EXPLORING PATTERNS OF POSITIVE AGING AMONG CENTENARIANS

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Abstract: The purpose of this study was to investigate the patterns of change in psychological outcomes in positive aging after 100 years of age. Data for this study was extracted from the Oklahoma 100-year Life Project May 2013- July 2018). The baseline sample consisted of n = 111 centenarians (M = 100.81, SD = 1.48). A follow-up assessment was conducted two years later at Time 2 (T2) and included a subset of n = 43 or 38% of surviving baseline sample participants (M = 102.90, SD = 1.74). A final follow-up at Time 3 (T3) was conducted one year after the T2 assessment and included a subset of n = 22 or 51.16% of surviving T2 participants (M = 103.90, SD = 1.44). The range of mean score in life satisfaction from T1 (M = 28.55) to T3 range from *(M* = 29.31), positive affect scores ranges from T1(*M = 34.69*) to T3(*M =28.22*), negative scores T1(M =12.14) to T3 (M = 13.59), sense of purpose in life range from T1(M = 36.42) to T3(M = 33.19) Patterns across life-satisfaction, positive/negative affect, and purpose-in-life seem to be relatively mixed. In particular, the overall pattern of life satisfaction showed a “U” shaped pattern across all centenarians; whereas positive affect and purpose-in-life resemble a pattern of decline after age 100. Second, patterns of positive aging exhibit a patterns of convergence and divergence by gender. Significant gender differences evolved for affect and purpose in life. Centenarian woman appeared to be more emotionally negative and possess a lower sense of purpose in life than male centenarians Third, there was an unexpected plateau and noticeable decline in life satisfaction and positive affect around 105 and 106 years of age. Findings from this study have potential implications relative to how geriatric practitioners, clinicians and policymakers may create and implement programs to promote mental health and quality-of-life for persons living long lives.

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CHAPTER I

INTRODUCTION

As the Baby Boomer generation continues to age, the older adult population will remain one of the fastest growing age demographics in the United States (Yogarson et al., 2018). By 2050, it is estimated that millions of these persons will live at least 100 years (Olashansky, Goldman, Zheng, & Rowe, 2009). Increase in the number of exceptionally long-lived persons is primarily the result of advancements in modern biomedical inventions (Olshansky, 2013). Such improvements have changed the way in which medical practitioners and other caregivers care, rehabilitate, and prevent acute and chronic health problems. However, human longevity can induce feelings of stress, worry, and burden (Beutell & Wittig-Berman, 2008). Although some old-old adults may feel mentally and emotionally content in life (King et al., 2013), others may feel overwhelmed by on-going circumstances such as declining physical health, economic insecurity, social losses, or exposure to on-going traumas linked to civil unrest, warfare, or natural disasters. Such unfavorable experiences can contribute to a deteriorated psychological state of mind over time (Merriam & Kee, 2014; Phillips & Ferguson, 2012; Roberts, Walton, & Viechtbauer, 2006). In turn, some very old adults may develop negative perceptions about their own human longevity. Maintaining a positive outlook in life is an asset for aging well. In fact, one way younger members of society can learn to age

positively is to learn from the life experiences and examples of oldest members. The qualities by which very old adults encounter age-associated stressors and regulate emotion is useful for teaching younger generations how to age well (Allen, 2008; Bishop et al., 2010). One example is the Blue Zones Inc. (Buettner & Skemp, 2016), a public health initiative based on evidence-based research on the world's longest lived adults. This program aims to uncover the secrets of longevity and help the general public live healthier. This initiative is designed to contribute to positive lifestyles by focusing on healthy behavioral changes for individuals, families, and communities. Yet, the focus on positive mental health has remained somewhat limited.

When it comes to positive psychological well-being, many older adults have a tendency to focus on the deterioration in physical and physiological functioning (Gerstorf et al., 2008). Yet, longevity offers an opportunity for redefining one's meaning in life with calmness and optimism (Margrett et al., 2011). Many researchers investigated psychological predictors related to subjective well-being among older adults, yet few studies have been conducted on centenarians. Bishop et al. (2010) noted that there has been limited effort to exclusively conduct research on positive aging attributes that emerge and evolve at 100 years or longer. This has contributed to a limited understanding regarding patterns of change in satisfaction with life, purpose in life, and emotional affect in the development of long-lived adults. Using the Theory of Gerotranscendence as a guiding framework (Tornstam, 2005), the purpose of this study was to investigate the patterns of change in psychological outcomes in positive aging after 100 years of age. This purpose of this study was to highlight whether positive aging increases or decreases after 100 years of age. Of particular interest is to understand the extent to which life satisfaction, emotional contentment, and purpose in life change after 100 years of age. Results from this study

have implications relative to providing recommended guidelines by which geriatric practitioners, family members, caregivers and policy makers can enhance mental well-being and quality-of-life for persons living an exceptional long life.

CHAPTER II

LITERATURE REVIEW

Aging and remaining positive is not an easy task. Most persons perceive growing old a distressing process (Tseng & Petrie, 2014). With advancing age, individuals commonly encounter normative declines in sensory, physical, and mental health functioning. This can contribute to a rapid fluctuation in emotion accompanied by noticeable declines in self-reported quality-of-life (Gerstorf et al., 2010). Among very old adults, there is a "terminal decline" of life satisfaction, or an abrupt decline in positive aging (Gerstorf et al.,2008). Although there is ample literature supporting this decline linked to on-going physical health decrements, particularly among persons 65-95 years old, there has been limited attempts to examine patterns of change in positive aging beyond 100 years of age. Therefore, the goal of this study is to explore patterns in positive aging outcomes linked to exceptional longevity. Results from the investigation are expected to have beneficial implications on how geriatric practitioners, family members, and caregivers develop practices and programs to that enhance the mental health and quality-of-life for long-lived persons.

