Physical Hardiness and Styles of Socioemotional Functioning in Later Life

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Although the aging literature suggests that there are many paths to later life adjustment, there have been few empirical attempts to identify different patterns of adaptation, or their relation to adaptive outcome. As a way to identify patterns of socioemotional functioning in later life associated with physical hardiness, a cluster analysis was applied to 11 measures of socioemotional functioning in a large sample (N = 1,085) of older adults (65–86 years). Ten subgroups were extracted, with clusters of individuals being primarily defined by social network variables, religious characteristics, and emotion profiles. Groups were then compared on a measure of physical hardiness. Patterns of adaptation characterized by high levels of negative emotions tended to represent less hardy adaptation, although there were nonetheless some patterns of noteworthy exception. In contrast, however, patterns of adaptation characterized by religiosity were typically associated with greater hardiness. Finally, physical hardiness was not exclusively the province of individuals exhibiting close social networks, with some groups high in connectedness being less likely to report high hardiness.

Recent life-span theory has depicted the life course as a process characterized by multidimensionality and multidirectionality in adaptation rather than as a universal progression toward a single end state suggested by earlier theories. Baltes and colleagues (e.g., P. B. Baltes, 1997; P. B. Baltes & Baltes, 1990), for example, model the life course as one of selection, optimization, and compensation. In their model, later life losses—activity limitation, reduced energy, and network attrition—challenge functioning and require heterotypic adaptations. In this manner, individual patterns of development and adaptation emerge from a dynamic interplay between gains and losses, potential and limits, and contextualism (e.g., P. B. Baltes & Baltes, 1990; Labouvie-Vief, 1982; Maddox, 1987). Within this model, a key developmental agenda involves exploring and characterizing the range of adaptive patterns in later life (P. B. Baltes, Lindenberger, & Staudinger, 1998).

Heterotypic adaptation in later life may be particularly salient in the domains of social relations and emotional functioning. Social networks typically narrow as people age, but some losses are due to cohort mortality, whereas other changes are elective and involve socioemotional selectivity (Carstensen, 1991, 1992). Although social network size may generally decline in later life, the growing economic, physical, and mental dependencies that accompany aging (M. M. Baltes, 1996; Blenkner, 1969) may create a competing need to preserve social relations or otherwise compensate. People vary in their preferences for closeness on the one hand and autonomy, solitude, and privacy on the other (M. M. Baltes, 1996; Jung, 1971; Magai et al., 2001; Rook, 1990). For example, the Berlin Aging Study demonstrated that the time older persons spent with others ranged from 10 min for some persons to 1.5 hr for the most active individuals (M. M. Baltes, Wilms, & Horgas, 1993). In terms of adaptation, whereas better developed social relationships, especially close relations, are generally viewed as a protective factor in aging and as having positive associations with health (e.g., Blazer, 1982; House, Landis, & Umberson, 1988; Sorkin, Rook, & Lu, 2002), other relationships may tax the individual’s well-being if they are emotionally demanding or stressful (Biegel, Magaziner, & Baum, 1991; Seeman, 2000). In theory, then, the dynamic interplay between such considerations may produce an array of social and emotional adaptations (Maddox, 1987; Thomae, 1981).

There has been some recent suggestion that religious beliefs or involvement may offset a lack of close social relations for some persons (e.g., Granqvist & Hagekull, 2000; Kirkpatrick, 1997). Religious beliefs and participation are closely related to positive aging outcomes, particularly life satisfaction (e.g., Ellison & Gay, 1990; French & Joseph, 1999; Pargament, 1997) and the absence of mental disorders (e.g., Hintikka, Koskela, Kontula, & Viinamaeki, 2000). Other authors have, however, argued that religious involvement may be adaptive in later life over and above its association with social support (e.g., Oman, Thoresen, & McMahon, 1999).

Relatedly, religious beliefs or participation may also provide some older adults with a powerful means of dealing with stressors. As we discuss more fully in the paragraphs that follow, although regulatory abilities are generally seen as increasing in later life, the frequency of potential stressors, particularly losses, may also increase. Research in younger samples has documented considerable variation in an individual’s primary means of dealing with stress. For example, the extent to which persons turn to their networks during times of stress may vary (e.g., Simpson, Rhole, & Nelligan, 1992), as may the exact pathways by which they secure social support (Collins & Feeny, 2000). Stress is a well-established risk factor for health impairment (e.g., Cobb & Steptoe, 1996, 1998), and variations in both stress levels and an individual’s response to them are likely to have profound implications for the person’s health.

Closely related to these changes are other changes in later life emotions and emotion regulation (see Magai, 2001). The influential theories of Carstensen (e.g., Carstensen, 1991,
been comparatively few studies that actively sought to identify patterns of adaptation to later life, to our knowledge there have been considerable variation in the form that this regulation takes. Lawton and colleagues (1999), for example, found that middle-aged and older adults could be typologically classified on the basis of how even or variable their emotions were, how open versus closed to emotional experience they were, how inhibited or expressive they were, and the kinds of emotions that were characteristic of them. Similarly, Labouvie-Vief and colleagues (e.g., Labouvie-Vief et al., 1995) have suggested that there are changes in at least two types of regulation, one involving positivity and the other emotional complexity; this pattern of adaptation includes acknowledging the presence of negative affects. Because of their documented relations with health in older adults (e.g., Consedine, Magai, Cohen, & Gillespie, 2002), affects. Because of their documented relations with health in older adults (e.g., Consedine, Magai, Cohen, & Gillespie, 2002), positive and negative emotion as well as emotion inhibition are specifically considered in the current study.

