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The Illinois Institute for Rural Affairs (IIRA) works to improve the quality of life for rural residents by partnering with public and private agencies on local development and enhancement efforts.



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# **Restaurant Inspections in Illinois: A Control Theory Analysis**

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## **Abstract**

Market-regulation is often imposed on industries that generate substantial external costs; restaurants are responsible for majority of foodborne illness in the nation. Data on restaurant inspections for the years 2020, 2021, and January 1, 2022 – May 10, 2022, were processed to gain insights into firm behavior. An analysis of 23,683 cases reveals that 56% of the inspections reported illness-risk-factor violations and retail-practices violations; only 15% of the inspections had no violations.

## **Introduction**

According to the CDC, each year approximately 16% of the nation's population succumb to foodborne illness<sup>2</sup>; restaurants are responsible for a majority of these cases<sup>3</sup>. To prevent such incidents, Illinois restaurants are inspected at least once a year and are required to display a summary of their health inspection results in a visible place for patrons to see<sup>4</sup>.

How do restaurants in Illinois score on health assessments? Do the frequency or the number of health assessments differ among

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<sup>2</sup> See, <https://wwwn.cdc.gov/norsdashboard/>.

<sup>3</sup> Firestone, M. et al (2020). Can aggregated restaurant inspection data help us understand why individual foodborne illness outbreaks occur? *Journal of food protection*, 83(5), 788-793.

<sup>4</sup> For legislation, see

<https://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1578&ChapAct=410%C2%A00ILCS%C2%A0625/&ChapterID=35&ChapterName=PUBLIC%20HEALTH&ActName=Food%20Handling%20Regulation%20Enforcement%20Act>.

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restaurants catering to different types of markets, for example, market size and household income? Are restaurant inspection scores correlated with restaurants' social media ratings? This paper addresses these and other related questions.

## Theory and Hypotheses

### Business Regulation

In business, the concept of 'control' refers to the process of setting standards, monitoring implementation, and taking corrective action on deviations from expectations<sup>5</sup>. The argument for government control or regulation of firms is based on the notion that there is public demand for the correction of inefficient and inequitable market practices of firms<sup>6</sup>. There are at least two premises for this argument: (i) that economic markets will operate inefficiently and inequitably if left alone and (ii) that government regulation is costless.

A theorem that follows from the argument is that market-regulation could be found in industries that generate substantial external costs; for example, restaurants may harbor the bacterium *Listeria monocytogenes* which is a major cause of foodborne illness and hospitalizations<sup>7</sup>. The argument also implies that large population centers would be more concerned about market practices of firms and thus, for example, would inspect a greater number of restaurants.

Table 1 lists the elements of a regulatory control system<sup>8</sup>. The *substantive rules* list the conduct, firm behavior, that is to be punished (Table 2). The substantive rules are supported by *remedial rules*, which specify the sanctions for violations of substantive rules. Both of these rules are administered by a *controller*, for example, Illinois Department of Public Health, for restaurants in the state.

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<sup>5</sup> Cybernetic is the common approach to study self-regulating systems; see, Galbraith, J. (1977). *Organizational Design*. Reading, MS: Addison-Wesley Publishing Company.

<sup>6</sup> It is often assumed that public interest is the reason for government regulation of industries; see, for example, Friendly, H. J. (2014). The federal administrative agencies. In, *The Federal*

*Administrative Agencies*. Harvard University Press.

<sup>7</sup>Prewitt, M. (2001). Feds. to test inspection program at Chicago Restaurants, *Nation's Restaurant News*, May 21, 312.

<sup>8</sup> Adapted from, Ellickson, R. C. (1987). A critique of economic and sociological theories of social control. *Journal of Legal Studies*, 16(January), 67-99.

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**Table 1: Elements of a Regulatory Control System**

Element	Definition
Controller	Agency with legally granted authority to enforce the rules of control.
Substantive rules	Acts and regulations that establish prescribed behaviors.
Remedial rules	Guidelines for supporting the substantive rules, for example, inspect firms and apply sanctions.

