

Barriers to Diabetes Prevention:

Does Bus Frequency Impact Program Attendance and Success in New Haven, CT?

Cartographer: Liz Marsh UEP 232 Fall 2018



New Haven Farms

New Haven Farms runs a Diabetes Prevention Program each summer on an urban farm in the neighborhood of Fair Haven, in the city of New Haven, CT. The 16-week lifestyle intervention, based off the materials developed by the CDC, was shown in clinical trials to be more effective than the leading drug, metformin, in preventing the onset of diabetes among patients diagnosed with prediabetes or with diabetes risk factors such as overweight, obesity or high cholesterol. New Haven Farms has shown that for every additional session a patient attends, they will lose more weight and thus be more likely to prevent the onset of diabetes. Patients are low-income and mostly Latino, and mostly speak Spanish, with a various range of abilities to speak English. Most patients are mothers, with young children and many have jobs that conflict with the time of the program, weekdays from 5:30pm to 7:30pm. An additional barrier that patients may face is difficulty of transport. The city of New Haven has some bus lines but not all run frequently.

Spatial Question

Do patients who have access to high frequency bus lines complete or enroll in the program at different rates than patients who live close to low frequency bus lines or bus lines that do not run at 7:30pm, when they would be leaving the program?

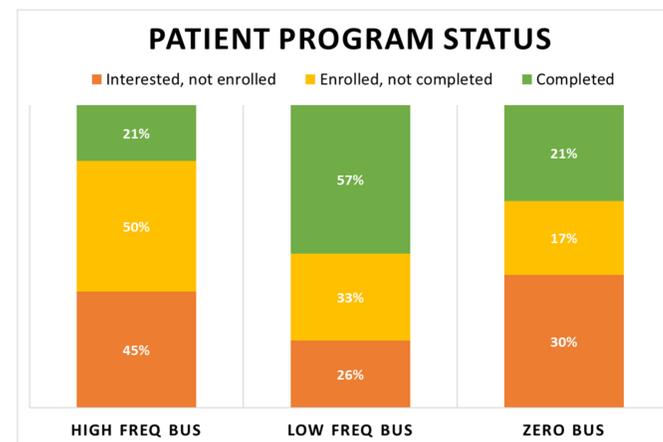
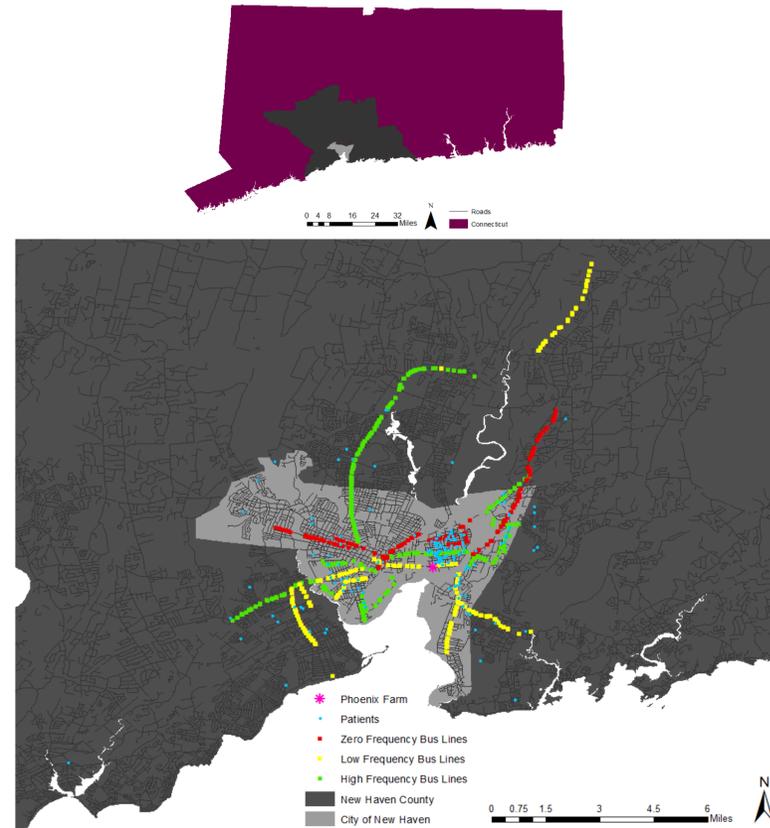
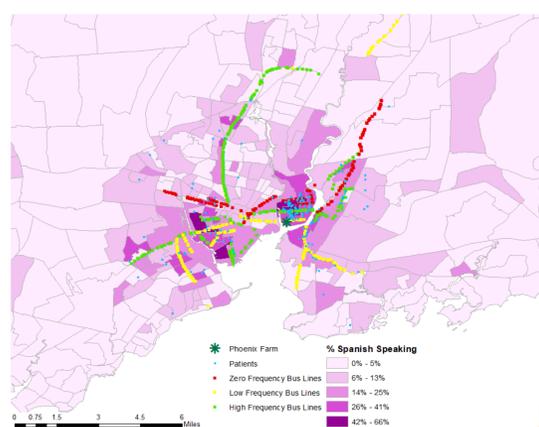
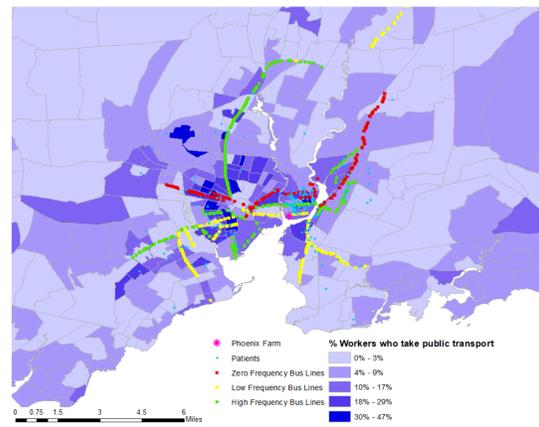
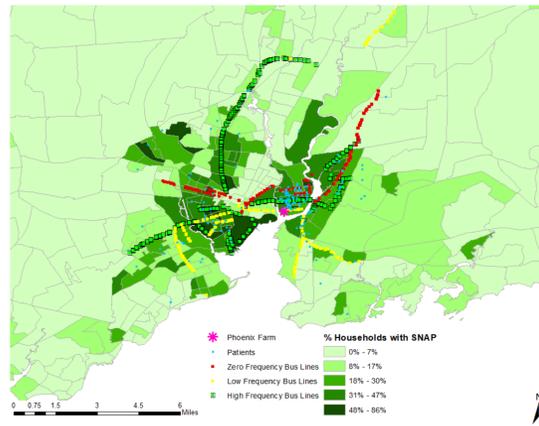
Methodology