Although this literature provides a general rationale supporting the expectation that there will be considerable variation in patterns of adaptation to later life, to our knowledge there have been comparatively few studies that actively sought to identify distinct patterns or their relation to adaptive outcome. Smith and Baltes (1999) used cluster analysis to identify groups of older individuals with different patterns of functioning across cognitive, personality, and social domains. Nine groups were identified, ranging from the cognitively fit and extroverted to the severely cognitively impaired, socially isolated. Four of the groups reflected desirable personality characteristics or functioning (e.g., openness), and five reflected less desirable configurations (e.g., negative affect). Using the same database as Smith and Baltes (1999), Staudinger, Freund, Linden, and Maas (1999) also examined facets of “aging satisfaction” in the face of somatic or socioeconomic risk factors. They found that personality, affect, and coping styles were related to psychological resilience.

Although these studies represent an important advance over previous research, the measures of functionality or adaptation used were more psychological than physical. In the Smith and Baltes (1999) study, for example, personality characteristics were deemed “desirable” or “undesirable” on the basis of what the authors judged as a consensus in the psychological literature regarding what is, “on average,” functional versus dysfunctional. In the study by Staudinger and colleagues (1999), resilience was based on the individual’s satisfaction with his or her own aging. Hence, in addition to providing a descriptive work identifying coherent patterns of adaptation in a diverse sample of older adults, we also sought to link patterns of socioemotional adaptation to a further assessment of outcome, namely physical hardness.

Operationalizing the physically hardy individual is a complex enterprise. Inasmuch as such a person can be expected to show better functioning across domains, our consideration of the concept can be related to the concepts of ego resiliency (Block & Block, 1980; Klohnen, 1996), physiological toughness (Dienstbier, 1989), and psychological hardiness (Kobasa, 1979). In terms of concepts specifically developed for gerontology, people who are hardy might also be described as “resource rich” in the manner of Lang (2001; see also Lang, Rieckmann, & Baltes, 2002). In Lang’s framework, resource-rich individuals are those people who adapt holistically, by using multiple physical, psychological, and social resources in a complex balancing act. On the basis of this literature, we chose to measure hardness in keeping with the spirit of its core definitions, which are also logically consistent with the characteristics of our particular older adult sample—we chose to focus on the ability to perform the activities of daily living (ADLs) in the context of declining health.

Specifically, we identify two subgroups of physically hardy and two groups of nonhardy individuals on the basis of their self-reported levels of morbidity and activity limitation. One group of hardy persons, characterized by low morbidity and low activity limitation, is termed the “intrinsic hardiness” group, whereas a second group, defined by high morbidity and low activity limitation, is termed the “earned hardiness” group. The first group can be said to display a physical robustness that fits well with lay concepts of invulnerability and toughness, whereas the second group may be better characterized as showing adaptive responding to physical decline. Although we overtly distinguish our operationalization from that of previous constructs, it shares emphasis with some. Persons who fit within Dienstbier’s (1989) concept of physiological toughness, for example, are characterized by an adaptive physiological response to challenge, low sympathetic nervous system arousal, and strong adrenal–medullary arousal. Individuals in our second group—earned hardiness—are less robust than the intrinsic group insofar as they report greater morbidity. They have, however, nevertheless managed to remain active. We suspect this group to be hardy at the level of coping, that is, they exhibit the ability to maintain functioning in the face of health impairment, stress, or adversity. In comparison to these groups, we also consider the distribution of diverse patterns of socioemotional adaptation across two further, “nonhardy” groups. A third group, characterized by low morbidity and high activity limitation, was termed the “underfunctioning group” because people in this group report greater difficulty with ADLs than might be expected given their health; a fourth group, characterized by high morbidity and high activity limitation, was termed “debilitated.”

In order to identify meaningful patterns that might be associated with differing levels of physical hardness, we used cluster analysis, a multivariate technique for grouping individuals who exhibit similar profiles across a variety of measures (Blashfield & Aldenderfer, 1988). The use of cluster analysis is perhaps particularly well suited to exploring the range of later life adaptation because it does not impose, a priori, a fixed set of categories but is instead guided by the internal systemic coherences between vectors and the naturally occurring groups that are defined by common parameters (Everitt, 1993; Lorr, 1983). Among the particular strengths of cluster analysis are its ability to identify natural groupings within a mixture of entities.
thought to represent several distinguishable populations and its capacity to identify homogeneous subgroups characterized by attribute patterns useful for prediction (Everitt, 1993; Lorr, 1983). It may be particularly appropriate with respect to aging populations because of its sensitivity to aspects of functioning that may be quite heterotypic.

In the present study, we examined 11 socioemotional variables thought to assess emotional functioning in individuals and to index the quality of interpersonal relationships: family relationships, friend relationships, positive affect, religiosity, stress, emotion inhibition, sadness, anger, fear, shame, and interpersonal conflict. In keeping with P. B. Baltes and colleagues’ (1998) call for a developmental research agenda that involves characterizing the range of adaptive patterns in later life, this study was primarily exploratory. We sought to characterize an array of adaptive patterns that could be linked to variations in physical hardiness.

METHODS

Participants

The data for the present investigation of socioemotional functioning and hardiness were taken from a larger population-based study of stress and coping in older Americans. Participants were 1,118 community-dwelling older adults living in a large urban city who were recruited on the basis of a stratified cluster sampling plan. Data on census blocks were gathered from the Household Income and Race Summary Tape File 3A of the 1990 Census files. Random selection without replacement was used to choose samples of block groups from each stratum. Trained interviewers were sent to conduct interviews with respondents who lived within the selected blocks and who received $20.00 for their participation. For further details of the sampling design, see Magai and colleagues (2001).

Because of the presence of missing data on certain variables and listwise deletion of data during analysis, the final total sample size was 1,085.

The mean age of the sample was 74 years (SD = 6.0), with 40% being persons of European descent and 60% being persons of African descent. As indicated in Table 1, 62% of the participants constituted a “young-old” age group (65 to 75 years); of these, 58% were female, 50% had a high school degree or better, 50% had less than a high school education, 43% were married, and 60% were single, divorced, or separated. Thirty-eight percent of the participants fell into the “old-old” age group (76 to 86 years); of these, 58% were female, 50% had a high school degree or better, and 28% were married.

