# SPATIAL POINT PATTERN ANALYSIS OF RETAIL BUSINESSES


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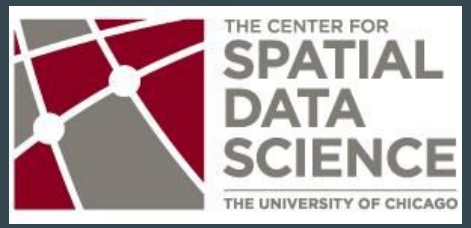


# Firm Demography

- Life and death of corporations and industries
- Context:
  - Focus on manufacturing
  - Liability in different moments of lifespan (Stinchcombe 1965)
  - Organizational Ecology (Hannan & Freeman 1977) - success of surviving in markets
  - Frequency distribution of firms lifespan as exponential (Coad 2010)
  - How does structure of communities encourage new businesses? (Sorenson 2018)

# Research Question

Within Chicago, what is the spatial distribution of births and deaths?

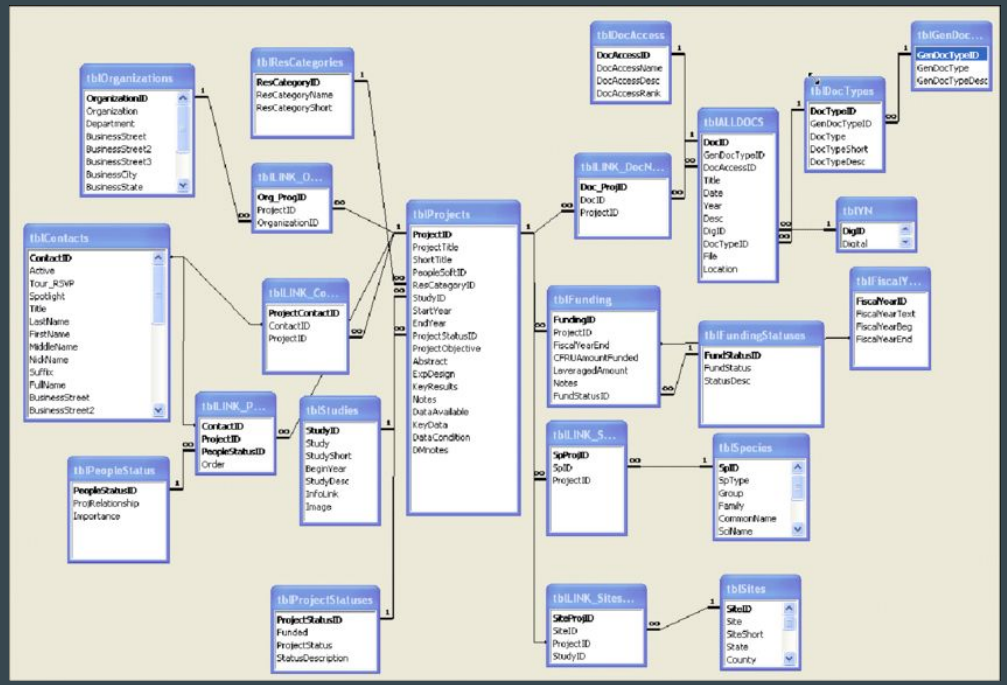
- Do they coexist?
- **When** have they survived the longest?
- **Where** do they survive longer?

# Data

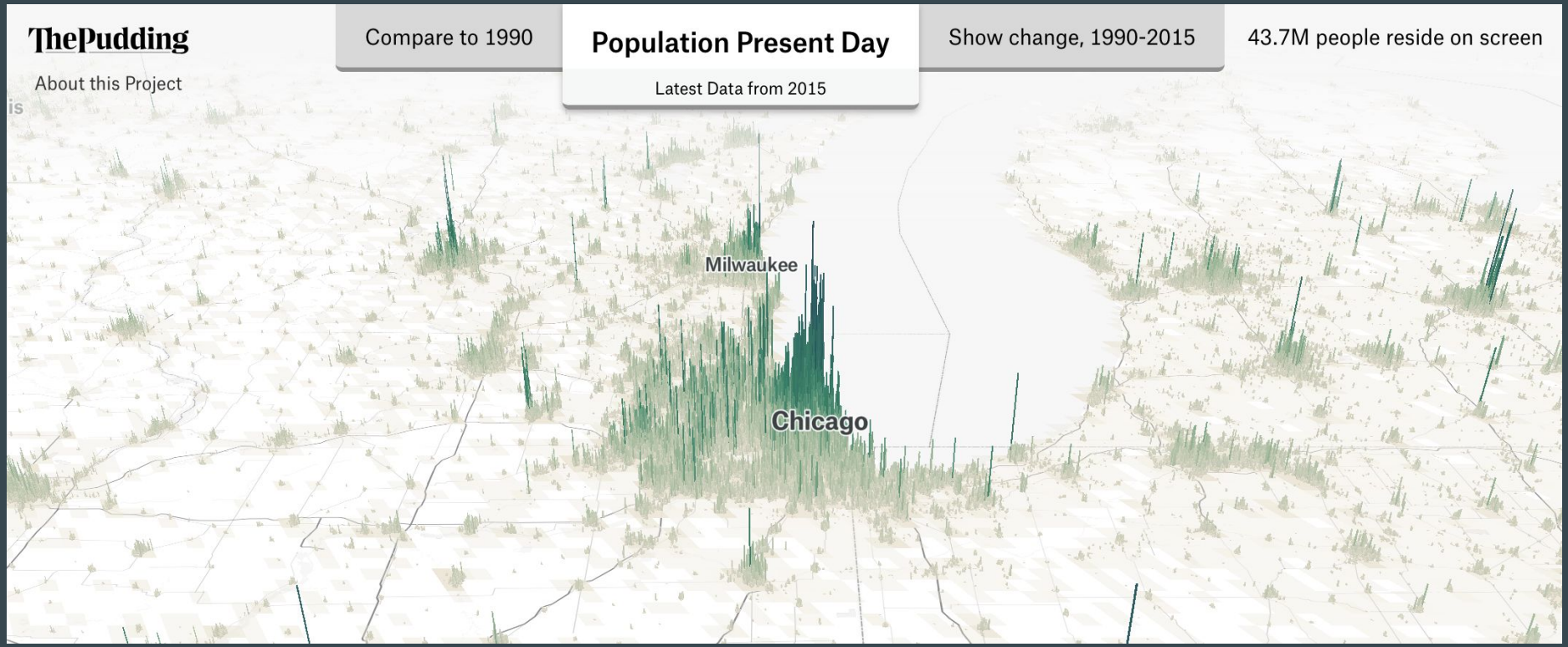
- Focus on retail sector using NETS data (1990 - 2014)
- latitude/longitude, no. employees, ownership type, industrial classification
- Retail: NAICS 44-45 and 311811 (bakeries)
- Number of retail establishments for USA: 2,183,332 out of 25,330,402 (for 2014)
- Focus on Chicago

# What is PostgreSQL / PostGIS?

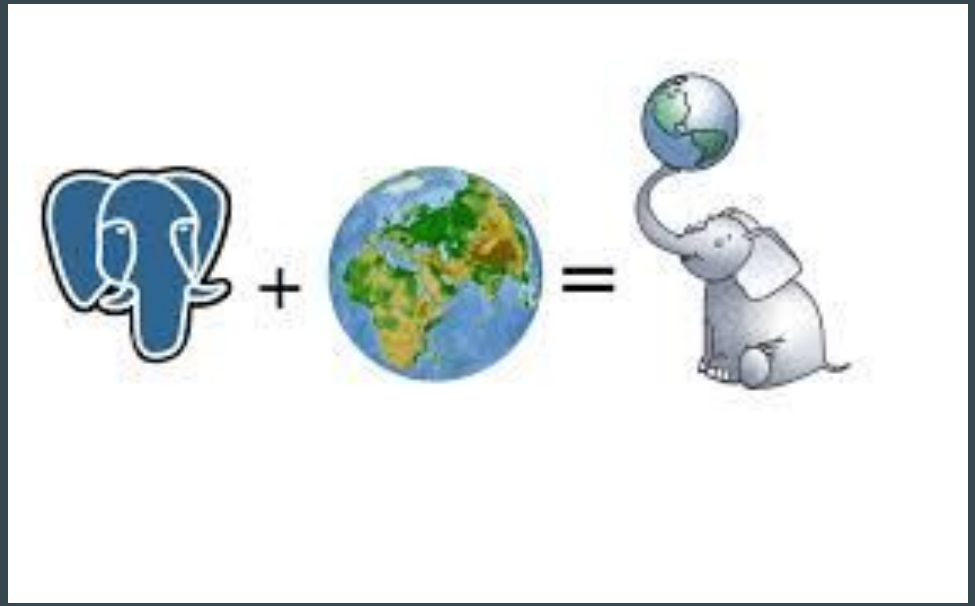
- Open-source relational database management system
- Add spatial extension table + geometry (points/lines/polygons)
- Query engine (efficiency based on indexes)



# What is PostgreSQL / PostGIS?



# NETS DATABASE!



+

POSTGRESQL + SPATIAL = POSTGIS + ANALYTICS

# Bridge database with R analytics

Packages

- RPostgreSQL **(dbGetQuery)**
  **postGIStools (get_postgis_query) → specify geometry**

