Abstract

100 words

**Questions**

Activity spaces represent the area within which an individual completes their daily activities. The size of an individual’s activity space can inform an understanding of their well-being, but it has limited usefulness as a stand-alone measure of welfare without an understanding of its causes. On the one hand, a person may have a small activity space because their movement is constrained. On the other hand, a small activity space might be the result of their ability to meet all their daily needs without the need for wide-ranging travel.

Destination accessibility offers a useful construct for understanding an individual’s ability to meet their daily needs within particular travel thresholds. A clearer understanding of the relationship between destination accessibility and activity spaces can inform the use of activity spaces as a measure of well-being. If small activity spaces are associated with lower accessibility, this would be consistent with a narrative that low accessibility constrains both travel and activity participation. If smaller activity spaces are associated with higher accessibility, this would be consistent with an alternative narrative that high accessibility allows for a wide range of activity participation without the need for wide-ranging travel. This study seeks to address the question of whether there is a positive or negative relationship between the destination accessibility of individuals’ home and and the areas of their activity spaces.

**Methods**

This study draws on data that was collected ….. (describe survey methodology).

For purposes of this study, an individual’s activity space was defined as (describe method for calculating activity space).

The average activity space for weekday travel was 17.24 square kilometers, and the standard deviation was 183.23 square kilometers. The average activity space for weekend travel was 34.31 square kilometers with a standard deviation of 203.04 square kilometers. One individual’s weekday activity space and three individuals weekend activity spaces were more than eight standard deviations from the mean. These were removed from the sample, resulting an average activity space of 7.9 square kilometers with a standard deviation of 25 square kilometers for weekdays and an average activity space of 17. 01 square kilometers with a standard deviation of 49.8 square kilometers for weekends.

To calculate destination accessibility, we drew on parcel-level land-use data for the province of Granada (describe dataset). We classified parcel land uses into four categories: leisure (retail, restaurants, and indoor culture and recreation), other services (including ….), outdoor recreation (including ….), and residential. The size of the land use at each location was taken as the gross floor area for leisure and other services, as the total land area for outdoor recreation, and as the estimated population for residential uses, where the population of a parcel was calculated as shown in Equation 1.

[insert equation]

We used the r5r package to calculate eight different accessibility metrics for the home location of each survey respondent: Accessibility by car for each of the four destination types and accessibility without a car (e.g. by walking and transit) for each of the four destination types. Accessibility was calculated using a logistic decay function with a median….

The correlations among the four access by car metrics were greater than 0.94, as were the correlations among the four access-without-a-car metrics. Each of these metrics were standardized to have a mean of zero and standard deviation of one, and then averaged within the categories of car or no-car to obtain overall access by car and access without a car metrics.

We estimated an ordinary-least squares linear regression model predicting the log-transformed area of the activity space for both the weekday and the weekend. Table 1 shows the independent variables included in the two models with some descriptive statistics. As Table 1 shows, some observations were removed from the sample due to missing values for car ownership, income, and employment status. The final sample included 327 individuals.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable name** | **Description** | **Mean or proportion** | **Standard deviation** | **Effect on sample (number of observations removed due to missingness)** |
| No vehicles | Respondent lives in a zero-vehicle household | 28% | NA | 12 |
| Access by car | Number of standard deviations from the mean accessibility by car at the respondent’s home | 0.00 | 0.95 | 0 |
| Car-free access | Number of standard deviations from the mean accessibility by transit and/or walking at the respondent’s home | -0.02 | 0.98 | 0 |
| Access by car : no vehicles | Interaction between *Access by car* and *No vehicles* | NA | NA | 0 |
| Car-free access : no vehicles | Interaction between *Car-free access* and *No vehicles* | NA | NA | 0 |
| *Work status* |  |  |  | 2 |
| Not in labor force | Not in a category below | 27% | NA |  |
| Student | Respondent is a student | 13% | NA |  |
| Unemployed | Seeking work | 11% | NA |  |
| Part-time | Employed part time | 11% | NA |  |
| Full-time | Employed full time or self-employed | 37% | NA |  |
| Female | Identifies as female | 53% | NA | 0 |
| Lives with children | Lives with children | 31% | NA | 0 |
| Lives with spouse/partner | Lives with spouse/partner | 46% | NA | 0 |
| Lives with parent(s) | Lives with own parent(s) | 13% | NA | 0 |
| *Household Income* |  |  |  | 35 |
| Low income | Less than 1,100 Euros per month | 24% | NA |  |
| Low middle | Between 1,100 and 1,800 Euros per month | 26% | NA |  |
| Middle income | Between 1,801 and 2,700 Euros per month | 28% | NA |  |
| High middle income | Between 2,701 and 3,900 Euros per month | 14% | NA |  |
| High income | Greater than 3,900 Euros per month | 8% | NA |  |

