infected with EBV strain P3HR-1, comprises various viral capsid proteins, including p22, gp33, gp40, gp41, gp42, gp116. EBV-VCA IgG antibody titers were assessed following instructions, with kit controls (one positive sample, one negative sample, and three calibrators) run in duplicate. After the initial 1:101 dilution, six serial two-fold dilutions of each sample were assayed, and the last positive value was the IgG antibody titer. Calculated viral titers for each sample were plotted and samples were rerun if the end point did not fall within the linear range (±15%).

2.3. Self-report measures

2.3.1. Attachment insecurity

Attachment insecurity was assessed using a modified version of the Experiences in Close Relationships (ECR-M16) scale (Lo et al., 2009). The ECR-M16 was designed to assess attachment insecurity in patients of diverse ages. The 16-item self-report measure assesses general attachment insecurity in close relationships; it contains two 8-item subscales, one assessing attachment anxiety and the other assessing attachment avoidance. The anxiety subscale includes items such as "I worry about being abandoned" and "I need a lot of reassurance that I am loved by people with whom I feel close to." The following items are representative of the avoidance scale: "I get uncomfortable when other people want to be very close to me," and "I don't feel comfortable opening up to other people." Both scales have high internal and test-retest reliability (Lo et al., 2009).

2.3.2. Beck Anxiety Inventory

The Beck Anxiety Inventory (BAI) assesses general anxiety symptoms. The BAI can discriminate between clinically anxious and non-clinically anxious people and has good test-retest reliability and internal consistency. The BAI provided a way to disentangle general anxiety from attachment anxiety (Steer and Beck, 1997).

2.3.3. Depression

The Center for Epidemiological Studies Depression Scale (CES-D) has been used extensively as a brief measure of depressive symptomatology (Basco et al., 1997; Radloff, 1977). Studies have shown acceptable test-retest reliability and excellent construct validity (Basco et al., 1997). Because the CES-D can distinguish depressed from non-depressed participants in community and clinical samples, discriminative validity appears acceptable as well (Basco et al., 1997). Population norms provide cutoffs for varying levels of depression (Basco et al., 1997), and it has been widely used in cancer studies (Demark-Wahnefried et al., 2003). The CES-D was included to disentangle the links among depression, attachment anxiety, and herpesvirus reactivation.

2.3.4. Comorbidities

The Charlson index is one of the most widely used comorbidity indices (Charlson et al., 1994). Originally developed for predicting mortality, it has now been widely used in cancer and non-cancer populations (Dobnig et al., 2008) The measure assigns weights to 19 comorbid conditions based on their potential to influence one-year mortality.

2.3.5. Sleep

The Insomnia Severity Index (Morin, 1993) reliably estimates insomnia severity (Bastien et al., 2001). Scores range from 0 to 28 with higher numbers indicating greater insomnia severity. The measure helped establish the link between attachment anxiety and herpesvirus reactivation independent of sleep problems.

2.3.6. Demographic and clinical variables

Participants answered questions about their age, race, highest level of education, marital status, smoking status, weekly average alcohol consumption, and current medication use. Following participants' authorization, electronic medical records were reviewed to obtain height and weight data to calculate their body mass index (BMI; kg/m^2).

