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Later life social interactions in community spaces

Maleah Fekete [1,*], Tianyao Qu [1], Brea L. Perry [1,2], Siyun Peng [3], Adam R. Roth [1,4]

[1]Irsay Institute, Indiana University, Bloomington, IN, United States
[2]Department of Sociology, Indiana University, Bloomington, IN, United States
[3]School of Aging Studies, University of South Florida, Tampa, FL, United States
[4]Department of Sociology, Oklahoma State University, Stillwater, OK, United States
*Corresponding author: Irsay Institute, Indiana University, 1165 E 3rd St, Bloomington, IN 47405, USA. Email: mafekete@iu.edu

Daily social interactions provide access to key social resources, yet little research has examined how these interactions vary across geographic space—particularly in later life. Using ecological momentary assessment data from a state-representative study of older adults in Indiana, we examine how interactions with different partners vary across a continuum of municipality population density. Further, we assess whether this variation is shaped by social opportunity structures—such as number of community parks, theaters, and volunteer organizations—and whether patterns persist during leisure time, when individuals are free to choose their interaction partners. Results show that higher population density is associated with more time spent alone, more interactions with "shared-foci partners" (i.e., partners known through foci of activity, such as neighbors, professionals, congregation members—though associations are driven primarily by professionals, strangers, and "others"), and fewer interactions with kin. Adjusting for social opportunity structures does not affect the observed association between population density and aloneness, interactions with shared-foci partners, or interactions with kin, indicating that differential access to social opportunity spaces does not explain these relationships. Restricting analyses to leisure activities reveals that differences in shared-foci partner interactions by population density disappear—implying they are driven by variation in obligatory tasks—while differences in kin interactions and, to a lesser extent, time spent alone persist. By identifying population density as a structural factor that shapes everyday sociality, this study underscores the role of geographic context in structuring older adults' access to social connection and the resources embedded in daily interaction.

Keywords social interactions, urban/rural areas, population density, older adults, ecological momentary assessment.

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Introduction

The people we interact with on a daily basis provide us with key social resources (Podolny 2001). A sense of belonging, help fixing a leaky roof, and the chance to share a joke, for instance, are all benefits that emerge from everyday social contact. Yet there is substantial individual variation in patterns of sociality, including who people interact with and in what ways in day-to-day life (Fournier et al. 2008; Heydari et al. 2018). Although prior research has identified a range of social forces that shape this stream—such as social context, age, cohort, and mobility (Roth and Peng 2024; Twenge and Spitzberg 2020; York Cornwell and Cagney 2017)—relatively little attention has been devoted to understanding how daily interaction patterns differ across geographical space.

This question matters because variation in interaction partners shapes access to different kinds of social resources. People who frequently interact with family members, for example, tend to benefit from the emotional support associated with strong ties (Krackhardt 1992; Perry et al. 2024; Thoits 2011), while people who interact more often with friends, acquaintances, and strangers benefit from the novel information associated with weak ties (Granovetter 1973; Katz et al. 2020; Perry et al. 2022a; Sommerlad et al. 2019). As such, structured patterns of interaction may help explain variation in individuals' health, happiness, behavior, and social mobility (Lin 1999; Smith and Christakis 2008; Thoits 2011).

Geographic variation in social interactions is especially important to consider in later life, when the stakes of social contact are heightened. As cognitive and physical capacities decline and the risk of isolation increases, even brief interactions can be meaningful—and diverse types of partners may be especially protective (Patterson and Margolis 2023; Perry et al. 2022b; Stern et al. 2020). Further, transitions such as retirement, widowhood, and health decline often tether older adults more tightly to their immediate environments, intensifying reliance on local settings for connection and support (Guralnik et al. 1993; Inagami et al. 2007; Pearce et al. 2009). At the same time that geographic space matters for older adult sociality, different types of spaces shape social life differently. For instance, urban residents tend to have larger, more diverse, and less kin-centric networks than rural residents (Beggs et al. 1996; Roth et al. 2022). Together, these findings suggest that geography shapes the types of social relationships older adults maintain—and, through these relationships, their access to key social resources, including those linked to health and cognition. Still, while there is strong reason to expect geographic differences in who older adults are engaging with in the momentary interactions that make up daily life, few studies have directly examined such variation in momentary interaction partners.

To address this gap, this study uses unique ecological momentary assessment (EMA) data to examine how daily social interactions among older adults vary across geographic space—which we conceptualize as a continuum of municipality population density, from less to more densely populated areas (e.g., Hirschl and Rank 1991; Tucker and Friedman 1972). By doing so, we contribute to sociological scholarship on aging and sociality by considering how structural theories of interaction explain patterns of social contact across geographic contexts. Specifically, we test hypotheses informed by Blau's (1977, 1994) opportunity structure theory and Feld's (1981) focus theory, and assess whether variation in foci of activity (i.e., the structured situations where interactions occur) helps explain geographic differences in interaction patterns. We also examine whether these patterns persist during leisure time, enabling us to assess whether the differences we observe are driven largely by externally imposed obligations or extend into discretionary, self-directed time. Together, these analyses offer new insight into how local environments shape everyday sociality in later life.

Before turning to our data and results, we first lay out the theoretical foundations that inform our analysis. Specifically, we review structural theories of interaction that provide expectations for how social contact may be shaped by geographic context. We then turn to empirical research on geographic variation in social life—particularly among older adults—to motivate the specific hypotheses we test in this study.

Background

Theories of interaction

In this section, we consider two influential structural theories of interaction that shed light on how geographic context may shape everyday interaction patterns: Blau's opportunity structure model and Feld's focus theory.

Departing from theories that center on individual motivation, the "opportunity structure" model of interaction—formulated by Blau (1977, 1994)—emphasizes how macro-level structural conditions shape interpersonal contact. According to this model, interaction patterns are not solely the result of individual preferences or psychological motivations, but rather emerge from the demographic and organizational composition of the surrounding social environment. Factors such as population density, group size, segregation, and categorical distinctions (e.g., race, gender, and age) condition the likelihood of social contact. Thus, the opportunity structure model focuses on how large-scale social structures influence the probability of intergroup contact.

Blau's theory is expansive, addressing both intergroup relations and the conditions under which integration or conflict is likely to occur. Of particular relevance to the present study is Blau's argument about urbanicity and population density. He argued that compared to rural dwellers, urbanites are more likely to spend a larger portion of their time associating with others because they are surrounded by such a dense population. This perspective suggests that urban residents will be exposed to a broader array of social contacts, albeit often fleetingly, whereas rural residents may engage in fewer interactions overall but potentially spend more time in deeper, more sustained exchanges (Blau 1977:161). According to this account, urban dwellers should spend less time alone and interact more frequently with weaker ties—such as acquaintances, club members, or fellow volunteers—while rural dwellers should spend more time interacting with kin and relatively more time alone.

However, despite these immediate implications of Blau's theory, there are also reasons to expect the opposite pattern—namely, that urban dwellers may spend more time alone than their rural counterparts. For example, urbanites may compartmentalize their social and solitary time to a greater extent, as passing through densely populated public spaces may be more draining than passing through public spaces in rural areas. Further, older adults who select into urban areas may be drawn to the relatively niche activities that cities uniquely provide (e.g., arts and entertainment) and be relatively less oriented toward family life. For these reasons, then, urban older adults may spend more time alone at any given moment than rural older adults.

In contrast to opportunity structure theory that emphasizes how large-scale social structures influence the probability of intergroup contact, focus theory highlights the role of organized settings and joint activity. Its central premise is that "foci of activity"—settings or entities around which joint activities are organized, such as a workplace, family, or hobby group—bring individuals into repeated interaction, which in turn facilitates tie formation (Feld 1981). Individuals typically participate in multiple foci at once, and over time tend to accumulate more. As this number grows, ties to any single focus—and to the people within it—may weaken. In this way, foci create a structure of relations in which interaction patterns are shaped by individuals' embeddedness in various social contexts (Feld et al. 2021; Hachen et al. 2024).

