The protective power of social connectedness: Individual vs. community influences on psychological distress in middle-aged Black adults

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ABSTRACT

Background: Social connectedness is a crucial determinant of mental health, yet its effects on Black adults remain understudied, particularly in distinguishing between individual and community-level influences. This study examined cross-sectional and longitudinal associations between social connectedness and psychological distress among Black adults at the individual- and neighborhood (census tract) levels.

Methods: Using data from the MIDUS (Midlife in the United States) study, we analyzed 897 Black adults aged 25–74 from an urban setting. Social connectedness was measured across six dimensions: neighborhood social cohesion, social integration, support from family and friends, contribution to the community, and spirituality. After extensive model diagnostics, we employed cluster-robust errors to account for clustering by census tracts. We constructed cross-sectional and longitudinal models using these cluster-robust errors with inverse probability weighting to address attrition, examining individual and census-level effects on psychological distress in immediate and long-term contexts.

Results: In 10-year longitudinal analyses, family support (β = −1.95, 95 % CI = −3.01, −0.90) and friend support (β = −1.09, 95 % CI = −1.66, −0.52) showed significant protective effects against psychological distress. Cross-sectional analyses confirmed protective relationships for neighborhood social cohesion (β = −2.19, 95 % CI = −3.10, −1.28), family support (β = −1.97, 95 % CI = −2.77, −1.16), and friend support (β = −0.74, 95 % CI = −1.40, −0.07). Census-level social connectedness measures were not significantly associated with psychological distress in longitudinal models.

Conclusions: These findings underscore the primacy of individual-level social connections in protecting against psychological distress among Black adults. Mental health interventions should prioritize strengthening personal and family-centered social support networks while incorporating community engagement components for long-term benefits.

1. Introduction

Social connectedness is a fundamental component of human well-being and a critical determinant of mental health across diverse populations (Lamblin et al., 2017; Wickramaratne et al., 2022). Social connectedness is a broad umbrella term that describes the perceived, actual, or objective aspects of relationships with others and the resources received or provided through those connections (Holt-Lunstad, 2022). Social connectedness encompasses various forms of social interaction, activities that connect people to the community (Townsend and McWhirter, 2005), and other aspects, including social networks, trust in one's neighbor, and feelings of belonging, which work together

to shape a person's social experience (Kawachi and Berkman, 2014, Lamblin et al., 2017; Ransome et al., 2022). The significant body of work on this topic has resurged with growing recognition of social connectedness as a public health concern (Kawachi et al., 2008; Holt-Lunstad et al., 2017; Hare-Duke et al., 2019; Office of the U.S. Surgeon General, 2023). Moreover, the rise in poor mental health after the COVID-19 pandemic has made investigating social connectedness even more important (Pantell and Shields-Zeeman, 2020).

Social connectedness varies substantially across demographic groups and has shown concerning downward trends over time, even before the COVID-19 pandemic (Kannan and Veazie, 2023). National data from 2003 to 2020 reveal a progressive decline in social engagement across

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all relationship types, with time spent in isolation increasing from 285 to 309 min per day and time spent with friends decreasing from 60 to 34 min per day (Kannan and Veazie, 2023). These declines have been particularly pronounced among certain demographic groups, with Black/African Americans reporting steeper increases in social isolation than whites between 2003 and 2019 (Cudjoe et al., 2020). Age differences are also notable. A study found that about 20 % of older adults aged 65 or above in the U.S. reported being socially disconnected (Cudjoe et al., 2020). On average, adults aged 65 or above spend 442 min per day alone compared to 234 min for young adults aged 15–24 (Kannan and Veazie, 2023). Older adults face unique challenges in maintaining social connections due to retirement, health limitations, and losing social network members over time (Wrzus et al., 2013; Donovan and Blazer, 2020).

1.1. Social connectedness and mental health outcomes

Social connections play a vital role in supporting mental health and overall well-being (Holt-Lunstad et al., 2010). Several key mechanisms link social connectedness to good mental health outcomes. Factors such as social cohesion, a sense of belonging, strong community bonds, and collective identity are consistently associated with a lower risk of depression and greater emotional well-being (Haslam et al., 2015). For instance, one study among middle-aged paired twin adults in the United States found that individuals with higher trust in their neighbors were less likely to develop major depression compared to those with low trust (adjusted OR = 0.43; 95 % CI 0.20, 0.93), after adjusting for various personal and social factors such as sex, education, and race (Fujiwara and Kawachi, 2008). These protective associations between social connectedness and mental health outcomes are thought to operate through multiple pathways, including the promotion of shared norms and health-enhancing behaviors, the fostering of trust and perceived connectedness, and the support of healthy stress response systems (Umberson et al., 2010; Delgado et al., 2023). While it is possible that the direction between social connectedness and mental health can be bidirectional (e.g., mental health predicting social connectedness) (Steine et al., 2020), evidence more strongly points to the direction where social connectedness is prospectively linked to better mental health (Saeri et al., 2018; Wickramaratne et al., 2022).

Both neighborhood-level and individual-level social connectedness influence individual-level outcomes (Kawachi et al., 2008; Gamble-George et al., 2025). Therefore, examining both levels with respect to mental health is important. At the individual level, the quality and diversity of social connections matter - family support, especially emotional support from spouses, plays a crucial role in buffering against depression (Gariepy et al., 2016) and depressive symptoms over time (Stafford et al., 2019). The frequency of meaningful social interactions and maintenance of diverse social networks have been particularly associated with reduced depression risk (Harasemiw et al., 2018; Misawa and Kondo, 2019; Liu and Yeo, 2022). At the neighborhood level, different mechanisms emerge - social cohesion and collective trust function as community-wide protective factors (Jakobsen et al., 2022). Neighborhoods with stronger social bonds demonstrate better mental health outcomes among residents, even after accounting for individual-level social connections (Liu et al., 2020). Neighborhood is particularly relevant in understanding health disparities, as social disadvantage tends to cluster in certain communities where poverty, violence, and features of the built environment contribute to poor mental health outcomes (Tigges et al., 1998; Mair et al., 2008). These findings underscore the importance of examining both neighborhood-level and individual-level social connectedness.

1.2. Social connectedness in Black adults

The interconnection between neighborhood-level and individual-level social connectedness on health is particularly significant for understanding Black American communities for several reasons. First, neighborhood social environments may serve as both a reflection of and an influence on individual social relationships through shared cultural norms, demographic patterns, and structural factors (Subramanian et al., 2003). Second, Black American families have traditionally relied on extended family and kinship networks that often extend into their immediate neighborhoods (Nguyen et al., 2016a; Taylor et al., 2021). These kinship networks create a social substructure that provides support, resilience, and cohesion, especially during times of crisis (Billingsley, 1992). Therefore, among Black American communities, neighborhood and family connectedness are not independent but interconnected dimensions of social support (Bengtson and Roberts, 1991). Understanding these interconnections is crucial for examining how different levels of social connectedness influence psychological well-being in Black communities.

Furthermore, for Black/African Americans in the United States, the importance of social connectedness is amplified by the historical and ongoing effects of systemic racism, such as divestment in jobs (Wilson, 2019a,b), residential segregation (Williams and Collins, 2001, Darden et al., 2010; Do et al., 2019), and health inequities, including lower access to quality healthcare and higher exposure to discriminatory environments (Rios et al., 2012; Bailey et al., 2017; Wang et al., 2018). Black/African American populations in the United States face multiple intersecting challenges that can undermine their social connectedness and social capital - the networks, norms, and trust that enable collective action (Fullilove, 2016; Bowleg, 2020; Gilbert et al., 2022; Kannan and Veazie, 2023). Demographic projections indicate concerning trends in family structure, suggesting that by 2050, 15.1 % of Black/African American women and 12.6 % of Black men will experience "kinlessness" - living without immediate family members such as a spouse, children, or parents (Verdery and Margolis, 2017). This familial isolation is compounded by broader structural inequities, such as residence in communities with fewer social, political, and economic resources (Redwood et al., 2010). The physical environment itself poses additional barriers to social connection. Black/African Americans are more likely to reside in neighborhoods with less access to facilities that promote socialization, such as parks and sidewalks, and have more infrastructure, such as one-way streets, that limit the movement of their residents (Schindler, 2014; Travieso, 2020). Furthermore, gentrification processes in historically Black/African American neighborhoods are disrupting long-established social networks and community ties, leading to increased social isolation as neighborhood demographics shift and longtime residents are displaced (Fullilove, 2016; Crewe, 2017). In addition, environmental barriers, including concentrated poverty, over-policing, mass incarceration, structural violence, and exposure to environmental hazards like poor air and water quality and high density of alcohol outlets, create additional burdens on social connection (Hanna-Attisha et al., 2016; Noonan et al., 2016; Fouad et al., 2017; Lee et al., 2020). These multiple layers of disadvantage - from individual family structures to neighborhood-level changes - create significant challenges for maintaining strong social connections within Black/African American communities, potentially exacerbating health disparities and psychological distress associated with social isolation and loneliness.

