Associations of Family Policy and Income Inequality with Loneliness in Midlife:

Cross-National Evidence from the United States and Europe

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Abstract

Loneliness is a global public health issue. Empirical evidence documents that today's middle-aged adults in the U.S., England, and Mediterranean Europe report elevated levels of loneliness compared to previous generations and middle-aged adults in Continental and Nordic Europe. We examine whether nation-level policy factors pertaining to family benefits and income inequality are associated with cross-national differences in midlife loneliness across the U.S. and Europe. Applying multilevel models to harmonized longitudinal panel survey data from the U.S. and 13 European nations ($N = 59,030$, ages 45 to 65) revealed that middle-aged adults in nations with less investment in family benefits (as % of Gross Domestic Product) and more income inequality (assessed using the GINI coefficient) report higher levels of individual-level loneliness and exhibit steeper within-person increase in loneliness over time. Findings from our observational study document that nation-level policy factors pertaining to family benefits and income inequalities are associated with cross-national differences in midlife loneliness.

Keywords: Midlife; Cross-National Approach; Policy Programs; Family Benefits; Income Inequality; Cohort Differences

Loneliness is a global public health issue. Many nations are showing high prevalence rates of loneliness, and several nations have appointed ministers of loneliness to help address and reverse the growing rates (Office of the U.S. Surgeon General, 2023; The Lancet, 2023; Surkalim et al., 2022). Elevations in loneliness lead to compromised immunity and increased risk for anxiety, depression, chronic illness, and mortality (Barjakova et al., 2023; Cacioppo et al., 2015; Lara et al., 2020; Luhmann et al., 2023). Our recent research showed that middle-aged adults in the U.S., England, and Mediterranean Europe report elevated levels of loneliness compared to previous generations and peers in Continental and Nordic Europe (Infurna et al., 2025). Historical increases in U.S. middle-aged adults' loneliness and disadvantages as compared with European nations are simultaneously transpiring with rises in depressive symptoms, heavy alcohol use, and daily stress as well as historical declines in memory, physical health, and life expectancy (Almeida et al., 2020; Ayyala-Somayajula et al., 2024; Blain & Boissonneault, 2025; Case & Deaton, 2020; Harris et al., 2021; Infurna et al., 2021; Kirsch et al., 2019; Wettstein et al., 2025). Despite these vulnerabilities among middle-aged adults in the U.S. and some nations/regions across Europe, we know little about whether nation-level policy factors are associated with these historical trends and disparities between nations. The objective of the current study is to examine whether policy pertaining to family benefits and income inequality are associated with these disparities in midlife loneliness between the U.S. and Europe. This research promises to provide insights into policy levers to help reduce midlife loneliness.

Significance of Midlife

Middle-aged adults form the backbone of society by constituting a large majority of the workforce and constituting family leadership that bridges younger and older generations (Infurna, Gerstorf, & Lachman, 2020; Lachman et al., 2015). Given the integral role that middle-

aged adults play in society and family, this makes them vulnerable to stressors that could be a detriment to their mental health and might increase their risk of loneliness. Stressors in midlife arise from disruptions in work/life balance, family discord, personal health issues, and job stress that have increased across historical time compared to younger and older adults (Almeida et al., 2020), which can accumulate over time to undermine mental health (Infurna et al., 2023; Zautra, 2006). Middle-aged adults also face demands on their time through increased work and caregiving responsibilities with (adult) children and aging parents (Fingerman et al., 2020). Financial vulnerabilities have arisen in the form of larger expenses for childcare, healthcare, and education (Infurna et al., 2020; Office of the U.S. Surgeon General, 2024). Following the Great Recession, U.S. middle-aged adults today exhibit more daily stress, health symptoms, chronic illness, functional limitations, and lower psychological well-being than their same-aged peers in the 1990s (Almeida et al., 2020; Goldman et al., 2018; Kirsch et al., 2019). Declining life expectancy and deaths of despair have been driven by rising mortality amongst working-age adults (Case & Deaton, 2020; Harris et al., 2021). These historical trends, typically operationally defined as differences based on individuals' birth year, are largely confined to the U.S., with European nations not showing such historical declines across numerous indicators spanning mental, cognitive, and physical health and life expectancy (Harris et al., 2021; Infurna et al., 2021, 2025; Wettstein et al., 2025). Specific to loneliness, previous research observed that later-born middle-aged adults in the U.S., England, and Mediterranean Europe reported elevations in loneliness, compared to earlier-born individuals, and historical stability was observed in Continental and Nordic Europe (Infurna et al., 2025). These historical trends pertaining to loneliness are largely specific to middle-aged adults. Empirical evidence suggests that for older adults (aged 65 and older) historical improvements have been observed in well-being and

cognition and declines in loneliness (Gerstorf et al., 2020; Hülür et al., 2016; Suanet & van Tilburg, 2019). In young adults, historical increases in loneliness have been observed (Buecker et al., 2021), whereas stability has been observed among children and adolescents (Clark et al., 2015; Lempinen et al., 2018). This raises the question of why middle-aged adults report better or worse mental health depending on the nation in which they reside.

The Role of Nation-Level Policy Factors in Midlife Development

Conceptual models examining midlife development have postulated that macro-level structures, such as policy and social and economic inequality, serve as upstream distal factors that could impact midlife outcomes through intermediary (e.g., community) and proximal (e.g., health behavior) mechanisms (Harris et al., 2021; Infurna et al., 2020). Theories on social change, such as the relative deprivation theory, posit that individuals and countries respond differently to the gradual changes in social, cultural, historical, and economic contexts (Power et al., 2020), which have implications for individual and population-level well-being. We examine two sets of policy factors that are likely associated with disparities in midlife loneliness trajectories and represent differences in availability of nation-level resources, namely, family benefits from the government (i.e., social capital resources) and income inequality (i.e., monetary resources).

Structural differences in macro-level structures of family benefits and income inequality exist across the U.S. and European nations, and research suggests that there are historical changes in each factor that align with the individual-level findings. For example, since the early 2000s, public spending on family benefits has risen in Europe, whereas it has remained stagnant/declined in the U.S. (Neef & Sodano, 2022; OECD, 2024, 2025; Piketty et al., 2018). Conversely, income inequality has risen in the U.S. during this same period, whereas income

inequality has stabilized and narrowed in most European nations (Neef & Sodano, 2022; OECD, 2024, 2025; Piketty et al., 2018).

Family policy. Policy models pertaining to family refer to government expenditure relating to financial support for families and children. These range from child-related cash transfers to families with children (e.g., child allowances and income support during parental leave) and public spending on services for families (e.g., subsidized childcare), all the way to financial support through the tax system (e.g., tax exemptions). In nations such as Germany and Sweden that have more generous family programs than the U.S. (e.g., subsidized childcare, income support during parental leave, and child allowances), both parents and non-parents in midlife report higher levels of well-being (Avendano et al., 2015; Glass et al., 2016), and life expectancy has been rising (Beckfield & Bambra, 2016; Lundberg et al., 2008). Expansions to paid family leave policies in the United Kingdom and Germany during the 1990s and early 2000s were associated with improvements in midlife well-being, even benefiting current generations of parents (Ribanszki et al., 2022). For middle-aged adults, family programs are highly relevant because insufficient short-term family care and lack of support for children beyond the period of infancy and childhood could contribute to financial pressures and workplace insecurity, each of which relates to compromised well-being (Jody et al., 2007). As discussed by Glass and colleagues (2016), greater investment in family programs benefits could increase the likelihood of both parents remaining in the workforce and contribute to attaining higher income and savings/assets. Previous research targeting family benefits has primarily focused on outcomes of life expectancy and well-being, but not loneliness. The lack of investment in family programs could lead to higher levels of and accelerated increases in loneliness through increasing parenting stress, time demands, and financial strain (Glass et al.,

2016), and parents (i.e., women) having to withdraw from the workforce (Heshmati et al., 2023), which restrict the time that is left for social activities and to maintain one's social network to counteract loneliness.

Social and economic inequality. Income inequality broadly refers to how nations differ in the (un)equal distribution of economic and social resources across citizens. The U.S. has pronounced disparities across SES, which likely contributes to between-nation differences in mental health (Avendano & Kawachi, 2014). Empirical research has primarily focused on well-being, showing that citizens in nations with greater income inequality report poorer well-being (Diener et al., 2015; Kung et al., 2022). A cross-sectional study focusing on older adults found that citizens of nations with higher income inequality, as measured by the GINI coefficient, report higher levels of loneliness (Tapia-Munoz et al., 2022). A notable limitation of this study was the lack of examination of longitudinal trends and the exclusion of middle-aged adults. Income inequalities likely shape midlife loneliness trajectories through social comparison and increasing barriers to resources, opportunities, and material conditions (Marmot, 2007).

The Present Study

We aim to better understand whether the nation-level policy factors of family benefits and income inequality are associated with between-nation disparities in levels and rates of change in midlife loneliness across historical time (i.e., birth year). Previous research targeting links between nation-level policy factors and midlife outcomes has primarily used cross-sectional data and focused on well-being and life expectancy. Our use of harmonized data from representative longitudinal panel surveys allows a direct test of whether public spending on family benefits and income inequality is associated with similarities and differences in trajectories of midlife loneliness in the U.S. and 13 European nations (England, Austria,

Belgium, Switzerland, Germany, Denmark, Spain, France, Greece, Italy, Netherlands, Sweden, and Israel). Another major step forward in our study is the use of longitudinal data that permits tracking within-person changes in midlife loneliness and the extent to which variations in nation-level policy factors impact within-person changes over historical time. Our focus on examining within-person changes over time permits for determining the long-term effects of nation-level policy factors on loneliness trajectories. Nation-level policies pertaining to family benefits and income inequality are pertinent to middle-aged adults due to their embeddedness in the workforce and family involvement. Findings arising from our study will identify specific social conditions, programs, and policies (e.g., increasing family benefits and reducing income inequality) that may inform reasons for differences in levels and rates of change in loneliness between the U.S. and European nations.

