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Comparing associations between personality and loneliness at midlife across three cultural groups

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Abstract

Objective: Loneliness represents a public health threat given its central role in predicting adverse mental and physical health outcomes. Prior research has established four of the Big Five personality traits as consistent cross-sectional predictors of loneliness in largely western, White samples. However, it is not clear if the personality predictors of loneliness vary across cultures.

Method: The present study estimates associations between the Big Five traits and loneliness across distinct samples of White American, Black American, and Japanese adults ($n = 6051$ at T1). Confirmatory factor analysis and exploratory structural equation modeling were used to examine measurement invariance properties of the Big Five and loneliness across these groups. The factor structures were then carried forward to estimate associations between personality and loneliness across two assessments waves using structural equation modeling.

Results: While Neuroticism was a strong predictor across groups, low Extraversion was more predictive of loneliness in Japan than in the U.S., and low Conscientiousness was only a significant predictor in the U.S.

Conclusions: Previous literature offers a framework for interpreting these findings in that loneliness may be shaped comparatively more through interconnectedness in Japanese culture, while, in the U.S., individual goals and personal romantic expectations are more salient.

KEYWORDS
Big Five, culture, loneliness, measurement invariance, personality

1 | INTRODUCTION

Loneliness has been defined as a distressing feeling that accompanies the perception that one's social needs are not being met by one's social relationships (Hawkley & Cacioppo, 2010). Distinct from objective social isolation, subjective, self-reported loneliness is associated with numerous adverse physical and mental health outcomes, including cognitive decline (Kuiper et al., 2015), internalizing psychopathology (Beutel et al., 2017), cardiovascular disease (Valtorta et al., 2016), and mortality (Holt-Lunstad et al., 2015). In 2018, as consensus grew that loneliness represents a public health threat, a Minister of Loneliness position was appointed in the United Kingdom, bringing the

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topic more into the mainstream (GOV.UK, 2018). Further, the COVID-19 pandemic has reignited not only lay concerns about the effects of social isolation and loneliness, but also empirical research into the matter (e.g., Killgore et al., 2020; Luchetti et al., 2020). The National Academy of Sciences has also emphasized the public health risks, especially in older adult populations,[1] of social isolation and loneliness. Its committee on the topic recommended "increased funding of basic research as a key to achieving the goal of developing a more robust evidence base on effective prevention, assessment, and intervention for social isolation and loneliness" (National Academy of Sciences, 2020, p. 71).

As a pressing public health concern, efforts have been made to predict and index individual differences in loneliness. Commonly, researchers have examined cross-sectional correlations between the Big Five personality traits and loneliness. Consistent links with Neuroticism and low Extraversion have been established across undergraduate (Saklofske & Yackulic, 1989; Stokes, 1985) and older adult samples (Hensley et al., 2012; Long & Martin, 2000). While less robust than associations with Neuroticism and low Extraversion, a recent meta-analysis provided evidence that low Agreeableness and low Conscientiousness were moderately associated with loneliness as well (Buecker et al., 2020). The fifth trait domain, Openness, was only weakly negatively associated with loneliness.

Cross-sectional links between loneliness and the Big Five are well-established, but there have been fewer longitudinal studies of the Big Five traits predicting future loneliness. Neuroticism was a significant predictor of future loneliness across three studies, and, while one study considered only Neuroticism (Abdellaoui et al., 2019), in the other two, low Extraversion also emerged as a strong predictor (Mund & Neyer, 2016; von Soest et al., 2020). In these two studies, the effects of low Agreeableness, low Conscientiousness, and low Openness were minimal. Further longitudinal work is necessary to better understand the personality predictors of residual change in loneliness.

Various mechanisms have been proposed to explain why the Big Five and loneliness are linked. Behavioral genetic evidence suggests that, while a large degree of the association is explained by shared genetic factors, environmental factors play a role as well (Schermer & Martin, 2019). For instance, extraverted individuals tend to enjoy social interactions, and therefore may seek out environments containing more interactions. Indeed, Extraversion predicts greater participation in social activity (Lucas et al., 2008) and is associated with attempting to befriend more people (Selfhout et al., 2010). Agreeableness, on the other hand, is not associated with more attempts to befriend, but is associated with being more likely to be befriended (Selfhout et al., 2010). In addition, in a study of junior high schoolers (mean age = 14.8 years), highly extraverted and agreeable individuals were described as more likeable and popular by their peers, while the opposite was true of highly neurotic individuals (van der Linden, Scholte, et al., 2010). Further, Neuroticism has been associated with dysfunctional interpersonal behavior (Vater & Schröder Abé, 2015) and lower relationship satisfaction, with longitudinal evidence suggesting bidirectional influences with satisfaction (O'Meara & South, 2019). Conscientiousness, on the other hand, is predictive of frequency and intensity of contact with family, perhaps buffering against loneliness (Asendorpf & Wilpers, 1998).

While some work has explored differential perceived causes of loneliness across cultures (Rokach et al., 2001; Rokach & Neto, 2005), no studies have specifically examined cultural differences in the relations between the Big Five and loneliness. Indeed, this was an area of interest to Buecker et al. (2020) in their meta-analysis, but, as the vast majority of studies were conducted with White participants in western countries, they were unable to examine if the associations between personality traits and loneliness were robust across different cultural groups.

Cultures differ not only in the form and meaning of social behavior, but also in the values ascribed to interpersonal relationships (Chen & French, 2008; van Staden & Coetzee, 2010), so it stands to reason that cultural variables may moderate the mechanisms linking personality and loneliness. For example, Japan is thought to have a relatively more interdependent culture, in which in-group norms have priority over personal needs, compared to the independent culture of the United States where personal goals are more strongly emphasized (Markus & Kitayama, 1991). In fact, autonomy and personal achievement are more predictive of well-being in independent contexts (Oishi, 2000; Uchida & Kitayama, 2009), while social harmony is more predictive of well-being in interdependent contexts (Kang et al., 2003). In addition, Japan is thought to have a relatively "tighter" culture than the U.S., in which norms are more strictly enforced (Chan, 1996). Societal norms on social interaction may influence the development of loneliness; people in looser cultures are more likely to live alone, but people in tighter cultures may have less autonomy in determining with whom they become close (Heu et al., 2021).