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From a firm’s viewpoint, response to regulation is not because of economic benefits of compliance, but the need to be law-abiding<sup>9</sup>. To this explanation, I add another reason for compliance: regulation in the form of inspections will help firms to optimize their business process. This assertion is based on the behavioral theory of the firm<sup>10</sup> which states that it is improbable for managers to engage in global optimization of business processes. Rather, managers will focus their attention only on elements of business processes that appear to be most important during regulatory inspections. As applied to restaurants, an inspection that finds

problems in the production process such as cooking temperature may influence the restaurant management to pay greater attention to the cooking practices. Since any of the 58 elements, substantive rules, could be found wanting, and subsequently the business process optimized, I expect violations to be uniformly distributed in the industry.

Table 2 lists examples of assessment criteria, or substantive rules; food establishments are assessed on two facets: for foodborne illness risk factors and business practices such as employee training.

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<sup>9</sup> Thornton, D., Gunningham, N. A., and Kagan, R. A. (2005) “General Deterrence and Corporate Environmental Behavior,” *Law & Policy* 27: 262–88.

<sup>10</sup> Cyert, R., and March, J. G. (1963) *A Behavioral Theory of the Firm*. Englewood Cliffs, N.J.: Prentice-Hall.

**Table 2: Food Establishment Inspection Criteria<sup>11</sup>**

Criteria	Value Labels for Score
<p><b>Illness Risk Factors:</b></p> <ul style="list-style-type: none"> <li>i. Food contact surfaces, cleaned</li> <li>ii. Proper cooking temperatures</li> <li>iii. Pasteurized foods used</li> <li>iv. Food additives: properly used</li> <li>v. Food obtained from approved source</li> </ul> <p><b>Good Retail Practices:</b></p> <ul style="list-style-type: none"> <li>i. Water and ice from approved source;</li> <li>ii. Approved food thawing methods used;</li> <li>iii. Food properly labeled;</li> <li>iv. Insects, rodents, and animals not present;</li> <li>v. In-use utensils; properly stored;</li> </ul>	<p>Pass = in compliance;            Fail = not in compliance, and            Pass, with conditions = corrected on-site during inspection.</p>

In summary, the discussion about business regulation suggests the following hypotheses:

**H<sub>1</sub>:** More the number of people in a region, more will be the government control of firms.

**H<sub>2</sub>:** Violations of substantive rules among firms will be uniformly distributed.

Should a restaurant inspection score covary with the restaurant’s Google star rating? Yes, but only at a low-to-moderate level; the argument for this conclusion is given next.

Judges’ Impressions of a Common Target, Restaurant

Do regulators and consumers agree with one another in their impressions of the firms that they evaluate? Judges are prone to leniency and halo biases hence exact consensus is rare<sup>12</sup>. The factors that determine consensus include<sup>13</sup>: *acquaintance* – the amount of information to which the judge is exposed; *overlap* – the extent to which the judges observe the same set of actions; *shared meaning systems* – whether judges label the behavior or action in a similar manner, and *extraneous information* – assessments based on other, “external criteria”. In the case of restaurants, health inspectors rate the firm based on two

<sup>11</sup> In all, 58 items are scored; only a handful of them are shown here; see, <https://dph.illinois.gov/topics-services/food-safety/retail-food.html>.

<sup>12</sup> Consensus does not imply accuracy; for example, both the health inspector and a diner may agree that the restaurant will win the best-in-the-world award, but the restaurant is unlikely to win that prize.

<sup>13</sup> Adapted from Brinberg, D., and Jaccard, J. (1989). *Dyadic Decision Making*. New York: Springer-Verlag.

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facets: illness risk and good retail practices (Table 2). In contrast, restaurant customers can award Google star ratings based on either their transaction-specific satisfaction or overall attitude towards the restaurant. These differences between judges suggest that their:

*H3*: Judgments will exhibit low correlations; a maximum of  $r = 0.3$ <sup>14</sup>.

## Methodology

Data on restaurant inspections for the years 2020, 2021, and January 1, 2022 – May 10, 2022, were obtained from the Chicago Department of Public Health’s Food Protection Program<sup>15</sup>. The dataset contained 23,683 cases. Table 3 lists the variables used in data analysis.

The geocoded location variables of the restaurants were used to classify each restaurant into one of the 866 US Census Tracts. Demographics of the Census tracts were obtained from the ACS, 2016-2020 data<sup>16</sup>.

