

Weather and Demographics vs Dog Walking: An Analysis Report for Wag

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Introduction to Wag, Weather Conditions, and Demographics

Wag is a dog-walking app that allows dog owners to schedule walks for their dogs; the walks are performed by vetted Wag walkers who are assigned to the walks based on location, schedule, and other preferences. As an analytical company, Wag would like to know how weather conditions and demographics play a role in dog-walking activity, and ultimately, their bottom line. This problem is twofold as we will present our data from both the owners' and walkers' perspectives. Essentially, are walks being cancelled or not scheduled due to extreme or unsuitable conditions, and are there not enough walkers available in the area due to these extreme or unsuitable conditions? Are demographic information such as household income and ethnicity indicators for tapping into additional sources of revenue?

Data and Why These Variables Matter

With Wag being a dog-walking company, our group is first approaching this scenario with Wag's ultimate beneficiaries in mind: the dogs themselves! We will be introducing some data points using research reports on what owners would consider inappropriate weather conditions for their dog to walk in. We are also looking at this data from the point of view of the employees available to take walks - we will be presenting some data points on what weather conditions people are less likely to be outside in. Weather matters because it determines whether dogs or people would want to be outside. The datasets we will be using to construct our weather visualizations are zip codes of owners, various temperature measurements, precipitation, and snow measurements across five major cities in the U.S. In order to further look at zip code information, we are also visualizing demographic information including ethnicity, revenue, and other household information to add additional layers of zip code information in these five major cities that contribute most to Wag business. Ultimately, these relevances are anecdotally impactful to Wag business, but obtaining the proper data for visualization and analysis will determine how they matter to the bottom line.

Steps Taken for Data Preparation

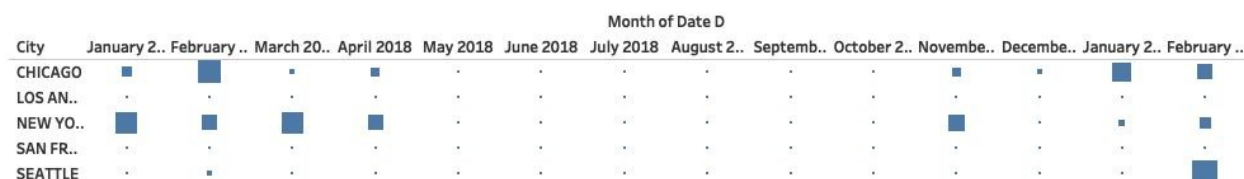
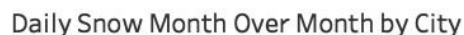
We began with a raw extract of public data for international weather stations. Using station identification numbers, data was filtered to U.S. weather stations with their latitudes, longitudes, and states. After gathering location information from the raw weather stations data, 2018 and 2019 daily weather data was downloaded. From this data, temperature, precipitation level, and snow depth were extracted for each U.S. weather station. Since Wag operates in the U.S. and there are numerous dog owners and walkers, their zip code information is relevant to understand if the weather at a location affects Wag users' decisions. Therefore, zip code data of the owners were matched to weather stations by selecting the minimum euclidean distance from weather stations to each zip code. With this approach, a weather station can be assigned to multiple zip codes, but a zip code cannot have multiple weather stations. After zip code and weather station matching, the weather data was cleaned to have a panel data structure, where

From an article published on Wag's website, it is clear that dogs, just like humans, are susceptible to a higher chance of contracting sickness in colder weather. PetMD guidelines suggest that once temperature drops below 45 degrees Fahrenheit (roughly 7 degrees Celsius) is when cold-averse dogs begin to feel uncomfortable. Vets-now.com reports that past 31 degrees Celsius is when true risk of heat stroke is posed to dogs, especially obese or flat-faced dogs. We proceed with our analysis keeping these rough thresholds in mind and also noting that human walkers would have a far larger threshold of tolerance to temperature because of our ability to regulate ourselves with clothing.