Culture also varies greatly within the United States, where both socioeconomic status and discrimination contribute to racial disparities in health and economic outcomes (Cuevas & Williams, 2018). Less discussed is how these factors shape interpersonal and emotional experiences. For instance, the lower prevalence of major depression among Black compared to White U.S. adults, despite

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greater exposure to cumulative stress (Mann et al., 2021), has spurred examination into the "Black-white depression paradox" (Pamplin & Bates, 2021). There have also been empirically demonstrated differences in the determinants of well-being across Black and White Americans, including religiosity (Blaine & Crocker, 1995) and coping behaviors following divorce (McKelvey & McKenry, 2000).

These known differences across the U.S. and Japan, and largely underexplored differences within the U.S., may be particularly relevant in understanding loneliness. van Staden and Coetzee (2010) argue that cultural meanings shape the experience of loneliness by creating expectations for the nature of relationships and social connectedness. To that end, some have drawn the distinction between individualistic and collectivist cultures in shaping the experience of loneliness (e.g., Dykstra, 2009). For instance, in Japanese culture, loneliness is thought to be experienced within interconnectedness where many considering suicide seek out others who are also suicidal, so that they feel they do not die alone (Ozawa-de Silva, 2008). In a more individualistic culture like the U.S., people are more likely to live alone or with just a spouse, so (lack of) individual autonomy or effective completion of goals (Anderson, 1999; Sawir et al., 2008) and unhappiness in personal romantic relationships (Seepersad et al., 2008) may shape the experience of loneliness comparatively more. Indeed, Rokach (2018) argues that:

> friends and family are of utmost importance in moderating loneliness in collectivistic cultures ... In individualistic cultures, on the other hand, that support is not as salient, and may thus be less expected...in individualistic cultures loneliness is more about personal romantic expectations, whereas in collectivistic cultures loneliness is more about social approval. (p. 4)

Thus, individualistic culture membership seems to create greater demands on autonomy or personal romantic relationship satisfaction that, when not met, may contribute comparatively more to loneliness, while membership in a collectivist culture may have a similar effect regarding interconnectedness. With cultural demands and the meaning and perception of loneliness varying, might also individual risk factors vary across cultures? For instance, a given personality trait might present more risk for the development of loneliness in a western setting than it would in a more collectivist environment, and, further, may vary across western subcultures. We sought to evaluate this possibility empirically. Our analytic sample was derived from three distinct cohorts of White American, Black American, and Japanese adults at midlife, a particularly relevant stage in the development of loneliness. This provided not only a large, diverse sample, but also allowed us to leverage these three cultural groups to first examine if the relevant constructs are invariant, a necessary precondition to next examining how they relate across groups.

Consistent with prior multivariate analyses, we hypothesize that Neuroticism and low Extraversion will both predict future loneliness across all groups and that the effects of low Agreeableness, low Conscientiousness, and low Openness will be minimal. Further, we hypothesize that differences in predicting loneliness will be observed across groups, especially regarding low Extraversion, due to known cultural differences in how social relationships shape the experience of loneliness. Given that social harmony is more predictive of well-being in interdependent contexts (Kang et al., 2003), we hypothesize that low Extraversion and low Agreeableness will be stronger predictors of loneliness in the Japanese sample than either U.S. sample. On the other hand, personal achievement is more predictive of well-being in independent contexts (Oishi, 2000; Uchida & Kitayama, 2009), so we hypothesize that Conscientiousness will be a stronger predictor in the U.S. samples. With less research explicitly exploring predictors of well-being across White and Black American populations, we do not have a priori hypotheses about differential predictors of loneliness across these samples.[2] Similarly, we do not have a priori hypotheses about differential prediction of loneliness by Neuroticism.

In sum, we set out to answer the following questions:

1. What major domains of personality predict future loneliness and residual change in loneliness, and how strongly?
2. Is our measurement of personality and loneliness reasonably invariant across White American, Black American, and Japanese populations?
3. If the constructs are reasonably invariant, how do relations between personality and loneliness compare in these groups?

2 | METHOD

2.1 | Sample

The sample includes adults who participated in the National Survey of Midlife Development in the United States (MIDUS; Brim et al., 2004) and the Survey of Midlife in Japan (MIDJA; Ryff et al., 2008). Data are used from the second and third waves of MIDUS, between 2004–2006 and in 2013, respectively. The second wave of MIDUS data collection added a new oversample, consisting of Black Americans adults residing in Milwaukee. The second wave of the Milwaukee oversample (concurrent

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with the third wave of MIDUS) is also used in the dataset. Data from the first and second waves of MIDJA, from 2008 and 2012 respectively, are used as well.

In order to make comparisons between relatively more distinct cultural groups, non-White participants from the main MIDUS sample (n = 490), and non-Black participants from the MIDUS Milwaukee sample (n = 39) were removed. In the remaining second wave (White participants only) of MIDUS data collection (n = 4473), the age of participants spanned 32–98 years (mean = 55.64, SD = 12.47). The sample was approximately 47% male and 53% female. The third wave of data collection took place approximately 8 years after the second. Longitudinal retention rates were high (n = 3026; ~68%). In the third wave, the age of participants spanned 42–93 years (mean = 63.77, SD = 11.38), and the sample was approximately 45% male and 55% female.

In the remaining first wave (Black participants only) of the MIDUS Milwaukee sample (n = 553), the age of participants spanned 34–85 years (mean = 51.87, SD = 11.85). The sample was approximately 38% male and 62% female. The second wave of data collection took place approximately 8 years after the first. Longitudinal retention rates were high (n = 363; ~66%). In the second wave, the age of participants spanned 44–93 years (mean = 61.17, SD = 10.46), and the sample was approximately 35% male and 65% female.

The MIDJA survey sample was recruited in 2008 to proportionately reflect the 23 neighborhood wards in Tokyo, stratified by age and gender and consists strictly of Japanese-speaking adults (n = 1027). The age of participants spanned 30–79 years (mean = 54.36, SD = 14.14). The sample was 49% male and 51% female. The second wave of data collection took place approximately 5 years after the first. Longitudinal retention rates were high (n = 657; ~64%). In the second wave, the age of participants spanned 34–85 years (mean = 59.25, SD = 13.54), and the sample was 47% male and 53% female.