To gain insights into variability of “inspection outcomes” across census tracts, the nominal variable, “outcome”, was recoded as follows: 1 = Fail; 2 = Pass with conditions, and 3 = Pass. This recoded, interval-level variable (outcome score) was regressed against three demographic predictors: population, education, and median income. In addition, zero-order correlation was computed between restaurant inspection or outcome scores and Google star ratings; a random sample of 30 restaurants operating as at May 16, 2022, were subjected to the correlational analysis<sup>17</sup>. Finally, a Chi-square goodness-of-fit test was performed to verify the presence of uniform distribution in violations, see Table 1, substantive-rules.

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<sup>14</sup> In other words, it is hypothesized that the restaurant inspection scores would explain at least 10% of the variance in Google star ratings.

<sup>15</sup> <https://data.cityofchicago.org/Health-Human-Services/Food-Inspections/4ijn-s7e5/data>. Nonmetro restaurant inspection data were either not available for download or lacking in details such as geolocation codes, violations and

remedies, etc. See, for example, <https://www.pikecountyil.org/health-department/restaurant-inspection-scores/>

<sup>16</sup> <https://www.census.gov/programs-surveys/acs/data.html>.

<sup>17</sup> Our interest is on estimating the magnitude of the relation between the variables; a random sample of restaurants would serve the purpose.

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**Table 3: Variables and their Definitions**

<b>Variable</b>	<b>Operational Definition (all variables measured at the census-tract level)</b>
Geocode	Geographical coordinates of restaurants, latitude and longitude.
Number of inspections	Total number of inspections during 2020, 2021, and 2022; approximately 29 months.
Outcome (Categorical)	Fail; Pass; Pass with conditions.
Outcome score	Fail = 1; Pass with conditions = 2; Pass = 3.
Population	Number of residents.
Education	Proportion of the population in each of these categories: less than 9 <sup>th</sup> grade, 9 <sup>th</sup> grade to 12 <sup>th</sup> grade, high school graduate, some college, Associate degree, Bachelor degree, Graduate degree or higher.
Income	Household median income.
Race	White, African American, American Indian / Alaska Native, and Asian.

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## Results and Discussion

On average, 17 restaurant inspections were conducted during the 28 months in each of the 735 census tracts (Figure 1). Proportionally, 56% of the inspections

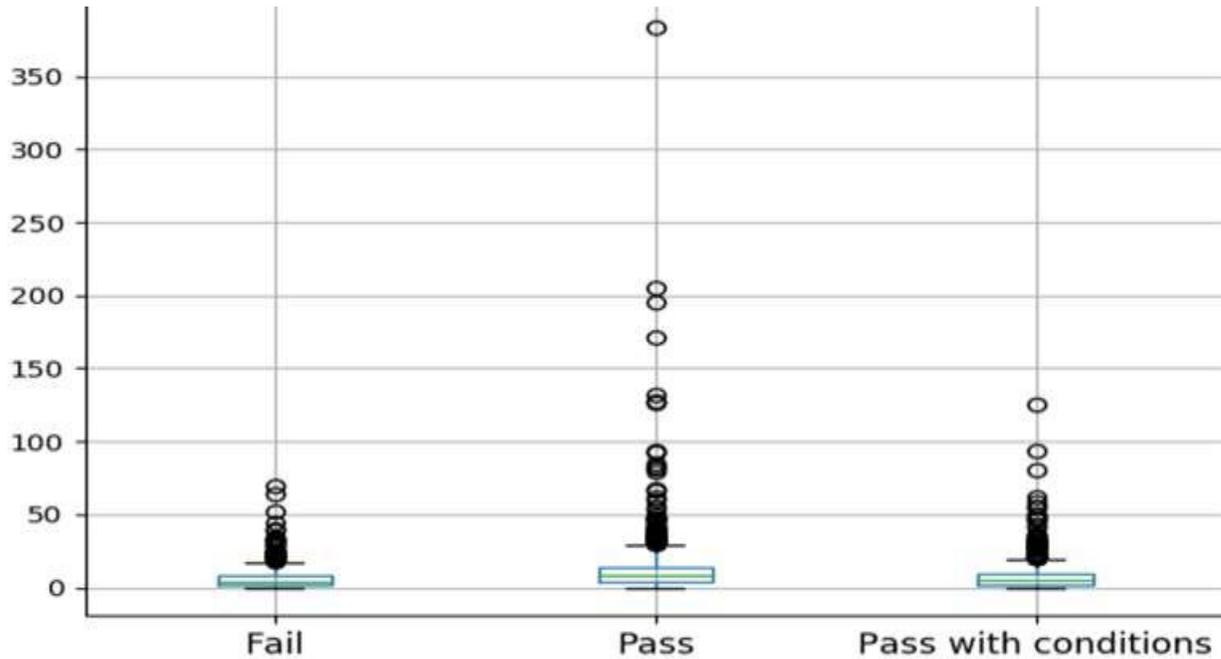
revealed both illness-risk-factor violations and retail-practices violations; only 15% of the inspections reported no violations (Table 4).