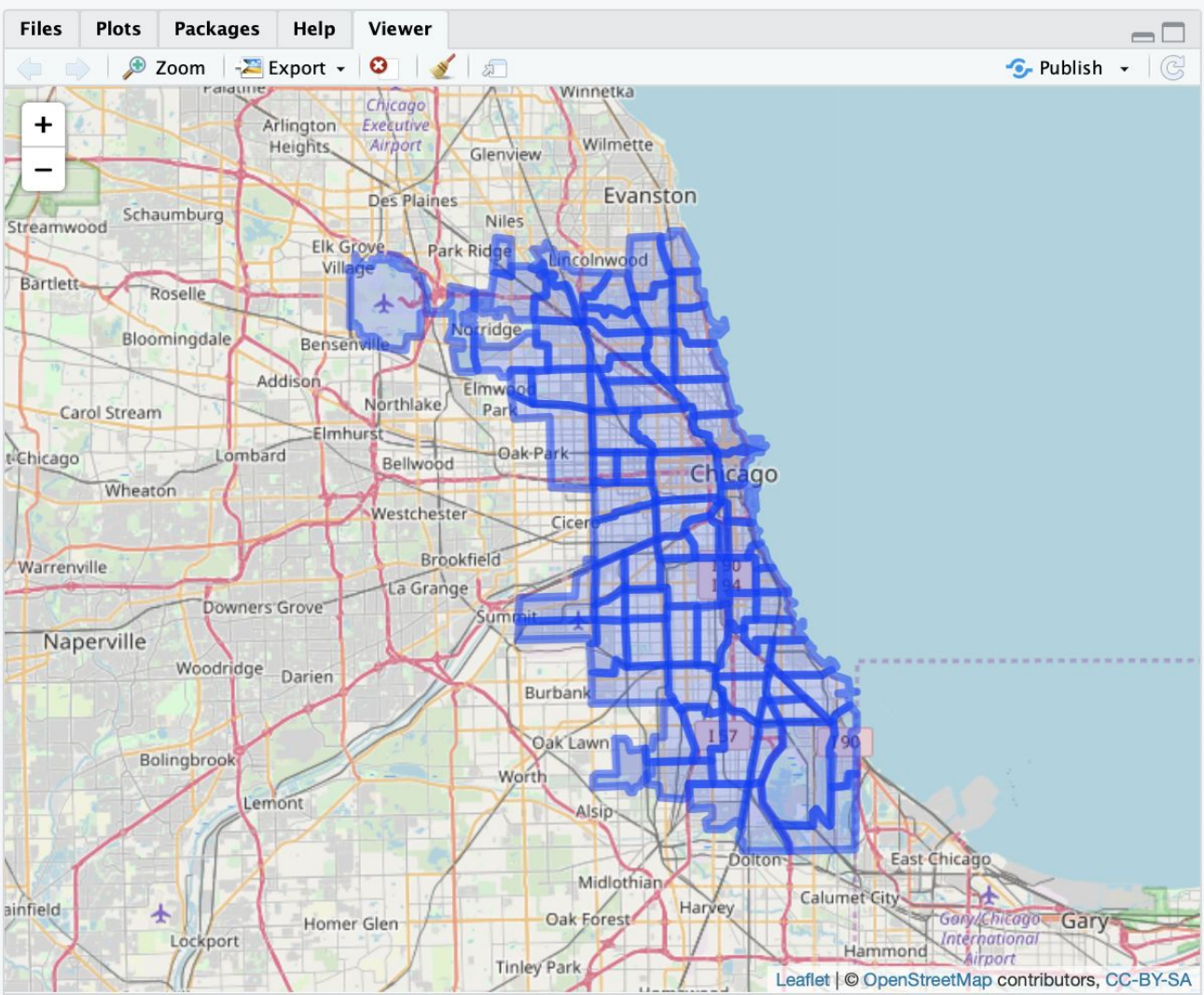
```
library(postGIStools)
library(rpostgis)

connection <- dbConnect(PostgreSQL(),
                        dbname = "NETS",
                        user = "irenef",
                        host = "la2.rcc.uchicago.edu",
                        password = "MY_PASSWORD")

system.time(boundaries <- get_postgis_query(connection,
                                            "select * from boundaries.chicago_community",
                                            geom_name = "geom"))


library(dplyr)
library(leaflet)

leaflet() %>%
  addTiles() %>%
  addPolygons(data = boundaries)
```


Files
Plots
Packages
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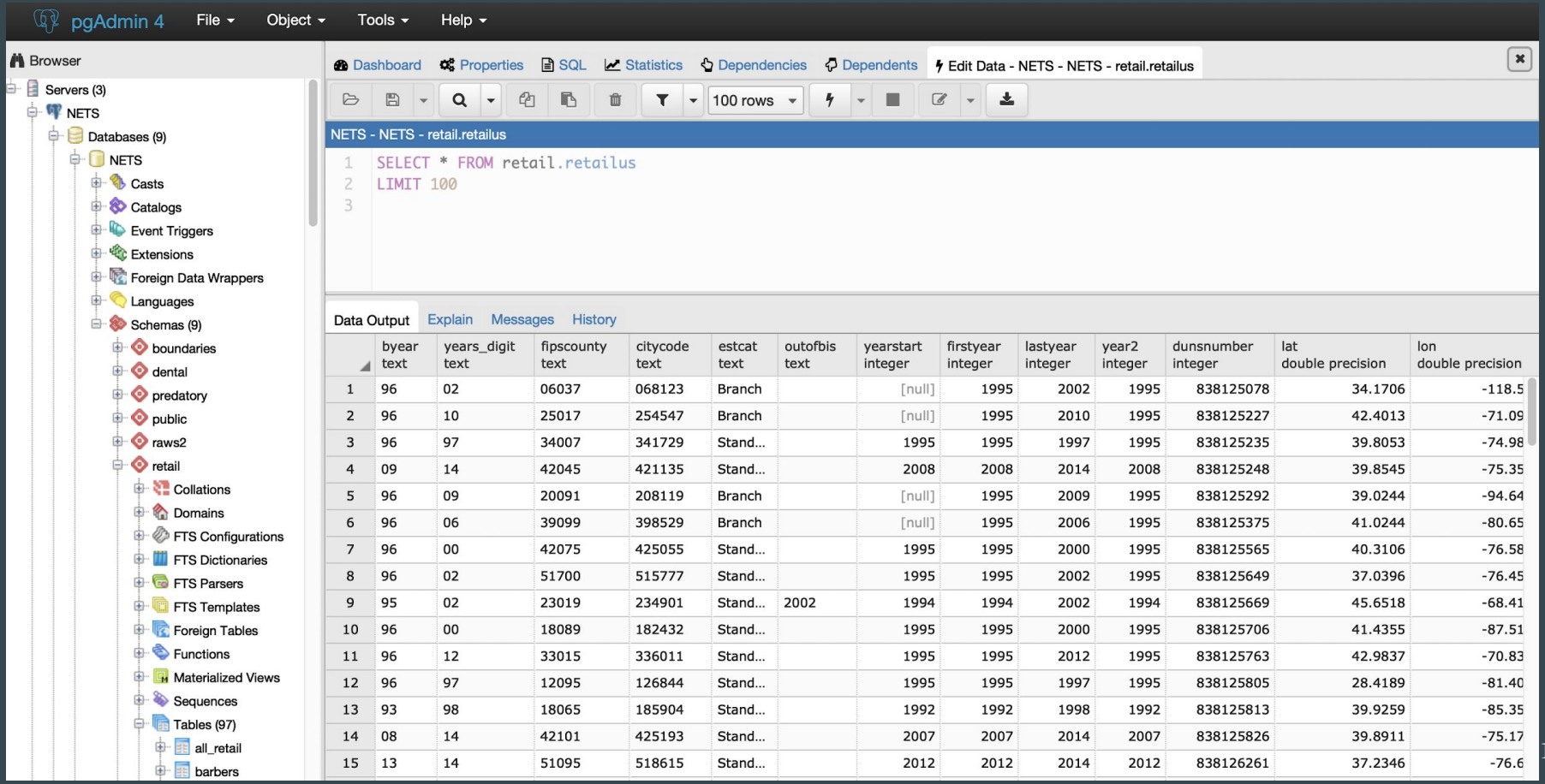
Chicago Executive Airport
Arlington Heights
Glenview
Wilmette
Evanston
Des Plaines
Niles
Schaumburg
Streamwood
Elk Grove Village
Park Ridge
Lincolnwood
Bartlett
Roselle
Bloomingdale
Bensenville
Norridge
Addison
Elmwood Park
Northlake
Carol Stream
Elmhurst
Lombard
Bellwood
Oak Park
Chicago
Wheaton
Westchester
Cicero
Brookfield
Warrenville
La Grange
Downers Grove
Naperville
Woodridge
Darien
Burbank
Oak Lawn
Bolingbrook
Worth
Lemont
Alsip
Dolton
East Chicago
Midlothian
Calumet City
Harvey
Homer Glen
Oak Forest
Gary
Gary/Chicago International Airport
Lockport
Hammond
Tinley Park
Leaflet | © OpenStreetMap contributors, CC-BY-SA