Methods

Study Design

Longitudinal panel surveys consisting of nationally representative samples were used from 14 different nations, including the U.S. (Health and Retirement Study, HRS), England (English Longitudinal Study of Ageing, ELSA), and Europe (Survey of Health, Ageing, and Retirement in Europe, SHARE; Austria, Belgium, Switzerland, Germany, Denmark, Spain, France, Greece, Italy, Netherlands, Sweden, and Israel). We used data harmonized by the Gateway to Global Aging team, which can be accessed via their website (https://g2aging.org). Harmonization involves combining datasets from different sources into a consistent, standardized, and comprehensive format for analysis. In the current study, each incorporated dataset assessed loneliness using an identical measure and involved midlife participants who were assessed longitudinally. This provides the opportunity to examine whether some of the

nation-level policy factors underlying historical change in midlife loneliness operate similarly or not across the gathered data. We included participants who provided data when they were aged 45 through 65 because this is the generally accepted age range for midlife (Lachman, 2004).

Transparency Statement

The syntax for data preparation and the analyses are provided through the Open Science Framework (https://osf.io/3qeyx/?view_only=0f76c620ef914681b08f45dd4db0abce). This study was not preregistered. Each dataset is publicly available and requires access through user agreements.

Participants and Procedures

Table 1 provides an overview of the data characteristics for each study.

The HRS (Sonnega et al., 2014) began in 1992. It is a nationally representative sample of households in the contiguous U.S. comprising adults aged 50 years and older and their spouses (spouses younger than 50 were included). Participants provide biennial data on sociological, psychological, and physical health information. Data is collected via in-person and telephone interviews, and every six years, a new cohort is recruited to maintain sample size and heterogeneity. We used data from 2002 to 2018 because 2002 is when data on loneliness began to be collected. In total, 13,217 participants who provided data when they were aged 45 to 65 were included in the analyses (60% women; education: 14% less than upper secondary education, 60% upper secondary education and vocational education, and 26% tertiary education; health conditions: $M = 2.22$, $SD = 1.60$, range 0 to 8; ever unemployed = 11%; ever divorced = 21%; ever widowed = 11%; have children = 91%). This analysis used data or information from the Harmonized HRS dataset and Codebook, Version C, as of January 2022, developed by the Gateway to Global Aging Data.

The ELSA (Steptoe et al., 2013) began in 2002 and is a nationally representative longitudinal survey collecting multidisciplinary data on adults aged 50 and older (and spouses younger than 50) living in England. We used biennial assessments from 2004 to 2018/2019 because 2004 is when data on loneliness began to be collected. In total, 9,793 participants who provided data when they were aged 45 to 65 were included in the analyses (56% women; education: 24% less than upper secondary education, 55% upper secondary education and vocational education, and 21% tertiary education; health conditions: $M = 1.44$, $SD = 1.29$, range 0 to 7; ever unemployed = 5%; ever divorced = 14%; ever widowed = 8%; have children = 83%). This analysis used data or information from the Harmonized ELSA dataset and Codebook, Version G.2 as of July 2021, developed by the Gateway to Global Aging Data.

The SHARE (Börsch-Supan et al., 2013) began in 2004 and is a cross-national longitudinal panel survey on the mental and physical health, and social and family networks of individuals in Europe and Israel. We only included nations that began in Wave 1 because these provide enough observations over a long enough time frame to examine within-person longitudinal change. These nations were Austria, Belgium, Switzerland, Germany, Denmark, Spain, France, Greece, Italy, Netherlands, Sweden, and Israel. We used data from 2010/11 to 2019/2020 because 2010/11 is when data on loneliness began to be collected. In total, 36,020 participants who provided data when they were aged 45 to 65 were included in the analyses (57% women; education: 33% less than upper secondary education, 39% upper secondary education and vocational education, and 28% tertiary education; health conditions: $M = 1.35$, $SD = 1.29$, range 0 to 8; ever unemployed = 9%; ever divorced = 9%; ever widowed = 5%; have children = 89%). This analysis used data or information from the Harmonized SHARE dataset and Codebook, Version F as of June 2022, developed by the Gateway to Global Aging Data.

Outcome

Loneliness in each study was assessed using the same Three-Item Loneliness Scale (Hughes et al., 2004), which asked how often participants experience the following feelings: *they lack companionship, feel left out, and feel isolated from others*. Participants answered using the following response scale: (1) hardly ever or never, (2) some of the time, and (3) often. The three items were averaged, with higher scores indicating higher levels of loneliness. To ease interpretability, we converted the measure to a T-Score metric ($M = 50$, $SD = 10$), using the entire sample of 59,030 participants. In a T-Score metric, 1-point is equivalent to .1 SD.

The Three-Item Loneliness Scale is derived from the longer 20-item UCLA Loneliness Scale and assesses global feelings of loneliness, particularly the isolation facet, as opposed to other facets of loneliness (relational connectedness and collective connectedness; see Hawkley et al., 2005). Using an indirect approach, items had been intentionally formulated to avoid the term loneliness as opposed to a direct approach that asks openly about feelings of loneliness (von Soest et al., 2020). Internal consistencies or Cronbach alpha at each wave of assessment in each study were as follows: HRS: α's ranged from 0.78 to 0.82; ELSA: α's ranged from 0.83 to 0.84; SHARE: α's ranged from 0.74 to 0.79. Regarding validity, previous research using this shortened three-item scale found that elevations in loneliness were associated with increased risk for accelerated biological aging, morbidity, disability, and mortality (Crowe et al., 2021).

Nation-Level Policy Factors

Public spending on family benefits is taken from the OECD data explorer database (OECD Social Expenditure database). Public spending on family benefits is government expenditure, including financial support exclusively for families and children. This includes child-related cash transfers to families with children and public spending on services for families

with children (benefits in kind). Child-related cash transfers include child allowances and public income support payments during periods of parental leave. Benefits in kind include direct financing or subsidizing childcare and early childhood education facilities, public childcare support through earmarked payments to parents, public spending on assistance for young people and residential facilities, and public spending on family services. This indicator is measured in percentage of GDP. Table S1 in the supplemental materials shows data on public spending on family benefits for each nation across assessments. Nations showing consistently higher levels of public spending on family benefits than the U.S. (Greece and Italy showed comparable levels to the U.S.) were England, Sweden, Austria, Belgium, Denmark, France, and Germany. For each nation, we took all available years during the study period and then included in our analyses the average across these years (U.S.: $M = 0.68$, $SD = 0.04$, range: 0.62 to 0.85; England: $M = 3.25$, $SD = 0.29$, range: 2.83 to 3.92; SHARE, Europe: $M = 2.25$, $SD = 0.79$, range: 1.21 to 3.73). The average across the assessment years for each participant was used in the analyses because the wave-to-wave correlations were above .90. Follow-up analyses targeted cash transfers vs. benefits in kind separately, and similar findings were observed (see Tables S6 and S7).

We used data from The World Bank on the GINI coefficient to assess income inequality (World Bank, Poverty and Inequality Platform). Income inequality is the difference in how income is distributed among the population. Income is defined as household disposable income in a particular year. It consists of earnings, self-employment, capital income, and public cash transfers; however, income taxes and social security contributions paid by households are deducted. Inequality is also described as the gap between rich and poor, wealth disparity, wealth and income differences, or the wealth gap. This is based on the comparison of cumulative proportions of the population against cumulative proportions of income they receive. It ranges

between 0 in the case of "perfect equality" (that is, each share of the population gets the same share of income) and 1 in the case of "perfect inequality" (that is, all income goes to the individual with the highest income). For ease of interpretation in our analysis, we multiplied the GINI coefficient by 100 to create a percentage index. Table S2 in the supplemental materials shows the data for each nation on the GINI coefficient across assessments. Nations showing the consistently lowest levels of income inequality were Sweden, Austria, Belgium, Denmark, France, the Netherlands, Switzerland, and Germany. For each nation, we took all available years during the study period and then included in our analyses the average across these years (U.S.: $M = 40.99$, $SD = 0.30$, range: 40 to 41.5; England: $M = 34.44$, $SD = 0.75$, range: 33.10 to 35.90; SHARE, Europe: $M = 31.80$, $SD = 3.34$, range: 27.20 to 39.90). The average across the assessment years for each participant was used in the analyses because the wave-to-wave correlations were above .90.

Statistical Analysis

Time-in-study, age, and cohort. Following Gerstorf et al. (2019) and Infurna et al. (2025), we examined intraindividual change as *time-in-study*, a time-varying variable quantified for each assessment as the number of years since baseline (T1) and centered at the middle of each individual's repeated measures time series. Age-related differences (age gradients) were examined as individuals' *chronological age* (at their middle assessment) and centered at age 50. Cohort-related differences were examined as individuals' *birth year* (centered at 1960), which was our operational definition of historical change.