**Table 4: Substantive Rule Violations (N = 19464 Inspections)**

		Illness Risk Factor Violations	
		Yes	No
Retail Practices Violations	Yes	10,918 (56%)	5,071 (26%)
	No	590 (3%)	2,885 (15%)

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**Figure 1: Five-Number Summary with Census Tract (CT) Labels for Outliers**



**Five-Number Statistics**

	Fail	Pass	Pass with conditions
Min	0	0	0
Q1	2	4	2
Median	4	8	5
Q3	8	14	9
Max	69 (CT8391)	383 (CT633.03)	125 (CT8309)

**Note:** See Appendix 1 for the location of the outliers on Chicago's Census Tract Map.

Earlier, I theorized that inspection numbers will covary with market characteristics. Of the three predictors, market characteristics measures employed in the regression, population or market size was positively associated with the criterion variable and was the only variable with a statistically significant association with the

dependent variable. College education was highly correlated with income ( $r = 0.53$ ;  $t = 17.43$ ;  $p < .001$ ), so to avoid collinearity problems in model estimation only income was used in the regression analysis. Table 5 shows the results of the regression analysis.

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**Table 5: Determinants of Restaurant Inspections**

ANOVA				
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Regression	2	550683.7	275341.8	34.90222
Residual	732	5774710	7888.948	
Total	734	6325394		

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	5.533197	7.280787	0.759972	0.447516
Population	0.015447	0.001849	8.35322	3.32E-16
Income	-3.8E-08	5.09E-08	-0.7411	0.458868

Hypothesis 2 predicts a uniform distribution of violations. The data didn't support this prediction; there were very little violations concerning employee hygiene such as "no discharge from eyes, nose, and mouth", but large

number of incidents related to "preventing contamination by hands" and keeping food and non-food contact surfaces clean (Table 6).

**Table 6: Violations: Types, Frequency, and Goodness-of-Fit Tests**

Type of Violation	Behavioral Example	Number of Violations
<b>Foodborne Illness Risk</b>		
<b>Factor</b>		
- Supervision	Person in charge present	1,883
- Employee Health	Procedures for responding to vomiting events	4,300
- Good Hygienic Practices	No discharge from eyes, nose, and mouth	9
- Preventing Contamination by Hands	Hands clean and properly washed	8,783
- Approved Source	Food obtained from approved source	1,266
- Protection from Contamination	Food separated and protected	1,550
- Temperature Control for Safety	Proper hot holding temperatures	2,388
- Highly Susceptible Populations	Pasteurized foods used	5
- Food Additives	Approved and properly used	82
- Conformance with Approved Procedures	Compliance with specialized process	137
-		
<b>Good Retail Practices</b>		
- Safe Food and Water	Water from approved source	131
- Food Temperature Control	Approved thawing methods used	2,309
- Food Identification	Food properly labeled	2,564
- Prevention of Food Contamination	Washing fruits and vegetables	5,627
- Proper Use of Utensils	In-use utensils properly stored	1,857
- Utensils, Equipment and Vending	Ware-washing facilities: installed and maintained	9,024
- Physical Facilities	Hot and cold water available	12,885
- Employee Training	Allergen training	5,232

**Note:** The hypothesis, that the observations fit a uniform distribution, was rejected;  $\chi^2 = 58,333$ .  $p < .001$

Finally, health inspectors and consumers do not agree on evaluations. The correlation between the (health

inspection) outcome scores and the Google star ratings was null:  $r = -.10$ ;  $t =$

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-0.55;  $p > .05$ . Appendix 2 provides the data used in the analysis.