Taken together, the first sampling wave for this project consists of the second wave of the main MIDUS sample (White), the first wave of the MIDUS Milwaukee sample (Black), and the first wave of the MIDJA (Japanese) sample (n = 6053). The first wave is 74% White American, 17% Japanese, and 9% Black American. The age of participants spans 30–98 years (mean = 55.08, SD = 12.76), and is approximately 47% male and 53% female. The second sampling wave consists of the third wave of the main MIDUS sample (White) and the second waves of the MIDUS Milwaukee (Black) and MIDJA (Japanese) samples. Longitudinal retention rates were high (n = 4046; ~67%). The second wave is 75% White American, 16% Japanese, and 9% Black American. The age of participants spans 34–93 years (mean = 62.80, SD = 11.81), and is approximately 45% male and 55% female. Additional information regarding participant recruitment and data collection can be found elsewhere (Brim et al., 2004; Ryff & Krueger, 2018).

2.2 | Measures

2.2.1 | The Big Five

Personality traits were measured using the Midlife Development Inventory (MIDI) (Lachman & Weaver, 1997). Participants were asked to indicate "how well each of the following [adjectives] describes you." Five adjectives were used to measure Conscientiousness, Extraversion, and Agreeableness. Four adjectives were used to measure Neuroticism, and seven adjectives were used for Openness. The MIDI includes a 6th trait domain, Agency, which was not used. Items were rated on a 4-point scale (4 = A lot, 3 = Some, 2 = A little, 1 = Not at all). Items were reverse coded when necessary so that higher average scores reflected higher levels of the trait. MIDJA survey items were created by translating and back translating MIDUS items, with native speakers adjusting item content where necessary.

2.2.2 | Loneliness

Loneliness was measured by asking participants to indicate "During the past 30 days, how much of the time did you feel [blank]". There were three items: "lonely", "close to others", and "like you belong". Items were rated on a 5-point scale (1 = None of the time, 2 = A little of the time, 3 = Some of the time, 4 = Most of the time, 5 = All of the time), and were reverse coded for the second and third items so that higher average scores reflected higher levels of loneliness. Though not a formal loneliness scale, these items resemble those of the often-used UCLA Loneliness Scale (Russell et al., 1978) and the de Jong Gierveld Loneliness Scale (de Jong-Gierveld, 1987). For instance, the UCLA scale asks participants how often they feel as though "(they) feel completely alone", "(are) no longer close to anyone", and "People are around me but not with me" (Russell et al., 1978). Further, the 20-item UCLA scale has been adapted to a 3-item short form with strong evidence for validity (Hughes et al., 2004). In addition, the single self-report "lonely" item has been used as an index of loneliness in MIDUS (Nersesian et al., 2018), and the three items are well-correlated ($.49 < r < .81$, $ps < .001$).

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3 | DATA ANALYTIC PROCEDURES

Data were downloaded from the MIDUS Colectica Portal (https://midus.colectica.org/) and prepared for analyses with R version 3.6.1. Data were exported from R to a .csv file which was imported into Mplus version 8.4 (Muthén & Muthén, 1998–2019). Absolute and incremental model fit was evaluated using root mean squared error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI). All models had ordinal indicators and were estimated using weighted least squares with mean and variance adjustments. Models were also compared using root deterioration per restriction (RDR), calculated using change in model chi-squared ($\Delta\chi^2$), which rescales $\Delta\chi^2$ to approximate an RMSEA metric ($RDR = \sqrt{\frac{\Delta\chi^2 - \Delta df}{\Delta df^* n}}$) as information criteria (AIC and BIC) are not available when models are estimated using weighted least squares. Because of strong similarity between RDR and RMSEA, we used a cut-off value of .08 to evaluate if models are considered approximately equal (Browne & Toit, 1992). The parameter estimates resulting from model fitting were compared by the arithmetic means and ranges of standardized regression coefficients predicting loneliness (β) and the percent of variance explained in loneliness (R^2).

Omega reliability coefficients (ω_T), zero-order correlations, and partial correlations between measures of the Big Five and loneliness are reported at each assessment (wave one and wave two) and for each sample (White, Japanese, and Black) in supplemental materials (Tables S1–S8). To prevent correlations from being an artifact of group differences associated with demographic factors, scale score for the Big Five and loneliness were residualized for the cross-sectional effects of age and sex.

To ensure that the measurement properties of the Big Five and loneliness scales were comparable across cultural groups, we tested for measurement invariance across the three cultural groups using multiple-group models. Details on the measurement invariance analyses and model specifications can be found in supplemental materials. First, a one-factor model of loneliness was estimated across the three sampling groups and its invariance properties were analyzed. Next, a five-factor model of personality was estimated across the three sampling groups. Confirmatory factor analysis (CFA) was used for the loneliness model, but CFA has been shown to be an inadequate approach for modeling personality structure because trait indicators often have secondary loadings on factors other than their primary factor (McCrae et al., 1996; Vazsonyi et al., 2015). CFA restricts indicators to loading onto only their primary indicator so exploratory structural equation modeling (ESEM) is a less restrictive alternative, as it allows for cross-loadings of indicators onto multiple factors (Asparouhov & Muthén, 2009). As a result, ESEM has often demonstrated better fit for personality structure than CFA (Marsh et al., 2010; Vazsonyi et al., 2015).

The factor structures of the Big Five domains and loneliness were then carried forward to estimate associations between personality and loneliness using structural equation models (SEMs),[3] as displayed in Figure 1. The Big Five domains at wave one, operationalized in the ESEM, were used as predictors for the latent loneliness factor at wave two. This model was specified both without and with wave one loneliness as a predictor to estimate the association between each trait and loneliness and residual change in loneliness, controlling for the effects of the other four traits. Age and sex are included as covariates in all models, and additional covariates were considered in sensitivity analyses (Tables S11 and S13). The latter, residual change model was included to account for the longitudinal stability of loneliness, allowing us to interpret the extent to which the Big Five domains predicted increases and decreases in loneliness over the course of several years.

Both models were specified three different ways. First, the entire sample was considered, without a grouping variable. Next, a configural model was defined wherein group differences in factor loadings and thresholds for the included variables were freely estimated. Finally, a scalar invariant model was defined, wherein factor loadings and thresholds were constrained to equality across White, Japanese, and Black samples. The configural and invariant models were compared using RDR to test whether constraining operationalizations of personality and loneliness to equality across groups resulted in loss of fit to the data. The programming syntax in Mplus version 8.4 and all model results can be found at Open Science Framework: https://osf.io/ckdjt/.