Procedures

Data were collected during face-to-face interviews that lasted approximately 1½ hr and were conducted in the respondent’s home or another location of his or her choice such as a senior center or a church. The measures were administered in a standard order for all respondents.

Measures

1. Demographics questionnaire.—This first questionnaire elicited information on age, gender, race, and household income.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Young-Old Adults</th>
<th>Old-Old Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>69.9 (3.2)</td>
<td>80.2 (3.2)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>42</td>
<td>32</td>
</tr>
<tr>
<td>Female (%)</td>
<td>58</td>
<td>68</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; High school (%)</td>
<td>50</td>
<td>57</td>
</tr>
<tr>
<td>≥ High school (%)</td>
<td>50</td>
<td>43</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single (%)</td>
<td>60</td>
<td>72</td>
</tr>
<tr>
<td>Married (%)</td>
<td>40</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: Young-old adults are aged 65–75 years, n = 673. Old-old adults are aged 76–86 years, n = 412.

2. Hardiness.—Hardiness was defined for the purposes of the current study as functional capacity relative to total health impairment and illness, or morbidity. For the measures of morbidity and functionality, we relied on scores derived from the physical health scales of the Comprehensive Assessment and Referral Evaluation (CARE) instrument (Golden, Teresi, & Gurland, 1984; Teresi, Golden, & Gurland, 1984). The CARE was originally developed to assess the health and social status of community-dwelling older adults in a cross-national study. The CARE is administered in a semistructured interview format, has been used extensively with older populations, and has demonstrated sound construct validity (Teresi, Golden, Gurland, Wilder, & Bennett, 1984), as well as good concurrent and predictive validity (Teresi et al., 1984). For example, Teresi and colleagues (1984) found that sleep disorder, activity limitation, ambulation, somatic conditions, and heart disease were significantly associated with subsequent mortality at 1 year after initial assessment.

In the present study we used the 12 physical health subscales that consist of 150 items scored on a present–absent basis. The scales tap acute and chronic diseases such as hypertension, stroke effects, cancer, and sleep disorder, and they yield a total impaired health score. The remaining scale, Activity Limitation, consists of 39 items and yields a score indexing functional impairment in the ability to perform ADLs. The coefficient alphas for all scales ranged from .72 for the Respiratory Symptoms subscale to .95 for the Activity Limitations subscale.

Hardiness was operationalized by applying a median split to the data on morbidity and activity limitation and grouping individuals into one of four cells. The first group, characterized by low morbidity and low activity limitation, was the intrinsic hardiness group; the second, defined by high morbidity and low activity limitation, was the earned hardiness group; the third, characterized by low morbidity and high activity limitation, was the underfunctioning group; and the final group, characterized by high morbidity and high activity limitation, was the debilitated group.

3. Quality of social networks.—The strength and quality of social networks was measured by use of the Network Analysis Profile (NAP; Cohen & Sokolovsky, 1979; Sokolovsky & Cohen, 1981). This semistructured interview assesses the quality of the respondent’s kin (family) and nonkin (friends
or neighbors) social network. Respondents indicate the total number of persons in their family (broadly defined as including the extended family) and friendship networks with whom they have had at least a 15-min conversation within the past 3 months or with whom they have engaged in other activities or material exchanges. The NAP also contains an affective–affiliative dimension that includes ratings on whether the respondent can share intimate thoughts, can count on each person, and be understood by each person (each scored 1 for yes and 0 for no). A total affiliative support score for family was calculated as the sum of positive responses (yes to the items) across the three variables summed across all persons rated; a similar score was calculated for nonkin. The alphas for the two scales were both .81. The distributions of these scores were positively skewed (family affiliation skewness = 2.27 and SE = .07; friend affiliation skewness = 2.56 and SE = .07), and they were improved to .36 (.07) and .33 (.07) by use of a standard square-root transformation (Tabachinick & Fidell, 2001).

4. Stress.—The stress measure was taken from the National Survey of Black Americans (Chatters, 1993). Respondents indicate the degree of stress experienced in 10 target life event areas: health, money, job, problems with family or marriage, problems with people outside the family, children, crime, police, love life, and racial conflict. Summing across the event domains yields a total stress score. The Cronbach alpha for the scale was .71. The distribution of the variable, which was positively skewed at .76 (SE = .07), was improved to −.42 (SE = .07) through square-root transformation (Tabachinick & Fidell, 2001).

5. Trait emotions. Negative affects: Anger, fear, sadness, and shame; Positive affect: Joy.—Emotional dispositions were measured by a trait version of the Differential Emotions Scale (DES; Version III; Izard, 1972). There are three items for each of 10 fundamental emotions: joy, surprise, interest, fear, sadness, anger, contempt, disgust, shame, and guilt. Respondents rate, on a scale of 1 to 5, how much each emotion characterizes their day-to-day experience. The scale has been used in numerous investigations of emotion and has strong psychometric properties (Izard, 1972), with alpha coefficients for all scales being .84 or greater. The average 1-week test–retest reliability for the scales is .77. In the present study, we used the four scales associated with clinically significant negative emotions—anger, sadness, fear, and shame. Their alpha coefficients were .80, .78, .85, and .74, respectively. The alpha coefficient for the positive affect of joy was .71.

6. Emotion inhibition.—The tendency to express or inhibit emotion was assessed by means of the Emotions as a Child (EAC) Questionnaire, a 48-item inventory that asked respondents to indicate the extent to which items reflected their response style when they were afraid, angry, sad, and ashamed as a child. Sample items include the following: “I try to solve the problem on my own,” “read,” “withdraw,” “keep the problem to myself,” and so forth. Items for the scale were developed from responses of research participants in another study to questions in an adapted version of the adult attachment interview (Magai, Hunziker, Mesias, & Culver, 2000). Scores for the inhibition items of anger, sadness, fear, and shame subscales were combined to form an aggregate inhibition scale.

