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Do Agonistic Motives Matter More Than Anger? Three Studies of Cardiovascular Risk in Adolescents

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Abstract

Objective—Three motivational profiles have been associated with recurring psychological stress in low-income youth and young adults: Striving to control others (*agonistic striving*), striving to control the self (*transcendence striving*), and not asserting control (*dissipated striving*); Agonistic Striving has been associated with elevated ambulatory blood pressure during daily activities. Three studies tested the hypotheses that: (1) Agonistic Striving is associated with poor anger regulation, and (2) Agonistic Striving and poor anger regulation *interactively* elevate blood pressure.

Design—Motivational profiles, anger regulation, and ambulatory blood pressure were assessed in a multiethnic sample of 264 urban youth.

Main outcome measures—(1) Anger regulation/recovery during laboratory challenge; (2) anger / blood pressure during daily activities (48 hours).

Results and conclusion—Replication of the profiles in distant cities showed they occur with similar frequency across differences of region, race, and gender. Analyses controlling for body size, race, and gender revealed that individuals with the Agonistic Striving profile had higher ambulatory pressure, especially during social encounters. They became more openly angry and aggressive when challenged, but did not exhibit difficulty regulating anger in the laboratory, nor did they feel more angry during monitoring. However, individuals with the Agonistic Striving profile who did display poor anger regulation in the lab had the highest blood pressure; deficient self-regulatory capability amplified the positive association between Agonistic Striving and cardiovascular risk in both genders and all ethnic groups. Although anger is thought to increase

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cardiovascular risk, present findings suggest that anger and elevated blood pressure are *co-effects* of agonistic struggles to control others.

Keywords

Anger regulation; Stress; Cardiovascular disease; Adolescent health

Stressful social relationships are implicated as risk factors for a variety of health problems, including cardiovascular disease; risk is greatest in those exposed to significant interpersonal stress over a long span of time (Smith et al., 2007). Social action theory (Ewart, 1994, 2009; Ewart, in press) offers a motivational analysis of self-regulatory mechanisms that create such exposure, and that can be modified to enhance human health through social-relational means. In a social action view, chronic stress develops through daily interpersonal encounters that induce strivings to influence, manage, or control others. We have shown in research with low-income multiethnic community samples of adolescents and young adults that persistent stress induced by striving to influence others is associated with higher blood pressure during normal daily activities—especially social interactions—than is persistent stress induced by striving to achieve demanding self-goals (Ewart, in press; Ewart & Jorgensen, 2004). We now report results of three new studies in a different multiethnic urban community to test the hypothesis that the association between self-goals and blood pressure in daily social encounters is moderated by anger regulation skills.

Methods to assess personal motives that shape daily stress experiences were developed in Project Heart, a series of community-based studies in Baltimore that, since the mid-1980's, have investigated how chronic exposure to social and psychological challenges affects the development of hypertension from adolescence into young adulthood in high-risk Black and White youth (e.g., Ewart, 1994, 2004; Ewart & Jorgensen, 2004; Ewart & Kolodner, 1991, 1993, 1994). Goals are identified with an emotionally evocative “stress narrative” task administered during the Social Competence Interview (Ewart, Jorgensen, Suchday, Chen, & Matthews, 2002; Ewart & Kolodner, 1991); assessment of “implicit” goals inferred from the narratives (see below) lets one ask if certain types of goals are more likely to foster stress, and if stress exposure is moderated by the ability to regulate negative emotions (Ewart & Kolodner, 1994).

Social-Motivational Analysis of Interpersonal Stress and Cardiovascular Risk

The theoretical framework guiding this research distinguishes between inwardly focused goals aimed at altering the self, and outwardly focused goals aimed at altering the external environment (Ford, 1992); striving to alter one's social environment (“agonistic” focus), as opposed to oneself (“transcendence” focus), is expected to generate higher blood pressure levels and greater cardiovascular risk (Christenfeld, Glynn, Kulik, & Gerin, 1998). Moreover, strong goal commitment, reflected in vigorous emotionally expressive speech during the interview, is expected to amplify the association between striving agonistically to alter one's social environment, higher blood pressure, and higher cardiovascular risk (Ewart & Kolodner, 1994).

Three Motivational Profiles

Data on participants' stress-related goals collected in successive Project Heart samples revealed that inward and outward goal orientations represent dichotomous mutually exclusive categories rather than a continuous dimension from inward to outward focus (Ewart, 1994; Ewart & Jorgensen, 2004; Ewart et al., 2002). The two goal orientations

combine with high and low levels of emotional expressiveness to form three emergent goal-expression configurations or profiles (Ewart, 1994; Ewart, in press; Ewart & Jorgensen, 2004). One large group of individuals exhibits a distinctive *Agonistic Striving* profile characterized by a high level of emotional expressiveness, a strong agonistic goal focus, and a low transcendence focus, while another large group exhibits a distinctive *Transcendence Striving* profile characterized by a high level of emotional expressiveness, a low agonistic focus, and a strong transcendence goal focus. A third group exhibits a profile characterized by a low level of emotional expressiveness and a relative lack of goal focus. Unlike individuals with strong Agonistic or Transcendence goal orientations, the latter are more guarded, disclose less, and speak with less affect. We have labeled this pattern “avoidant,” or “dissipated” (Ewart, in press)

Cardiovascular Consequences of Agonistic Stress

A social action perspective suggests that Agonistic Striving may increase risk for hypertension, heart disease, and stroke (Ewart, 1991, 1994; Ewart, in press). Attempts to influence or control others involve trying to shape the course of a social interaction, an aim that has been found to evoke pronounced rises in blood pressure (Ewart, Taylor, Kraemer, & Agras, 1991; R. A. Wright, Dill, Green, & Anderson, 1998). An agonistic goal focus requires that one remain alert and on guard with others, in a state of heightened vigilance, a pattern associated with increased systemic vasoconstriction reflected in elevated total peripheral resistance and diastolic blood pressure, which happens to be the hemodynamic response profile elicited by the Social Competence Interview (Ewart, Jorgensen, Schroder, Suchday, & Sherwood, 2004). Such responses are thought to contribute to sustained hypertension by promoting vascular remodeling (Folkow, 1990), which is regarded as one mechanism by which hostile social environments may increase cardiovascular risk (Schwartz et al., 2003). Thus, by chronically inducing states of hypervigilance during daily social encounters, individuals who strive to control others may unknowingly increase their vulnerability to cardiovascular disorders (Gump & Matthews, 1998; Lovallo & Gerin, 2003). On the other hand, persons who energetically pursue self-development goals (Transcendence Striving) should experience less interpersonal stress (Ewart, 1994; Ewart, in press). This possibility was supported in research with a community sample of Black and White youth that tested predictions derived from social action theory and previous findings; relative to the Transcendence Striving profile group, individuals with the Agonistic Striving profile exhibited higher mean levels of diastolic pressure during normal daily activities, especially during social encounters (Ewart & Jorgensen, 2004).

Beyond Trait Hostility

These findings encourage further study of the Agonistic, Transcendence, and Dissipated profiles as qualitatively different motivational categories. By affording new insights into *causal* mechanisms of psychological stress, the motivational profiles may suggest new ways to enhance preventive intervention. Unlike constructs such as Type A behavior, hostility, or trait anger, dominance, or antagonistic personality (which are construed as behavioral trends or averages), a social-motivational analysis specifies how modifiable self-goals motivate, guide, and organize social expectancies, appraisals, behaviors, emotions, and physiological responses to increase stress vulnerability or enhance resilience.

Motivation, Self-Regulation, and Anger

A social action analysis distinguishes between motivational and self-regulatory mechanisms of stress vulnerability and exposure (Ewart, in press). Motives affect interpersonal stress *directly* by influencing the type, frequency, and character of day-to-day social encounters; self-regulation skills affect stress levels *indirectly* by shaping the course that an interaction

takes and how one responds to it. Motives may foster stress also by shaping emotional reactions to threatening events. Previous research has established a direct link between agonistic motives and cardiovascular risk indexed by ambulatory blood pressure. Three new studies reported here extend this work by testing the hypotheses that self-regulatory capabilities *moderate* the link between agonistic motives and blood pressure, and heightened anger arousal *mediates* this relationship (Siegman & Smith, 1994). The research design is shown in Figure 1, which summarizes the major hypotheses and the sequence and timing of the studies. The present report follows this outline.