Given these multiple layers of adversity in Black/African American communities, social connectedness plays an especially vital protective role. A literature review of 85 studies by Ransome and colleagues demonstrated that various forms of social connection buffered the impacts of racism and discrimination on mental health outcomes, including depression and psychological distress (Ransome et al., 2023). For example, church-based connections significantly buffered the negative mental health impacts of discrimination (Nguyen et al., 2018; Steers et al., 2019). Additionally, Black/African Americans with stronger ethnic-specific social connections demonstrated better resilience against racial microaggressions and associated anxiety symptoms (Liao et al., 2016). However, the relationship is complex - in some cases, higher

social connectedness among Black/African American adults was associated with stronger rather than weaker associations between discrimination and poor health outcomes, possibly because individuals under racial distress may reach out more to their social networks for support (Nguyen et al., 2018). Furthermore, age differences were observed, with social support being particularly crucial for young (18–34 years) and older (≥55 years) Black/African American men in managing discrimination-related stress (Ransome et al., 2023). The effectiveness of social connectedness also varies by type - ethnic-specific social support (such as connections within the Black/African American community) often proved more protective against discrimination's negative health effects compared to general social support, highlighting the importance of culturally specific social resources in promoting resilience against racism-related stressors.

1.3. Current study

Despite the increasing recognition of social connectedness as a public health priority, there remains a paucity of studies on the topic among Black/African Americans. To advance equity in health outcomes, it's essential to generate sufficient research on the topic within underrepresented groups, ensuring that the evidence informing policies is unbiased, as representation matters. Given the gaps that currently exist in social connectedness and mental health (i.e., a few multilevel studies with different measures) and limited studies among Black/African Americans, we proposed this study to examine the relationship between neighborhood and individual-level social connectedness in association with psychological distress among Black/African Americans at midlife from Milwaukee, Wisconsin. Milwaukee provides a compelling setting for examining social connectedness and psychological distress in this population. As one of the five most racially segregated metropolitan areas in the United States (Kent and Frohlich, 2019; Cheng, 2022), Milwaukee exemplifies the persistent impact of structural racism on neighborhood conditions and health outcomes (Osypuk and Acevedo-Garcia, 2010; Downs, 2015, Beyer et al., 2016). The city's population of 569,330 includes a substantial Black/African American population (39.8 %), with 25 % of residents living in poverty and a median household income of $43,125 as of the 2020 Census (United States Census Bureau, 2021). These demographic and socioeconomic characteristics, combined with documented racial disparities in mental health outcomes and days in poor mental health, make Milwaukee an important case study for understanding how neighborhood-level and individual social connections influence psychological well-being among Black/African Americans.

Our research has several aims. First, we examined the correlations between different measures of social connectedness at both the individual and neighborhood levels. This analysis is particularly critical in the Black/African American communities, where individual and neighborhood social connectedness are often deeply intertwined through extended family networks, church-based connections, and community-rooted support systems. Second, we evaluated the relationships between social connectedness and psychological distress. We employed a multilevel approach that simultaneously assessed individual and census-level social connectedness in relation to psychological distress. Third, we investigated both the immediate and sustained long-term association between social connectedness and psychological distress using cross-sectional and longitudinal analyses. We hypothesized that higher social connectedness at both the neighborhood and individual levels would correlate with lower psychological distress in Black/African American adults at midlife. Given that contextual-level social connectedness often exerts a larger influence on health, we also hypothesize that neighborhood measures will demonstrate a larger effect size in this sample. While we make no specific predictions about the relative strength of different social connectedness measures, our ten-year longitudinal analysis will provide valuable evidence regarding which aspects have enduring effects on psychological well-being.

2. Methods

2.1. Participants

The present study focuses on Black/African American participants in the MIDUS study, utilizing data from multiple cohorts for both longitudinal and cross-sectional analyses. The Black/African American sample was first introduced in MIDUS 2 through targeted recruitment from Milwaukee, Wisconsin (n = 592). This sample was obtained using a stratified area probability sampling design focusing on census tracts where at least 40 % of residents were Black/African American. Half of the selected tracts had median household incomes below $40,000, ensuring representation of lower-income communities.

We draw upon data from MIDUS 2 (wave 1, 2004–2006) and MIDUS 3 (wave 2, 2013–2014) for two-wave longitudinal analyses. Our longitudinal analysis treated the two-wave data as an exposure-outcome sequence rather than modeling within-person change over time. Social connectedness measures from MIDUS 2 (2004–2006) served as baseline exposures, with psychological distress from MIDUS 3 (2013–2014) as the outcome. Given the substantial time interval and limited number of waves, we focused on between-person differences in long-term outcomes rather than within-person trajectories of change. Of these initial Black/African American participants from MIDUS 2, 389 participated in MIDUS 3 approximately 9–10 years later, representing a retention rate of 65.7 %. When excluding participants who died during the follow-up period, this represents a mortality-adjusted response rate of 78 % (389 of 592 baseline respondents). Among these 389 follow-up participants, 327 individuals (84 %) completed the full interview component. The MIDUS dataset and detailed documentation of recruitment methods and data collection procedures are accessible through the Inter-university Consortium for Political and Social Research (ICPSR) and related publications (Radler and Ryff, 2010; Barry, 2014; Institute on Aging and University of Wisconsin-Madison, 2022).

For cross-sectional analyses, we combine data from MIDUS 3 (2013–2014; n = 389) with the MIDUS Refresher cohort (2011–2014; n = 508). The Refresher study recruited a new and distinct probability sample of adults aged 25–74, with data collection occurring in two phases: the younger cohort (ages 25–54) recruited in 2011, and the older cohort (ages 55–74) recruited in 2013. MIDUS 3 and Refresher participants completed comparable assessments, including telephone interviews and extensive self-administered questionnaires, with additional questions addressing experiences related to the 2008–2009 economic recession.

In all waves, participants remained representative of English-speaking, non-institutionalized Black/African American adults in their respective sampling frames. While the longitudinal sample experienced attrition between MIDUS 2 and MIDUS 3, the retention rate was comparable to that of other longitudinal studies with similar follow-up periods. The combination of longitudinal data (MIDUS 2–3) and cross-sectional data (MIDUS 3 + Refresher) allows for a comprehensive examination of both temporal changes in health outcomes and period effects in this historically understudied population.

This study utilized secondary analysis of existing data. All participants provided informed consent for their data to be used in statistical analyses. The Institutional Review Board reviewed this study protocol and determined it did not constitute human subjects research as defined by 45 CFR 46.102(e)(1), exempting it from further IRB oversight.

2.2. Mental health outcome–psychological distress

Psychological distress was assessed using the 6-item Kessler Screening Scale for Psychological Distress (K6)(Kessler et al., 2002). The K6 measures non-specific psychological distress and comprises six items asking respondents how often they felt: "so sad nothing could cheer you up," "nervous," "restless or fidgety," "hopeless," "that everything was an effort," and "worthless" during the past 30 days. Each item is rated on a

5-point scale (0 = none of the time, 1 = a little of the time, 2 = some of the time, 3 = most of the time, 4 = all of the time), yielding a total score range of 0–24. Higher scores indicate greater psychological distress. The K6 has demonstrated good internal consistency across the MIDUS subsamples (α ranging from 0.83 to 0.85) (Tomitaka et al., 2017).

