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Do Demographic Changes Jeopardize Social Integration among Aging Adults Living in Rural Regions?

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Abstract

Objectives: Contextual influences of the living environment on the social integration of adults have been primarily studied cross-sectionally. Here, we argue that context (i.e., urban vs rural environment) as well as changes in context (i.e., population decline) are potentially important for the development of social integration across middle adulthood and late life.

Method: We used a large-scale longitudinal data set representative of the late middle-aged and older German population (N = 4,790; aged 40 to 85 years) that assessed participants every 6 years across 3 waves. To examine our assumptions, we implemented multilevel latent growth curve models.

Results: We found that declines in network size were more pronounced in rural than in urban areas. Moreover, age-related declines in network size, social engagement, and social support were particularly pronounced in rural districts that demonstrated above average population decline.

Discussion: Our results imply that ongoing demographic changes, particularly in rural areas, may introduce additional barriers for maintaining social integration into late life.

Keywords: Developmental methods, Life events and contexts, Personal relationships, Social support

Individuals are conceptualized as having “social convoys” of relationships that move with them throughout their life course (Antonucci, Ajrouch, & Birditt, 2014). High levels of social integration, a multifaceted construct consisting of both structural (e.g., network size) and functional (e.g., social support) aspects of individuals’ social relationships, is considered a sign of successful aging (Rowe & Kahn, 1998). Life-span psychology research has successfully linked changes in social integration to individual-level processes (e.g., Carstensen, Isaacowitz, & Charles, 1999; Charles, 2010; Hess, Emery, & Neupert, 2012), and has also conceptualized such changes as embedded and shaped to some degree by the opportunity structure provided by the context (e.g., Baltes, Reese, & Lipsitt, 1980; Krause, 2006, 2011). For example, Windsor and colleagues (Windsor, Fiori, & Crisp, 2012) showed that older adults living in a neighborhood possessing strong social cohesion exhibited larger social networks than elderly people living in less cohesive environments, even after controlling for a number of individual differences.

Contexts can be conceptualized on different levels, ranging from macro-level cultural and societal factors to meso-level influences of the immediate living environment (Bronfenbrenner, 1977). Naturally, environmental contexts are not static entities, but are themselves subject to historical change (e.g., Baltes et al., 1980). However, changes in environmental conditions have rarely been linked to changes at the individual level. To address this gap, we aim to investigate whether the macro-level influence of demographic change is differentially associated with individual
trajectories of social integration among adults living in different meso-level environments (i.e., rural vs urban).

In this study, we focus on three measures of social integration thought to differentially affect health and well-being (Berkman, Glass, Brissette, & Seeman, 2000). First, the overall size of an older adult’s social network is an indicator of the structure of the network. Next, social engagement (i.e., participating in social activities) and social support (i.e., having others to rely on) are indicators of the function of the network. Berkman and colleagues (2000) consider these aspects to be more “downstream” social pathways than network size, in that they more directly affect physiological and psychological functioning. Our own research (Huxhold, Fiori, & Windsor, 2013) has shown that the size of older adults’ social networks does not directly affect well-being, but rather influences well-being through its relationship to social engagement and social support.

Both structural and functional aspects of social integration have been shown to be negatively affected by critical life events (e.g., divorce and loss of employment in middle age; widowhood in late adulthood) and losses in resources (i.e., functional health) associated with aging (Huxhold et al., 2013; Wrizus, Hänel, Wagner, & Neyer, 2013). However, whereas the size of the personal network tends to decrease linearly across the second half of life (Wrizus et al., 2013), adults appear to maintain levels of both social engagement (Lang, Rieckmann, & Baltes, 2002) and social support (Shaw, Krause, Liang, & Bennett, 2007) into late life. Lang and colleagues (2002) showed that social engagement is maintained through adaptive processes (e.g., investing more time in a less diverse array of activities), and that these processes develop in reaction to the loss of resources (primarily functional health). Similarly, Carstensen and colleagues (1999) theorize that social support is maintained through a focus on fewer, more intimate, relationships, primarily in reaction to a decrease in future time perspective.