## Summary and Conclusion

This paper addresses three questions about restaurant inspections in Illinois:

**Q1:** How do restaurants in Illinois score on health assessment?

Poorly; a majority of the 19,464 health inspections (56%) reported hygiene and retail-practices violations.

**Q2:** Do the frequency or the number of health assessments differ among restaurants catering to different types of markets, for example, market size and household income?

Yes; population or market size is positively associated with the criterion variable, number of health inspections. Household income at the census tract level is not a determinant of health inspections.

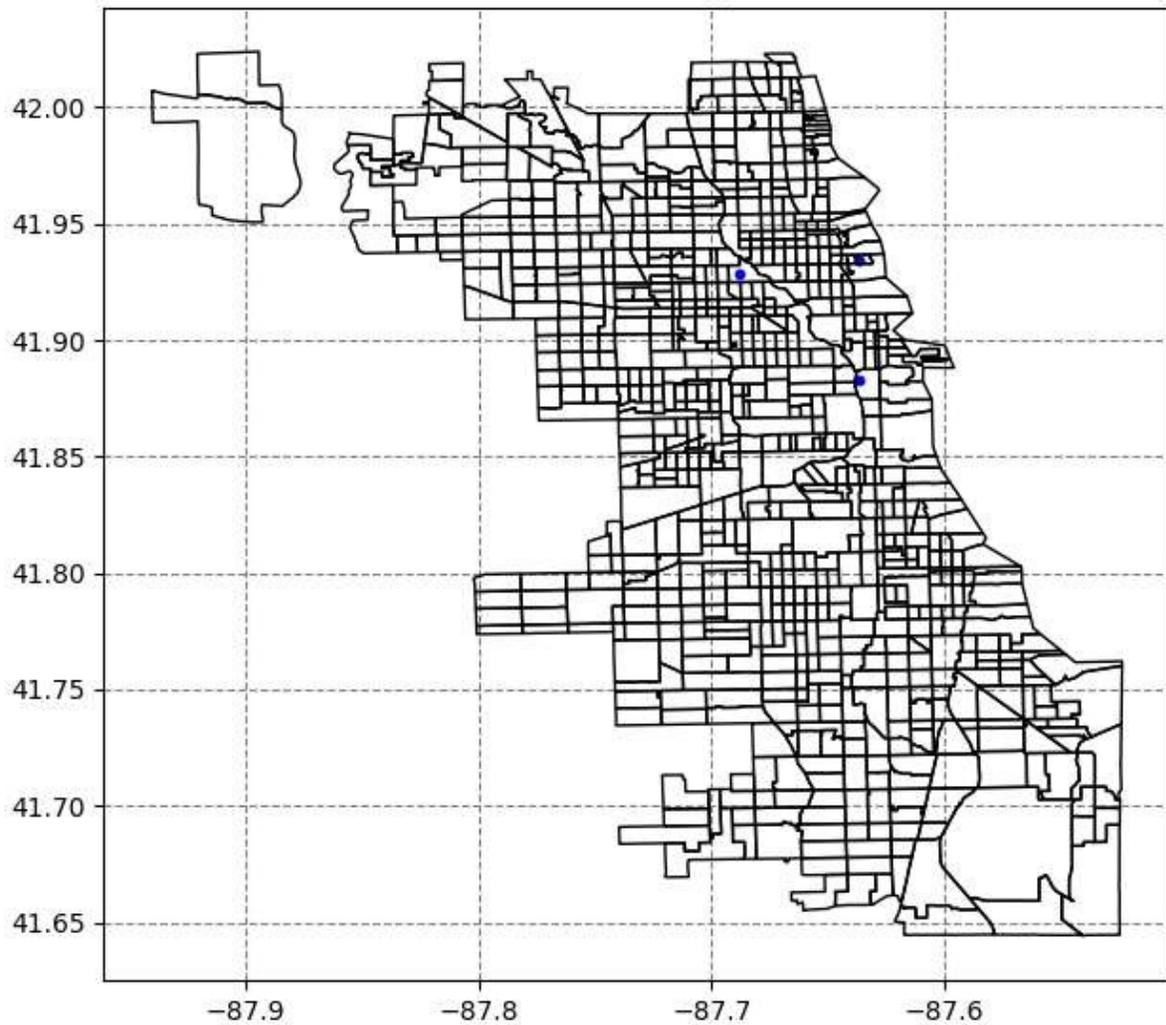
**Q3:** Are restaurant inspection scores correlated with restaurants' social media ratings?

