Positive attitude towards life and emotional expression as personality phenotypes for centenarians

Kaori Kato1,2, Richard Zweig1, Nir Barzilai3, and Gil Atzmon3

INTRODUCTION

Living to be 100 years of age is still a rare event. According to the US Census Bureau, there are approximately 53,000 centenarians in the US which remain only .2% of the population [1]. The number of centenarians has been rapidly increasing at a rate of 8% per year in the US [2]. Some suggest that centenarians may carry biological markers of successful aging since by and large they have delayed or escaped major illnesses [3]. However, less is known regarding factors which contribute to diversity in successful aging/longevity in centenarians [4].

Among many factors associated with longevity, personality has been linked to health outcomes and longevity [5]. Personality refers to a stable set of cognitive, motivational, social, and emotional traits and behavioral patterns, which is influenced by familial history, genetic predisposition, environment, and sociocultural factors [6]. The NEO Personality Inventory-Revised (NEO-PI-R) and NEO-Five Factor Inventory (NEO-FFI) are personality measures developed for longitudinal studies of personality and aging [7] and are based on the Five Factor Model (FFM) which represents traits including neuroticism/emotional stability, extraversion, openness to experience, agreeableness, and conscientiousness. Select FFM traits have been associated with favorable health outcomes and longevity in older adults [5, 8-10].

Additionally, several studies have suggested that centenarians also share particular personality traits. The Georgia Centenarian Study reported that centenarians...
have a lower level of neuroticism and higher levels of extraversion, competence (a facet of conscientiousness), and trust (a facet of agreeableness) than the mixed-age US population [9]. Similarly, Japanese cognitively intact female centenarians were reported to have higher levels of extraversion and conscientiousness than the Japanese middle-aged and older adults [11]. Further, the Swedish Centenarian Study [12] showed that centenarians appeared more easygoing, relaxed, capable, and efficient than the Swedish mixed-age population.

The personality – longevity relationship has been further explored by examining pathways through which personality may influence health outcomes. Achieving 100 years of age seems to have a very strong genetic influence [13], and the genetic contribution has been found to be the largest in the oldest old population [14]. Personality may represent underlying genetic and neurophysiological mechanisms which may directly affect health outcomes [15, 16]. Additionally, certain personality traits shared by centenarians such as low neuroticism and high extraversion and conscientiousness [9, 11] may also have strong heritable/genetic components [16]. Distel and colleagues [17] reported that heritability estimates of FFM personality traits such as neuroticism, conscientiousness, and extraversion were 43%, 43%, and 47% respectively, suggesting that these traits are highly heritable. Similarly, the offspring of centenarians have been reported to show a lower level of neuroticism and a higher level of extraversion than the general population [18].

Second, personality traits (e.g., neuroticism, an enduring tendency to experience negative emotions) may affect health outcomes through mediating processes such as emotion regulation [19]. Specifically, depression, which may be viewed as a result of emotion dysregulation, has been reported to be a significant predictor for negative health outcomes and mortality [20-22], and neuroticism has been found to be an important risk factor for depression [19] and early mortality [23]. Further, some researchers argue that prolonged negative affect (e.g., depression and anxiety) is linked to disease susceptibility through physiological changes in SNS (sympathetic nervous system), HPA (hypothalamic-pituitary-adrenal) axis, stress hormones, blood pressure, metabolism, and immune function [19, 23-26]. Therefore, mediators linked to personality traits, such as chronic emotion dysregulation may have an adverse impact on health outcomes through their effect on physiological/biological function.

Third, personality may influence health outcomes through affecting an individual’s choice of health-related behaviors [5, 12, 27]. Conscientiousness has been tied to longevity, and research suggests that people with high conscientiousness tend to practice healthy behaviors (e.g., engaging in physical exercise) and avoid risky health behaviors (e.g., excessive drinking and smoking) [28-31].

