Associations between neighborhood characteristics, well-being and health vary over the life course

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Abstract

Background: Neighborhood characteristics are important determinants of individual health and well-being. For example, characteristics such as noise and pollution affect health directly, while other characteristics affect health and well-being by either providing resources (e.g. social capital in the neighborhood), which individuals can use to cope with health problems, or limiting the use thereof (e.g. crime). This also suggests that there might be age differentials in the impact of these characteristics, since individuals at different stages of life might need different resources. However, there is a lack of empirical evidence on age differentials in associations between well-being, health, and neighborhood characteristics.

Objective: This paper studies associations between a wide range of neighborhood characteristics with the health and well-being of residents of the greater Berlin area. In particular, we focus on differences in the effects between younger (aged 20-35) and older (aged 60+) residents.

Methods: We used data from the Berlin Aging Study II (312 younger and 993 older residents of the Berlin metropolitan area in Germany). We used survey data on health and well-being, combined these with subjective perceptions of the neighborhood, and geo-referenced indicators on the neighborhood, e.g. amenities (public transport, physicians, and hospitals).

Results: The results show that access to public transportation is associated with better outcomes on all measures of health and well-being, and social support is associated with higher life satisfaction and better mental health. There are considerable differences between both age groups: While the associations between access to public transport with health and well-being are similar for both age groups, neighborhood social capital shows stronger associations for older residents. However, the difference is not always statistically significant.

Conclusion: Having access to services is associated with better health and well-being regardless of age. Local policy makers should focus on lowering barriers to mobility in order to improve the

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health and well-being of the population. Since the social capital of a neighborhood is associated with better health and well-being among older residents, investments that increase social capital (e.g. community centers) might be warranted in neighborhoods with higher shares of older residents.

Keywords: health, well-being, neighborhood, neighborhood amenities, BASE-II

Running head: Neighborhood characteristics, health and well-being

Introduction

Characteristics of residential neighborhoods are potentially important determinants of health and well-being. Neighborhood characteristics can have direct effects (e.g. pollution or noise levels). Further, some neighborhood characteristics can be regarded as resources that allow residents to maintain their health and cope with health problems (e.g. green spaces, community centers, public transport), while other characteristics limit the use of these resources (e.g. fear of crime).

Associations between residential neighborhood and health are well documented in the empirical literature with a large number of studies focusing on different aspects of the neighborhood as well as different dimensions of health. An important strand of the literature investigated associations between measures of neighborhood socio-economic status (SES), poverty and/or affluence on health ([1-7]). While most studies found large correlations between neighborhood SES and health, these correlations typically vanish once individual SES is taken into account. Other studies focused on specific features of the neighborhood. For example, residential stability ([8-9]), social capital ([1],[10-13]) and the concentration of the elderly [8] show positive correlations with individual health. High levels of crime ([3],[10],[14]) as well as perceived noise and pollution ([15]) are negatively associated with health, whereas access to services ([8]) is not associated with health. Further studies focused on the impact of both objective and self-reported neighborhood conditions on mental health and well-being among older individuals [16-17]. Their results indicate that self-reported neighborhood conditions are more important for mental health than objectively measured conditions (e.g. indices of deprivation).

These neighborhood characteristics are likely to have a heterogeneous impact on different socio-economic groups. For example, poorer individuals are more reliant on public transport (see e.g. [18]). Similarly, older individuals might be more confined in their mobility, since age affects both their ability to drive and to walk longer distances. Another example is the social capital of a neighborhood. Since individuals with pre-existing health problems and limitations (e.g. seniors) require more support from others, they might benefit more from social capital. Surprisingly, there is little empirical evidence on neighborhood effects over the life course. Qualitative research suggests that the neighborhood might matter more for older residents, since they are more confined in their ability to relocate [19]. Moreover, for younger individuals family and friends play a larger role, whereas older residents rely more on social networks in their close neighborhood [17]. Several empirical studies in the gerontological literature focus on elderly people ([3-6],[8-9],[16-17],[20-22]). However, these studies lack a younger comparison group – i.e. the neighborhood effects specific to older people can only be identified by comparing their findings to the results reported in the literature.