Because various authors have suggested that the tendency toward emotion expression or inhibition begins early in life (Houston & Vavak, 1991; Kagan & Snidman, 1991; Matthews, Stoney, Rakaczky, & Jamison, 1986), we used a trait measure of inhibition designed to tap inhibition as a characterological style established in childhood. There is a substantial literature documenting the continuity of expressive patterns over a broad period of developmental time (Magai, 2001).

The 2-week test–retest reliability for the aggregate inhibition score was .72 in an independent sample (n = 60) of adults, and α = .77. In a further independent sample (n = 288, mean age = 27 years, SD = 10.0, and 75% female), scores on the EAC emotion inhibition variable were compared with scores on an adult analog of the EAC: the Present Personality Questionnaire (PPQ), which is a 24-item scale that measures the tendency to inhibit emotion in the respondent’s present life. Sample items include “I have difficulty expressing my anger,” “I try not to let my anxiety show,” and “I call on my friends when i feel sad.” The alpha for the PPQ inhibition scale was .82 and correlated with the inhibition subscale from the EAC scale at r = .58, p < .0001. This shows that the two measures are significantly correlated, though there is still substantial variance unaccounted for. Nevertheless, as indicated in the results section, this (recollected) childhood emotion regulation style seemed implicated in later life hardiness.

Finally, a study of the convergent validation of the emotion inhibition scale with the Ambivalence About Emotion Scale (King & Emmons, 1990) and an adapted version of the Avoidant Coping subscale of the Ways of Coping Scale (Folkman & Lazarus, 1988), in an independent sample of 160 adults, produced correlation coefficients of .59 and .25, respectively.

7. Religiosity.—Because research has indicated that patterns of formal religious participation and personal religious devotions are related to coping and later life adaptation (George, 1994; Pargament, 1997), we used three items that tapped these domains. Participants rated the frequency with which they attended church or temple on a scale of 0 to 4, and the degree to which religion (or God or both) was a source of strength for them on a scale of 0 to 3. These items were combined to create an aggregate religiosity score. The alpha coefficient was .65.

8. Interpersonal conflict.—In order to assess interpersonal conflict, we used the Conflict Tactics Scale (CTS) developed by Straus (1979). The CTS is one of the most well-validated and comprehensive scales for assessing interpersonal conflict. The scale includes a range of responses to disputes between two parties, such as “discussed the issue calmly” and “insulted or swore at the other one,” as well as frequency with which each response was used over the past year (from never to more than 20 times a year). The scale demonstrates good psychometric properties, with norms from a national survey published in Straus (1979). The alpha in the present study was .82.

Analytic Strategy
To identify differing socioemotional styles and examine their relation to hardiness, we chose cluster analysis. Our goal was not to create a definitive typology for classifying individuals in terms of adjustment to aging—their hardiness—but rather to...
examine subgroups of socioemotional similarity in multivariate space and then use cluster membership to predict hardness. In the present study, we used the 11 socioemotional variables already described to cluster individuals. As a first step, the 11 variables were $z$ transformed to ensure a common metric (per Cronbach & Gleser, 1953).

We took a two-stage approach to the cluster analysis. In the first step, we sought to identify the appropriate or optimum number of clusters; in the second, we determined the location of each person in the clusters. To ensure that our results were robust, we performed replications within the larger data set. The overall sample was blocked on gender, race, and income, and persons were randomly assigned to one of two replication samples, balancing for these variables. Members of the two subsamples were separately clustered by use of the Ward $= s$ hierarchical method with squared Euclidean distances, using Clustan software (Wishart, 1999, 2000). We applied the $k$ means clustering algorithm to the two replication samples, and we plotted the means from the two independent samples. The profiles of the clusters from the two analyses were quite consistent with one another and could be interpreted in the same fashion as the clusters in the overall sample. Standardized group means and plots are available from the authors on request.

A number of different rules for determining the number of clusters that best represent a dataset have been proposed (Blashfield & Aldenderfer, 1988; Lorr, 1983). Milligan and Cooper (1985) used Monte Carlo procedures to contrast 30 stopping rules that can be used to discern the number of clusters in a sample. The pseudo-$T^2$ statistic, a measure of the dissimilarity of the two clusters most recently joined, provides an indication of the appropriate number of clusters by means of local troughs in its values (Duda & Hart, 1973). This is seen when a small value of the pseudo-$T^2$ index for a given hierarchical level is followed by a large value for the following fusion. Inspection of the iterative partitions suggested that either a 10- or an 11-cluster solution was appropriate for the first replication sample and a 10-cluster solution for the second. In the overall analysis as well, a 10-cluster solution was indicated as the ideal solution. Table 2 shows pseudo-$T^2$ values for Cluster Solutions 1 to 12 in our sample.

In order to determine final case location in the separate subgroups, we used the $k$ means algorithm and Clustan’s (Wishart, 1999, 2000) focal point option, which reassigns the members of the initial clusters iteratively so as to improve the Euclidean sum of squares (ESS) clustering criterion and finishes when no further moves can be made to reduce the ESS. The program saves a range of best solutions and permits an evaluation of the stability of the solution by using random starts. In the present study, the three top solutions were compared; there was a 96.3% overlap between the first and second solution and a 96.2% overlap between the first and third, indicating robust stability in the cluster structure.

RESULTS

We first present descriptive data on the intercorrelations among the variables entered into the cluster analysis and then proceed to examine the makeup of the clusters and their relation to hardness.