4 | RESULTS

4.1 | Loneliness CFA

To test measurement invariance of the 3-item loneliness scale at wave two[4] across the sampling groups, we used multiple-group confirmatory factor analysis. Fit statistics of the configural, metric, and scalar invariant models are summarized in Table 1. With only one factor from three indicators, the configural model was "just-identified" (i.e., had 0 degrees of freedom), so goodness of fit evaluation does not apply (Brown & Moore, 2012). The metric invariant model displayed near perfect fit (CFI = 1.00, RMSEA = .004), indicating that constraining factor loadings does not result in significant loss of fit to the data. The scalar invariant model displayed good fit to the data

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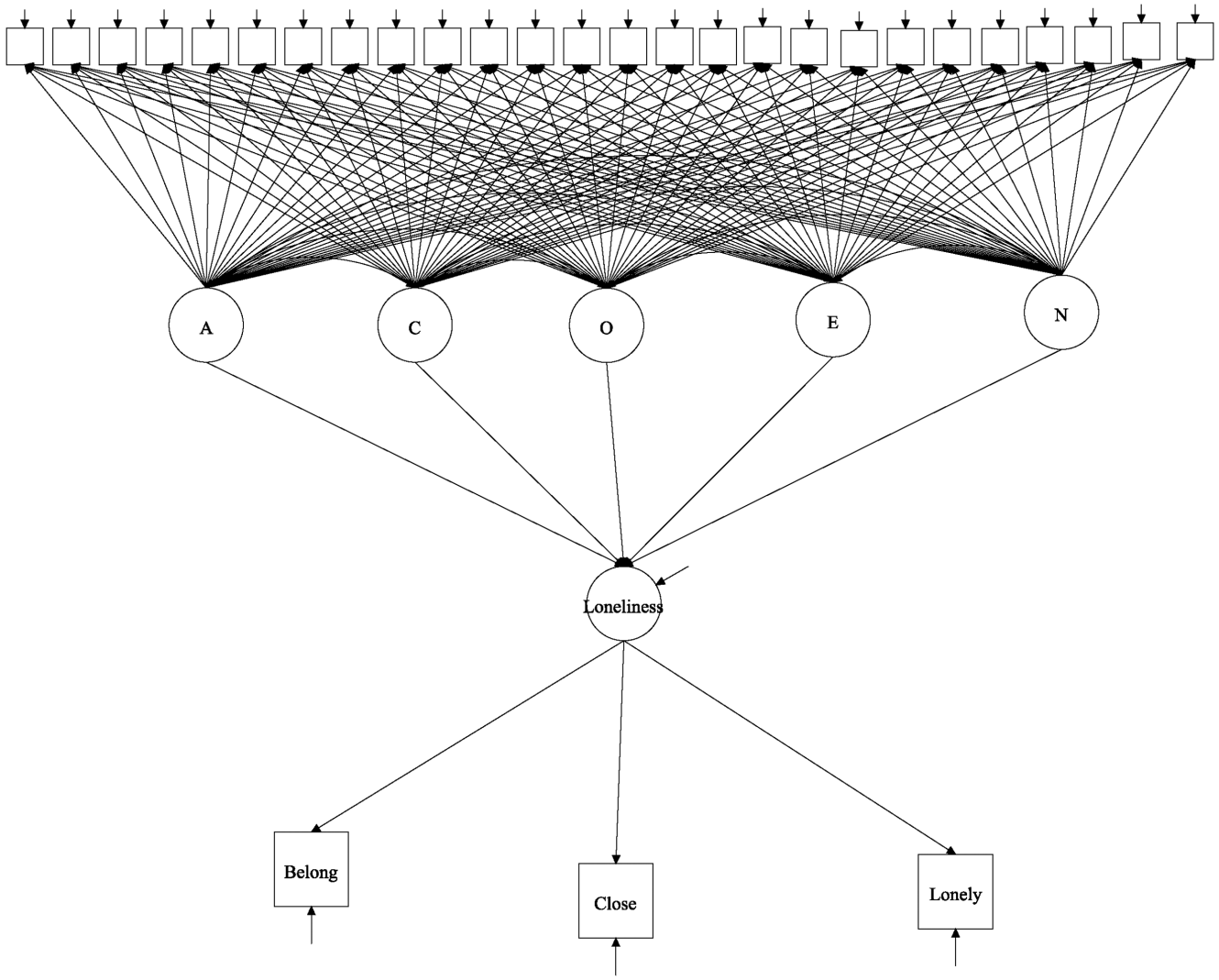

FIGURE 1 Path diagram of the structural equation model estimating associations between Big Five personality domains and loneliness. Loneliness at wave two is operationalized as a latent variable indicated by three questions ("Belong", "Close", and "Lonely"). The Big Five domains at wave one (A, C, O, E, N) are operationalized using latent factors indicated by 26 ordinal adjectives (not labeled). The model was estimated first without a grouping variable, second with factor loadings, thresholds, and residual variances free to vary across groups, and third constrained to equality across groups to reflect measurement invariance across cultures. The path diagram was created using the Mplus Diagrammer.

TABLE 1 Invariance tests of loneliness CFA across cultures at wave two

		Absolute and incremental fit				Comparative fit					
Model	χ^2	***df***	**CFI**	**RMSEA**	**TLI**	$\Delta\chi^2$ **(**Δdf**)**	***p***	**ΔCFI**	**ΔRMSEA**	**ΔTLI**	**RDR**
Configural	.0	0	1.000	.000	1.000						
Metric	2.1	2	1.000	.004	1.000	2.0 (2)	.361	.000	.004	.000	.000
Scalar	89.3	20	.997	.053	.998	84.6 (18)	<.001	.003	.049	.002	.033

Note: The configural model is a CFA of 3 indicators so it is "just identified" and by definition has 0 degrees of freedom. The metric model required an additional constraint to identify; The factor variance for the Black Milwaukee sample was set to its closing value (when freely estimated), rather than being freely estimated as it was in the other two groups. No additional constraints were need for the scalar invariant model.

Abbreviations: CFI, comparative fit index; *df*, degrees of freedom; RDR, root deterioration per restriction; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index; χ^2, Chi-square test of model fit.