General Method

Participants in this research took part in three separate assessments to measure motivational profiles, anger regulation and recovery skills, anger responses to personal threats assessed in the laboratory and during and daily activities, and ambulatory diastolic pressure. Diastolic pressure was chosen as the primary cardiovascular outcome variable in these studies because it is highly sensitive to changes in peripheral resistance related to vasoconstriction, a large rise in diastolic pressure is associated with threat appraisals (Blascovich, Spencer, Quinn, & Steele, 2001) and marks the hemodynamic signature of the Social Competence Interview (Ewart et al., 2004). Moreover, the Agonistic profile was characterized by higher ambulatory diastolic pressure levels in prior research (Ewart & Jorgensen, 2004).

Study 1

Study 1 first tested the prediction that the three stress profiles identified in the Baltimore research would be replicated in a new demographically similar population in a different city and region of the United States, and that the Social Competence Interview would evoke the signature “vascular” response (reflected in increased diastolic pressure) in this sample. More importantly, this study extended previous research by evaluating the hypotheses (Figure 1) that persons with the Agonistic profile experience greater anger arousal when re-experiencing a recurring personal stressor, and that increased anger is associated with increased diastolic responding. Prior research (Ewart & Jorgensen, 2004; Ewart et al., 2004) indicated that the Social Competence Interview, by focusing attention on a personally important threat, evokes equivalent diastolic responses in Agonistic and Transcendence profile groups. But angry emotions may be a mechanism by which agonistic motives increase blood pressure, and it is possible also that angry emotions may affect blood pressure independently of agonistic motivation.

Method

Participants—The sample included 264 high school students who participated in Project Heart 5, a study of psychological stress and cardiovascular risk in low- to middle income urban youth and young adults. All participants attended a large public high school in Syracuse, New York, that draws students from throughout the city. Students in ninth grade were invited to participate in the research after a parent had given consent; all procedures were approved by the institutional review board of Syracuse University. Participation rates were high: About 80% of parents gave consent, and an equivalent percentage of students with parental consent chose to participate. The sample included 110 Blacks, 106 Whites, and 48 persons of other ethnic self-identifications; their mean age was 14.4 years ($SD = 0.5$ years). Fifty-five percent of participants were female; gender ratios were equivalent across ethnic groups, $\chi^2(2) = 1.00, p = .61$. The median family income reported by parents was \$25,000; half of the parents had completed high school.

Participants were excused from classes to participate in assessments, which were conducted in a field laboratory located in an office dedicated to the project. Participants were excluded

from assessment if they reported tobacco, caffeine, or medication use on the day of the interview. Prior to the interview, participants' height and weight were recorded and, after 10 min quiet rest, 3 blood pressure recordings were obtained at 2-min intervals with a Dinamap Vital Signs Monitor (Model #8100), Critikon, Tampa, FL); the second and third reading were averaged to yield an estimate of initial resting blood pressure. The Quetelet body mass index was computed by the formula: Weight (Kg) / Height (Meters)².

Interview procedure—Measures of goal-directed striving and expressiveness derived from audiorecordings and interviewer ratings were used to identify the Agonistic, Transcendence, and Dissipated profiles. The interview procedure has been described elsewhere (Ewart & Jorgensen, 2004; Ewart et al., 2002); a detailed manual is available from the first author (Ewart, Ditmar, Suchday, & Sonnega, 2007). Participants first describe and relive a problem situation that causes them recurring personal stress, then they pretend that they are a movie director making a film about a person like themselves with a similar problem. They are invited to invent a desirable but realistic ending for the film, and to construct an appropriate plot line. The ending suggests the participant's (implicit) goal in situations that often cause stress; the ability to vividly describe the stressors, and to express the emotions they arouse, indexes the goal's importance in daily life. The interviewers—White female graduate students in clinical psychology—were trained by the first author; audio recordings of interviews were monitored regularly to ensure adherence to the interview protocol. Interviewers were not aware of the study hypotheses.

Profile scales—A reliable and valid coding system (Ewart & Ditmar, 2006) was used to measure goal-directed strivings and emotional expressiveness from two sources: (a) Interviewer ratings completed immediately after the interview; and (b) interview audiorecordings coded by trained observers. Scale items and data on reliability and validity are available in Ewart et al., 2002. Interviewer ratings provided a direct observational assessment, unaffected by problems with recording procedures that sometimes occur in field settings, or by loss of data due to a participant's desire to not have an audio recording made. The ratings by independent coders were used to validate the interviewer data, and to permit comparisons with previous studies that used the same audio coding protocol. Interviewer ratings were made on 7-point Likert-type scales (1 = *Not at all*, 7 = *Very much*); observers used 5-point scales with identical anchor points (coders used a rating format used in previous studies, to permit cross-study comparisons; interviewers used a format developed for this project). Descriptions of scale content are available in Ewart et al., 2002, and also on line as supplemental materials. The internal consistencies of the scales, assessed on interviewer ratings by Cronbach's alpha (N = 264) were: *Expressiveness*, .93; *Agonistic Striving* (Self-Defense, .78; Acceptance-Affiliation, .87); *Transcendence Striving* (Approval-Seeking, .89; Self-Improvement, .93). A previous study found these scales to have adequate temporal stability over a 3-month period (Ewart et al., 2002).

Coding procedure—Codings were 5 graduate students in clinical psychology trained and supervised by the first author; training materials included a detailed coding manual and recorded samples from interviews. Levels of inter-rater agreement estimated by Pearson coefficients exceeded $r = .80$. Pairs of coders' ratings agreed within 1 unit on the 5-point rating scale on 90% or more of comparisons. Correlations between the interviewers' ratings and the coders' ratings (the mean of two coders) exceeded $r = .66$.

Subjective affect—Participants reported their negative and positive affect on 7-point Likert-type scales before and immediately after completing the interview. They rated the extent to which they felt Angry, Nervous, and Sad (1 = *Very slightly or not at all*, 7 = *Extremely*), as well as their positive feelings of Alert Energy (1 = *Extreme sleepiness*, 7 =

Extremely awake and energized), and Pleasant Affect (1 = *Extremely unpleasant feelings*, 7 = *Extremely pleasant feelings*). These ratings were made at the end of a pre-interview resting baseline before the interview started, and again immediately after the interview. At the second assessment, they were asked to indicate specifically “how you felt *during the interview* when talking about the problem that causes you stress.” Changes in emotion were assessed by subtracting the first emotion rating from the second.

Diastolic Reactivity—Blood pressure was recorded with the Dinamap Vital Signs Monitor. After the procedure was described and the recording equipment was attached, the participant sat quietly for 8 min. The interviewer then introduced the interview, and conducted the 10-min procedure, which was followed immediately by a 6-min recovery baseline. Eleven readings were recorded at 2-min intervals as follows: Pre-interview resting baseline, 4 readings; Interview, 4 readings; post-interview recovery baseline, 3 readings. The mean of the last 2 readings recorded during each baseline was the Baseline mean; the mean of the first 3 readings recorded during the interview was the interview mean. The baseline mean was subtracted from the interview mean to derive a diastolic reactivity score.

Results

The prediction that the Agonistic, Transcendence, and Dissipated stress profiles would be replicated in a new community sample was tested by performing a combination of hierarchical and *k*-means cluster analytic procedures to identify the number of motivational subgroups in the sample and to define the distinctive profiles of goals and expressive behaviors that characterized them (Aldenderfer & Blashfield, 1984; Wishart, 2006). These procedures are described in detail elsewhere (Ewart & Jorgensen, 2004). Figure 2 shows the resulting clusters profiles represented as T-scores on the Expressiveness, Agonistic goals, and Transcendence goals scales; the clusters obtained from the present study sample in Syracuse, shown on the right of Figure 2, are juxtaposed with the corresponding cluster profiles obtained earlier in a Baltimore sample (Ewart & Jorgensen, 2004). The present cluster profiles clearly fit the predicted Agonistic, Transcendence, and Dissipated patterns, and closely approximated the corresponding cluster profiles obtained in Baltimore. After 14 participants were excluded as outliers due to profiles that differed by ≥ 3 SD's from all cluster means, the remaining sample of 250 exhibited the demographic and motivational profile characteristics shown in Figure 1. Chi-square tests disclosed that the three clusters did not differ significantly with respect to gender, race, or age (all values of $p \geq .61$).

One-way ANOVAs comparing the three cluster profile groups on indices of body mass and initial resting blood pressure levels revealed no statistically significant differences. The mean body mass index and resting blood pressure levels of the three profile groups closely approximated those of the full sample, which were: body mass index, $M = 25.4$ ($SD = 6.1$), systolic pressure, $M = 116.4$ mmHg ($SD = 14.8$ mmHg); and diastolic pressure, $M = 63.3$ mmHg ($SD = 8.9$ mmHg). These findings replicate the cluster profile characteristics reported in the previous study (Ewart & Jorgensen, 2004).