This paper studies associations between neighborhood composition and amenities with the health and well-being of older urban residents in the greater Berlin area. We used survey data from the Berlin Aging Study II (BASE-II) combined with geo-referenced administrative data on neighborhood composition, OpenStreetMap data on amenities and services, and crime statistics from the Berlin Police. We estimated associations with measures of health (morbidity index, self-reported health, physical and mental health scores) and well-being (general life satisfaction, health satisfaction). Based on our reading of the literature we hypothesized that perceived noise, perceived pollution and crime should be negatively associated with health and well-being, and the associations with well-being and mental health were expected to be larger than for physical health. Furthermore, we expected that access to physicians, hospitals and public transport matter more for older residents, as they are more limited in their mobility than younger residents. Similarly, crime was expected to show stronger associations for elderly people, since fear of crime might limit their mobility more than those of younger residents. Finally, we expected that social capital is associated with better health and well-being, especially of older residents whose social networks outside the neighborhood (e.g. workplace) might be more limited.

The rest of the paper is structured as follows: The following section describes the data and the statistical models used in this analysis. Then, we provide the results for the overall population and both age groups. We discuss the strength and limitations of our analysis, and the final section concludes.

Methods

Study description: The Berlin Aging Study II (BASE-II)

The Berlin Aging Study II is a multidisciplinary prospective cohort study of older individuals living in the Berlin metropolitan area. The study sample consists of at most 2,200 individuals divided into a "young" subsample (600 men and women aged 20 to 35) and an "old" subsample (1,600 men and women aged 60 to 80). The data collection involved a medical anamnesis and examination by the Geriatrics Research Group of the Charite-Universitaetsmedizin Berlin, a survey administered by the SOEP group at DIW BERLIN, and a cognitive and psychological assessment conducted at the MAX-PLANCK-INSTITUTE FOR HUMAN DEVELOPMENT. For further details on the study and the sample see [23].

In this study we used data from the socio-economic module of BASE-II. Participating households answered one household questionnaire as well as one personal questionnaire per household member. The survey took place between September 2012 and January 2013. For a detailed description of the socio-economic module see [24]. We restricted the sample to

individuals residing in the Berlin metropolitan area who completed the socio-economic questionnaire in 2012. The final sample contained information on 1,305 individuals (993 older residents and 312 younger residents).

Outcomes

Our outcomes of interest were measures of well-being and health. Specifically, we used general life satisfaction, health satisfaction, self-assessed health, scores for physical and mental health, and a morbidity index. This index was computed based on participant reported and physician-observed medical diagnoses (supported by additional blood laboratory assessments) of mostly chronic diseases representing the following categories of the Charlson co-morbidity index ([25]): myocardial infarct, congestive heart disease, peripheral vascular disease, cerebrovascular disease, chronic pulmonary disease, connective tissue disease, diabetes, hemiplegia, moderate or severe renal disease, diabetes with end organ damage, any tumor, leukemia, lymphoma and moderate or severe liver disease. Life satisfaction and health satisfaction were measured on an 11-point scale between 0 and 10, where 0 stands for "completely dissatisfied" and 10 represents "completely satisfied". Self-assessed health was rated on a 5-point scale. Respondents were asked to rate their current health status as "very good", "good", "satisfactory", "fair" or "poor". We created a binary variable for individuals in good health status, which takes on the value 1 for the best two categories ("good" and "very good" health status). Our measures of physical and mental health are continuous scores derived from the SF12, a widely used instrument consisting of 12 questions that cover different dimensions of health (for further details see [26]; the related SF36 has e.g. been used in [13]). Descriptive statistics for all outcomes are given in Table 1.As can be inferred from Table 1, younger residents are on average in better health (i.e. higher satisfaction with health, a better physical health score and a higher propensity to report a good health status), whereas older residents score higher on life satisfaction and mental health.

[Insert Table 1 about here]

Neighborhood information in BASE-II

The socio-economic module put a particular focus on perceived neighborhood conditions. For example, participants were asked to what extent they are affected by noise and pollution in their neighborhood.[1] The scale ranges from 1 ("not at all") to 5 ("very strongly"). We operationalized this information by creating a binary variable that takes the value 1 if the respondents stated that they are strongly or very strongly affected, and 0 otherwise. Our variable for *high social support*

[1] These questions were asked in the household questionnaire, i.e. in theory they were answered by the "head of the household".

takes on the value 1 if individuals stated that there is "strong social cohesion" in their neighborhood or that the neighbors "are sometimes talking to each other," and 0 if they reported that the neighbors "barely know each other." Moreover, participants reported how long it takes to access specific services and amenities by foot (e.g. shops, physicians, parks etc.). We used this information to generate three variables – *access to physicians*, *access to shops*, and *access to public transport*. These binary variables take on the value 1 if the respondents stated that they live within 10 minutes walking distance of the particular service.