Conceptualizing Positive Aging

Positive aging is rooted in personal experience, appraisal, and meaning. Positive aging is best operationalized as. a process by which individuals contemplatively

perceive being old as developmentally normative (Levy et al., 2002). However, most persons who survive beyond the normative limits of life expectancy commonly encounter an increasing number of age-associated losses in biological, psychological and social functioning (Poon et al., 2010). Such changes contribute to an increased dependence on others for assistance. This can result in a developmental dualism involving a pessimistic versus optimistic outlook toward one's state of being. Joan Erickson (1987) referred to this process as the "Ninth Stage" in human development (Erickson, J., 1987, p.106). It is proposed that the achievement of satisfaction, emotional contentment, and meaning in life represented one of the greatest developmental challenges for human who reach advanced old age (Erickson, 1987, p. 107).

Theory of Gerotranscendence

As an extension of the Joan Erikson's Ninth Stage concept, Tornstam devised the Theory of Gerotranscendence (2005) as theoretical basis for examining positive human aging and development in old-old age. Tornstam posited three underlying dimensions to positive aging: (1) cosmic transcendence or the reorientation of life perspective involving heightened satisfaction with one's past lived experiences; (2) self-transcendence or an increased acceptance of self through the emotional expression of contentment and; (3) social-personal connectedness or the exhibition of seeking and finding meaning and purpose to further connect the self and to others (Tornstam, 2005). Tornstam theorized that these three positive aging elements contribute to gerotranscendence and essentially play instrumental role in how very old persons come to view human aging positively.

Longevity and Life Satisfaction

One key attribute of positive aging involves feeling satisfied with one's life

(Boehm, Winning, Segerstrom, & Kubzansky, 2015; Xu & Roberts, 2010). Life satisfaction represents an age-associated paradox. In fact, reported life satisfaction generally peaks around age sixty-five and gradually declines thereafter (Mroczek, Daniel, Sporo, & Avron, 2005). Despite diminished satisfaction with life, reported feelings of emotional contentment or happiness continue to remain stable or increase with advancing age (Aberg, Sidwell, Hepworth, O'Reilly, & Lithell, 2005). In turn, persons who continue living exceptionally long lives tend to feel emotionally content but less satisfied with life.

Some experts argue that diminished life satisfaction is the result of diminished physical stamina and functioning which erodes the ability to be socially productive (Aberg, Sidwell, Hepworth, O'Reilly, & Lithell, 2005). Others argue that life satisfaction declines with advancing age due to a perceived fear of impending death (Gerstorf et al., 2008; Mroczek, Daniel, Sporo, & Avron, 2005). It is plausible that the longer an individual continues to live, the more dissatisfied with life he or she becomes. This has implications relative to living beyond normative life expectancy. For instance, octogenarians who report feeling contentment with their current life experience a two-fold decline in mortality risk compared to those who remain dissatisfied with life (Lyrra et al., 2006). However, the patterns of change experienced in life satisfaction after 100 years of age among remains relatively unknown. Therefore, one aim of this study was to examine the pattern of change in life satisfaction among centenarians.

Emotional Affect and Longevity

Emotional affect is second contributing outcome of positive aging. According to Diener et al. (1997), emotional affect consists of two attributes: (1) positive affect which is best defined as a state of mind with feelings of pleasure, joy and happiness either about

past or present life and; (2) negative affect which entails a mental state encompassing feelings of sadness, nervousness, upset, or pain. Diener et al. (1997) hypothesized that these two emotional states create a "hedonic treadmill" or a set point of emotion in everyday life. Diener, Lucas, and Scollon (2006) defined the "hedonic treadmill" as human emotion that is fluid and often fluctuates between periods of contentment versus discontentment. However, the timing of this fluctuation is short-lived. Persons generally return to neutral point or a baseline point of contentment. According to Diener (1984), emotional contentment is a stable determinant that has a pre-determined fixed state. Yet, empirical results concerning this assumption are mixed within gerontological literature. Some experts contend that emotional contentment among very old persons reflects a positivity bias (Carstensen et al., 2011; Charles, 2010) due to a growing body of empirical evidence that supports the reality that positive affect may actually decline with age (Carstensen et al., 2011; Ostir, Ottenbacher, & Markides, 2004; Isaacowitz & Smith, 2000). In turn, the longer older adults survive, the more they will experience feelings of negativity. Such older adults tend to die earlier as compared to those who continue to express positive emotional contentment (Levy et al., 2002; Danner, Snowdon, & Friesen, 2001; Wilson et al., 2003). It is plausible that positive emotional expression after 100 years of older may represent a selection effect. It stands to reason that the longer persons live, the happier they were. It may well be that those who live extremely long lives represent those who were, are, and continue to be happiest of all. To determine whether this assumption might be true, additional aim of this study is to explore changes in positive and negative affect among older adults who survived up to 100 years and above.

Longevity and Purpose in Life

Purpose in life is a final attribute of positive aging defined as essential to providing individual orientation and direction in life (Ryff, 1989; Troutman, Nies, & Seo, 2010). Maintaining a strong sense of purpose in life is associated greater emotional contentment emotional contentment and reduced mortality-risk (Haugan, 2014; Holahan & Suzuki, 2006; Krause, 2009; Windsor et al., 2015; Zaslavsky et al., 2014). However, gerontological research detailing the development progression of purpose in life among old and very old adults has remained inconclusive. There is some evidence that purpose in life may decrease with age (Francis et al., 2010; Hedberg, Gustafson, & Brulin, 2010; Kim, Stretcher, & Ryff, 2014; Pinquart, 2002). Yet, other experts countered this notion by suggesting that purpose in life increases with age (Bondevik & Skogard, 2000). This may be particularly true for those living exceptionally long-lives. For example, nonagenarians typically have higher scores of purpose in life compared to octogenarians (Bondevik & Skogstad, 2000). Nonetheless, the extent to which purpose in life may increase or decrease over time among old-old adults warrants further investigation. Therefore, this study was aimed at providing further evidence regarding whether patterns in purpose in life over time increase of decrease with continued longevity.

Research Question and Hypotheses

Based on the literature, a key question of interest of the present investigation is: Do persons living 100 years of age and longer continue to have a satisfying, happy, and purposeful life? To answer this question, this study will aim to examine longitudinal patterns in the self-reported life satisfaction, positive/negative affect, and purpose-in-life.