Thus, it appears that individual resources (e.g., health) affect the structural and functional aspects of social integration differentially. In the present study, we argue that contextual conditions may also differentially affect the structural and functional aspects of social integration. Whereas the number of people available with whom to interact may be driven primarily by the environmental context (Berkman et al., 2000), the ways in which we engage with these potential network contacts should be driven more by individual motivations and adaptive processes. Therefore, we hypothesized that regional context would have a greater impact on structural aspects of social integration (i.e., network size) than on more functional aspects (social engagement and social support). However, if there are massive, negative changes in the context (i.e., severe population decline), adaptations in the face of declining resources (i.e., compensatory strategies such as focusing on close others) may be more difficult to maintain, most notably in already “impoverished” environments (i.e., rural regions). Thus, we also hypothesized that population decline would negatively affect all aspects of social integration, but only in rural, not urban, areas.

Influences of Urban and Rural Environments on Changes in Social Integration

There are no clear-cut methodological standards by which regions can be distinctly categorized as either urban or rural (Wahl, 2005), although one would assume that environmental resources for social integration might differ between these areas. Empirical evidence of such differences, however, is rather mixed; that is, advantages in terms of social integration for older adults have been found in both settings (Burholt & Dobbs, 2012; Burholt & Scharf, 2014; Mair & Thivierge-Rikard, 2010). Two reasons for this existing empirical ambiguity could be that (a) most studies comparing urban and rural regions have contrasted mean differences in social integration rather than differences in developmental trajectories; and (b) regional differences in developmental trajectories may vary with respect to the specific facet of social integration under study (e.g., Burholt & Scharf, 2014; Mair & Thivierge-Rikard, 2010). For example, urban environments might be particularly beneficial for counteracting detrimental developments in network size associated with aging, as the superiority of public transport systems and greater geographical proximity of network ties could facilitate the maintenance of social ties despite declines in functional health (Buffel, Phillippson, & Scharf, 2012). Furthermore, although network size typically declines with advancing age, research shows that new social ties are integrated into personal networks even into old age (Conway, Magai, Jones, Fiori, & Gillespie, 2013; Cornwell, 2019; Lang, 2000). The high population density of cities may facilitate this integration. In contrast, compensating for age-related losses in network size could be more difficult in rural areas where there are fewer people who could potentially replace a lost tie.

In contrast, although the infrastructure and cultural assets of urban environments may provide more opportunities for social engagement (Buffel et al., 2012), individuals living in rural environments could overcome these contextual limitations for social engagement by spending more time on fewer activities. Furthermore, rural settings tend to have larger household sizes (Schilling & Wahl, 2002), which may relate to more social support from family members. Rural areas may also be characterized by high levels of closeness with family members, friends, and neighbors (Burholt & Dobbs, 2012; Mair & Thivierge-Rikard, 2010). This increased closeness may facilitate the maintenance of close supportive ties. Thus, we hypothesize that structural facets of social integration (i.e., network size) will be more affected by differences between urban and rural regions than functional facets of social engagement and social support.

Impact of Demographic Changes on Social Integration in Rural Regions

Unfortunately, advantages of rural areas and the use of compensatory strategies may be less effective in the face of ongoing demographic changes. All advanced economies
have been facing an increasing aging of their populations (Glasgow & Brown, 2012; Johnson, Field, & Poston, 2015), and a number of European countries demonstrate population loss on a national level (Johnson et al., 2015). Changes in population density, however, vary greatly across regions within countries (Glasgow & Brown, 2012; Johnson et al., 2015). Specifically, although there are also urban areas in Europe and the United States demonstrating population decline (e.g., Detroit metropolitan area), negative birth–death ratios and population shrinkage are on average more likely in rural areas (Glasgow & Brown, 2012; Johnson et al., 2015). Population loss results from both reduced fertility rates and out-migration (Glasgow & Brown, 2012). Economic decline can particularly trigger young adults to migrate from rural to urban areas for the sake of better educational and work opportunities (Van den Broek, Dykstra, & Schenk, 2014). Population decline in rural areas could have a pronounced effect on all facets of social integration among aging adults. Out-migration is more likely in already sparsely populated areas (Chen, Etuk, & Weber, 2013), rendering the compensation of age-related social losses in network size even more difficult for those living in these areas. Furthermore, given that the social networks of older adults consist to a large degree of family members (Wrizus et al., 2013), and that social support to older adults is typically provided by adult children (Silverstein, Gans, & Yang, 2006), the out-migration of young adults (i.e., their children and grandchildren) may be particularly detrimental for the social integration of older adults living in rural regions (both in terms of network size and social support). Moreover, a declining population in rural areas is often associated with decreasing community services and facilities, and may even lead to a declining willingness to participate in community activities and events (Stockdale, 2004)—both of which could reduce levels of social engagement among older adults in rural areas. In contrast, population decline may not have these effects on all three aspects of social integration for late middle-aged and older adults living in urban areas, for at least two reasons: (a) their children/grandchildren are less likely to be moving out of the city; and (b) the infrastructure of the city is less affected by population decline.