2.3. Social connectedness variables

We conceptualized social connectedness as six distinct dimensions: neighborhood social cohesion, social integration, support from family and friends, contribution to the community, and spirituality. Neighborhood social cohesion refers to the perceived degree of connectedness and solidarity within a neighborhood and the resources an individual can access via membership in a neighborhood (Keyes, 1998, Kawachi et al., 1999; McNeill et al., 2006; Cramm et al., 2013). Social integration measures individuals' engagement in community roles and relationship-building (Keyes, 1998, Brissette et al., 2000). Support from family and friends is a form of social support, and it represents distinct aspects of social connection, with family providing long-term stability and inherited bonds, while friendships offer chosen relationships and peer support (Walen and Lachman, 2000, Ozbay et al., 2007; Hare-Duke et al., 2019). Contribution to the community represents a critical form of social engagement that strengthens social integration (Seeman, 1996; Keyes and Ryff, 1998). This involvement can take two forms: formal participation through structured organizations and informal participation through casual social activities. Beyond traditional social connections, spirituality emerges as a unique dimension of social connectedness, offering individuals a sense of community, belonging, faith, and transcendent purpose (Dyson et al., 1997; de Brito Sena et al., 2021).

2.3.1. Individual-level social connectedness measures

We used the established measures from the MIDUS dataset that have been extensively validated and used in previous research (Son and Wilson, 2011; Carbone, 2020; Carbone and Clift, 2021, Woods et al., 2023, Pichardo et al., 2024, Masters et al., 2025). We measured those social connectedness dimensions at the individual level and aggregated neighborhood social cohesion and community contribution at the census level, providing a perspective on neighborhood-level social dynamics.

We constructed social connectedness measures and grouped them by survey wave using structural equation modeling (SEM) with maximum likelihood estimation for missing values (MLMV) (Maydeu-Olivares, 2017). This approach allowed us to create latent variables that capture the underlying constructs while accounting for missing data patterns across waves (Feng and Hancock, 2024). For all measures, we verified the distributions of the latent variables.

We measured Neighborhood Social Cohesion (NHSC) through eight items measuring neighborhood safety (e.g., "Safe alone in the neighborhood at day"), trust (e.g., "Neighbors trust each other"), and quality (e.g., "Buildings and streets kept in good repair") This scale was originally developed and validated by Keyes (1998) (Keyes, 1998). After reverse-coding all items except one ("Hopeless to improve neighborhood"), confirmatory factor analysis in the SEM model was used to predict a latent variable, with higher scores indicating greater neighborhood social cohesion. Items were rated on a 4-point scale (1 = not at all to 4 = a lot). The scale demonstrated good internal consistency (Cronbach's α = .80).

Social Integration (SOCIALINT) was measured using three items that assess a sense of belonging and community connection (e.g., "Feel close to others in community," "Community is source of comfort") developed by Keyes (1998) (Keyes, 1998). After reverse-coding "Have something valuable to give the world," the SEM model generated a latent variable, where higher scores reflect greater social integration. Items were rated on a 7-point scale (1 = strongly agree to 7 = strongly disagree). The scale demonstrated poor internal consistency (Cronbach's α = .54).

Support from Family (SUPPORTFAM) was assessed using four items measuring emotional support from family members (e.g., "Family members really care about you," "Family members understand the way you feel") developed by Walen and Lachman (2000) (Walen and Lachman, 2000). All items were reverse-coded before entering the SEM model, resulting in a latent variable where higher scores indicate greater family support. The items used a 4-point scale (1 = not at all to 4 = a lot). The scale demonstrated good internal consistency (Cronbach's α = .84).

Support from Friends (SUPPORTFR) was measured using four parallel items to the family support scale (Walen and Lachman, 2000). Following the same reverse-coding procedure, the SEM model created a latent variable, where higher scores represent greater friend support. The same four-point response scale was used. The scale demonstrated good internal consistency (Cronbach's α = .88).

Contribution to Community (CONTCOM) was evaluated using six items measuring perceived societal contributions (e.g., "Many people come to you for advice," "Feel other people need you") developed by Keyes and Ryff (1998) (Keyes and Ryff, 1998). After reverse-coding all items, the SEM model produced a latent variable where higher scores indicate greater community contribution. Items were measured on a 4-point scale (1 = not at all to 4 = a lot). The scale demonstrated good internal consistency (Cronbach's α = .81).

Spirituality (SPIRIT) was assessed using eight items measuring spiritual beliefs and experiences. The items included measures of spiritual identity ("How spiritual are you"), spiritual importance ("Spirituality important in your life"), spiritual worldview ("Life is part of larger spiritual force"), and daily spiritual experiences including emotional and transcendent dimensions: "Feeling of deep inner peace (frequency/day)," "Moved by beauty of life (frequency/day)," "Strong connection to all life (frequency/day)," "Sense of deep appreciation (frequency/day)," and "Sense of caring for others (frequency/day)." This multidimensional approach captures both cognitive aspects of spirituality (beliefs and importance) and experiential aspects (daily spiritual feelings and connections) (Ryff et al., 2007). After reverse-coding all items, the SEM model generated a latent variable where higher scores reflect greater spirituality. Items were rated on a 4-point scale. The scale demonstrated good internal consistency (Cronbach's α = .89).

2.3.2. Census tract-level social connectedness measures

To capture neighborhood-level social dynamics, we aggregated individual-level social connectedness measures to the census tract level using average scores of residents within each tract. This aggregation method follows established frameworks in neighborhood effects research (Sampson et al., 1997; Fujiwara and Kawachi, 2008). The census tract-level measures offer valid indicators of the collective social environment that can influence residents' health outcomes through mechanisms such as collective efficacy, social norms, and available social resources (Sampson et al., 2002; Kawachi et al., 2004). They also reflect the shared social environment within geographically defined neighborhoods, complementing individual-level measures.

Census-Tract Level Neighborhood Social Cohesion (NHSC_Cens) was created by averaging the individual-level neighborhood social cohesion scores (NHSC) for all respondents living within the same census tract. To distinguish between individual and collective effects (Kawachi et al., 2004), we statistically separated the census-tract scores from individual-level responses through group-mean centering. Higher census tract scores indicate greater collective neighborhood social cohesion among residents in the same area. Higher census tract scores indicate greater collective neighborhood social cohesion among residents in the same area.

Census-Tract Level Community Contribution (CONTCOM_Cens) was calculated by averaging the individual-level community contribution scores (CONTCOM) for all respondents residing within the same census tract. Higher census tract scores indicate greater collective community contribution among residents living in the same area.

2.4. Covariates

Individual-level covariates were selected by reviewing prior studies (Fujiwara and Kawachi, 2008; Friedman et al., 2024; Kemppainen and Timonen, 2024) on the topic along with those suggested by Harpham colleagues (Harpham et al., 2002). We included the participant's age (centered around the mean age for each survey wave), sex (male, female), and education level (categorized as less than high school, completed high school, some college, or graduated from college). Working status was classified into four groups: full-time working (including working and self-employed), retired, unemployed (including unemployed and temporarily laid off), and other (including homemaker, student, on leave, and disabled). Marital status was classified as married, previously married (including separated, divorced, or widowed), or never married. Health status was assessed through self-rated physical health, categorized as poor/fair, good, or very good/excellent. Residential characteristics included years lived in the current neighborhood (continuous measure) and homeownership (dichotomized as owning a home (including outright or mortgage) versus renting or other arrangements). Socioeconomic status was measured by annual household income from wages, pension, social security, and other sources (continuous measure, divided by 1000 dollars).

Census tract-level covariates included demographic and socioeconomic characteristics. Demographic measures included the percentage of immigrants and residents aged 65 or older within each census tract. A composite measure of census tract socioeconomic conditions was created using principal component analysis, incorporating five indicators: percentage of residents living in poverty, percentage with below high school education, unemployment rate, percentage of renters, and median income (reversed scored to maintain consistent directionality with other indicators, where higher scores indicate more adverse conditions). This composite measure provides a comprehensive assessment of neighborhood socioeconomic conditions.