2.4. Analytic method

Using linear mixed models, we addressed the question of whether attachment anxiety was associated with EBV VCA IgG antibody titers across both visits. We utilized restricted information maximum likelihood (REML) estimation to fit all models. REML is superior to listwise deletion for handling attrition (Jeličić et al., 2009). It also performs well when data are missing at random and improves nonrandom circumstances over ignoring cases entirely (Schafer and Graham, 2002). We employed an unstructured within-subjects covariance matrix and examined the model residuals to confirm that they were distributed normally. EBV VCA IgG antibody titers were log transformed prior to analyses because the original distribution was skewed. The log transformation normalized the distribution and alleviated concerns about ceiling effects. We adjusted for age, BMI, sleep, alcohol consumption, comorbidities, sex, and smoking status based on work showing relationships between these factors and cellular immune function; we also adjusted for general anxiety, which allowed us to focus our results on people who were anxious about their close relationships rather than simply anxious in general (Fraley and Shaver, 2000a; Messingham et al., 2002; Sopori, 2002; Stowe et al., 2007). Both attachment styles were included in the models simultaneously based on recommendations for utilizing the Experiences in Close Relationships Scale (Fraley et al., 2000; Lo et al., 2009). Smoking status, BMI, weekly alcohol use, sleep problems, comorbidities, age, and general anxiety were included as time-varying predictors. Attachment anxiety, attachment avoidance, and gender were time invariant predictors because they were only measured at the first assessment.

We conducted a series of ancillary analyses. First, we investigated whether the relationship between attachment style and EBV VCA IgG antibody titers differed between the first and second visit because the period surrounding the benign cancer diagnosis (i.e., visit 1) could potentially be stressful. To accomplish this goal, we added the attachment anxiety/attachment avoidance by visit interactions to the model. We also replaced the covariate of general anxiety with depressive symptoms because attachment anxiety is also consistently related to depression (Rholes et al., 2011) and depression and anxiety are closely related. Finally, we adjusted for cancer screening site (i.e. breast or colon) rather than sex (i.e. male or female) because all of the participants with benign breast cancer screening results were women.

3. Results

3.1. Preliminary analyses

Table 1 reports descriptive sample information for all individuals who were EBV seropositive (i.e., the individuals included in the analysis). There was considerable variability in both attachment anxiety and EBV VCA IgG antibody titers. In addition, people who were higher on attachment anxiety were above the normal range for patient populations based on the extant literature using the ECR-M16 (Neel et al., 2013; Sockalingam et al., 2012, 2013). Individuals who were lost to attrition did not significantly differ on any of the study variables compared with those who completed both visits; however, substantive differences may be biased by uneven group sizes. Attachment anxiety was positively associated with attachment avoidance ($b = .37$, $p < .001$). Attachment anxiety was also associated with more general anxiety symptoms ($b = .40$, $p < .001$), but attachment avoidance was not ($b = .08$, $p = .25$). General anxiety was not statistically different while participants' were awaiting diagnosis compared with a year later ($b = .08$, $p = .25$). Furthermore, the association between attachment anxiety and general anxiety did not differ across visits ($b = .03$, $p = .55$). Accordingly, the association between attachment anxiety and general anxiety was not more pronounced while participants were awaiting their diagnosis compared with a year after learning their diagnosis was benign. Attachment anxiety was not associated with any other study variable besides EBV VCA antibody titers (as described below). Females had lower attachment avoidance than males ($b = -4.7$, $p < .001$).

3.2. Primary analysis

As can be seen in Table 2, participants with higher attachment anxiety had higher EBV VCA IgG antibody titers than those with lower attachment anxiety. Attachment avoidance was not associated with EBV VCA IgG antibody titers. EBV VCA IgG antibody titers did not differ across study visits. To estimate the magnitude of the EBV VCA titers by attachment status between participants lower and higher in attachment anxiety, we used the covariate-adjusted means at 1 standard deviation above and below the mean of attachment anxiety (see Fig. 1). Participants with higher attachment anxiety (+1 *SD*) had 11.8% higher EBV antibody titers than those with lower attachment anxiety (−1 *SD*).

3.3. Secondary analyses

In additional analyses, we tested for the interaction between attachment anxiety and visit. The interaction was not significant ($b = .01$, $p = .40$) demonstrating that the strength of the association between attachment anxiety and EBV VCA IgG antibody titers did

Table 1
Sample characteristics of EBV seropositive individuals.