Data analysis. Intraindividual changes, age-related, history-related, and nation-related differences were examined using multilevel models (Grimm et al., 2017). This permitted tracking how loneliness develops as people move through midlife (i.e., within-person change),

how this may differ across historical time (i.e., between-person differences), and how this may differ across nations (i.e., between-nation differences). Our multilevel model included three levels: longitudinal observations of loneliness (level 1) nested within person (level 2) who are nested within nations (level 3).

The model was specified as

$$loneliness_{ti} = \beta_{0i} + \beta_{1i}\,(timeinstudy_{ti}) + \beta_{2i}\,(timeinstudy^2_{ti}) + e_{ti} \tag{1}$$

where person i's score on loneliness at observation t, $loneliness_{ti}$, is modeled as a function of a person-specific intercept, β_{0i}; a person-specific linear slope coefficient, β_{1i}; a person-specific quadratic slope coefficient, β_{2i}, and residual error e_{ti}. Individual differences in the person-specific coefficients were modeled as

$$\beta_{0i} = \gamma_{00} + \gamma_{01}\,(age_i) + \gamma_{02}\,(birthyear_i) + \gamma_{03}\,(birthyear^2_i) + \gamma_{04}\,(birthyear_i * age_i)$$
$$+ \gamma_{05}\,(birthyear^2_i * age_i), \tag{2}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}\,(age_i) + \gamma_{12}\,(birthyear_i) + \gamma_{13}\,(birthyear^2_i) + \gamma_{14}\,(birthyear_i * age_i) + \gamma_{15}\,(birthyear^2_i$$
$$* age_i), \tag{3}$$

$$\beta_{2i} = \gamma_{20} \tag{4}$$

(i.e., Level 2 model) where γ_{00}, γ_{10} and γ_{20} are the sample means or fixed-effects from the model and u_{0i} estimate between-person differences in each parameter and are assumed to be normally distributed, correlated with each other, and uncorrelated with the residual errors, e_{ti}. The age parameter indicates whether age (centered at age 50) is associated with levels of loneliness (γ_{01}) and within-person changes over time (γ_{11}). The birth year parameter indicates whether birth year (centered at 1960) is associated with levels of loneliness (γ_{02}) and within-person changes over time (γ_{12}) and the quadratic terms (γ_{03} and γ_{13}) test for non-linearity in this association. The birth

year x age interactions (γ_{04} and $\gamma_{14;}$) interactions with quadratic birth year terms: (γ_{05} and γ_{15}) aim to determine whether birth year effects differ across the age range tested (ages 45 to 65).

The level 3 component of the expanded model accommodates the fact that individuals were nested within nations. We will model nation-specific intercepts, γ_{00n}; linear slopes, γ_{10n}; and quadratic slopes, γ_{20n}; as

$$\gamma_{00n} = \mu_{000} + v_{00n}, \tag{5}$$

$$\gamma_{10n} = \mu_{010} \tag{6}$$

$$\gamma_{20n} = \mu_{020} \tag{7}$$

where μ_{000}, μ_{010}, and μ_{020} are sample means across all nations, and v_{00n} are nation deviations from those means. The between-person and between-nation differences are assumed to be multivariate, normally distributed, correlated with each other, and uncorrelated with all other residuals. With this model, we aim to determine the extent of cohort differences in each outcome and whether these differences vary across nations.

Another advantage of this 3-level model is that it allows an examination of the proportion of between-person differences in intercept that are attributed to nation-level differences. Following the logic and use of the intraclass correlation for quantifying the proportion of between-person variance in multilevel models, we will quantify the proportion of between-person and between-nation variance in the intercept (for one application, see Gerstorf et al., 2010).

The expanded Level 3 component of the model is shown below for family benefits; similar procedures were implemented for income inequality.

$$\gamma_{00n} = \mu_{000} + \mu_{001}\,(\text{family benefits}_n) + v_{00n}, \tag{8}$$

$$\gamma_{01n} = \mu_{010} + \mu_{011}\,(\text{family benefits}_n) \tag{9}$$

$$\ldots \text{ (for } \gamma_{02n}, \gamma_{03n}, \gamma_{04n}, \gamma_{05n}, \text{ respectively)}$$

$$\gamma_{10n} = \mu_{100} + \mu_{101} \text{ (family benefits}_n) + \nu_{00n}, \tag{10}$$

$$\gamma_{11n} = \mu_{110} + \mu_{111} \text{ (family benefits}_n) + \tag{11}$$

$$\ldots \text{ (for } \gamma_{12n}, \gamma_{13n}, \gamma_{14n}, \gamma_{15n}, \text{ respectively)}$$

Models were fit using SAS (Proc Mixed; Littell et al., 2006). Following good practice (e.g., Grimm et al., 2017), we used Full Information Maximum Likelihood (FIML) procedures to accommodate incomplete data under usual missing at random assumptions (Little & Rubin, 2002). The models included the following variables as covariates because each is associated with loneliness (Barjakova et al., 2023; Luhmann et al., 2023; Morrish & Medina-Lara, 2021): gender, education, health conditions (sum index of high blood pressure, diabetes, cancer or malignant tumor, lung disease, heart condition, stroke, psychiatric problems, and arthritis), whether participants have children and whether participants had experienced unemployment, divorce, or widowhood during the study period. Descriptive information on the covariates is included above in the participants and procedure section for each dataset and in Table 1, and Table S3 shows the descriptive statistics and correlations at the entire sample level. We tested family benefits of public spending and the GINI coefficient in separate models and follow-up analyses that included both simultaneously revealed substantially similar findings to those we report on below (see Table S5). Given the large sample size for the analyses and to guard against false positives (for discussion, see Lakens et al., 2018), we use the $p < .0001$ cut-off for statistical significance for intercept-related parameters, $p < .001$ for time-related parameters at Level 2, and $p < .05$ for nation-related parameters at Level 3. We have chosen these different cut-offs because as shown by Feingold (2021), the power to detect intercept differences was 9.7 times greater than the power to detect slope differences.

Results

We first examined the extent to which individual differences in midlife loneliness are accounted for by the nations in which individuals reside. The three-level multilevel model acknowledges that individuals are nested within nations, and the "total" variance in intercepts was decomposed into a portion that could be attributed to between-person differences and a portion that could be attributed to between-nation differences. There are substantial differences in levels of loneliness in midlife and a notable portion of these differences are attributed to differences among the nation in which people live. Table S4 shows that a significant portion of the variance in the intercept could be attributed to between-nation differences. Quantified as an intraclass correlation (6.37 / 6.37 + 51.38), the proportion of between-nation variance was 0.1103. That is, 11.03% of the overall differences in levels of loneliness could be attributed to differences among nations, with the remaining 88.97% being attributed to differences among people. We next included public spending on family benefits and the GINI coefficient as predictors into the three-level multilevel model to examine whether these were predictive of levels and rates of change in midlife loneliness.

Public Spending on Family Benefits Predicting Midlife Loneliness

Table 2 shows our results from the model examining whether family benefits predict midlife loneliness trajectories. Middle-aged adults who live in nations that devote a larger percentage of their GDP to programs pertaining to family benefits, on average, report lower levels of loneliness (estimate = –1.41 T-score units, $p < .0001$). For comparison, the average percentage of GDP directed towards family benefits was as low as 0.68% in the U.S. (during the study period from 2002 to 2019), whereas it was as high as 3.48% in Sweden (during the study period from 2010 to 2019). Based on the parameter estimates of the model, this results in a 3.97

T score unit (d = 0.39) difference between the two nations in midlife loneliness for 50-year-olds born in 1960 (i.e., the model centering point).

Public spending on family benefits was also found to moderate historical changes in midlife loneliness (family benefits x birth year estimate = –0.04, p < .05). Figure 1A shows that participants in nations with greater public spendings in family benefits (i.e., spending at + 1 *SD* or 3.06% and beyond, which includes Denmark, England, and Sweden) reported lower levels of loneliness and there were less pronounced historical increases. Conversely, Figure 1B shows that participants residing in nations with less public spending in family benefits (i.e., spending at –1 *SD* or 1.02% and below, which includes the United States) reported higher levels of loneliness, and there were greater historical increases (i.e., early and late boomers and Gen X reported higher levels compared to the Silent Generation). Based on the parameter estimates for levels of public spending on family benefits resembling that of the U.S., a 50-year-old born in 1968 is expected to report higher levels of loneliness compared to a 50-year-old born in 1952 (2.30 T score units or 0.23 *SD*). In contrast, based on the parameter estimates for levels of family benefits resembling that of Sweden, a 50-year-old born in 1968 is expected to report similar levels of loneliness compared to a 50-year-old born in 1952 (–0.51 T score units or –0.05 *SD*).

Public spending on family benefits also impacted within-person changes in loneliness (family benefits x time estimate = –0.08, p < .001). Figure 1B shows that for individuals earlier in midlife, lower public spending on family benefits was associated with stronger increases in loneliness over time. Middle-aged adults in nations with greater spending on family benefits showed within-person stability in loneliness over time (see Figure 1A).

In follow-up analyses, we separated family benefits into the two components of (a) family cash transfers and (b) benefits in kind or public spending on services. Results revealed

substantially similar findings to those reported for the combined family benefits (see Tables S6-S7 in the supplemental materials). In nations with more spending on family cash transfers and public spending on services for families with children, on average, middle-aged adults report lower levels of and stability over time in loneliness and less historical increases in loneliness across cohorts.

