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Study of loneliness and wisdom in 482 middle-aged and oldest-old adults: a comparison between people in Cilento, Italy and San Diego, USA

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ABSTRACT

Objectives: There has been growing research interest in loneliness and wisdom in recent decades, but no cross-cultural comparisons of these constructs using standardized rating measures in older adults, especially the oldest-old. This was a cross-sectional study of loneliness and wisdom comparing middle-aged and oldest-old adults in Cilento, Italy and San Diego, United States.

Method: We examined loneliness and wisdom, using the UCLA Loneliness Scale Version 3 (UCLA-3) and San Diego Wisdom Scale (SD-WISE), respectively, in four subject groups: adults aged 50-65 and those ≥90 years from Cilento, Italy (N = 212 and 47, respectively) and San Diego, California, USA (N = 138 and 85, respectively).

Results: After controlling for education, there were no significant group differences in levels of loneliness, while on SD-WISE the Cilento ≥90 group had lower scores compared to the other three groups. There was a strong inverse correlation between loneliness and wisdom in each of the four subject groups. Loneliness was negatively associated while wisdom was positively associated with general health, sleep quality, and happiness in most groups, with varying levels of significance.

Conclusion: These results largely support cross-cultural validity of the constructs of loneliness and wisdom, and extend previous findings of strong inverse correlations between these two entities. Loneliness has become a growing public health problem, and the results of our study suggest that wisdom could be a protective factor against loneliness, although alternative explanations are also possible. Research on interventions to reduce loneliness by enhancing wisdom in older adults is needed.

Introduction

The world population is aging rapidly (United Nations Department of Economic and Social Affairs, P.D., 2019). The fastest growing segment of the population is that of the oldest-old; it is also the segment that generates the highest healthcare costs because of medical comorbidities. In recent decades there has been growing concern about loneliness across all ages, but particularly in middle-aged and older adults (Anderson & Thayer, 2018; Dahlberg, Andersson, McKee, & Lennartsson, 2015; Holt-Lunstad, 2017). Empirical research on loneliness received prominence with Weiss's seminal book (Weiss, 1973), followed by others (Peplau, 1982). Loneliness has been defined as the subjective feeling of being isolated (National Academies of Sciences, E., & & Medicine, 2020) or a subjective negative experience that results from inadequate meaningful connections (Fried et al., 2020). Loneliness is consistently associated with unhealthy aging. It has been identified as a major risk factor for adverse mental and physical health

outcomes (L. C. Hawkley & Cacioppo, 2010; Holt-Lunstad, 2017; D. V. Jeste, Lee, & Cacioppo, 2020), including worse general health, poor quality of sleep, lower levels of well-being or happiness, depression (J. T. Cacioppo, Hawkley, Berntson, et al., 2002; J. T. Cacioppo, Hawkley, Crawford, et al., 2002), frailty, cardiovascular disease (Thurston & Kubzansky, 2009), Alzheimer's disease (Wilson et al., 2007), accelerated biological aging (Louise C. Hawkley & Cacioppo, 2007), and premature mortality (Holt-Lunstad, 2017; Shiovitz-Ezra & Ayalon, 2010)) . Conversely, increased morbidity has been shown to increase loneliness (Kristensen, König, & Hajek, 2019). The public health impact of loneliness is comparable to that of cigarette smoking and obesity (McGregor, 2017).

We previously found, in a study of community-dwelling individuals across adult lifespan, that the relationship between loneliness severity and age was non-linear, with loneliness peaking in late-20s, mid-50s, and late-80s (Ellen E. Lee et al., 2019). A novel finding from our study was a

significant inverse correlation between loneliness and wisdom – i.e. people with higher scores on a measure of wisdom were less lonely and *vice versa* (Ellen E. Lee et al., 2019). This finding was supported in a qualitative study of loneliness in older adults (Morlett Paredes et al., 2019). Wisdom has been discussed in religious and philosophical literature since ancient times (Achenbaum & Orwoll, 1991; M. Ardelt, 1997; Monika Ardelt, 2000; Clayton & Birren, 1980; Smith & Baltes, 1990; Sternberg, 1990; Sternberg & Jordan, 2005), but has been receiving increasing attention as a topic of empirical research in the past few decades (Dilip V Jeste & Lee, 2019). Wisdom is a holistic, multidimensional human trait comprised of several specific components: prosocial behaviors including empathy, compassion, and altruism; emotional regulation; self-reflection; decisiveness in the face of uncertainty; acceptance of divergent value systems; and social advising (Dilip V Jeste et al., 2010; Dilip V Jeste & Lee, 2019; Jeste & Vahia, 2008; Meeks & Jeste, 2009). Definitions of wisdom over centuries and across cultural and geographic boundaries share surprising similarities, suggesting a unique biological construct (Jeste & Vahia, 2008; Meeks & Jeste, 2009)). Recent studies have identified neural correlates of the components of wisdom, suggesting that the putative neurocircuitry of wisdom involves prefrontal cortex and limbic striatum (Dilip V Jeste & Lee, 2019; Meeks & Jeste, 2009).

Both loneliness and wisdom are personality traits. Most personality traits including loneliness are partially inherited and partly determined by environment – i.e. epigenetics (Abdellaoui et al., 2019; S. Cacioppo, Capitanio, & Cacioppo, 2014). While there are no large-scale genetic studies using a validated scale of wisdom, it is likely that wisdom too is determined partly by genes and partly by environment. Family upbringing as well as cultural factors affect personality development. Loneliness is more common among racial/ethnic minorities and immigrants (Louise C Hawkley et al., 2008). Grossmann, Weststrate, Ferrari, and Brienza (2020) examined cultural factors and related contexts that may impact wisdom, and found differences in both concepts of wisdom by culture and differences by group on performance in measures of wisdom. In contrast to loneliness, wisdom is reportedly associated with greater well-being, satisfaction with life, and overall better health, all indicators of successful aging (M. Ardelt, 1997; Dilip V. Jeste, Lee, Palmer, & Treichler, 2020).