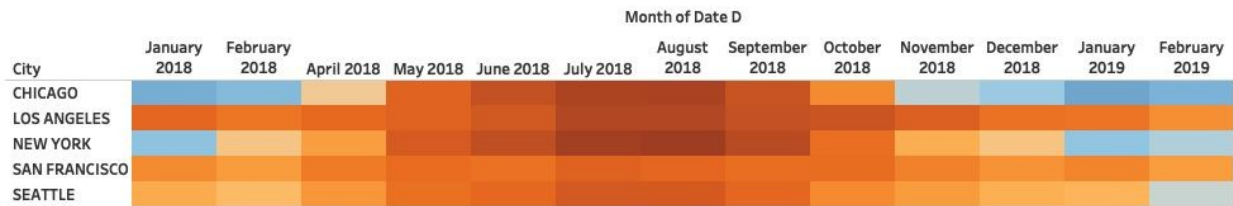
<https://wagwalking.com/wellness/can-dogs-get-sick-from-cold-weather>
<https://www.petmd.com/dog/care/how-cold-too-cold-dog>
<https://www.vets-now.com/summer/when-is-it-too-hot-to-walk-a-dog/>

Weather Analysis

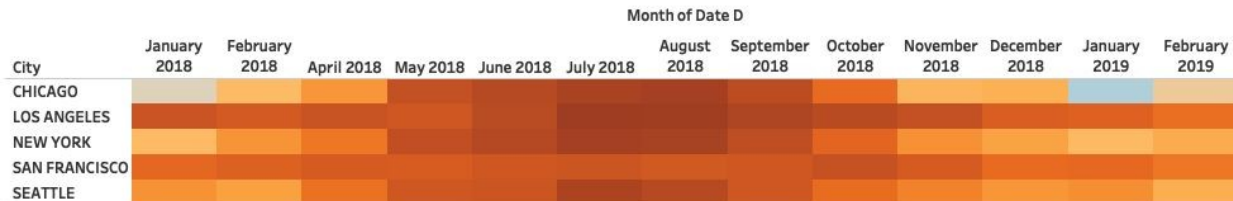
Daily Precipitation Month Over Month by City



