

## **II.F. Statistical Analysis of Madison vs. Midwest Cities**

Case studies have been carried out on Lincoln NE, Des Moines IA, Austin TX, and Milwaukee WI comparing their geography, economics, and demographics. Yet, no research has been done to get an overall comparison of Midwestern and US cities to Madison. Two statistical studies will be done in order to understand how far from the norm Madison sits with no public pools.

When researching public pools and Madison's current policy situation, its geographical region should be looked at first. The cities of the Midwest are very similar when it comes to climate. The region's temperate climate brings cold winters and warm summers. The outdoor pool season is almost always the 3 months of June, July, and August. The climatic variable thus should be a controlled factor in our analysis and allow us to critically compare Madison to other cities in the Midwest. One main factor has to be city population and the number of people a pool needs for business. The population of the city ideally should be the main dictator of total pool space and number of public pools. Other possible factors such as geography, economics, and demographics in this analysis are held constant. In the regression model of randomly sampled mid-size Upper-Midwest cities (Table 1), there is a positive correlation between public pool numbers and population. The correlation is not strong ( $r=.6$ ) but indicates that an increase in population often increases the number of public pools. The average number of pools per city was 4.0901 pools and the average city in the study contains a population of 154,320 people (a lower population than Madison which has 208,054 people). According to the regression equation, Madison should have approximately 5 pools. The lowest number of pools in any city other than Madison was 2 pools in Lansing, MI (pop. 119,128) and the

highest number was 8 in Sioux Falls, SD (pop. 123,975). To see if the number of public pools in Madison is significantly lower than the rest of the cities, a 2-tailed hypothesis T-test was ran on the data. (Hypotheses and calculations shown on the previous pages). The test shows that the difference between the average number of pools of Upper-Midwestern cities and Madison is statistically significant and the chance of this happening by random variation is .01513%. Therefore the null hypothesis was rejected. The number of public pools in Madison is significantly different (or in this case less) than other cities in the Midwest.

#### Statistical Analysis: Madison vs. US Cities of Population Equivalence

By looking regionally and trying to hold constant temperature (like we did in Table 1), insight was gained into how Madison's number of pools compares to other locales in the immediate geographical area of the Upper Midwest. In this comparison however, the cities ranged from 67,158 (Champagne, IL) to 287,151 people (St. Paul, MN), a difference of 219,993. The correlation between public pools and population was positive but the relationship was not that strong. We as a policy group feel however that population does play a strong role in the number of public pools a city runs. Instead of focusing on cities of population equivalence in the Upper-Midwest which we could have tested, a comparison was run on the whole country. We sampled the 10 cities closest in population to Madison (which we could find pool information) and then statistically analyzed the results. Holding population constant in the data, the average number of public pools was 4.8181. The average was slightly higher than Upper-Midwestern cities (4.0901) because of southern cities with large numbers of pools (Greensboro, Shreveport, Glendale) and the huge number of pools in Lincoln (11 pools). To see if the number of

public pools in Madison is significantly lower than other cities of near population equivalence in the US, a 2-tailed hypothesis T-Test was ran on the data. The test shows that the difference between the average number of pools for a city around 210,000 people and Madison is statistically significant and the chance of this happening by random variation is .02526%. Therefore the null hypothesis was rejected. The number of public pools in Madison is significantly different (or in this case less) than other cities in the Midwest.