Analysis of bus route frequency was done by obtaining bus stop data through CT Open Data. Bus times were not included in the data, and had to be accessed through CTtransit, by looking at schedules for the most common bus routes that would get patients to and from the program. Buses ran more frequently around the program start time (5:30pm) than around the program end time (7:30pm), so bus frequencies were determined by the frequency of buses at 7:30pm and after, as this was the limiting factor in bus times. Bus lines that ran at 30 minute intervals or less were categorized as High Frequency, bus lines that ran greater than 30 minute intervals at 7:30pm or later were categorized as Low Frequency and bus lines that did not run at all at 7:30pm from the program area were categorized as Zero Frequency. Relevant bus lines were plotted and color coded. De-identified patient addresses, shared from New Haven Farms, were geocoded to TIGER street files. Patients were put into three categories: those who said they were interested in joining the program but did not enroll, patients who enrolled but did not complete the program, and patients who completed the program.

To determine numbers of patients in each category and which frequency bus routes were closest to them, first high frequency bus lines were selected, using Select by attribute, then patients who lived within .25 miles of that line were counted. The same process was performed for each of the bus frequencies: High, Low, and Zero. This resulted in a table that could be analyzed.

Patient Status	High freq bus	Low freq bus	Zero freq bus
Interested but not enrolled(1)	69	40	46
Enrolled but not completed (2)	12	8	4
Completed(3)	3	8	3
Total	84	56	53

To analyze the table, an initial Chi-squared analysis was run. This resulted in a χ^2 value of 7.8395 and a p-value of 0.098. If we are testing our hypothesis at a $p < .05$ level, there is not enough evidence that the categories are dependent upon each other, so these results do not show that there is any significant difference between patient status and bus frequency. A key assumption for χ^2 analysis is that each cell value be 5 or greater. Some of the cells had less than 5 patients, so a Fisher's exact test was run on the data. This resulted in a p-value of .117, which confirms our results from the χ^2 analysis that there is no significant association between groups.



Results

The results of both the chi-squared and Fisher's exact tests indicate that there is no significant difference between groups. The sample size is very small however and with more data, perhaps from other years, we might be able to learn more information about to what extent bus access is a barrier to program participation. The table yields the patient status stacked bar chart, which shows an interesting trend difference between patient status groups. The highest percentage of participants completing the program were those who had low frequency bus access. The lowest percent of participants who completed the program were those who had high frequency bus access. There was a high percentage of patients who were interested but did not enroll among those who had high frequency bus access (45%) and those who had zero frequency bus access (30%). One essential variable missing in this analysis is patients who own a car, have access to a car, and whether or not they use a car, walk or take the bus to get to the program. By looking at the purple map of percent workers who take public transport, we see the areas that have high bus use are close to all 3 categories of bus lines, although bus use is concentrated close to the city center, and decreases further from the city center.

Further nuance about potential barriers to program participation may be gleaned through the other two maps. The green map shows the percentage of households with SNAP and the scale goes from 0% to a highest category of 48% to 86%. In order to qualify for SNAP, households must have an annual gross income within 185% of the Federal poverty line. In Connecticut, this translates to a monthly income of \$3,793 for a family of 4 (\$45,516 annually) or less. Households that use SNAP also indicate that they may benefit from the New Haven Farms program, which in addition to nutritional education, gives each family enough vegetables for a family of 4, each week for 16 weeks during the summer, and provides additional assistance in the winter months. We see that patients (blue dots) are clustered close to Phoenix Farm and close to the city center, these addresses also correspond to some of the neighborhoods with the highest rates of SNAP (48%-86%). The pink map shows the percentage of New Haven area residents who speak Spanish by block group. The highest areas of concentration for Spanish speakers corresponds with the program participants, because for this particular program, the instruction is given all in Spanish. Spanish language, we see corresponds somewhat with areas of high percentages of SNAP. Understanding bus access for Spanish speakers is important because there are limited services offered in Spanish and thus it is important that people who need them can access them.

Lastly, this analysis fails to include an analysis of people who walk to the program. The blue dots of patients show that many live close to the farm and thus can potentially walk. However, living close to the farm does not necessarily mean people will walk, because people may perceive their neighborhood to be too dangerous to walk at night or that it is too much effort to walk with young children. Bus access may remain a considerable barrier to patients ability to attend the program, however, more research is needed.

Conclusion

The analysis here with a small sample size indicates that there may merit more research into the impact of the frequency of buses on residents of New Haven's ability to attend health programs and more broadly move around the city. Given that there are high rates of poverty in New Haven, as proxied through the SNAP map and high rates of immigrant status, lack of bus access is an equity issue and should be investigated further, so that all New Haven residents can have a fair chance at improving their health.

Data Sources

Patient and garden addresses from New Haven Farms, Inc.
 CT Transit New Haven Bus Stops from CTtransit
<https://catalog.data.gov/dataset/ct-transit-new-haven-bus-stops>

U.S. Census Bureau. (2012). 2009-2011 American Community Survey. ESRI DataMaps 10. Accessed through Tufts Data Lab.

References

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Santilli, A., & O'Connor Duffany, K. (2017). The State of Hunger in New Haven. CARE. Accessed from: https://publichealth.yale.edu/care/resources/Hunger_10272017_319495_284_11205_v3.pdf

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