Based on the literature, the following hypotheses are proposed to reach the stated aim:

(H1) Life satisfaction among centenarians will continue to decline with advancing age;

(H2) Positive affective emotions will continue to increase with age, but negative affective emotions will decrease with advancing age;

(H3) Centenarians will develop a sense of purpose in life and a will increase with advancing age.

CHAPTER III

METHODOLOGY

Procedure

Data for this study was extracted from the Oklahoma 100-year Life Project May 2013- July 2018). This project employed purposeful convenience sampling of community-dwelling men and women 100 years of age and older. Criteria for participation included that all participants currently reside in the state of Oklahoma, be 100 years of age or older, and exhibit satisfactory cognitive orientation relative to memory recall, time, and place. All identified centenarians were assessed for cognitive status using the Mini-Mental Status Examination Brief Version (MMSE-BV; Folstein, Folstein, White, & Messer, 2010). A recommend MMSE-BV cut-off score of ≥11 was used to determine whether participants were cognitively intact. A total of n = 131 centenarians were recruited. Of these centenarians, only n = 112 met criteria for participation (MMSE, *M* = 12.55; *SD* = 1.55). In addition, one participant ending participating during the study. This resulted in a final sample of n = 111community-dwelling centenarians (*M* = 100.88 years; *SD* = 1.48) residing in Oklahoma. Participants were evaluated at three separate time points, including baseline (Time 1), a two-year follow-up (Time 2), and a final one-year follow-up (Time 3). To maintain consistency in measures used during all assessment procedures, only standardized instruments were used. These same semi-structured and standard questionnaires were used across all three time-points of evaluation.

Measures:

Positive/ Negative Affect Balance Scale. The positive/ negative affect was assessed using twenty items from the Positive and Negative Affect Balance Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Participants were asked to indicate different emotions or feelings in the present moment of the interview response was noted on a Likert scale from 1 = *Not at al*l to 5 = *Extremely*. Sample items included distressed, excited, and interested. Some items were reverse coded, and a score is computed by summing the response on each items. Higher affect score will indicate a more positive or negative emotion; whereas a lower score will indicate low positive or negative emotion. Reliability for positive affect has been reported to range from .87 to.90 and from .84 to .87 for negative affect. In the current study, test-retest reliability (r) for positive affect ranged from *r* = .20 to .61, and for negative affect *r* = .31 to .51.

Satisfaction with Life Scale. The Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) was used as the primary evaluation of life satisfaction. Five items were used to determine life satisfaction, and response was coded on a Likert scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. Participants were asked to indicate their level of agreement in response to following items: 'In most ways, my life is close to ideal,' 'The conditions of my life are excellent,' and 'I am satisfied with my life.' Scores were computed by summing the response to each item. High score represented greater satisfaction with one's life; whereas a lower score reflected low satisfaction. The Cronbach's alpha for the life satisfaction scale is .68. In the present study the test-retest reliability for satisfaction with life in the current study ranged from r = .63 to .65.

Purpose in Life Scale. Purpose in life was assessed using purpose in life scale with seven items (Ryff, 1989). Cronbach's alpha for this scale ranges from .86 to .93. Examples of items in this scale include: 'I live life one day at a time and do not really think about future', I have a sense of direction and purpose in life,' I do not have a good sense of what I am trying to accomplish in life,' My daily activities often seem trivial and unimportant to me,' I enjoy making plans for the future and working to make them a reality,' Some people wander aimlessly through life, but I am not one of them,' and I sometimes feel as if I have done all there is to do in life. Response choices were based on a Likert scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. A higher score reflects a high sense of purpose in life; whereas a low score indicates a low sense of purpose in life. The test-retest reliability in the current study ranged from r = .25 to .35.

Analytical Statistics. Statistical Package for Social Sciences (IBM/SPPSS) 20.0 was used to analyze the data for the current study. Analysis involved three steps to test H1 to H3. First, descriptive statistics were used to understand the demographic characteristics of the Time 1 sample (n = 111), Time 2 follow-up sample (n = 82), and Time 3 follow up sample (n = 24). Demographic variables such as age, education, sex, ethnicity, self-reported health, perceived stress, and cognitive orientation were also included in this analysis. In addition, bivariate correlations were calculated across all demographic and positive aging variables. Second, analytic comparison of group averages on the life satisfaction, positive/negative affect, and sense of purpose in life for Time 1, Time 2, and Time 3 were evaluated across the full sample, as well as by gender. Finally, paired sample T-tests were used to assess significant of changes in mean scores across Time 1, Time 2, and Time 3. Next, patterns of change in life satisfaction,

positive/negative affect, and purpose in life were examined across time and age. This entailed the plotting of average mean scores based across ages 100 to 110 for descriptive comparison.

CHAPTER IV

RESULTS

Sample demographics have been summarized in Table 1. The baseline sample consisted of n = 111 centenarians (M =100.81, SD = 1.48). A follow-up assessment was conducted two years later at Time 2 (T2) and included a subset of n = 43 or 38% of surviving baseline sample participants (M =102.90, SD =1.74). A final follow-up at Time 3 (T3) was conducted one year after the T2 assessment and involved a subset of n = 22 or 51.16% of surviving T2 participants (M = 103.90, SD = 1.44). The overall majority of respondents were White-Caucasian women who were relatively well educated.

Participant indications of perceived health appeared mixed across the three-time point assessments. During the baseline assessment (T1), 65.8% of participants reported their health good; whereas, 79% participants viewed their health as fair at Time 2. Nearly 81.8% of respondents perceived their health as poor at T3. A chi-square test was conducted to determine significant differences in demographic characteristics within the sample. Perceived health (T2) emerged as significant by gender χ^2 (4, n = 43) = .006, $p \leq .01$. In particular, centenarian women reported significantly better health at T2 compared to male centenarians.