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as well (CFI = .997, RMSEA = .053). While the increase in RMSEA (.049) is above most conventions for accepting scalar invariance (Putnick & Bornstein, 2016), the RDR (.033), a metric specifically designed to compare the relative fit of nested models, was below our cut-off (.08), above which nested models are deemed to significantly differ. Further, standardized factor loadings did not vary notably across metric and scalar models. For instance, of the 9 factor loadings, the largest difference across models was .09 and the other 8 loadings varied by less than .03. Thus, with good absolute fit to the data, a low RDR, and minimal change in substantive values when constraints were added, we concluded that the one-factor loneliness model displayed scalar invariance across the three sampling groups.

Standardized parameter estimates from the CFA for loneliness are reported in Table S9. These estimates represent data from the entire sample at wave two, without a grouping variable considered. The pattern of factor loadings provided support for the construct validity of the latent loneliness factor. All three items significantly loaded onto the first latent factor (range of $\lambda = .56$ to .92, $ps < .01$),

4.2 | The Big Five ESEM

To test measurement invariance of the Big Five domains at wave one, we used multiple-group exploratory structural equation modeling. Fit statistics of the configural, metric, and scalar invariant models are summarized in Table 2. The configural model displayed adequate fit to the data (CFI = .956, RMSEA = .060), and the metric invariant model displayed limited decrease in fit (ΔCFI < .01, RMSEA decreased). While the scalar invariant model resulted in a decrease in CFI (.020) slightly greater than a recommended cut-off of .015, the RMSEA only increased by .006, well-below the convention of .015 (Putnick & Bornstein, 2016). In addition, the RDR (.063) was below the cut-off (.08). Further, standardized factor loadings did not vary notably across metric and scalar models. For instance, of the 130 MIDUS sample factor loadings, the largest difference across models was .13, while the average absolute difference in loadings was .03, and 80% of loadings varied by less than .05. Thus, fit statistics (RMSEA and CFI) for the ESEM of the Big Five displayed adequate, but not excellent fit to the data, but fit only decreased marginally when constraints across groups were added (and had little effect on the substantive values), providing evidence for scalar invariance.

Standardized parameter estimates from the ESEM for the Big Five domains are reported in Table S10. These estimates represent data from the entire sample at wave one, without a grouping variable considered. The pattern of factor loadings provided support for the construct validity of the Big Five adjectival scales. Items that measured Neuroticism loaded onto the first latent factor (range of $\lambda = .44$ to .82, $ps < .01$), with smaller but appreciable cross-loadings from items that measured Conscientiousness (e.g., "Careless"; $\lambda = .27$). Items that measured Extraversion loaded onto the second latent factor (range of $\lambda = .41$ to .80, $ps < .01$), with smaller but appreciable cross-loadings from items that measured Openness (e.g., "Adventurous"; $\lambda = .33$), and Agreeableness (e.g., "Warm"; $\lambda = .43$). Items that measured Openness loaded onto the third latent factor (range of $\lambda = .37$ to 1.00, $ps < .01$), with smaller but appreciable cross-loadings from items that measured Extraversion (e.g., "Active"; $\lambda = .28$). Items that measured Conscientiousness loaded onto the fourth latent factor (range of $\lambda = .49$ to .77, $ps < .01$), with smaller but appreciable cross-loadings from items that measured Agreeableness (e.g., "Helpful"; $\lambda = .36$), Openness (e.g., "Intelligent" "; $\lambda = .36$), and Extraversion (e.g., "Active"; $\lambda = .20$). Items that measured Agreeableness loaded onto the fifth latent factor (range of $\lambda = .38$ to .84, $ps < .01$), with smaller but appreciable cross-loadings from items that measured Neuroticism (e.g., "Calm"; $\lambda = .34$), Openness (e.g., "Broadminded"; $\lambda = .30$), Conscientiousness (e.g., "Responsible"; $\lambda = .22$), and Extraversion (e.g., "Friendly"; $\lambda = .49$).

These results replicate the ESEM of Big Five domains by Mann et al. (2020) and extend the findings to more diverse sample containing not only the primarily White MIDUS participants, but also Japanese and Black participants from MIDJA and Milwaukee, respectively.

TABLE 2 Invariance tests of Big Five ESEM across cultures at wave one

		Absolute and incremental fit				Comparative fit					
Model	χ^2	***df***	**CFI**	**RMSEA**	**TLI**	$\Delta\chi^2$ (Δdf)	***p***	**ΔCFI**	**ΔRMSEA**	**ΔTLI**	**RDR**
Configural	4356.6	615	.956	.060	.930						
Metric	5275.2	815	.947	.057	.937	1732.0 (200)	<.001	.009	−.003	−.007	.039
Scalar	7112.3	919	.927	.063	.922	2190.7 (104)	<.001	.020	.006	.015	.063

Abbreviations: CFI, comparative fit index; *df*, degrees of freedom; RDR, root deterioration per restriction; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index; χ^2, Chi-square test of model fit.

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Therefore, this model was used to measure the Big Five domains, rather than the residualized scale scores which have unknown measurement properties across cultural groups, in the SEMs predicting loneliness.

4.3 | The Big Five and loneliness

Model fit statistics of the SEMs of the ESEM of the Big Five domains at wave one predicting the latent loneliness factor at wave two are reported in Table 3. The first model considers the whole sample without a grouping variable. This model displayed excellent fit to the data (CFI = .969, RMSEA = .049). Adding a grouping variable significantly increased the model complexity and degrees of freedom, resulting in some loss of fit to the data (ΔCFI = .019), but RMSEA remained low (.053, ΔRMSEA = .004). This configural model, which allowed factor loadings and indicator thresholds to vary for loneliness and the Big Five ESEM, was compared to the nested, scalar invariant model that held these values equal across groups. The loss of fit to the data was minimal (RDR = .044, RMSEA decreased), indicating that our model was invariant across the three cultural groups.

The results of the first, ungrouped model and the third, scalar invariant model are summarized in Table 4 and Figure 2. Neuroticism and low Extraversion were significant predictors of loneliness across groups. Noteworthy group differences in Extraversion were observed, with the trait appearing more negatively predictive of loneliness in the Japanese sample ($\beta = -.37$, 95% CI = −.49 to −.25) than in the White sample ($\beta = -.16$, 95% CI = −.22 to −.10).