Additional follow-up analyses targeted gender differences due to the potential for family benefits of public spending to differentially impact men and women. Analyses stratified by gender are shown in Table S8 and Figure S1 in the supplemental materials. Results revealed that greater investment in family benefits of public spending was associated with lower levels of loneliness for both men (-1.19, $p < .01$) and women (-1.50, $p < .001$). Public spending on family benefits moderated historical changes in midlife loneliness for women (family benefits x birth year estimate $= -0.05$, $p < .05$) and men (family benefits x birth year squared estimate $= 0.01$, $p < .05$). Based on Figure S1, the findings suggest that, on average, women who live in nations with greater public spending in family benefits reported lower levels of loneliness and there were less pronounced historical increases.

GINI Coefficient Predicting Midlife Loneliness

Table 3 shows our results from the model examining whether the GINI coefficient predicts midlife loneliness. Middle-aged adults living in nations with less income inequality (as measured by the GINI coefficient), on average, report lower levels of loneliness (estimate $= 0.40$ T-score units, $p < .0001$). For comparison, the average for the U.S. across the assessments (2002 to 2019) was 0.41, whereas in Sweden, the average was 0.29 (2010 to 2019). Based on the parameter estimates of the model, this results in a 4.85 T score unit ($d = 0.48$) difference between the two nations in midlife loneliness for 50-year-olds born in 1960 (i.e., the model centering

point). Figure 2A shows that participants in nations with less inequality (i.e., –1 *SD*, which includes Belgium, Denmark, the Netherlands, and Sweden) reported lower levels of loneliness. In contrast and as illustrated in Figure 2B, participants in nations with more inequality (i.e., +1 *SD*, which includes the United States and Israel) reported higher levels of loneliness. The GINI coefficient did not moderate historical changes in loneliness (i.e., no moderation with birth year or birth year squared). However, the GINI coefficient moderated within-person changes (GINI coefficient x time estimate = 0.03, *p* < .0001). Figure 2B shows that for middle-aged adults born earlier, more income inequality was associated with stronger within-person increases in loneliness over time. Middle-aged adults in nations with lower income inequality showed within-person stability in loneliness over time (Figure 2A).

Follow-up analyses targeted gender differences due to the potential for income inequality to differentially impact men and women. Analyses stratified by gender are shown in Table S9 and Figure S2 in the supplemental materials. Results revealed that the direct effect of income inequality was associated with loneliness for both men (0.45, *p* < .0001) and women (0.40, *p* < .0001). Income inequality moderated historical changes in midlife loneliness for women (income inequality x birth year estimate = 0.01, *p* < .05) and men (income inequality x birth year squared estimate = –0.003, *p* < .05). Based on Figure S2, the findings suggest that, on average, men who live in nations with greater income inequality reported higher levels of loneliness and there were more pronounced historical increases as compared to women.

Discussion

Our findings demonstrate that nation-level policy factors pertaining to family benefits and income inequality are associated with midlife loneliness. In nations that underinvest in family benefits (as % of GDP) and those with high-income inequality, middle-aged adults are

more likely to report higher levels of and exhibit steeper historical increases in loneliness over time. Our findings extend earlier reports of how family benefits and less income inequality are associated with better well-being and higher life expectancy (Glass et al., 2016; Lundberg et al., 2008; Oishi et al., 2011) by showing that nation-level disparities in midlife loneliness are in part tied to these policy factors. This insight into how nation-level policy factors pertaining to family benefits and income inequality are associated with midlife loneliness prompts discussion about how specific policy levers (e.g., increasing family benefits and reducing income inequality) inform reasons for differences in levels and rates of change in loneliness between the U.S. and European nations.

The Role of Nation-Level Factors in Midlife Development

Family policy. Underinvestment in policy pertaining to family benefits was associated with elevations of and historical increases in loneliness over time for middle-aged adults. Follow-up analyses revealed that both family cash transfers and benefits in kind or public spending on services were associated with lower levels of loneliness. We also observed gender differences; women residing in nations with greater investment in family benefits policy showed less strong historical increases in loneliness, which could be due to greater ability of women to remain employed in the workforce in countries who invest more in family benefits (Glass et al., 2016). This is in line with previous research (Heshmati et al., 2023) and suggests that when childcare benefits or parental leave income are limited, women may be more likely to withdraw from the workforce, potentially leading to elevations in loneliness. The family policy programs of the 14 nations drastically differ from one another. For example, in Sweden, France, and Germany, more generous programs come in the form of a monthly allowance to help offset costs associated with raising children, generous parental leave support, greater investment in education

facilities, and low childcare costs through subsidization (Collins, 2019). These types of family programs are not mandated in each of the included nations and differ widely in their availability and extensiveness of coverage (Feinberg, 2018). Glass and colleagues (2016) observed that lower nation-level childcare costs (indexed via % median wage) were associated with higher happiness for all parents, not just those with young children. Potential explanations include subsidies for childcare lower costs, resulting in higher incomes and greater savings and assets across the lifespan. Lower childcare costs could also relate to broader cultural support for families, including feelings of social inclusion and community support (Glass et al., 2016).

Family policy programs that include cash transfers can be regarded as an investment in social capital, which can directly and positively affect household income (through purchasing goods) and reduce family poverty (Lundberg et al., 2008). Generous family benefits likely lessen loneliness in midlife through individuals not being solely reliant on their own resources and needing to create their own safety net, which is especially pertinent in the U.S., where midlife adults show more residential mobility and are typically less embedded in and isolated from their community (U.S. Surgeon General Report, 2024). Such a safety net would have downstream benefits, including reducing financial strain and overall demands/stressors involved with parenting (Collins, 2019). Family benefit investment allows for better work-life balance (less conflict between work and family responsibilities) and increases parental time with children. Such programs contribute to fewer cultural demands and financial pressures (Luthar et al., 2020).

Income inequality. Middle-aged adults in nations with larger income inequalities report higher levels of and stronger increases in loneliness over time. Follow-up analyses revealed gender differences; men residing in nations with greater income inequality showed stronger historical increases in loneliness, which could be due to fewer economic opportunities for

intergenerational and employment mobility, which may be more harmful for men than for women (Baarck, Bode, & Peichl, 2025). The included nations differ in their (un)equal distribution of economic and social resources across citizens, with the U.S., Israel, Greece, Italy, and Spain showing the highest levels of income inequality. Income inequality produces differences in material conditions, exacerbates poverty rates, increases relative deprivation, and reduces the possibility of moving up the SES gradient (Marmot, 2020; Tapia-Munoz et al., 2022). Social gradients determine access to education, jobs, social services, income, and wealth, each of which has downstream effects on loneliness (Marmot, 2017). Increased income inequality leads to reductions in general trust and perceived fairness, as well as less satisfaction with public goods (e.g., education and public transportation), each of which is linked to higher loneliness (Oishi et al., 2011, 2012). In countries with a greater income inequality, those with low incomes might, following relative deprivation theory, come up with the "judgment that one or one's group is worse off compared to some standard accompanied by feelings of anger and resentment" (p.., Smith & Pettigrew, 2015), and probably also by feelings of social exclusion and loneliness.

Limitations

We note several limitations that point to future routes of inquiry. First, our study focused on two nation-level policy factors that conceptually and empirically have been associated with mental health and well-being and have reason to be linked to loneliness in middle-aged adults (Harris et al., 2021; Infurna et al., 2020). However, future research is warranted to explore other pertinent policy factors and cultural variables, including, but not limited to unemployment rates, public health spending, as well as individualism, and religiosity, each of which have been targeted in other periods of the lifespan (Harris et al., 2021). Second, when conducting research

on cross-national samples, the issue of measurement equivalence arises. We note that testing for measurement invariance is a huge endeavor that is beyond the scope of this study because it requires testing for invariance across the entire midlife age range, nations, historical time and within-person time, gender and SES strata. The empirical evidence available indicates that effects of longitudinal measurement invariance are small (Luhmann et al., 2023), loneliness is a universal experience that can be measured reliably and validly across cultures (Hawkley et al., 2010, 2020; Maes et al., 2016), and the nomological network (e.g., correlations with personality) has not changed across historical time (Bücker et al., 2021). Third, the testing of three-level multilevel models is challenging, especially when estimating the variance to differ across nations. We deliberately chose model convergence and stability of model estimation over less stable dynamic modeling. Furthermore, given that we used time-invariant constructs for policy factors, this makes it difficult to interpret within-person trends as driven by time-varying national policy factors. We cannot draw inferences about how changes in policies are intertwined with historical increases in loneliness although the wave-to-wave correlations for each of the policy factors are above .90, suggesting that variability in policy factors over time seems to be limited. Furthermore, it is possible that loneliness could be the predictor of macro-level factors, rather than the outcome; future research based on quasi-experimental variation or on instrumental variables is needed for more insights regarding causality and disentangle this association.

Conclusion

Nation-level policy factors are associated with loneliness in midlife and should be taken into consideration for alleviating loneliness. Levels and rates of change in loneliness were related with structural-level factors related to family benefits and income inequality, which informs policy and public endeavors aimed at reducing loneliness. Directions for future research would

be to further explore between-person differences in the extent to which policy factors are associated with midlife loneliness, whether other policy factors show a similar impact on loneliness, linking historical changes in policy factors with historical changes in key outcomes, such as loneliness and extend this approach to nations beyond the U.S. and Europe (Akhter-Khan et al., 2004). Our findings provide guidance for future research oriented towards identifying mechanisms as a way for policy to ameliorate the loneliness global public health problem.