2.5. Statistical analyses

2.5.1. Descriptive analyses

We began with descriptive analyses of all study variables. For continuous measures, we calculated means and standard deviations, and for non-normally distributed variables such as annual household income, we reported medians and interquartile ranges (IQR). For categorical variables, including sex, marital status, education level, working status, and self-rated physical health, we computed proportions. We examined these descriptive statistics separately for the MIDUS 2 baseline sample (n = 592), MIDUS 3 follow-up sample (n = 389), and MIDUS Refresher sample (n = 508) to assess potential differences in sample characteristics and evaluate patterns of attrition. We examined bivariate correlations among all social connectedness measures using pairwise correlations with Bonferroni-adjusted significance levels. For longitudinal analyses, we also assessed correlations between measures across waves to examine the temporal stability of these constructs.

2.5.2. Multicollinearity analyses

To assess potential multicollinearity among predictor variables, we calculated variance inflation factors (VIFs) for all potential social connectedness measures and covariates. VIF values quantify how much the variance of a regression coefficient increases due to collinearity, with values above 10 generally indicating problematic multicollinearity, though some researchers suggest a more conservative threshold of 5 (O'brien 2007, Hair et al., 2010). We computed VIFs separately for both longitudinal and cross-sectional model specifications to ensure consistency across our analytical approaches.

The multicollinearity assessment revealed that all VIF values were well below conventional thresholds of concern (Supplementary Table 1). Across both model types, VIF values ranged from 1.15 to 2.71, with the majority of variables showing VIFs between 1.15 and 2.20. The

highest VIF was observed for census-level neighborhood social cohesion (2.71) in both longitudinal and cross-sectional models, likely reflecting its derivation from individual-level neighborhood social cohesion scores. All other social connectedness measures showed VIFs below 2.5, and demographic and socioeconomic covariates demonstrated VIFs below 2.0. These results indicated that multicollinearity was not a significant concern and would not substantially influence the stability or interpretation of our regression coefficients.

2.5.3. Model selection process

The MIDUS datasets have multilevel (census and individual levels) components. We conducted extensive model diagnostics to determine the most appropriate analytical approach. First, we tested whether census tract-level variables significantly contributed to the model using likelihood ratio tests comparing models with and without tract-level predictors (Supplementary Tables 2 and 5); the findings supported including tract-level variables. We then compared standard OLS models with cluster-robust standard errors to assess the importance of accounting for within-tract correlation. Substantial differences in standard errors (>10 % for key predictors) supported cluster-robust approaches (Supplementary Tables 3 and 6). We tested multilevel models with census tracts as the higher-level unit, calculating intraclass correlation coefficients (ICC) to assess between-tract variance (Supplementary Tables 4 and 7). Low ICC values (<0.05) suggested limited between-tract variation in psychological distress outcomes. Finally, we selected a pooled OLS model with cluster-robust standard errors as our primary analytical approach based on these comprehensive diagnostics. This choice was made because it appropriately handled the nested data structure, avoided convergence issues observed in random effects models, provided equivalent results to more complex multilevel specifications, and offered better coefficient interpretability.

2.5.4. Inverse probability weighting for selection

Due to attrition between MIDUS 2 and MIDUS 3 (loss to follow-up rate = 34.3 %, retention rate = 65.7 %), we implemented inverse probability weights (IPWs) to address potential selection bias from differential attrition.

2.5.4.1. Variable selection for IPW models.
We used univariate analyses to identify predictors of attrition. Variables showing associations with attrition (p < .10) were prioritized for inclusion in IPW models. The strongest predictors of attrition were spirituality (p = .001), age (p < .001), and work status (p = .002). Moderate predictors of attrition (p < .10) included poorer physical health (p = .039), lower social integration (p = .063), and male sex (p = .067) (Supplementary Table 8).

2.5.4.2. IPW model specification.
We estimated stabilized weights using two logistic regression models to predict the probability of being observed at follow-up. The first model is the denominator model, which included a more comprehensive set of predictors based on theories and prior knowledge, such as baseline K6 scores, all social connectedness measures, and detailed sociodemographic characteristics (sex, age, marital status, education, work status, self-rated health, home ownership, years in neighborhood, and income) to capture all potential confounders of the attrition-outcome relationship. The second model is the numerator model, which is more parsimonious and includes the strongest empirical predictors of attrition (spirituality, age, work status, sex) plus key exposure variables (family and friend support) to maintain theoretical relevance while preventing the numerator model from overfitting (Kang and Schafer, 2007).

2.5.4.3. Weight calculation and assessment.
Stabilized weights were calculated as the ratio of predicted probabilities from the numerator and denominator models. The resulting weights demonstrated excellent properties (mean = 1.00, SD = 0.09, range = 0.77–1.38). We applied

1st-99th percentile trimming as our primary approach (mean = 1.00, SD = 0.09, range = 0.81–1.27), with 2.5th-97.5th percentile trimming for sensitivity analysis (mean = 1.00, SD = 0.08, range = 0.85–1.22) (Cole and Hernán, 2008; Peterson et al., 2008; Austin and Stuart, 2015).

We assessed balance diagnostics using standardized differences, calculated as the mean difference divided by the pooled standard deviation for unweighted comparisons and by the overall standard deviation for weighted comparisons (Austin and Stuart, 2015). Standardized differences less than 0.10 indicated excellent balance, 0.10–0.20 indicated good balance, and values greater than 0.25 suggested potential bias concerns (Mamdani et al., 2005; Austin, 2009; Austin and Stuart, 2015). We examined balance for all variables included in the IPW models to evaluate the effectiveness of our weighting strategy in reducing selection bias.

2.5.5. Final modeling

Our final analysis strategy for the longitudinal analyses employed two models: weighted regression models with clustered standard errors and generalized estimating equations (GEE) models. GEE models allow us to incorporate the time-varying covariates further. Our longitudinal analysis treated the two-wave data as an exposure-outcome sequence rather than modeling within-person change over time. Social connectedness measures from MIDUS 2 (2004–2006) served as baseline exposures, with psychological distress from MIDUS 3 (2013–2014) as the outcome. The rationale for this approach is that our dataset has a long follow-up period, with nearly a decade between waves. Therefore, we centered our research questions on whether social connectedness at baseline has protective effects against future psychological distress among individuals. Our model structure is as follows: Level 1: Individuals; Level 2: Census tracts (geographic clustering addressed through cluster-robust standard errors); and time was treated as an exposure-outcome sequence rather than a nested level. This approach is consistent with established literature examining long-term health outcomes (Singer and Willett, 2003; Fujiwara and Kawachi, 2008). We compared results from unweighted analyses with those using the stabilized, trimmed weights in both models.

We performed cross-sectional analyses using regression models with clustered standard errors. The analyses consisted of three models. Model 1 examined individual-level social connectedness indicators, including neighborhood social cohesion, social integration, family support, friend support, community contribution, and spirituality. Model 2 focused on neighborhood-level social connectedness variables measured at the census tract level: neighborhood social cohesion and community contribution. Model 3 combined both individual and neighborhood-level social connectedness variables while controlling for potential confounders. These confounders included census tract-level variables (socioeconomic factors derived from the PCA, percentage of immigrants, and percentage of residents aged 65 or older) and individual-level characteristics (age, centered at the mean, sex, marital status, education, employment status, year(s) of living in the neighborhood, home ownership, annual income, and self-rated physical health).

We performed the sensitivity analyses by testing alternative specifications of the K6 outcome (continuous vs. binary using a clinical cutoff of 13) and calculated variance inflation factors to check for multicollinearity. All analyses were conducted using Stata version 16, with statistical significance set at $p < .05$ (two-tailed).