Despite growing research, large gaps remain in our understanding of loneliness and wisdom – for example, rates and drivers of loneliness in different populations, including the effects of cultural and societal factors (Fried et al., 2020), key therapeutic elements of potential interventions to reduce loneliness (National Academies of Sciences et al., 2020), and sociocultural differences in wisdom using standardized rating scales and appropriate covariates, especially in the oldest-old (Dilip V. Jeste, Lee, & Cacioppo, 2020).

The goals of the current study were to evaluate loneliness and wisdom and their relationship with relevant psychological and physical functioning, in samples of middle-aged and oldest-old adults from Cilento, Italy and San Diego, California, USA. The Cilento region in southwestern Italy is the birthplace of the Mediterranean diet (Keys & Keys, 1959). It is a relatively isolated, rural area believed to have a relatively high concentration of the oldest-old individuals ($\geq$ 90 years). The present investigation was born out of the Cilento Initiative on Aging Outcomes (CIAO) study (Scelzo et al., 2018). We have previously reported that, compared to their younger (age 50-75) cohabitants, people aged $\geq$90 exhibited better mental well-being, with resilience, optimism, religiosity, family bonds, and stubbornness (Scelzo et al., 2018), a healthier metabolic and cardiovascular profile (Daniels et al., 2019), and no significant differences in the laboratory assessment of oxidative stress and APOE genotype (Pizza et al., 2020). The people > 90 did not have severe cognitive impairment, and the prevalence of dementia was low.

Our U.S. cohort came from the Successful AGing Evaluation (SAGE) Study at UC San Diego, comprised of community-dwelling individuals from predominantly urban and suburban areas of San Diego County. We have reported a "paradox of aging" in this sample, with better mental health than younger adults, despite declining physical function (Dilip V Jeste et al., 2013; Michael L Thomas et al., 2016).

In the present investigation, we compared loneliness and wisdom in middle-aged and oldest-old samples from Cilento and San Diego, using validated rating scales. We hypothesized that cross-cultural validity of these constructs would be supported by comparable levels of loneliness and wisdom as well as similar relationships of these constructs with relevant measures of physical and mental health. For the purposes of external validation, we sought to evaluate correlations of loneliness and wisdom with general health, quality of sleep, and happiness.

Methods

Study participants

CIAO study

This study is designed to assess the impact of lifestyle and other factors on healthy aging and aging-related diseases among residents of Cilento, Italy. Study participants included 212 individuals aged 50 to 65 years and 47 individuals aged 90 or above. Thirty general practitioners (GPs) from the Cilento region referred to this study their consenting patients in the specified age groups. Exclusion criteria were: 1) inability to complete study assessments, and 2) a diagnosis of dementia or other major neurological disorder. The GPs made an appointment with the invited subjects, from whom they first obtained a signed informed consent before enrolling in the CIAO Study. The study included 17 villages in the Cilento area: Asceai, Cannalonga, Casal Velino, Ceraso, Cuccaro, Futani, Mandia, Pollica, Laurino, Novi Velia, Montano Antilia, San Mauro La Bruca, Gioi, Stella Cilento, Stio, Sessa Cilento, and Vallo della Lucania. To visit and assess participants, trained study staff traveled across these villages.

SAGE study

The Successful AGing Evaluation (SAGE) study includes community-dwelling subjects across the adult lifespan (D. V. Jeste et al., 2013; M. L. Thomas et al., 2016). A structured multi-cohort design was employed to recruit a demographically representative sample of San Diego County residents

using a modified form of random digit dialing. Study participants included 138 individuals aged 50-65 years and 85 individuals ages 90 years or above. Exclusion criteria were: 1) residence in a nursing home or need for daily skilled nursing care, 2) a diagnosis of dementia made by the subject's treating clinician, as reported by the subject, and 3) terminal illness or need for hospice care. All the subjects signed a written informed consent form either online or in person, and completed a paper and pencil or online survey questionnaire.

The study protocol received the approval of the IRB of the ASL Salerno (ethics committee Campania Sud) number 48 and UC San Diego Human Research Subjects Protection Program. All study participants provided written consent to participate.

Sociodemographic and clinical characteristics

Sociodemographic and lifestyle characteristics (age, sex, race/ethnicity, education, marital status, employment status, smoking, and alcohol use) were obtained through structured interviews with participants in Cilento and through a survey questionnaire in San Diego. Italian versions of standardized published measures were used in Cilento. General health was assessed with a single question from the 36-item Medical Outcomes Study Short Form (MOS SF-36) ("In general, would you say your health is … .",(Ware & Sherbourne, 1992)), and sleep quality was evaluated with a single item from the PROMIS Sleep Disturbance Measure ("My sleep quality is … ", Cella et al., 2010 (Cella et al., 2010)), each to be rated on a 1-to-5 scale. Happiness was measured using the 4-item Happiness (positive affect) subscale of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). Additional measures of physical health included comorbid medical conditions reported as well as body mass index (BMI).

Loneliness measure

The UCLA Loneliness Scale (Version 3) (UCLA-3) (Russell, 1996), a widely used measure of loneliness was administered. It consists of 20 statements that do not use the word "lonely" explicitly. Higher scores indicate greater loneliness. The UCLA-3 has demonstrated good to excellent test-retest reliability (Russell, 1996), internal consistency (Lasgaard, 2007; Russell, 1996; Vassar & Crosby, 2008), discriminant validity (Lasgaard, 2007), and convergent validity (Lasgaard, 2007; Russell, 1996).