Analytic procedure for cluster comparisons—Having replicated the three predicted profiles in this sample, it now was possible to test predicted differences between the Agonistic and Transcendence profile groups. The remaining analyses in the Profiling Study, and all analyses in Anger Studies 1 and 2 used the same analytic approach, which consisted of planned group contrasts to test a priori hypotheses. Each contrast used a general linear model with type-III sums of squares solutions (SAS Institute, Cary, NC) to test predicted profile group differences. Further exploratory analyses comparing the Agonistic and Transcendence groups to the Dissipated group were conducted by performing post hoc tests with a Scheffe adjustment. In the analyses of cardiovascular outcomes, we followed the

initial profile group comparisons with secondary analyses to determine if the group differences might be attributable to body size, gender, or race—variables often associated with diastolic pressure. This second analysis included Profile group and Body Mass, Gender, Race, and all interactions of these variables; in cases where one or more of the latter variables was significantly associated with diastolic pressure, the Profile group comparisons were repeated in an analysis that included (controlled for) the correlated variable(s). These analyses are reported only when the control variable(s) accounted for significant variance in the dependent variable.

Does Agonistic Striving increase anger responses to personal threats?—This hypothesis was tested with planned contrasts comparing the Agonistic and Transcendence profile groups on participants' ratings of anger and other emotions experienced before and during the interview. Group differences in affect during the pre-interview baseline were evaluated first, followed by predicted group differences in changes in affect while reliving a personally stressful experience during the interview. Results are shown in Table 1.

The analysis of *baseline* affect ratings detected no significant Agonistic - Transcendence profile group differences in the levels of reported negative affect (Anger, Sadness, Anxiety) before the interview. Significant group differences, however, were found in baseline positive affect; planned a priori comparisons between the Agonistic and Transcendence profile groups disclosed that individuals with the Agonistic profile reported feeling less Alert Energy, $t(249) = -2.63, p = .01$, and less Pleasant Affect, $t(249) = -1.93, p = .05$, than persons with the Transcendence profile.

Analyses of *changes* in affect revealed that, compared with the Transcendence profile group, persons with the Agonistic profile experienced larger increases in Anger, $t(249) = 3.08, p = .01$, and Sadness, $t(249) = 3.18, p < .001$, during the interview but also experienced larger increases in alert Energy, $t(249) = 2.13, p = .03$. The Agonistic and Transcendence groups did not differ significantly with respect to the other affect variables.

Corresponding exploratory Scheffe-adjusted comparisons with the Dissipated Striving group indicated that, during the pre-interview *baseline*, persons with this profile reported lower levels of Alert Energy than the Transcendence group, $t(249) = -2.95, p = .02$, but did not differ from the Transcendence or Agonistic groups with respect to the other affect variables. Scheffe-adjusted comparisons evaluating *changes* in emotion during the interview indicated that changes reported by persons with the Dissipated profile did not differ from those reported by those with the Agonistic or Transcendence profiles.

Does the interview evoke the signature surge of diastolic pressure?—As in previous research (Ewart, Jorgensen, & Kolodner, 1998; Ewart, Jorgensen, Schroder, Suchday, & Sherwood, 2005; Ewart & Kolodner, 1991, 1993), the Social Competence Interview evoked the large signature surge in diastolic pressure, which rose by a mean 10.9 mmHg (SD = 6.5 mmHg) above its baseline level of 64.2 mmHg (SD = 6.1 mmHg), which is equivalent to 1.8 baseline SD's above the pre-interview resting level. As in previous studies, systolic pressure rose by a mean 10.8 mmHg (SD = 8.4 mmHg), or about 1 SD above the resting baseline of 111.5 mmHg (SD = 10.2 mmHg), and heart rate rose only by a mean 5.4 bpm (SD = 5.9 bpm) above its baseline level of 76.8 bpm (SD = 10.4 bpm), or about half an SD. Planned group contrasts controlling for Body Mass, Gender, and Race, indicated that profile group differences in baseline diastolic levels and diastolic reactivity to the interview were not statistically significant. Thus, the interview evoked the predicted signature diastolic surge in all profile groups.

Do anger responses to personal threats increase diastolic reactivity?—This hypothesis was tested by correlating the Anger change score and the diastolic, systolic, and heart rate change scores. The resulting coefficients were not statistically significant (all values of $p \geq .76$).

Discussion

Study 1 reproduced in a new urban sample, in a different region of the US, the same motivational profiles that had emerged earlier in Baltimore (Ewart & Jorgensen, 2004). The profiles occurred with equal frequency across differences of ethnicity and gender. The Social Competence Interview evoked the predicted surge in diastolic pressure, equivalent to nearly two SD's of baseline pressure. The changes were of similar magnitude all three profile groups; all reacted similarly to an important personal threat.

As predicted, persons with the Agonistic profile reported greater increases in anger during the interview, as well as greater sadness. It is worth noting, however, that these feelings were accompanied by increased alert energy, which may be regarded as a positive affective state (Watson, Clark, & Tellegen, 1988). The hypothesis that angry emotions aroused by reliving a personal stressor increase blood pressure (or heart rate) was not supported; the correlations between changes in anger and changes in blood pressure were not significant.

Study 2

Study 2 evaluated the possibility that Agonistic Striving impairs one's ability to regulate angry emotions, thereby increasing cardiovascular risk (Jorgensen, Johnson, Kolodziej, & Schreer, 1996). Repeated exposure to interpersonal conflict causes one to become angry more quickly and intensely when challenged, to behave more aggressively, and to use fewer constructive problem solving strategies (Granic & Patterson, 2006). It is possible too that, during a stressful interpersonal exchange, individuals with the Agonistic Striving profile have difficulty controlling their anger by shifting their attention to positive thoughts, memories, or anticipations that let them generate and express non-hostile or friendly affect, and thereby "repair"(or redirect) a challenging encounter.

This analysis generates two separate hypotheses, one involving the manner and degree to which persons with the Agonistic profile attempt to regulate anger when aroused ("regulation" hypothesis), and the other involving their ability to engage in self-regulatory activities that let them recover from angry episodes in social settings ("recovery competence" hypothesis). The *regulation* hypothesis predicts that, when recalling and describing a recent anger-provoking event, individuals with the Agonistic profile will exhibit more intense anger, and their account of the incident will offer less evidence of deliberate efforts to regulate angry emotions, relative to individuals with the Transcendence Striving profile. Further, the *recovery competence* hypothesis predicts that, once angered, individuals with the Agonistic profile will have greater difficulty disengaging from anger and generating positive emotions that could help them reshape social encounters.

Data obtained with the Social Competence Interview in Study 1 did not address these questions because participants were free to select the personal threat that caused them the greatest recurring distress; for some participants (e.g., the Agonistic-focused), such threats evoked intense anger, for others (e.g., the Transcendence-focused) they did not. Thus, the assessment of anger was confounded with type of threat. In Study 2, therefore, all participants were asked to perform a standard anger recall task that permitted comparisons of the three profile groups on anger *regulation*, or how they managed anger during a real-life incident. In addition, to measure the ability to *recover* from anger, we devised a new assessment technique guided by research on emotion regulation, which suggests that affect

modulation in stressful situations is facilitated by shifting one's attention away from distressing thoughts or environmental stimuli and by attending selectively to positive internal and external cues (Gross & Thompson, 2007).

But in the midst of a stressful interpersonal encounter it often is not possible to regulate one's anger by stopping to think about something else, or by taking time to privately reappraise or reframe one's understanding of the problem. Resolving the conflict often involves quickly shifting attention to a positive goal or concern that both parties share; a "win-win" strategy that lets both "transcend" the conflict by focusing on a higher-level shared concern (Ewart, in press). Such "online" anger recovery through cooperative refocusing calls for an ability to instantly access positive self-thoughts and expectations that may contribute to mutual understanding, and to express them in a friendly way. A novel anger recovery (transcendence) task was used in Study 2 to evaluate the hypothesis that the ability to quickly recover from anger by shifting attention and expressing friendly affect is impaired in persons with the Agonistic profile. This protocol also allowed us to determine if impaired anger regulation might affect diastolic recovery, and thus might mediate a link between agonistic motives and cardiovascular responses (Figure 1).