The Current Study

The purpose of the present study was to demonstrate that regional context and changes in contexts are related to changes in different facets of social integration as adults age. Furthermore, we explored the idea that differences between urban and rural environments should have a stronger relationship with changes in structural aspects of social integration (i.e., network size) than with changes in functional aspects of social integration (social engagement and social support). In contrast, we predicted that population decline in rural areas should influence age-related changes in all three facets of social integration similarly. Given mixed empirical evidence, we examined rural and urban differences in initial levels of social integration in an exploratory manner.

H1: Age-related declines in network size will be significantly more pronounced in rural compared to urban regions, whereas the effect of region on changes in social engagement and social support will be less pronounced.

H2: Declines in population density will be associated with age-related declines in network size, social engagement and social support in rural areas, but not urban areas.

Method

Data

We analyzed data from the German Ageing Survey (DEAS), provided by the Research Data Centre of the German Centre of Gerontology (DZA) (Engstler & Schmidae, 2013). DEAS is a representative survey of adults between 40 and 85 years of age living in private households in Germany and funded by the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (BMFSFJ).

Participants

In 1996, 4,838 participants were assessed. In 2002, 1,524 of them were re-interviewed, and 993 of them were assessed again in 2008. Participants who moved from one district to the next during the study interval—1% of the sample—were excluded from the analysis to avoid cross-classification. The analysis sample was on average 60.1 years of age (standard deviation [SD] = 12.2 years), 49.2% were female, and 25.5% had obtained a college education. Participants providing longitudinal data were on average better socially integrated, healthier, had a more positive view on aging, had higher education, and were younger than participants who were assessed only once. Sample attrition effect sizes, however, never exceeded a medium effect size of $d > 0.5$ (average selectivity effect $d = 0.28$). To reduce selective attrition bias, information from all remaining participants ($N = 4,790$) was included in the analyses irrespective of the number of data points they provided (Newman, 2003). Full information maximum likelihood estimation (FIML) was used to account for missing data. FIML has been shown to effectively compensate for selective attrition biases in parameter estimates as long as variables in the model are predictive of dropout (Graham, 2009). Attrition rates did not differ between urban and rural regions, nor across districts with varying levels of population density. Thus, contrasts between urban and rural areas and between districts within these areas are unlikely to be influenced by selectivity biases.
Districts
On the administrative level Germany is subdivided into 402 districts. Districts are responsible for constructing and maintaining public infrastructure (public transportation, hospitals, schools, etc.) and for providing social welfare. Additionally, financial support for culture, adult education, and sports is often organized at the district level. In terms of population size and square footage, German districts are comparable to counties in the United States. The recruitment strategy of the DEAS included drawing participants from 211 districts representative of the diversity of living conditions across Germany.

Measurements
Continuous variables at all three time points were standardized to the T-metric \((M = 50, SD = 10)\) using the mean and SD at 1996. Continuous variables were network size, social engagement, social support, time-varying covariates, age at the within-person level, and population density at the district level.

Social integration variables
Social integration was represented using three constructs—network size, social engagement, and social support—for which convergent and discriminant validity have been demonstrated previously (Huxhold et al., 2013). All three measures of social integration were assessed with simple sum scores. To assess network size, individuals were asked to report the number of people they considered important and with whom they had regular contact (up to a maximum of eight). The DEAS interview also asked with whom the participant was living. If coresidents were not mentioned previously, their count was added to the network size variable. The variable social engagement was derived from a series of nine items asking for participation in specific typical activities in the last year (e.g., meeting with friends or going for a walk). We included only “social activities,” which were classified as such if participants indicated in a subsequent question they had performed a specific activity together with others. Time spent on these activities was measured with a question asking “How often have you performed this activity in the last year?” Answers were given on a scale ranging from 1 (less than once per month) to 6 (daily). Both measures—number of social activities and time spent on social activities—were transformed to T-scores. Consistent with the approach used in Huxhold and colleagues (2013), we averaged these two measures to compute the variable social engagement.

