



Keynote article

Optimistic Expectancies and Immunity: Context Matters

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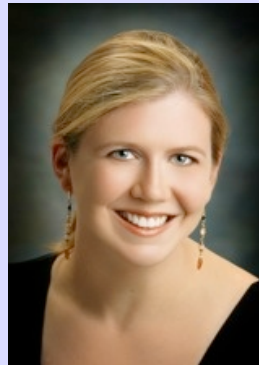
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Dispositional optimism – the belief that the future holds positive rather than negative events and outcomes – accompanies a number of adaptive psychological qualities. People who are more rather than less optimistic have less psychological distress, even when things don't go their way (see Carver, Scheier, & Segerstrom, in press, for a review). They cope with stressors more actively and more adaptively, using problem-focused strategies when those are likely to be effective (i.e., in controllable situations such as academic challenge) and emotion-focused strategies when those are likely to be effective (i.e., in uncontrollable situations such as trauma) (Solberg Nes & Segerstrom, 2006). In prospective studies, people who were more optimistic had more academic and professional success as measured by GPA and income (Segerstrom, 2007b; Solberg Nes, Evans, & Segerstrom, 2009). People who are more optimistic also have more successful social relationships (e.g., Srivastava, McGonigal, Richards, Butler, & Gross, 2006).

In light of these broad-ranging psychosocial successes, it seems that people who are more optimistic might also have better physical health. A large literature on the relationship between personality and health risk links adaptive psychosocial qualities to lesser morbidity and mortality, with effect sizes that rival biomedical interventions (Roberts, Kuncle, Shiner, Caspi, & Goldberg, 2007). In a recent meta-analysis, dispositional optimism also associated with lesser morbidity and mortality, including that from causes related to the functioning of the immune system such as HIV and cancer (Rasmussen, Scheier, & Greenhouse, 2009). However, these long-term, summary effects disguise a relationship between optimism and immune function, particularly cellular immune function, which actually varies significantly based on context. For the past 10 years, my research has illuminated this variability and the situations and people for whom optimism associates with stronger cellular immunity and those for whom the relationship may not be as strong – or even reversed.

Dispositional optimism

In my first study of optimism and immunity, I related dispositional optimism to changes in immune parameters over 8 weeks in first-year law students, a



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highly stressed population. In this study, there was not much evidence that dispositional optimism was related to immune parameters (cell numbers and natural killer cell cytotoxicity) at all. There was a small-to-medium positive relationship between dispositional optimism and number of CD8+ cytotoxic T cells, but no relationship between optimism and CD4+ helper T cells, CD19+ B cells, CD16/56+ natural killer cells, or cytotoxicity (Segerstrom, Taylor, Kemeny, & Fahey, 1998). (The results were more promising for situational optimism, discussed below.) As I prepared to pursue this line of inquiry, therefore, I had to consider whether there might be moderators of the relationship between dispositional optimism and immune parameters. Optimism is, of course, not the only potential buffer against stress; for example, social integration and social support are thought to be robust buffers. I therefore proceeded to use a proxy for social integration or disruption (staying home or relocating to attend law school) as a moderator. I expected that optimism would be most strongly related to immune parameters when the alternate buffer, social integration, was absent. This was in fact the case: dispositional optimism was positively related to immune parameters for students who moved away from home to go to law school, and this was true both in the initial sample and in a new sample (Segerstrom, 2001). It was unexpected, however, to find that students who ►

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Keynote article

Segerstrom (cont'd)

did not move away from home yielded a negative relationship between optimism and number of helper T cells and, in the second sample, an *in vivo* measure of cellular immunity. In both samples, optimism correlated positively with immune cell numbers and function in students who moved away from home, but negatively with parameters in students who did not move away from home. Students who had a double buffer, high optimism and social integration, had lower cellular immune function than those who were integrated but not optimistic.

This was not the first study to report an interaction between dispositional optimism and situational factors in predicting immune parameters. In a sample of community women, optimism was associated with higher numbers of T cells when women experienced brief (< 1 week) stressors but with lower numbers of T cells when stressors were prolonged (> 1 week) (Cohen, Kearney, Zegans, Kemeny, Neuhaus, & Stites, 1999). In a laboratory study, optimism was associated with higher cytotoxicity when participants felt control over a loud noise stressor, but lower cytotoxicity when participants felt no control (Sieber et al., 1992). In both of these studies, the inverse relationships between optimism and immune parameters were attributed to expectancy violation. Stressor persistence and uncontrollability violated optimists' belief in a positive future, distressing them and perturbing their immune systems.