Wisdom measure

The San Diego Wisdom Scale (SD-WISE) (Thomas et al., 2019) was designed to assess six components or domains of wisdom (emotional regulation, self-reflection or insight, pro-social behaviors, acceptance of divergent values, decisiveness, and social advising), and to produce psychometric estimates of a higher-order and latent construct—a putative measure of personal wisdom. The words "wisdom" and "wise" are not used explicitly in any statement. The scale includes 24 items, with four items for each of the six components, and higher scores are indicative of higher levels of those components. The SD-WISE has shown good to excellent psychometric properties (Thomas et al., 2019).

Two bilingual coauthors from Rome (MS and AB) spent several months in San Diego, familiarizing themselves with the SAGE study, including the use of various measures. They translated the UCLA-3 and SD-WISE scales into Italian, back-translated them into English, and with input from various investigators from Italy and the U.S., retranslated into Italian to ensure cultural coherence of the scale items.

Statistical analysis

The study cohorts were compared across the four age groups: CIAO age 50-65 (Group 1), SAGE age 50-65 (Group 2), CIAO age ≥ 90 (Group 3), and SAGE age ≥ 90 (Group 4). Participant sociodemographic and clinical characteristics, including loneliness and wisdom, were compared across the four groups using one-way analysis of variance (ANOVA) with post-hoc Holm Adjustment (Holm, 1979) for continuous variables and Chi-square tests for discrete variables. Please note that we conducted four post-hoc group comparisons: Groups 1 vs. 2, 1 vs. 3, 2 vs. 4, and 3 vs. 4. (We did not compare Groups 2 vs. 3 as they differed in both age and site.) A two-sided alpha level of $p < 0.05$ was used to determine statistical significance. Given that education level differed significantly between age groups in SAGE and CIAO cohorts ($\chi^2 = 331$, $p < 0.0001$), analyses were repeated, controlling for education. To improve robustness of study findings, estimating equations were used for inference (Tang, He, & Tu, 2012).

Pearson's correlations were used to evaluate the relationship between loneliness and wisdom as well as the associations of these constructs with other variables including medical comorbidity, BMI, general health, sleep quality, and happiness. The Fisher r-to-z transformations were performed to compare the correlations across groups. To assess the associations of loneliness and wisdom across the subject groups and covariates, linear regression with backwards elimination was performed, with loneliness or wisdom as the dependent variable and all other covariates by group interactions as predictors. Unlike forward selection, backward elimination starts with a less biased model and thus provides more reliable variable selection (Wang et al., 2017).

Results

Demographic and clinical characteristics of the four subject groups are presented in Tables 1a and 1b. The total sample comprised of 485 participants, including 262 from the CIAO cohort (Group 1: CIAO ages 50-65, $n = 215$; Group 3: CIAO ages ≥ 90, $n = 47$) and 223 from the SAGE cohort (Group 2: SAGE 50-65, $n = 138$; Group 4: SAGE ≥ 90, $n = 85$). The groups did not differ on sex distribution. Middle-aged adults were more likely to be married or cohabiting with a partner than the oldest-old. The CIAO cohort had considerably lower education level compared to the SAGE cohort, with CIAO oldest-old having the fewest proportion of individuals who obtained some college education. Among middle-aged adults, SAGE cohort was more likely to be employed compared to CIAO cohort. Unsurprisingly, the number of total medical conditions endorsed was higher and general health rating was lower in oldest-old adults compared to middle-aged adults among both CIAO and SAGE cohorts.

Table 1a: CIAO vs. SAGE Study Comparisons by Age Groups.

	Age 50-65		Age >90			
	CIAO (N = 212) Group 1 Mean (SD) or %	SAGE (N = 138) Group 2 Mean (SD) or %	CIAO (N = 47) Group 3 Mean (SD) or %	SAGE (N = 85) Group 4 Mean (SD) or %	F or x^2	p
Socio-demographics						
Age (years)	57.8 (4.5)	58.1 (4.9)	92.7 (3)	93.2 (3.2)	3018	<.0001
Sex						
Female	53%	49%	68%	48%	2	0.100
Race						
Caucasian	100%	75%	100%	94%	83	0.020
Marital Status						
Married or cohabiting	82%	70%	19%	39%	40	<.0001
Education						
Some College and Above	12%	94%	5%	85%	331	<.0001
Employment Status						
Employed professionally (full-time or part-time)	56%	75%	0%	2%	295	<.0001
Lifestyle Factors						
Smoker - current	29%	11%	0%	4%	42	<.0001
Smoker - ever	56%	26%	16%	48%	46	<.0001
Alcohol Use (current)						
Non-drinker	37%	15%	56%	33%	119	<.0001
Drinker	63%	85%	44%	68%		
Physical and Mental Health						
Medical Conditions						
High Blood Pressure	45%	31%	77%	67%	17	<.0001
High Cholesterol	46%	29%	34%	37%	4	0.010
Diabetes	9%	4%	18%	17%	4	0.010
Heart Attack	1%	2%	11%	12%	3	0.020
Stroke	1%	1%	7%	11%	4	0.005
Cancer	5%	18%	12%	46%	21	<.0001
Ulcer	5%	2%	5%	0%	7	0.080
Colitis	2%	1%	9%	0%	15	0.002
Emphysema/COPD	4%	2%	23%	4%	4	0.006
Total medical conditions endorsed	1.1 (1.0)	0.9 (0.9)	1.9 (1.4)	1.9 (1.3)	18.11	<.0001
BMI	28.4 (4.8)	28.2 (6.3)	26.9 (3.9)	25.4 (3.9)	11	<.0001
General Health Rating (range 1-5)	3.4 (0.7)	3.6 (0.9)	3.1 (0.8)	3.3 (0.9)	6	0.0009
Sleep Quality (range 1-5)	3.4 (0.9)	3.6 (0.9)	3.2 (0.8)	3.9 (0.8)	7	0.0001
CESD Happiness Scale (range 0-12)	6.9 (3.3)	9.8 (2.7)	4.9 (2.2)	9.3 (2.8)	26	<.0001
Loneliness						
UCLA Loneliness Scale Total Score (range 20-80)	39.9 (8.4)	36.8 (10)	44.7 (8.1)	37.0 (10.8)	10	<.0001
Wisdom (range 1-5)						
SD-WISE - Pro-Social Behaviors	4.1 (0.6)	4.2 (0.5)	3.5 (0.7)	4.2 (0.5)	16	<.0001
SD-WISE - Emotional Regulation	3.2 (0.7)	3.8 (0.7)	3.1 (0.7)	3.6 (0.6)	25	<.0001
SD-WISE - Self-Reflection (Insight)	3.7 (0.6)	3.8 (0.7)	3.2 (0.5)	3.5 (0.5)	16	<.0001
SD-WISE - Acceptance for Divergent Values	3.9 (0.6)	4.0 (0.6)	3.4 (0.7)	3.8 (0.5)	7	<.0001
SD-WISE - Decisiveness	3.4 (0.8)	3.8 (0.8)	3.2 (0.7)	3.7 (0.7)	12	<.0001
SD-WISE - Social Advising	3.6 (0.6)	3.8 (0.6)	3.3 (0.5)	3.6 (0.6)	13	<.0001
SD-WISE - Total	3.7 (0.4)	3.9 (0.4)	3.3 (0.4)	3.7 (0.4)	24	<.0001