Characteristic	%	Mean (SD)	Range
Attachment anxiety	–	21.31 (9.72)	8–45
Attachment avoidance	–	24.35 (8.89)	– 8–50
EBV VCA IgG antibody titers			
Visit 1	–	1988.25 (18114.7)	101–6464
Visit 2	–	2090.39 (1788.90)	101–6464
Marital status			
Single	10	–	10
Married	63.3	–	63.3
Domestic partner	1.7	–	1.7
Separated/ divorced	21.1	–	21.1
Widowed	3.9	–	3.9
Sex			
Female	80	–	80
Male	20	–	20
Cancer screening site			
Breast	51.6	–	51.6
Colorectal	48.4	–	48.4
Body mass index (BMI)			
Visit 1	–	29.03 (6.59)	17.9–49.6
Visit 2	–	28.38(6.32)	17.0–50.0
Sleep quality			
Visit 1	–	8.28 (5.69)	0–26
Visit 2	–	8.57 (5.24)	0–24
General anxiety symptoms			
Visit 1	–	8.94 (8.18)	0–51
Visit 2	–	8.37 (8.29)	0–51
Depressive symptoms			
Visit 1	–	13.92 (11.54)	0–49
Visit 2	–	12.46 (10.80)	0–53
Age, years			
Visit 1	–	55.93 (10.36)	32–83
Visit 2	–	57.03 (10.51)	34–84
Education			
High school or less	22.0	–	22.0
Some college	17.7	–	17.7
College or university graduate	31.4	–	31.4
Graduate or professional training	28.0	–	28.0
Comorbidities			
Visit 1	–	.49 (.85)	0–5
Visit 2	–	.66 (1.07)	0–6
Race			
Asian	2.3	–	2.3
Black	16.6	–	16.6
White	80.6	–	80.6
Other	.6	–	.6
Method(s) of diagnosis – breast*			
Biopsy	100	–	100
Fine needle aspiration	3.1	–	3.1
MRI	2.0	–	2.0
Ultrasound	64.3	–	64.3
Mammogram	82.4	–	82.4
Method(s) of diagnosis – colon*			
Biopsy	26.4	–	26.4
Colonoscopy	82.4	–	82.4

* All participants completed their first visit after an initial suspicious test. Participants eventually received a benign diagnosis as the result of one or more follow-up tests; these follow-up tests are reported under method(s) of diagnosis.

not differ across visits. Likewise, attachment avoidance did not interact with visit ($b = .01$, $p = .55$). We also adjusted for cancer screening site (i.e. breast or colon) rather than sex (i.e. male or female); neither the p-values nor the point estimates substantively changed. We also tested for the interaction between attachment anxiety and attachment avoidance predicting EBV VCA IgG and it was not significant ($b = .00$, $p = .92$). We then examined the association between attachment insecurity and EBV VCA IgG antibody titers adjusting for depressive symptoms rather than anxiety. The association between attachment anxiety and EBV VCA IgG antibody titers remained significant in the adjusted model ($b = .008$, $p = .03$), while there was still no significant association between attachment avoidance and EBV VCA IgG antibody titers ($b = -.005$, $p = .25$). Finally, we examined the association between attachment anxiety and EBV VCA IgG antibody titers without any of the covariates in the model. The association between attachment anxiety and EBV VCA IgG antibody titers remained significant in the unadjusted model ($b = .008$, $p = .03$), while there was still no significant association between attachment avoidance and EBV VCA IgG antibody titers ($b = -.005$, $p = .20$).

4. Discussion

Individuals who were more anxiously attached had higher EBV VCA IgG antibody titers, reflecting poorer cellular immune system control of the latent virus, than their less anxiously attached counterparts. They also had higher levels of general anxiety than those who had lower attachment anxiety. Attachment avoidance was not associated with EBV VCA IgG antibody titers or general anxiety. This study is the first to show an association between latent herpesvirus reactivation and attachment anxiety.

These results complement recent work showing a relationship between high attachment anxiety and other biologically relevant health outcomes. Indeed, other work from our lab demonstrated that higher attachment anxiety is associated with cell-mediated immunity, specifically fewer T-cells (Jaremka et al., 2013). Cortisol, which can dysregulate cellular immune function, was also higher among those who were more anxiously attached compared with those who were less anxiously attached (Jaremka et al, 2013).