In summary, favorable personality characteristics have been associated with positive health outcomes in late life and longevity through various mechanisms. Less is known regarding whether genetically homogenous groups of centenarians share particular personality characteristics. Practical constraints to assessing the personality of centenarians (e.g., cognitive/sensory impairment) have also raised the need for a brief measure of personality. Therefore, this study developed a brief measure of personality characteristics in centenarians namely, the Personality Outlook Profile Scale (POPS), through examining the construct and internal consistency of the POPS (scale development study), as well as the concurrent validity of the POPS with the NEO-FFI, and LOT-R (validation study). To increase our ability to detect genetically-based personality phenotypes, the study targeted a genetically homogeneous sample of Ashkenazi Jewish centenarians.

RESULTS

Demographic Characteristics of the Participants

Demographic, cognitive, and personality characteristics of centenarians are presented in Table 1. The participants in the scale development study (N = 243) had a mean age of 97.6 ±2.79 and were predominantly female (75%). Years of education ranged from 0 to 25 years with a mean level of 12.7±3.89 years. The MMSE mean score was 19.8±11.95. The participants of the self-report group in the validation study (n = 19) had a mean age of 99.8±2.87 and were predominantly female (68%) with a mean score of 5.63±1.54 in the MIS-T, indicating that all were cognitively intact. The participants in the informant-report group of centenarians (n = 26) had a mean age of 100±2.27 and were predominantly female (69%). The mean scores and standard deviations (SD) of personality measures in the validation study, the population means of the NEO-FFI based on the normative data (derived from a representative sample of the US population) [7], and the mean score of the LOT-R based on a mixed age group (age 36 to 82 years with a mean age of 64.3 years) [32] are also presented in the Table 1. Centenarians in both self- and informant-report groups tended to be optimistic, easygoing, and outgoing and to consider laughter as an important part of their life, based on the raw mean scores of items on the POPS (ranging from
3.34 to 4.09 in the self-report group and from 3.68 to 4.21 in the informant-report group on a scale of 1 through 5). Further, the results of t-tests to compare mean scores of the NEO-FFI traits in the current sample to the normative population mean scores [7] found that participants in the self-report group showed lower mean scores of neuroticism, t(18) = -3.81, p < .01, as well as higher mean scores of extraversion, t(18) = 3.03, p < .01, agreeableness, t(18) = 3.82, p < .01, and conscientiousness, t(18) = 2.42, p < .05, than the US population means. Participants in the informant-group also showed lower mean scores of neuroticism, t(25) = -2.24, p < .05, and higher mean scores of conscientiousness, t(25) = 2.88, p < .01, than the US population means. The results of t-tests to compare the mean score of the LOT-R in the current sample to the mean score of a mixed age group [32] also showed that participants in the informant-report group had a higher mean score of dispositional optimism, t(25) = 2.60, p < .05, than the mean score of the mixed age group.

Table 1. Demographic, Cognitive, and Personality Characteristics of Centenarians

| Groups | Scale Development study | Validation study | US Population/Mixed Age Group |
|--------|-------------------------|------------------|-------------------------------|
| Sample Size | N = 243 | n = 19 | n = 26 |
| Demographic Variable | Mean (SD) | Mean (SD) | Mean (SD) |
| Age | 97.6 (2.79) | 99.8 (2.87) | 100 (2.27) |
| Gender | | | |
| Males (%) | 62 (25%) | 6 (32%) | 8 (31%) |
| Females (%) | 181 (75%) | 13 (68%) | 18 (69%) |
| MMSE (score) | 19.8 (11.95) | N/A | N/A |
| MIS-T (score) | | N/A | 5.63 (1.54) |
| POPS PATL (z-score) | 0.03 (0.70) | -.03 (0.42) | -.01 (0.60) |
| Optimism | 3.35 (1.26) | 4.21 (0.86) | 3.88 (0.82) |
| Easygoing | 3.34 (1.26) | 3.68 (1.16) | 3.19 (1.13) |
| Laughter | 4.09 (0.96) | 4.17 (0.96) | 4.29 (0.99) |
| Introversion/Outgoing | 3.71 (1.01) | 3.68 (1.20) | 3.65 (1.29) |
| POPS EE (z-score) | 0.02 (0.49) | 0.00 (0.80) | 0.00 (0.92) |
| Bottle Up Emotions | 2.62 (0.95) | 2.53 (0.96) | 2.77 (1.07) |
| Express Feelings Openly | 2.43 (0.88) | 2.68 (1.06) | 2.46 (1.07) |
| NEO-FFI (score) | | | |
| Neuroticism | N/A | 11.16 (9.06) | 13.81 (11.97) | 19.07 (7.68) |
| Extraversion | N/A | 33.84 (8.85) | 31.04 (8.59) | 27.69 (5.85) |
| Openness to Ex | N/A | 26.53 (8.93) | 26.88 (8.15) | 27.03 (5.84) |
| Agreeableness | N/A | 40.00 (8.17) | 34.54 (9.50) | 32.84 (4.97) |
| Conscientiousness | N/A | 39.21 (8.34) | 39.81 (9.28) | 34.57 (5.88) |
| LOT-R (score) | | | |
| Dispositional Optimism | N/A | 17.11 (5.08) | 17.50 (4.59) | 15.16 (4.05) |