Method

Participants—Individuals who completed Study 1 were invited to take part in Study 2; 213 (85%) participated. The Profile groups did not differ significantly with respect to demographics, body mass or resting pressure. Study 2 was conducted 2.5 months after Study 1.

Anger Transcendence Challenge—To test the hypothesis that individuals with the Agonistic profile have difficulty transcending anger by quickly accessing positive thoughts and using them to build mutual understanding, we developed a new social attention shifting task, the "Anger Transcendence Challenge" (Ewart, 2005). In this procedure, participants first recall and describe a recent situation that made them very angry. Then they are immediately asked to perform an affiliative self-disclosure exercise that requires them to generate friendly affect in an imaginary social encounter. The recovery hypothesis predicts that, when performing this exercise immediately following anger recall, individuals with the Agonistic profile will exhibit less friendly or positive affect, and slower diastolic recovery, than individuals with the Transcendence profile.

This 12-min protocol consisted of Self-Focus (3-min), Anger Recall (3-min), and Anger Transcendence (6-min). It was preceded and followed by 5-min baselines during which the participant rested quietly while blood pressure was recorded. The Self-Focus task prepared the participant for Anger Recall by directing attention inward (also was facilitated by having the participant face a blank wall during the procedure). During Self-Focus, the participant was asked to "walk me through your day." This was followed by Anger Recall; the participant was asked to describe a recent occasion when "you felt so angry you thought you might lose it." Next, the interviewer quickly introduced the Anger Transcendence task, which consisted of two exercises in affiliative self-disclosure. The first was to describe a personal memory that "you might share with a friend you are just getting to know because this memory reveals something important about you." This was followed immediately by a "future projection" task that invited the participant to describe "your life and friendships one year from now." The protocols were implemented by the Study 1 interviewers.

Diastolic Reactivity and Recovery—Blood pressure was recorded at 1-min intervals during baselines and task protocols. *Reactivity* scores were computed by subtracting the mean of the last three baseline readings obtained immediately before the interview (minutes

3 to 5) from the mean of the second and third readings obtained during Anger Recall. The 11 readings obtained between the last Anger Recall reading and the end of the final resting baseline were used to estimate Recovery blood pressure. The rate of *recovery* was derived by calculating the *area under the curve* formed by these readings, using a geometric approach (Kario et al., 2002).

Anger regulation behavior scales—Anger regulation behavior exhibited during the Anger Recall task was coded from interview audiorecordings by trained observers. Indices of anger *regulation* were derived by rating behaviors described in participants' narrative accounts of their anger experience, as well as participants' demeanor when reliving the anger-provoking incident during the interview; ratings were made using 5-point Likert-type scales (1 = *Not at all*, 5 = *Very much*). The trained observers rated the extent to which the participant's narrative and demeanor exhibited five aspects of anger regulation derived from the literature on anger and cardiovascular disease risk (Siegman & Smith, 1994); each aspect of anger was represented by two to four items: Anger Intensity, exhibits intense anger (a) during incident, (b) during interview; Angry Aggression (a) angrily confronted or attacked someone, (b) tried to get revenge or even the score, (c) attacked another's character, said mean things; Hostile Reaction, (a) feels cynical, bitter, untrusting, (b) shows disgust, contempt, for someone (c) complains, whines, (d) pities self; Suppression; (a) did not express anger openly, (b) concealed emotions, (c) removed self from situation; Constructive Problem Solving: (a) tried to discuss, resolve problem, (b) constructively and calmly asserted self.

Friendly Affect index of anger recovery—Participants' ability to recover from anger was coded from interview audiorecordings by a different team of trained observers. Indices of anger *recovery* were derived by rating participants' expressions of *friendly affect* during Anger Transcendence. Participants' ability to recover from anger by shifting focus and engaging in friendly self-disclosure was assessed with a Friendly Affect scale which consisted of three items: (a) friendly attitude/ demeanor (e.g., toward interviewer); (b) positive emotional content; (c) positive non-verbal emotional tone / vocal expression. Each of the three items was rated on a 9-point Likert-type scale (1 = *Not at all*, 9 = *Very much*). The Friendly Affect score was computed by summing the three item scores.

Coding procedure—Coders were six graduate students in clinical psychology who were trained and supervised by the first author. The Anger Recall and Transcendence segments of the protocol were rated at separate times by different coders. All interviews were coded independently by two coders; levels of inter-rater agreement estimated by Pearson coefficients were above .77 for all scales.

Subjective anger recovery—At the end of the initial resting baseline, and again at the end of the recovery baseline, participants completed the same six affect ratings that were administered in Study 1. Pre-post changes in the anger rating indexed subjective anger recovery.

Results

Study hypotheses were tested with a priori group contrasts. All profile group comparisons in Studies 2 and 3 followed the analytic procedure used in Study 1.

Does Agonistic Striving impair anger regulation?—To test the prediction that, compared with the Transcendence group, persons with the Agonistic profile will display more intense anger during Anger Recall, and their narratives will reveal less effort to regulate angry emotions, planned group comparisons were performed on observer ratings of

anger regulation behaviors indexed by higher levels of Anger Intensity, Angry Aggression, and Hostile Reaction, and lower levels of Anger Suppression and Constructive Problem Solving. The prediction that individuals with the Agonistic profile would exhibit greater diastolic reactivity was tested by comparing diastolic changes during Anger Recall (changes in systolic pressure and heart rate were examined also).

Results of these analyses are shown in Table 2. Planned profile group comparisons revealed that, as predicted, individuals with the Agonistic profile exhibited higher levels of Anger Intensity during Anger Recall than did individuals with the Transcendence profile, $t(210) = 3.92, p < .001$. Similar results were found for the planned Agonistic and Transcendence group comparisons on other indices of anger regulation as follows: Aggression, Agonistic behaved more aggressively when angry than Transcendence, $t(210) = 2.98, p < .001$; Anger Suppression: Agonistic made more attempts to conceal angry emotions than Transcendence, $t(210) = 3.76, p < .001$; Hostile Reaction: Agonistic expressed more lingering hostility and contempt than Transcendence, $t(210) = 2.00, p = .05$. Planned Agonistic and Transcendence group comparisons on ratings of Constructive Problem Solving revealed that, as predicted, individuals with the Agonistic profile made less use of constructive conflict resolution techniques than individuals with the Transcendence profile did, $t(210) = -1.95, p = .05$.

Post hoc Scheffe-adjusted comparisons between the Dissipated profile group and the Agonistic profile group disclosed that persons with the Dissipated profile exhibited lower levels of Anger Intensity, $t(210) = -6.79, p < .001$, Aggression, $t(210) = -2.94, p = .01$, Anger Suppression, $t(210) = -3.73, p < .001$, and Hostile Reaction, $t(210) = -3.56, p = .002$; but did not differ with respect to Constructive Problem Solving. Post hoc comparisons between the Dissipated group and the Transcendence group disclosed that persons with the Dissipated profile exhibited lower levels of Anger Intensity, $t(210) = -2.84, p = .02$, but that the two profile groups did not differ significantly with respect to Aggression, Suppression, or Hostile Reaction. Those with the Dissipated profile exhibited lower levels of Constructive Problem Solving than individuals with the Transcendence profile, $t(210) = -2.43, p = .05$.

Does Agonistic Striving increase diastolic reactivity?—Responses to Anger Recall are shown in Table 3. The prediction that persons with the Agonistic profile would exhibit greater diastolic reactivity during Anger Recall was tested with planned profile group comparisons controlling for Body Mass, Gender, and Race. Comparisons of *baseline* diastolic levels did not detect significant group differences. Planned comparisons of diastolic *reactivity* scores indicated that, during Anger Recall, individuals with the Agonistic profile exhibited a larger surge in diastolic pressure than did individuals with the Transcendence profile, $t(216) = 2.30, p = .02$. The Agonistic group exhibited a significantly larger change of heart rate relative to the Dissipated group, $t(216) = 2.45, p = .01$. No other significant profile group differences were detected.

Does Agonistic Striving impair anger recovery?—A second set of analyses tested the anger recovery hypothesis by comparing Profile group responses during Anger Transcendence with respect to: (a) levels of Friendly Affect; and (b) diastolic recovery curves.

Friendly Affect—Group comparisons revealed that the level of Friendly Affect generated by individuals with the Agonistic profile did not differ significantly from the level of Friendly Affect generated by individuals with the Transcendence profile. Post hoc Scheffe-adjusted comparisons with the Dissipated profile group indicated that the level of Friendly Affect generated by individuals with this profile was significantly lower than the levels generated by the Agonistic profile group, $t(210) = -2.89, p = .02$; or the Transcendence

profile group, $t(210) = -4.58, p < .001$. Thus, persons with the Dissipated profile proved to be the ones who had difficulty generating Friendly Affect following anger.