# Retail tables



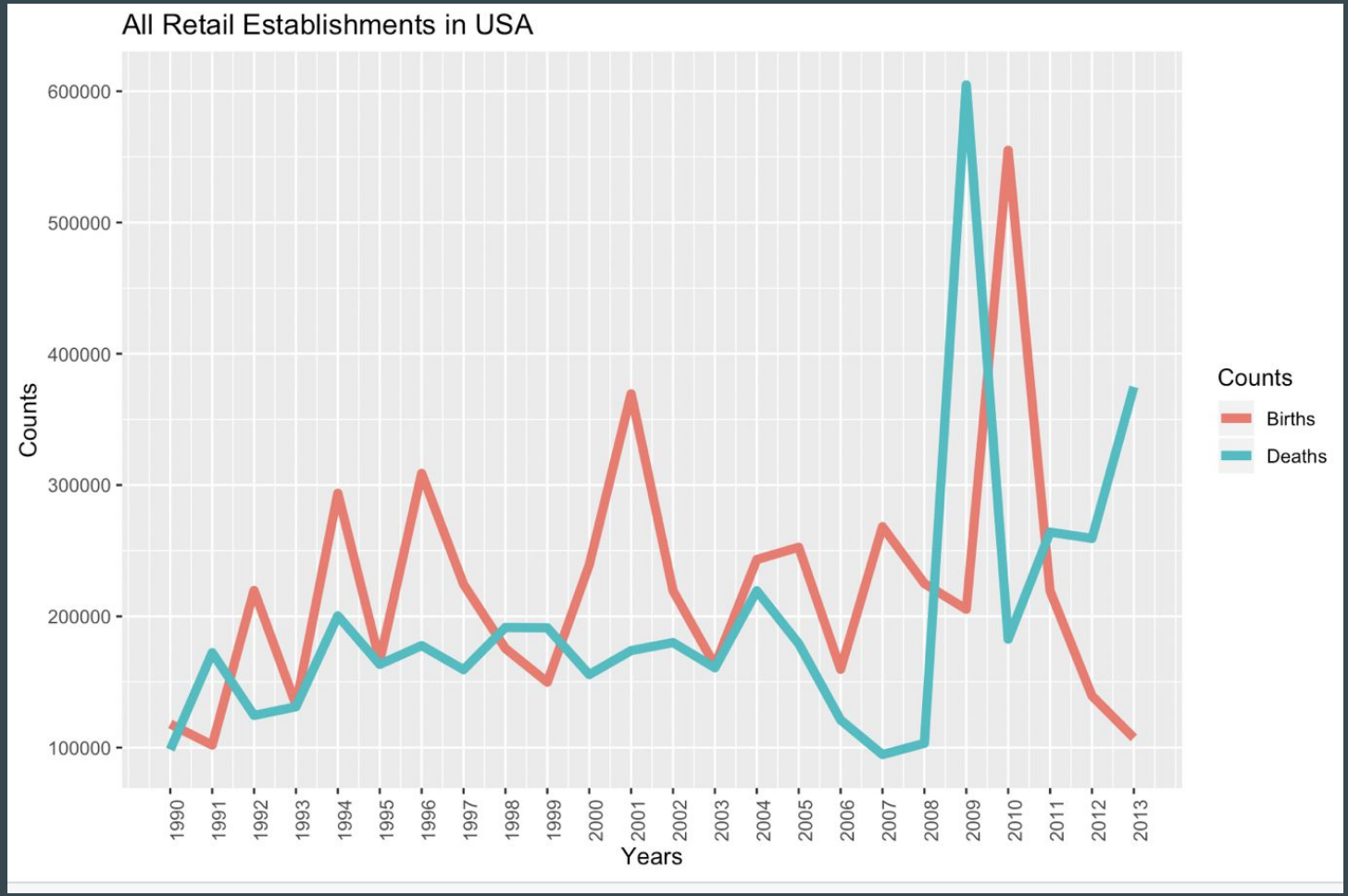

| | byear text | years_digit text | fipscounty text | citycode text | estcat text | outofbis text | yearstart integer | firstyear integer | lastyear integer | year2 integer | dunsnumber integer | lat double precision | lon double precision |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 96 | 02 | 06037 | 068123 | Branch | | [null] | 1995 | 2002 | 1995 | 838125078 | 34.1706 | -118.5 |
| 2 | 96 | 10 | 25017 | 254547 | Branch | | [null] | 1995 | 2010 | 1995 | 838125227 | 42.4013 | -71.09 |
| 3 | 96 | 97 | 34007 | 341729 | Stand... | | 1995 | 1995 | 1997 | 1995 | 838125235 | 39.8053 | -74.98 |
| 4 | 09 | 14 | 42045 | 421135 | Stand... | | 2008 | 2008 | 2014 | 2008 | 838125248 | 39.8545 | -75.35 |
| 5 | 96 | 09 | 20091 | 208119 | Branch | | [null] | 1995 | 2009 | 1995 | 838125292 | 39.0244 | -94.64 |
| 6 | 96 | 06 | 39099 | 398529 | Branch | | [null] | 1995 | 2006 | 1995 | 838125375 | 41.0244 | -80.65 |
| 7 | 96 | 00 | 42075 | 425055 | Stand... | | 1995 | 1995 | 2000 | 1995 | 838125565 | 40.3106 | -76.58 |
| 8 | 96 | 02 | 51700 | 515777 | Stand... | | 1995 | 1995 | 2002 | 1995 | 838125649 | 37.0396 | -76.45 |
| 9 | 95 | 02 | 23019 | 234901 | Stand... | 2002 | 1994 | 1994 | 2002 | 1994 | 838125669 | 45.6518 | -68.41 |
| 10 | 96 | 00 | 18089 | 182432 | Stand... | | 1995 | 1995 | 2000 | 1995 | 838125706 | 41.4355 | -87.51 |
| 11 | 96 | 12 | 33015 | 336011 | Stand... | | 1995 | 1995 | 2012 | 1995 | 838125763 | 42.9837 | -70.83 |
| 12 | 96 | 97 | 12095 | 126844 | Stand... | | 1995 | 1995 | 1997 | 1995 | 838125805 | 28.4189 | -81.40 |
| 13 | 93 | 98 | 18065 | 185904 | Stand... | | 1992 | 1992 | 1998 | 1992 | 838125813 | 39.9259 | -85.35 |
| 14 | 08 | 14 | 42101 | 425193 | Stand... | | 2007 | 2007 | 2014 | 2007 | 838125826 | 39.8911 | -75.17 |
| 15 | 13 | 14 | 51095 | 518615 | Stand... | | 2012 | 2012 | 2014 | 2012 | 838126261 | 37.2346 | -76.6 |

# Births and Deaths of Retail Across the US

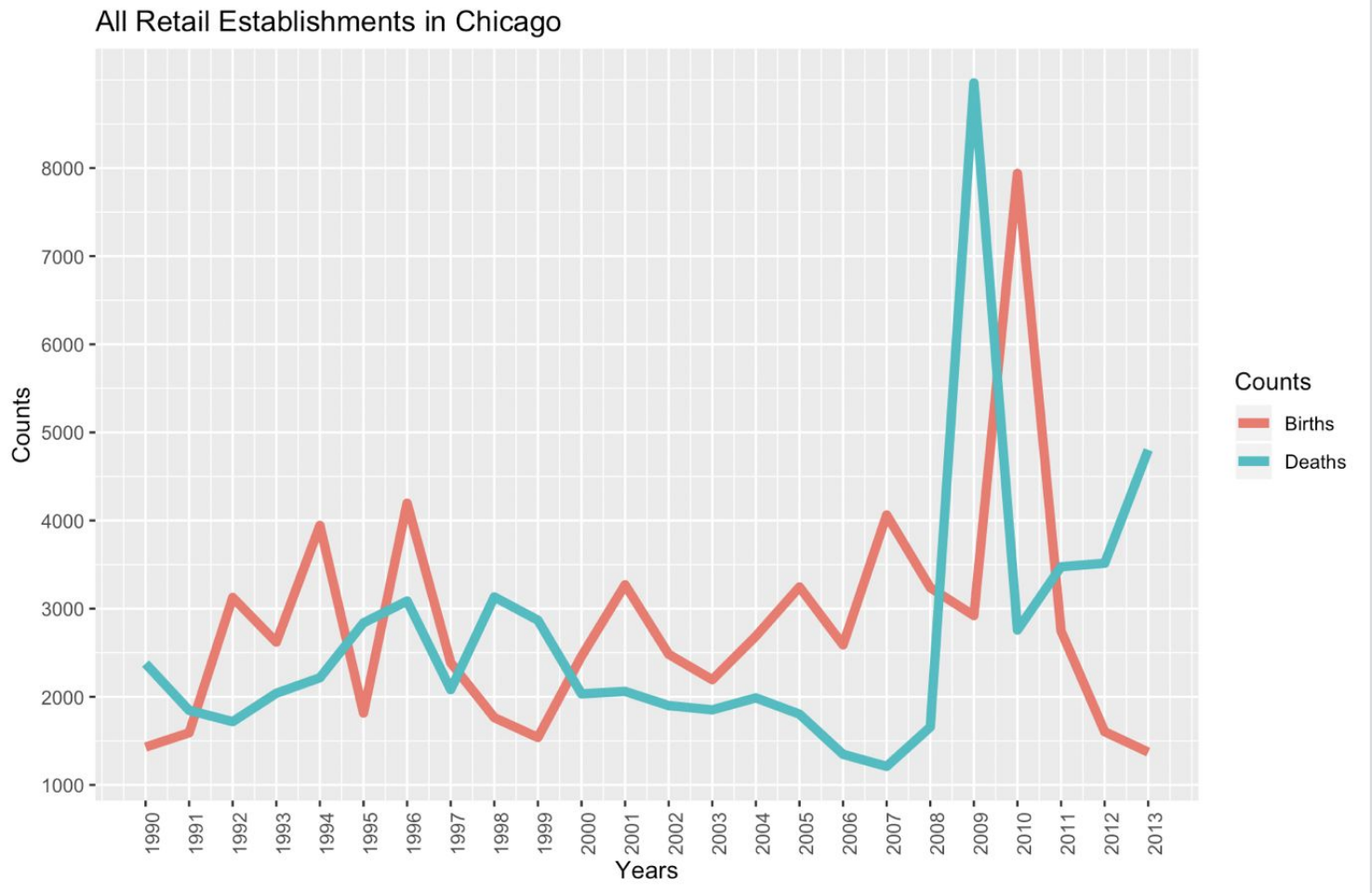
```
count_ret <- dbGetQuery(connection,
                        "select count(*)
                        from retail.retailus")

birth_usa <- get_postgis_query(connection,
                       "select count(*), year2
                       from retail.retailus
                       where year2>1988
                       group by year2
                       order by year2 asc")

death_usa <- get_postgis_query(connection,
                       "select count(*), lastyear
                       from retail.retailus
                       group by lastyear
                       order by lastyear asc")

total <- merge(birth_usa,death_usa,by.x="year2", by.y="lastyear")
colnames(total) <- c("year","births","deaths")

library(ggplot2)
options(scipen=10000)
ggplot(data = total)+
  geom_line (aes(x = year, y = births, color = "#00AFBB"), size = 2) +
  geom_line (aes(x = year, y = deaths, color = "#FC4E07"), size = 2) +

  scale_x_continuous(breaks=seq(1990,2013,1), labels=seq(1990,2013,1),limits=c(1990,2013)) +
  theme(axis.text.x = element_text(angle = 90)) +
  scale_y_continuous(breaks=seq(100000,600000,100000),labels=abs(seq(100000,600000,100000))) +
  scale_color_discrete(name = "Counts", labels = c("Births", "Deaths"))+
  labs(title="All Retail Establishments in USA", x="Years",y="Counts")
```

→ 6,866,824

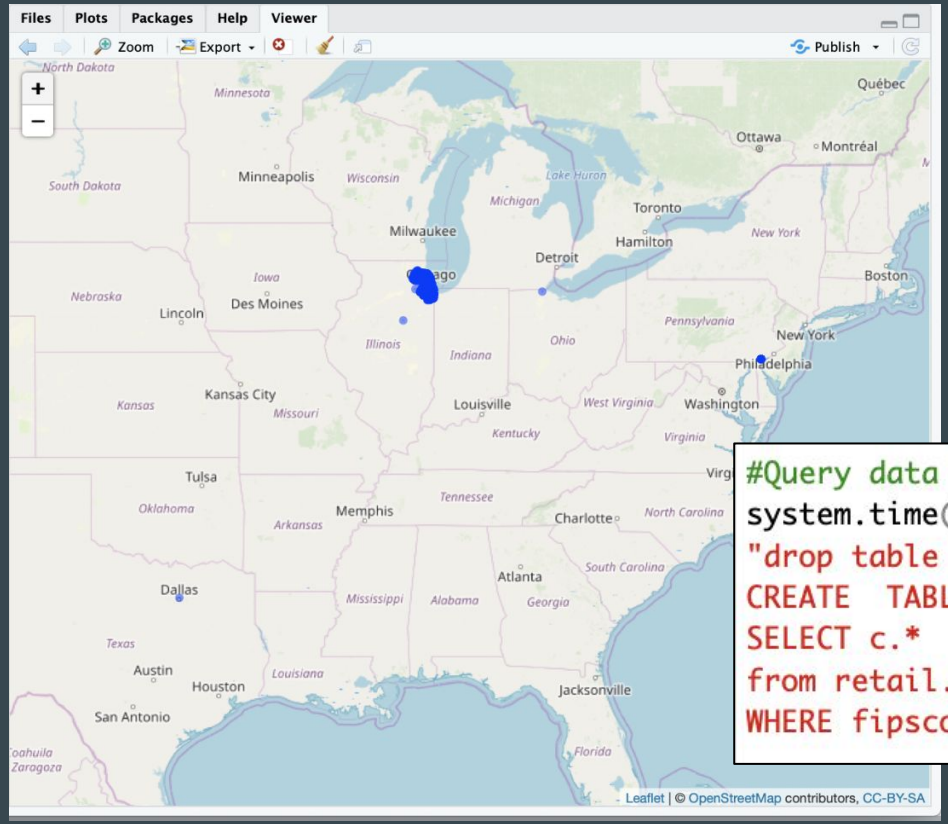
# Births and Deaths of Retail Across the US