Average Min Temperatures Month over Month



Average Max Temperatures Month over Month



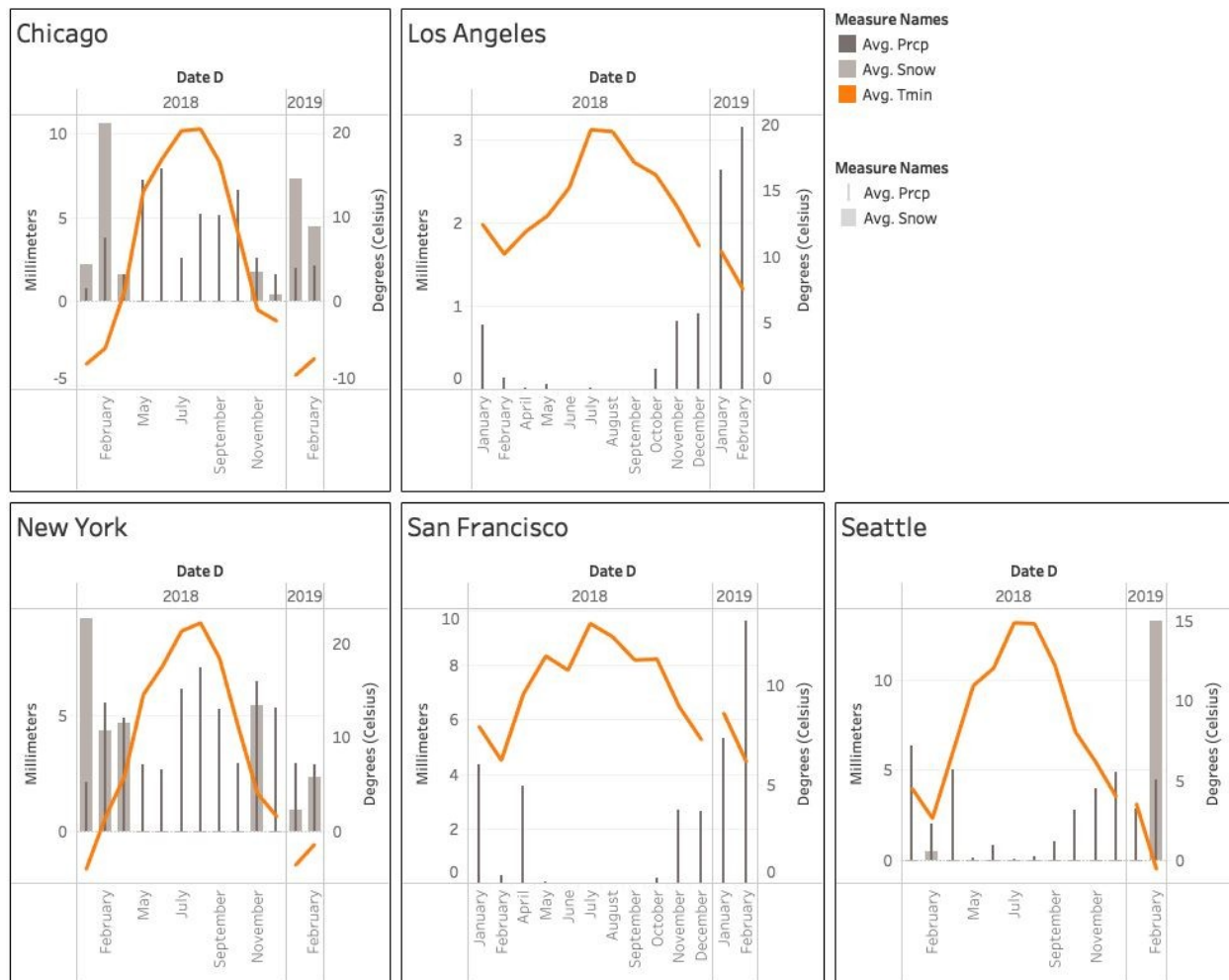
At a glance, the above graphics give us a good sense of which of the five major cities experience the most extreme temperatures, precipitation, and snowfall. Given our prior discussion about weather preferences for dog walkers, we can assume that dog owners in Los Angeles and San Francisco are the least concerned among all time periods about how weather affects their walking conditions, since there is no to minimal reported snow, precipitation, and extreme temperature differences. The same will hold true for Wag employees in Los Angeles and San Francisco - weather is not a deterrent to performing walks.

The cities of Chicago and New York experience the most precipitation during the summer months as well as the most snow during the winter months.

Since the data above are point estimates at any observed period of time and not a time-series data set, we cannot be certain that extreme temperatures hold constant throughout any given day. For example, extreme snow for a few hours in the morning yet a calmer afternoon means a dog can likely still be walked post-snowfall; however, since the data we are using are averages, we make the assumption that any extreme weather event means it is likely a dog was not walked at all that day.

The following visual contains weather trends within the five major cities, mapping average precipitation (thinner grey bars), average snowfall (light grey bars), and average minimum temperatures (orange trendline). Units are in millimeters (left axis) for precipitation and snowfall and in degrees Celsius (right axis) for temperature.

Average Precipitation, Snowfall, and Minimum Temperature by City:



We chose to visualize minimum temperature (as opposed to maximum/average temperature) as we postulate that it is likely to be more of a limiting factor for dog walks - it is more common to be 'too cold' for a walk than 'too hot.'

We believe that Wag could use the above visualization to decide optimal months to market its service. For example, we predict that July has the highest potential for total walks - we can see that the average minimum temperature trendline clears our minimum temperature for walks (7 degrees Celsius) while average precipitation is kept to a minimum within the summer, warmer months. A similar observation can be made for the months of May and June in New York.

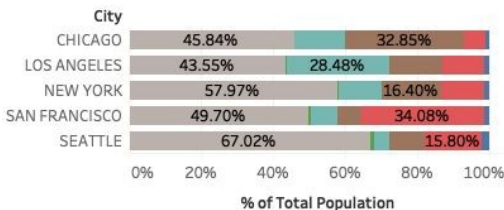
It is important to note that this visualization also allows us to spot outlier months in weather trends. Los Angeles, typically a solid market for Wag with its warm weather throughout the year, experienced extraordinary rainfall in the first two months of 2019. We don't expect these outliers to affect the viability of the Los Angeles market going forward. Similar outliers are observed in the other West Coast cities - San Francisco had similar rainfall spikes as Los Angeles and Seattle experienced extraordinary snowfall in February of 2019.