Mean-associated longitudinal patterns in life satisfaction, positive affect, negative affect and purpose in life across all centenarians are reported in Figure 1. The mean score of life satisfaction decreased from T1 ($M = 28.44$) to T2 (M = 27.21).

The average score on satisfaction with life increased after that until the last follow-up. For positive affect, the average mean score at T1 was 32.59, declined to (*M = 30.84)* in T2. The pattern of positive affect showed a sharp decline in T3 (*M =28.22).* Negative affect varied across time. For instance, from T1 to T2 negative affect decreased from (*M* = 12.36 to *M* = 10.59). However, negative affect score among centenarians increased from 10.59 to 13.59 in T3. The pattern of purpose in life increased from T1 (*M* = 34.14) to T2 (*M* =35.95) but declined across time from T2 (*M* =35.95) to T3 (*M* = 29.31).

Mean-level change in the pattern of purpose in life among centenarian men and women is displayed in Figure 2. Centenarian women had a significantly greater average scores related to purpose in life (*M* = 35.60, *SD*= 31.80, *t* (111) = -2.53, $p \leq .05$) compared to centenarian men (*M* = 31.80, *SD* = 7.93) at T1. This was also true at T3 in which centenarian women demonstrated significantly higher mean scores reflecting purpose in life (*M* = 35.23, *SD = 6.19, t* (22) = -2.15, $p \leq .05$) than centenarian men (*M* = 29.11, *SD* = 7.07). There were no significant gender difference reflecting Time 2 scores for purpose in life. Furthermore, no other significant gender difference emerged relative to the longitudinal patterns of life satisfaction or negative and positive affect.

To further consider convergent and divergent patterns linked to survivorship, longitudinal patterns of life satisfaction, positive affect, negative affect, and purpose in life among survivors plotted by gender as shown in Figure 3. The pattern indicated an overall decline in life satisfaction from T1 to T2 but increased from T2 to T3 among centenarian men. The pattern of satisfaction with one's life appeared stable for centenarian women across the three-time points. Relative to positive affect, across the

time points centenarian men appear to experience greater positive affect on average than centenarian men. In relation to negative affect, the pattern of negative affect for centenarian women was higher in T1 (M = 12.92, SD = 3.49) to T2 (M = 11.00, SD = 2.25) in comparison with centenarian men. However, the gender difference between T1 and T2 negative affect was not statistically significant. From T2 to T3, the pattern of negative affect seemed to increase across gender. Relative to purpose in life among survivors, centenarian women (M = 37.50, SD = *5.13*, t (22) = -3.01, $p \leq .01$) at T1 reported a significantly higher sense of purpose in life than centenarian men (M = 30.11, SD = 6.52). From T2 to T3, mean scores reflecting purpose in life were significant across gender, suggesting greater mean scores of purpose in life score among centenarian women (M= 35.23, SD = 6.19, t (22) = -3.006, $p \leq .05$) compared to centenarian men (M = 29.11, SD = 7.07).

Age was used a final marker by which to inspect the patterns of change in positive aging indicators (see Figure 4). Average mean scores were computed from the total sample across the three time points and then plotted across age ranging from 100 to 110 years old. It is important to note that no participants were 109 years old. Overall indicators of positive aging among centenarians appeared relatively stable across time. However, patterns of life satisfaction and positive affect appeared to decline after 105 years old with stability once centenarians turn 106 years old. The patterns of negative affect tend to remain stable across age until centenarians reached 105 years of age. Negative affect slightly increased at 106 years of age then slightly declined and remained stable thereafter. Purpose in life appeared to decrease slightly at 101 years of age but then remained stable after that.

CHAPTER V

DISCUSSION

The aim of this investigation was to provide insight into patterns of positive aging attributes after 100 years of age or older. Three key findings emerged relative to providing a better understanding of life satisfaction, positive/negative affect, and purpose-in-life. Foremost, the patterns across life-satisfaction, positive/negative affect, and purpose-in-life seem to be relatively mixed. In particular, the overall pattern of life satisfaction supported a "U" shaped pattern across all centenarians; whereas positive affect and purpose-in-life resemble a pattern of decline after the age of 100. Second, patterns of positive aging exhibit patterns of convergence and divergence by gender. Third, there is an unexpected plateau and noticeable decline in life satisfaction and positive affect around 105 and 106 years of age. In line with theory of Gerotranscendence, increased solitude and tendency to disengage from the social connectedness might have led to noticeable change for predictors of positive aging.

Patterns of Satisfaction, Affect, and Purpose

It was originally hypothesized that life satisfaction among centenarians would decline with advancing age. Among all centenarians, the pattern of life satisfaction plotted by time resembled a U-shaped pattern. In other words, life satisfaction appeared to decline initially and then increase. This result may reflect two possible processes.

First, decline in life satisfaction may represent terminal decline (Gerstorf et al., 2008; Mroczek, Daniel, Sporo, & Avron, 2005). This tends to be common among older adults who live exceptionally long lives (Gerstorf et al., 2008).

Some investigators have argued that terminal drop in life satisfaction may stem from deteriorating health functioning, as well as fear related to impending death (Gerstorf et al., 2008; Lynch & George, 2002). Older adults tend to underestimate their actual life satisfaction, preferring to take a more pessimistic view (Lang, Weiss, Gerstorf, & Wagner, 2013). Second, a rebound or increase in life satisfaction after 100 years of age may indicate the essential role of social orientation (Gerstorf et al., 2016). In particular, older adults who remain socially engaged and continue to be motivated in life by proactive social goals experience a slower rate and a later onset of decline in reported life satisfaction (Gerstorf et al., 2016). As a result, it seems plausible that centenarians represent a selective group of humans who generally remain interested in and satisfied with living their lives.

It was posited that positive affective emotions would continue to increase with age; whereas negative emotional affect would decrease. Findings from the present study reject the proposed hypothesis. The pattern of positive affect diminished with time across all centenarians, while negative affect initially diminished but then increased over time. Interestingly, positive affect decreased with time, and negative affect increased over time among centenarians who continue to survive. Results appear to reject an age-associated "positivity effect," in which centenarians have a tendency to embrace positive over negative emotions (Reed & Carstensen, 2012). Centenarians often fail to fully adapt to cumulative or multiple age-associated restrictions with advancing age. According to Jopp

and Rott (2006), this might explain why centenarians have a greater tendency to experience negative emotions (Jopp & Rott, 2006).