# Births and Deaths of Retail in Chicago

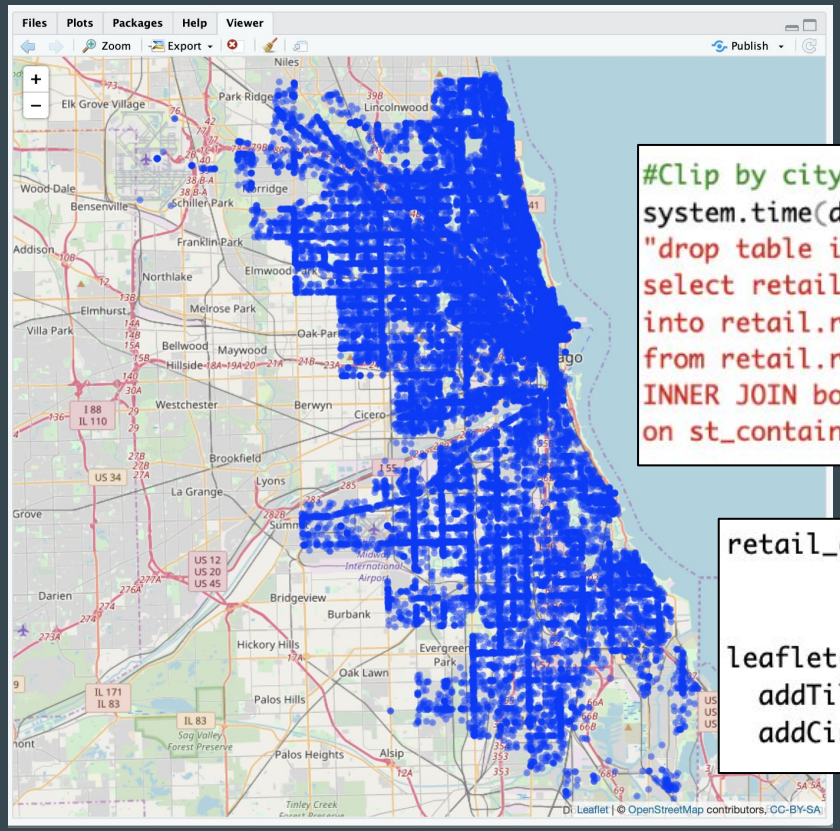


# Querying for Chicago




```
#Query data by Chicago
system.time(dbGetQuery(connection,
"drop table if exists retail.ret_chicago;
CREATE  TABLE retail.ret_chicago AS
SELECT c.*
from retail.retailus as c
WHERE fipscounty IN ('17031');"))
```

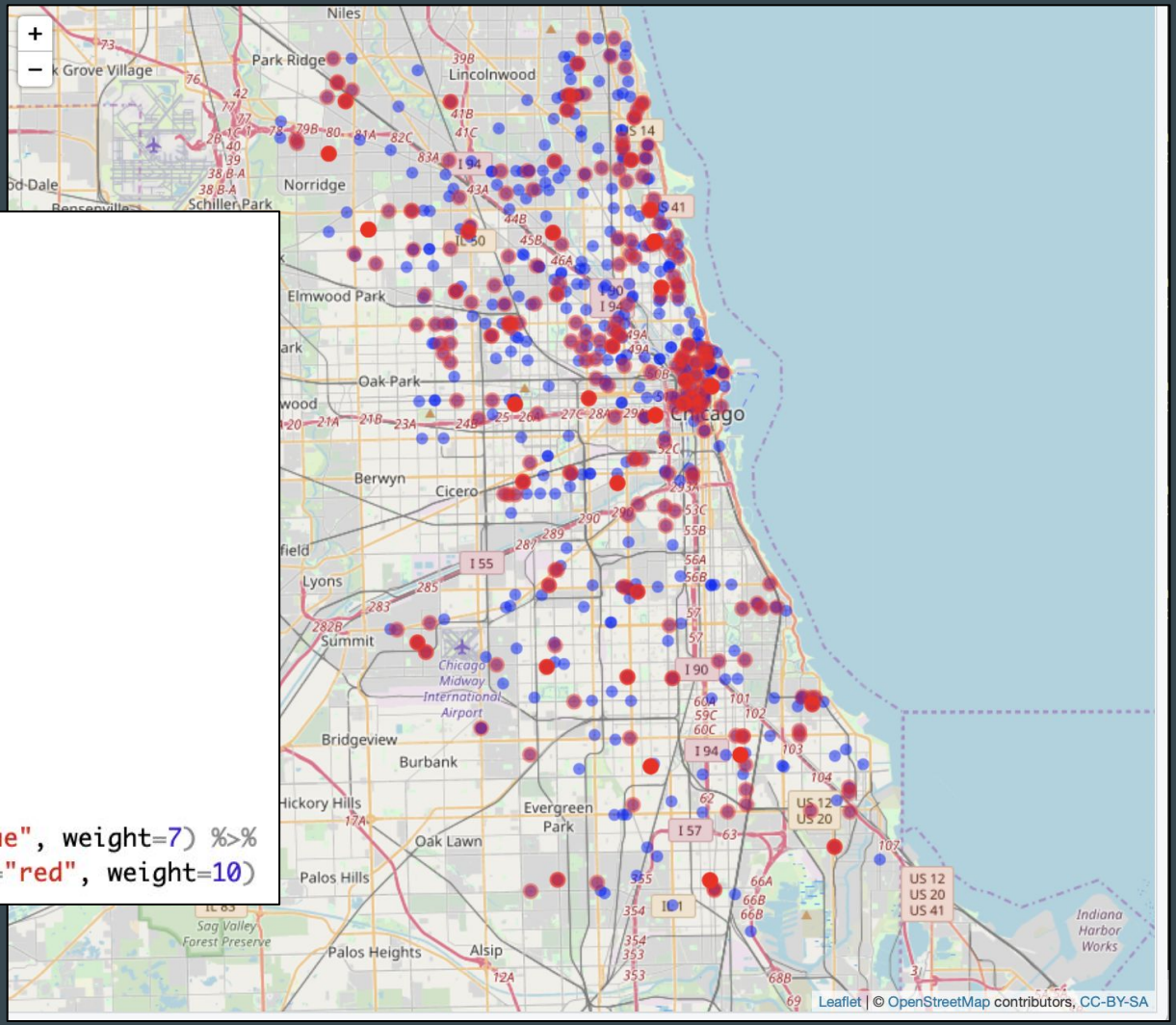
# Querying for Chicago = 46,204




```
#Clip by city of Chicago
system.time(dbGetQuery(connection,
"drop table if exists retail.ret_chicago_clip;
select retail.ret_chicago.*
into retail.ret_chicago_clip
from retail.ret_chicago
INNER JOIN boundaries.chicago_community
on st_contains(boundaries.chicago_community.geom,retail.ret_chicago.geom2);"))
```

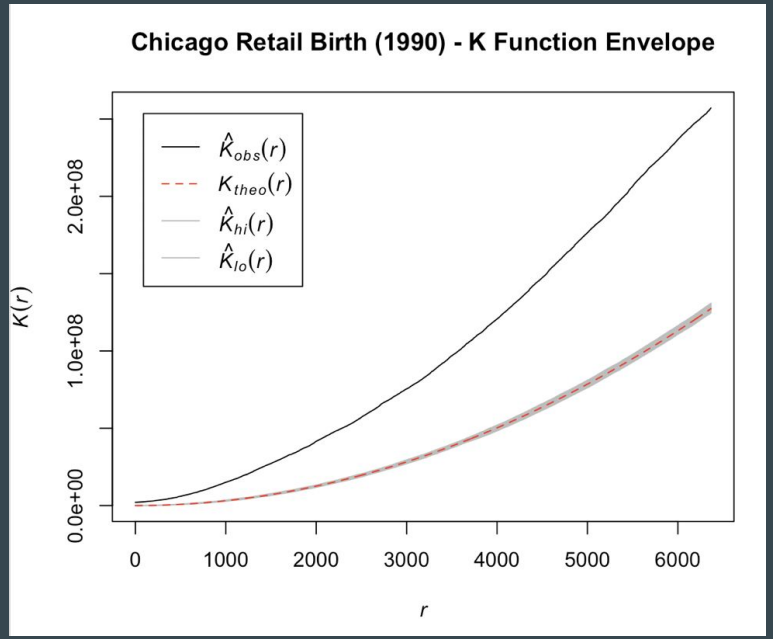
```
retail_clip <- get_postgis_query(connection,
                                 "select * from retail.ret_chicago_clip",
                                 geom_name = "geom2")
leaflet() %>%
  addTiles() %>%
  addCircles(data = retail_clip)
```

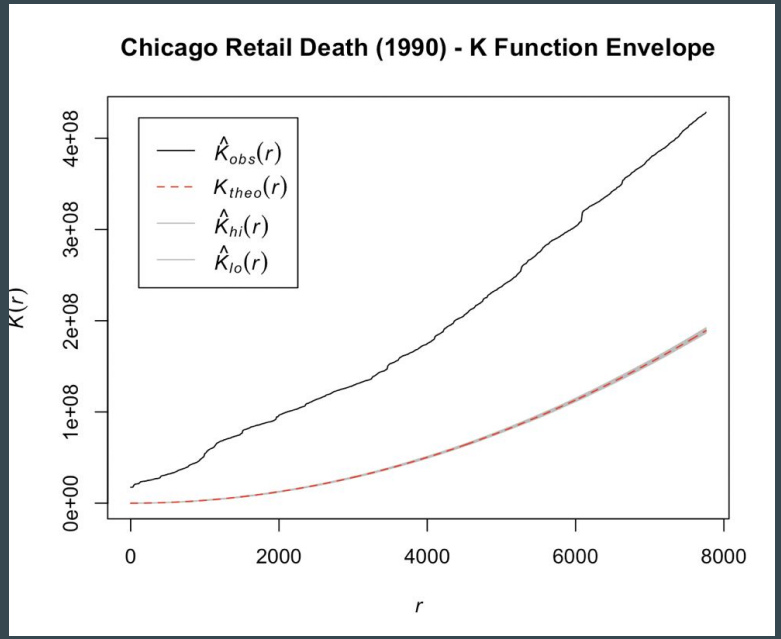
```
deaths91_95 <- dbGetQuery(connection,
"select *
from retail.ret_chicago_clip
where year2=1990 and
(lastyear=1991 or
lastyear=1992 or
lastyear=1993 or
lastyear=1994 or
lastyear=1995)")

birth90 <- dbGetQuery(connection,
"select *
from retail.ret_chicago_clip
where year2=1990")

leaflet() %>%
  addTiles() %>%
  addCircles(data = birth90, color="blue", weight=7) %>%
  addCircles(data = deaths91_95, color="red", weight=10)
```



# Point pattern analysis - K function 1990 - library(spatstat)

Are points dispersed, clustered, or randomly distributed throughout Chicago?