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Table 1
Descriptive Information for Each of the Datasets Used in the Current Study

	United States (HRS)	England (ELSA)	Continental, Mediterranean, and Nordic Europe (SHARE)
Data Collection Years	2002 to 2018 (biennially)	2004 to 2018/19 (biennially)	2010/11 to 2019/20 (biennially)
Sample Size	$N = 13,217$	$N = 9,793$	$N = 36,020$
Age at Baseline	$M = 56.51$ ($SD = 4.45$) range: 45 to 65	$M = 55.80$ ($SD = 4.46$) range: 45 to 65	$M = 56.67$ ($SD = 4.82$) range: 45 to 65
Gender (% Women)	60%	56%	56%
Education	14% less than upper secondary; 60% upper secondary and vocational; 26% tertiary	24% less than upper secondary; 55% upper secondary and vocational; 21% tertiary	33% less than upper secondary; 39% upper secondary and vocational; 28% tertiary
Health conditions	$M = 2.22, SD = 1.60$	$M = 1.44, SD\ 1.29$	$M = 1.35, SD\ 1.29$
Ever unemployed (%)	11%	5%	9%
Ever divorced (%)	21%	14%	9%
Ever widowed (%)	11%	8%	5%
Have children (%)	91%	83%	89%
Public spending on family benefits	$M = 0.68, SD = 0.04$	$M = 3.25, SD = 0.29$	$M = 2.25, SD = 0.79$
GINI coefficient	$M = 40.99, SD = 0.30$	$M = 34.44, SD\ 0.75$	$M = 31.80, SD = 3.34$
Year of birth	$M = 1953$ ($SD = 7.16$) range: 1937 to 1973	$M = 1951$ ($SD = 7.14$) range: 1939 to 1974	$M = 1955$ ($SD = 5.27$) range: 1945 to 1974

Note. HRS = Health and Retirement Study. ELSA = English Longitudinal Study of Ageing. SHARE = Survey of Health, Ageing, and Retirement in Europe. Continental Europe consists of France, Austria, Belgium, Germany, Switzerland, and Israel. Mediterranean Europe consists of Italy, Spain, and Greece. Nordic Europe consists of Denmark, Netherlands, and Sweden.

Table 2
Results from Multilevel Model Examining Historical Changes in Loneliness: Effect of Public spending on family benefits

	Loneliness	
Parameters	Estimate	SE
Fixed Effects		
Intercept	50.56***	0.63
Time	0.16***	0.04
Time squared	–0.01***	0.003
Age	–0.04	0.03
Age*time	–0.03***	0.01
Birth year	0.09***	0.02
Birth year squared	–0.02***	0.003
Birth year*time	–0.02	0.01
Birth year squared*time	0.001	0.001
Birth year*age	–0.01***	0.003
Birth year squared*age	0.0003	0.0002
Birth year*age*time	0.001	0.001
Birth year squared*age*time	0.000004	0.0001
Family benefits	–1.41***	0.31
Family benefits x age	–0.02	0.02
Family benefits x time	–0.08**	0.02
Family benefits x time x age	0.02***	0.005
Family benefits x birth year	–0.04*	0.02
Family benefits x birth year squared	0.005	0.003
Family benefits x age x birth year	0.004	0.003
Family benefits x age x birth year squared	–0.0001	0.0002
Family benefits x birth year x time	0.03	0.01
Family benefits x age x birth year x time	–0.001	0.0005
Fixed Effects: Covariates		
Women	0.71***	0.07
Education	–0.68***	0.05
Unemployment	1.53***	0.12
Divorced	4.27***	0.10
Widowed	3.41***	0.14
Health conditions	1.26***	0.03
Children	–2.24***	0.11
Random Effects: Individual level		
Intercept	42.95***	0.41
Random Effects: Nation level		
Intercept	5.29*	2.01
Residual variance	41.95***	0.23

Note. *N* = 59,030 individuals and 125,954 observations. Loneliness is in a *T-score* metric (*M* = 50, *SD* = 10). The model was centered at birth year 1960 and age 50.
*p < .05. **p < .001. ***p < .0001.

Table 3
Results from Multilevel Model Examining Historical Changes in
Loneliness: Effect of the GINI Coefficient

Parameters	Loneliness	
	Estimate	SE
Fixed Effects		
Intercept	51.06***	0.54
Time	0.16***	0.04
Time squared	−0.01***	0.003
Age	−0.01	0.03
Age*time	−0.04****	0.01
Birth year	0.09***	0.02
Birth year squared	−0.01***	0.003
Birth year*time	−0.02*	0.01
Birth year squared*time	−0.001	0.001
Birth year*age	−0.01	0.003
Birth year squared*age	0.0002	0.0002
Birth year*age*time	−0.001	0.001
Birth year squared*age*time	0.0001	0.0001
GINI coefficient	0.40***	0.08
GINI coefficient x age	0.01	0.01
GINI coefficient x time	0.03***	0.01
GINI coefficient x time x age	−0.01***	0.001
GINI coefficient x birth year	0.01	0.005
GINI coefficient x birth year squared	−0.001	0.001
GINI coefficient x age x birth year	−0.001	0.001
GINI coefficient x age x birth year squared	−0.0000006	0.00004
GINI coefficient x birth year x time	−0.01***	0.001
GINI coefficient x age x birth year x time	0.0001	0.0001
Fixed Effects: Covariates		
Women	0.72***	0.07
Education	−0.67***	0.05
Unemployment	1.64***	0.12
Divorced	4.27***	0.10
Widowed	3.41***	0.14
Health conditions	1.27***	0.03
Children	−2.24***	0.11
Random Effects: Individual level		
Intercept	42.95***	0.41
Random Effects: Nation level		
Intercept	3.64*	1.39
Residual variance	41.96***	0.23

Note. $N = 59{,}030$ individuals and $125{,}954$ observations. Loneliness is in a *T-score* metric ($M = 50$, $SD = 10$). The model was centered at birth year 1960 and age 50.

$*p < .05. **p < .001. ***p < .0001.$

Figure Captions

Figure 1. Nation-level differences in model-implied trajectories of loneliness pertaining to public spending on family benefits. The long thin lines for each generation represent the age trends, and the short-thick lines for each cohort represent within-person changes over 5 years with 1-year age increments. In nations that invest in more family benefits (as a % of GDP), there is relative stability or little differences between cohorts of middle-aged adults in levels of loneliness and there is overall stability in within-person changes in loneliness (A). In contrast, in nations that invest less in family benefits (as a % of GDP), later-born cohorts of middle-aged adults report higher levels of loneliness (i.e., Early Boomers, Late Boomers, and Gen X, relative to the Silent Generation) and stronger within-person increases in loneliness (B).

Figure 2. Nation-level differences in model-implied trajectories of loneliness pertaining to the GINI coefficient or income inequality. The long thin lines for each generation represent the age trends and the short-thick lines for each cohort represent within-person changes over 5 years with 1-year age increments. In nations with less income inequality, there is relative stability or little differences between cohorts of middle-aged adults in levels of loneliness and there is stability in within-person changes in loneliness (A). In contrast, in nations with more income inequality, later-born cohorts of middle-aged adults report higher levels of loneliness (i.e., Early Boomers, Late Boomers, and Gen X, relative to the Silent Generation) and stronger within-person increases in loneliness (B).

A: High Family Benefits (+1 *SD*)

B: Low Family Benefits (−1 *SD*)