Conscientiousness was a significant negative predictor of loneliness in the White ($\beta = -.13$, 95% CI = −19 to −.07) and Black ($\beta = -.29$, 95% CI = −.56 to −.02), but not Japanese ($\beta = -.03$, 95% CI = −.17 to .11) samples. Associations with low Agreeableness and low Openness did not meet a traditional threshold for statistical significance in any group or in the whole sample (i.e., $ps > .05$), providing evidence that the relations between these personality traits and loneliness may be driven by relations with other personality traits or demographic factors like sex and age.

Age was a significant predictor of loneliness in the whole sample, the White sample, and the Japanese

TABLE 3 Model fits of SEMs of Big Five domains predicting loneliness

		Absolute and incremental fit				Comparative fit					
Model	χ^2	***df***	**CFI**	**RMSEA**	**TLI**	**$\Delta\chi^2$ (Δdf)**	***p***	**ΔCFI**	**ΔRMSEA**	**ΔTLI**	**RDR**
No Grouping	4688.3	334	.969	.049	.957						
Configural Model	6118.5	1002	.950	.053	.930			.019	.004	.027	
Scalar Invariant	7863.9	1326	.936	.052	.933	2483.8 (324)	<.001	.014	−.001	−.003	.044

Abbreviations: CFI, comparative fit index; *df*, degrees of freedom; RDR, root deterioration per restriction; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index; χ^2, Chi-square test of model fit.

TABLE 4 Standardized regression coefficients (β) of Big Five domains predicting loneliness and full model R^2 Values

	β (SE)				R^2
	Entire sample	**β (SE)**	**β (SE)**	**β (SE)**	**Entire sample**
Predictor	**(no grouping)**	**White**	**Japanese**	**Black**	**(White, Japanese, Black)**
Full Model					.279 (.242, .312, .268)
Neuroticism	**.33** (.02)	**.34** (.02)	**.31** (.05)	**.18** (.08)	
Extraversion	**−.25** (.03)	**−.16** (.03)	**−.37** (.06)	**−.27** (.11)	
Openness	.03 (.03)	.04 (.03)	−.02 (.06)	.07 (.11)	
Conscientiousness	**−.13** (.03)	**−.13** (.03)	−.03 (.07)	**−.29** (.14)	
Agreeableness	−.05 (.03)	−.06 (.03)	.02 (.08)	.11 (.11)	
Age	**−.13** (.02)	**−.15** (.02)	**−.12** (.05)	−.09 (.07)	
Sex	**.05** (.02)	.02 (.02)	**.16** (.04)	.04 (.06)	

Note: White, Japanese, and Black values derive from the scalar invariant model. $p < .05$ for values in **bold.**

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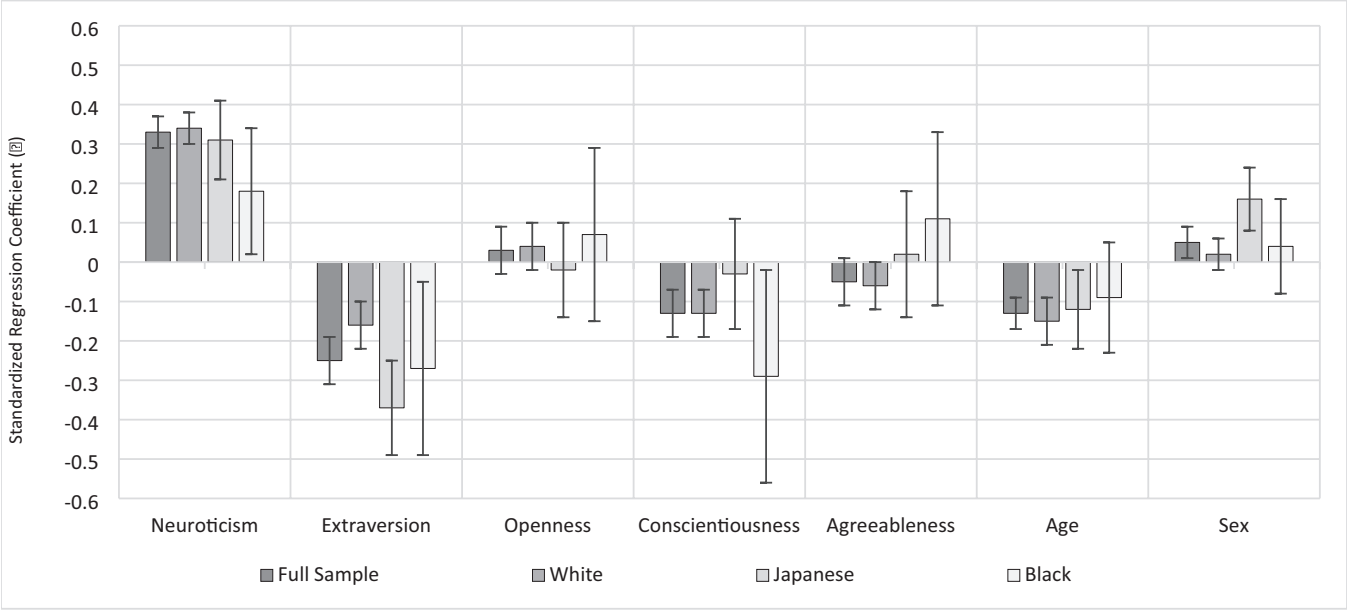

FIGURE 2 Standardized regression coefficients (β) of Big Five domains predicting loneliness. Big Five domains and demographic factors at wave one (Mean Age = 55.1) predict loneliness at wave two (Mean Age = 62.8). Bars depict 95% confidence intervals.

sample, with older participants displaying lower levels of loneliness, but not the Black sample, for which the effect of age was estimated with comparatively low precision. Sex was a significant predictor in Japan with male participants displaying higher levels of loneliness. Overall, the model accounted for a moderate amount of variance in loneliness, with more variance accounted for in the Japanese (R^2 = .312) than the White (.242) or Black (.268) samples. Finally, we conducted a sensitivity analysis that included marital status, religiosity, and education level as covariates because they are known to be correlated with both personality and loneliness. Regression weights were largely unchanged with the added covariates and each of the previously reported effects remained statistically significant (p < .05). Results of this model are summarized in Table S11.