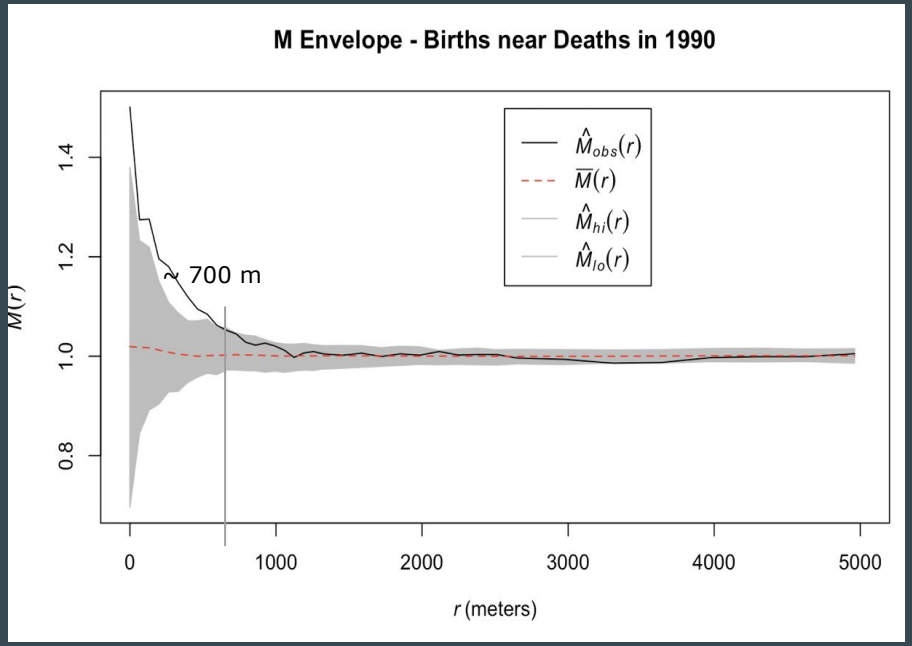


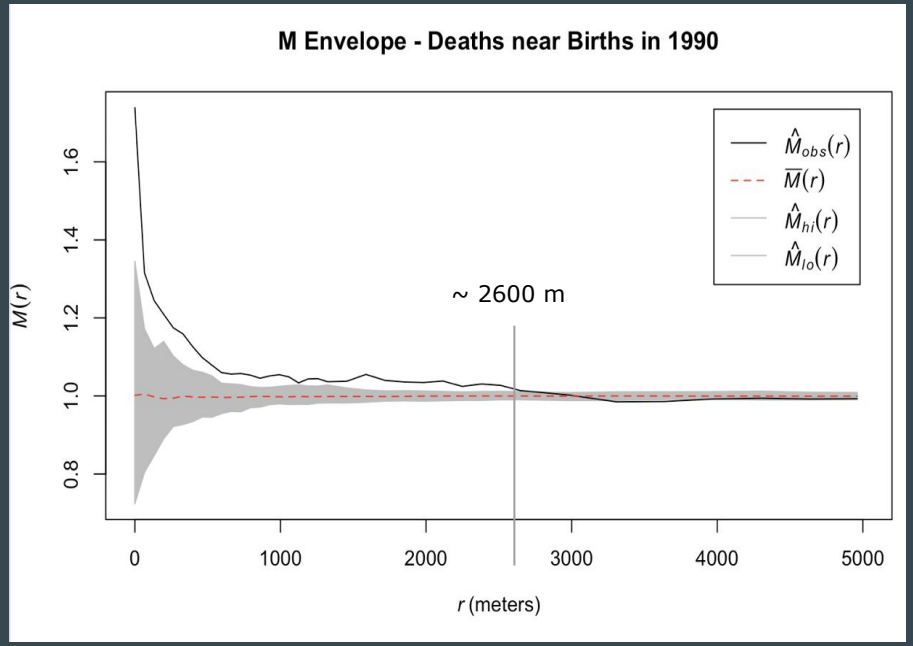




```
envelope(ret_chi,fun=Kest)
```

# Point pattern analysis - M function (1990) - library(dbmss)

How many births are nearby deaths? (death=control)




```
MEnvelope(ret_chi,
          NumberOfSimulations = 1000,
          ReferenceType = "2", NeighborType = "1",
          SimulationType = "RandomLabeling")
```

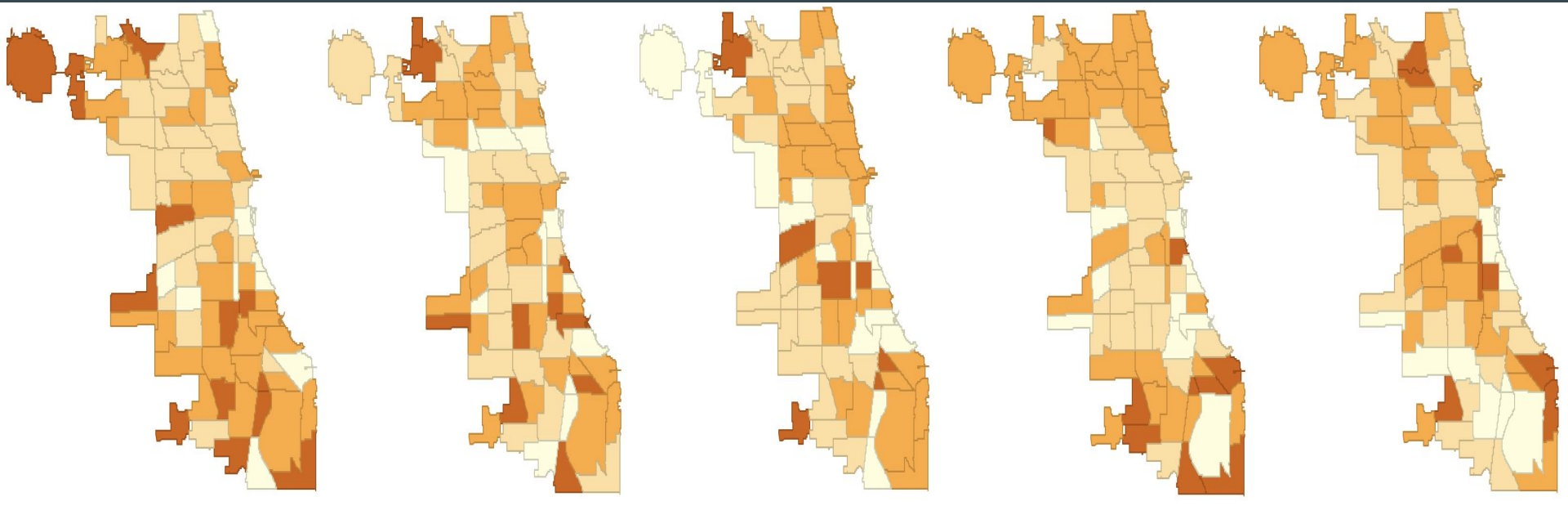
```
MEnvelope(ret_chi,
          NumberOfSimulations = 1000,
          ReferenceType = "1", NeighborType = "2",
          SimulationType = "RandomLabeling")
```

# LOCATION QUOTIENTS

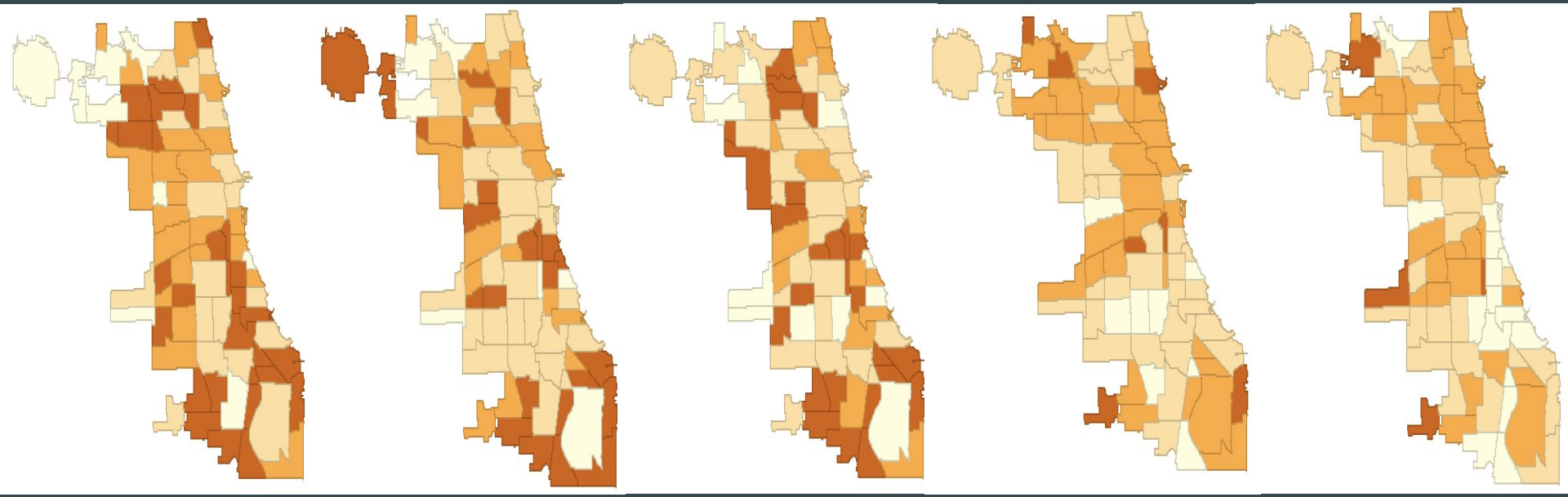
$$Location\ Quotient\ births = \frac{ratio\ of\ births}{ratio\ of\ all\ retail} = \frac{\frac{births\ in\ neighborhood}{births\ in\ Chicago}}{\frac{retail\ in\ neighborhood}{all\ retail\ in\ Chicago}}$$

$$Location\ Quotient\ deaths = \frac{ratio\ of\ deaths}{ratio\ of\ all\ retail} = \frac{\frac{deaths\ in\ neighborhood}{deaths\ in\ Chicago}}{\frac{retail\ in\ neighborhood}{all\ retail\ in\ Chicago}}$$

# Births Chicago



# Deaths Chicago




1990 - 1994 → 1995 - 1999 → 2000 - 2004 → 2005 - 2009 → 2010 - 2013

# Future work

- Call for action for more efficient bridge between **PostGIS and R**
- Analyze co-location patterns across different time periods.
- Functional analysis modeling curves assessing for differences between cities.
- Do neighborhoods have an impact on firms' lifespan?
  - What are the characteristics of those neighborhoods?