Note. MMSE = Mini Mental Status Exam; MIS-T = Memory Impairment Screen – Telephone; PATL = Positive Attitude Towards Life; EE = Emotional Expression; NEO-FFI = NEO Five Factor Inventory; LOT-R = The Life Orientation Test-Revised; POPS = Personality Outlook Profile Scale.
Scale Development Study: The Generation of the POPS Personality Domains

The results of a principal component analysis generated three personality domains based on nine items which were highly inter-correlated (Tables 2): Domain 1: Positive Attitude Towards Life (PATL: Easygoing, Optimism, Laughter, and Introversion/Outgoing); Domain 2: Emotional Expression (EE: Bottle Up Emotions and Express Feelings Openly); Domain 3: Transcendent Outlook (TO: Spirituality and Relaxation). Findings based on an examination of internal consistency (Cronbach’s alpha) showed alpha levels of .65 (PATL), .63 (EE), and .50 (TO). Two domains, PATL and EE, were selected for the POPS measure due to their adequate internal consistency.

Validation Study: The Concurrent Validity of the POPS with Personality Measures

The validation study examined the concurrent validity of the POPS with the NEO-FFI and LOT-R. The results of the bivariate correlations (Tables 3) demonstrated that, in the self-report group of centenarians, PATL was positively associated with extraversion (r = .82, p < .01) and conscientiousness (r = .53, p < .05). EE was also negatively correlated with neuroticism (r = -.51, p < .05). In the informant report group of centenarians, PATL was negatively correlated with neuroticism (r = -.52, p < .01), and positively correlated with extraversion (r = .74, p < .01) and dispositional optimism (r = .69, p < .01). Additionally, EE was positively associated with extraversion (r = .45, p < .05). There were no other significant associations between the POPS domains and other personality traits/measures in both groups.

DISCUSSION

The purpose of the present study was to detect genetically-based personality phenotypes through developing a brief measure of personality of centenarians, the Personality Outlook Profile Scale (POPS) and examining its construct, internal consistency (scale development study), and concurrent validity with the NEO-FFI and LOT-R (validation study) in a sample of Ashkenazi Jewish centenarians. The scale development study generated two domains: domain 1, Positive Attitude Towards Life (PATL: optimism, easygoing, laughter, and introversion/outgoing); domain 2, Emotional Expression (EE: Table 2. Principal Component Analysis of Personality Characteristics with Varimax Rotation

| Variable                     | Component 1 | Component 2 | Component 3 |
|------------------------------|-------------|-------------|-------------|
| Spiritual                    | 0.22        | -0.04       | -0.78       |
| Relaxation                   | 0.07        | 0.01        | -0.84       |
| Bottle Up Emotions           | 0.12        | 0.83        | -0.08       |
| Express Feelings             | -0.03       | 0.82        | 0.03        |
| Creative                     | 0.45        | -0.06       | 0.09        |
| Easygoing                    | 0.64        | 0.28        | 0.20        |
| Optimistic                   | 0.64        | 0.18        | 0.20        |
| Laughter                     | 0.71        | -0.06       | 0.01        |
| Introverted/Outgoing         | 0.62        | -0.51       | 0.00        |