**Findings**

Table 2 shows the results of the regression models for the areas of weekday and weekend activity spaces.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Weekday activity-space area (log-transformed)** | | | | | **Weekend activity space area (log-transformed)** | | |
| R2 = 0.19 | | | | | R2 = 0.13 | | |
| Estimate | | Standard Error | | p-value | Estimate | Standard Error | p-value |
| Intercept | **0.98** | | **0.20** | | **< 0.001** | **1.49** | **0.28** | **< 0.001** |
| No vehicles | **-0.39** | | **0.17** | | **0.021** | **-0.53** | **0.23** | **0.021** |
| Access by car | -0.10 | | 0.08 | | 0.179 | -0.00 | 0.10 | 0.986 |
| Car-free access | **-0.29** | | **0.08** | | **0.001** | -0.11 | 0.11 | 0.336 |
| Access by car : no vehicles | 0.28 | | 0.28 | | 0.327 | 0.07 | 0.39 | 0.858 |
| Car-free access : no vehicles | 0.18 | | 0.17 | | 0.290 | 0.20 | 0.24 | 0.398 |
| *Work status (relative to not in labor force)* | | | | | | | | |
| Student | 0.15 | | 0.23 | | 0.522 | 0.19 | 0.32 | 0.546 |
| Unemployed | 0.45 | | 0.25 | | 0.071 | 0.50 | 0.34 | 0.146 |
| Part-time | 0.25 | | 0.23 | | 0.285 | **0.86** | **0.32** | **0.0086** |
| Full-time | **0.47** | | **0.17** | | **0.007** | **0.85** | **0.24** | **< 0.001** |
| Female | -0.23 | | 0.13 | | 0.069 | 0.17 | 0.18 | 0.325 |
| Lives with children | 0.02 | | 0.16 | | 0.891 | **-0.78** | **0.22** | **< 0.001** |
| Lives with spouse/partner | 0.01 | | 0.16 | | 0.972 | -0.13 | 0.22 | 0.562 |
| Lives with parent(s) | -0.32 | | 0.23 | | 0.168 | -0.49 | 0.31 | 0.122 |
| *Household income (relative to middle income)* | | | | | | | | |
| Low income | -0.36 | 0.20 | | 0.076 | | **-0.80** | **0.28** | **0.005** |
| Low middle income | -0.25 | 0.17 | | 0.145 | | **-0.49** | **0.24** | **0.038** |
| High middle income | 0.05 | 0.21 | | 0.798 | | **-0.68** | **0.29** | **0.019** |
| High income | 0.18 | 0.26 | | 0.475 | | **-0.87** | **0.35** | **0.014** |
| Note: **Bold text** indicates 95% confidence, gray text indicates less than 90% confidence. | | | | | | | | |

As shown, household vehicle availability is associated with a larger activity space for both weekday and (to an even greater extent) weekend travel. Being employed full-time is likewise associated with a larger activity space on both weekends and weekdays, with a larger effect on weekend travel than on weekday travel. Greater accessibility by non-car modes is associated with smaller weekday activity spaces, and accessibility by car modes has no significant relationship. These relationships (or absence of a relationship) seem to hold regardless of whether the individual lives in a household with or without a car. Accessibility does not have a significant relationship with weekend activity spaces.

Other research has shown that women tend to have shorter commutes than men (cite), but gender does not have a relationship with activity space area on weekdays (except at 90% confidence) or on weekends.