## LOCATION QUOTIENTS OF BIRTHS

### 1995–1999

| 1990–1994 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 8.3% | 33.3% | 33.3% | 25.0% |
| [0.8, 1) | 20.7% | 41.4% | 34.5% | 3.4% |
| [1, 1.2] | 3.7% | 40.7% | 33.3% | 22.2% |
| >1.2 | 22.2% | 22.2% | 22.2% | 33.3% |

### 2000–2004

| 1995–1999 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 20.0% | 30.0% | 20.0% | 30.0% |
| [0.8, 1) | 10.3% | 41.4% | 41.4% | 6.9% |
| [1, 1.2] | 8.0% | 40.0% | 36.0% | 16.0% |
| >1.2 | 7.7% | 30.8% | 15.4% | 46.2% |

### 2005–2010

| 2000–2004 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 12.5% | 50.0% | 37.5% | 0.0% |
| [0.8, 1) | 13.8% | 44.8% | 31.0% | 10.3% |
| [1, 1.2] | 8.0% | 52.0% | 32.0% | 8.0% |
| >1.2 | 13.3% | 20.0% | 26.7% | 40.0% |

### 2010–2013

| 2005–2010 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 22.2% | 22.2% | 33.3% | 22.2% |
| [0.8, 1) | 15.2% | 36.4% | 36.4% | 12.1% |
| [1, 1.2] | 8.3% | 50.0% | 41.7% | 0.0% |
| >1.2 | 0.0% | 36.4% | 18.2% | 45.5% |

## LOCATION QUOTIENTS OF DEATHS

### 1995–1999

| 1990–1994 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 55.2% | 24.1% | 17.2% | 3.4% |
| [0.8, 1) | 22.7% | 27.3% | 45.5% | 4.5% |
| [1, 1.2] | 0.0% | 27.8% | 66.7% | 5.6% |
| >1.2 | 25.0% | 0.0% | 25.0% | 50.0% |

### 2000–2004

| 1995–1999 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 73.9% | 13.0% | 8.7% | 4.3% |
| [0.8, 1) | 38.9% | 22.2% | 33.3% | 5.6% |
| [1, 1.2] | 3.4% | 20.7% | 55.2% | 20.7% |
| >1.2 | 14.3% | 14.3% | 28.6% | 42.9% |

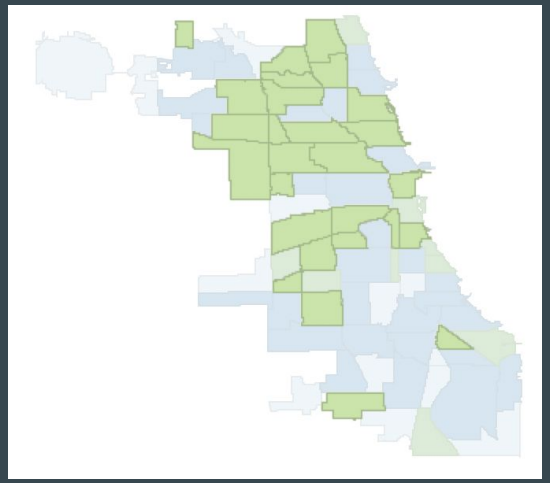
### 2005–2010

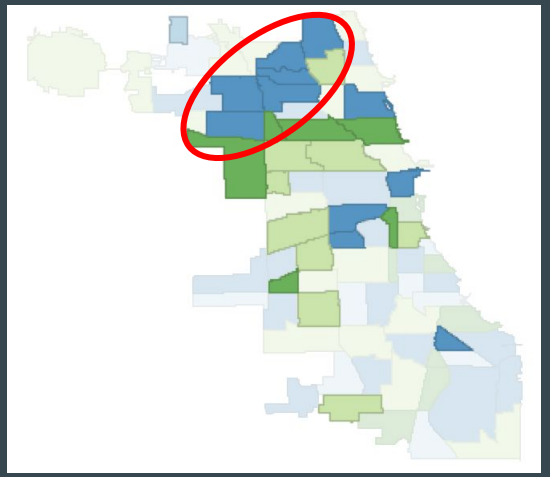
| 2000–2004 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 11.5% | 34.6% | 42.3% | 11.5% |
| [0.8, 1) | 0.0% | 50.0% | 42.9% | 7.1% |
| [1, 1.2] | 7.7% | 38.5% | 46.2% | 7.7% |
| >1.2 | 18.2% | 36.4% | 27.3% | 18.2% |

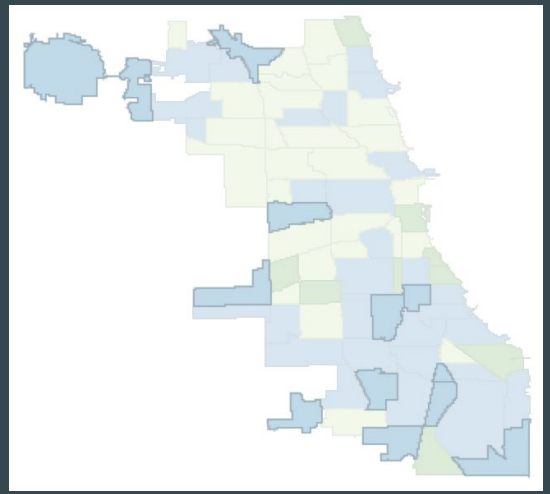
### 2010–2013

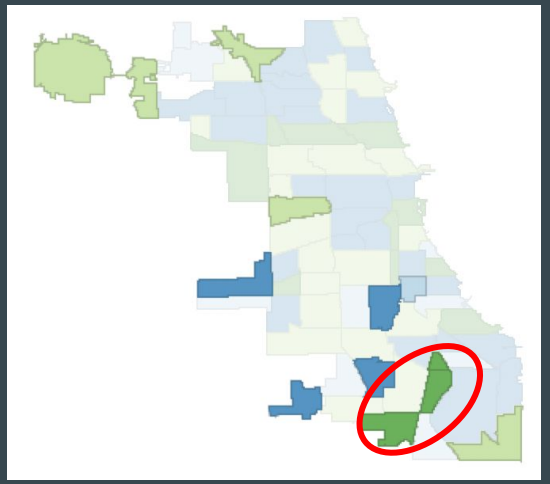
| 2005–2010 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 14.3% | 57.1% | 28.6% | 0.0% |
| [0.8, 1) | 10.0% | 50.0% | 30.0% | 10.0% |
| [1, 1.2] | 0.0% | 31.3% | 43.8% | 25.0% |
| >1.2 | 0.0% | 12.5% | 37.5% | 50.0% |

# Births









< 0.800
[0.800, 1)
[1, 1.200]
> 1.200

1990 - 1994 → 1995 - 1999

## LOCATION QUOTIENTS OF BIRTHS

### 1995–1999

1990–1994

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 8.3% | 33.3% | 33.3% | 25.0% |
| [0.8, 1) | 20.7% | 41.4% | 34.5% | 3.4% |
| [1, 1.2] | 3.7% | 40.7% | 33.3% | 22.2% |
| >1.2 | 22.2% | 22.2% | 22.2% | 33.3% |

### 2000–2004

1995–1999

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 20.0% | 30.0% | 20.0% | 30.0% |
| [0.8, 1) | 10.3% | 41.4% | 41.4% | 6.9% |
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### 2005–2010

2000–2004

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
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### 2010–2013

2005–2010

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 22.2% | 22.2% | 33.3% | 22.2% |
| [0.8, 1) | 15.2% | 36.4% | 36.4% | 12.1% |
| [1, 1.2] | 8.3% | 50.0% | 41.7% | 0.0% |
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1990–1994

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 55.2% | 24.1% | 17.2% | 3.4% |
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| [1, 1.2] | 0.0% | 27.8% | 66.7% | 5.6% |
| >1.2 | 25.0% | 0.0% | 25.0% | 50.0% |

### 2000–2004

1995–1999

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 73.9% | 13.0% | 8.7% | 4.3% |
| [0.8, 1) | 38.9% | 22.2% | 33.3% | 5.6% |
| [1, 1.2] | 3.4% | 20.7% | 55.2% | 20.7% |
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### 2005–2010

2000–2004

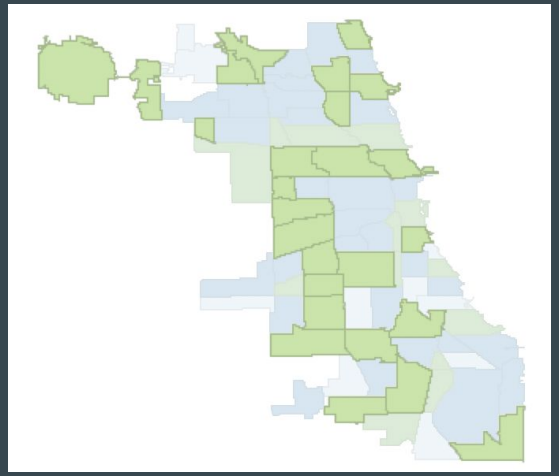
| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 11.5% | 34.6% | 42.3% | 11.5% |
| [0.8, 1) | 0.0% | 50.0% | 42.9% | 7.1% |
| [1, 1.2] | 7.7% | 38.5% | 46.2% | 7.7% |
| >1.2 | 18.2% | 36.4% | 27.3% | 18.2% |

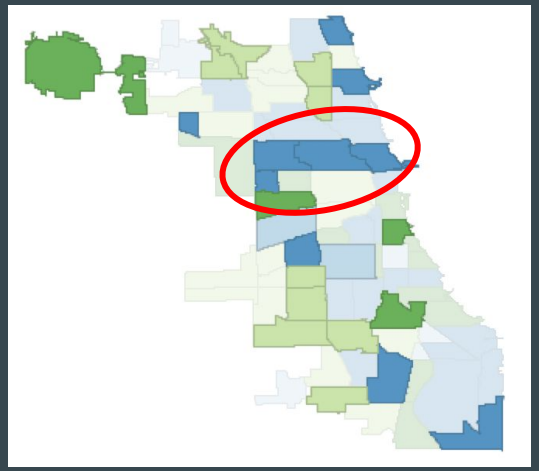
### 2010–2013

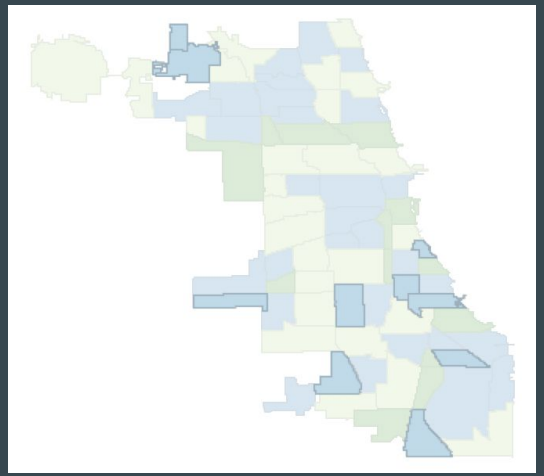
2005–2010

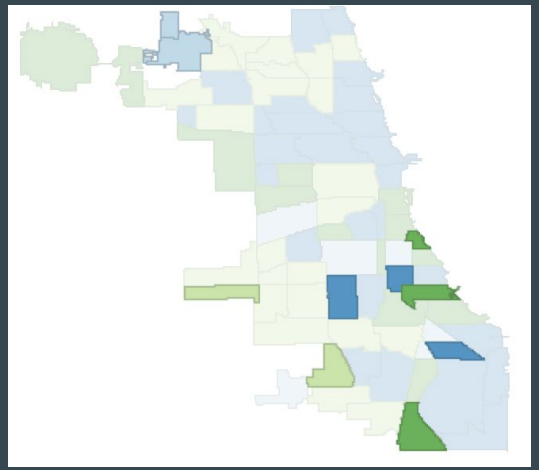
| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 14.3% | 57.1% | 28.6% | 0.0% |
| [0.8, 1) | 10.0% | 50.0% | 30.0% | 10.0% |
| [1, 1.2] | 0.0% | 31.3% | 43.8% | 25.0% |
| >1.2 | 0.0% | 12.5% | 37.5% | 50.0% |