Table 2. Pseudo-$T^2$ Values for Cluster Numbers in the Sample

<table>
<thead>
<tr>
<th>No. of Clusters</th>
<th>Pseudo-$T^2$</th>
</tr>
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<tbody>
<tr>
<td>12</td>
<td>72.27</td>
</tr>
<tr>
<td>11</td>
<td>82.36</td>
</tr>
<tr>
<td>10</td>
<td>85.79</td>
</tr>
<tr>
<td>9</td>
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<tr>
<td>7</td>
<td>157.96</td>
</tr>
<tr>
<td>6</td>
<td>164.77</td>
</tr>
<tr>
<td>5</td>
<td>208.07</td>
</tr>
<tr>
<td>4</td>
<td>261.53</td>
</tr>
<tr>
<td>3</td>
<td>392.34</td>
</tr>
<tr>
<td>2</td>
<td>888.38</td>
</tr>
</tbody>
</table>

Intercorrelation Among the Socioemotional Variables Entered Into Cluster Analysis

Table 3 presents the intercorrelations among the 11 socioemotional variables entered in the cluster analysis. As indicated, family affiliation (quality of social network) was positively associated with positive affect, as might be expected. It was also correlated with anger and interpersonal conflict, although weakly. Friend affiliation was correlated with both positive affect and religiosity. Positive affect was positively associated with religiosity, and both were negatively associated with stress and with the several negative emotions. As would be expected, stress was positively associated with the negative affects and interpersonal conflict, as well as with the tendency to inhibit affect. The negative emotions were all moderately intercorrelated with one another, particularly trait anger, and with interpersonal conflict.

Profiles of Socioemotional Clusters in Older Adults

As already noted, the cluster analysis suggested that 10 clusters best represented the data. Subsequent one-way multivariate analyses of variance (MANOVAs) with cluster membership as the independent variable confirmed, as would be expected, that the clusters were significantly different from one another, with Wilks’s lambda = 0.67,61 and $p < .0001$. Follow-up univariate ANOVAs were significant for all clustering variables (see Table 4). Games–Howell multiple-comparison tests confirmed that each of the derivation variables (clusters) showed substantial differences between at least 27 of cluster pairs, suggesting that each group was a sufficiently separate entity.

Table 4 presents the size of the clusters and their standardized group means. There was satisfactory dispersion across the 10 groups, ranging from 69 members in Cluster 3 to 171 members in Cluster 1. In subsequently labeling the clusters profiles of standardized scores, we take into account differences in the means both within and across clusters (their scatter and pattern of high and low scores). Particular attention was given to the profile peaks (identified in boldface in Table 4), operationally defined as the variables for which members of the cluster scored half a standard deviation higher or lower than the sample mean.

Four clusters were best characterized by their combination of scores on religious and social network variables (Clusters 1, 2, 5, and 9). Cluster 1 had low connectedness with both friend and family networks but reported high religiosity and a pattern of emotion characterized by high positive emotion and low levels
of all negative emotions. This cluster is referred to as religious—socially isolated. Cluster 2 was similarly religious and positive in terms of emotion but was more connected to social networks; this cluster is referred to as religious-connected. In contrast, Cluster 5 individuals were no less connected than these persons, but they reported extremely low religiosity and did not have the same positive emotion profile. They were termed nonreligious-connected. Finally, Cluster 9 members were referred to as nonreligious—socially isolated. They reported poor connectedness and low religiosity, along with low levels of positive affect and greater sadness.

A further three clusters were most clearly defined by their scores on emotion and emotion regulatory variables. Given their scores on anger, stress, interpersonal conflict, and emotion inhibition, Cluster 3 was characterized as a Type A group (Malatesta-Magai, Jonas, Shepard, & Culver, 1992). Cluster 4 was labeled negative affect because of the high scores on all four negative emotions, that is, fear, anger, sadness, and shame, as well as the levels of reported stress. Finally, Cluster 10 individuals had low connectedness with family and reported low stress. However, their profile is most clearly noteworthy for the extremely high scores on the shame and anxiety measures; they were labeled socially shy.

The final three clusters were best characterized by aspects of their coping styles. Cluster 7 was characterized by strong friend but low family networks as well as being high on stress and sadness; they are referred to as the coping with aid of friends group. Conversely, Cluster 6 had a smaller friend network and reported lower sadness and fear. It is their score on emotion inhibition that most clearly defines them; they are referred to as the inhibited group. Lastly, Cluster 8 individuals were low on both family and friend affiliation, but they also reported low stress and low levels of all emotions, both positive and negative; because of this latter pattern, we refer to this group as tranquil.

Cluster Membership and Demographic Makeup of the Clusters

In order to ensure that the cluster patterns were not solely a product of differences in the demographic composition of the groups, we conducted an ANOVA on age and income and chi-square analyses for gender and education with cluster group as the independent variable. There were no significant differences among the clusters with respect to age or income. There was a significant difference among the clusters for gender, that is, $\chi^2(9) = 72.23$ and $p < .01$, and for education, that is, $\chi^2(9) = 57.12$ and $p < .01$. Hays’s (1994) standardized residual method was used to determine which cells were different in magnitude than those expected by chance. If the residuals, which are derived from the expected frequencies, are greater than or less than 1.96, then the frequency for that cell is significantly greater or less than would be expected by chance.

This analysis indicated that there were more men (vs. women) in the inhibited and tranquil clusters than expected by chance, and more women in the coping with aid of friends group. In terms of education effects, there were significantly more highly educated persons in the connected–nonreligious group than expected by chance, and greater numbers of low-education persons in the tranquil cluster. No other cell comparisons were significant.

Cluster Membership and Hardiness

Table 5 presents the cross-classification of cluster profiles by hardiness group. A chi-square analysis indicated that there were significant differences in cluster membership by hardiness group, that is, $\chi^2(27) = 147.93$ and $p < .0001$. To locate where the specific differences were with respect to any particular clusters, we used Hays’s (1994) standardized residual method. The patterns are summarized in Table 5.

Intrinsic hardiness.—Three clusters were significantly more likely to manifest intrinsic hardiness, defined by low illness and low activity limitation: The religious–socially isolated, the religious–connected, and the tranquil clusters. Conversely, the negative affect and nonreligious–connected clusters were less likely to include this group than expected by chance, as were, marginally, persons in the Type A cluster.