www.impactaging.com 362 AGING, May 2012, Vol.4 No.5
expressing emotions openly and not bottling up emotions). These domains evidenced adequate levels of internal consistency. Findings of the validation study demonstrated moderate to high associations between the POPS and select personality traits from the NEO-FFI and LOT-R. Specifically, PATL was highly associated with extraversion in both groups. PATL was also moderately associated with conscientiousness in the self-report group, and moderately to highly associated with dispositional optimism and neuroticism (negative correlation) in the informant-report group. EE was moderately and negatively associated with neuroticism in the self-report group and was moderately associated with extraversion in the informant-report group. Therefore, findings suggest that the POPS has acceptable psychometric characteristics and measures personality aspects of extraversion, neuroticism, and possibly conscientiousness, as well as dispositional optimism.

Particularly noteworthy findings were the favorable personality characteristics of centenarians in this study compared to the US population means, and personality characteristics of centenarians found in this study seem to be consistent with findings from previous studies. Specifically, centenarians in both self- and informant-report groups in the validation study showed lower mean scores of neuroticism and higher mean scores of conscientiousness than the US population means. These results coincided with several studies that have identified that centenarians may share higher levels of extraversion and conscientiousness, and low levels of neuroticism [9, 11]. However, whether centenarians have maintained these particular personality traits across their lifespan remains unknown since this question has not been addressed longitudinally, although some age-associated changes in personality in older adults have been reported [7, 33].

Table 3. Correlations between Personality Domains, the LOT-R, NEO-FFI

| Groups          | Self-Reports (n=19) | Informant-Reports (n=26) |
|-----------------|---------------------|-------------------------|
| Variable        | PATL    | EE      | PATL     | EE      |
| NEO-FFI:        | Neuroticism | -0.35   | -0.51*   | -0.52*  | -0.21   |
|                 | Extraversion | 0.82**  | 0.26     | 0.74**  | 0.45*   |
|                 | Openness  | 0.36    | -0.23    | 0.12    | -0.19   |
|                 | Agreeableness| 0.05    | 0.07     | 0.17    | 0.04    |
|                 | Conscientiousness| 0.53*   | 0.11     | 0.17    | -0.01   |
| LOT-R:          | Optimism  | 0.25    | 0.25     | 0.69**  | 0.35    |

Note. PATL = Positive Attitude Towards Life; EE = Emotional Expression; NEO-FFI = NEO Five Factor Inventory; LOT-R = The Life Orientation Test-Revised; POPS = Personality Outlook Profile Scale.

*p < .05  **p < .01  ***p < .001
The present study has a number of limitations. Although the use of a genetically and environmentally homogeneous sample was an effective method to identify genetically-based personality phenotypes, the use of a homogeneous group potentially reduces the generalizability of this study’s findings. However, because Ashkenazi Jewish individuals are not expected to have more longevity than other groups and their survival/causes of death are similar to those reported in the general Caucasian US population [34], we do not expect that their personality phenotypes are unique, and thus our findings may well be relevant to other populations. Another limitation of this study is that the sample size of the validation study was small because most participants in the original study were unable to participate due to their health issues or mortality. There were some methodological challenges in assessing centenarians’ personality characteristics using the self-report measures include their sensory impairment, cognitive constraints, and physical disabilities. In the scale development study, the Centenarian Questionnaire was completed by participants with the assistance of a family member in order to increase the reliability of participants’ responses to the questionnaire. Also, in the validation study, the informant-report group was used in addition to the self-report group. Although sufficient levels of the agreement between self- and informant-reports on personality measures have been demonstrated [35, 36], informant-reports may not represent the true personality characteristics of the participants.