# Births









< 0.800
[0.800, 1)
[1, 1.200]
> 1.200

1995 - 1999 → 2000 - 2004

## LOCATION QUOTIENTS OF BIRTHS

### 1995–1999

| 1990–1994 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 8.3% | 33.3% | 33.3% | 25.0% |
| [0.8, 1) | 20.7% | 41.4% | 34.5% | 3.4% |
| [1, 1.2] | 3.7% | 40.7% | 33.3% | 22.2% |
| >1.2 | 22.2% | 22.2% | 22.2% | 33.3% |

### 2000–2004

| 1995–1999 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 20.0% | 30.0% | 20.0% | 30.0% |
| [0.8, 1) | 10.3% | 41.4% | 41.4% | 6.9% |
| [1, 1.2] | 8.0% | 40.0% | 36.0% | 16.0% |
| >1.2 | 7.7% | 30.8% | 15.4% | 46.2% |

### 2005–2010

| 2000–2004 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 12.5% | 50.0% | 37.5% | 0.0% |
| [0.8, 1) | 13.8% | 44.8% | 31.0% | 10.3% |
| [1, 1.2] | 8.0% | 52.0% | 32.0% | 8.0% |
| >1.2 | 13.3% | 20.0% | 26.7% | 40.0% |

### 2010–2013

| 2005–2010 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 22.2% | 22.2% | 33.3% | 22.2% |
| [0.8, 1) | 15.2% | 36.4% | 36.4% | 12.1% |
| [1, 1.2] | 8.3% | 50.0% | 41.7% | 0.0% |
| >1.2 | 0.0% | 36.4% | 18.2% | 45.5% |

## LOCATION QUOTIENTS OF DEATHS

### 1995–1999

| 1990–1994 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 55.2% | 24.1% | 17.2% | 3.4% |
| [0.8, 1) | 22.7% | 27.3% | 45.5% | 4.5% |
| [1, 1.2] | 0.0% | 27.8% | 66.7% | 5.6% |
| >1.2 | 25.0% | 0.0% | 25.0% | 50.0% |

### 2000–2004

| 1995–1999 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 73.9% | 13.0% | 8.7% | 4.3% |
| [0.8, 1) | 38.9% | 22.2% | 33.3% | 5.6% |
| [1, 1.2] | 3.4% | 20.7% | 55.2% | 20.7% |
| >1.2 | 14.3% | 14.3% | 28.6% | 42.9% |

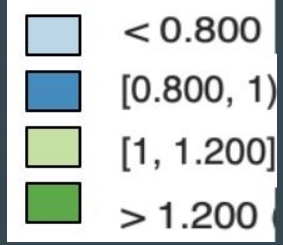
### 2005–2010

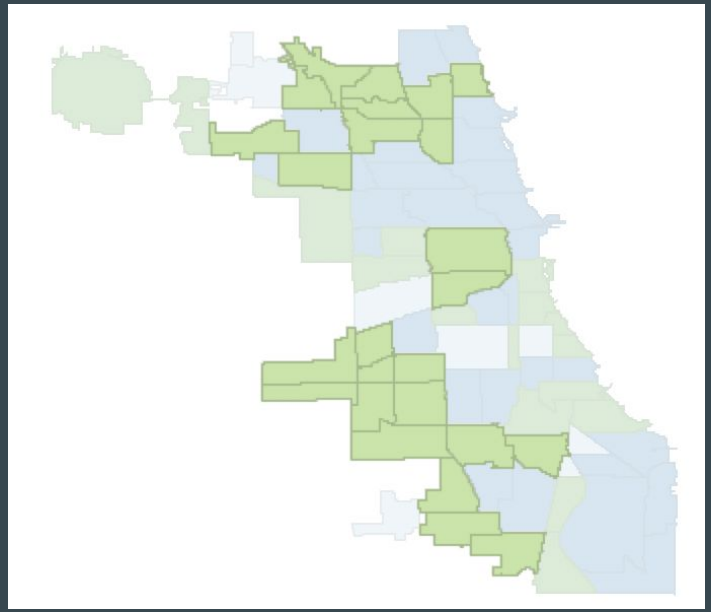
| 2000–2004 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 11.5% | 34.6% | 42.3% | 11.5% |
| [0.8, 1) | 0.0% | 50.0% | 42.9% | 7.1% |
| [1, 1.2] | 7.7% | 38.5% | 46.2% | 7.7% |
| >1.2 | 18.2% | 36.4% | 27.3% | 18.2% |

### 2010–2013

| 2005–2010 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 14.3% | 57.1% | 28.6% | 0.0% |
| [0.8, 1) | 10.0% | 50.0% | 30.0% | 10.0% |
| [1, 1.2] | 0.0% | 31.3% | 43.8% | 25.0% |
| >1.2 | 0.0% | 12.5% | 37.5% | 50.0% |

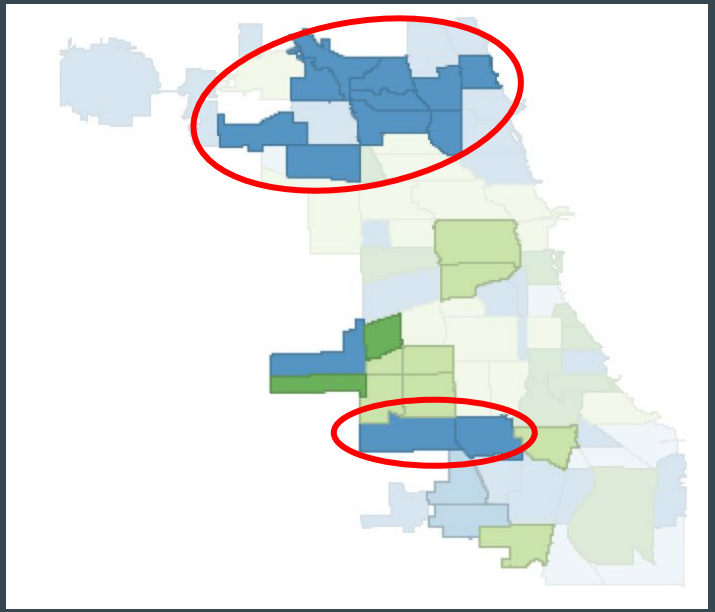
# Decrease Births



2000 - 2004

→



2005 - 2009

## LOCATION QUOTIENTS OF BIRTHS

### 1995–1999

| 1990–1994 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 8.3% | 33.3% | 33.3% | 25.0% |
| [0.8, 1) | 20.7% | 41.4% | 34.5% | 3.4% |
| [1, 1.2] | 3.7% | 40.7% | 33.3% | 22.2% |
| >1.2 | 22.2% | 22.2% | 22.2% | 33.3% |

### 2000–2004

| 1995–1999 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 20.0% | 30.0% | 20.0% | 30.0% |
| [0.8, 1) | 10.3% | 41.4% | 41.4% | 6.9% |
| [1, 1.2] | 8.0% | 40.0% | 36.0% | 16.0% |
| >1.2 | 7.7% | 30.8% | 15.4% | 46.2% |

### 2005–2010

| 2000–2004 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 12.5% | 50.0% | 37.5% | 0.0% |
| [0.8, 1) | 13.8% | 44.8% | 31.0% | 10.3% |
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| >1.2 | 13.3% | 20.0% | 26.7% | 40.0% |

### 2010–2013

| 2005–2010 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 22.2% | 22.2% | 33.3% | 22.2% |
| [0.8, 1) | 15.2% | 36.4% | 36.4% | 12.1% |
| [1, 1.2] | 8.3% | 50.0% | 41.7% | 0.0% |
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## LOCATION QUOTIENTS OF DEATHS

### 1995–1999

| 1990–1994 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
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| [1, 1.2] | 0.0% | 27.8% | 66.7% | 5.6% |
| >1.2 | 25.0% | 0.0% | 25.0% | 50.0% |

### 2000–2004

| 1995–1999 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 73.9% | 13.0% | 8.7% | 4.3% |
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| [1, 1.2] | 3.4% | 20.7% | 55.2% | 20.7% |
| >1.2 | 14.3% | 14.3% | 28.6% | 42.9% |

### 2005–2010

| 2000–2004 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 11.5% | 34.6% | 42.3% | 11.5% |
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### 2010–2013