Note: One-way ANOVA were performed for continuous variables and Chi-square tests were performed for categorical variables.
Abbreviations:.
BMI = Body Mass Index.
CESD = Center for Epidemiologic Studies Depression Scale.
COPD = Chronic Obstructive Pulmonary Disease.
SD-WISE = San Diego Wisdom Scale.

Comparison of loneliness across groups

Initial analysis of UCLA-3 scores across groups revealed differences among all the four groups, except between SAGE middle-aged and oldest-old adults (Tables 1a and 1b). Loneliness levels were highest in the CIAO ≥90 group, compared to CIAO 50-65 and SAGE ≥90 groups. CIAO middle-aged adults were also lonelier than their SAGE middle-aged counterparts. However, after controlling for education, there were no significant differences in loneliness among the four groups (Table 2a; Figure 1).

Comparison of wisdom across groups

Initial analysis of the SD-WISE across groups revealed differences in total wisdom level among all the four groups (Tables 1a and 1b). Oldest-old adults had lower scores than middle-aged adults (in both CIAO and SAGE cohorts), and

CIAO participants had lower scores than SAGE participants (in both middle-aged and oldest-old adults). The CIAO ≥90 group had lower scores than both CIAO 50-65 and SAGE ≥90 groups. Examination of SD-WISE subscales revealed that the CIAO ≥90 group had lower scores on each component compared to the SAGE ≥90 group, and on every component except for emotional regulation and decisiveness compared to CIAO 50-65 group.

However, after controlling for education, total wisdom score was no longer different between CIAO and SAGE middle-aged adults, but other differences remained: ≥90 adults had lower total SD-WISE scores than each of the other three groups (Tables 2a and 2b; Figure 1). On the SD-WISE subscales, middle-aged adults had higher scores on self-reflection and social advising components than oldest-old adults (in both CIAO and SAGE cohorts). The CIAO ≥90 group had lower scores on the pro-social behavior component compared to CIAO 50-65 and SAGE ≥90

Table 1b: CIAO vs. SAGE Study Comparisons by Age Groups - Pairwise Significance (p-values).

	1 vs 2	1 vs 3	2 vs 4	3 vs 4
Socio-demographics				
Age (years)	0.9754	<.0001	<.0001	0.9754
Sex				
Female	N/A	N/A	N/A	N/A
Race				
Caucasian	0.0000	1.0000	0.0000	0.5556
Marital Status				
Married or cohabiting	0.5430	<.0001	<.0001	0.1224
Education				
Some College and Above	<.0001	0.0000	0.2213	<.0001
Employment Status				
Employed professionally (full-time or part-time)	0.0000	0.1894	0.0477	0.8940
Lifestyle Factors				
Smoker - current	0.0003	0.0000	0.3902	0.5705
Smoker - ever	0.0000	0.0000	0.0035	0.0009
Alcohol Use (current)				
Non-drinker	0.0033	0.0016	0.6020	0.3777
Drinker				
Physical and Mental Health				
Medical Conditions				
High Blood Pressure	0.0201	0.0002	0.0000	0.2508
High Cholesterol	0.0079	0.7042	0.7042	1.0000
Diabetes	0.0622	0.0001	0.0000	0.9741
Heart Attack	0.3376	0.2008	0.0186	0.8098
Stroke	1.0000	0.0110	0.0032	1.0000
Cancer	0.9001	0.0634	0.0001	0.6710
Ulcer	N/A	N/A	N/A	N/A
Colitis	0.0020	0.4313	0.0000	0.0000
Emphysema/COPD	0.8384	0.0060	0.8384	0.0019
Total medical conditions endorsed	0.0620	0.0000	0.0000	0.9740
BMI	0.8203	0.2825	0.0005	0.3348
General Health Rating (range 1-5) ↑ better	0.2582	0.0235	0.0235	0.2582
Sleep Quality (range 1-5) ↑ better	0.1575	0.2203	0.0709	0.0006
CESD Happiness Scale	0.0000	0.0382	0.2807	0.0000
Loneliness				
UCLA Loneliness Scale Total Score	0.0123	0.0123	0.8873	0.0001
Wisdom				
SD-WISE - Pro-Social Behaviors	0.0473	0.0000	0.4815	0.0000
SD-WISE - Emotional Regulation	0.0000	0.2719	0.1767	0.0001
SD-WISE - Self-Reflection (Insight)	0.2566	0.0000	0.0049	0.0049
SD-WISE - Acceptance for Divergent Values	0.7698	0.0000	0.1747	0.0051
SD-WISE - Decisiveness	0.0000	0.1156	0.2131	0.0021
SD-WISE - Social Advising	0.0028	0.0028	0.0053	0.0105
SD-WISE - Total	0.0000	0.0000	0.0049	0.0000