This highly influential framework has inspired hundreds of empirical studies examining how clubs, classrooms, musical tastes, extracurricular activities, and the like shape interaction patterns (Hachen et al. 2024; Kossinets and Watts 2009; Schaefer et al. 2011). By locating the source of social ties in external settings, focus theory offers a meso-level structural explanation for social interaction that contrasts with more psychological models that emphasize individual preferences and broader macro-level theories that emphasize demographic factors.

Applied to geographic variation, focus theory predicts that the quantity and type of available foci shape interaction patterns. While most people engage with broadly available foci like family, only those living near specialized foci—such as a bowling alley or museum—can form ties around such niche interests. Urban areas typically support a broader array of highly specialized settings,

allowing older adults in these areas to participate in a greater number and diversity of foci. This pattern likely reflects both supply and demand: more populous areas can sustain more diverse foci, and the presence of these institutions may in turn attract individuals seeking access to particular activities or social settings. Urban density, then, both enables and reflects a higher concentration of foci.

As individuals become embedded in a greater number of foci, ties within any one focus may weaken. Thus, to the extent that densely populated areas support more numerous and diverse foci, urban residents may interact more frequently with weak ties than their rural counterparts. This association may emerge not only from structural differences in the availability of foci, but also from selection processes: individuals may choose to live in areas with greater access to the types of social settings they value. The Differential Investment of Resources Model, for example, highlights how older adults' social relationships reflect both individual and contextual factors. Highly extroverted individuals are drawn toward weak-tie interactions and away from kin-based interaction, and they are more likely to select into environments that support these preferences (Huxhold et al. 2022). This model suggests that urban density both enables and reflects a higher concentration of individuals oriented toward weak-tie interaction—interactions that are often embedded in foci. While these multiple mechanisms complicate purely structural interpretations of focus theory, they also underscore its relevance. By locating the origins of social ties in the external organization of daily life, focus theory provides a valuable lens for understanding one way that geographic differences in institutional availability shape everyday interaction.

Together, these theories offer general predictions about how social interaction unfolds. Structural theories—including Blau's opportunity structure model and Feld's focus theory—propose that interaction is shaped by external conditions such as the demographic density of one's environment or the availability of foci. From these perspectives, interaction patterns should vary across geographic contexts to the extent that those contexts differentially structure opportunities for contact.

Social interaction patterns in community spaces

A relatively small sociological literature suggests that social lives take on systematically different forms across geographic contexts, with important implications for the types of partners people engage with. For example, using 1985 General Social Survey data, Beggs et al. (1996) found that rural residents tended to occupy personal networks that were smaller, denser, and more kin-centered, with stronger and more multiplex ties than their urban counterparts. While Beggs et al.'s work remains one of the most comprehensive studies of place-based variation in social ties, a small number of subsequent studies have similarly linked rurality with strong-tie networks and urbanicity with weak-tie networks. These studies show that urban networks tend to include ties from a greater number of distinct cliques, resulting in more "bridging" social capital compared to rural networks (Butts et al. 2012; Roth et al. 2022).

The aforementioned studies highlight how social network structures vary across geographic contexts. These findings hold important implications for understanding a variety of outcomes across urban and rural spaces such as access to information, social support, and health behaviors (Perry, Roth, and Small 2024). Yet it is equally important to recognize that social networks are distinct from social interactions. Networks represent a web of social relationships—ties that exist regardless of whether people are physically co-present—whereas social interactions refer to the specific encounters people have in everyday life, including with individuals who may not be part of their network (Roth and Peng 2024).

Building on this distinction, we use prior research to motivate expectations about how momentary interaction patterns may differ across urban and rural settings. Although rural residents tend to report fewer friends in their core networks than urban residents (Fischer 1982; Beggs et al. 1996), this does not necessarily imply fewer friend interactions in daily life. Because network size and interaction frequency need not align, we have no a priori expectation about how interaction

with friends will vary across geographic areas. In contrast, urban residents tend to include fewer kin members in their networks than rural residents (Mollenhorst et al. 2014), and we expect this difference to extend into momentary interaction. This is because urbanites must distribute their time across a larger number of friendships and the demands of urban life (Huxhold et al. 2022), and cultural norms in more populous areas may place relatively less emphasis on family bonds than those in rural communities (Hofferth and Iceland 1998). Accordingly, we hypothesize that urban residents spend less time interacting with kin at any given moment compared to rural dwellers.

Collectively, this prior research and reasoning motivate our first hypothesis.

- H1. Population density will be negatively associated with kin interaction frequency, such that people in less population dense locations will interact more frequently with kin than those in denser locations.

Other research has considered why urban and rural environments foster different types of networks, focusing particularly on two structural mechanisms: spatial propinquity and population diversity. The intuitive premise linking spatial propinquity to social interaction is captured by the so-called first law of geography, that "everything is related, but near things are more related than distant things" (Tobler 1970:236). In urban areas, higher population densities reduce physical distance between people, thereby lowering barriers to interaction and facilitating more frequent contact, particularly with weaker ties (Small and Adler 2019). Empirical evidence supports this logic: as geographic distance separating people increases, face-to-face contact declines sharply—especially with weak ties—while kin ties tend to be more stable and less affected by spatial separation (Lee 1980; Mok and Wellman 2007). While this may affect social networks insofar as distance may lead to turnover in friends (Mollenhorst et al. 2014), the way it affects momentary interactions is less clear. Rather than affecting the frequency of interactions with friends, reduced physical distance between people may lead to urbanites having more frequent interactions with weak ties such as acquaintances and members of foci of interaction, such as fellow club members. These kinds of urban interactions may be facilitated both by the ease of access to foci of activity—given their spatial proximity—and by the greater density and diversity of such foci, which increases the likelihood that individuals find activities or groups that are especially appealing to them.

Indeed research suggests that not only does spatial propinquity enable interaction with these kinds of weak ties, but population density may also increase the frequency and diversity of this kind of social contact (see Pan et al. 2013). Mayhew and Levinger (1976) modeled social interaction as increasing exponentially with city size, a finding they supported using violent crime rates as a proxy for interaction frequency. Blau (1977) extends this argument, proposing that higher population density generates not only more opportunities for contact but also more casual, short-duration interactions and broader circles of acquaintances. According to Blau, because they are surrounded by a larger and more varied pool of potential interaction partners, urban residents are more likely than rural residents to spend time with weakly connected others—including what we term "shared-foci partners," which are relatively distant individuals with whom interaction is facilitated by a shared foci, such as a church, sports club, or neighborhood. This is consistent with Fischer's (1982) finding that urban environments foster socially diverse networks and the formation of subcultural enclaves, as well as with Butts et al.'s (2012) simulation-based evidence showing that high-density areas promote network "clumping," embedding individuals in overlapping cohesive subgroups and increasing the likelihood of contact with socially diverse others.

More densely populated areas may also support a greater number and variety of foci of activity. Because a larger population can sustain more specialized social organizations (Youn et al. 2016), urban residents have greater access to structured settings tailored to diverse interests and identities. These settings serve as mechanisms through which population density may translate into more varied social encounters. In particular, they increase the likelihood of interaction with shared-foci partners. Building on this framework, we expect that residents of more densely

populated areas will engage in more frequent contact with shared-foci partners, due to the greater availability and accessibility of relevant foci.

Following this body of research, we propose two additional hypotheses:

- H2: Population density is positively associated with shared-foci partner (e.g., fellow club members, professionals) interaction frequency, such that people in more population dense locations will interact with shared-foci partners more frequently than those in less dense locations.
- H3: Foci of activity explains variation in the association between population density and shared-foci partner interactions such that a greater density of foci will explain a greater frequency of contact.

We test these hypotheses using novel data capturing the day-to-day interaction patterns of older adults across a continuum of municipality population densities. The sections that follow describe our data, analytic strategy, and findings, which reveal how population density is associated with social contact in later life.

Data and methods

Survey

This study uses data from the Social Environment and Cognitive Health in Urban and Rural Areas (SECHURA) study. SECHURA leverages the sampling frame and baseline data from the Person to Person Health Interview Study (P2P), a large probability sample of 2,685 Indiana residents. P2P was launched in 2018 with sampling, recruitment, and survey methods designed to match the gold standard General Social Survey. The survey sampled participants from a range of socioeconomic backgrounds and oversampled in economically depressed rural counties.