To estimate the extent to which personality predicts residual change in loneliness, we also ran the analysis with loneliness at wave one included as a predictor (along with the ESEM of the Big Five, age, and sex). In other words, this model was the same as before (and as Figure 1) aside from the new inclusion of wave one loneliness as a predictor. Model fit statistics of these SEMs are reported in Table S12 and are very similar to the prior results. The first model considers the whole sample without a grouping variable. This model displayed adequate fit to the data (CFI = .963, RMSEA = .050). Adding a grouping variable significantly increased the model complexity and degrees of freedom, resulting in some loss of fit to the data (ΔCFI = .017), but RMSEA remained low (.053, ΔRMSEA = .003). This configural model, which allowed factor loadings and indicator thresholds to vary for loneliness and the Big Five ESEM, was compared to the nested, scalar invariant model that held these values equal across groups. The loss of fit to the data was minimal (RDR = .044, RMSEA decreased), indicating that our model was invariant across the three cultural groups.

The results of the first, ungrouped model and the third, scalar invariant model are summarized in Table 5. Overall, personality traits were relatively weak predictors of residual change in loneliness, but similar cross-cultural differences across groups emerged. Neuroticism was a significant predictor of residual change in loneliness in the White (β = .12, 95% CI = .07 to .16) and Japanese (β = .12, 95% CI = .03 to .22) samples, while low Extraversion only significantly predicted residual change in loneliness in Japan (β = −.17, 95% CI = −.29 to −.06). Low Conscientiousness remained a significant predictor in the whole sample (β = −.05, 95% CI = −.10 to −.001) but dropped below significance in each individual group. Notably, the trend of Conscientiousness being more negatively predictive of later loneliness in the U.S. than in Japan remained. Overall, the model accounted for a large amount of variance in loneliness, with more variance accounted for in the Japanese (R^2 = .526) than in the White (.460) or Black (.404) samples. Finally, we conducted sensitivity analyses with the same covariates. Again, regression weights were largely unchanged, and results of this model are summarized in Table S13.

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TABLE 5 Standardized regression coefficients (β) of Big Five domains and initial loneliness predicting later loneliness and full model R^2 Values

	β (SE)				R^2
	Entire sample	β (SE)	β (SE)	β (SE)	Entire sample
Predictor	(no grouping)	White	Japanese	Black	(White, Japanese, Black)
Full Model					.470 (.460, .526, .404)
Loneliness	**.56** (.02)	**.59** (.02)	**.57** (.04)	**.49** (.09)	
Neuroticism	**.11** (.02)	**.12** (.03)	**.12** (.05)	.04 (.08)	
Extraversion	**−.06** (.03)	−.01 (.03)	**−.17** (.06)	−.06 (.12)	
Openness	−.00 (.03)	.02 (.03)	−.03 (.05)	−.02 (.10)	
Conscientiousness	**−.05** (.03)	−.02 (.03)	.05 (.06)	−.19 (.13)	
Agreeableness	.00 (.03)	.01 (.03)	.03 (.07)	.09 (.11)	
Age	**−.13** (.02)	**−.14** (.02)	**−.12** (.04)	−.09 (.07)	
Sex	**.05** (.02)	.02 (.02)	**.15** (.04)	.04 (.06)	

Note: White, Japanese, and Black values derive from the scalar invariant model. $p < .05$ for values in **bold.**

5 | DISCUSSION

Measuring and predicting individual differences in loneliness is a key first step towards effective prevention, assessment, and intervention. Overall, about 24%–31% of variance in loneliness could be accounted for by just the Big Five domains, age, and sex, replicating findings that personality is a robust predictor of loneliness (Buecker et al., 2020). Including initial loneliness in the model increased the amount of variance accounted for in later loneliness to 40%–53%. Further, in these models, personality at midlife (Mean Age = 55.1) predicted later-life loneliness (Mean Age = 62.8), a high-risk period because of an increased likelihood to face predisposing factors like living alone, loss of family and friends, chronic illness, and sensory impairments (National Academy of Sciences, 2020). Neuroticism and low Extraversion were the strongest predictors of future loneliness, replicating prior longitudinal work (Mund & Neyer, 2016; von Soest et al., 2020), and this new evidence suggests that low Conscientiousness also influences future loneliness, beyond its covariation with Neuroticism and low Extraversion. Further, Neuroticism, low Extraversion, and low Conscientiousness were significant predictors of residual change in loneliness, indicating that these traits are associated with increases and decreases in loneliness later in life over the course of several years.

Low Extraversion and low Conscientiousness also stood out for the cross-cultural differences observed in their prediction of loneliness. While it was difficult to pinpoint differences with the Black American sampling group due to the high standard errors of estimation observed resulting from relatively smaller sample sizes, differences emerged in these two traits between the U.S. (White MIDUS and Black Milwaukee samples) and Japan. This evidence suggests that low Extraversion is more predictive of loneliness in Japan than in the U.S., and the opposite is true of low Conscientiousness.

Much has been written about if loneliness is more common in individualistic or collectivist cultures, but evidence is conflicting (for a review, Dykstra, 2009). Heu et al. (2021) interpret these mixed results by suggesting a culture-loneliness framework. They argue that collectivist cultures tend to have more restrictive norms about social relationships, offering protection from social isolation (lack of social relationships altogether), but increase the risk of emotional or perceived isolation, as might be the case with relationships that are not individually satisfying. On the other hand, in a looser culture like the U.S., risk for social isolation is higher, but, with less restrictive norms, the social relationships one develops tend to be more individually satisfying.

High Extraversion, then, might be relatively more protective from loneliness in a restrictive culture, in that higher sociability is needed to establish new relationships outside of one's ingroup. In fact, the degree to which an outcome is typical or common in a given culture may influence its personality correlates (Eck & Gebauer, 2022). In the U.S., where collectivism beyond the nuclear family is not as strongly emphasized, establishing these relationships (e.g., via greater participation in social activity (Lucas et al., 2008) or attempting to befriend more people (Selfhout et al., 2010) both of which are predicted by Extraversion) is relatively more normative, so high Extraversion might not offer as much of a "boost" of protection. On the other hand, a highly introverted person,

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with unfulfilling relationships, in a highly interconnected culture may be less likely to be socially isolated, but, as suggested by Ozawa-de Silva (2008), more likely to view themself in relation to others, making the pain of their unfulfilling relationships more acute. Indeed, if loneliness is experienced through interconnectedness in Japan, then it follows that the trait that defines one's sociability and surgency will be highly influential.