Finally, social support was assessed by asking participants to name up to six people from whom they would likely obtain advice, and up to six people from whom they would likely obtain solace. Both indicators were transformed to a T-metric and averaged to index the variable social support (as in Huxhold et al., 2013). These combined scores (for social engagement and social support) were both stronger predictors of health and well-being than the individual indicators (number of activities and time spent on activities, as well as number of people providing advice and number of people providing solace, respectively). Furthermore, analyses run separately by indicator provided comparable results.

District variables
The district-level indicators were compiled by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) in their indicator system INKAR and provided by the DZA. Population density is defined as number of inhabitants per km². The BBSR defines urban regions as districts with a population density of at least 150 inhabitants per km². We examined differences between urban and rural regions by including a dummy coded variable rural (urban = 0; rural = 1) in the analyses, created based on the BBSR distinction. Previous research has used a similar process of distinguishing between urban and rural areas based on population density (e.g., Mair & Thivierge-Rikard, 2010).

In order to investigate the effects of population decline on changes in the social integration variables, we converted the population density values into T-scores based on the mean and SD of population density at 1996 (i.e., mean = 651.11 persons per km²; SD = 800.00 persons per km²) to avoid overly large variance components estimates in the multilevel models. Descriptively, the average decline of population density from 1996 to 2008 was rather small (approximately 4 persons per km²) but the SD of the change was substantial (SD of change = 57.01).

Covariates
We employed extensive robustness tests to demonstrate that potential contextual effects were not due to interindividual differences at the within-person level. Specifically, we controlled for interindividual differences in self-rated health, number of illnesses, individual views on aging, in addition to differences in age, sex, and education. By centering covariates around the grand mean, we were able to estimate a purer environmental effect controlling for sampling heterogeneity between districts (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009). This implies that the average effects (as displayed in Figures 1 and 2) refer to a person of average education aging from 60 (sample mean at 1996) to 72 (sample mean at 2008). Variable descriptions of the covariates can be found in Supplementary Appendix.

Analyses
Multilevel latent growth curve modeling using MPLUS 8 (MLGC; Muthén & Asparouhov, 2011) was employed to examine changes in social integration within individuals across districts. We refer to the individual level as the “within level” and the district level as the “between level.” Figure 1 shows the model used to address Hypothesis 1. Figure 2
displays the model diagram for Hypothesis 2. At the within level, repeated measurements of the three social integration indicators are expressed as an initial level intercept factor and a linear slope factor; within-level variances are estimated for both. Error variances of the observed variables are freely estimated. To obtain an acceptable model fit, a covariance between the residuals of the observed variables network size and social support at 2002—likely caused by a period effect—had to be integrated into the models (not shown in figures for purposes of clarity). Intercepts (i.e., initial levels) and slope factors at the within level were allowed to covary and were regressed on the time-constant covariates to control for sample heterogeneity. Covariates were treated as within-level variables and not modeled at the between level. A comprehensive description of the implementation of time-varying control variables into the models can be found in Supplementary Appendix. Differences in social integration between districts were expressed as estimated means and variances in intercepts and slopes of the three social integration indicators at the between level. Following common convention, time-specific between-level residuals were set to zero (Muthén & Asparouhov, 2011).

To address the first hypothesis, between-level intercepts and slopes of the social integration variables were regressed on the rural–urban dummy variable (see Figure 1). To address Hypothesis 2, a latent growth model of population density across time points was integrated into the model at the between level (see Figure 2). Between-level intercepts and slopes of the social integration indicators were regressed on the intercepts and the slopes representing changes in population density. Associations between developments in population density and social integration were analyzed separately for urban and rural regions, because multigroup models estimating the effects of population density on social integration in both regions simultaneously did not converge. Before we ran the analyses on the impact of population decline on changes in social integration, we made sure that potential differences between urban and rural environments were not caused by rural areas showing a greater magnitude of decline (see Supplementary Appendix).