Between November 2023 and March 2024, SECHURA surveyed P2P respondents who (1) were 55 years or older, (2) lived in Indiana, and (3) had consented to follow-up. Of 868 invited, 510 respondents completed a computer-assisted personal interview (CAPI), yielding a 61 percent response rate. These in-person interviews collected information on social networks, sociodemographic characteristics, health, and social engagement. Afterward, 273 (53.5 percent) of these respondents also completed a weeklong EMA module via smartphone. See Roth et al. (2024) for further detail on the SECHURA methodology.

Ecological momentary assessment

EMAs enabled repeated collections of individuals' self-reports of their activities, interactions, settings, and subjective states in real time through short, momentary surveys (Browning et al. 2024; Roth 2024). In the SECHURA study, EMAs were administered via the LifeData smartphone app. For the seven days following the CAPI survey, respondents received four random EMAs daily between 8:00 a.m. and 8:00 p.m., spaced at least 2 hours apart. Each EMA asked respondents the same series of questions except for the first one of each day, which also included a retrospective question on the number of people interacted with the day before.

Each EMA asked 8–14 items on respondents' real-time reports of where they are (setting), what they are doing (activity), and whom they are with (interaction). Responses were collected via touchscreen and had a 20-minute response window, with three reminders at five-minute intervals. Most respondents (84.0 percent) completed each EMA in under 2 minutes. The 273 participants produced a total of 5677 EMAs.

To address potential selection bias into the EMA survey—completed by 53.5 percent of eligible respondents—we conducted a nonresponse analysis comparing EMA joiners and non-joiners. Results indicated that age, gender, college education, and month of survey were significantly associated with participation.[1] Accordingly, we adjust for these covariates in all models to help account for differential participation (for more detail on EMA selection, see Roth et al. 2026). We choose to adjust for these covariates rather than including inverse probability sampling weights.

Measures

We measured our independent variable (municipality population density), theorized mechanisms (foci of interaction), and dependent variable (interaction partner(s)) using the SECHURA survey and EMA data as well as linked public datasets.

Interaction Partner(s). Our dependent variable captures the type of people who respondents engaged with during daily life, as measured through EMA data. During each EMA prompt, respondents were first asked, "Were you interacting with anyone (face-to-face or via telecommunication) when you heard the notification?" If they responded "no," the interaction was coded as "alone." If they responded "yes," they were asked, "Which of the following types of people were you interacting with when you heard the notification? (Select all that apply)." Sixteen role categories were provided: Spouse/romantic partner, Parent (including step- or in-law), Sibling (including step- or in-law), Child (including step- or in-law), Grandchild/great-grandchild, Other relative, Friend, Co-worker/colleague/employer/employee, Neighbor, Fellow church group member, Fellow group member (sports, social, leisure club, etc.), Fellow volunteer, Professionals (e.g., health care provider, lawyer, accountant), Acquaintance, Stranger (i.e., someone you are meeting for the first time), and Other. We grouped these roles into four broader categories: kin, friends, coworkers, and shared-foci partners. Shared-foci partners are individuals with whom the respondent interacts primarily due to externally organized but relatively elective social contexts, such as neighborhoods, congregations, voluntary organizations, and service settings. This includes neighbors, professionals, and fellow group members. Acquaintance, stranger, and "other" were also included in this category. Including "alone," our dependent variable comprises five mutually exclusive categories.

We treat coworkers as analytically distinct from shared-foci partners, despite both types of ties being shaped by external structures. This distinction rests on the degree of social obligation embedded in the relationship. Coworkers are typically encountered through compulsory participation in formal occupational roles, making interaction with them a largely non-elective feature of daily life. In contrast, shared-foci partners—such as neighbors, congregation members, and professionals—are encountered through relatively more elective participation in local institutions and activities, contexts that individuals can more easily avoid or disengage from. For example, while one may be unable to avoid sustained interaction with a frustrating coworker during a workday, one often has more agency in opting out of a conversation with a neighbor encountered on the street. This distinction is especially useful in the context of our study because, relative to coworkers, interactions with shared-foci partners may serve as an important mechanism for developing or maintaining weak ties—relationships that are more likely to emerge from elective, diverse, and contextually varied social environments.

Although respondents could select multiple partners, we assigned a single interaction type per EMA by prioritizing the least "structured" partner present. This reflects the assumption that any interaction involving a weak tie confers the social stimulation and resource benefits associated with weak tie interactions, whereas the benefits of strong tie interaction are typically accessible through interactions exclusively with strong ties. For instance, if a respondent interacted with both a spouse and a friend, the interaction was coded as "friend(s)." If they interacted with a spouse, friend, and fellow church member, the coding still prioritized "friend(s)." The full prioritization order was: friend(s), shared-foci partner(s), coworker(s), kin, and alone.

To assess whether this prioritization influenced results, we replicated all models using an alternative coding scheme that prioritized the most structured partner. Results were substantively consistent (see Appendix A). We also estimated mixed-effects logistic regression models using a fully disaggregated 16-category dependent variable, as well as a set of binary models for each interaction type (e.g., interacting with a friend vs. not). Both approaches yielded substantively similar findings (Appendices C–D).

Municipality population density. Our primary independent variable is municipality population density, assigned based on respondent home address (see fig. 1). We use home municipalities to define our geographic exposure because we reason that residential context, rather than the location

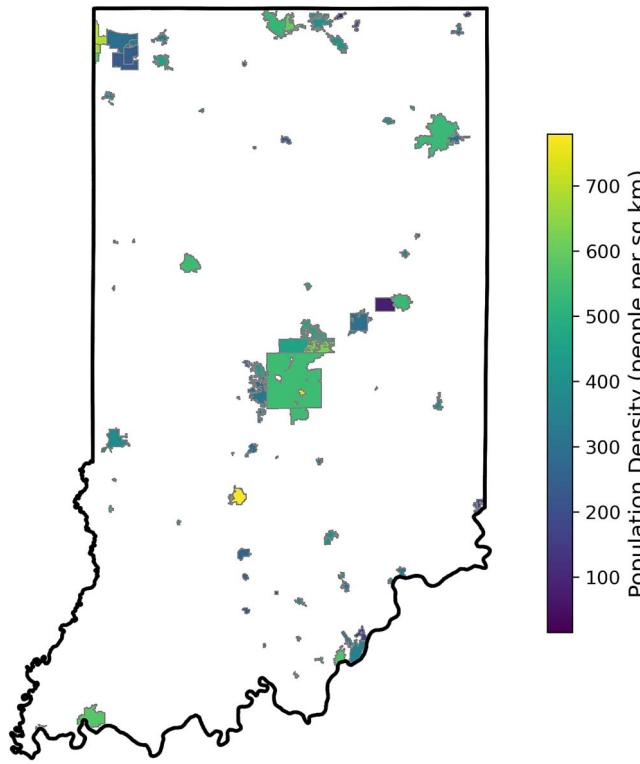

Figure 1 Indiana municipalities in SECHURA, colored by population density.

of any single encounter, structures people's broader patterns of mobility and social interaction. To assess whether this choice affects results, we conducted a robustness analysis by re-estimating our baseline model using only EMAs completed within respondents' home municipalities; results were substantively unchanged (results available upon request).

To construct this measure, we matched respondent home addresses to open-source geographic and demographic data from two sources: (1) IndianaMap.org, a subsidiary of the Indiana Geographic Information Office, which provides shapefiles for municipal boundaries ("IndianaMap," n.d.); and (2) Indiana Demographics, a subsidiary of the for-profit data vendor Cubit, which provides U.S. Census Bureau population estimates (Carney 2024). Using these sources, we calculated population density as the number of people per square kilometer within each municipality's boundary. To ease interpretation of model coefficients, we divided this measure by 1000, such that a one-unit increase reflects a difference of 1000 people per square kilometer.

