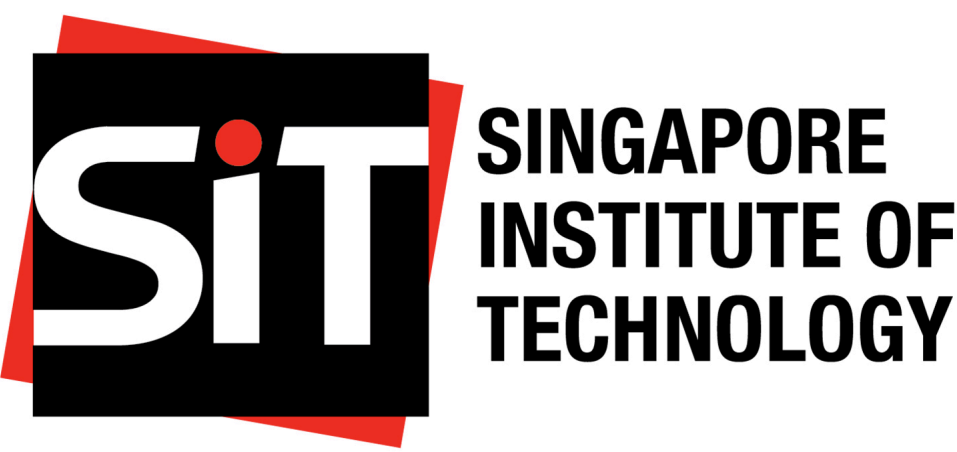# The Rise of Virtual Kitchens (2019–2023)

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Introduction

The COVID-19 pandemic has transformed numerous industries, and the food and beverage sector is no exception. One of the most notable developments during this period has been the rapid growth of virtual kitchens, also known as ghost kitchens or cloud kitchens. These innovative culinary ventures have gained significant traction, reshaping the landscape of food service.

Virtual restaurants in this context means that the restaurant is only available for pickup/delivery and there's no dine in option. They are "ghost restaurants", there is no place to walk up to, no signage, no seating. These restaurants operate out of commercial warehouses or trailers. And people usually patronize these virtual restaurants through delivery apps due to the restaurant names, and attractive images.[1]

The significance of virtual kitchens extends beyond mere convenience. They represent a fundamental shift in how food is produced and consumed. In this project, we aim to improve the previous visualizations and provide a comprehensive overview on how virtual kitchens have expanded across the various states and transform the food industry, encouraging consumers and restaurateurs to adapt to and embrace this new model.

Previous Visualization

The explosion of virtual restaurants
Since 2021, the number of virtual restaurants listed on Uber Eats has quadrupled in the U.S. and Canada.

2019 — 3,000
2021 — 10,000
2023 — 40,000

Notes: Figures are estimates.
Source: Uber
Graphic: Jasmine Cui and Joe Murphy / NBC News

Figure 1: Number of virtual restaurants listed on Uber Eats from 2019 to 2023.