A: Low Gini Coefficient (−1 *SD*)
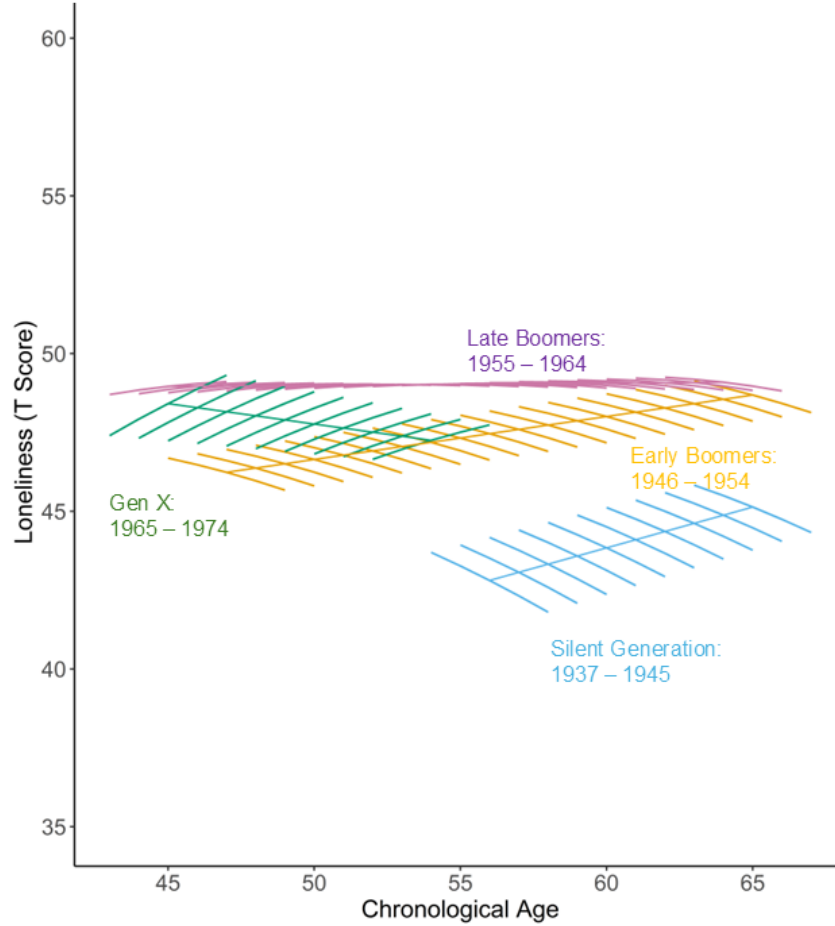
B: High Gini Coefficient (+1 *SD*)
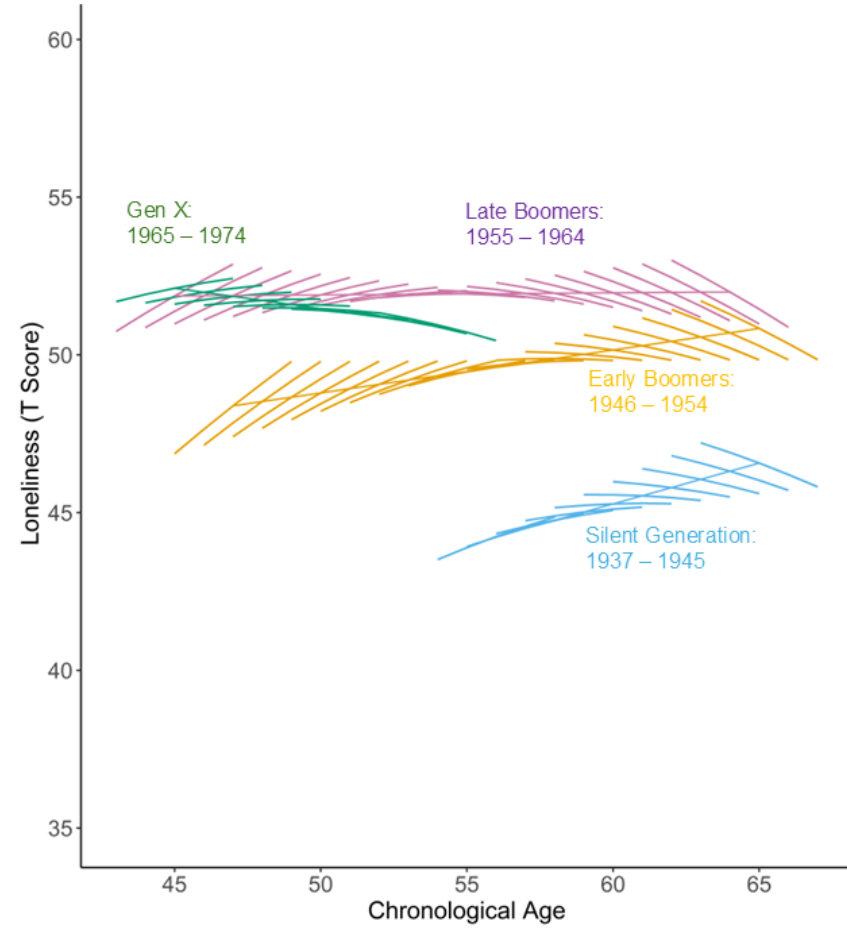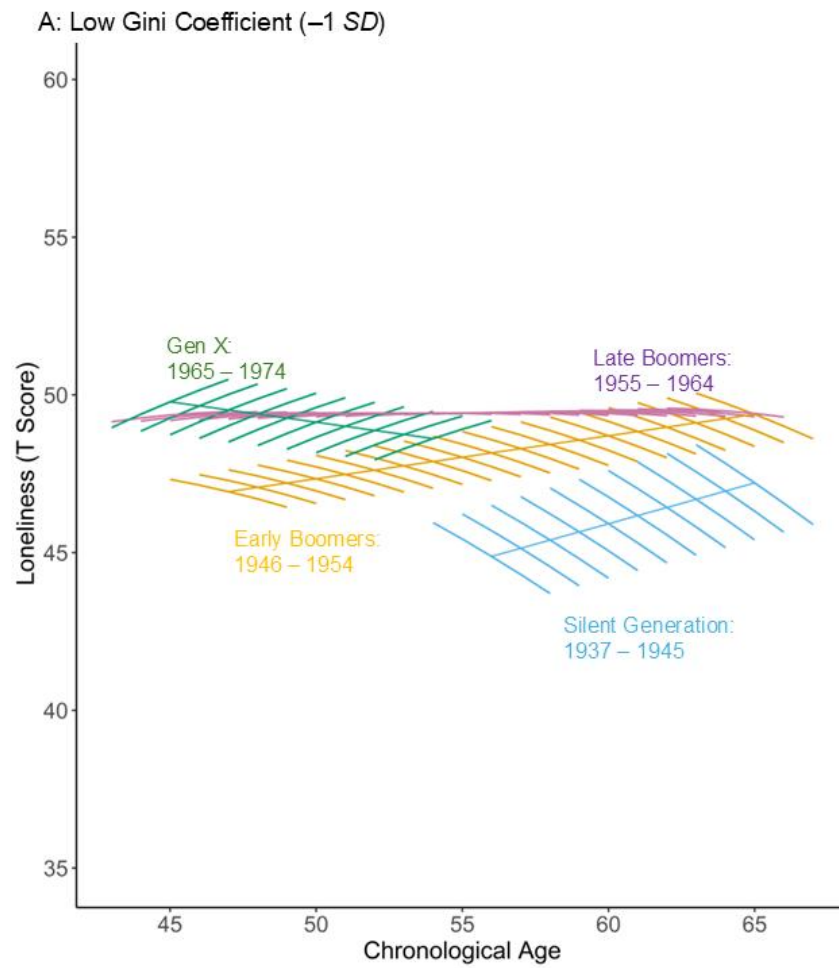
Supplemental Materials

Table S1

Family Benefits of Public Spending over Time Periods of Assessment

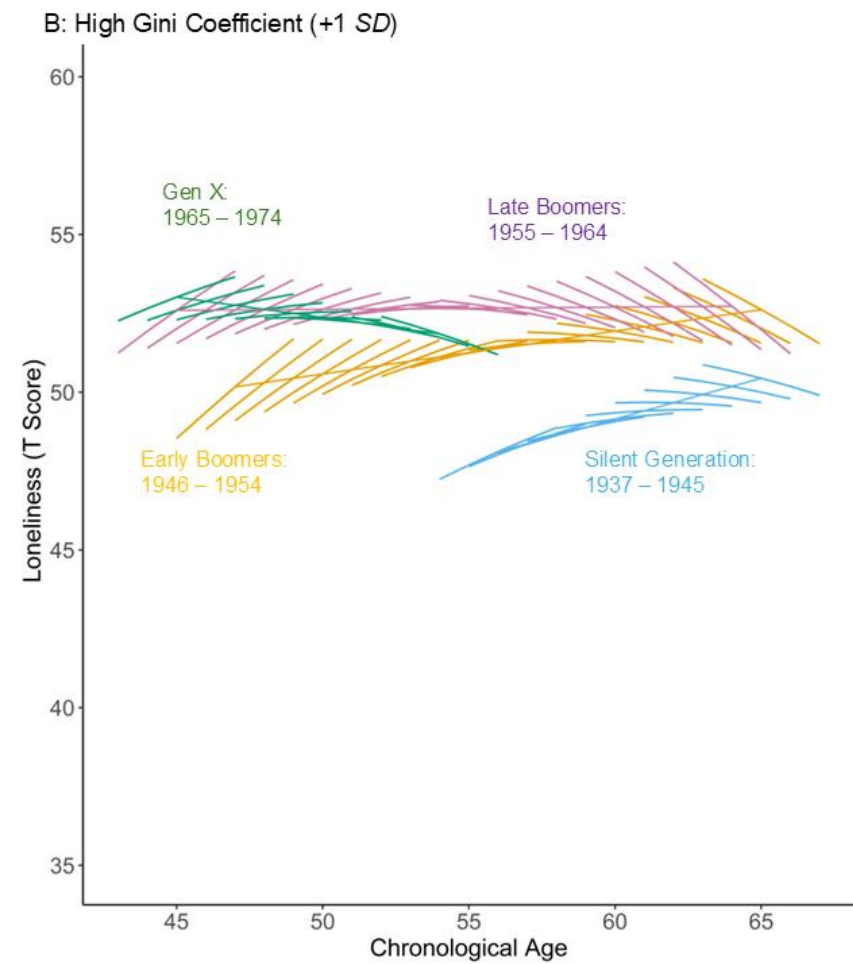| Nation	2002	2004	2006	2008	2010	2012/2013	2014/2015	2016/2017	2018/2019
United States	0.846	0.745	0.709	0.701	0.750	0.684	0.644	0.640	0.621
England		2.874	2.825	3.320	3.916	3.866	3.457	3.283	2.982
Austria					2.953	2.660	2.661	2.607	2.513
Belgium					2.831	2.844	2.777	2.744	2.771
Denmark					2.893	3.732	3.519	3.399	3.313
France					2.923	2.978	2.928	2.858	2.712
Germany					2.189	2.215	2.264	2.335	2.420
Greece					0.978	1.329	1.285	1.655	1.768
Israel					1.971	1.938	1.824	2.203	2.065
Italy					1.320	1.412	1.393	1.408	1.419
The Netherlands					1.527	1.322	1.441	1.491	1.575
Spain					1.425	1.312	1.238	1.205	1.274
Sweden					3.374	3.544	3.457	3.384	3.421
Switzerland					1.454	1.535	1.743	1.760	1.731

Note. Family benefits are measured as % GDP. For the nations of Austria and below, individuals were assessed in 2013, 2015, 2017, and 2019. This is when SHARE assessed those participants.