Twelve municipalities were missing boundary and/or population data, largely because they were unincorporated areas or had small populations (i.e., less than 100).[2] To fill these gaps, we hand-coded population and area estimates using a third open-access source: Census Reporter, a grant-funded initiative aimed to make American Community Survey data more accessible ("Census Reporter," n.d.). This process allowed us to assign a population density value to all respondents in our dataset, who resided in 74 different municipalities. (See fig. 1 for a map of SECHURA municipalities, excluding the 12 without available boundary shapefiles.) After reducing our data to the final analytic sample (N = 5237; see below), there are 71 unique municipalities, include nine that were hand-coded (Mill Creek, Ninevah, and Springville were dropped). When we exclude the 491 observations from these nine municipalities, our results remain largely consistent.[3]

To assess whether municipalities were the appropriate unit for capturing geographic variation in social interaction, we conducted supplementary analyses using census tract and county-level data. These analyses yielded less variation in interaction partner outcomes—likely because census tracts are too small to reflect broader community characteristics, while counties are too large and internally heterogeneous. These findings support our use of municipalities as the most meaningful geographic scale for capturing the community-level mechanisms we theorize. Full results for census tract- and county-level models are available upon request.

Foci of activity. To assess whether geographic variation in foci of activity explain differences in exposure to interaction partners, we operationalize these foci as the count of community gathering spaces within respondents' municipalities. We group these spaces into three types: arts and entertainment, civic and social organizations, and parks. Arts and entertainment spaces are counts of museums, aquariums, movie theaters, gambling facilities, and related spaces (Melendez et al. 2024a). Civic and social organizations are counts of religious gathering spaces (e.g., churches, mosques), veterans' organizations, youth organizations, and civic associations (Melendez et al. 2024b). Finally, parks are counts of open parks (Melendez et al. 2023).

We use 2022 data sourced from the National Neighborhood Data Archive (NaNDA) via ICPSR. They are merged with SECHURA data using census tract-level FIPS codes. All 5,677 EMA observations were successfully matched with data on these local features. After merging, tract-level foci count variables are summed by municipalities to create municipality-level foci variables.

Leisure Activity. To examine how patterns of interaction partners vary across types of daily activities, we analyze EMA responses that occurred during elective activities. Specifically, we use responses to the EMA question, "What were you doing when you heard the notification?" which included 10 activity categories: eating/drinking, socializing, relaxing, working, shopping, household chores, volunteering, transporting (e.g., car, bus, and bike), medical care, other. Each activity was classified into one of two mutually exclusive categories: leisure or non-leisure. Most activities—such as working, shopping, or household chores—reflect externally structured or obligatory routines and are classified as non-leisure. We also include Volunteering in this group, as it typically involves pre-commitment and external coordination.[4] By contrast, we define leisure activities as those involving greater personal discretion and autonomy. Accordingly, we restrict our leisure-specific analyses to EMA instances in which respondents reported eating/drinking, socializing, or relaxing. This classification allows us to investigate whether geographic variation in interaction patterns may reflect underlying differences in how non-leisure time is structured across places.

Demographic Covariates. To avoid confounding the relationship between geographic context and interaction partners, we include a set of individual-level demographic covariates. They are age, gender, education, and race. Gender is coded as a binary variable, as all respondents identified as either women or men. Education is coded as a binary indicator for whether respondents attained a 4-year college degree. Given the racial composition of the sample—92 percent of respondents identify as White, with the next largest group (Black respondents) comprising 7 percent—we include race as a binary variable indicating White versus non-White respondents.

In addition to standard demographic characteristics, we include six variables that may plausibly shape daily social interaction: marital status (coded 1 if currently married or cohabiting), parenthood (1 if the respondent has one or more children), employment status (1 if currently employed), physical functionality (1 if the respondent reports needing assistance with at least some daily tasks), weekend (1 if the EMA was collected on a Saturday or Sunday), and non-holiday month (1 if the EMA was collected in January, February, or March as compared to November or December). These covariates help account for social roles and situational factors that may structure patterns of interaction.[5]

Analysis strategy

To assess how patterns of interaction partners vary across geographic contexts, we estimate three-level multinomial generalized structural equation models (GSEMs) using Stata 18. These models

are specified at the EMA level, with random intercepts at both the respondent and municipality levels to account for the nesting of repeated observations within individuals and individuals within municipalities. This model structure adjusts for intra-respondent and intra- municipality correlation and accommodates variation in the number of EMAs per respondent. Our primary goal is to estimate the association between municipality-level population density and the likelihood of interacting with different types of social partners.

In the second step of our analysis, we introduce measures of local "foci of activity" as additional covariates to assess whether geographic differences in access to social settings account for part of the association between population density and interaction partners. This step allows us to examine whether including these measures attenuates the observed associations, providing suggestive evidence that activity settings help explain differences in everyday social interaction across geographic contexts.

In the third step, we restrict the sample to EMAs involving leisure activities to test whether the associations we observe are driven by structural differences in obligatory tasks. If geographic variation in interaction partners is largely a function of task structure—such as errands or caregiving—we would expect the associations to attenuate when focusing only on leisure activities. Conversely, if the associations persist, this suggests that geographic differences in social interactions extend beyond externally imposed obligations and into discretionary, self-directed time. In other words, activities like employment are strongly shaped by structural constraints (e.g., availability of local jobs, workplace norms), which vary across urban and rural contexts and so do not allow us to observe choices made independent of such constraints. Leisure activities, by contrast, provide a context where choices about interaction partners are more voluntary and thus allow us to observe patterns of interaction when individuals have the greatest agency in how and where they spend their time. We model leisure activities differently from foci because the two capture distinct dimensions of social life. While foci refer to physical characteristics of municipalities that shape opportunities for contact, leisure activities represent momentary characteristics of EMA prompts describing what respondents were doing at the time of interaction. Because foci vary at the community level, we cannot restrict analyses to them in the same way we can for momentary characteristics such as leisure activities.

We present results as average marginal effects (AMEs), which represent the average change in the predicted probability of each interaction type associated with a one-unit increase in an independent variable, holding all other covariates constant. This approach facilitates interpretation of coefficients from nonlinear models with categorical outcomes. Municipality population density—the primary independent variable of interest—is standardized in all models to ease interpretability. Finally, Table A13 in Appendix D reports predicted probabilities of each interaction type at one standard deviation above and below the mean municipality population density to illustrate their practical significance for our main model.

Analytic sample

Eighteen of the total 273 EMA respondents were excluded due to missing data on key variables such as geographic location and demographic covariates. The final analytic sample included 255 respondents and 5,237 EMA observations. Respondents in this sample produced, on average, 3.5 EMAs per day and 23 EMAs in total during study period. Based on self-reported location in the analytic sample, 71 percent of EMA prompts were taken at home.

Results

Descriptive statistics for the study sample are presented in Tables 1 and 2. Approximately 60 percent of EMAs involved no social interaction, 22 percent involved interaction with one other person, and 18 percent involved interactions with two or more partners. The most common type of interaction partner was kin, involved in about 65 percent of reported social interactions (not

Table 1 Respondent characteristics and municipality density distribution.

Variable	N (%)
N	255
Age	
Mean (SD)	67.02 (7.70)
Education (%)	
Less than a 4-year college degree	147 (57.6%)
4-year college degree or more	108 (42.4%)
Married (%)	
No	134 (52.5%)
Yes	121 (47.5%)
Gender	
Male	80 (31.4%)
Female	175 (68.6%)
Has children	
No	30 (11.8%)
Yes	225 (88.2%)
Currently working	
No	164 (64.3%)
Yes	91 (35.7%)
Race	
Non-White	21 (8.2%)
White	234 (91.8%)
Physical Functionality (%)	
Can do most activities w/o assistance	236 (92.5%)
Needs assistance	19 (7.5%)
Mun. population density	
Mean (SD)	0.395 (0.148)
Range	[0.015, 0.780]

Table 2 Distribution of daily interaction count and role type composition.