In addition to these self-reported neighborhood characteristics, the almost exact geo-coordinates of the houses that the BASE-II participants lived in allowed us to combine the BASE-II data with any available geo-referenced information on environmental and neighborhood characteristics. For the purpose of this study we used data on neighborhood composition, distances to amenities, and local crime statistics. We used data from the STATISTICAL OFFICE BERLIN-BRANDENBURG on the age structure (share of children under 15 years and seniors over 65 years in percent) and socio-economic status (measured by the share of welfare recipients) in the neighborhood. In addition, we used data from the OpenStreetMap project (in form of a shapefile provided by the enterprise Geofabrik) to calculate distances to hospitals, physicians and public transport stops (i.e. bus stops, tram stops, subway stations and train stations). Finally, our data on local crime statistics came from the Berlin Police and is measured on the level of the 12 districts.

In all models we included control variables for sex, a quadratic age trend, marital status, years of education, number of children under 14 in the household, and log of equivalized net monthly household income. Descriptive statistics for both individual and neighborhood characteristics are shown in Table 1. As Table 1 shows, older residents are less likely to report having access to amenities, which is partly reflected in (on average) larger distances to these amenities. However, older residents are also less likely to report problems with pollution and noise, and have a higher propensity to report a high level of social support from their neighbors.

Statistical models

We used linear regression models to estimate the effect of neighborhood characteristics on life satisfaction, health satisfaction, physical and mental health, self-rated health and a morbidity index based on most of the categories of the Charlson co-morbidity index. All models include heteroskedasticity-robust standard errors.

We estimated four models for each outcome variable: First, we estimated the overall effects of neighborhood characteristics using the full sample. In a second step, we split the sample by age

and estimated separate models for the young age group (<60 years) and the old subsample (>60 years). This allowed us to compare the influence of each factor across both age groups. To assess the statistical significance of these differences, we also estimate a model in which all neighborhood characteristics are interacted with an indicator for age group. However, these models are less flexible than separate models for younger and older residents, since they impose the assumption that the impact of the individual characteristics is the same across both age groups.

Results

Table 2 shows the results for the full estimation sample. For the sake of brevity, we provide only the estimated coefficients for the neighborhood characteristics. Table 2 shows that there are no appreciable correlations between neighborhood composition and health and well-being. All estimates are almost virtually zero. This finding is consistent with the literature, since most studies have found that, e.g., poverty is not associated with worse health beyond the influence of individual-level income and socio-economic status, which we control for in our models.

In contrast, living in close proximity to public transport is associated with significantly higher well-being and better health status, in particular a significantly lower morbidity index. Surprisingly, we found no significant correlations between crime levels and health or well-being. This result does not change when we distinguish between violent crimes, property crimes and other crimes. High noise levels seem to be correlated with worse mental health, and there is some evidence for a positive association between high social support and well-being and mental health.

All in all, the analysis of the full sample shows that access to public transport and social support show the largest associations with health and well-being for the full sample.

[Insert Table 2 about here]

Our sample also allowed us to advance the literature by comparing younger and older residents in the same metropolitan area. The results for all six outcomes are shown in Figure 1. Here, the dots mark the point estimates for the effect of the covariates on the standardized outcome. The lines provide the 95% confidence interval. Consequently, if the line includes zero (horizontal line), the corresponding effect is not significant on a 5% level. Similarly, if the confidence intervals for the younger and older age group overlap, the difference between these groups is statistically not significant. Additionally, we also assessed the statistical significance by estimating an interacted model as discussed above.