Note: 1–Age 50-65 CIAO, 2–Age 50-65 SAGE, 3–Age ≥90 CIAO, 4–Age ≥90 SAGE.
Holm Adjustment was used to adjust for multiple comparisons of the pairwise significances.
NA = Not Applicable as the ANOVAs in Table 1b were not significant.

groups. On the component of acceptance of diverse perspectives, the CIAO 50-65 group had lower scores compared to SAGE 50-65 group, and CIAO ≥90 had lower scores compared to CIAO 50-65 group. There were no group differences on emotional regulation and decisiveness components.

Correlations of loneliness and wisdom

Pearson's correlations revealed strong inverse associations (p <.001) between loneliness and total SD-WISE score, in all four subject groups (Figure 2; Table 3); there were no significant differences in r values, although the Cilento ≥90 group (r = −.755) had a numerically higher correlation than the other three groups (r = −.5 to −.6). Participants with higher scores on UCLA-3 had lower scores on SD-WISE, and *vice versa*. Loneliness also correlated inversely with most of the SD-WISE subscale scores in the four groups, though the level of significance varied. Loneliness was negatively correlated with general health, quality of sleep, and happiness while wisdom was positively correlated with those variables with the exception of happiness in the CIAO >90 group; however, the levels of significance

varied considerably across groups (Supplemental Tables 1 and 2). There were very few significant correlations between either loneliness or wisdom and the total number of medical conditions reported or BMI.

Discussion

We compared the psychological constructs of loneliness and wisdom, and examined their relationships to relevant measures of physical and mental health, in middle-aged and oldest-old adults in Cilento, Italy and San Diego, California, USA. Loneliness did not differ across age or cultural groups after controlling for education. The same was true for SD-WISE scores except for the oldest-old adults in Cilento, Italy, who had lower scores than the other groups. Loneliness was negatively correlated with wisdom in both age groups in both Cilento and San Diego, with no significant differences among the four cohorts. Similarly, loneliness had an inverse correlation with general health, sleep quality, and happiness whereas the reverse was true for wisdom (except for the CIAO >90 group), with varying levels of significance. Thus, the overall validity of the two constructs was largely supported, with the specified exception.

Educational attainment and other indicators of socioeconomic status are consistently reported to be associated with access to collectively desired resources (Oakes n.d.)and with health and life outcomes in old age (Darin-Mattsson, Fors, & Kåreholt, 2017) (Several studies in older adults have highlighted significant associations of loneliness with lower educational attainment (Chen, Conwell, & Chiu, 2014; Cohen-Mansfield, Hazan, Lerman, & Shalom, 2016). In the Chicago Health, Aging, and Social Relations Study, Hispanic and Black participants were lonelier than White participants; however, high school education and household income explained a substantial portion of this race/ethnicity variance (L. C. Hawkley et al., 2008). After controlling for these variables (education, income), the racial/ethnic difference in loneliness was no longer significant) . Similarly, several studies have shown a positive association between educational attainment and intelligence in youth and later life (Hegelund et al., 2020)). As noted earlier, intelligence is necessary but not sufficient for wisdom. Therefore, controlling for education may have some impact on associations with wisdom.

In the present study, educational levels differed significantly between the Cilento and San Diego samples. The CIAO cohorts had lower level of education than the SAGE cohorts. This could be related to the rural setting in Cilento in contrast to the urban/suburban setting in San Diego. The Cilento participants aged >90 had the smallest proportion of individuals who had obtained some college education. This difference in the years of formal education between the groups could reflect on possible impact of World War II on educational infrastructure in Italy (versus US) during the 1940s and 1950s. When we statistically controlled for education, group differences in loneliness and wisdom were no longer significant (except for wisdom in the oldest-old CIAO sample). Thus, differences in education level seemed to explain, at least partially, the observed reginal differences in loneliness and to a smaller extent, wisdom. However, caution is warranted in interpreting the results of statistical control, especially when the samples are unbalanced on that specific variable. Larger studies of Italian and US samples with comparable educational attainment are needed to confirm similarity in levels of loneliness and wisdom in the two populations.

One of our findings was that wisdom score was lower in oldest-old adults. The literature on the relationship between age and wisdom is surprisingly limited. There are no published longitudinal studies of changes in wisdom with aging, employing a validated rating scale of wisdom. Most research on wisdom and aging is based on cross-
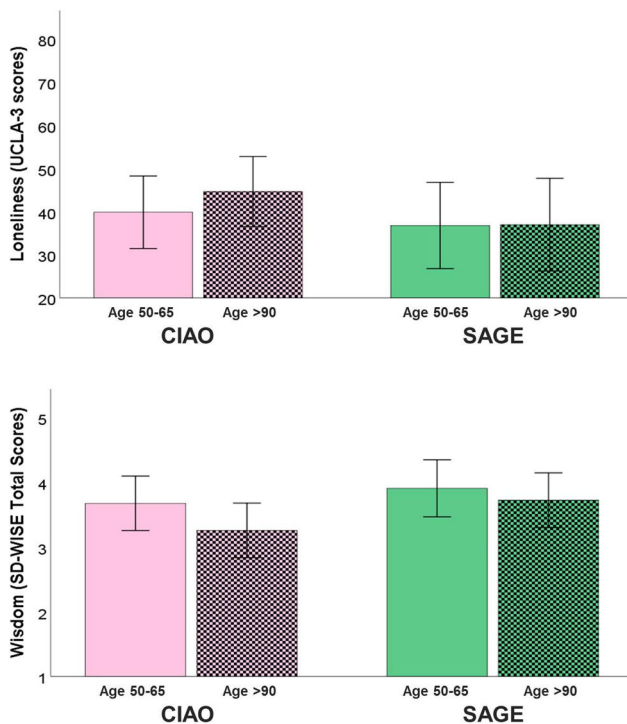

Figure 1. Comparison of Loneliness and Wisdom Scale Scores in the Cilento and San Diego Samples by Age Group (50-65 and >90 years).