In summary, the findings of the present study demonstrated that the POPS displays adequate psychometric characteristics as a brief measure of personality in centenarians and measures aspects of neuroticism, extraversion, and possibly conscientiousness, as well as optimism. This study adds to a growing body of knowledge which suggests that centenarians may share particular personality characteristics and suggests that genetically-based aspects of personality may play an important role in achieving positive health outcomes and exceptional longevity. Future research should continue to examine further reliability and validity (e.g., discriminant validity) of the POPS as the development of brief and robust measures of personality, validated for the oldest old, in order to stimulate further research regarding successful aging in this rapidly growing population.

METHODS

Participants
As part of the Longevity Genes Project, Ashkenazi Jewish centenarians (age 95 to 107), who were living independently at 95 years of age as a reflection of good health, were recruited [34]. The use of the Ashkenazi Jews in this study was due to their genetic and environmental homogeneity which is an effective method to facilitate genetic association. Survival and causes of death in the Ashkenazi Jewish population are similar to those reported in the general Caucasian US population, and participants also had relatively similar socio-cultural, economical, and educational backgrounds. The study’s sampling, recruitment, and procedures have been described previously [34, 37-39]. Within the archival data consisting of N = 396 Ashkenazi Jewish centenarians (age 95 to 107), 153 individuals were excluded due to missing questionnaire responses. These individuals were not different from the participants who were included in the analysis. Thus, N=243 participants were included in the scale development study. For the validation study, cognitive screening measures were employed to reduce variance due to cognitive impairment. N=210 cognitively intact centenarians, who scored 24 points or higher on the Mini-Mental State Exam (MMSE) were selected. Of those, 102 subjects were still alive at the time of this study, and 26 centenarians and their children were available to participate. Most were unable to participate in the study due to their health issues and practical constraints. Of these, 7 centenarians in the self-report group were excluded due to health issues and cognitive impairment (scores of lower than four points on the Memory Impairment Screen by Telephone) [40]. Therefore, participants in the validation study included centenarians (n=19) in the self-report group and their children (n=26) in the informant-report group.

Procedures
In the Longevity Genes Project, the Centenarian Questionnaire was filled out by participants with the assistance of their children in the event that participants had difficulty responding to questions in a reliable manner (e.g., due to mild cognitive and sensory/motor impairment). A single research nurse administered the MMSE to each participant. In the validation study, MIS-T [40], POPS, NEO-FFI [7], and LOT-R [32] were administered to centenarians through an in-person or phone interview (self-reports). Their children were also asked to complete the personality measures through an in-person or phone interview or by mail (informant-reports).

Measures
The Centenarian Questionnaire and Personality Outlook Profile Scale (POPS)
The 98-item Centenarian Questionnaire, developed by the Longevity Genes Project, measures participants’ personal demographics, personality, health/medical
history, and health-related behaviors [41]. This questionnaire had served as the basis for the development of the POPS. Initially, 11 items of the Centenarian Questionnaire, which reflected centenarians’ lifetime personality and related behaviors, were selected as candidate items for the POPS. These items were developed using a rational content-based approach and derived from extant longevity research and theoretical concepts. Based on a principal component analysis, six of the original eleven candidate items were selected, and two robust components were identified: Positive Attitude Towards Life (PATL: optimism, easygoing, laughter, and introversion/outgoing) and Emotional Expression (EE: expressing emotions openly and not bottling up emotions). A composite score of each domain is based on a mean z-score of respective personality items for each domain. Higher scores reflect more favorable personality traits.

**NEO-Five Factor Inventory (NEO-FFI)**
The NEO-Five Factor Inventory (NEO-FFI) is a self-and informant-report 60-item inventory which is a short-version of the NEO-PI and measures five broad dimensions of personality traits. Each personality trait scale is comprised of 12 likert-type items rated on a five-point scale. Total scale scores are derived by summing responses of the 12 items for each trait. Higher scores indicate higher levels on a given trait. The NEO-FFI has demonstrated correlations with the NEO-PI ranging from .75 to .91 [7].