[Insert Figure 1 about here]

We noted that access to public transport is associated with higher well-being for both age groups. The effects for the young sample are very similar in magnitude to those in the old subsample, although they are not statistically significant. This is likely due to the lower statistical power. This effect was found for all outcomes, with the exception of the morbidity index. Here, we noted that access to public transport is associated with a significantly lower morbidity index, but only for older residents. The estimated correlation for younger residents is positive but insignificant. The interacted model shows that, under the assumption that the impact of individual characteristics does not vary with age, having access to a physician is associated with a higher likelihood to report a good health status only for younger residents. This difference is statistically significant on a 5 percent level.

Moreover, we find a negative association for noise with mental health for younger residents. Older residents' mental health is more affected by pollution, however the difference between younger and older residents is statistically not significant which is likely due to the small sample size in both groups. Again, in the less flexible interacted model, these differences in the associations of pollution and noise become significant.

Lastly, high social support has no discernible impact on health and well-being of younger residents, whereas the associations for older residents are consistently positive, and significant in the case of life and health satisfaction. This suggests that social support within the neighborhood is more important for older residents, likely because they have fewer social ties with people outside their neighborhood (e.g. coworkers). However, it should be noted that the difference in the associations between older and younger residents is not statistically significant. While this is likely due to the small sample size, we cannot exclude the possibility that the true associations for older and younger residents are very similar in magnitude. The interacted model shows a significant difference between younger and older residents for health satisfaction and good health status.

We also examined how the associations between health and well-being and amenities vary with the distance to these amenities. The analyses revealed no clear pattern. The detailed results are available in the Online Appendix.

Discussion

Our findings advance the literature in several ways: First of all, our sample allowed us to directly compare the effects on younger and older residents of the same metropolitan area using a single data set. Contrary to our prior hypotheses, we found little differences between the older and younger cohort. The hypothesized difference in the associations with respect to access to public

transport could only be confirmed for the morbidity index, where older residents with access to public transportations were diagnosed with a lower number of comorbidities. There were also significant differences in the associations between perceived noise and pollution and mental health. For example, younger and older residents may have different expectations towards their neighborhood. A noisy neighborhood (e.g. caused by schools and nurseries, traffic or music venues) might be regarded as a sign of a lively neighborhood by younger residents who utilize these resources, whereas they present a nuisance for older residents. In contrast, younger residents might be more worried about pollution, and in particular the effect on their (young) children's health. Clearly, further qualitative research is needed to explore potential pathways for these associations. We also found differences in the associations between social support and several measures of health and well-being. However, these differences were only significant in our interacted model, which imposed the assumption that associations between individual characteristics and health and well-being do not vary with age. This demonstrates one of the caveats of our study, namely that the sample size might not be large enough to detect smaller differences across age groups without assumptions that restrict the flexibility of our statistical models.

Our study further contributes to the literature by including a wide range of neighborhood characteristics, both self-reported and administrative information. In particular, we provided evidence on the positive associations between access to public transport and health and well-being, which has not been studied before. Previous studies [16-17] demonstrated that self-reported neighborhood conditions show stronger associations with mental health than objective measures. This could reflect reverse causality, i.e. individuals with worse health and well-being might simply report worse neighborhood conditions. However, qualitative research [17] also suggests that this could simply reflect the heterogeneity in how residents define their neighborhood. Consequentially, objectively measured conditions in administrative units (e.g. census tracts) might not adequately reflect the conditions in their neighborhood for a majority of the residents. The inclusion of both objectively measured and self-reported conditions can therefore provide stronger evidence than the use of either one of them.

A further concern is that the BASE-II sample is a selective sample, and therefore not necessarily representative for the whole German population. Selectivity analyses ([27]) imply that the BASE-II participants are on average better educated, healthier and have greater well-being. Hence, we would expect that the neighborhood effects in the whole population are even more pronounced, since the literature typically reports larger effects for individuals from disadvantaged backgrounds (see e.g. [10]). Lastly, there is the general problem of selection into neighborhoods. Since we

controlled for a number of individual-level characteristics (e.g. income and employment status), we can exclude the possibility that our results are entirely driven by clustering of households with high income and better education. However, we cannot rule out that individuals with a lower tolerance towards certain characteristics (e.g. noise) move out of affected neighborhoods. In this case our results would be downward-biased.