It was hypothesized that centenarians would develop a sense of purpose in life and will increase with advancing age. Results from this study partially support the hypothesis. The pattern of purpose in life across all centenarians until second follow-up support the hypotheses. Nonetheless, purpose in life among surviving centenarians decreased over time. This finding is in line with the existing research evidence suggesting purpose-in-life diminishes with advancing older age (Hedberg, Gustafson, & Brulin, 2010; Pinquert, 2002; Ryff, Singer, & Dienberg, 2004). The possible reason for decreased purpose-in-life might be due to increasing negative perceptions of self-arising from personal concerns and worry about one's own aging (Hedberg et al., 2010). Therefore, purpose-in-life most likely diminishes across time for exceptionally old persons due to the fact of changes in self-identity linked to what they can or cannot do or accomplish at a very old age.

Gender Difference in Positive Aging Attributes

Despite empirical evidence suggesting similar diminishing pattern between men and women (Emslie et al., 2002; Hunt & Annandale, 1999), our findings demonstrated significantly higher sense of purpose in life among women as compared to men. This finding contradicts the previous empirical evidence which suggests that older women tend to be more negative/unhappy as compared to centenarian men (Easterlin, 2003; Inglehart, 2002; Pinquart & Sorensen, 2001; Zuckerman, Li, & Diener, 2017). Relative to gender across all centenarians, centenarian women reported to have higher sense of purpose in life as compared to males. However, relative to purpose in life amongst

survivors, male centenarians reported to have a low sense of purpose in life as compared to female centenarians. Nevertheless, the reason for these differences remains unclear. It can be argued that marital status such as widowhood, loss of independence, significant other's overall health status, and spouse mental well-being might negatively influence purpose in life among centenarians, but this argument is speculative. Further examination of purpose-in-life during extreme old age is therefore needed.

Age Associated Patterns in Positive Aging

An unexpected but interesting finding in this study involved age-related patterns of change in positive aging attributes. For the most part, positive aging indicators seem to remain stable as centenarians continue to advance in age. These findings parallel previous evidence from longitudinal and cross-sectional studies indicative of well-being improvements in late adulthood (Diener et al., 2006, Mroczek & Kolarz, 1998). However, there appeared to be a noticeable plateau in reported life satisfaction, positive affect and negative affect between 105-106 years of age. This plateau might suggest that centenarians might walk through challenges related to maintaining positivity and satisfaction with life during terminal period of life (Barbi et al., 2018). The idea of being happier and content across aging is called the "paradox of aging" (Thomas et al., 2016, p. 1024). Findings from this study support this notion among centenarians (100-110 years of age) except an evident decline in life satisfaction at (105-106 years of age). It is suggested that the diminishing pattern of life satisfaction has been significantly associated with negative affect among older adults (An, An, O'Conner, & Wexler, 2008). However, our findings do not suggest significant association between negative affect and life satisfaction among centenarians.

Limitations

Although results from this study investigated the patterns of positive aging outcomes among centenarians, several limitations should be noted. First, this investigation involved a purposeful convenience sample of centenarians. This convenience sampling technique might have contributed to the selectivity effect. This effect may have added centenarians who are better educated, cognitively healthier, reported fewer stressors and provided good self-rated overall health. Random sampling would improve representativeness and enhance an ability to make generalize findings across other centenarian population. Therefore, caution should be taken when generalizing results from this study across other centenarian population. Second, methodological limitations exist due to the limited number of participants available for addressing the questions about the association of predictors across age. For instance, statistical power was reduced at T3 compared to T1 and T2, simply because the analyses were based on fewer number of participants (n = 24). The sample size declined from T1 (n=111) to T2 (n =43), and (n= 22) in T3. The inclusion of a large sample size would have improved the association between predictors and positive aging outcomes. Also, these findings may not represent different geographical locations as data were collected from Oklahoma residents. The test retest reliability for positive affect/negative affect appeared to be low and could reflect potential skewness, meaning that centenarians appeared to be happy. Lastly, the test-retest reliability for purpose in life appeared to be relatively low. This scale may not reflect how centenarians view sense of purpose in life. Low test-retest reliability could also be due to use of the shortened scale version.

Future Directions and Implications

Despite these limitations, findings from this study have implications concerning how healthcare practitioners, clinicians and case managers advance stress management programs to promote the mental health of exceptionally long-lived people. Further investigation of centenarians necessitates exploration of key predictors of positive aging as an indispensable treatment modality for those centenarians continuing to live beyond average life expectancy.

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Table 1

Frequencies, Means, and Standard Deviations of Sample Demographics

Variables	T1(n=111)				T2(n=43)				T3(n=22)			
	Freq.	*%.*	*Mean*	*SD*	Freq.	%	Mean	*SD*	Freq.	%	Mean	*SD*
Age			100.81	1.48			102.90	1.74			103.90	1.44
Gender												
Male	43	38.7			11	25.6			9	40.9		
Female	68	61.3			32	74.4			13	59.1		
Ethnicity												
Caucasian	87	74.4			32	74.4			17	77.3		
Black	8	6.8			5	11.6			3	13.6		
Indian	2	1.7			1	2.3						
Multi-race	14	12.0			5	11.6			2	9.1		
Education												
≤ high school	37	33.3			17	39.5			8	36.4		
High School	36	32.4			13	30.2			6	32.4		
College	13	11.7			9	20.9			5	22.7		
Graduate	25	21.4			4	9.3			3	13.6		
Perceived Health												
Poor	2	1.8			9	20.9*			18	81.8		
Fair	17	15.3			34	79.0*			4	18.2		
Good	73	65.8			--	--			--	--		
Excellent	19	17.1			--	--			--	--		
Cognitive Status			12.55	1.55			11.04	2.83			10.59	2.53