Table S2
GINI Coefficient over Time Periods of Assessment

Nation	2002	2004	2006	2008	2010	2012/2013	2014/2015	2016/2017	2018/2019
United States	0.404	0.403	0.414	0.408	0.400	0.409	0.415	0.411	0.414
England		0.348	0.359	0.354	0.337	0.331	0.331	0.331	0.337
Austria					0.303	0.308	0.305	0.297	0.302
Belgium					0.284	0.277	0.277	0.274	0.272
Denmark					0.272	0.285	0.282	0.287	0.277
France					0.337	0.325	0.327	0.316	0.312
Germany					0.303	0.315	0.314	0.319	0.317
Greece					0.341	0.361	0.360	0.344	0.331
Israel					0.426	0.399	0.397	0.382	0.383
Italy					0.347	0.349	0.354	0.359	0.346
The Netherlands					0.278	0.281	0.282	0.285	0.292
Spain					0.352	0.362	0.362	0.347	0.343
Sweden					0.277	0.288	0.292	0.288	0.293
Switzerland					0.326	0.325	0.323	0.327	0.340

Note. The GINI coefficient ranges between 0 in the case of perfect equality (that is, each share of the population gets the same share of income) and 1 in the case of "perfect inequality" (that is, all income goes to the individual with the highest income). For the nations of Austria and below, individuals were assessed in 2013, 2015, 2017, and 2019. This is when SHARE assessed those participants.

Table S3

Descriptive statistics and correlations amongst the variables of interest at Time 1

Variables	M (SD)	1	2	3	4	5	6	7	8	9	10
1. Loneliness	1.33 (0.49)	–									
2. Birth year	1954 (6.22)	0.01**	–								
3. Women	57%	0.06***	0.06***	–							
4. Education	2.00 (0.73)	–0.06***	0.08***	–0.04***	–						
5. Children	88%	–0.07***	–0.04***	0.05***	–0.03***	–					
6. Health conditions	1.56 (1.41)	0.22***	–0.26***	0.02***	–0.11***	0.02***	–				
7. Unemployed	9%	0.07***	0.07***	–0.03***	–0.06***	–0.03***	0.03***	–			
8. Divorced	13%	0.20***	–0.001	–0.05***	0.02***	0.01*	0.10***	0.06***	–		
9. Widowed	7%	0.10***	–0.17***	–0.13***	–0.06***	–0.03***	0.12***	–0.001	–0.04***	–	
10. Family benefits	2.06 (1.04)	–0.14***	–0.04***	–0.03***	0.07***	–0.03***	–0.15***	–0.06***	–0.04***	–0.05***	–
11. Gini coefficient	34.32 (4.55)	0.22***	–0.08***	0.03***	–0.03***	0.02*	0.20***	0.04***	0.08***	0.08***	–0.71***

Note. The time one assessment was used for loneliness, family benefits, and gini coefficient.

* $p < .05$, ** $p < .001$, ***$p < .0001$.

Table S4

Results from Multilevel Model With and Without Modeling of Nation-Level Differences

Parameters	Individual Variables		Individual and Nation Variables	
	Estimate	SE	Estimate	SE
Fixed Effects				
Intercept	50.13***	0.04	49.00***	0.68
Time	–0.03**	0.008	–0.01	0.008
Time squared	0.00002	0.003	–0.01	0.003
Random Effects: Individual level				
Intercept	59.28***	0.50	51.38***	0.46
Random Effects: Nation level				
Intercept			6.37*	2.42
Proportion of variance attributable to nation differences			11.03%	
Residual variance	42.03***	0.23	41.99***	0.23

Note. $N = 59,030$ individuals and 125,954 observations. Loneliness is in a *T-score* metric ($M = 50$, $SD = 10$).

*p < .05. **p < .001. ***p < .0001.

Table S5

Results from Multilevel Model Examining Historical Changes in
Loneliness: Combined Effect of Public Spending on Family Benefits
and Gini Coefficient

	Loneliness	
Parameters	Estimate	SE
Fixed Effects		
Intercept	51.26***	0.59
Time	0.17***	0.04
Time squared	–0.01***	0.003
Age	–0.02	0.03
Age*time	–0.04***	0.01
Birth year	0.09***	0.02
Birth year squared	–0.02***	0.003
Birth year*time	–0.03	0.01
Birth year squared*time	0.002	0.001
Birth year*age	–0.01*	0.004
Birth year squared*age	0.0003	0.0002
Birth year*age*time	0.001	0.001
Birth year squared*age*time	–0.0001	0.0001
Family benefits	–0.91***	0.34
Family benefits x age	0.11	0.04
Family benefits x time	–0.06**	0.04
Family benefits x time x age	0.01	0.01
Family benefits x birth year	0.04	0.03
Family benefits x birth year squared	0.01*	0.004
Family benefits x age x birth year	0.01*	0.01
Family benefits x age x birth year squared	–0.0001	0.0003
Family benefits x birth year x time	0.04	0.01
Family benefits x age x birth year x time	–0.002–	0.001
GINI coefficient	0.37***	0.10
GINI coefficient x age	0.03*	0.01
GINI coefficient x time	0.003	0.01
GINI coefficient x time x age	–0.002	0.002
GINI coefficient x birth year	0.01	0.01
GINI coefficient x birth year squared	0.001	0.001
GINI coefficient x age x birth year	0.002	0.001
GINI coefficient x age x birth year squared	–0.00002	0.0001
GINI coefficient x birth year x time	0.003	0.002
GINI coefficient x age x birth year x time	–0.0003	0.0002
Fixed Effects: Covariates		
Women	0.72***	0.07

Education	−0.67***	0.05
Unemployment	1.64***	0.12
Divorced	4.27***	0.10
Widowed	3.42***	0.14
Health conditions	1.27***	0.03
Children	−2.24***	0.11
Random Effects: Individual level		
Intercept	42.94***	0.41
Random Effects: Nation level		
Intercept	4.33*	1.73
Residual variance	41.92***	0.23

Note. $N = 59{,}030$ individuals and 125,954 observations. Loneliness is in a *T-score* metric ($M = 50$, $SD = 10$). The model was centered at birth year 1960 and age 50.
*p < .05. **p < .001. ***p < .0001.

Table S6

Results from Multilevel Model Examining Historical Changes in
Loneliness: Effect of Family Cash Transfers

Parameters	Loneliness	
	Estimate	SE
Fixed Effects		
Intercept	50.53***	0.66
Time	0.16***	0.04
Time squared	–0.01***	0.003
Age	–0.05	0.03
Age*time	–0.03***	0.01
Birth year	0.08***	0.02
Birth year squared	–0.02***	0.003
Birth year*time	–0.02***	0.01
Birth year squared*time	0.001	0.001
Birth year*age	–0.01***	0.003
Birth year squared*age	0.0003	0.0002
Birth year*age*time	0.001	0.001
Birth year squared*age*time	0.000001	0.0001
Family cash transfer	–1.91***	0.49
Family cash transfer x age	–0.02	0.03
Family cash transfer x time	–0.09*	0.04
Family cash transfer x time x age	0.02***	0.01
Family cash transfer x birth year	–0.06*	0.02
Family cash transfer x birth year squared	0.01	0.004
Family cash transfer x age x birth year	0.01	0.005
Family cash transfer x age x birth year squared	–0.0001	0.0002
Family cash transfer x birth year x time	0.04***	0.01
Family cash transfer x age x birth year x time	–0.002*	0.001
Fixed Effects: Covariates		
Women	0.71***	0.07
Education	–0.68***	0.05
Unemployment	1.62***	0.12
Divorced	4.27***	0.10
Widowed	3.41***	0.14
Health conditions	1.26***	0.03
Children	–2.25***	0.11
Random Effects: Individual level		
Intercept	42.96***	0.41
Random Effects: Nation level		
Intercept	5.79*	2.20
Residual variance	41.95***	0.23

Note. N = 59,030 individuals and 125,954 observations. Loneliness is in a *T-score* metric (M = 50, SD = 10). The model was centered at birth year 1960 and age 50.

p < .05. **p* < .001. ****p* < .0001.

Table S7
Results from Multilevel Model Examining Historical Changes in
Loneliness: Effect of Family in Kind Transfers

Parameters	Loneliness	
	Estimate	SE
Fixed Effects		
Intercept	50.47***	0.63
Time	0.13**	0.04
Time squared	–0.01***	0.003
Age	–0.04	0.03
Age*time	–0.03**	0.01
Birth year	0.09***	0.02
Birth year squared	–0.02***	0.003
Birth year*time	–0.01	0.01
Birth year squared*time	0.001	0.001
Birth year*age	–0.01	0.003
Birth year squared*age	0.0002	0.0002
Birth year*age*time	0.0004	0.001
Birth year squared*age*time	0.00001	0.0001
Family in kind	–2.23**	0.61
Family in kind x age	–0.10	0.06
Family in kind x time	–0.35***	0.06
Family in kind x time x age	0.09***	0.01
Family in kind x birth year	–0.16*	0.05
Family in kind x birth year squared	0.02*	0.01
Family in kind x age x birth year	0.02	0.01
Family in kind x age x birth year squared	–0.0004	0.0004
Family in kind x birth year x time	0.09	0.01
Family in kind x age x birth year x time	–0.001	0.001
Fixed Effects: Covariates		
Women	0.71***	0.07
Education	–0.68***	0.05
Unemployment	1.63***	0.12
Divorced	4.27***	0.10
Widowed	3.41***	0.14
Health conditions	1.26***	0.03
Children	–2.24***	0.11
Random Effects: Individual level		
Intercept	42.96***	0.41
Random Effects: Nation level		
Intercept	5.37*	2.06
Residual variance	41.95***	0.23

Note. $N = 59,030$ individuals and 125,954 observations. Loneliness is in a *T-score* metric ($M = 50$, $SD = 10$). The model was centered at birth year 1960 and age 50.

p < .05. **p* < .001. ***p* < .0001.