Variable	N (%)
EMA	5237
Number of interactions	
0	3146 (60.1%)
1	1151 (22.0%)
2	391 (7.5%)
3	171 (3.3%)
4 or more	378 (7.2%)
Interaction partner (least structured priority)	
Alone	3137 (59.9%)
Kin	1184 (22.6%)
Coworker	225 (4.3%)
Shared-foci partner	336 (6.4%)
Friend	355 (6.8%)
Interaction partner (most structured priority)	
Alone	3137 (59.9%)
Friend	207 (4.0%)
Shared-foci partner	275 (5.3%)
Coworker	244 (4.7%)
Kin	1374 (26.2%)

shown). Social interactions involved friends or shared-foci partners approximately 17 percent and 18 percent of the time, respectively (not shown). Approximately 35 percent of respondents in this older adult sample were employed, and social interactions involved coworkers about 13 percent of the time.

Before turning to the main models, we assessed how much variation in daily interaction patterns was between-municipality versus between-individual using multiple mixed-effects logistic regressions (for each of the five levels of our outcome variable). The variance components indicate that between-municipality differences account for a relatively small share of the total variance—approximately 0–5 percent depending on the outcome—while between-individual differences explain substantially more (approximately 17–46 percent). Although municipality-level clustering is modest, these diagnostics provide evidence of nonindependence at both cluster levels, justifying the use of multilevel models that account for repeated observations nested within individuals and individuals nested within municipalities.

Geographic variation in social interaction patterns

Results from the GSEM analysis with demographic covariates (Table 3) show that municipality population density is significantly associated with daily interactions with kin and shared-foci partners (driven primarily by interactions with professionals, strangers, and "others"; see Appendix D). Consistent with Hypotheses 1 and 2, individuals residing in sparsely populated (rural) areas are more likely to interact with family members, while those in more densely populated (urban) areas interact more frequently with shared-foci partners. Interestingly, individuals residing in densely populated cities are more likely to report being alone than those in less densely populated areas (see fig. 2). As expected, interactions with coworkers are not significantly associated with municipality population density. Finally, there is no significant association between municipality population density and interactions with friends.

The practical significance of these results is illustrated by the predicted probabilities based on moving from one standard deviation below to one standard deviation above the mean of municipality population density—a shift roughly comparable to moving from the semi-rural community of Lexington, Indiana to Indianapolis (see Appendix D). This change in population density is associated with a 4.7 percentage point increase in the probability of being alone on any given prompt (from 0.58 to 0.62), a 6.4 percentage point decrease in interacting with kin (from 0.26 to 0.19), and a 1.8 percentage point increase in interacting with shared-foci partners (from 0.06 to 0.07). While these changes are relatively modest, given the frequency of daily social interactions captured in the EMA design, they imply several additional instances of being alone and interacting with shared-foci partners, and fewer interactions with close family for residents of denser municipalities.

As robustness checks, we conducted five supplementary sets of analyses. First, we replicated the models using an alternative coding scheme that prioritized the most structured rather than the least structured interaction partner (Appendix A). Results were consistent: municipality population density was significantly associated with being alone, interacting with kin, and interacting with shared-foci partners. Second, we ran mixed-effects logistic regressions separately for each of the five interaction types (alone, kin, coworker, shared-foci partner, and friend), with all covariates (Appendix C). These models showed consistent patterns: population density was positively associated with being alone and shared-foci partner interactions and negatively associated with kin interactions, although the effect for aloneness did not reach statistical significance. Third, we disaggregated the five-level dependent variable into its 16 constituent role categories, creating a 16-level dependent variable and estimated multinomial bivariate models (without covariates, due to convergence issues) under both the "least structured" and "most structured" coding schemes (Appendix D). Disaggregating the shared-foci partner category reveals that the strongest positive associations with population density are concentrated among other, stranger, and professional partners, with smaller contributions from church members and group members. Fourth, we added a binary time-of-day covariate, distinguishing earlier (8 a.m.–2 p.m.) from later (3 p.m.–8 p.m.) hours, and working hours (8 a.m.–5 p.m.) from at-home hours (6 p.m.–8 p.m.). Including these covariates did not affect results, indicating that significant associations are not driven by systematic differences in time of day (results available upon request). Finally, we estimated a model using

Table 3 Association between population density and interaction partner type.

Variable	Outcome	Model 1: Unadjusted			Model 2: Adjusted		
		Marg. effect	SE	*P*	Marg. effect	SE	*P*
Mun. pop. density (**z**)	Alone	0.025*	0.010	.012	0.023*	0.009	.013
	Kin	−0.037**	0.011	.001	−0.032**	0.010	.002
	Coworker(s)	0.003	0.004	.441	−0.003	0.003	.428
	Shared-foci partner(s)	0.008*	0.003	.028	0.009*	0.004	.012
	Friend(s)	0.001	0.004	.734	0.002	0.004	.551
Age (in decades)	Alone				0.050***	0.014	.000
	Kin				−0.047**	0.015	.003
	Coworker(s)				−0.007	0.005	.190
	Shared-foci partner(s)				0.004	0.005	.459
	Friend(s)				−0.000	0.006	.981
College degree (vs. no degree)	Alone				−0.060**	0.019	.002
	Kin				0.023	0.021	.291
	Coworker(s)				0.011	0.006	.076
	Shared-foci partner(s)				0.022**	0.007	.003
	Friend(s)				0.005	0.008	.549
Has kids (vs. no kids)	Alone				−0.037	0.026	.149
	Kin				0.087**	0.026	.001
	Coworker(s)				−0.003	0.010	.771
	Shared-foci partner(s)				−0.013	0.012	.265
	Friend(s)				−0.033*	0.014	.019
Female (vs. male)	Alone				−0.055**	0.020	.007
	Kin				0.026	0.022	.247
	Coworker(s)				−0.008	0.007	.259
	Shared-foci partner(s)				0.019**	0.007	.009
	Friend(s)				0.018*	0.008	.029
Married (vs. not)	Alone				−0.155***	0.019	.000
	Kin				0.157***	0.021	.000
	Coworker(s)				0.001	0.006	.909
	Shared-foci partner(s)				0.013	0.007	.079
	Friend(s)				−0.016	0.008	.054
Employed (vs. not)	Alone				0.006	0.022	.776
	Kin				−0.098***	0.023	.000
	Coworker(s)				0.082***	0.009	.000
	Shared-foci partner(s)				0.022*	0.009	.015
	Friend(s)				−0.012	0.009	.223
Non-White (vs. White)	Alone				−0.069*	0.033	.035
	Kin				0.026	0.041	.522
	Coworker(s)				−0.011	0.009	.260
	Shared-foci partner(s)				−0.025*	0.011	.021
	Friend(s)				0.078***	0.022	.000
Physical limitations (vs. none)	Alone				0.025	0.038	.502
	Kin				0.017	0.040	.668
	Coworker(s)				−0.029**	0.009	.001
	Shared-foci partner(s)				−0.007	0.014	.623
	Friend(s)				−0.007	0.014	.606
Weekend (vs. weekday)	Alone				−0.007	0.014	.644
	Kin				0.062***	0.012	.000
	Coworker(s)				−0.045***	0.005	.000
	Shared-foci partner(s)				−0.021**	0.007	.003
	Friend(s)				0.011	0.008	.172
Non-holiday month (vs. holiday)	Alone				0.026	0.019	.170
	Kin				−0.009	0.020	.676
	Coworker(s)				0.008	0.007	.205
	Shared-foci partner(s)				0.007	0.007	.332
	Friend(s)				−0.032***	0.008	.000

*$P < .05$; **$P < .01$; ***$P < .001$. N = 5237.

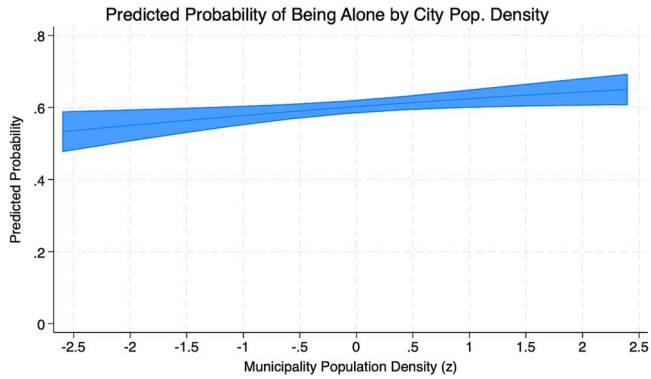

Figure 2 Illustrating the significant effect of municipality population density on likelihood of being alone in real time. N = 5237.