Conclusion

In this paper, we studied associations between a wide range of neighborhood characteristics and measures of health and well-being using an age heterogenous sample of residents of the Berlin metropolitan area. We estimated the effect of neighborhood composition, access to services and amenities, and environmental characteristics on well-being and measures of physical and mental health. The results indicate that access to public transport, and social support are associated with better health and well-being. We also estimated separate models for older and younger residents, finding that access to public transportation is associated with increased well-being in both groups. However, neighborhood social capital is only associated with better health and well-being for older residents. In contrast, for younger residents noise is associated with worse mental health.

This study contributes to the literature in two ways: *(i)* We estimated the effects of a wide-range of neighborhood characteristics, using data from different sources. For example, we provide evidence for the effect of access to public transport, which has not been studied before in the literature. *(ii)* Our study design allowed us to directly compare results for younger and older residents. Nevertheless, our study is subject to a number of limitations, most importantly the relatively small sample size, selectivity and possible reverse causality. We addressed these concerns by running a number of robustness checks, which confirmed our conclusions.

In summary, we conclude that mobility is an important determinant of well-being regardless of age. Local policy makers should aim to provide sufficient access to public transport, and should also seek to eliminate neighborhood disorder as a barrier to mobility of older residents. Finally, interventions to build up neighborhood social capital (e.g. community centers) might be warranted in residential areas with a high share of senior citizens.

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Table 1: Summary statistics

Variable	All (n=1,305)	Young (n=312)	Old (n=993)	min	max
A. Outcomes					
Life satisfaction	7.54±1.83	7.23±1.84	7.63±1.82	0	10
Health satisfaction	6.83±2.15	7.25±2.00	6.69±2.17	0	10
Physical health (SF12)	48.18±9.68	55.18±6.90	45.98±9.38	14.85	69.16
Mental health (SF12)	50.10±9.97	46.69±10.30	51.16±9.63	13.41	71.25
Good health status (2/5 SAH)	54.25%	71.80%	48.74%	0	1
Morbidity index (n=806)	0.62±1.06	0.04±0.26	0.76±1.12	0	6
B. Individual characteristics					
Age	60.82±16.47	33.27±9.00	69.48±4.18	22.17	87.17
Male	46.97%	50.00%	46.02%	0	1
Marital status	53.18%	23.72%	62.44%	0	1
Years of education	14.45±2.95	15.23±2.64	14.21±3.00	7	18
Number of children living in the household	0.05±0.28	0.22±0.53	0.00±0.03	0	3
Equivalized household income	1875.96±973.76	1895.09±986.24	1869.95±970.23	350.00	10,300.00
C. Neighborhood characteristics					
Share of children in neighborhood (<15 years)	11.88±2.39	12.33±2.63	11.74±2.30	5.30	22.89
Share of seniors in neighborhood (>65 years)	17.06±6.58	13.24±7.04	18.26±5.94	2.23	38.22
Share of welfare recipients in neighborhood	12.15±8.04	14.94±9.53	11.27±7.30	0.76	50.45
Access to physicians	35.10%	52.56%	29.61%	0	1
Access to shops	66.44%	84.30%	60.83%	0	1
Access to public transport	86.67%	96.47%	83.59%	0	1
Distance to physician (100 m)	10.15±10.22	9.07±10.13	10.48±10.23	0.20	68.76
Distance to hospital (100 m)	38.25±22.02	36.27±19.79	38.87±22.65	0.48	121.67
Distance to public transport (100 m)	1.89±1.19	1.70±1.06	1.95±1.22	0.06	10.53
Problems with pollution	4.83%	8.33%	3.73%	0	1
Problems with noise	17.47%	21.47%	16.21%	0	1
Problems with crime	11.88%	13.78%	11.28%	0	1
Crimes per 100,000 residents	4.10±0.14	4.13±0.15	4.09±0.13	3.94	4.41
High social support	85.21%	72.12%	89.33%	0	1

Source: BASE-II, Statistical Office Berlin-Brandenburg, OpenStreetMap, own calculation.