Significant chi-square emerged relative to perceived health (T2) relative to gender χ^2 (4, n = 43) = .006, $p \leq .01$

Table 2
Inter-item Correlation between Predictors of Positive Aging

Predictors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)Life Satisfaction(T1)	-											
(2)Positive Affect(T1)	.22*	-										
(3) Negative Affect(T1)	-.34*	-.13	-									
(4) Purpose in Life(T1)	.20*	.38*	-.12	-								
(5) Life Satisfaction(T2)	.65*	.12	-.21	.32*	-							
(6) Positive Affect(T2)	.35*	.51*	-.20	-.38*	.02	-						
(7) Negative Affect(T2)	-.37*	-.19	.51*	-.02	.38*	.02	-					
(8) Purpose in Life(T2)	.20	.30*	.14	.32*	.01	.25	.06	-				
(9) Life Satisfaction (T3)	.63*	.18	-.11	.36	.65*	.55*	-.72**	.18	-			
(10) Positive Affect (T3)	.26	.20	-1.6	-.58	.44*	.61*	-.26	.20	.52	-		
(11) Negative Affect (T3)	-.17	.08	.05	-.17	-.17	.04	.31	.37	-.14	.21	-	
(12) Purpose in Life(T3)	-.26	-.31	.11	.25	.02	.29	.09	.05	.12	.33	.28	-
Mean	28.44	32.59	12.36	34.14	27.21	30.84	10.97	35.95	29.31	28.22	13.59	32.77
SD	5.43	8.35	3.40	7.71	6.46	9.32	1.81	5.98	5.60	8.54	4.27	7.10

** $p \leq .01$, *$p \leq .05$

Table 3

Average Pre-and Post-Test Responses for Predictors of Positive Aging

Predictors	T1	T2	T2	T3	T1	T3
Life Satisfaction	28.55	27.21(1.79)	28.50	28.80(-.274)	30.36	29.31(1.09)
Positive Affect	34.69	30.84**(2.98)	30.05	28.15(1.05)	33.40	28.22(2.22) **
Negative Affect	12.14	10.97**(2.69)	10.90	13.95*(-3.27)	12.27	13.59(-1.21)
Purpose in Life	36.52	36.06(.37)	36.10	32.75(1.66)	34.47	33.19(.70)

** $p \leq .01$, *$p \leq .05$

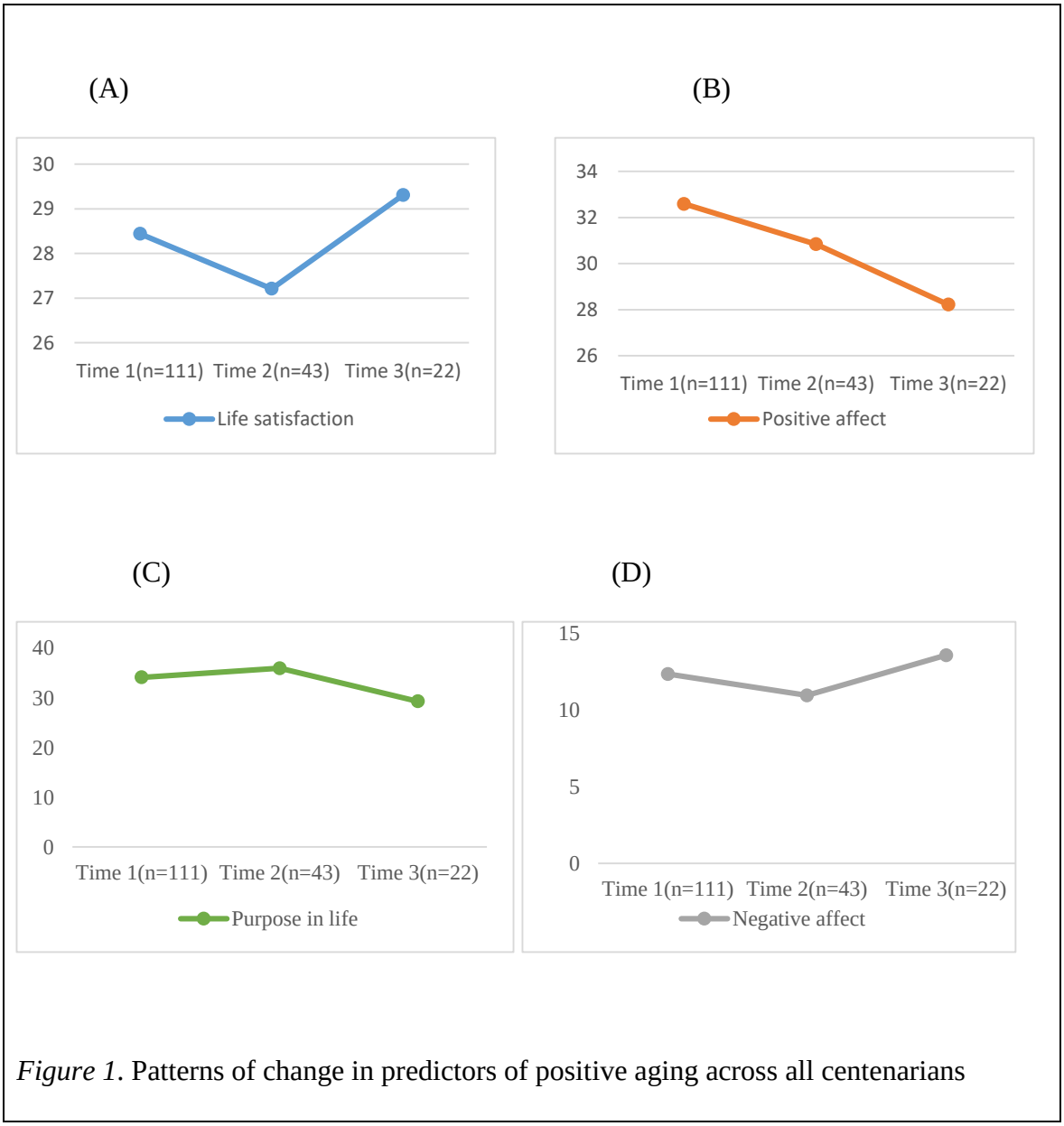

Figure 1. Patterns of change in predictors of positive aging across all centenarians