Table 4 Pairwise correlations between municipality density and foci of activity counts.

	Municipal density	Open parks	Civic/ social orgs	Arts/ entertainment
Mun. pop. density (*z*)	1.000			
Open parks (count)	0.399***	1.000		
	(0.000)			
Civic/social orgs (count)	0.422***	0.856***	1.000	
	(0.000)	(0.000)		
Arts/entertainment (count)	0.369***	0.873***	0.923***	1.000
	(0.000)	(0.000)	(0.000)	

*$P < .05$; **$P < .01$; ***$P < .001$. Pearson pairwise correlations with *P*-values in parentheses.

perceived interactional closeness[6] as the dependent variable, rather than interaction partner role type, to assess whether the role-based patterns we observe are mirrored in affective proximity (e.g., where interactions with kin tend to be closer than those with shared-foci partners). These analyses show a modest, marginally significant negative association between population density and perceived interactional closeness ($\beta = -.185$, $P = .053$), consistent with our primary findings (Appendix Table A14).

Do foci of activity explain geographic differences?

Next, we consider the available foci of activity by geographic areas. We do so by first assessing the correlations between municipalities' population densities and the counts of each of the three types of foci (Table 4). As expected, we find consistent, significant positive associations: more densely populated municipalities have more available interaction spaces. These results indicate that urban areas, with their greater population concentrations, provide more settings for social interaction.

To test whether associations between geographic context and interaction partners are explained by differences in available foci of activity, we incorporate the three foci count variables—arts/entertainment organizations, civic/social organizations, and open parks—into our GSEM (Table 5). Including these foci variables does not meaningfully change the associations between municipality population density and interaction partner type. The effects of density on being alone, interacting with kin, and interacting with shared-foci partners all remain significant and nearly identical in magnitude to the main model. In contrast to Hypothesis 3, this suggests that geographic variation in social interaction patterns is not explained by the density of local activity settings.

Table 5 Associations between municipality population density and foci of activity (AMEs), four models.

		Model 1: Arts/Ent.		Model 2: Civic/Social		Model 3: Open Parks		Model 4: All Foci	
Variable	**Outcome**	**AME**	***P* (SE)**	**AME**	***P* (SE)**	**AME**	***P* (SE)**	**AME**	***P* (SE)**
Municipality pop. density (z)	Alone	0.022*	.027 (0.010)	0.019	.064 (0.010)	0.025*	.015 (0.010)	0.021*	.042 (0.010)
	Kin	−0.029**	.009 (0.011)	−0.029*	.011 (0.011)	−0.033**	.003 (0.011)	−0.031**	.006 (0.011)
	Coworker(s)	−0.001	.686 (0.003)	−0.001	.677 (0.003)	−0.000	.923 (0.003)	−0.002	.576 (0.003)
	Shared-foci partner(s)	0.009*	.020 (0.004)	0.010**	.007 (0.004)	0.008*	.036 (0.004)	0.010**	.007 (0.004)
	Friend(s)	−0.000	.924 (0.004)	0.002	.725 (0.004)	0.001	.823 (0.004)	0.002	.654 (0.004)
Arts/ent. orgs (count, in 100 s)	Alone	0.003	.636 (0.007)					−0.013	.442 (0.017)
	Kin	−0.005	.510 (0.007)					−0.021	.271 (0.019)
	Coworker(s)	−0.003	.196 (0.002)					0.004	.501 (0.006)
	Shared-foci partner(s)	0.001	.835 (0.002)					0.009	.177 (0.006)
	Friend(s)	0.004	.138 (0.003)					0.022**	.005 (0.008)
Civic/social orgs (count, in 100 s)	Alone			0.001	.275 (0.001)			0.003*	.040 (0.001)
	Kin			−0.000	.553 (0.001)			−0.001	.653 (0.002)
	Coworker(s)			−0.000	0.378 (0.000)			0.001	.196 (0.000)
	Shared-foci partner(s)			−0.000	.379 (0.000)			−0.001**	.004 (0.001)
	Friend(s)			0.000	.652 (0.000)			−0.001*	.024 (0.001)
Open parks (count, in 100 s)	Alone					−0.001	.865 (0.005)	−0.012	.178 (0.009)
	Kin					0.002	.706 (0.005)	0.019	.053 (0.010)
	Coworker(s)					−0.004*	.014 (0.001)	−0.010**	.004 (0.003)
	Shared-foci partner(s)					0.001	.446 (0.002)	0.005	.079 (0.003)
	Friend(s)					0.001	.498 (0.002)	−0.002	.554 (0.004)

*$P < .05$; **$P < .01$; ***$P < .001$. N = 5237. For foci count variables, AMEs and SEs are multiplied by 100, interpretable as change in predicted probability per 100 additional foci.

Direct effects of the foci variables themselves are weak and mostly nonsignificant, with the exception of open parks, which show a small negative association with coworker interactions. When each type of foci variable is included separately, results remain substantively consistent: associations between population density and interaction patterns persist with minimal change (Table 5). These results again suggest that differences in the availability of foci of activity do little to account for the association between geographic context and older adults' daily social interactions.

As a robustness check, we model foci in terms of their density within municipalities, rather than raw counts (Appendix B). The results are highly consistent, with the effects of municipality population density on being alone, interacting with kin, and interacting with shared-foci partners having nearly the same magnitude as those in the count-based model.

Extending the foci framework: leisure activities as social context

In addition to physical or organizational settings, we also consider how activities relate to who people interact with. Specifically, we examine whether patterns of interaction across geographic contexts persist when we restrict the analysis to leisure activities, which represent contexts of relatively high individual discretion and low external constraint (Table 6).

For kin interactions, the results remain consistent with prior models: residents of less densely populated (rural) areas continue to interact more frequently with kin than their (urban) counterparts, even during leisure. This suggests that such preferences are not merely a function of externally imposed routines but persist during elective social time as well. By contrast, the previously significant association between municipality population density and shared-foci partner interactions disappears in the leisure-only model (see fig. 3). This indicates that the higher frequency of shared-foci partner interactions in denser areas is likely driven by externally structured activities—such as medical appointments, transportation, or volunteering—rather than by free-choice socializing. In other words, when people are unconstrained in how and with whom they spend their time, urban and rural residents are equally likely to interact with shared-foci partners. The relationship between population density and being alone also becomes less certain when the analysis is restricted to leisure-time activities. In this model, the association is no longer statistically significant.

As a supplementary analysis, we estimated a simple multinomial logit model (without random effects) to assess whether the leisure-only findings were sensitive to model specification; namely including volunteering as a leisure activity. Because this model does not require non-zero probabilities for all outcome–activity combinations, it can be estimated even when volunteering includes no coworker interactions. We found that the association between population density and aloneness is positive and significant, suggesting that the loss of significance in the leisure-only random-effects model may indeed reflect a loss of precision. We also find that when volunteering is included as leisure, population density significantly predicts shared foci-partner interactions. This is consistent with the idea that some shared foci-partner contact in denser areas arises through organized activities such as volunteering.

To more precisely examine whether these patterns are concentrated in specific types of activities, we disaggregate the data by activity type. Figure 4 presents average marginal effects of interaction partner type across all activities, and separately for socializing, working, and externally structured contexts (i.e., medical care, transportation, and volunteering). The association between population density and shared-foci partner interactions is concentrated in externally structured activities, suggesting that these types of interactions are particularly embedded in routine obligations and institutionally organized settings. By contrast, the association is negligible in leisure activities and in socializing contexts. These patterns reinforce the idea that shared-foci partners—such as professionals, neighbors, and congregation members—are most likely to be encountered in institutional or externally imposed contexts, rather than through discretionary activities.

Table 6 Association between population density and interaction partner type, leisure only.