Empirically, however, this attribution did not hold up when I tested mechanisms by using cognate traits and affective pathways. First, I replicated the interaction between expectancies and stress in a laboratory study (Segerstrom, Castaneda, & Spencer, 2003). The relationship between optimism about academic qualifications and *in vivo* immunity was moderated by task type: When participants rested, optimism correlated with more robust immune responses, but when they performed an arithmetic task that was both difficult and impossible to master, optimism correlated with less robust immune responses. The study also tested whether this interaction would occur when optimism was replaced in the model with one of two related personality characteristics: neuroticism (predisposition to negative thoughts and feelings) or conscientiousness (predisposition to being hard-working and goal-oriented). Conscientiousness duplicated the optimism effect, but neuroticism did not. Therefore, these findings indicated that the aspect of optimism that has to do with positive thoughts and feelings (i.e., the inverse of neuroticism) was not responsible – the aspect that has to do with persistence and engagement (i.e., conscientiousness) was.

Second, in another naturalistic study with law students, optimism and relocation once again interacted, but affective states did not mediate the relationship (Segerstrom, 2006), further calling into question that idea that expectancy violation and disappointment were acting on optimists' immune systems.

These findings led me to a different interpretation of mechanisms occurring with first-year law students who did not relocate to attend law school: These students were experiencing conflict between their academic and personal lives. More optimistic students were attempting to engage and overcome this conflict, whereas their less optimistic counterparts were disengaging from goals (Segerstrom & Solberg Nes, 2006). Differences in responses to the *in vivo* immune test potentially reflected a cost of pursuing an optimistic but energetically demanding strategy (Segerstrom, 2007a; *in press*).

Situational optimism

It is interesting to note that dispositional optimism, the broad, characterological measure of outcome expectancy, seems to relate to the immune system differently than does situational optimism, the narrower measure of expectancy about a specific situation. Again using first-year law students, I have examined the effects of beliefs about one's own abilities and future outcomes specifically with regard to law school.

Situational optimism has stronger main effects on immunity, particularly measures of cellular immunity, than does dispositional optimism. In my first sample of law students, positive expectancies about law school correlated with higher numbers of helper T cells as well as higher cytotoxicity at mid-semester, controlling for baseline immune parameters (Segerstrom et al., 1998). This relationship was recently replicated in a within-person design, where changes in law school optimism covaried with changes in *in vivo* cellular immunity over the first 6 months of law school (Segerstrom & Sephton, 2010). Situational optimism also has different mediators. Although dispositional optimism's relationship to immune function is not mediated by affect, there was evidence that about half the relationship between situational optimism and immune function could be accounted for by affect, particularly positive affect.

One important characteristic of the within-person covariation between law school optimism and immunity was that this relationship had a significant random effect, that is, there was variability between ►



Keynote article

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people in the strength of this relationship. This variability was not related to dispositional optimism (i.e., law school optimism was not more or less strongly related to immunity based on levels of dispositional optimism), minority status, standardized test scores, or undergraduate academic performance. The only variable that approached significance was gender, with men having a stronger relationship between law school optimism and immune function than women did.

This was interesting in light of other findings in this sample with regard to gender that suggest that optimistic attitudes and behaviors might associated with better cellular immune function for men than women. Law school is a traditionally male environment, and although women are now equally represented in most US law schools, they still face both explicit and implicit sexism. The difficulty inherent in confronting and attempting to overcome sexism (an uncontrollable quality of the environment) might make active coping strategies less effective. As might be expected in this kind of environment, male law students had stronger immune responses than women, a gender difference that was not found in a control group. Furthermore, this difference was largely driven by the frequency and immune correlates of active coping. Men were more likely to report that they coped with law school stress by persisting or trying harder, and those men who reported coping strategy had more robust in vivo immune responses than those who did not. Women were less likely to report this coping strategy. Furthermore, those women who did report this coping strategy had less robust in vivo immune response than those who did not (Flynn, Schipper, Roach, & Seegerstrom, 2009).

Conclusion

The effects of optimism – and potentially optimistic modes of coping such as persistence and re-engagement – on the immune system appear to be exquisitely sensitive to the demands as well as the obstacles inherent in the situation. This sensitivity may indicate both benefits and costs and even a tradeoff between psychosocial and physiological benefits and costs. Limited resources may dictate that a person who chooses to exert the effort it takes to make progress on diverse goals cannot run all systems at full throttle, and the immune system may be a place from which resources can be diverted. Depending on the person's own psychological and physiological strengths and vulnerabilities, this "decision" may have positive or negative consequences for health. ■

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