3. Results

Descriptive statistics are presented in Table 1. For MIDUS 2 (n = 592), the mean age was 51.6 years (SD = 11.9), and the majority of respondents were female (62.7 %). Most participants had completed high school or some college education (62.5 %), and approximately half (51.5 %) were employed full-time. The MIDUS 3 sample (n = 389) exhibited similar characteristics, with an expected increase in mean age (61.1 years, SD = 10.6) and a higher proportion of retirees (21.6 % vs.

Table 1
Sociodemographic characteristics of the participants.

Variable	MIDUS 2 (N = 592)	MIDUS 3 (N = 389)	MIDUS Refresher (N = 508)
Mean age (SD)	51.6 (11.9)	61.1 (10.6)	43.0 (11.1)
Sex			
Male	221 (37.3 %)	135 (34.7 %)	219 (43.1 %)
Female	371 (62.7 %)	254 (65.3 %)	289 (56.9 %)
Marital status			
Married	175 (29.6 %)	95 (24.4 %)	108 (21.3 %)
Previously married	244 (41.2 %)	180 (46.3 %)	128 (25.2 %)
Never married	173 (29.2 %)	114 (29.3 %)	272 (53.5 %)
Education			
Below high school	114 (19.3 %)	69 (17.8 %)	90 (17.7 %)
Completed high school	215 (36.3 %)	113 (29.1 %)	145 (28.5 %)
Some college	155 (26.2 %)	123 (31.7 %)	141 (27.8 %)
College or above	107 (18.1 %)	83 (21.4 %)	132 (26.0 %)
Working status			
Full-time employed	307 (51.5 %)	156 (40.1 %)	288 (56.7 %)
Retired	114 (19.3 %)	84 (21.6 %)	20 (3.9 %)
Unemployed or other	168 (28.6 %)	73 (18.8 %)	143 (31.7 %)
Missing	4 (0.7 %)	76 (19.5 %)	57 (11.2 %)
Year(s) living in the current neighborhood (mean, SD)	9.8 (10.5)	12.5 (11.9)	7.0 (8.0)
Home ownership	266 (44.9 %)	160 (41.1 %)	134 (26.4 %)
Missing	2 (0.3 %)	3 (0.8 %)	7 (1.4 %)
Median annual income (per 1000 dollars, IQR)	21.1 (6.5–35.3)	23.8 (9–47.6)	20.0 (6.0–36.3)
Self-rated physical health			
Poor/Fair	207 (35.0 %)	151 (38.8 %)	186 (36.6 %)
Good	177 (29.9 %)	144 (37.0 %)	147 (28.9 %)
Very good/Excellent	208 (35.1 %)	93 (23.9 %)	175 (34.5 %)
Missing	0 (0 %)	1 (0.3 %)	0 (0 %)

19.3 % in MIDUS 2). The loss-to-follow-up rate between MIDUS 2 and 3 was 34.3 %. Analysis of attrition patterns (Supplementary Table 8) revealed that participants lost to follow-up were significantly older at baseline (53.2 vs. 49.7 years, $p < .001$), more likely to be retired or unemployed, and had poorer self-rated physical health. However, no significant differences were observed in baseline psychological distress (K6 scores) or most social connectedness measures between retained and lost participants, suggesting that attrition was not systematically related to our primary variables of interest. The MIDUS Refresher sample (n = 508) was notably younger (mean age = 43.0 years, SD = 11.1) and had a higher proportion of never-married participants (53.5 %) compared to MIDUS 2 (29.2 %) and MIDUS 3 (29.3 %).

Analysis of social connectedness measures (Table 2) revealed significant correlations across multiple domains. In MIDUS 2, neighborhood social cohesion (NHSC) showed moderate positive correlations with social integration (r = 0.22, $p < .05$), contribution to community (r = 0.20, $p < .05$), and spirituality (r = 0.19, $p < .05$). Social integration demonstrated significant positive associations with support from family (r = 0.22, $p < .05$) and support from friends (r = 0.15, $p < .05$). The strongest correlation was observed between census-level NHSC and individual-level NHSC (r = 0.64, $p < .05$).

Cross-sectional analyses using OLS models with cluster-robust errors (Table 3) revealed significant associations between social connectedness measures and psychological distress across three model specifications. In Model 1, which examined individual-level social connectedness indicators, neighborhood social cohesion demonstrated the strongest protective association (β = −3.11, 95 % CI = −4.34, −1.89, $p < .001$),

Table 2
Social connectedness measures correlations.

MIDUS 2								
	NHSC	SOCIALINT	SUPPORTFAM	SUPPORTFR	CONTCOM	SPIRIT	NHSC_Cens	CONTCOM_Cens
NHSC	1.00							
SOCIALINT	0.22*	1.00						
SUPPORTFAM	0.13	0.22*	1.00					
SUPPORTFR	0.16*	0.15*	0.34*	1.00				
CONTCOM	0.20*	0.18*	0.12	0.22*	1.00			
SPIRIT	0.19*	0.34*	0.16*	0.16*	0.27*	1.00		
NHSC_Cens	0.64*	0.10	0.04	0.05	0.07	0.11	1.00	
CONTCOM_Cens	0.15*	0.07	0.10	0.12	0.29*	0.14*	0.23*	1.00
MIDUS 3								
NHSC	1.00							
SOCIALINT	0.26*	1.00						
SUPPORTFAM	0.19*	0.29*	1.00					
SUPPORTFR	0.22*	0.33*	0.46*	1.00				
CONTCOM	0.21*	0.15	0.14	0.28*	1.00			
SPIRIT	0.13	0.23*	0.34*	0.29*	0.23*	1.00		
NHSC_Cens	0.45*	0.11	0.13	0.07	0.06	0.14	1.00	
CONTCOM_Cens	0.08	0.04	0.09	0.06	0.33*	0.13	0.19*	1.00
MIDUS Refresher								
NHSC	1.00							
SOCIALINT	0.26*	1.00						
SUPPORTFAM	0.14*	0.32*	1.00					
SUPPORTFR	0.18*	0.30*	0.46*	1.00				
CONTCOM	0.17*	0.12*	0.18*	0.27*	1.00			
SPIRIT	0.16*	0.28*	0.30*	0.30*	0.23*	1.00		
NHSC_Cens	0.43*	0.12*	0.11*	0.07	0.03	0.12*	1.00	
CONTCOM_Cens	0.04	−0.05	0.03	0.04	0.33*	−0.03	0.09	1.00

Abbreviation.

NHSC: neighborhood social cohesion; SOCIALIST: social integration; SUPPORTFAM: support from family; SUPPORTFR: support from a friend(s); CONTCOM: contribution to the community; SPIRIT: spirituality; NHSC_Cens: census-level neighborhood social cohesion; CONTCOM_Cens: census-level contribution to the community.
*p-value<0.05.

followed by support from family ($\beta = -2.25$, 95 % CI $= -3.14$, -1.37, p $< .001$). Support from friends also showed a significant negative association with psychological distress ($\beta = -1.04$, 95 % CI $= -1.71$, -0.37, p $< .01$). Model 2, focusing solely on census tract-level variables, showed that census-level neighborhood social cohesion was significantly associated with lower psychological distress ($\beta = -6.32$, 95 % CI $= -8.13$, -4.52, p $< .001$), while census-level community contribution was not significant. In the fully adjusted Model 3, which combined both individual and neighborhood-level measures with demographic and socioeconomic controls, support from family maintained the strongest protective association ($\beta = -1.97$, 95 % CI $= -2.77$, -1.16, p $< .001$), followed by neighborhood social cohesion ($\beta = -2.19$, 95 % CI $= -3.10$, -1.28, p $< .001$) and support from friends ($\beta = -0.74$, 95 % CI $= -1.40$, -0.07, p $< .05$). Notably, the census-level measures lost statistical significance in the fully adjusted model. The model's explanatory power increased substantially from Model 1 ($R^2 = 0.137$) to Model 3 ($R^2 = 0.316$), indicating the importance of demographic and socioeconomic factors in explaining variance in psychological distress.