**The Life Orientation Test-Revised**
The Life Orientation Test–Revised (LOT-R) is a measure of dispositional optimism, which examines generalized expectancies about future life events. Likert-type items are rated on a 0 (disagree strongly) to 4 point scale (agree strongly). Total scores are derived by the summation of scores on six items; 4 items are filler items and not scored. Scores range from 0 to 24, with 24 reflecting extreme optimism, with a mean score of 15 in a mixed-age adult sample. The LOT-R has adequate levels of internal consistency, test-retest reliability, convergent/discriminant validity, and validity for older adults [32].

**Mini Mental Status Exam (MMSE)**
The Mini Mental Status Exam (MMSE) is a standard 30-item measure validated as a screening tool for cognitive impairment. The MMSE has demonstrated acceptable levels of internal consistency, test-retest reliability, and concurrent validity. A standard cutoff score of ≥24 on the MMSE26 for intact cognitive function was required for inclusion in the validation study [42, 43].

**The Memory Impairment Screen by Telephone (MIS-T)**
The MIS-T is a telephonically administered adaptation of the Memory Impairment Screen (MIS), a four-item screening test for dementia which assesses an individual’s verbal memory based on the delayed free and cued recall trials. The MIS-T is a valid screening tool for Alzheimer’s type dementia in older adults. Total scores are derived by the summation of the correct responses. A cut-off score of four has adequate levels of sensitivity (.80) and specificity (.96) to detect Alzheimer’s dementia [40, 44], and a score of four or above was required for inclusion in the validation study.

**Statistical Methods**
Analyses were completed with the statistical software, SPSS Statistics (Version 17.0). In the scale development study, a principal component analysis was conducted to generate the domains of the POPS. Cronbach’s alpha was computed to test the internal consistency of each domain. In the validation study, the concurrent validity of the POPS with other measures was examined using Pearson’s correlation coefficients.

**ACKNOWLEDGMENTS**
We thank many centenarians and their families for their dedication and contribution to this study. We also thank Mr. William Greiner, the research nurse and other members of the Longevity Genes Project for their contributions and support. This research was supported in part by the National Institute of Aging, Grant P01 (AG027734; AG028872) and a Nathan Shock Center grant.

**CONFLICT OF INTERESTS STATEMENT**
The authors of this manuscript have no conflict of interest to declare.

**REFERENCES**

1. US Census Bureau. The older population 2010: 2010 census briefs (online). Available at: http://www.census.gov/prod/cen2010/briefs/c2010br-09.pdf. Accessed January 20, 2012.
2. Perls T. Centenarians and genetics. In: Read CY, Green RC, Smyer MA, eds. Aging, biotechnology and the future. Baltimore, MD: Johns Hopkins University Press, 2008, pp. 89-99.
3. Motta M, Bennati E, Ferlito L, Malaguarnera M, and Motta L. Successful aging in centenarians: Myth and reality. Arch Gerontol Geriatr. 2005; 40: 241-251.
4. Poon LW, and Perls TT. The trials and tribulations of studying the oldest old. In: Poon LW, Perls TT, eds. Annual review of gerontology and geriatrics. New York, Springer, 2008, vol. 27, pp 1-10.
5. Terracciano A, Löckenhoff CE, Zonderman AB, Ferucci L, and Costa PT Jr. Personality predictors of longevity: Activity, emotional stability, and conscientiousness. Psychosom Med. 2008; 70: 621-627.

6. McCrae RR, and Costa PT. A five-factor theory of personality. In: Pervin LA, John OP, eds. Handbook of personality: Theory and research. New York: Guilford Press, 1999, pp 139-153.

7. Costa PT Jr, and McCrae RR. Revised NEO-Personality Inventory and NEO Five-Factor Inventory: Professional Manual. PAR. Odessa, FL: Psychological Assessment Resources, Inc, 1992.

8. Fry PS, and Debats DL. Perfectionism and the five personality traits as predictors of mortality in older adults. J Health Psychol. 2009; 14: 513-524.