Underfunctioning group.—Persons in the negative affect cluster were significantly more likely to be found in the underfunctioning group than would be expected by chance.

Earned hardiness group.—This group, though experiencing a high degree of health impairment, nevertheless had low activity limitation. Persons from the negative affect cluster were significantly less likely to appear in this group, whereas those in the socially shy cluster were more likely than would be expected.

The debilitated group.—This group, the sickest and least hardy of all—characterized by high illness and high activity limitation—was labeled debilitated group. This group, the sickest and least hardy of all—characterized by high illness and high activity limitation—was labeled debilitated group. This group, though experiencing a high degree of health impairment, nevertheless had low activity limitation. Persons from the negative affect cluster were significantly less likely to appear in this group, whereas those in the socially shy cluster were more likely than would be expected by chance.
limitation—had disproportionately fewer numbers of persons from the religious–socially isolated and religious–connected clusters. Conversely, persons from the negative affect cluster were disproportionately likely to be represented in this group.

**DISCUSSION**

The cluster analysis applied to our large sample of older adults generated 10 distinct configurations of social and emotional adaptation. The fact that our cluster analytic technique identified 10 different styles in an older sample is in general keeping with theoretical formulations regarding the diversity of adaptations to age (P. Baltes, 1987), as well as with the relatively large number of styles identified in one other recent cluster analytic study (Smith & Baltes, 1997). There are, furthermore, some noteworthy similarities between the clusters of individuals reported here and those discovered in previous cluster analyses.

Focusing on seven emotion and emotion regulatory factors, Lawton and colleagues (1999), in their study of adults ranging in age from 31 to 60 and older, found five affect–experiential subtypes: free spirited, inhibited, vigorous, even-tempered, and unstable. There are obvious similarities between their inhibited individuals and our Cluster 6 (inhibited), between their even-tempered group and our tranquil cluster (Cluster 8), and, perhaps, between their unstable group and our negative affect group (Cluster 4). However, whereas members in Lawton’s unstable group were characterized by poorer social connectedness, those in our negative affect group were not, a finding that may reflect the fact that network variables form a key part of the clustering procedure in the current study rather than being examined after the cluster analysis, as in Lawton’s study. Smith and Baltes’s (1999) Group 1 (cognitively fit, extroverted, and not lonely) bears some resemblance to our religious–connected group, at least insofar as individuals in both groups were generally positive and well connected.

These similarities noted, however, there were also clear differences between the clusters that emerged across the studies, presumably because the factors entering the cluster algorithms varied. Smith and Baltes (1999) included cognitive variables in addition to social variables, whereas our study focused exclusively on socioemotional factors and, given its prominence in the lives of older cohorts, included religion (Pargament, 1997). It is noteworthy that both negative emotions and religious participation were important in characterizing and distinguishing our clusters, notwithstanding variations in social networks.

Persons from clusters characterized by high levels of negative emotion were typically less likely to manifest either of the hardy patterns—intrinsic or earned hardiness—and were proportionately more likely to fall into either the underfunctioning or debilitated groups. Persons from the Type A cluster were significantly less likely to be in the intrinsic hardness group, as were persons in the negative affect cluster. These latter individuals were also less likely to be in the other “hardy” grouping (earned hardness), and they were significantly more likely to be in the two poor hardness groups—underfunctioning and debilitated.

Although these data are not of a type that permits unambiguous causal interpretation, a number of explanatory possibilities are evident. Although it may be that persons with excessive negative emotion make unappealing social partners (Carstensen, 1995), leading to isolation and a lack of hardiness, the social networks of the Type A and negative affect clusters were no poorer than average. Consistent with previous research, we suggest that the association between clusters defined by high negative emotion and low hardiness is rooted in the characterological negative emotion is directly associated with health. Although reports of ADL limitation or morbidity may be elevated among persons high in negative emotions (Leventhal & Patrick-Miller, 2000), recent theory suggests that characterological negative emotion is directly associated with poor physical outcomes (Mayne, 1999). Prospective studies have shown that negative affect measured at an earlier time is predictive of health at a later time (e.g., Barefoot, Dahlstrom, & Williams, 1983), and the data from Consedine, Magui, Cohen, and Gillespie (2002) show this relation to be independent of the role of negative affect in promoting health-deleterious behaviors.

With respect to the general pattern linking more hardy patterns with negative affect, however, two other findings are worthy of comment. First, the two least hardy groups (Type A

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**Table 4. Profiles of the 10 Clusters: Standardized Group Means for the 11 Socioemotional Variables by Cluster Group**