We evaluated model fit according to the suggestions provided by Marsh, Hau, and Wen (2004); RMSEA values less than 0.08 and CFI values beyond 0.90 indicated an acceptable fit. To evaluate each of the hypotheses we used...
χ²-difference tests in a three-step process. First, pathways connecting the urban/rural (Hypothesis 1) or population density (Hypothesis 2) variables to the social integration variables were set to zero. Second, these pathways were estimated but set to be equal across social integration indicators. A significant change in fit between these models indicates that between-level predictors (i.e., the urban/rural dummy, or intercepts or changes in population density) were associated with between-level intercepts or changes in social integration. Third, these pathways were allowed to freely vary. If this freeing of parameters was accompanied with a significant increase in model fit, it indicated that the between-level predictor variables were differentially related to the three social integration variables. To compare nested models, we used the chi-square statistic obtained with the robust maximum likelihood (MLR) estimator provided in MPlus. Confidence intervals (CIs) and standardized effect sizes were approximated by applying an MLR estimator in conjunction with a numerical integration algorithm (i.e., Monte Carlo) to the final models. It is important to note that even if unstandardized effects are equal across parameters, standardized effect sizes may differ because of possible differences regarding the variance of parameters. Thus, we report a range of standardized effects.

Results
All models showed an acceptable fit. The Root Mean Square Error of Approximation (RMSEA) values ranged from 0.040 to 0.032, and Comparative Fit Index (CFI) fit indices ranged from 0.90 to 0.93. Network size and social support decreased significantly, on average, across the observation period (p < .05). The mean change in social engagement across the observation period was not significant (p > .05), implying that social engagement remained stable, on average. The models revealed, however, significant within-person variances as well as between-person variances in all three facets of social integration (p < .05). Thus, multilevel analyses of age-related changes in these variables were justified. The within-level variances of the slopes, however, did not differ significantly across social integration indicators (p > .10). Therefore, to facilitate model identification, within-level variances of the slope parameters were set to be equal in subsequent analyses.

Exploratory Analyses
Our exploratory analyses of intercepts revealed that the dummy variable urban–rural was significantly related to the intercepts (i.e., initial levels) of the three social integration indicators at the between level (ΔΧ² = 4.99; Δdf = 1; p = .025). The strength of the association, however, did not differ across the three indicators (ΔΧ² = 1.27; Δdf = 2; p > .25). This means that the average initial levels of network size, social engagement, and social support were all slightly higher in urban than in rural districts (b = 0.62; CI = 0.04–1.20; β = 0.08–0.12). Exploratory analyses also showed that the intercept of population density was not significantly related to any change in social integration within either urban or rural areas (p > .10).

Hypotheses 1: Age-Related Changes in Network Size Will Be Significantly More Pronounced in Rural Compared to Urban Regions
Contrasting a model in which changes in network size, social engagement, and social support were unrelated to the urban–rural dummy variable with a model in which associations between the dummy variable and the three indicators of social integration were freely estimated but set to be equal, did not lead to a significant increase in model fit (ΔΧ² = 0.93; Δdf = 1; p > .25). This means that there was no overall effect of the urban–rural dummy variable on social integration. However, freely estimating these associations resulted in a significant increase in model fit (ΔΧ² = 6.34; Δdf = 2; p = .042). Post hoc analyses showed that urbanity was significantly related to changes in network size (ΔΧ² = 5.31; Δdf = 1; p = .021), but not to changes in social engagement (ΔΧ² = 0.46; Δdf = 1; p > .25) or social support (ΔΧ² = 0.07; Δdf = 1; p > .25). Thus, consistent with Hypothesis 1, the average decline in network size was less pronounced in urban than in rural areas (b = 1.11; CI = 0.39–1.83; β = 0.15; see Figure 3). Individuals aging in urban environments were able to maintain a larger network for a longer time span than individuals living in rural areas. Declines in social support and social engagement were of comparable magnitude in both types of regions.

Hypothesis 2: Declines in Population Density Will Be Associated With Age-Related Changes in Network Size, Social Engagement and Social Support in Rural Areas, But Not Urban Areas
Consistent with Hypothesis 2, changes in population density were unrelated to trajectories of social integration in urban areas (equal strength: ΔΧ² = 0.85; Δdf = 1; p > .25; unequal strength: ΔΧ² = 0.04; Δdf = 2; p > .25). Thus, even in urban regions that demonstrated a population decline, age-related changes in network size, social engagement, and social support were not affected.