Table 2a. Comparison of UCLA Loneliness and SD-WISE Scale Scores of CIAO vs. SAGE Study Comparisons by Age Groups, controlling for Education.

	Age 50-65		Age >90			
	CIAO (N = 212) Mean (SD) or %	SAGE (N = 138) Mean (SD) or %	CIAO (N = 47) Mean (SD) or %	SAGE (N = 85) Mean (SD) or %	F or x^2	p
UCLA Loneliness Scale Total Score	39.9 (8.4)	36.8 (10)	44.7 (8.1)	37.0 (10.8)	1.1025	0.2937
SD-WISE - Pro-Social Behaviors	4.1 (0.6)	4.2 (0.5)	3.5 (0.7)	4.2 (0.5)	8.4397	0.0037
SD-WISE - Emotional Regulation	3.2 (0.7)	3.8 (0.7)	3.1 (0.7)	3.6 (0.6)	0.1299	0.7186
SD-WISE - Self-Reflection (Insight)	3.7 (0.6)	3.8 (0.7)	3.2 (0.5)	3.5 (0.5)	36.9121	<.0001
SD-WISE - Acceptance for Divergent Values	3.9 (0.6)	4.0 (0.6)	3.4 (0.7)	3.8 (0.5)	16.3054	0.0001
SD-WISE - Decisiveness	3.4 (0.8)	3.8 (0.8)	3.2 (0.7)	3.7 (0.7)	0.1736	0.6770
SD-WISE - Social Advising	3.6 (0.6)	3.8 (0.6)	3.3 (0.5)	3.6 (0.6)	13.0819	0.0003
SD-WISE - Total	3.7 (0.4)	3.9 (0.4)	3.3 (0.4)	3.7 (0.4)	15.7921	0.0001

Note: GEE was performed to compare the difference across 4 groups, controlling for Education.

Table 2b. Comparison of UCLA Loneliness and SD-WISE Scale Scores of CIAO vs. SAGE Study Comparisons by Age Groups, controlling for Education – Pairwise significance (p-values).

	1 vs 2	1 vs 3	2 vs 4	3 vs 4
UCLA Loneliness Scale Total Score	N/A	N/A	N/A	N/A
SD-WISE - Pro-Social Behaviors	0.9740	<0.0001	0.4490	<0.0001
SD-WISE - Emotional Regulation	N/A	N/A	N/A	N/A
SD-WISE - Self-Reflection (Insight)	0.0660	0.0001	0.0024	0.8198
SD-WISE - Acceptance for Divergent Values	0.0485	0.0023	0.1772	0.3781
SD-WISE - Decisiveness	N/A	N/A	N/A	N/A
SD-WISE - Social Advising	0.6059	0.0220	0.0065	0.7697
SD-WISE - Total	0.9220	<0.0001	0.0020	0.0047

Note:GEE was performed to compare the difference across 4 groups, controlling for Education.
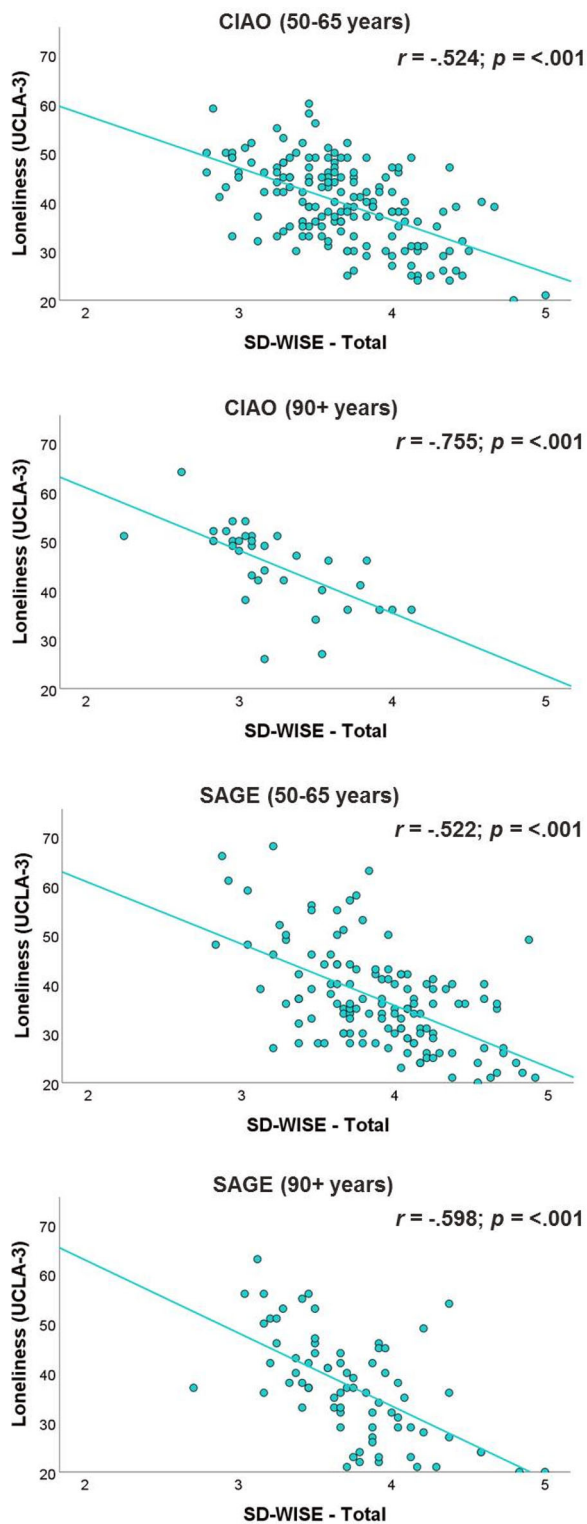NA = Not Applicable as the ANOVAs in Table 2b were not significant.