Diastolic Recovery—Initial analyses indicated that diastolic recovery was not related to body mass, gender, or race, or their interactions. Group comparisons showed that there were no significant differences in recovery curves between the profile groups (the largest value of $t(211) = 1.19, p = .24$). Thus, the profile group comparisons did not support the hypothesis that individuals with the Agonistic profile experience impaired diastolic recovery after anger. Similar results were obtained for systolic and heart rate recovery.

Does anger impair diastolic recovery?—This hypothesis was tested, first, by correlating changes in subjective anger levels (Recovery Baseline minus Baseline 1) with blood pressure recovery. None of the correlations with diastolic (systolic, heart rate) recovery curves were statistically significant (all values of $p > .39$). Examination of correlations between blood pressure recovery indices with the behavioral index of Anger Intensity during the Anger Recall task revealed that none of the coefficients were significant (all values of $p > .18$).

Discussion

Observer ratings of anger regulation behavior during a recent anger-provoking incident supported the predictions that individuals with the Agonistic profile exhibit fewer attempts to regulate anger than individuals with the Transcendence profile, as indexed by observer ratings of Anger Intensity, Aggression, and continuing Hostile Reaction, and by less use of Constructive Problem Solving techniques in their anger narratives. The one regulatory activity exhibited with higher frequency by the Agonistic group was Anger Suppression, perhaps reflecting attempts to keep an escalating angry exchange from spinning out of control. The prediction that the Agonistic profile would be associated with greater diastolic reactivity during anger was supported. Thus, the Agonistic profile was associated with more aggressive and less regulated anger, and with increased diastolic pressure during anger recall.

The prediction that the Agonistic profile would be associated with an inability to *recover* from anger (indexed by lower levels of Friendly Affect), accompanied by impaired diastolic recovery, was not supported. Persons with the Agonistic profile appeared fully capable of shifting their attention to positive self-thoughts and generating friendly affect immediately after feeling intensely angry, when invited to do so. Nor was diastolic recovery related to anger. Neither the change in subjective anger assessed after the recovery task, nor the behavioral index of Anger Intensity exhibited during anger recall, were correlated with diastolic (systolic, heart rate) recovery.

Post hoc Scheffe-adjusted exploratory group comparisons indicated that persons with the Dissipated profile exhibited the lowest levels of anger arousal during the Anger Recall task. Like persons with the Agonistic profile, those with the Dissipated profile used fewer Constructive Problem Solving tactics when angered. The latter expressed less Friendly Affect during Anger Transcendence than did individuals with the other profiles, suggesting that the Dissipated profile may be associated with difficulty in generating positive emotions.

Study 3

The Agonistic profile group's larger diastolic response to the Anger Recall task may or may not indicate higher cardiovascular risk. Assessments of anger and blood pressure reactivity in laboratory settings do not necessarily generalize to the normal environment (Ewart & Kolodner, 1993), nor are they generally regarded as useful indices of actual

cardiovascular disease risk, which is indexed more reliably by prevailing levels of ambulatory blood pressure aggregated over the course of a typical day's activities (Kamarck & Lovallo, 2003). Previous research with the Social Competence Interview found that the Agonistic profile predicted higher prevailing diastolic pressure throughout a normal day, especially during social encounters, indicating that people with the Agonistic profile may indeed be at greater risk (Bao, Threefoot, Srinivasan, & Berenson, 1995). Study 3 sought to replicate this important finding, and to determine if higher mean levels of diastolic pressure during social interactions in persons with the Agonistic profile are associated with inability to regulate or recover from anger during Anger Transcendence in Study 2, or with a higher mean daily intensity and frequency of anger arousal.

Study 3 tested two hypotheses about the associations between motivational profiles, emotion regulation skills, anger arousal, and diastolic pressure in the natural environment. We predicted that, as in previous research (Ewart & Jorgensen, 2004), individuals with the Agonistic profile would exhibit higher mean levels of ambulatory diastolic pressure during normal activities, especially during social encounters, and thus are at greater risk. Our first hypothesis posited that the impact of agonistic motives on blood pressure levels is moderated by anger recovery skills; individuals with the Agonistic profile who in Study 2 generated less friendly affect during Anger Transcendence will exhibit higher mean levels of ambulatory diastolic pressure. Our second major hypothesis was that, during daily activities, the social interactions experienced by individuals with the Agonistic profile are characterized by a greater intensity and frequency of angry emotions than are the social interactions experienced by individuals with the Transcendence profile. The higher diastolic pressure of the Agonistic profile group is mediated by a higher mean intensity and frequency of anger arousal throughout the day.

Method

Participants—Individuals who completed Study 2 were invited to take part in Study 3; 167 (78%) of Study 2 participants did so. Profile groups did not differ significantly with respect to demographic composition, body mass, or initial resting blood pressure.

Risk Index: Anger and 48-Hr ambulatory blood pressure—At the end of the laboratory Anger Recall / Transcendence session Study 2, participants were fitted with an ambulatory monitor (Oscar, SunTech Medical, Morrisville, NC) which was programmed to record blood pressure and heart rate at 30-min intervals during daytime hours and at 60-min intervals during nighttime sleep. During the 48-hr recording period (two days and two nights), participants recorded their activities and angry emotions on an electronic diary using custom software (Palm Pilot zire22, Sunnyvale, CA) which prompted them to complete a brief series of questions each time a reading was recorded. They were instructed to hold their arm motionless during the reading, and not to complete the diary entry until after the reading was taken. The entries included their location (school: in class, between classes or at lunch; home; in car or bus; other), position (*lying down, sitting, standing*), activity level (*walking, running/ climbing stairs*), whether they had interacted with someone in the past 10 min ("Yes" / "No"), and the degree to which they felt "Angry-Upset" (earlier work revealed that some persons reported instances of anger as "feeling upset" with someone). The diary form also included several other questions and appraisals that are not the focus of this study. Anger ratings were made on 7-point Likert-type scales (1 = *Not at all*, 7 = *Very much*). Although most participants went to bed between 10pm and midnight, and arose between 5am and 7am, it turned out that many reported that they did not go to sleep soon after going to bed or did not arise soon after waking. Therefore, to estimate blood pressure during nighttime sleep, 2-hr "shoulders" were interposed after 10pm and before 7am, and nighttime Sleep was defined as the interval between 12am and 5am.

To enhance adherence to the monitoring protocol, a representative of the research project contacted the participant in the evening after the first day of monitoring to answer questions and review the protocol. Participants visited the Project Heart lab at school the next morning to check the monitor and make adjustments as needed. They returned it to the lab after the 48-hr recording period.

Data preparation—Ambulatory data were edited to identify erroneous values. Following the recommendations of Lee and colleagues (Lee, Farmer, Swift, & Jackson, 1995), means and SD's of blood pressure were computed separately within each activity category in males and in females. Values that were more than two SD's above or below the activity category mean for all persons of the participant's gender were examined manually to determine if they might represent errors. Approximately 1.4% of the readings were judged to be erroneous by these criteria and were discarded. Data quality was examined further by estimating the interval between the time when the Oscar completed a reading and the time when the participant completed the diary entry for that reading. Sixty-nine percent of the readings were followed within 5 min by an accompanying diary entry. The reading to diary entry time interval did not differ significantly among the three Profile Groups ($F = 0.17$, $p = .84$), nor did it correlate significantly with Friendly Affect scores, diary reports of Anger, or with levels of pressure (all values of $p > .10$). Activities reported in the diaries were grouped into three categories that reflected study hypotheses and yielded sufficient numbers of readings to permit analysis: (a) Social Interaction; (b) Awake (7am to 10pm); and (c) Sleep (12am to 5am). Within each category, participants' reports of anger (electronic diary) and ambulatory recordings (Oscar) were averaged to generate an activity category mean. "Social Interactions" were encounters that occurred ≤ 10 min prior to a reading, and were reported within 5 min after the reading.

Results

All tests of predicted profile group differences followed the same analytic approach used in Study 2. Study 3 differed from Study 2, however, in that the mediating and dependent variables—anger frequency/intensity and diastolic levels—were created by aggregating multiple observations within the three major daily activity categories to form reliable indices of risk.