Variable	Outcome category	AME	SE	*P*-value
Municipality population density (z)	Alone	0.020	0.015	.190
	Kin	−0.026*	0.013	.049
	Coworker(s)	−0.001	0.002	.498
	Shared-foci partner(s)	0.004	0.004	.260
	Friend(s)	0.003	0.006	.580
Age (in decades)	Alone	0.064**	0.022	.004
	Kin	−0.059**	0.019	.002
	Coworker(s)	0.003	0.003	.389
	Shared-foci partner(s)	0.001	0.005	.880
	Friend(s)	−0.008	0.009	.390
College degree (vs. no degree)	Alone	−0.072*	0.031	.020
	Kin	0.043	0.027	.113
	Coworker(s)	0.005	0.004	.230
	Shared-foci partner(s)	0.005	0.007	.447
	Friend(s)	0.020	0.012	.106
Has kids (vs. no kids)	Alone	−0.070	0.044	.110
	Kin	0.111**	0.034	.001
	Coworker(s)	0.002	0.006	.728
	Shared-foci partner(s)	−0.000	0.011	.978
	Friend(s)	−0.042*	0.021	.045
Female (vs. male)	Alone	−0.062	0.033	.056
	Kin	0.040	0.028	.148
	Coworker(s)	−0.004	0.005	.412
	Shared-foci partner(s)	0.003	0.007	.624
	Friend(s)	0.022	0.013	.076
Married (vs. not)	Alone	−0.187***	0.031	.000
	Kin	0.211***	0.027	.000
	Coworker(s)	−0.003	0.004	.413
	Shared-foci partner(s)	0.011	0.007	.107
	Friend(s)	−0.032**	0.012	.009
Employed (vs. not)	Alone	0.016	0.037	.666
	Kin	−0.054	0.030	.071
	Coworker(s)	0.024*	0.009	.011
	Shared-foci partner(s)	0.011	0.009	.229
	Friend(s)	0.004	0.015	.802
Non-White (vs. White)	Alone	−0.011	0.055	.846
	Kin	−0.042	0.045	.351
	Coworker(s)	0.007	0.009	.410
	Shared-foci partner(s)	0.003	0.013	.844
	Friend(s)	0.043	0.025	.086
Functionally limited (vs. not)	Alone	0.008	0.054	.881
	Kin	−0.019	0.046	.686
	Coworker(s)	−0.001	0.008	.858
	Shared-foci partner(s)	0.014	0.015	.335
	Friend(s)	−0.002	0.020	.921
Weekend (vs. weekday)	Alone	−0.025	0.019	.188
	Kin	0.045*	0.018	.011
	Coworker(s)	−0.010**	0.003	.002
	Shared-foci partner(s)	−0.004	0.007	.514
	Friend(s)	−0.005	0.012	.652
Non-holiday month (vs. holiday)	Alone	0.020	0.015	.190
	Kin	−0.026*	0.013	.049
	Coworker(s)	−0.001	0.002	.498
	Shared-foci partner(s)	0.004	0.004	.260
	Friend(s)	0.003	0.006	.580

*$P < .05$; ** $P < .01$* N = 2664.

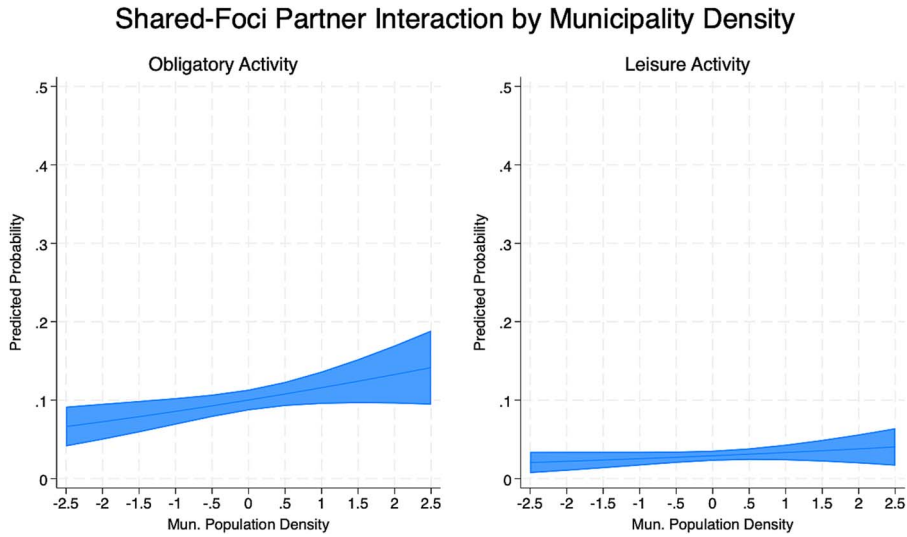

Figure 3 Illustrating the differential effects of pop. density on likelihood of interacting with shared-foci partners by obligatory versus leisure activity. Left: N = 2573. Right: N = 2664.

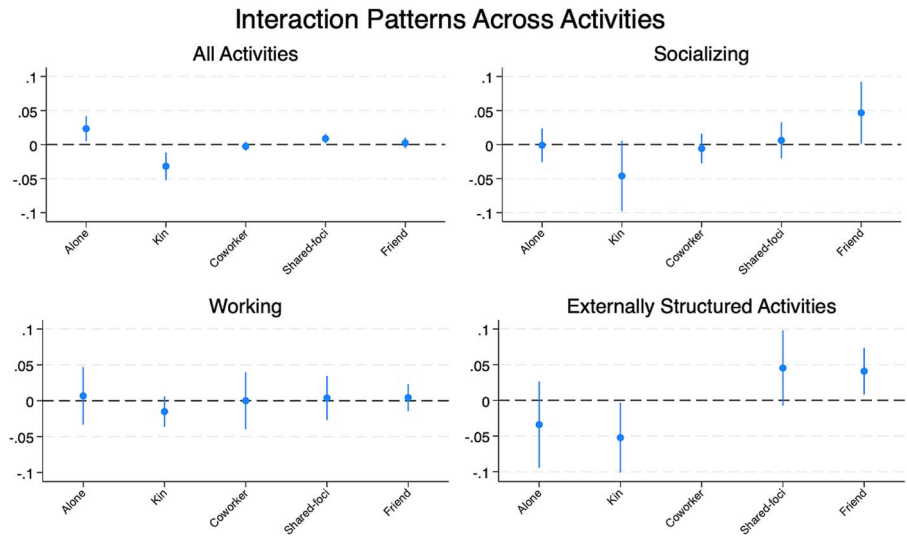

Figure 4 Illustrating the varying effects of municipality pop. density on interaction partners by activity types. Top left: N = 5237. Top right: N = 480. Bottom left: N = 783. Bottom right: N = 274. Top models include the full set of covariates. Working includes age, education, gender, and non-holiday month; externally structured activities include all covariates except functional limitations due to model convergence issues.

Patterns of aloneness by activity type are less clear. The activities included in this disaggregation are mostly structured,[7] so it may be that elevated aloneness in dense areas is more pronounced during unstructured or transitional times not captured here. Finally, we observe that residents of denser areas are more likely to interact with friends during explicitly social activities. This may reflect different modes of accompaniment: while residents in less densely populated (rural) areas may move through daily routines—such as shopping[8]—with kin, those in more densely populated

(urban) communities may have less familial access and instead rely more on friends for social contact during leisure. These results highlight how different types of activities, like different types of spaces, may serve as important forms of social organization that interact with geography to shape patterns of interaction in later life.

Discussion and conclusion

Building on theories of social interaction, this study examined how older adults' patterns of interaction vary across geographical space. In line with social-structural theories (Blau 1977, 1994; Feld 1981), we find that population density is associated with the types of social interactions in which older adults engage. In less densely populated communities, older adults are more likely to interact with others—especially family members—as they go about daily routines. In contrast, older adults in more densely populated communities spend more time alone during routine activities but interact more frequently with friends when they do socialize. Echoing prior research on rural–urban network structures, we find that urban residents are more likely to engage with relatively weak ties (particularly professionals, strangers, and "others"), while rural residents tend to interact more with stronger ones.