Figure 2. Pearson's Correlations between Loneliness and Wisdom Scale Scores in the Cilento and San Diego Samples by Age Group (50-65 and >90 years).

sectional comparisons of younger and older adults on specific wisdom-related ability areas. Early studies of wisdom, which focused on cognitive rather than emotional components of wisdom, reported that wisdom was not significantly related to age from 20 to 80 years (Staudinger, 1999). Above age 80, however, there was a negative relationship between age and wisdom, likely due to cognitive decline. However, the number of participants over age 80 was too small to draw firm conclusions. On the other hand, more recent studies have reported that several wisdom components are present at a higher level in older (ages 58 to 84) than in younger (ages 18 to 30) adults; these include decision making, pragmatic reasoning, theory of mind, and self-knowledge (Grossmann et al., 2020; Mickler & Staudinger, 2008; Worthy, Gorlick, Pacheco, Schnyer, & Maddox, 2011). There is clearly a need for longitudinal studies of wisdom across the adult lifespan, including the oldest-old adults.

Rather surprisingly, the oldest-old adults in Cilento had lower scores on SD-WISE total as well as several subscales than the other three groups. This finding suggests a potential cohort effect in this specific group and possible cultural variations involving differences in the fundamental pragmatics of current life in a rural environment in Cilento compared to the urban and suburban milieu in San Diego. We also need to consider the different personal narratives and values among the Cilento nonagenarians and centenarians (Scelzo et al., 2018), who had to weather economic depression and World War II, which did not directly involve most of the people in any of the other three cohorts. Other possibilities may relate to varied experience with participation in research protocols and responses to assessments of mental functioning. Finally, while the UCLA-3 and SD-WISE scales were translated and adapted in Italian, their validity in the context of Italy, specifically the rural communities of Cilento, remains unknown.

The inverse association between loneliness and wisdom is consistent with findings from our previous study of loneliness in adults across the lifespan (Ellen E. Lee et al., 2019). Extending the results from that prior study, we explored relationships between loneliness and specific components of wisdom. While loneliness levels were negatively correlated with most subscales of the SD-WISE in most of the subject groups, the effect sizes and levels of significance varied. Notably, the effect sizes were consistently in the medium to large range (from −.370 to −.606) for prosocial behaviors versus small (range from −.023 to −.275) for self-reflection.

The strong inverse association between loneliness and wisdom in all the four cohorts in our study suggests that wisdom may serve as a protective factor and a potential intervention against loneliness. However, this interpretation is limited by the cross-sectional nature of this study. Thus, an alternative explanation would be that loneliness prevents people from gaining wisdom. Considering the detrimental health implications of loneliness, the need for unique solutions is imperative. Unlike interventions that emphasize external factors such as facilitation of social interactions, interventions based on increasing wisdom may be focused internally on increasing components like pro-social behaviors which may positively impact the quality (and not necessarily the quantity) of social relationships. With increased empathy, lonely individuals may be more apt to recognize and process social and emotional cues relevant to social decision making.

As expected, loneliness was negatively correlated with happiness and sleep quality in most groups. Previous studies have also reported loneliness to be associated with lower levels of positive psychological traits/states, including optimism, resilience, and satisfaction with life, and lower levels of adverse mental states such as depression, anxiety, and sleep disturbances (Etezadi & Pushkar, 2013; Ellen E. Lee et al., 2019; Zebhauser et al., 2014). Although

Table 3. Pearson's Correlations of UCLA Loneliness Scale with SD-WISE Subscale Scores by Age Group and Site.

	Age 50-65		Age >90		x^2	p
	CIAO (N = 212)	SAGE (N = 138)	CIAO (N = 47)	SAGE (N = 85)		
Pro-Social Behaviors	-.370***	-.514**	-.426*	-.606***	5.32	0.150
Emotional Regulation	-.306***	-.460***	-.406*	-.483***	3.39	0.336
Self-Reflection (Insight)	-.275***	-.233*	−0.023	-.267*	2.47	0.482
Acceptance of Divergent Behaviors	-.345***	-.277*	-.574**	-.252*	4.94	0.176
Decisiveness	-.398***	-.470***	−0.315	-.435***	1.12	0.773
Social Advising	-.372***	-.428***	-.455**	-.465***	0.826	0.843

*p = <.01.
**p = <.001.
***p = <.001.

associated with mental health measures and self-rated general health, loneliness did not correlate with physical comorbidity or BMI, suggesting that physical health is impacted to a greater extent by other psychosocial or environmental factors.

Wisdom was associated with happiness (except in the CIAO ≥90 group) and better self-reported general health and sleep quality. Prior studies suggest that adaptive coping (problem-solving, positive reappraisal), sense of self-efficacy, and meaning in life may mediate the positive relationship between wisdom and positive affect (Etezadi & Pushkar, 2013). The lack of a significant association between wisdom and happiness in the CIAO >90 group may suggest that in this oldest-old, rural population, happiness is based on placing greater value on eudemonic than hedonic well-being and growth. This is consistent with our previous finding of a high level of religiosity in Cilento's oldest-old (Scelzo et al., 2018) . We did not assess religiosity or spirituality in the present study.