Do anger recovery skills moderate the association between Agonistic Striving and ambulatory pressure?—Before testing the predicted associations between the Agonistic profile, anger recovery skills, and elevated ambulatory diastolic pressure (Figure 1), we compared the profile groups on the numbers of ambulatory readings recorded during various daily activities, as reported on the electronic diaries: (a) *Awake* (yes/no); (b) *Social Interaction* (yes/no); and (c) *Position / Activity Level* (reclining, sitting, standing, walking / running). Preliminary analyses revealed that the numbers of readings, and the numbers of readings in each activity category, did not differ among the three profile groups; values of $t(166)$ ranged from 0.09 ($p = .99$), to 1.80 ($p = .20$).

Analytic approach—Predicted associations between stress Profiles and ambulatory data were tested with ANOVA's that used Type III sums of squares solutions; dependent variables were the mean levels of diastolic pressure recorded during Social Interaction, while Awake, and while Asleep. These analyses tested the a priori hypotheses that individuals with the Agonistic profile exhibit higher cardiovascular disease risk than individuals with the Transcendence profile due to increased vascular resistance during Social Interaction and when Awake overall, as reflected in higher levels of diastolic pressure, and that individuals with the Agonistic profile who have poor anger recovery skills exhibit the highest diastolic levels. To test this hypothesis, we used an analytic approach in

which the dependent variable, diastolic pressure, was predicted by Body Mass, Gender, Race, Profile Group, Friendly Affect, and the Profile Group by Friendly Affect interaction. Initial analyses of predicted profile group effects on ambulatory pressure that included Body Mass, Gender, Race, and all interactions, indicated significant main effects for Gender and Body Mass, and for Profile Group, but not for Race. None of the interaction terms involving Body Mass, Gender, or Race were statistically significant. Accordingly, models testing the predicted Agonistic- Transcendence group differences in cardiovascular risk, as well as the Profile Group by Friendly Affect interaction, included Gender and Body Mass as covariates. To obtain a more complete picture of long-term risk, this model also was tested with systolic pressure and heart rate levels in addition to diastolic pressure. Significant interactions were evaluated by testing the simple effect of Friendly Affect on diastolic pressure separately within each profile group to see if anger recovery was related to mean diastolic levels in individuals within each level of the *profile* variable, and by comparing the simple effects of the three profiles to see if they differed as predicted.

Profile Group and Friendly Affect—Results of analyses testing predicted profile differences in pressure levels are shown in Table 4. Planned comparisons revealed that, during Social Interactions, the mean diastolic pressures of individuals with the Agonistic profile were significantly higher than the diastolic pressures of individuals with the Transcendence profile, diastolic, $t(166) = 2.84, p = .01$; mean systolic and heart rate levels also were higher in the Agonistic group: Systolic, $t(166) = 2.95, p = .004$; heart rate, $t(166) = 2.08, p = .04$. Although our hypotheses focused on social interactions, we also tested the prediction that the same pattern of profile group differences would be observed when blood pressure and heart rate were aggregated across all Awake readings but not when aggregated during Sleep. Results confirmed this prediction; individuals with the Agonistic profile exhibited higher mean diastolic levels when Awake than individuals with the Transcendence profile, $t(166) = 2.15, p = .03$; systolic pressure was higher in the Agonistic group also, $t(166) = 2.55, p = .01$. There were no other significant Agonistic vs Transcendence group differences. Nor did planned comparisons of group means during Sleep reveal any statistically significant group differences. All Scheffe-adjusted exploratory comparisons with the Dissipated group were non-significant; values of $t(166)$ ranged from .02 ($p = .99$) to 2.05 ($p = .14$).

Next, we tested the hypothesis that the Agonistic profile and poor anger recovery skills (low levels of Friendly Affect during Anger Transcendence) interact to raise diastolic pressure during Social Interactions. The analyses detected a significant main effect of Profile Group on all diastolic, systolic, and heart rate variables (e.g., Table 4), but disclosed no significant main effect for Friendly Affect. However, as predicted, the hypothesized interaction between Profile Group and Friendly Affect in predicting mean diastolic pressure did prove to be significant, $t(166) = 1.74, p = .05$. To evaluate this interaction, we tested the simple effects of Friendly Affect on diastolic pressure separately within each of the profile groups. These analyses revealed a significant slope only in the Agonistic group, Beta = $-.96, SE = .37, p = .01$; in the Agonistic profile group, lower levels of Friendly Affect during Anger Transcendence predicted higher mean levels of diastolic pressure while interacting with others during normal daily activities. Friendly Affect was unrelated to diastolic pressure in the Transcendence group, Beta = $-.18, SE = .34, p = .59$, and the Dissipated group, Beta = $.33, SE = .38, p = .38$.

We then compared the significant slope of the Agonistic profile group to the nonsignificant slopes of the other two profile groups by performing two sets of contrasts; first, two separate contrasts compared the significant Friendly Affect slope of the Agonistic group to the two nonsignificant slopes of the Transcendence group and the Dissipated group, while a second contrast compared the slope of the Agonistic profile group to the slope that characterized the

remainder of the sample (i.e., the Transcendence and Dissipated groups combined). The latter comparison maximized statistical power by combining the Transcendence and Dissipated groups, thus including all 167 participants in a single contrast.

The first set of comparisons revealed that the difference between the slope of the Agonistic profile group and that of the Dissipated group was statistically significant, $Beta = -1.29$, $SE = .53$, $p = .02$, and that the difference between the slope of the Agonistic group and the Transcendence group was in the predicted direction but did not achieve statistical significance, $Beta = -.78$, $SE = .50$, $p = .12$. The comparison involving all Study 2 participants (Figure 3) revealed that the slope of the Agonistic group differed significantly from that of the combined Transcendence + Dissipated group, $Beta = -1.03$, $SE = .45$, $p = .02$, consistent with the hypothesis that the combination of an Agonistic focus on controlling others and poor anger recovery skills indexed by Friendly Affect during Anger Transcendence is associated with significantly higher prevailing diastolic blood pressure levels during Social Interactions.

Does anger mediate the association between Agonistic Striving and ambulatory blood pressure?—Analyses testing this hypothesis disclosed no evidence for profile differences in the mean intensity of anger experienced during daily activities, $F(2, 167) = .99$, $p = .61$. We also computed the percentage of occasions during the day when participants reported feeling any degree of anger at all, that is, those occasions when an anger rating exceeded a value of “0.” Seventy-five percent of participants reported at least one occasion on which they felt some degree of anger ($M = 1.82$, $SD = .83$). Further analyses disclosed no statistically significant profile differences in the frequencies with which participants felt some degree of anger, $F(2, 167) = 0.69$, $p = .50$, nor in the percentages of occasions when they did so, $F(2, 167) = .50$, $p = .61$. Thus, the hypothesis that the Agonistic profile is associated with greater subjective anger during normal daily activities, and that anger thus might mediate the link between Agonistic Striving and ambulatory blood pressure, was not supported.

Does anger increase diastolic blood pressure levels?—The association between the mean intensity of anger during daily activities (Interacting, Awake) and diastolic / systolic pressure levels was evaluated also. None of the correlations were statistically significant (coefficients ranged from $r = .00$ to $.04$, all values of $p \geq .63$). Correlations between anger frequency and ambulatory blood pressure levels ($r = .05$ to $-.10$) were nonsignificant also (all values of $p \geq .23$).

Discussion

As predicted, individuals with the Agonistic profile exhibited higher mean levels of diastolic pressure, especially during social interactions, than individuals with the Transcendence profile. They also had higher mean levels of diastolic pressure throughout the entire day (Awake). These findings closely replicate findings of the earlier study of a demographically similar multi-ethnic population in Baltimore, thus indicating that the Agonistic profile is associated with significantly greater cardiovascular risk. The data supported the hypothesis that the link between the Agonistic motivational profile and risk is magnified by an inability to recover from anger by generating and expressing friendly affect. But the finding that all three motivational profile groups experienced angry emotions with similar mean frequency and intensity over the 48-hour monitoring period, and that anger levels were unrelated to ambulatory blood pressure, undermines the hypothesis that the connection between the Agonistic profile and higher disease risk is mediated by anger, or that angry emotions independently increase risk.

Although the mean level of diastolic pressure observed in the Dissipated profile group during social interactions was 3.2 mmHg lower than the mean diastolic pressure of the Agonistic profile group, and was much closer to levels observed in the Transcendence group, the Agonistic-Dissipated difference was not found to be statistically significant. This statistical result contrasts with findings in the earlier Baltimore study, where a mean Agonistic vs Dissipated Social Interaction diastolic difference of the same magnitude—3.2 mmHg—was significant at $p = .03$ (Ewart & Jorgensen, 2004). The inconsistency between the two studies may be due in part to the present decision to use a more conservative Scheffe-corrected statistical test in all exploratory post hoc comparisons involving the Dissipated group.