Also consistent with Hypothesis 2, changes in population density were significantly related to changes in social integration in rural areas (ΔΧ² = 4.02; Δdf = 1; p = .044). Moreover, in accordance with our hypothesis, the strength of the association did not differ by social integration indicator (ΔΧ² = 1.37; Δdf = 2; p > .25). Population decline in rural districts was associated with an increased decline in social integration, irrespective of the particular indicator under observation (b = 10.30; CI = 3.11–17.49; β = 0.23–0.49; see Figure 4).
Covariate Analyses

Additional analyses showed that the regional effects, which we identified, were robust against controlling for a great variety of interindividual differences at the within-person level. Results remained unchanged after controlling for the time-constant covariates age, sex, and education, and after controlling for the time-varying covariates self-rated health, number of illnesses, and two different views on aging (see Supplementary Appendix for details).

Discussion

To our knowledge, differences in social integration between rural and urban environments have been almost exclusively examined in a cross-sectional fashion (e.g., Burholt & Dobbs, 2012). Our exploratory analyses of mean differences showed that there are some differences between urban and rural districts in terms of sizes of social networks, levels of social support, and intensity of social engagement. However, the effect sizes of these contrasts were rather small. Instead, and consistent with our predictions, our findings suggest that regional influences may play a larger role in the maintenance of different aspects of social integration in mid- to late life. Specifically, we found differences between urban and rural environments in terms of changes in network size, but not in terms of changes in social engagement and social support. Our results also indicated that population decline was associated with stronger declines in all three facets of social integration, but only in rural areas. The reported contextual effects were robust, remaining even after controlling for a variety of time-constant and time-varying covariates at the individual level.

Age-Related Changes in Network Size Were Significantly More Pronounced in Rural Compared to Urban Regions

In contrast to the rather small differences in the overall levels of social integration across all facets, the more substantial difference found between urban and rural areas was in terms of changes in social networks. That is, aging adults were better able to maintain large networks in metropolitan districts. This could be due in part to the relatively greater accessibility of network partners in urban compared to rural areas, which may allow for frequent contact despite...
age-related declines in mobility (e.g., decreases in functional health) at older ages. Furthermore, the greater number of people available in urban compared to rural regions may help aging individuals to form new bonds as a way to compensate for age-related losses in their personal networks (Conway et al., 2013; Cornwell, 2015; Lang, 2000).

In contrast, declines in social engagement and social support did not differ by region. This finding is in line with our prediction that the effect of urbanity would be particularly strong for the structural aspect of social integration (e.g., network size), since presumably individuals in more sparsely populated areas can better compensate in the more “downstream” (Berkman et al., 2000) functional aspects of social integration such as social engagement and social support. In our view, this finding can be explained by adaptive processes at the behavioral level. From a theoretical perspective, although behavioral changes are thought to be driven by declines in individual resources, they could also serve as compensatory strategies for environmental barriers. For example, it has been shown empirically that aging individuals facing functional restrictions tend to focus on the most preferred activities within a given activity domain (Lang et al., 2002). Since our measure of social engagement was the average of the number of social activities and the time spent on those activities, individuals aging in rural environments may have adapted to a lower opportunity structure by spending more time on fewer activities than urbanites. Similarly, rural adults may be spending more time fostering their close relationships, which could explain why we do not see regional differences regarding changes in social support.

### Declines in Population Density Were Associated With Age-Related Declines in Network Size, Social Engagement and Social Support in Rural Areas, But Not Urban Areas

Our results provide some evidence that capacities for individual adaptation appear to be limited. Irrespective of the overall levels of population density in rural areas (e.g., tiny village vs small town), we found that population decline in rural areas was broadly associated with pronounced declines in every aspect of social integration examined (network size, social engagement, and social support). There are several possible explanations for these associations. First, reductions in the available number of people with whom to bond could exacerbate difficulties with compensating for aging-related losses in social networks. Second, the exodus of children (and grandchildren) from rural areas (Van den Broek et al., 2014) may further threaten social support networks, especially if such exodus results in declines in household size (Schilling & Wahl, 2002). Third, decreasing public transportation and cultural facilities associated with population loss could make it particularly difficult for aging adults experiencing mobility restrictions to maintain involvement in social activities (Burholt & Scharf, 2014). Finally, it has been reported that the experience of population loss may have a negative impact on the motivation of individuals to participate in local activities and events (Stockdale, 2004); thus, psychological side effects of population loss could further reduce social engagement. In sum, the negative consequences of population decline in rural areas may overwhelm individuals’ capacities for behavioral adaptation.