<table>
<thead>
<tr>
<th>Variable</th>
<th>R-I 1</th>
<th>R-C 2</th>
<th>Type A 3</th>
<th>Neg. Affect 4</th>
<th>NR-C 5</th>
<th>Inhibited 6</th>
<th>CF 7</th>
<th>Tranquil 8</th>
<th>NR-I 9</th>
<th>SS 10</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Family affiliation</td>
<td>−.64</td>
<td>.78</td>
<td>0.45</td>
<td>0.08</td>
<td>0.66</td>
<td>−.36</td>
<td>.48</td>
<td>−.22</td>
<td>−.03</td>
<td>−.51</td>
<td>58.21</td>
</tr>
<tr>
<td>2. Friend affiliation</td>
<td>−.62</td>
<td>.89</td>
<td>0.22</td>
<td>0.01</td>
<td>0.66</td>
<td>−.51</td>
<td>.74</td>
<td>−.67</td>
<td>−.12</td>
<td>−.30</td>
<td>94.60</td>
</tr>
<tr>
<td>3. Positive affect</td>
<td>.66</td>
<td>.92</td>
<td>0.07</td>
<td>−.76</td>
<td>0.00</td>
<td>0.35</td>
<td>−.07</td>
<td>−.72</td>
<td>−.12</td>
<td>−.17</td>
<td>83.21</td>
</tr>
<tr>
<td>4. Religiosity</td>
<td>.76</td>
<td>.65</td>
<td>−.24</td>
<td>−.65</td>
<td>−.10</td>
<td>0.38</td>
<td>.79</td>
<td>−.38</td>
<td>−.07</td>
<td>0.63</td>
<td>114.22</td>
</tr>
<tr>
<td>5. Stress</td>
<td>−.22</td>
<td>−.64</td>
<td>0.94</td>
<td>0.97</td>
<td>0.13</td>
<td>−.06</td>
<td>.52</td>
<td>−.78</td>
<td>0.39</td>
<td>−.64</td>
<td>60.35</td>
</tr>
<tr>
<td>6. Inhibition</td>
<td>−.23</td>
<td>−.35</td>
<td>0.58</td>
<td>0.42</td>
<td>−.19</td>
<td>1.32</td>
<td>.30</td>
<td>−.88</td>
<td>0.07</td>
<td>−.49</td>
<td>64.19</td>
</tr>
<tr>
<td>7. Sadness</td>
<td>−.63</td>
<td>−.78</td>
<td>0.84</td>
<td>1.50</td>
<td>0.26</td>
<td>−.61</td>
<td>.54</td>
<td>−.76</td>
<td>0.62</td>
<td>0.30</td>
<td>145.25</td>
</tr>
<tr>
<td>8. Anger</td>
<td>−.65</td>
<td>−.64</td>
<td>1.42</td>
<td>1.09</td>
<td>0.46</td>
<td>−.22</td>
<td>.22</td>
<td>−.62</td>
<td>−.11</td>
<td>0.39</td>
<td>90.11</td>
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<tr>
<td>9. Shame</td>
<td>−.61</td>
<td>−.43</td>
<td>0.72</td>
<td>1.32</td>
<td>0.11</td>
<td>−.39</td>
<td>−.20</td>
<td>−.67</td>
<td>0.20</td>
<td>1.30</td>
<td>103.25</td>
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<td>10. Fear</td>
<td>−.44</td>
<td>−.57</td>
<td>0.48</td>
<td>1.92</td>
<td>0.00</td>
<td>−.63</td>
<td>.25</td>
<td>−.68</td>
<td>0.11</td>
<td>0.79</td>
<td>141.46</td>
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<tr>
<td>11. Interpersonal conflict</td>
<td>−.16</td>
<td>−.40</td>
<td>2.14</td>
<td>0.14</td>
<td>0.01</td>
<td>0.26</td>
<td>−.17</td>
<td>−.55</td>
<td>−.27</td>
<td>−.22</td>
<td>93.37</td>
</tr>
</tbody>
</table>

*Notes: Boldfaced numbers indicate defining peaks of the profiles (i.e., >.5 SD above or below the sample mean). All F ratios are significant at .0001. R-I = religious–socially isolated, n = 171; R-C = religious–connected, n = 136; Type A, n = 69; negative affect, n = 95; NR-C = nonreligious–connected, n = 125; inhibited, n = 106; CF = coping with friends, n = 127; tranquil, n = 114; NR-I = nonreligious–socially isolated, n = 87; SS = socially shy, n = 83.*
tion; debilitated ¼ high activity limitation; earned hardiness ¼
tness ¼ from chance (i.e., Hayes’s standardized [std.] residual
Socially shy
Nonreligious–isolated
Tranquil
Nonreligious–connected
Type A
Negative affect
Nonreligious–connected
Inhibited
Coping with friends
Tranquil
Nonreligious–isolated
Socially shy

and negative affect) were also both more inhibited than
average. This is an interesting finding, given that previous
research on older samples has suggested that increased control
over emotional expression is adaptive (Carstensen, Gottman, &
Levenson, 1995). However, increased ability to control is
distinguishable from habitually controlling, possibly underscoring
the importance of volition and responsiveness to contextualism (Keltner & Bonanno, 1997). In contrast to this
pattern, however, less inhibition is only salient in one higher
hardiness grouping—among persons with low levels of affect
(the tranquil group), perhaps indicating the dynamic interplay
between experienced emotion and emotion expression (Con-
sedine, Magai, Cohen, et al., 2002).
Consistent with this complexity, other findings suggest that
the adaptiveness of negative emotions in later life may depend
on the discrete emotions that are present. The individuals in the
socially shy cluster, defined by high shame and anxiety, were
significantly more likely to appear in the earned hardiness
and no more likely to be in the low hardiness groupings. In
emotion theory, shame arises from perceived inadequacies or
deficits in the self (Tangney, 1990). Functionally, this affect
may have communicative appeal (Einstein & Lanning, 1998;
Frijda & Mesquita, 1994), particularly in terms of appealing
social others (Keltner, 1995; Keltner & Buswell, 1996) and
motivating the acquisition of skills–attributes to bring the self
into line with the expectations of others (Consedine & Magai,
2003). Experiences of shame and social anxiety in the absence
of more interpersonally threatening emotions, such as anger,
may contribute to physical hardiness by motivating the repair
of social relationships.
As expected, adaptive aging, at least insofar as indicated
by our operationalization of physical hardiness, was not the
exclusive province of individuals with well-developed social
networks. Taken in isolation, network considerations were in-
sufficient when we sought to label clusters or interpret the
distribution of persons from different clusters across levels of
hardiness. An inspection of the patterns in Table 5, for example,
shows us that although religious–connected persons were less
likely to be debilitated (low hardiness) and were more likely to
be intrinsically hardy, the exact same pattern is evident in the
religious–socially isolated cluster.
This finding may be taken as consistent with the notion that
social networks can have both positive and negative con-
sequences for older adults (Seeman, 2000) and that several
aspects of the individual and his or her social environment
cohere in ways that determine whether networks are predictive
of successful aging. Networks impart obligations as well as
provide support and can be sources of, as well as buffers
against, stress (Seeman, 2000). Certain classes of network may
be particularly demanding and burdensome, as in the case of
families in which grandparents take on the responsibility of
raising their own grandchildren, an increasingly common
phenomenon (e.g., Edwards, 2001; Grant, 2000).
In contrast to this picture, however, the absence of religiosity
was consistently a predictor of low hardiness. As noted, per-
sons in both religious–connected and religious–isolated clusters
were more likely to be intrinsically hardy and less likely to be
debilitated, despite variations in social networks. Such a pattern
is consistent with a growing literature on the protective role
of religious beliefs and practices in the health of older adults
(Koenig, 1991, 1993), particularly insofar as it suggests that
religious involvement may have some benefits aside from any
associations with social support (e.g., Oman et al., 1999).
Additionally, however, persons in Cluster 5, the nonreligious–
connected cluster, were significantly less likely to show intrin-
sic hardiness, a finding we suspect may relate to the generally
high levels of religiosity in our sample. Only 15% of the
sample reported never going to a church or temple, almost half
(47.2%) reported attending one at least once per week, and