General Discussion

Three categorically distinct motivational profiles—*Agonistic Striving*, *Transcendence Striving*, and *Dissipated Striving*—occur widely across differences of geographic region, race, and gender, and hold differing implications for exposure to chronic psychological stress and related risk for hypertension, heart disease, and stroke (Bao et al., 1995; Treiber et al., 2003; Schwartz et al., 2003). This study is the first to analyze how social-motivational and self-regulatory mechanisms separately and interactively raise blood pressure during daily interpersonal encounters to generate large individual differences in cardiovascular risk. Present data indicate that the Agonistic profile, which reflects recurring stress involving struggles to influence, manage, or control other people, confers significantly greater risk than does the Transcendence profile, which reflects recurring stress involving struggles to alter, direct, or control the self.

Uncovering the Motivational Origins of Cardiovascular Risk

Previous research suggested that the Agonistic profile may confer significant risk for future cardiovascular illness (Ewart & Jorgensen, 2004). Study 3 replicated this important finding in a new population: Even after controlling for body size and gender correlates of blood pressure in this sample, young people with the Agonistic profile were found to exhibit higher levels of ambulatory diastolic / systolic pressure and heart rate during daily social interactions than individuals with the self-focused Transcendence profile; they also exhibited higher levels when awake more generally. As predicted, impaired self-regulation magnified this relationship. When blood pressure levels were regressed on the Agonistic profile, self-regulatory ability (Friendly Affect), and their interaction, the Agonistic profile and the interaction term each accounted for significant variation in diastolic levels, but self-regulation alone did not. This finding supports the importance of distinguishing between motivational and self-regulatory mechanisms, and is consistent with the social action hypothesis that agonistic motives affect stress and blood pressure levels *directly*, by influencing the type, frequency, and character of social encounters, whereas self-regulatory abilities influence stress and blood pressure levels more *indirectly*, by moderating the course and impact of challenging interpersonal exchanges.

It is noteworthy that, during social interactions, the absolute magnitude of the difference between the mean diastolic pressures of persons with the Agonistic profile and persons with the Transcendence profile (adjusted for body mass and gender) was approximately 4.5 mm Hg, which is virtually identical to the corresponding Agonistic vs. Transcendence diastolic pressure difference of 4.6 mmHg observed in the earlier study of a demographically similar Baltimore sample (Ewart & Jorgensen, 2004). In both the Syracuse and the Baltimore studies, the magnitude of this difference was equivalent to approximately two-thirds of the standard deviation of diastolic pressure levels recorded in the laboratory a resting baseline (pre-interview). The mean social interaction diastolic difference between the Agonistic and Dissipated groups was 3.2 mmHg, or nearly half of a resting SD, in both studies. These large

differences, found in two geographically distant populations, suggest that the Agonistic profile may denote significantly greater risk for future disease. The fact that the frequency of social interactions was equivalent across the three profile groups strongly suggests that it is the *mode of interpersonal engagement* associated with Agonistic Striving, and not just interacting with someone, that raises blood pressure levels and increases risk.

Profile group differences in blood pressure were not detected during resting baselines that preceded and followed the laboratory tasks, or during nighttime sleep. This finding is consistent with the inference that the profile differences in ambulatory pressure levels are mediated by agonistic motives, and with evidence that early pathophysiologic changes in hypertension are not reflected in levels of resting pressure until people enter their thirties or forties (Bao et al., 1995).

Do Agonistic Motives Matter More Than Anger?

Agonistic motives might conceivably affect blood pressure by frequently triggering angry emotions, and anger also might independently increase risk. A strength of the present studies is the multiple and varied assessment of angry affect, including subjective anger aroused by a significant personal threat, subjective and behavioral indices of anger evoked by re-living an anger-arousing incident, and subjective anger experiences sampled repeatedly in the natural environment over the course of two days. These data supported the hypothesis that the Agonistic profile is associated with anger-proneness, yet failed to support the hypothesis that agonistic motives increase ambulatory blood pressure levels by evoking anger, or that angry affect independently increases cardiovascular risk.

As predicted, Agonistically –focused individuals experienced greater anger and sadness when describing a recurring personal stressor during the Social Competence Interview. In anger arousing situations assessed by the Anger Recall task, they became more aggressively angry, more prone both to express and suppress anger, to feel lingering resentment later, and less inclined to engage in constructive problem solving. These behaviors were accompanied by larger surges of diastolic pressure than were seen in persons with the Transcendence profile. Yet persons with the Agonistic profile were not less capable of generating friendly affect after the anger recall task. Nor did they exhibit impaired diastolic recovery following anger. Recovery was neither mediated by nor related to anger: Neither the change in subjective anger following the recall task, nor the behavioral index of Anger Intensity exhibited during recall, was correlated with diastolic / systolic recovery. Individuals with the Agonistic profile thus appear to become intensely angry and aggressive when challenged, and are less likely to regulate their anger, but do not seem to have greater difficulty regaining their composure than do individuals with the other profiles. This suggests that the anger regulation deficits seen in those with the Agonistic profile are more attributable to social control motives than to lack of social-emotional competence. For example, an angry outburst may serve a goal of influencing, controlling, or dominating someone, rather than reflecting an underlying inability to regulate hostile affect. Viewed together, this pattern of findings suggests that, as determinants of long term cardiovascular illness risk, agonistic motives may matter more than anger.

This suggests a need for new thinking about the possible links between anger and illness. Indeed, present data raise the possibility that anger and elevated blood pressure are outcomes of agonistic striving to control others, implying that both may be regarded as *co-effects* of the Agonistic motivational profile. We measured anger with a method used widely in health research, which involves asking the respondent to make a cognitive appraisal that he or she experiences an emotion that should be labeled “anger.” But it is possible that agonistic motives, by affecting attentional focus, monitoring, and other activities, may alter brain states in ways that elevate blood pressure *directly* without generating the cognitive

appraisals that create emotional experience (Kagan, 2007). It is possible, too, that in cases where striving for control does induce cognitive appraisals that create emotions, these affects take the form of emotion *blends*. Much anger mixes positive and negative affect, for example, as when one relishes feelings of “righteous wrath,” or savors “sweet revenge.” Note that, in Study 1, persons with the Agonistic profile who reported feeling greater anger during the Social Competence Interview also reported greater feelings of alert energy, which may be regarded as a positive affect.

Why Do Agonistic and Transcendence Motives Affect Risk Differently?

Social action theory’s motivational analysis (Ewart, in press) systematizes a wide and diverse research literature in the field of stress related illness. The concept of control focus offers a testable model to explain why agonistic motives may repeatedly elicit stress responses. Decades of research in animals and humans have shown that the magnitude of physiologic responses to stress can be modulated by an organism’s ability to predict or control threatening events (Bandura, 1997; Ewart, in press). Struggling to influence, manage, or control another person’s actions entails investing in a goal and outcome that the other person ultimately controls, and can foster power struggles whose eventual consequences and ramifications are hard to predict or manage. Transcendence striving, on the other hand, can be highly stressful because one may fail to achieve an important self-goal or standard. Yet predicting one’s own behavior is less uncertain than predicting another’s. And, although achievement threats and failures can foster intense feelings of anxiety and despondency, it often is feasible to modulate such emotions by readjusting one’s goals, standards, strategies, or implementation plans.

The Dissipated Striving Profile: Unhappy and Alone?

Present findings shed further light on the Dissipated profile. Post hoc Scheffe-adjusted group comparisons indicated that participants with this profile exhibited the lowest levels of anger arousal during the anger recall task, yet, like persons with the Agonistic profile, were less likely than persons in the Transcendence profile group to handle their anger by engaging in constructive problem solving. Of the three groups, individuals with the Dissipated profile were least able to generate friendly affect during Anger Transcendence following anger recall. Overall, they appeared unhappy, guarded, and somewhat withdrawn. A motivational analysis suggests that, in some individuals, the Dissipated profile could indicate difficulties in forming goals needed to engage with others, or to experience strong positive emotions (e.g., optimism, hope), and could be associated with an irritable reactive interpersonal style that fosters social isolation, a condition associated with a variety of health risks (Hawkey & Cacioppo, 2007; Uchino, 2009).