Longitudinal analyses using MIDUS 2 and 3 datasets (Table 4) examined the relationships between social connectedness measures and psychological distress over approximately 10 years using three analytical approaches: weighted regression with clustered standard errors and inverse probability weighting (IPW), generalized estimating equations (GEE) without IPW, and GEE with IPW. Across all three model specifications, support from family demonstrated the most consistent protective association with psychological distress (weighted regression with IPW: $\beta = -1.95$, 95 % CI $= -3.01$, -0.90, p $< .001$; GEE without IPW: $\beta = -1.53$, 95 % CI $= -2.50$, -0.57, p $< .01$; GEE with IPW: $\beta = -1.51$, 95 % CI $= -2.61$, -0.41, p $< .01$). Support from friends also showed significant protective effects across models (weighted regression with IPW: $\beta = -1.09$, 95 % CI $= -1.66$, -0.52, p $< .01$; GEE without IPW: $\beta = -0.85$, 95 % CI $= -1.37$, -0.33, p $< .01$; GEE with IPW: $\beta = -0.66$, 95 % CI $= -1.27$, -0.05, p $< .05$). Interestingly, contribution to community

showed a positive association with psychological distress across all models, suggesting potential increased distress among those more engaged in community activities (weighted regression with IPW: $\beta = 1.35$, 95 % CI $= 0.52$, 2.18, p $< .01$; GEE with IPW: $\beta = 1.56$, 95 % CI $= 0.71$, 2.42, p $< .001$). Individual-level neighborhood social cohesion showed protective effects in the GEE models but not in the weighted regression model. Census-level measures of social connectedness were not significantly associated with psychological distress in any of the longitudinal models, reinforcing the primacy of individual-level social connections in long-term mental health outcomes.

The IPW balance diagnostics showed that our IPWs achieved excellent balance for the primary outcome (psychological distress: standardized difference $= 0.017$) and most social connectedness measures (Supplementary Table 9). However, residual imbalance remained for age (0.440) and spirituality (0.296), indicating potential limitations in addressing differential attrition.

4. Discussion

With the rising prevalence of poor mental health among U.S. adults and the structural conditions that contribute to these issues, we sought to investigate the role of social connectedness, given its significant impact on health. While some research exists on this topic, we specifically concentrated on examining social connectedness and psychological distress among Black/African Americans in the MIDUS Milwaukee study. This approach aligns with health equity practices to ensure our findings can assist all groups in achieving their optimal health. We found that support from family and friends showed strong associations with psychological distress. However, neighborhood-level social connectedness did not significantly relate to psychological distress, and our hypothesis that it would have stronger effects on health than individual measures was not supported. In longitudinal analyses, family support continued to demonstrate protective associations against psychological

Table 3
Analysis results from the OLS model with cluster-robust errors using the MIDUS 3 and refreshers datasets (N = 897).

Variable	Model 1	Model 2	Model 3
	β (95 % C.I.)	β (95 % C.I.)	β (95 % C.I.)
Individual social connectedness measure			
Neighborhood social cohesion	**−3.11 (-4.34, -1.89)*****		**−2.19 (-3.10, -1.28)*****
Social integration	−0.64 (−1.56, 0.28)		−0.58 (−1.45, 0.29)
Support from family	**−2.25 (-3.14, -1.37)*****		**−1.97 (-2.77, -1.16)*****
Support from friends	**−1.04 (-1.71, -0.37)****		**−0.74 (-1.40, -0.07)***
Contribution to community	0.25 (−0.52, 1.02)		0.38 (−0.58, 1.33)
Spirituality	−0.93 (−2.06, 0.21)		−0.43 (−1.68, 0.82)
Neighborhood/Census tract-level social connectedness measure			
Census-level neighborhood social cohesion		**−6.32 (-8.13, -4.52)*****	−1.38 (−4.51, 1.75)
Census-level contribution to community		1.85 (−0.58, 4.29)	0.77 (−2.32, 3.85)
Covariates			
Census-level percent of immigrants			0.01 (−0.09, 0.12)
Census-level socioeconomic factors (PCA)			−0.01 (−0.09, 0.07)
Centered age			−0.03 (−0.06, 0.01)
Sex			
Male (Ref.)			
Female			−0.01 (−0.62, 0.59)
Marital status			
Married (Ref.)			
Previously married			0.09 (−0.61, 0.78)
Never married			0.03 (−0.73, 0.80)
Education			
Below high school (Ref.)			
Completed high school			−0.97 (−1.77, −0.18)*
Some college			**−1.94 (-2.80, -1.08)*****
College or above			**−1.60 (-2.76, -0.45)****
Working status			
Full-time employed (Ref.)			
Retired			−0.03 (−0.95, 0.91)
Unemployed			**2.35 (1.23, 3.48)*****
Other			**1.86 (1.11, 2.60)*****
Year(s) living in the current neighborhood			0.02 (−0.02, 0.06)
Home ownership			**−0.92 (-1.63, -0.20)***
Annual income (per 1000 dollars, IQR)			0.001 (−0.004, 0.007)
Self-rated physical health			
Poor/Fair (Ref.)			
Good			**−2.15 (-2.98, -1.33)*****
Very good/Excellent			**−2.84 (-3.67, -2.02)*****
R-squared	0.137	0.033	0.316

Significance level: ***p < .001; **p < .01; *p < .05.

Table 4
Longitudinal analysis results using MIDUS 2 and 3 datasets (N = 592).

Variable	Weighted regression with clustered standard errors with IPW	GEE without IPW	GEE with IPW
	β (95 % C.I.)	β (95 % C.I.)	β (95 % C.I.)
Individual social connectedness measure			
Neighborhood social cohesion	−0.68 (−1.74, 0.37)	**−1.04 (-1.98, -0.11)***	**−1.35 (-2.39, -0.30)***
Social integration	0.10 (−1.05, 1.24)	−0.19 (−1.10, 0.72)	−0.61 (−1.67, 0.46)
Support from family	**−1.95 (-3.01, -0.90)*****	**−1.53 (-2.50, -0.57)****	**−1.51 (-2.61, -0.41)****
Support from friends	**−1.09 (-1.66, -0.52)****	**−0.85 (-1.37, -0.33)****	**−0.66 (-1.27, -0.05)***
Contribution to community	**1.35 (0.52, 2.18)****	**1.38 (0.56, 2.21)****	**1.56 (0.71, 2.42)*****
Spirituality	−0.96 (−2.32, 0.41)	**−1.27 (-2.39, -0.15)***	**−1.41 (-2.67, -0.15)***
Neighborhood/Census tract-level social connectedness measure			
Census-level neighborhood social cohesion	0.12 (−3.84, 4.08)	0.40 (−3.20, 4.00)	3.22 (−1.12, 7.56)
Census-level contribution to community	−0.92 (−3.35, 1.51)	−1.03 (−3.47, 1.40)	−1.71 (−4.31, 0.88)
Covariates			
Census-level socioeconomic factors (PCA)	−0.18 (−0.51, 0.15)	−0.19 (−0.48, 0.11)	−0.05 (−0.40, 0.31)
Census-level percent of immigrants	−0.05 (−0.14, 0.04)	−0.07 (−0.15, 0.02)	−0.09 (−0.18, 0.01)
Census-level percentage of people aged 65 or above	0.03 (−0.06, 0.12)	0.03 (−0.05, 0.10)	−0.01 (−0.09, 0.07)
Centered age	**−0.09 (-0.13, -0.05)*****	**−0.09 (-0.13, -0.05)*****	**−0.07 (-0.12, -0.03)****
Sex			
Male (Ref.)			
Female	0.50 (−0.18, 1.17)	0.52 (−0.14, 1.18)	0.13 (−0.66, 0.92)
Marital status			
Married (Ref.)			
Previously married	0.29 (−0.49, 1.06)	0.37 (−0.36, 1.10)	−0.07 (−0.93, 0.80)
Never married	−0.27 (−1.14, 0.60)	−0.18 (−1.02, 0.66)	−0.10 (−1.07, 0.87)
Education			
Below high school (Ref.)			
Completed high school	−0.64 (−1.64, 0.36)	−0.62 (−1.54, 0.30)	−0.75 (−1.81, 0.31)
Some college	**−1.53 (-2.49, -0.58)****	**−1.36 (-2.26, -0.46)****	**−1.54 (-2.56, -0.51)****
College or above	−0.90 (−2.13, 0.33)	−0.90 (−2.08, 0.29)	−1.01 (−2.39, 0.37)
Working status			
Full-time employed (Ref.)			
Retired	0.34 (−0.45, 1.13)	0.22 (−0.49, 0.93)	0.15 (−0.68, 0.98)
Unemployed or other	**2.82 (1.40, 4.24)*****	**2.27 (0.99, 3.55)****	**1.77 (0.44, 3.10)****