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Intrinsic Hardiness</th>
<th>Underfunctioning</th>
<th>Earned Hardness</th>
<th>Debilitated</th>
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<tr>
<td>Religious–isolated</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Frequency</td>
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<td>25</td>
<td>39</td>
<td>38</td>
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<tr>
<td>Expected count</td>
<td>54.1</td>
<td>27.2</td>
<td>34.7</td>
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</tr>
<tr>
<td>Std. residual</td>
<td>2.0</td>
<td>−0.4</td>
<td>0.7</td>
<td>−2.3</td>
</tr>
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<td>Religious–connected</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Frequency</td>
<td>67</td>
<td>14</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Expected count</td>
<td>43.0</td>
<td>21.6</td>
<td>27.6</td>
<td>43.7</td>
</tr>
<tr>
<td>Std. residual</td>
<td>3.7</td>
<td>−1.6</td>
<td>0.1</td>
<td>−2.5</td>
</tr>
<tr>
<td>Type A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>13</td>
<td>14</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>Expected count</td>
<td>21.8</td>
<td>11.0</td>
<td>14.0</td>
<td>22.2</td>
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<tr>
<td>Std. residual</td>
<td>−1.9</td>
<td>0.9</td>
<td>0.5</td>
<td>0.8</td>
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<tr>
<td>Negative affect</td>
<td></td>
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<tr>
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<td>9</td>
<td>47</td>
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<tr>
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<td>−4.6</td>
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<td>−2.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Nonreligious–connected</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Frequency</td>
<td>20</td>
<td>28</td>
<td>26</td>
<td>51</td>
</tr>
<tr>
<td>Expected count</td>
<td>39.5</td>
<td>19.9</td>
<td>25.4</td>
<td>40.2</td>
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<tr>
<td>Std. residual</td>
<td>−3.1</td>
<td>1.8</td>
<td>0.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Inhibited</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>36</td>
<td>14</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>Expected count</td>
<td>40.2</td>
<td>20.2</td>
<td>21.5</td>
<td>34.1</td>
</tr>
<tr>
<td>Std. residual</td>
<td>0.4</td>
<td>−0.7</td>
<td>0.5</td>
<td>−0.4</td>
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<tr>
<td>Coping with friends</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Frequency</td>
<td>39</td>
<td>13</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>Expected count</td>
<td>40.2</td>
<td>20.2</td>
<td>25.8</td>
<td>40.8</td>
</tr>
<tr>
<td>Std. residual</td>
<td>−0.2</td>
<td>−1.6</td>
<td>0.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Tranquil</td>
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<td></td>
<td></td>
<td></td>
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<td>29</td>
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<td>18.1</td>
<td>23.1</td>
<td>36.7</td>
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<td>Std. residual</td>
<td>3.2</td>
<td>−1.0</td>
<td>−1.5</td>
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<td>Nonreligious–isolated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>22</td>
<td>13</td>
<td>17</td>
<td>35</td>
</tr>
<tr>
<td>Expected count</td>
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<td>13.8</td>
<td>17.7</td>
<td>28.0</td>
</tr>
<tr>
<td>Std. residual</td>
<td>−1.1</td>
<td>−0.2</td>
<td>−0.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Socially shy</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Frequency</td>
<td>26</td>
<td>8</td>
<td>28</td>
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<td>Expected count</td>
<td>26.2</td>
<td>13.2</td>
<td>16.9</td>
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<td>0.0</td>
<td>−1.4</td>
<td>2.7</td>
<td>−1.1</td>
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</tbody>
</table>

Notes: Bold numbers indicate cells where frequencies differed significantly from chance (i.e., Hayes’s standardized [std.] residual > 1.96). Intrinsic hardiness = low illness, low activity limitation; underfunctioning = low illness, high activity limitation; earned hardiness = high illness, low activity limitation; debilitated = high illness, high activity limitation.
only 7% said they were not at all religious. Therefore, it may be that a low level of involvement or a lack of religious beliefs indexes an atypical developmental trajectory among this older cohort. Speculation regarding whether these relations are causal or the product of third variables is not possible within the current data set, but the process of identifying and testing possible causal mechanisms would seem to be a key late-life developmental agenda. There appear to be few costs to religious involvement (Pargament, 1997), and our typological analysis suggests that religion is consistently associated with greater physical hardness notwithstanding variations in social networks.

Conclusions

The variety of adaptations to aging evident in our study is not surprising when we recall the complexity of the changes that accompany the aging process. Aging research is only just beginning to examine the means by which older adults satisfy, mitigate, or avoid the challenges that confront them and how these adaptations affect their health and well-being. Our research suggests that the role of negative emotions in aging may depend on which emotions are being considered and how the emotions cohere with other variables. More generally, however, it also suggests that attempting to identify the patterned coherence among the socioemotional substrates of successful aging is a worthwhile developmental agenda. This is encouraging, for it indicates that the research agenda of social gerontologists has indeed been accessing constructs or domains that are important to an understanding of the aging process.

Acknowledgments

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