Limitations and Future Directions

A limitation of this research is the relatively short period (2 days) when anger was monitored; anger might have assumed a larger role had participants recorded their emotions over a longer interval (Averil, 1982), or had focused on specific conflict situations. A social action perspective suggests, for example, that persons with the Agonistic profile may display anger *tactically*, to deter, intimidate, or coerce specific individuals; their other social exchanges may not provoke anger (Ewart, in press). A resort to anger may be dictated by situational factors, such as whether one is trying to influence an unfriendly peer as opposed to a close friend, one’s teacher or employer, a younger sibling, or a parent (J. C. Wright, Lindgren, & Zakriski, 2001). Tactical use of anger by persons with the Agonistic profile might not have adverse cardiovascular consequences beyond those associated with striving for interpersonal control. Such research would benefit from the use of longitudinal and experimental methods; the cross-sectional design used in the present study precludes demonstrating the direction of causation. Replication in younger and older age groups could

suggest how motivational and self-regulation mechanisms operate to generate health damaging stress across the life span.

These limitations notwithstanding, the social-motivational approach to stress developed here has the potential to inform causal analysis and guide applied intervention in ways not suggested by other constructs (e.g., hostility, trait anger, Type A). Social action analysis clearly specifies modifiable mechanisms in the form of implicit other-control vs. self-control motives and self-regulatory capabilities, and distinguishes these from angry emotions, hostile beliefs, and antagonistic or domineering attitudes and behaviors. This analysis affords concrete suggestions for prevention. For example, present findings indicate that motivational profiles assessed with a 10-min interview can detect large differences in cardiovascular risk that are not discernable in measures of resting blood pressure or self-reported affect. Data we recently reported elsewhere indicate, further, that participants' self-ratings of personal goals expressed in their Social Competence Interview film narratives, although made on the Agonistic Striving and Transcendence Striving goal scales described above, do not predict their levels of ambulatory blood pressure (Schoolman, Elder, Parekh, & Ewart, 2010). This suggests that motivational profiling methods used here may provide unique and crucial information to enhance prevention by identifying young people who are at significantly greater risk for cardiovascular disease.

Interventions to lower risk should attempt, first, to identify and alter agonistic goals and then, where needed, to offer supplementary training in self-regulatory techniques (e.g., cognitive control, relaxation, meditation) to those agonistically-focused individuals who exhibit difficulties recovering from anger. To enhance resilience, evidence that persons with the Transcendence profile have lower blood pressure when interacting with others suggests that preventive intervention might seek to foster a more "transcendent" approach to interpersonal challenges (e.g., by teaching people how to view social encounters as opportunities for self-development, as in altering self-goals and expectations, and developing communication and interpersonal problem-solving skills; Ewart et al., 1983; Ewart et al., 1984). The larger overarching goal is thus to help those at risk work toward converting their everyday agonistic struggles into transcendence strivings.

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Figure 1.
Three Studies Testing Hypothesized Effects of Agonistic Striving and Anger on Cardiovascular Reactivity, Recovery, and Risk Indexed by Ambulatory Blood Pressure.

Figure 2.

Three stress profiles (Agonistic, Transcendent, Dissipated) generated by cluster analyses of T-scores on the Social Competence Interview Expressiveness (EX), Agonistic Striving (AS), and Transcendent Striving (TS) scales in the Baltimore sample (Ewart & Jorgensen, 2004) and in the present Syracuse sample.

Figure 3.

Interaction between Friendly Affect generated during the Anger Transcendence Challenge in the laboratory and diastolic pressure levels during daily social interactions in the natural environment by Stress Profile Group. The Friendly Affect scale (X-Axis) is shown in standard deviation units.

Self-Rated Affect During Pre- Social Competence Interview Baseline and Change in Affect During the Social Competence Interview By Profile Group.

Table 1

Profile Group							
Affect Rating		Agonistic (n=77)		Transcendence (n=76)		Dissipated (n=96)	
		M	SD	M	SD	M	SD
Angry	Baseline	1.7	2.0	1.5	1.0	1.5	1.0
	Change	0.9 _a	2.1	0.0 _b	1.2	0.4	2.3
Sad	Baseline	1.7	1.9	1.4	1.0	1.4	1.6
	Change	0.9 _a	1.9	0.0 _b	1.2	0.6	1.7
Nervous	Baseline	2.8	2.2	3.0	1.7	2.5	2.0
	Change	0.4	2.1	0.1	1.9	0.7	2.0
Energetic	Baseline	3.9 _a	1.9	4.7 _b	1.4	3.9 _a	2.2
	Change	1.3 _a	2.0	0.6 _b	1.1	0.9	2.1
Pleasure	Baseline	4.5 _a	2.0	5.1 _b	1.3	4.6	2.4
	Change	0.0	2.3	0.1	1.0	0.1	2.9

Note: Significantly different group means are indicated by different subscripts. Contrasts involving the Dissipated profile group are Scheffe-adjusted.

Table 2
Observer Ratings of Anger Regulation Behavior During A Recent Anger Episode By Profile Group

Anger Regulation Behavior	Profile Group					
	Agonistic (n = 78)		Trancendence (n = 76)		Dissipated (n = 96)	
	M	SD	M	SD	M	SD
Anger Intensity	5.9 _a	1.2	5.1 _b	1.2	4.5 _c	1.3
Aggression	6.8 _a	3.0	5.3 _b	2.8	5.3 _b	2.6
Suppression	6.6 _a	1.5	5.6 _b	1.7	5.6 _b	1.6
Hostile Resentment	6.9 _a	1.9	6.3 _b	1.8	5.8 _b	1.5
Problem Solving	2.8 _a	1.4	3.3 _b	1.7	2.7 _a	1.3

Note: Significantly different group means are indicated by different subscripts. Contrasts involving the Dissipated profile group are Scheffe-adjusted.

Table 3
Blood Pressure and Heart Rate During Pre-Anger Recall Baseline and Change During Anger Recall By Profile Group.

Measure	Profile Group					
	Agonistic (n = 67)		Transcendence (n = 72)		Dissipated (n = 78)	
	M	SD	M	SD	M	SD
Systolic (mm Hg)						
Baseline	112.9	11.6	111.3	9.1	112.2	10.3
Change	9.6	9.1	10.3	9.6	10.1	9.3
Diastolic (mm Hg)						
Baseline	62.5	6.0	61.8	6.3	62.2	6.7
Change	10.8 _a	5.9	8.4 _b	6.8	9.3	6.4
Heart Rate (bpm)						
Baseline	80.4 _a	11.9	76.2 _b	10.3	77.6	12.8
Change	4.7 _a	6.2	4.0	5.5	2.4 _b	4.7

Note: Significantly different group means are indicated by different subscripts. Means are least square means adjusted for body mass, race, and sex (see text). Contrasts involving the Dissipated profile group are Scheffe-adjusted.

Table 4
Ambulatory Blood Pressure and Heart Rate, and Number of Readings Recorded, When Participants Were: (a) Engaged in Social Interaction; (b) Awake (All Readings); and (c) Asleep

Measure and Activity	Profile Group					
	Agonistic (n = 49)		Transcendence (n = 61)		Dissipated (n = 57)	
	M	SD	M	SD	M	SD
Systolic (mm Hg)						
Social Interaction	131.8 ^a	11.1	125.6 ^b	10.8	127.9	11.2
Awake: All readings	131.7 ^a	10.9	126.4 ^b	10.2	128.5	10.5
Asleep	114.5	14.5	109.4	13.9	110.6	13.5
Diastolic (mm Hg)						
Social Interaction	75.7 ^a	8.3	71.2 ^b	8.5	72.5	8.2
Awake: All readings	75.0 ^a	7.6	71.9 ^b	7.7	72.8	7.5
Asleep	57.6	1.3	54.9	1.1	55.3	1.1
Heart Rate (bpm)						
Social Interaction	84.5 ^a	9.7	80.5 ^b	10.1	80.6	9.7
Awake: All readings	84.0 ^a	9.0	80.7 ^b	9.3	80.4	9.0
Asleep	65.8	11.1	66.4	10.1	67.4	9.7
Number of readings						
Social Interaction	20.4	11.9	22.5	13.0	19.2	13.4
Awake: All readings	37.9	14.0	41.8	17.8	38.4	16.2
Asleep	3.3	3.4	4.2	3.2	4.0	3.4

Note: Significantly different group means are indicated by different subscripts. Means shown here are least square means adjusted for body mass and gender (see text). Exploratory contrasts involving the Dissipated profile group are Scheffe-adjusted.