Table 4 (*continued*)

Variable	Weighted regression with clustered standard errors with IPW	GEE without IPW	GEE with IPW
	β (95 % C.I.)	β (95 % C.I.)	β (95 % C.I.)
	2.09 (1.07, 3.11)* **	**2.01 (1.09, 2.94)*** **	**2.09 (0.99, 3.19)*** **
Year(s) living in the current neighborhood	0.01 (−0.02, 0.05)	0.02 (−0.01, 0.04)	0.03 (−0.001, 0.06)
Home ownership	−0.39 (−1.05, 0.28)	−0.48 (−1.10, 0.13)	**−0.79 (-1.45, -0.13)***
Annual income (per 1000 dollars, IQR)	−0.003 (−0.011, 0.005)	−0.01 (−0.01, 0.002)	**−0.01 (-0.02, -0.003)** **
Self-rated physical health Poor/Fair (Ref.)			
Good	**−1.68 (-2.42, -0.94)*** **	**−1.77 (-2.44, -1.11)*** **	**−1.78 (-2.55, -1.01)*** **
Very good/Excellent	**−2.07 (-2.86, -1.27)*** **	**−2.24 (-3.00, -1.48)*** **	**−2.48 (-3.37, -1.58)*** **

Significance level: ***p < .001; **p < .01; *p < .05.

distress over the 10-year period, and community contributions showed significant long-term protective effects, although no associations were observed in the cross-sectional analysis. These findings suggest that while neighborhood-level social connectedness may have a limited impact, individual-level social connections—specifically through family support and ongoing community involvement—are critical in protecting against psychological distress within Black/African American communities.

Support from family and friends exhibited consistent protective effects against psychological distress in both cross-sectional and longitudinal analyses over the 10-year period. This finding aligns with extensive literature documenting the protective role of family support against contextual stressors in Black/African American populations (Taylor et al., 2014; Taylor et al., 2015; Priest et al., 2020). Support from family members has been a strong coping mechanism for Black/African Americans facing various stressors, such as racial discrimination, economic hardship, and workplace stress (Goosby et al., 2012). The support involves various types, including emotional and instrumental support, such as childcare and transportation. Extended family networks play a crucial role in providing informal social support, with over half of Black/African American adults regularly engaging in reciprocal assistance within these networks (Lincoln et al., 2013). Support from friends also plays an important role in coping with stressors in life among Black/African Americans. Strong friend support can buffer against various psychological stressors, and high levels of friend support could protect against the effects of perceived discrimination on depressive symptoms over time (Qin et al., 2020). The positive influence of friendships extends to general well-being, as evidenced by findings linking the number of friends available for problem discussion (Nguyen et al., 2016b). However, some studies indicate complexity in these relationships, finding that family support can increase stress levels or may not improve mental well-being (Cichy et al., 2014; McNeil Smith et al., 2020). These mixed findings suggest heterogeneous family dynamics across different sociodemographic subgroups within Black/African American families (Qin et al., 2020; Taylor et al., 2021).

We found that individual-level neighborhood social cohesion was significantly associated with lower levels of both short-term and long-term psychological distress. However, the neighborhood-level aggregated neighborhood social cohesion generally had non-significant effects in both short-term and longitudinal models, suggesting the primacy of close personal relationships in protecting against psychological

distress. Studies on the influence of neighborhood-level social connectedness on psychological well-being reported mixed findings. Some found that neighborhood social connectedness was associated with better mental health (Kawachi and Berkman, 2000, Michalski et al., 2020) and could protect against neighborhood disadvantages, while other studies reported no significant associations (Echeverría et al., 2008). The mixed findings in the literature suggest that the benefits of social connectedness may vary by neighborhood socioeconomic position, or city or neighborhood conditions, with several studies indicating stronger protective effects in more affluent neighborhoods (Huang et al., 2020; Méndez et al., 2021). An important methodological consideration is that our neighborhood social cohesion was an aggregated measure, which could introduce measurement errors (Echeverría et al., 2008; Pruitt et al., 2012). Such aggregation might mask individual variations in experiences of social cohesion within neighborhoods and might not fully capture the complex, multidimensional nature of neighborhood social cohesion, including aspects like trust, reciprocity, and shared norms. Additionally, our study was limited in directly testing how the impact of neighborhood social connectedness might vary across different types of neighborhoods. Future research should investigate these potential differential effects more systematically, examining how neighborhood characteristics such as socioeconomic status, racial composition, and urbanicity might moderate the relationship between social connectedness and psychological well-being.

We found that "contribution to community" had a significant protective association against psychological distress in the longitudinal analysis. This result indicates that the benefits of community contribution may accumulate over time, leading to more substantial mental health outcomes in the long run. The mechanism behind this relationship may be explained by how community engagement fosters social connections and identity (Reicher et al., 2010). When individuals actively contribute to their community through volunteering, they develop deeper social connections and an enhanced sense of community belonging (Bowe et al., 2020). This strengthened social identification, developed through sustained participation and help-giving, can unlock important psychological resources (Haslam et al., 2024). Research has shown that this enhanced social connectedness and sense of belonging can serve as long-term protective factors against psychological distress, creating a positive feedback loop where community contribution strengthens social bonds that then buffer against future stressors (Cyril et al., 2015; O'Mara-Eves et al., 2015).

We saw a significant protective association between community contribution and psychological distress in the longitudinal analysis, while no immediate relationship was detected in cross-sectional analyses. This temporal pattern aligns with existing literature demonstrating that sustained community involvement yields progressively positive health outcomes over time (Yeung et al., 2018). The mechanism behind this relationship may be rooted in how community engagement fosters deeper social connections and enhances a sense of belonging (Seppala et al., 2013; Suragarn et al., 2021), particularly within Black/African American communities where civic engagement and service hold profound cultural significance. This commitment manifests through various forms of community service, including neighborhood care, church volunteerism, civil rights advocacy, and educational program support (Stanfield, 1993). Through such active participation and help-giving behaviors, individuals develop stronger social identification with their communities, which can activate crucial psychological resources (Haslam et al., 2018). These community-based social structures serve as vital supports for managing stress, confronting discrimination, and navigating systemic challenges. The absence of significant short-term effects, contrasted with the longitudinal associations, suggests that the psychological benefits of community contribution accumulate gradually rather than manifest immediately. Additionally, the divergent findings between cross-sectional and longitudinal analyses highlight how point-in-time assessments may fail to capture the important temporal dynamics of community involvement, which

become more apparent through longitudinal investigation.

The comparison of analytical approaches in our longitudinal analyses revealed important methodological considerations for understanding the effects of social connectedness over time. While both weighted regression with cluster-robust standard errors and GEE models yielded consistent findings regarding the strongest predictors, support from family and friends, they differed in their sensitivity to detect associations for other measures of social connectedness. Specifically, individual-level neighborhood social cohesion and spirituality demonstrated significant protective associations in the GEE models but not in the weighted regression models. This indicates that GEE's explicit modeling of within-person correlation over time may be more sensitive to certain longitudinal relationships. This pattern may reflect GEE's superior ability to account for the temporal dynamics of social connectedness, as it directly models the correlation structure of repeated observations within individuals rather than merely adjusting standard errors for clustering. The discrepancies highlight that some effects of social connectedness may only become apparent by accounting for individual trajectories over time. Nonetheless, the convergent findings for family and friend support across both approaches strengthen confidence in these as robust predictors of psychological distress over the 10-year follow-up period, while the model-dependent findings for neighborhood cohesion and spirituality suggest that these relationships may be more sensitive to analytical specification and warrant cautious interpretation.

