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**Local population income, geographic space and interactions predict increased presence of physical activity facilities in NYC metro census tracts, 1990-2010**

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Introduction:

Physical activity is associated with improved health and is supported, in part, by the presence of facilities that provide space and equipment to pursue a variety of physical activities. We sought to identify socio-geographic characteristics predicting commercial physical activity facility pervasiveness over time. A longitudinal examination of physical activity facility presence with respect to population characteristics, geographic features, and their interactions can inform our response to disparities in access to public and private physical activity venues.

Methods:

We used data from the National Establishment Time-Series (NETS), a longitudinal database of U.S. businesses, focusing on 23 counties in the New York City metropolitan area and on decennial intervals for which population census data were also available (1990, 2000, 2010). Commercial physical activity facilities (e.g., gyms, tennis courts, martial arts studios) were defined based on Standard Industrial Classification (SIC) codes and name searches. Facility counts were aggregated to 2010 census tract boundaries and linked to local population characteristics. Comparisons across decennial intervals were used to define increasing count of physical activity facilities and shifting population demographics. Associations were evaluated using lasso logistic regression to estimate relationships with model shrinkage and variable subset selection through 10-fold cross-validation for minimization of test set model deviance.

Results:

Among the 4028 census tracts in the 23 county metropolitan area, the number of census tracts with at least one physical activity facility increased over time (1990=1172, 2000=2295, 2010=2365). Greater tract-level median income, larger land area, and higher previous total physical activity facilities were positively associated with greater odds for local increase in physical activity facilities (OR=1.27 per SD median income; OR=1.30 per SD land area; OR=1.14 per SD lagged facility count). Inclusion of two-way interaction terms increased estimates for McFadden’s pseudo R2 from the main effect model’s value of 0.30 to 0.33, suggesting explanation of an additional 3% of the variation in facility count increase. Subset selection through lasso to minimize cross-validation error resulted in retention of 11 of 21 possible two-way predictor interactions. The association of increased median income with increased physical activity facility count was stronger in geographically larger census tracts (interaction OR=1.05); a similar interaction was seen for increased number of tract residents with larger census tracts (interaction OR=1.05).

Conclusion:

Local population, geographic, and business environment characteristics are associated with change in availability of physical activity facilities. Inclusion of interaction terms improved prediction.