Table 2: Neighborhood effects for the full sample

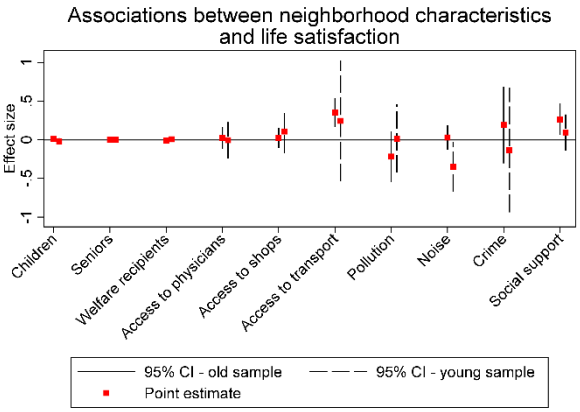
Variable	*Life satisfaction*	*Health satisfaction*	*Physical health*	*Mental health*	*Good health status*	*Morbidity index*
Children	0.01	-0.01	0.02	-0.06	0.99	0.03
	0.03	*0.03*	*0.11*	*0.14*	*0.03*	*0.02*
Seniors	0.01	-0.01	-0.01	-0.01	1.01	0.01
	0.01	*0.01*	*0.05*	*0.05*	*0.01*	*0.01*
Welfare recipients	-0.01	0.00	-0.06 *	0.01	1.00	0.01
	0.01	*0.01*	*0.03*	*0.04*	*0.01*	*0.01*
Access to physicians	0.04	0.22	0.70	0.71	1.22	-0.08
	0.11	*0.14*	*0.53*	*0.60*	*0.16*	*0.08*
Access to shops	0.02	0.11	0.82	0.64	1.15	0.09
	0.11	*0.15*	*0.59*	*0.65*	*0.16*	*0.10*
Access to public transport	0.67 ***	0.38 *	1.86 **	2.04 **	1.82 ***	-0.30 **
	0.17	*0.19*	*0.78*	*0.94*	*0.34*	*0.13*
Problems with pollution	-0.30	-0.26	-2.02 *	0.08	0.65	0.05
	0.24	*0.35*	*1.14*	*1.35*	*0.20*	*0.20*
Problems with noise	-0.13	-0.07	-0.46	-2.56 ***	0.82	-0.04
	0.13	*0.17*	*0.67*	*0.75*	*0.14*	*0.10*
Crimes per capita (log)	0.20	0.35	2.86	1.19	2.12	0.05
	0.39	*0.47*	*1.86*	*2.22*	*1.02*	*0.30*
High social support	0.32 **	0.15	-0.18	1.96 **	0.92	0.07
	0.15	*0.18*	*0.68*	*0.85*	*0.16*	*0.11*
N	1,305	1,305	1,305	1,305	1,305	805
R^2	0.09	0.03	0.23	0.08	-	0.06

Source: BASE-II, Statistical Office Berlin-Brandenburg, OpenStreetMap, Berlin Police, own calculation. Notes: Estimates in columns 1-4 and 6 are derived from a linear regression with robust standard errors. Estimates in column 5 come from a logistic regression with robust standard errors. The coefficients reported in column 5 are odds ratios. All models include controls for a quadratic age trend, marital status, log of household income, number of children and years of education. Standard errors are given in Italics. Significance as follows: ** p<0.1, ** p<0.05, *** p<0.01.*

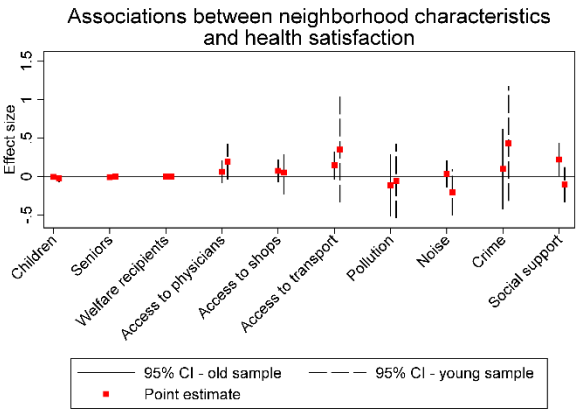
Figure legends

Figure 1

Life satisfaction



B. Health satisfaction



C. Physical health

D. Mental health

E. Good health status

F. Morbidity Index

Source: SOEP-BASE, own calculations. Notes: Figure A.1 shows the results from separate linear regressions on the (standardized) outcome for the younger and older sample. The dots mark the point estimates, the lines provide 95% confidence intervals. All regressions included control variables for sex, a quadratic age trend, marital status, years of education, number of children under 14 in the household, and log of equivalized net monthly household income.