Previous literature also offers a framework for interpreting the result that Conscientiousness is more protective against loneliness in the U.S. than in Japan. In a more independent rather than interdependent culture, an individual's self-construal will likely be more tied to the notion that they are an autonomous, effective agent, rather than where they stand within the broader social context (Anderson, 1999). As a result, loneliness is shaped comparatively more by viewing the self as not independent or not able to reach individual goals. High Conscientiousness may be protective against failure to reach individual goals, or to effectively live autonomously, offering a greater degree of protection against experiences that shape loneliness relatively more in the U.S. than in Japan. Another possibility is that high Conscientiousness leads to greater frequency and intensity of contact with family (Asendorpf & Wilpers, 1998), buffering against loneliness in the U.S., while in Japan, frequent and intense in-group contact is more normative, so Conscientiousness might not offer as much protection.

These results hinge on the ability to measure personality and loneliness with reasonable invariance across cultures. Prior authors have examined the invariance properties of the Big Five traits across the primarily White MIDUS and Japanese MIDJA samples, concluding that, for most traits, metric, but not scalar invariance could be established (Chopik & Kitayama, 2018; Haas & vanDellen, 2020). However, they looked at CFAs of trait domains separately, rather than a concurrent ESEM of all domains. With this alternative methodology, we provide evidence that the Big Five domains may be more comparable across MIDUS and MIDJA, and, therefore, the U.S. and Japan than previously suggested.

These findings highlight the domains of personality that have the strongest associations with loneliness. Personality traits, especially Neuroticism and Extraversion, are moderately responsive to psychological intervention (Roberts et al., 2017). Taken together, this suggests that loneliness could presumably be combatted through such interventions on personality. Further, broader domains of personality (compared to narrower symptoms, such as loneliness) have been argued to be highly fruitful targets of applied interventions, given their effects on a wide variety of life outcomes (Bleidorn et al., 2019). Evidence of cross-cultural differences in the predictors of loneliness may inform differential treatment targets (e.g., targeting Conscientiousness may be more effective for lonely individuals in the U.S., compared to Japan), cultural adaptations of loneliness interventions, and delivery of existing interventions with cultural competence and humility.

Notably, older adulthood is a high-risk period for the development of loneliness, and loneliness is as strong in magnitude as other well-established risk factors for mortality such as obesity and substance use (Holt-Lunstad et al., 2015). Thus, middle to late adulthood is a critical period for prevention and intervention efforts, and the MIDUS study was designed for understanding the factors that contribute to healthy aging across these periods of lifespan development (wave one mean age = 55.08; wave 2 mean age = 62.80).

In sum, we found evidence of unique trait contributions of Neuroticism, low Extraversion, and low Conscientiousness in the prediction of future loneliness. We were able to measure these constructs with reasonable invariance across White American, Black American, and Japanese adult samples at midlife. Cultural differences were observed regarding Extraversion and Conscientiousness in the U.S. and Japan, contributing to the evidence base on the prediction of loneliness- a subjective, emotional experience that has broad public health implications.

This study has a few noteworthy limitations. First, self-report scales were used to measure all variables. As a result, the extent to which shared method variance contributed to associations between personality and loneliness is unknown. This shared variance may be due to a phenomenon called evaluative consistency bias, defined as the tendency for people to be consistent in rating themselves as having desirable qualities or not (Anusic et al., 2009). Future studies would benefit from incorporating information from multiple informants.

Some of the intercorrelations between the Big Five domains have been shown to be consistent rather than artifactual (van der Linden, te Nijenhuis, & Bakker, 2010), creating difficulty for inference on the uniqueness of trait contributions. Our study and others examined multivariate associations whereby the other four traits are controlled for in a semi-partial correlation between the trait of interest and loneliness, or, similarly, in multivariate linear regressions. Across two studies (Abdellaoui et al., 2019; Schermer & Martin, 2019), only correlations with Neuroticism remained large after covariation from the other four traits was partialed out. However, using a Meta-Analytic Structural Equation Modeling approach, Buecker et al. (2020), found that multivariate effect sizes for low Extraversion remained large and comparable to Neuroticism, while those of low Agreeableness and low Conscientiousness remained moderate to small, and that of low Openness was not statistically significant. Thus,

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there is strong evidence of a unique association between Neuroticism and loneliness, and these results suggest meaningful contributions from low Extraversion and low Conscientiousness as well. Future studies could model personality at varying levels of breadth, as an alternative approach to handling personality trait intercorrelations. Moreover, future studies may also focus on more narrowly defined facets of personality, which have been shown to predict subjective well-being more strongly than broader domains of personality (Anglim et al., 2020), a construct that is distinct but related to loneliness.

An additional limitation is that differences between sampling groups may be due to various factors outside of cultural differences, as they were interpreted above. One particularly relevant difference between sampling groups is the time between evaluations. While there was about eight years between the White MIDUS and Black Milwaukee waves, there were only five years between the Japanese MIDJA waves. It is unclear how these temporal differences would influence the outcomes, but they nonetheless are confounded with group status, as are likely minor differences in sampling procedures that naturally result from data collection across multiple sites.

AUTHOR CONTRIBUTIONS

Study conception and design: FDM and RFK; Data analysis, interpretation of results, and draft manuscript preparation: CDF; manuscript editing: FDM and RFK. All authors reviewed the results and approved the final version of the manuscript.

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ETHICS STATEMENT

Data collection for the MIDUS study is reviewed and approved by the Education and Social/Behavioral Sciences and the Health Sciences IRBs at the University of Wisconsin-Madison.

CONFLICT OF INTEREST

We have no known conflict of interest to disclose.

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ENDNOTES

[1] Mean loneliness levels appear to have two peaks across the lifespan: in late adolescence and in late adulthood (beginning in the early to mid-60s and onward; Luhmann & Hawkley, 2016), making midlife a key developmental stage to identify and prevent those who are likely to suffer from loneliness.

[2] Nonetheless, with limited work exploring relations between personality and loneliness in a primarily Black American sample, we opted to keep White and Black American samples separate to allow for these exploratory analyses.

[3] We also considered a cross-lagged panel model, but model fit indices were inadequate, perhaps because personality traits and loneliness are relatively time-invariant and strong autoregressions are not well accounted for in such models (Hamaker et al., 2015).

[4] Invariance tests were conducted at both waves, but, because results were similar and we were interested in how personality predicts future loneliness, we report Big Five results from wave 1 and loneliness results from wave 2.

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