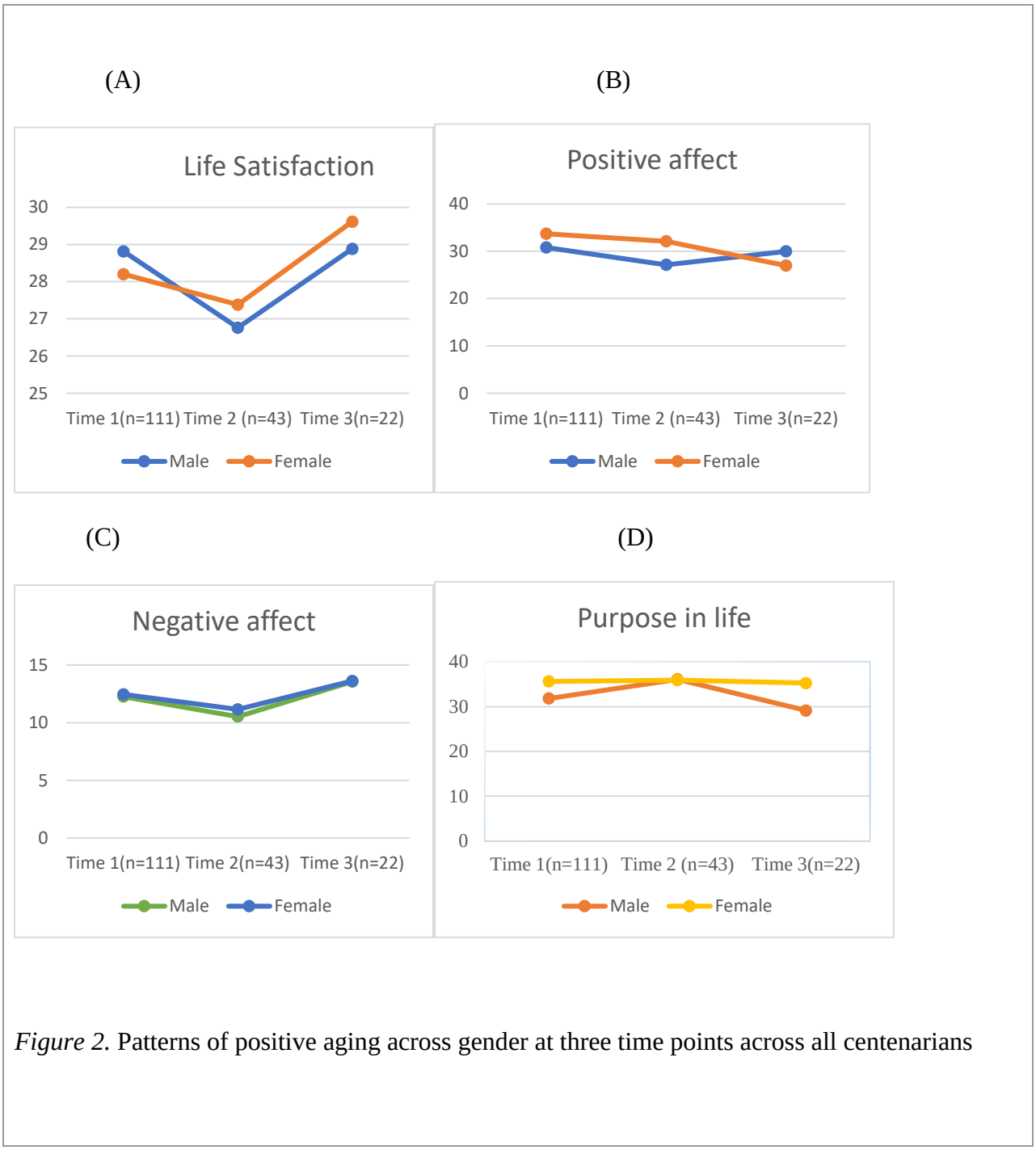

Figure 2. Patterns of positive aging across gender at three time points across all centenarians

* purpose in life T1 & T3; $p < .05$

Figure 3. Patterns of positive aging across gender among survivors

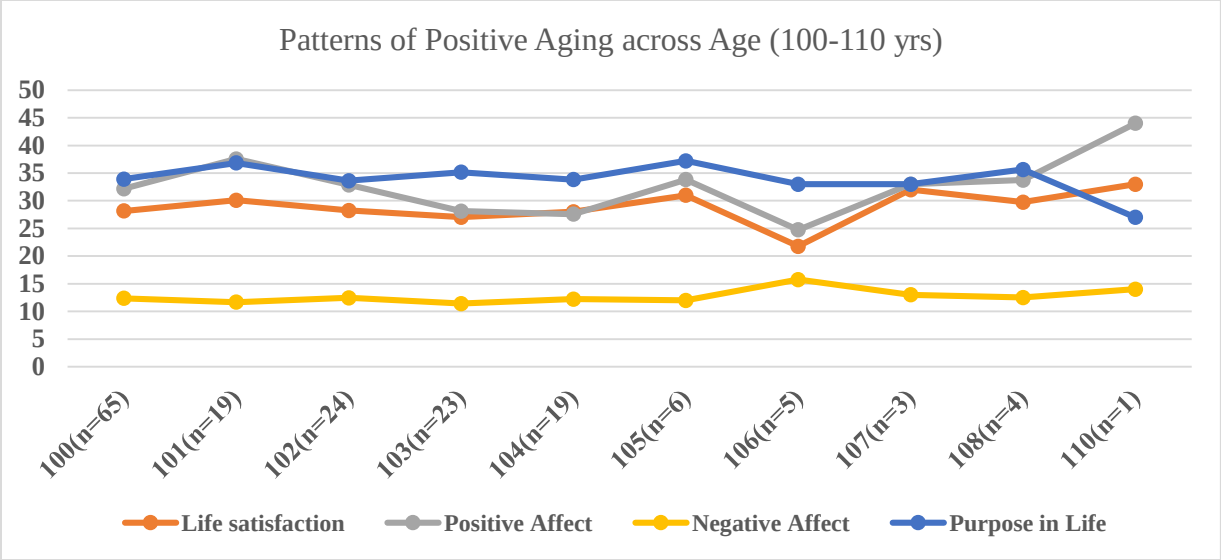

Figure 4. Illustrating patterns in positive aging across among all centenarians (100 to 110 years of age)

APPENDICES

Demographics

Read: I would now like to ask you a few questions about your social and demographic background.