The association between attachment anxiety and EBV VCA IgG antibody titers remained significant over and above both general anxiety and depressive symptoms. Accordingly, these findings suggest that attachment anxiety is a potent social stressor with unique physiological costs that are independent of general anxiety and depression (Diamond and Fagundes, 2010; Diamond, 2001) Indeed, attachment processes are critically important for people's ability to regulate their emotions when experiencing stress (Pietromonaco et al., 2013). Those with more attachment anxiety appraise adversities as threatening, irreversible, and uncontrollable. Researchers have argued that the sense of helplessness and lack of perceived support that characterizes individuals with more attachment anxiety impairs peoples' ability to put both past and current stressors behind them (Mikulincer and Florian, 1998). It will be important for future studies to examine what aspects of attachment anxiety promote immune dysregulation.

The current study extends prior work on close relationships and physical health in new and important directions. Prior work from our lab demonstrated that attachment anxiety is related to differences in T-cell counts (Jaremka et al., 2013). This study is the first to link attachment anxiety to cellular immune competence by demonstrating that attachment anxiety is related to viral reactivation. Attachment anxiety is characterized by constant vigilance and hypersensitivity to cues of rejection, which in turn leads those with high attachment anxiety to easily perceive threats in their environment and frequently experience social interactions as stressful and worrisome (Mikulincer et al., 2003; Shaver and Mikulincer, 2002). This chronic relationship stress may be a key psychological feature driving the link between attachment anxiety and EBV reactivation that is independent of generalized anxiety and depressive symptoms.

We did not find an association between attachment avoidance and EBV VCA IgG antibody titers. As previously mentioned, attachment avoidance is not reliably linked to chronic stress or physical health (Dewitte et al., 2010; Jaremka et al., 2013). Indeed, most of the work relating attachment avoidance to stress-related physiological outcomes has focused on acute stress reactivity (Diamond and Fagundes, 2010; Gouin et al., 2009). Because chronic and acute stress reactivity are differentially related at both the psychological

Table 2
Summary of mixed models analysis predicting EBV VCA IgG antibody titers.

Variable	EBV VCA IgG (log_{10})			
	B	SE	*p*	95% CI
Attachment anxiety	.008	.004	.036	.001, .016
Attachment avoidance	−.004	.004	.264	−.013, .004
Visit	.017	.018	.373	−.020, .053
Gender (Female = 0, Male = 1)	.021	.090	.808	−.148, .190
BMI	.002	.005	.633	−.007, .012
Smoker (No = 0, Yes = 1)	−.070	.080	.358	−.220, .080
Weekly alcohol use	−.002	.002	.356	−.010, .002
Sleep problems	.001	.004	.764	−.008, .010
Comorbidities	.032	.026	.210	−.018, .083
Age	.002	.003	.534	−.004, .008
General anxiety	.001	.003	.670	−.004, .006

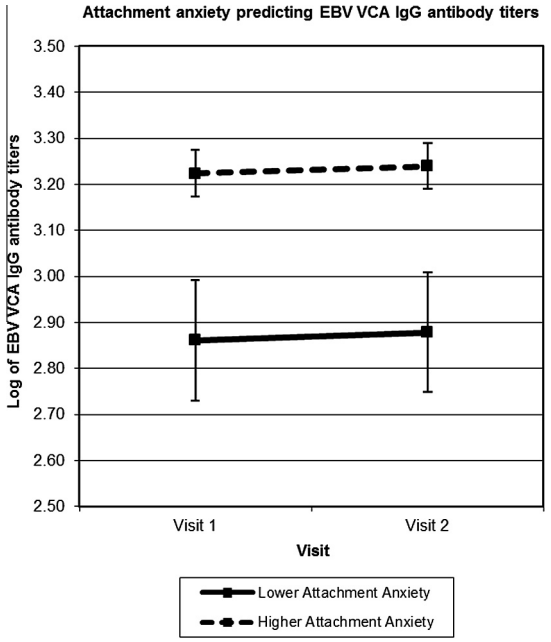

Fig. 1. Mean EBV antibody titers across time in high and low anxiously attached individuals based on attachment anxiety scores 1 *SD* above and below the mean level of attachment anxiety. Those with more attachment anxiety had higher EBV antibody titers compared with those with less attachment anxiety reflecting poorer cellular immunity.