9. Martin P, da Rosa G, Siegler IC, Davey A, Macdonald M, and Poon LW. Personality and longevity: Findings from the Georgia Centenarian Study. Age. 2006; 28: 343-352.

10. Weiss A, and Costa PT Jr. Domain and facet personality predictors of all-cause mortality among medicare patients aged 65 to 100. Psychosom Med. 2005; 67: 724-727.

11. Masui Y, Gondo Y, Inagaki H, and Hirose, N. Does personality characteristics predict longevity? Findings from Tokyo Centenarian Study. Age. 2006; 28: 353-361.

12. Samuelsson SM, Alfredsson BB, Hagberg B, Samuelsson G, Nordbeck B, Brun A, Gustafson L, and Risberg J. The Swedish centenarian study: A multidisciplinary study of five consecutive cohorts at the age of 100. Int J Aging Hum Dev. 1997; 45: 223-253.

13. Gudmundsson H, Gudbjartsson DF, Frigge M, Gukher JR, and Stefansson K. Inheritance of human longevity in Iceland. Eur J Hum Genet. 2000; 8: 743-749.

14. Sebastiani P, Solovieff N, Dewan AT, Walsh KM, Puca A, Hartley SW, Melista E, Andersen S, Dworkis DA, Wilk JB, Myers RH, Steinberg MH, Montano M, Baldwin CT, Hoh J, and Perls TT. Genetic signatures of exceptional longevity in humans. PLoS One. 2012; 7(1): e29848.

15. Figueredo AJ, Vasquez G, Brumbach BH, Sefcek JA, Kirner BR, and Jacobs WJ. The K-factor: Individual differences in life history strategy. Pers Individ Diff. 2005; 39: 1349-1360.

16. Kim H-N, and Kim H-L. Trends and directions in personality genetic studies. Genomics Inform. 2011; 9: 45-51.

17. Distel MA, Trull TJ, Willemsen G, Vink JM, Derom CA, Lynskey M, Martin NG, and Boomsma DI. The five-factor model of personality and borderline personality disorder: A genetic analysis of comorbidity. Biol Psychiatry. 2009; 66: 1131-1138.

18. Givens JL, Frederick M, Silverman L, Anderson S, Senville J, Silver M, Sebastiani P, Terry DF, Costa PT, and Perls TT. Personality traits of centenarians’ offspring. J Am Geriatr Soc. 2009; 57: 683-685.

19. Steunenberg B, Beekman TF, Deeg DJ, and Kerkhof AJ. Personality and the onset of depression in late life. J Affect Disord. 2006; 92: 243-251.

20. Beekman ATF, Geerlings SW, Deeg DJH, Smit MJ, Schoevers RS, de Beurs E, Braam AW, Penninx BW, and van Tilburg W. The natural history of late-life depression: A 6-year prospective study in the community. Arch Gen Psychiatry. 2002; 59: 605-611.

21. Geerlings S, Beekman A, Deeg D, Twisk J, and van Tilburg W. Duration and severity of depression predict mortality in older adults in the community. Psychol Med. 2002; 32: 609-618.

22. Schulz R, Drayer R, and Rollman B. Depression as a risk factor for non-suicide mortality in the elderly. Biol Psychiatry. 2002; 52: 205-225.

23. Wilson RS, Mendes de Leon CF, Bienias JL, Evans DA, and Bennett DA. Personality and mortality in old age. J Gerontol B Psychol Sci Soc Sci. 2004; 59B: 110-116.

24. Kiecolt-Glaser JK, McGuire L, Robles TF, and Glaser R. Emotions, morbidity, and mortality: New perspectives from psychoneuroimmunology. Ann Rev Psychol. 2002; 53: 83-107.

25. Richman LS, Kubzansky L, Maselko J, Kawachi I, Choo P, and Bauer M. Positive emotion and health: Going beyond the negative. Health Psychol. 2005; 24: 422-429.

26. Todaro JF, Shen B-J, Niaura R, Spiro III A, and Ward KD. Effect of negative emotions on frequency of coronary heart disease (the normative aging study). Am J Cardiol. 2003; 92: 901-906.