### Strengths, Limitations, and Future Directions

Our analysis is one of the only studies of which we are aware to investigate how changes in the environment are related to changes at the individual level. However, specific living conditions, individual resources, and mentalities of individuals may differ tremendously between countries, and consequently the impact of demographic change on the development of social integration may differ accordingly. Moreover, changes in governmental policies, technological advances (e.g., social media), and increasing fitness of younger cohorts of older adults may moderate the association of demographic change with changes on the individual level. Thus, our findings need to be replicated in different national settings and historical contexts.

Furthermore, levels of network size and social support decreased from the age of 40 onwards, irrespective of the context. The critical life events and developmental processes that cause these declines may, however, differ across different life phases (i.e., competing responsibilities of work, childcare, and eldercare in midlife; widowhood and higher functional impairments in later life). Thus, one might speculate that contextual effects on the changes in development may differ as well. In particular, in line with Lawton’s “environmental docility hypothesis” (Lawton, 1990), it can be expected that contextual effects would be more pronounced for older adults. Unfortunately, because of the cross-classification problem in our data (i.e., participants were simultaneously nested in age groups and districts), we were unable to run a conclusive statistical test that contrasted contextual effects in different age groups. Simply dividing the sample at the age of 65 years and running separate models for younger and older adults revealed that the contextual effects (i.e., the urban–rural difference on changes in network size and the effect of population decline on changes in all three aspects of social integration) were significant in both age groups (analyses available on request). This finding does not preclude the existence of age moderation, but it does suggest that district-level contextual effects operate across the adult life span and may exacerbate age-related declines in social integration.

Finally, the present study included only structural and functional aspects of social integration, and not more qualitative aspects such as loneliness. This exclusion was driven by our assumption that qualitative aspects would be less affected by contextual factors. According to Berkman and colleagues’ (2000) model of how social networks affect health, such aspects are even further “downstream” from the context level than are the functional aspects of social engagement.
and social support, which are influenced to a larger degree by the accessibility of social resources in the environment. In contrast, qualitative experiences of social integration, such as loneliness, result from a combination of objective social integration and individual specific social expectations (De Jong-Gierveld, 1987). Thus, individuals who experience reduced “objective” social integration due to population decline may avoid an associated decrease in their subjective, qualitative, experience by lowering their expectations.

Future research should focus on potential individual resources and compensatory strategies that might lessen the negative effects of environmental influences on social development and, ultimately, on health. For example, interventions directed at specific mechanisms by which demographic changes influence individual development (e.g., by increasing the motivation for participation) could ameliorate the threat of population decline in rural areas on the social integration of older adults. In addition, the efficient and frequent use of technology and social media could be implemented as a means of maintaining contact with increasingly geographically distant social network members.

**Implications for Aging Research**

Our findings demonstrate that the contextual influence of demographic change is differentially associated with individual trajectories of social integration among adults living in urban or rural environments. Specifically, we found that even very small declines in population density can negatively affect changes in social integration in aging adults living in rural areas. Certainly, these individual trajectories are simultaneously shaped by a variety of other, more individual-level processes (e.g., age-related changes in motivation; Carstensen et al., 1999). However, our analyses suggest that population decline broadly exacerbates existing age-related reductions in structural and functional aspects of social integration in rural areas across a number of different indicators. This finding is alarming, because due to the increased physiological vulnerability and overall reduced pool of individual resources associated with aging, social engagement and social support may increase in importance for maintaining health and well-being (Antonucci, Birditt, & Webster, 2010; Huxhold et al., 2013; Schöllgen, Huxhold, Schiz, & Tesch-Römer, 2011). Demographic change is a global phenomenon, and population loss in some rural regions has been found in both a variety of European countries and in the United States (Glasgow Brown, 2012; Johnson et al., 2015). Understanding how these demographic trends may interact and shape opportunities for successful aging for future generations should become an important endeavor for future research.

**Supplementary Material**

Supplementary data is available at The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences online.

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**Conflict of Interest**

None reported.

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