and physiological levels (Segerstrom and Miller, 2004), it may not be surprising that EBV VCA IgG antibody titers were related to higher levels of attachment anxiety, but not higher levels of attachment avoidance.

The period in which individuals were awaiting a diagnostic test did not elicit more self-reported anxiety than the follow-up assessment 1 year later. This is likely why we did not find a difference between antibody titers at the first visit compared with the second. Likewise, this may explain why the strength of the association between attachment anxiety and EBV VCA IgG antibody titers did not differ across visits. Indeed, it is possible that even when overall stress levels differ, the strength of the relationship between attachment anxiety and EBV reactivity would remain the same. This is consistent with the argument that attachment anxiety functions as a chronic *interpersonal* stressor, which may be the key psychological mechanism driving our results.

Although herpesvirus reactivation is asymptomatic and typically benign, latent herpesvirus reactivation may promote increased inflammation (Fagundes et al., 2012; Glaser et al., 2006; Harris et al., 1999; Roberts et al., 2010; Simanek et al., 2011; Stassen et al., 2006; Trzonkowski et al., 2003). Elevated inflammation has been linked to a number of age-related diseases (Steptoe et al., 2007). Indeed, older adults who have chronically elevated proinflammatory cytokines are at greater risk for cancer, cardiovascular disease, type II diabetes, osteoporosis, periodontal disease, and rheumatoid arthritis (Ershler and Keller, 2000; Libby, 2007). Accordingly, the findings of the current study may tap into one possible mechanism linking attachment anxiety to a number of chronic diseases.

Our sample was predominately white; it will be important for future studies to investigate if these findings exist among a more racially diverse sample. Furthermore, a large proportion of our sample was older. Normal aging is already marked by dysregulated immune function, including elevated herpesvirus antibody titers (Aw et al., 2007; Glaser and Kiecolt-Glaser, 2005a). Accordingly, it is noteworthy that our findings were detectable in this group of mostly older adults. Indeed, chronic interpersonal stress may be particularly detrimental to older adults because they already have maladaptive age-related immune changes (Glaser and Kiecolt-Glaser, 2005b). We conceptualized attachment anxiety as a stable construct and only measured it at the first visit; however, it would be interesting for future studies to examine how attachment insecurity may change as a result of a stressful life event such as a potential cancer diagnosis. Finally, as with most measures in the field of psychoneuroimmunology, there are currently no recommendations for clinically meaningful differences or clinical cut-offs in relation to EBV antibody titers. However, the percentage difference in antibody titers between those who were low on attachment anxiety compared with those high on attachment anxiety was 11.8%. This percentage is similar to percent differences found in other studies linking psychosocial and behavior factors to EBV VCA IgG antibody titers (Esterling et al., 1993; Glaser et al., 1999, 1985; Lutgendorf et al., 2001).

In conclusion, the current study demonstrated that people who have higher attachment anxiety have elevated EBV VCA IgG antibody titers compared with those who have lower attachment anxiety. Because elevated herpesvirus antibody titers reflect poorer cellular immune system control over the latent virus, these data suggest that high attachment anxiety is associated with cellular immune dysregulation. These findings extend attachment theory in an important direction by demonstrating the utility of a psychoneuroimmunological approach to the study of attachment insecurity. The current results also add to our growing understanding of how interpersonal relationships and chronic interpersonal stress influence immune function.

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