To investigate a potential mechanism behind these patterns, we considered the role of foci of activity. According to focus theory (Feld 1981), social interactions often arise through joint participation in shared contexts—such as clubs, organizations, or recreational spaces. We hypothesized that differences in the number or type of available foci might help explain observed differences in interaction patterns across places. After accounting for these differences in foci, we found that the patterns of interaction across communities of varying population densities remained largely unchanged. Thus, we do not find evidence to support the hypothesis that foci of activity explain place-based differences in older adult interaction patterns.

These findings show that, while the majority of variation in interaction patterns is within municipalities at the individual level, a small but meaningful proportion of variation occurs between municipalities and is explained by community population density. In densely populated communities, older adults may be likely to experience social encounters frequently in the course of daily life—while walking the dog, visiting the doctor, or grabbing a coffee—by virtue of living in close proximity to other residents. These frequent but fleeting interactions may deplete the desire for additional social contact during routine activities, leading residents to perform everyday tasks alone. Alternatively, older adults residing in densely populated communities may face more fragmented schedules and competing demands, limiting opportunities to coordinate routines with close others. In less densely populated settings, by contrast, the relative scarcity of competing demands or diversions may make it easier for older adults to align their routines with kin, resulting in more frequent shared activity. As such, cities may help to foster broader and more diverse interaction networks, while rural areas are more likely to support sustained contact with close ties. Older adults across these geographic contexts may make small but important adaptations to match local conditions by structuring interaction in distinct ways.

These results have several implications for research on aging and place. First, the interaction patterns we document may help explain disparities in social resources between rural and urban older adults. Since social ties serve as conduits for information, emotional support, and practical aid (Burt 1992; Granovetter 1973; Small 2017), differences in interaction frequency and type will shape access to such resources. There are, for instance, well-documented disparities in the cognitive decline of urban- versus rural-dwelling older adults (Russ et al. 2012; Weden et al. 2018), and differences in the cognitively-protective social resources provided by weak ties may help explain these differences (Perry et al. 2022a). At the same time, rural older adults—who tend to interact more with strong ties—may be comparatively more protected from the emotional and psychological challenges of aging (Bell 2014), given the well-documented mental health benefits of emotionally supportive, strong relationships (Krackhardt 1992; Perry et al. 2024). Second, the observed differences, while modest in magnitude, indicate that opportunity structures vary across place. This has implications not only for understanding individual social resources, but also for

sociological theories of integration. Specifically, our findings lend support to Blau's (1977) theory of heterogeneity and inequality. The structural configuration of a setting—especially its population density—may shape interaction patterns in ways that can enhance or limit intergroup cohesion.

These findings also provide a starting point for future research. For example, research could build on these findings by investigating whether the implications of different interaction types for well-being vary across rural and urban contexts. Using EMA data to link daily social experiences with measures of affect or stress would clarify whether, for instance, structured or weak-tie interactions carry different emotional consequences depending on the density and social organization of local environments. Further, research could link EMA data to social network data to more thoroughly investigate how closeness to interaction partners (rather than perceived closeness in an interaction) varies across activities and geographical contexts.

There are also several limitations to this work. First, although we interpret differences in interaction patterns as a function of opportunity structures, selection effects remain possible. For example, family-oriented individuals may opt into rural environments, while friend-oriented or more gregarious individuals may gravitate toward cities. Future research should explore how selective migration might shape local interaction dynamics. Second, our data is from older adults living in Indiana. The culture of rurality or urbanicity in Indiana may affect how people interact with others in differently populated spaces and may differ from other geographic regions. Still, our findings provide a critical step toward understanding how interaction patterns vary by place. Third, our sample includes only older adults who agreed to participate in experience sampling via smartphones. Because 46 percent of eligible SECHURA participants did not complete any EMAs, our findings may not fully reflect the interaction patterns of less tech-comfortable or lower-resource older adults.

Limitations aside, this study indicates that the structure of daily social interaction among older adults is shaped to some extent by the spatial context in which people live. By leveraging EMA data, this research captures how social interactions unfold across different environments and daily activities—offering insight into patterns that may be difficult to observe through retrospective or survey-based approaches. Methodologically, this study demonstrates the value of combining high-resolution behavioral data with contextual measures of place. The use of a multilevel framework allows for a detailed examination of interactional variation across both individual and municipal levels, revealing how differences in everyday social contact are modestly aligned with broader spatial patterns. Substantively, the findings suggest that place-based opportunity structures subtly help to organize the flow of daily social interaction in later life—not only by shaping who is available, but also by influencing how people move through daily routines. By documenting these patterns, this study contributes to sociological understandings of aging, community, and spatial inequality, and offers a foundation for future research on how local environments are associated with social interaction patterns across the life course.

About the authors

Maleah Fekete is a postdoctoral fellow at the Irsay Institute for Sociomedical Sciences Research at Indiana University and an incoming assistant professor at Hong Kong University of Science and Technology. Her areas of research include medical sociology, biosociology, mental health, social psychology, and social networks. Her recent work has appeared in *Rural Sociology*, *Social Science & Medicine*, and *American Sociological Review*.

Tianyao Qu is a postdoctoral fellow at the Irsay Institute for Sociomedical Sciences Research at Indiana University and an incoming assistant professor in the School of Social Sciences at Singapore Management University. Her research uses social network analysis, sequence analysis, and mixed methods to study how social relationships shape cognitive aging, health, and gendered experiences across the life course. Recent work appears in *Social Science & Medicine*, *Social Networks*, and the *Journal of Health and Social Behavior*.

Brea Perry is the Grimshaw Professor in the Department of Sociology and Director of the Irsay Institute for Sociomedical Sciences Research at Indiana University. Her areas of research include social networks, biosociology, aging, medical sociology, and mental health. Brea was a National Academy of Medicine Emerging Leaders in Health and Medicine Scholar (2019–2022) and received a MERIT Award (R37) from the National Institutes of Health in 2025.
Siyun Peng is an assistant professor in the School of Aging Studies at the University of South Florida. A gerontologist, sociologist, and applied statistician, Dr. Peng examines the reciprocal links between social relationships and health across the life course. His expertise spans social networks, family, health, cognitive aging, biomarkers of aging, ecological momentary assessment, and advanced quantitative methods. He currently serves as Co-Investigator on five NIH R01 grants.
Adam R. Roth is an assistant professor at Oklahoma State University. His research appears in outlets such as *Social Networks*, *Social Science & Medicine*, *Socius*, and *Journals of Gerontology: Social Sciences*. He is the principal investigator of the SECHURA study, which is funded by the National Institute on Aging.

Endnotes

1. Our nonresponse analysis indicated that technological comfort was associated with EMA participation. As a robustness check, we added a binary covariate for technological comfort (1 for uses a computer less than daily; 5.3 percent of observations). Including this variable did not meaningfully change results.
2. These were Depauw, Deputy, Fredericksburg, Henryville, Lexington, Mill Creek (Lincoln Township), Ninevah, Pekin, Springville (Perry Township), Underwood, Wadesville, and Windfall.
3. The coefficient for interactions with shared-foci partners by municipality population density becomes marginally significant ($P = .061$). The coefficient is about the same in the model without hand-coded municipalities ($\beta = .008$) as the original model ($\beta = .009$). Other results are entirely consistent across these two models.
4. We also conduct supplementary analyses modeling volunteering as a leisure activity; results are reported below.
5. We also included a binary time-of-day covariate in supplementary analyses; results remained consistent.
6. These data are from an item asking respondents to rate, from 1 to 10, the degree to which: "I felt a close, personal connection during this social interaction."
7. [7]Models for other activities, except shopping, did not converge. This is likely due to small cell size.
8. Shopping alone is positively associated with municipality population density, while shopping with family members is negatively associated with it. This suggests that residents of more densely populated areas are more likely to shop alone, whereas those in less densely populated areas are more likely to shop with family.

Supplementary material

Supplementary Material is available at *Social Forces* online.

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Conflicts of interest

None declared.

Data availability

The data used in this study were collected through a survey funded by the National Institute on Aging (R01AG078247). The data are not currently publicly available but are expected to be archived at ICPSR by 2027.

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