| 2005–2010 | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
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| <0.8 | 14.3% | 57.1% | 28.6% | 0.0% |
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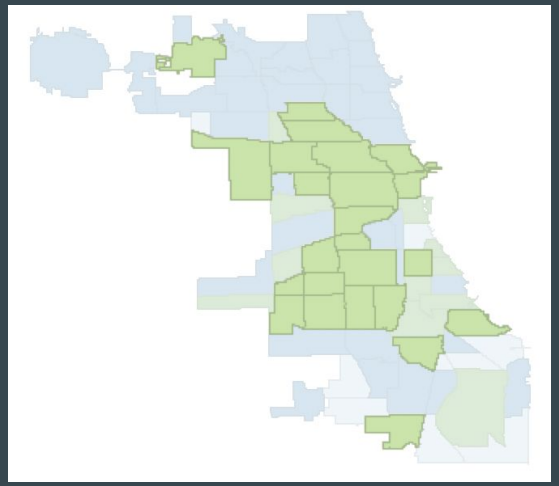
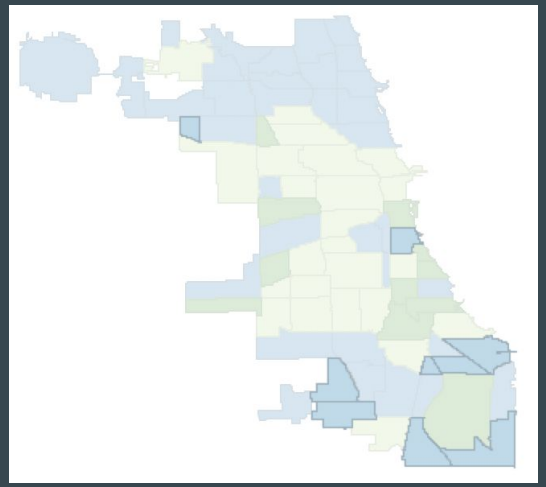
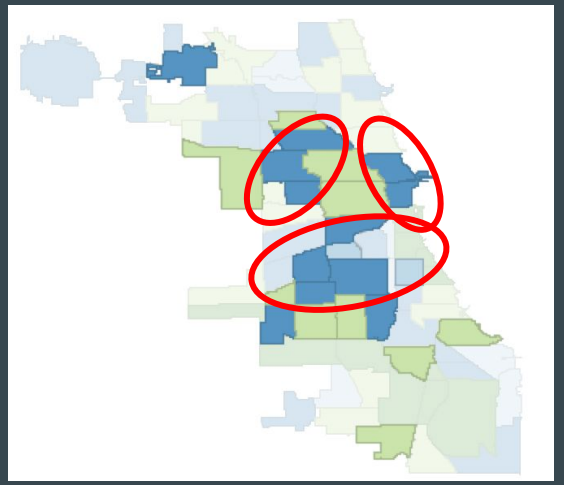
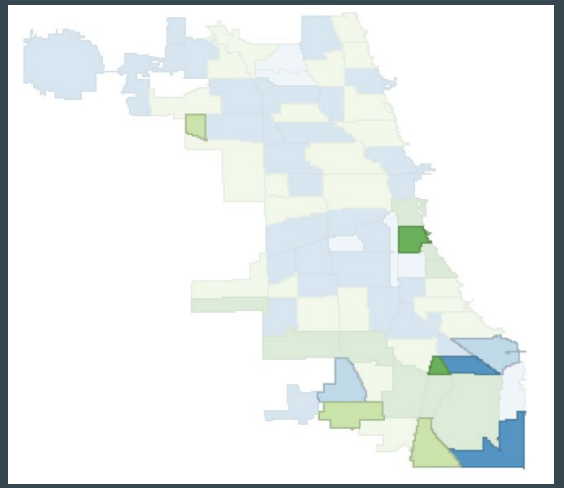
# Births







2005 - 2009 → 2010 - 2013

## LOCATION QUOTIENTS OF BIRTHS

### 1995–1999

1990–1994

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 8.3% | 33.3% | 33.3% | 25.0% |
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| >1.2 | 22.2% | 22.2% | 22.2% | 33.3% |

### 2000–2004

1995–1999

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 20.0% | 30.0% | 20.0% | 30.0% |
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2000–2004

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### 2010–2013

2005–2010

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 22.2% | 22.2% | 33.3% | 22.2% |
| [0.8, 1) | 15.2% | 36.4% | 36.4% | 12.1% |
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## LOCATION QUOTIENTS OF DEATHS

### 1995–1999

1990–1994

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 55.2% | 24.1% | 17.2% | 3.4% |
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| [1, 1.2] | 0.0% | 27.8% | 66.7% | 5.6% |
| >1.2 | 25.0% | 0.0% | 25.0% | 50.0% |

### 2000–2004

1995–1999

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
|---|---|---|---|---|
| <0.8 | 73.9% | 13.0% | 8.7% | 4.3% |
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| [1, 1.2] | 3.4% | 20.7% | 55.2% | 20.7% |
| >1.2 | 14.3% | 14.3% | 28.6% | 42.9% |

### 2005–2010

2000–2004

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
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| <0.8 | 11.5% | 34.6% | 42.3% | 11.5% |
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### 2010–2013

2005–2010

| | <0.8 | [0.8, 1) | [1, 1.2] | >1.2 |
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| <0.8 | 14.3% | 57.1% | 28.6% | 0.0% |
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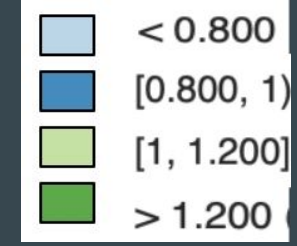
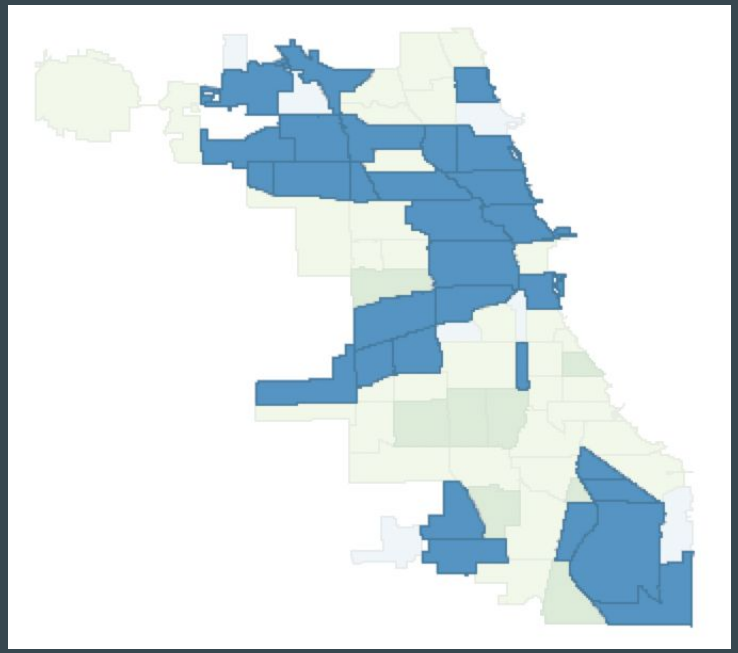
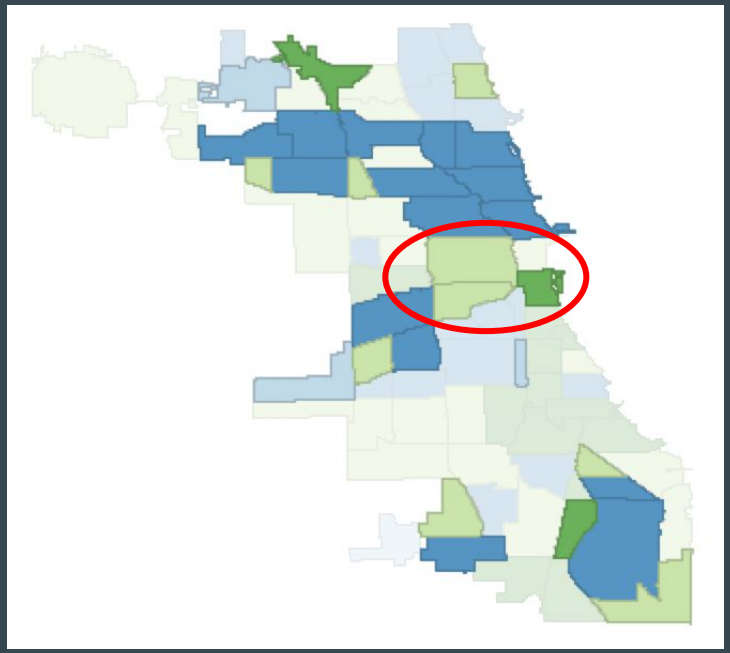
| >1.2 | 0.0% | 12.5% | 37.5% | 50.0% |

# Increase Deaths





1990 - 1994 → 1995 - 1999

## LOCATION QUOTIENTS OF BIRTHS

### 1995–1999

1990–1994

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2005–2010

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## LOCATION QUOTIENTS OF DEATHS

### 1995–1999

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| >1.2 | 25.0% | 0.0% | 25.0% | 50.0% |

### 2000–2004

1995–1999

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2000–2004

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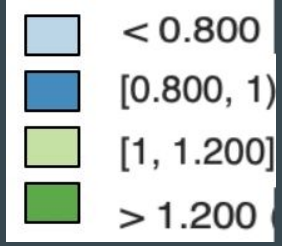
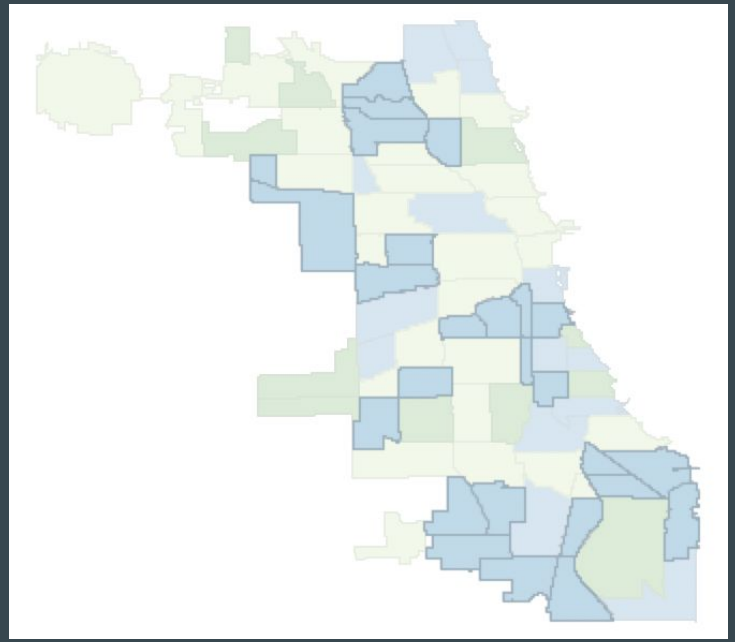
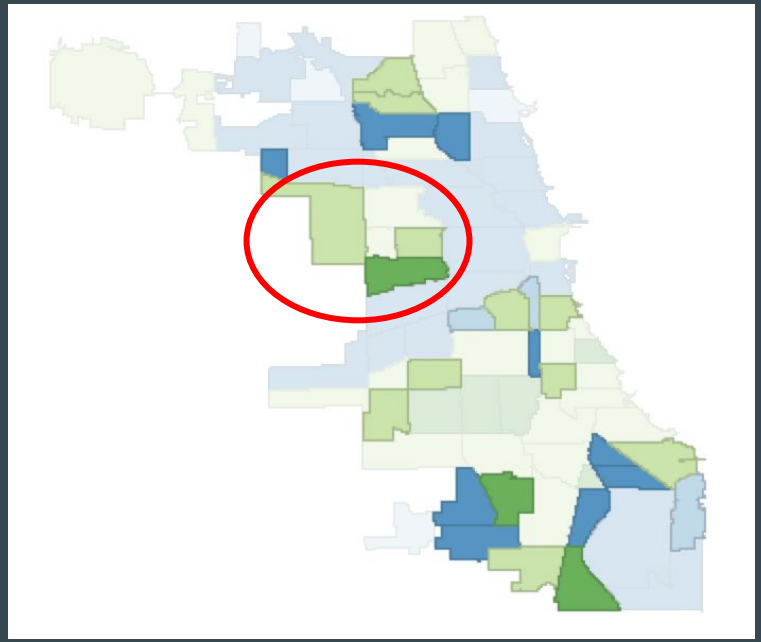
# Increase Deaths





2000 - 2004 → 2005- 2009