1. **Gender:** _____Male _____Female

2. **Race/Ethnic Background**

_____White/White-Caucasian

_____ Black or African American

_____ Hispanic/Latino Origin

_____ American Indian

_____ Asian or Asian-American

_____ Native Hawaiian and Pacific Islander

_____ Alaska Native

_____Two or More Races/Multi-racial (**Specify**: _____)

_____ Other **(Specify_____)**

3. **Education**

___ Grade school (K-8)

_____ Some high school
_____ High school diploma
_____ Trade school or vocational degree
_____ Some college degree

_____ Associate Arts degree

_____ College degree
_____Some post graduate education
_____ Graduate degree
_____Ph.D./Doctoral degree

Total years of education: _____

7.) HEALTH

a. How would you rate your overall health at the present time?

____Excellent ____Good ____Fair ____Poor

b. How much do your health troubles stand in the way of doing the things you want to do?

____Not at all ____A little or some ____A great deal

c. Rate the following:

a.) Your eyesight (with glasses or contacts) ___Excellent ___Good ___Fair ___Poor

b.) Your hearing (without a hearing aid) ___Excellent ___Good ___Fair ___Poor

d.) How have you felt in the past month?	**Not at all**	**A little**	**Moderately**	**Quite a bit**	**Extremely**
I feel worn out.	1	2	3	4	5
I feel energetic.	1	2	3	4	5
I feel slowed down in my thinking.	1	2	3	4	5
I do quite a lot within a day.	1	2	3	4	5
I have trouble concentrating.	1	2	3	4	5
I feel drowsy.	1	2	3	4	5
Physically, I feel in good shape.	1	2	3	4	5
I have low output.	1	2	3	4	5
I have trouble with my memory.	1	2	3	4	5
I feel rested.	1	2	3	4	5
I can concentrate well.	1	2	3	4	5

e. In the last month, how often have you felt that you were unable to control the important things in your life?

___0 = never ___1 = almost never ___2 = sometimes ___3 = fairly often ___4 = very often

f. In the last month, how often have you felt confident about your ability to handle your personal problems?

___0 = never ___1 = almost never ___2 = sometimes ___3 = fairly often ___4 = very often

g. In the last month, how often have you felt that things were going your way?

___0 = never ___1 = almost never ___2 = sometimes ___3 =f airly often ___4 = very often

h. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

___0 = never ___1 = almost never ___2 = sometimes ___3 =fairly often ___4 = very often

Life Satisfaction

Read: I am going to read some statements that reflect how persons feel about their life. Think about how you currently feel and indicate your level of agreement.

1 = Strongly Disagree

2 = Disagree

3 = Slightly Disagree

4 = Neither/Neutral

5 = Slightly Agree

6 = Agree

7 = Strongly Agree

1. **In most ways, my life is close to ideal.**
   1 2 3 4 5 6 7
2. **The conditions of my life are excellent.**
   1 2 3 4 5 6 7
3. **I am satisfied with my life.**
   1 2 3 4 5 6 7
4. **So far, I have gotten the important things I want in life.**
   1 2 3 4 5 6 7
5. **If I could live my life over, I would change almost nothing.**

   1 2 3 4 5 6 7

Mood

Read: The following words describe different emotions or feelings persons may have. Please indicate the extent to which you feel this way right now, that is, in the present moment.

1	**2**	**3**	**4**	**5**
Not at all	A little	Moderately	Quite a bit	Extremely

_____ Interested	_____Irritable
_____Distressed	_____Alert
_____Excited	_____Ashamed
_____Upset	_____Inspired
_____Strong	_____Nervous
_____Guilty	_____Determined
_____Scared	_____Attentive
_____Hostile	_____Jittery
_____Enthusiastic	_____Active
_____Proud	_____Afraid

Purpose

Read: The next set of questions reflect how persons think about their life purpose. Think about your life goals and accomplishments, then indicate your level of agreement with each question.

Strongly Disagree **Neither** **Strongly Agree**

1 2 3 4 5 6 7

1. I live life one day at a time and don't really think about the future.

   1 2 3 4 5 6 7

2. I have a sense of direction and purpose in life.

   1 2 3 4 5 6 7

3. I don’t have a good sense of what it is I’m trying to accomplish in life.

   1 2 3 4 5 6 7

4. My daily activities often seem trivial and unimportant to me.

   1 2 3 4 5 6 7

5. I enjoy making plans for the future and working to make them a reality.

   1 2 3 4 5 6 7

6. Some people wander aimlessly through life, but I am not one of them.

   1 2 3 4 5 6 7

7. I sometimes feel as if I've done all there is to do in life.

   1 2 3 4 5 6 7

Oklahoma State University Institutional Review Board

Date	Wednesday, March 7, 2018	**Protocol Expires:**	**3/6/2019**
IRB Application No:	HE1338		
Proposal Title:	Oklahoma's Oldest Citizens: The Oklahoma 100 Year Life Project 2.0		

Reviewed and Processed as: Expedited
Continuation

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s):

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Approvals are valid until the expiration date, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

☐ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

Enrollment closed subjects still in follow-up. One withdrawal due to health. No reportable events, complaints, or new/additional funding.

Signature:

Hugh Crethar, Chair, Institutional Review Board

Wednesday, March 7, 2018
Date

VITA

Sabita Poudel

Candidate for the Degree of

Master of Science

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