Table S8

Results from Multilevel Model Examining Historical Changes in Loneliness: Effect of Public Spending on Family Benefits for Men and Women

Parameters	Men		Women	
	Estimate	SE	Estimate	SE
Fixed Effects				
Intercept	50.05***	0.62	50.90***	0.67
Time	0.14*	0.06	0.16**	0.05
Time squared	–0.02**	0.004	–0.01*	0.004
Age	–0.06	0.04	–0.04	0.03
Age*time	–0.02	0.01	–0.04***	0.01
Birth year	0.10*	0.03	0.08*	0.03
Birth year squared	–0.02**	0.005	–0.02***	0.004
Birth year*time	–0.02	0.01	–0.02*	0.01
Birth year squared*time	0.0001	0.0003	0.001	0.001
Birth year*age	–0.02*	0.01	–0.01*	0.004
Birth year squared*age	0.0001	0.0002	0.0003	0.0002
Birth year*age*time	0.004	0.002	–0.001	0.001
Birth year squared*age*time	0.0002	0.0001	–0.0001	0.0001
Family benefits	–1.19*	0.41	–1.50**	0.40
Family benefits x age	–0.04	0.04	–0.01	0.03
Family benefits x time	–0.10*	0.05	–0.08*	0.03
Family benefits x time x age	0.02*	0.01	0.02**	0.006
Family benefits x birth year	0.001	0.03	–0.05*	0.02
Family benefits x birth year squared	0.01*	0.004	0.002	0.003
Family benefits x age x birth year	–0.003	0.005	0.01	0.004
Family benefits x age x birth year squared	–0.001*	0.0003	0.0001	0.0002
Family benefits x birth year x time	0.02*	0.01	0.03***	0.01
Family benefits x age x birth year x time	–0.0003	0.001	–0.001	0.001

Fixed Effects: Covariates

Education	–0.55***	0.07	–0.75***	0.07
Unemployment	1.75***	0.17	1.54***	0.17
Divorced	4.72***	0.16	4.01***	0.14
Widowed	3.09***	0.27	3.44***	0.16
Health conditions	1.08***	0.04	1.39***	0.04
Children	–2.60***	0.14	–1.92***	0.15
Random Effects: Individual level				
Intercept	38.01***	0.56	46.40***	0.58
Random Effects: Nation level				
Intercept	4.65*	2.60	5.92*	2.28
Residual variance	36.94***	0.32	45.48***	0.33

Note. Analyses reported are stratified by gender. Loneliness is in a *T-score* metric ($M = 50$, $SD = 10$). The model was centered at birth year 1960 and age 50.

$*p < .05$. $**p < .001$. $***p < .0001$.

Table S9

Results from Multilevel Model Examining Historical Changes in Loneliness: Effect of the GINI Coefficient for Men and Women

Parameters	Men		Women	
	Estimate	SE	Estimate	SE
Fixed Effects				
Intercept	50.61***	0.54	51.42***	0.60
Time	0.16*	0.07	0.17**	0.05
Time squared	−0.02**	0.004	−0.01*	0.004
Age	−0.04	0.04	−0.004	0.03
Age*time	−0.03	0.01	−0.05***	0.01
Birth year	0.09*	0.03	0.09*	0.03
Birth year squared	−0.01*	0.005	−0.01**	0.004
Birth year*time	−0.02	0.01	−0.02*	0.01
Birth year squared*time	−0.002	0.0003	−0.001	0.001
Birth year*age	−0.01	0.01	−0.01	0.005
Birth year squared*age	0.0001	0.0003	0.0003	0.0002
Birth year*age*time	0.003	0.002	−0.003*	0.002
Birth year squared*age*time	0.0003*	0.0001	−0.0001	0.0001
Gini coefficient	0.45***	0.10	0.40***	0.10
Gini coefficient x age	−0.01	0.01	0.01	0.01
Gini coefficient x time	0.02*	0.01	0.03**	0.01
Gini coefficient x time x age	−0.01*	0.002	−0.01***	0.002
Gini coefficient x birth year	−0.002	0.01	0.01*	0.01
Gini coefficient x birth year squared	−0.003*	0.001	−0.0001	0.001
Gini coefficient x age x birth year	−0.001	0.001	−0.001	0.001
Gini coefficient x age x birth year squared	0.0001	0.0001	−0.00005	0.00005
Gini coefficient x birth year x time	−0.01*	0.002	−0.01***	0.001
Gini coefficient x age x birth year x time	0.0001	0.0002	−0.000002	0.0001
Fixed Effects: Covariates				
Education	−0.55***	0.07	−0.74***	0.07

Unemployment	1.75***	0.17	1.56***	0.17
Divorced	4.72***	0.16	4.01***	0.14
Widowed	3.09***	0.27	3.41***	0.16
Health conditions	1.09***	0.04	1.39***	0.04
Children	–2.60***	0.14	–1.91***	0.15
Random Effects: Individual level				
Intercept	38.01***	0.56	46.40***	0.58
Random Effects: Nation level				
Intercept	3.01*	1.14	4.22*	1.62
Residual variance	36.95***	0.32	45.49***	0.33

Note. Analyses reported are stratified by gender. Loneliness is in a *T-score* metric ($M = 50$, $SD = 10$). The model was centered at birth year 1960 and age 50.

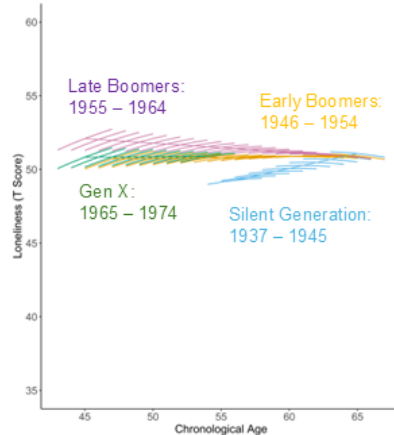$*p < .05.$ $**p < .001.$ $***p < .0001.$

Figure Captions

Figure S1. Gender differences in model-implied trajectories of loneliness pertaining to public spending on family benefits. The long thin lines for each generation represent the age trends, and the short-thick lines for each cohort represent within-person changes over 5 years with 1-year age increments. In nations that invest in more family benefits (as a % of GDP), women show historical stability and lower levels of loneliness (C) as compared to men (A). Conversely, in nations that invest less in family benefits (as a % of GDP), later-born cohorts of middle-aged women (D), compared to men (B), report higher levels of loneliness (i.e., Early Boomers, Late Boomers, and Gen X, relative to the Silent Generation) and stronger within-person increases in loneliness.

Figure S2. Gender differences in model-implied trajectories of loneliness pertaining to the GINI coefficient or income inequality. The long thin lines for each generation represent the age trends and the short-thick lines for each cohort represent within-person changes over 5 years with 1-year age increments. In nations with less income inequality, for both men and women, there is relative stability or little differences between cohorts of middle-aged adults in levels of loneliness and there is stability in within-person changes in loneliness (B and D). In contrast, in nations with more income inequality, later-born cohorts of middle-aged men and women report higher levels of loneliness (i.e., Early Boomers, Late Boomers, and Gen X, relative to the Silent Generation) and stronger within-person increases in loneliness (A and C).
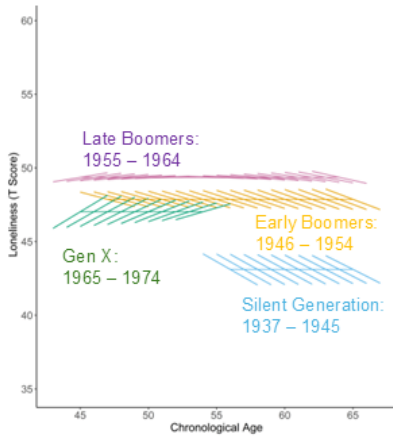
A: High Family Benefits (+1 *SD*): Men
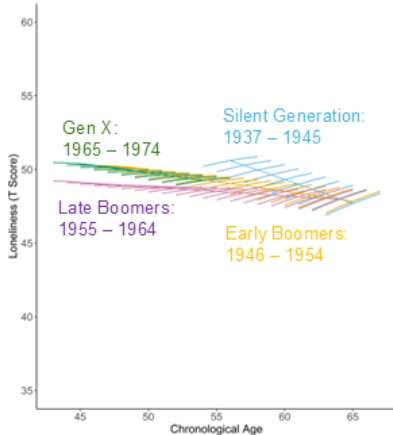
B: Low Family Benefits (−1 *SD*): Men

C: High Family Benefits (+1 *SD*): Women

D: Low Family Benefits (−1 *SD*): Women

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A: High Gini Coefficient (−1 *SD*): Men

B: Low Gini Coefficient (−1 *SD*): Men

C: High Gini Coefficient (−1 *SD*): Women

D: Low Gini Coefficient (−1 *SD*): Women