The present study compared two markedly different cultures – a rural region of southern Italy and an urban/suburban county in the US, both with different native languages and unique historical backgrounds. Yet, we found only quantitative differences in loneliness and wisdom between the two cultures, with similar associations of those constricts with each other and with other variables like health, sleep, and happiness (except for the CIAO >90 group). Therefore, we believe that the basic constructs of loneliness and wisdom appear to be similar across these cultures.

Strengths and limitations

This investigation is, to our knowledge, the first comparison of loneliness and wisdom using validated rating scales in middle-aged and oldest-old adults from two different countries thousands of miles away from each other and with markedly different histories as well as native languages. Considering that the fastest growing segment of the modern western population is that of the oldest-old, it is important to examine nuances in positive and negative psychological states and traits in this subgroup of older adults. This study extends previous findings showing an inverse correlation between loneliness and wisdom, with an examination of the relationships of different components of wisdom with loneliness.

At the same time, the present study also has several limitations. As this was a cross-sectional study, no definitive causal interpretations can be made. While wisdom may serve as a protective factor against loneliness, it is also plausible that loneliness may limit a person's ability to

develop or enhance components of wisdom. Furthermore, our sample may be biased in that the oldest-old participants in this study were functional, capable of completing interviews or survey questionnaires. We should add, however, that these were not super-normal older adults as they had a number of comorbid medical conditions. Not surprisingly, the sample sizes were smaller for the oldest-old groups. Our Cilento and San Diego samples may not represent the general population in Italy or the US, respectively. The differences between the two sites may relate to other variations such as the fact that the Cilento sample was from a rural region unlike the more urban and suburban San Diego sample. Reflecting this, there was a large difference in the level of education, with a much greater proportion of the San Diego sample having had at least some college education than the Cilento participants. To address this issue, we re-ran the analyses after controlling for education. Our results may not generalize to non-Western cultures. All our measures were subjective and thus likely to include self-report bias. Finally, we did not have neurocognitive assessments.

Future work should examine the cultural equivalency of the UCLA-3 and SD-WISE in eastern cultures. Whereas western conceptualizations of wisdom place greater value on personal and hedonic well-being and growth, eastern interpretations of wisdom tend to emphasize eudemonic well-being and social judgment (Jeste & Vahia, 2008; Takahashi & Bordia, 2000). Also, future clinical studies should be accompanied by an evaluation of objective measures of the behavioral constructs as well as relevant blood-based biomarkers of pathological processes like inflammation which underlie unhealthy aging. Similarly, functional neuroimaging studies may help shed light on the neurobiology of loneliness and wisdom.

Our study has implications for interventions to reduce loneliness by enhancing wisdom. Unlike interventions that emphasize external factors such as increasing social interactions to reduce objective social isolation, interventions aimed at reducing loneliness would be focused internally on increasing levels of components of wisdom. For example, with increased empathy, lonely individuals may become more apt to recognize and process social and emotional cues, thereby positively impacting the quality (and not necessarily the quantity) of social relationships. Lonely people may differ from one another in levels of different components of wisdom, even when their total scores on the wisdom scale are similar. Therefore, some people may need help in improving emotional regulation while others may require therapy to promote pro-social behaviors. Several randomized controlled trials have shown that

behavioral interventions can increase components of wisdom like emotional regulation and pro-social behaviors (E. E. Lee et al., 2020) and even overall wisdom (Treichler et al., 2020).

Conclusion

Our cross-country study results largely support the validity of the constructs of loneliness and wisdom, and extend previous findings of a strong negative correlation between these two entities. Loneliness has become a modern behavioral pandemic contributing to worse physical, cognitive, and mental health as well as greater mortality (D. V. Jeste, Lee, & Cacioppo, 2020). While the cross-sectional nature of the present study prevents causal inferences, the notably consistent and highly significant inverse correlations between loneliness and wisdom in middle-aged and oldest-old people from two markedly different cultures suggest that wisdom may be a protective factor against loneliness. Furthermore, loneliness was consistently associated with poor general health, worse quality of sleep, and less happiness, whereas the reverse was generally true for wisdom.

Much of the literature on interventions for loneliness is limited by methodological shortcomings, and there is currently insufficient evidence to identify the most effective interventions for loneliness (National Academies of Sciences et al., 2020). Therefore, multi-site randomized controlled trials of interventions to enhance wisdom should be conducted in efforts to reduce loneliness and promote healthy aging. Healthier aging with reduced loneliness may also lead to lower healthcare costs for older people. This will have important implications for clinical practice as well as healthcare policy. Routine assessment of loneliness with a validated brief measure and evidence-based wisdom-focused interventions for prevention and management of loneliness should become an integral part of geriatric clinical practice.

Disclosure statement

Data availability statement

Description of authors' roles

Dilip Jeste designed the study, provided research supervision and support, and prepared the manuscript.

Salvatore Di Somma designed the CIAO study, provided research supervision and support, and edited the paper.

Ellen Lee conducted literature review, helped with data analysis, and edited the paper.

Tanya Nguyen conducted literature review, helped with data analysis, and helped prepare the manuscript.

Mara Scalcione translated the loneliness and wisdom scales into Italian and supervised their administration in Cilento.

Alice Biaggi translated the loneliness and wisdom scales into Italian and supervised their administration in Cilento.

Rebecca Daly managed the data and helped with analyses.

Jinyuan Liu conducted statistical analyses.

Xin Tu designed, supervised, and interpreted the statistical analyses.

Douglas Ziedonis edited the paper.

Danielle Glorioso helped conduct the SAGE study.

Paola Antonini helped design the CIAO study, provided support, and edited the paper.

David Brenner helped design the overall study, provided research support, and edited the paper.

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