27. Amirkhan JH, Risinger RT, and Swickert RJ. Extraversion: A “hidden” personality for coping. J Pers. 2006; 63: 189-212.

28. Hampson SE, Goldberg LR, Vogt TM, and Dubanoski JP. Forty years on: Teachers’ assessments of children’s personality traits predict self-reported health behaviors and outcomes at midlife. Health Psychol. 2006; 2: 57-64.

29. Roberts BW, and Bogg T. A longitudinal study of the relationships between conscientiousness and the social-environmental factors and substance-use behaviors that influence health. J Pers. 2004; 72: 325-353.

30. Ruiz MA, Pincus AL, and Schinka JA. Externalizing pathology and the five-factor model: A meta-analysis of personality traits associated with antisocial personality disorder, substance use disorder, and their co-occurrence. J Pers Disord. 2008; 22: 365-388.

31. Terracciano A, Löckenhoff CE, Crum RM, Bienvenu OJ, and Costa PT Jr. Five-factor model personality profiles of drug users. BMC Psychiatry. 2008; 8: 22.

32. Scheier MF, Carver CS, and Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. J Pers Soc Psychol. 1994; 67: 1063-1078.

33. Roberts BW, Walton KE, and Viechtbauer W. Patterns of mean-level change in personality traits across the life-course: A meta-analysis of longitudinal studies. Psychol Bull. 2006; 132: 1-25.

34. Barzilai N, Atzmon G, Schechter C, Schaefer EJ, Cupples AL, Lipson R, Cheng S, and Shuldiner AR. Unique lipoprotein phenotype and genotype associated with exceptional longevity. JAMA. 2003; 290: 2030-2040.

35. Ducheck JM, Balota DA, Storandt M, and Larsen R. The power of personality in discriminating between healthy and early-stage Alzheimer’s disease. J Gerontol B Psychol Sci Soc Sci. 2007; 62B: 353-361.

36. Rankin KP, Baldwin E, Pace-Savitsky C, Kramer JH, and Miller BL. Self awareness and personality change in dementia. J Neurol Neurosurg Psychiatry. 2005; 76: 632-639.

37. Atzmon G, Gabriely I, Greiner W, Davidson D, Schechter C, and Barzilai N. Plasma HDL levels highly correlate with cognitive function in exceptional longevity. J Gerontol A Biol Sci Med Sci. 2002; 57: M712-M715.

38. Atzmon G, Rincon M, Schechter C, Shuldiner AR, Lipton RB, Bergman A, and Barzilai N. Lipoprotein genotype and conserved pathway for exceptional longevity in humans. PLoS Biol. 2006; 4: e113.

39. Atzmon G, Pollin TI, Crandall J, Tanner K, Schechter CB, Scherer PE, Rincon M, Siegel G, Katz M, Lipton RB, Shuldiner AR,
and Barzilai N. Adiponectin levels and genotype: A potential regulator of life-span in humans. J Gerontol A Biol Sci Med Sci. 2008; 63: 447-453.

40. Lipton RB, Katz MJ, Kuslansky G, Sliwinski MJ, Stewart WF, Verghese J, Crystal HA, and Buschke H. Screening for dementia by telephone using the Memory Impairment Screen. J Am Geriatr Soc. 2003; 51: 1382-1390.

41. Barzilai N, Atzmon G, Derby CA, Bauman JM, and Lipton RB. A genotype of exceptional longevity is associated with preservation of cognitive function. Neurol. 2006; 67:2170-2175.

42. Folstein MF, Folstein SE, and McHugh PR. “Mini-Mental State.” A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975; 12: 189–198.

43. Crum RM, Anthony JC, Bassett SS, and Folstein MF. Population-based norms for the Mini-Mental State Examination by age and educational level. JAMA. 1993; 269: 2386–2391.

44. Buschke H, Kuslansky G, Katz M, Stewart WF, Sliwinski MJ, Eckholdt HM, and Lipton. Screening for dementia with the Memory Impairment Screen. Neurol. 1999; 52: 231-238.