Nashville, Tenn. — 31%
Atlanta — 22
San Jose, Calif. — 22
Philadelphia — 21
New York City — 21
Denver — 20
Portland, Ore. — 19
San Antonio — 19
Los Angeles — 18
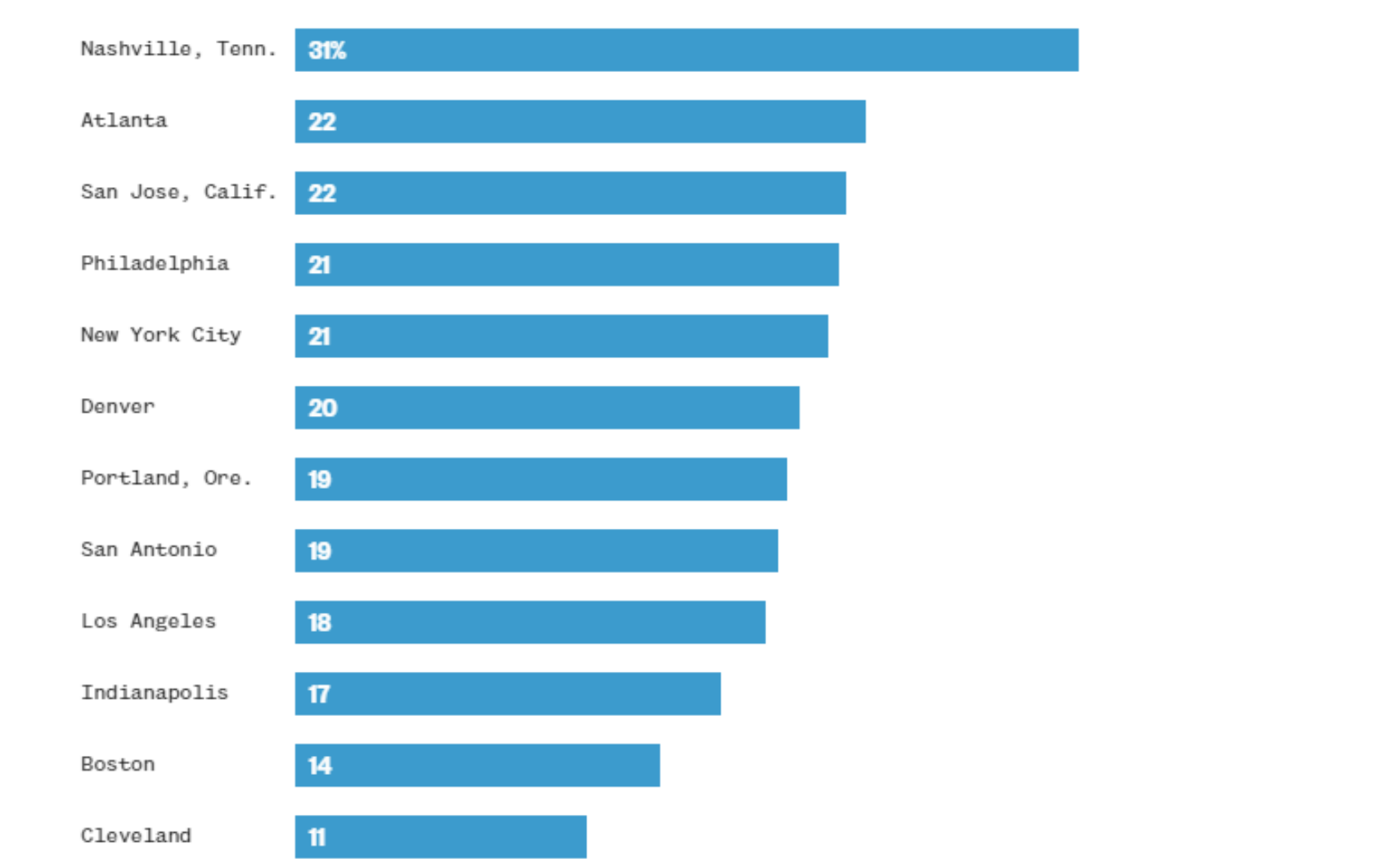Indianapolis — 17
Boston — 14
Cleveland — 11

Figure 2: Percentage of restaurant listings in a city.

Strengths

- The visualisation used in the article emphasises the increase in the number of virtual restaurants listed on Uber Eats from 2019 to 2023.
- The visualisation also highlights the top 12 cities with the highest percentage of virtual restaurants.

Suggested Improvements

1. *Add a plot title and a source note* so that the figure can be understood in isolation (e.g., when shared on social media).
2. *Identify missing data.* Identifying missing data can help readers understand the limitations of the visualization.
3. *Adding a legend.* A legend can help readers understand the visualization more easily.
4. *Include statistics for every state.* Statistics will help readers get an overview of the virtual restaurants in each state.
5. *Using a heatmap.* A heatmap can help readers visualize the distribution of virtual restaurants in different states more effectively.
6. *Having a mulitple heatmaps.* Multiple heatmaps can help readers compare the number of virtual restaurant over the years.

Implementation

Data

- The data used in this visualisation was obtained from Kaggle[2], that was scraped from Uber Eats[3]. The dataset contains information on the number of restaurants and important data such as name, full address, lat, long.
- However, for the purposes of the visualisation, since there was no data available for the inception of virtual kitchens in each state, we have randomly generated data for the years 2019 to 2023.

Software

We used the Quarto publication framework and the R programming language, along with the following third-party packages:

- *readxl* for data import
- *tidyverse* for data transformation, including *ggplot2* for visualization based on the grammar of graphics
- *knitr* for dynamic document generation

Improved Visualization

Further Suggestions for Interactivity

Due to the intention of the visualisation to be used in a poster, there are no interactive elements. However, if the visualisation were to be used in a digital format, the following interactive elements could be added:

1. *Hover-over information*: When hovering over a state, the user can see the number of virtual kitchens in that state.
2. *Filtering*: Users can filter the data by year to see how the number of virtual kitchens has changed over time.
3. *Zooming*: Users can zoom in on a specific region to see the number of virtual kitchens in more detail.
4. *Search*: Users can search for a specific state to see the number of virtual kitchens in that state.

Conclusion

We have implemented the suggested improvements to the visualization. By using a heatmap, it ensures that the data is much more easily understood as readers can identify areas with a higher percentage of virtual kitchens and get an overview of the distribution of virtual kitchens.

[1] https://academy.getbackbar.com/understanding-the-concept-of-virtual-restaurants

[2] https://www.kaggle.com/datasets/ahmedshahriarsakib/uber-eats-usa-restaurants-menus?resource=download&select=restaurants.csv

[3] https://www.ubereats.com