No; health inspectors rate a restaurant based on two facets: illness risk and good retail practices. In contrast, restaurant customers award Google star ratings based on either a transaction-specific satisfaction or their overall attitude towards the restaurant.

Our research provides instrumental value for policymakers: it shows that the median number of restaurant inspections at the census tract level is seven per year; is this adequate? At the conceptual level, it shows that customers ratings of restaurants are independent of health inspection scores. This information could be of "tactical" use for policymakers wanting to persuade colleagues to minimize restaurant regulations.

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**Appendix 1: Extreme Observations: Five-Number Summary: Supplement to Figure 1**



**Note:**

- CT8391 (Chicago Loop): Lat = 41.886704; Long = -87.628054.
- CT633.03 (Lakeview): Lat = 41.934403; Long = -87.636806.
- CT8309 (Logan Square): Lat = 41.932052; Long = -87.688545.

## Appendix 2: Data for Correlational Analysis: Outcome Scores and Google Star Ratings

Address	License #	Restaurant Type	Inspection Outcome	Outcome Score	Google Star Rating
2438 W CERMAK RD	1332927	Fast food	Pass	3	3.5
2610 N CALIFORNIA AVE	2583492	Sandwich shop	Fail	1	4.5
4108-4116 N HAMLIN AVE	2809100	Art Center	Fail	1	4.8
824 W BELMONT AVE	2528066	Cafe	Fail	1	4.7
11101 S MICHIGAN AVE	2560851	American restaurant	Fail	1	3.6
1651 N WESTERN AVE	2246679	Ice cream shop	Fail	1	3.5
6040 S ARCHER AVE	2565168	Chicken restaurant	Fail	1	3.6
1514 N MILWAUKEE AVE	2492527	Clothing & coffee	Fail	1	4.4
2815 N CENTRAL AVE	2522811	grocery, taco	Fail	1	4.4
2222-2224 S ARCHER AVE	2341764	Chinese restaurant	Fail	1	4.2
3109 W 59TH ST	2831585	Mexican	Pass	3	3.8
6222 S ARCHER AVE	1357956	Mexican	Pass	3	3.7
3511 W DEVON AVE	2827254	Fast Food	Pass	3	3.6
11601 W TOUHY AVE	1120626	Pizza restaurant	Pass	3	3
4557 N RAVENSWOOD AVE	1816937	Pub	Pass	3	4.6
811 W JACKSON BLVD	2590021	Mexican	Pass	3	4.1
5700 S CICERO AVE	2689813	Italian	Pass	3	3.6
11601 W TOUHY AVE	2791586	Lounge	Pass	3	4.3
6650 S PULASKI RD	6476	Restaurant	Pass	3	4.3
3334 N MILWAUKEE AVE	2600464	Mexican	Pass	3	4.7
3728 S ARCHER AVE	2368973	Restaurant	Pass	3	3.8
1716 W LUNT AVE	1330889	Yoga & food	Pass	3	4.8
2825 N MILWAUKEE AVE	2303647	Pizza	Pass	3	4.4
658-660 N WELLS ST	40853	American	Pass	3	3.9
2127 S CHINA PL	2822455	Barbecue restaurant	Pass w/ Conditions	2	4.8
5046 W ARMITAGE AVE	2374752	Mexican	Pass w/ Conditions	2	4.5
3960 W IRVING PARK RD	1904868	Convenient store	Pass w/ Conditions	2	1.6
5344 W FULLERTON AVE	2758268	Mexican	Pass w/ Conditions	2	4.6
9956 S WESTERN AVE	149	Pizza	Pass w/ Conditions	2	4.2
10320 S KEDZIE AVE	81721	Fast food	Pass w/ Conditions	2	3.5