While our multilevel analysis showed stronger associations at the individual level compared to the neighborhood level, this differs from previous studies, such as Fujiwara and Kawachi (2008), who found substantial neighborhood effects. These differences may be attributed to our use of census tracts rather than larger geographic units, or the relative socioeconomic homogeneity of our sample neighborhoods, as reflected in the low intraclass correlation coefficients we observed. Fujiwara's paper measured social capital at the individual level instead of a multilevel study (Fujiwara and Kawachi, 2008). Some studies have demonstrated similar findings to ours that individual-level social capital has a more consistent relationship with psychological distress or mental well-being than ecological-level social capital (Murayama et al., 2012; Yamaguchi et al., 2019). The relationship between contextual social capital and mental health outcomes appears more complex; an explanation of the inconsistent findings could be the measurement approach (De Silva et al., 2005; Kawachi et al., 2008; Mobley et al., 2008). A recent systematic review found that multilevel studies show mixed findings regarding associations between individual and ecological-level social capital/connectedness and mental health outcomes, with the heterogeneous measurement of ecological-level social connectedness making it particularly challenging to draw reliable conclusions (Kemppainen and Timonen, 2024). In our study, we aggregated individual-level social connectedness at the census level as the ecological-level social connectedness indicator rather than directly measuring social connectedness characteristics in a neighborhood. Moreover, measuring at the census level could lead to losing valuable information due to imprecise measurement (Mobley et al., 2008). Given these measurement limitations, we cannot reach a solid conclusion about the multilevel relationship between social connectedness and psychological distress at the census level.

There are key methodological strengths that enhance the robustness of our study findings. Our analyses employed both cross-sectional and longitudinal approaches, allowing us to examine immediate associations while capturing temporal relationships between social connectedness and psychological distress over time. We implemented inverse probability weighting to address potential bias from loss to follow-up, strengthening our longitudinal findings. Furthermore, our multilevel analyses accounted for factors at both neighborhood and individual levels, including area-level socioeconomic indicators, community resources, and individual sociodemographic and health characteristics. Combined with our cross-sectional and longitudinal strategies, this

analytical approach provides robust evidence for understanding how social connectedness influences psychological distress across different timeframes.

Notably, most of our social connectedness measures demonstrated good internal consistency: neighborhood social cohesion (NHSC; Cronbach's α = .80), support from family (SUPPORTFAM; Cronbach's α = .84), support from friends (SUPPORTFR; Cronbach's α = .88), contribution to community (CONTCOM; Cronbach's α = .81), and spirituality (SPIRIT; Cronbach's α = .89). These reliability estimates are comparable to or exceed those reported for similar validated instruments in the literature. Our NHSC measure's internal consistency (α = .80) aligns closely with established neighborhood social cohesion scales, including the Neighborhood Social Cohesion Scale (α > .80) (Sampson et al., 1997; Cagney et al., 2009; Kim and Kawachi, 2017), developed by Cagney et al. (2009) using two samples in Chicago that were predominantly Black/African Americans (Cagney et al., 2009). It falls within the range reported in longitudinal studies using the Neighborhood Social Cohesion Scale (α = .68–0.74) (Cail et al., 2024). Our family and friend support measures (α = .84 and 0.88, respectively) demonstrate comparable reliability to the widely-used Multidimensional Scale of Perceived Social Support (MSPSS), which consistently reports Cronbach's alpha values above 0.90 (Wongpakaran et al., 2011; Brugnoli et al., 2022). The contribution to community measure (α = .81) shows strong internal consistency similar to the Brief Sense of Community Scale (BSCS), which reports overall scale reliability ranging from 0.89 to 0.92 (Peterson et al., 2008; Lardier et al., 2022). Only our social integration measure showed lower internal consistency (α = .54), which may reflect the conceptual breadth of this construct or the limited number of items. Despite this limitation, we retained this measure given its theoretical importance and widespread use in MIDUS research. Overall, our measures demonstrate adequate to excellent reliability and are well-aligned with established instruments in the social connectedness literature, supporting the validity of our findings.

5. Limitations

The study has some limitations. First, the notably low intraclass correlation coefficients (ICC <0.05) indicate minimal variation in psychological distress between different census tracts, suggesting that most of the observed variation occurred at the individual rather than neighborhood level. Part of this could be because some census tracts had sparse populations. Therefore, we utilized the cluster-robust error method to enable us to properly account for the clustering nature of the dataset while using a more parsimonious method.

Second, there was substantial participant attrition between MIDUS 2 and MIDUS 3, where approximately one-third (34.3 %) of our sample was lost. However, to mitigate the impact of this retention, we used inverse probability weighting in our analyses to address potential selection bias stemming from this attrition. The IPW successfully balanced most characteristics, including our main outcome; however, there was still a significant imbalance in age and spirituality measures. This suggests a potential limitation in applying the findings to different age groups and levels of spirituality. Third, beyond attrition-related bias, our study may be subject to selection bias inherent in the original MIDUS recruitment design. The Black/African American sample was recruited specifically from Milwaukee census tracts with at least 40 % Black/African American residents, which may limit the generalizability of the findings to Black/African American adults living in more racially diverse neighborhoods or different geographic contexts. Additionally, participation required English proficiency and non-institutionalized status, potentially excluding vulnerable populations whose social connectedness patterns and mental health outcomes may differ systematically from our sample.

Fourth, while GEE is appropriate for correlated longitudinal data, applying it to our two-wave design has limitations in capturing within-subject differences that would be better detected with more frequent

measurements. However, given the substantial 10-year interval between MIDUS 2 and MIDUS 3, this design could still examine long-term associations, as the extended follow-up period allows detection of meaningful changes in both social connectedness and psychological distress that might not be apparent over shorter intervals (Liang and Zeger, 1986; Singer and Willett, 2003). Moreover, GEE outperforms mixed-effect models in scenarios with fewer repeated measures (Hubbard et al., 2010). Future research with more frequent assessments could examine within-person changes in social connectedness and their dynamic relationship with psychological distress over time.

Fifth, our analyses may be subject to unmeasured confounders. For example, the quality of interpersonal relationships and personality traits are key confounders that could influence both social connectedness and psychological distress (Lee et al., 2001). Cognitive functioning (Samtani et al., 2022; Krendl et al., 2024) and caregiving responsibilities (Yuen and Wilson, 2021) may impact social functioning and mental health outcomes simultaneously. Neighborhood-level factors not captured in our census measures, such as availability of community resources, could also contribute to residual confounding.

6. Conclusion

Our findings have several important implications for policy development and intervention strategies. Given the' predominance of individual-level associations in our findings, interventions that strengthen personal social support networks may offer the most immediate impact (Fullilove et al., 2000; Fullilove et al., 2024). However, we emphasize that individual interventions should not be considered in isolation from structural factors, as neighborhood environments may significantly influence both access to and utilization of social support resources. The consistent protective associations we found between family support and mental health across time points highlight the critical importance of family-centered interventions, particularly those culturally tailored for Black/African American families. For example, the Strong African American Families (SAAF) program demonstrates this approach through its family skills training intervention, bringing together small groups of caregivers and their adolescents to participate in a structured curriculum addressing racial discrimination (Kogan et al., 2023). Such programs could build upon existing family strengths while addressing unique contextual challenges Black/African American communities face.

CRediT authorship contribution statement

Yu-Tien Hsu: Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Katelyn Kostakis:** Resources, Project administration, Methodology, Investigation, Conceptualization. **Shazel Muhammad:** Resources, Project administration, Methodology, Investigation, Conceptualization. **Yusuf Ransome:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Ethical approval

This study was determined to be exempt from review by the Yale University School of Public Health Institutional Review Board (IRB exemption number: 2000035165).

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) utilized Claude 4.0 Sonnet to conduct grammatical checks. After employing this tool/service, the author(s) carefully reviewed and edited the content as

necessary and assumed full responsibility for the content of the published article.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2025.118585.

Data availability

Data will be made available on request.

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