Demographic Analysis

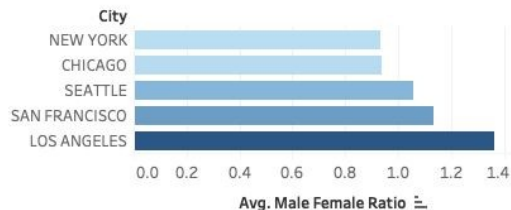
The following visual contains comparative information on Chicago, Los Angeles, New York, San Francisco, and Seattle's breakdown by ethnicity, income, male:female ratio, and age.

Comparisons of Major Cities Demographics

Ethnicity



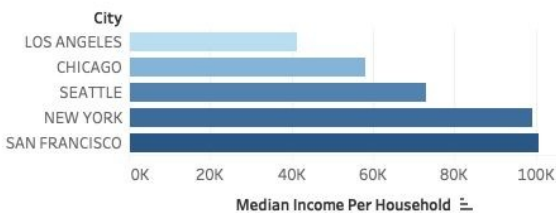
Male female ratio



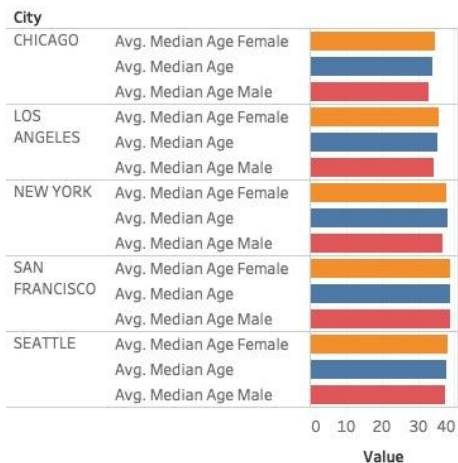
Ethnicity

White Populati.. Hispanic and .. Asian Population
Native Hawaiia.. Black or African.. American India..

Median income per household



Median age



To summarize the above visual, Seattle has the largest population that identifies as White, Los Angeles has the highest number of males compared to females, San Francisco and New York have the highest median income per household with Los Angeles being the lowest median income, and Chicago reports the youngest median age while San Francisco reports the oldest.

In order to better understand what this data means for Wag, our group researched the characteristics of dog owners throughout the U.S.

Pet Population and Ownership Trends in the U.S.: Dogs, Cats, and Other Pets, 2nd Edition has overarching insights on dog ownership with data collected from National Pet Owner Surveys and Simmons National Consumer Study in sporadic months from 2015 to 2017. Some general key points made in this trends report were that about half of dog-owners live in the top-25 largest metro areas (including the five major cities we are visualizing), the non-Hispanic White population own the most dogs of all the dog-ownership population, and there is a growth in dog ownership among high-income households as well as unmarried and childless households.

Conclusion

Various major cities are all potential revenue sources for Wag, given unique characteristics about these cities that also identify with increasing dog ownership. Assuming the key points discussed in the Demographic Analysis section will hold true for 2018 to 2019, we can apply these to our business decisions for Wag:

- Considering that dog ownership is seen the most in White populations, Seattle is a potential revenue opportunity for Wag.
- Another metric that Wag could look into is the *increase in dog ownership* among populations with relatively high incomes. Assuming this data point correlates with the given demographic information about median income, New York and San Francisco are further targets for Wag marketing as we predict that dog ownership will continue to rise in these cities.
- Since the number of unmarried and childless dog owners is increasing, for the sake of analyses, let us assume that the age < 35 years encompasses this segment. This would mean there this is a rise in dog-ownership in the city of Chicago, another target segment for Wag in terms of marketing opportunities.
- A recommendation here would be to market dog owners in the target population groups in these segments to register on Wag, ahead of the seasons of spring and summer, as well as marketing towards potential Wag employees living in these areas to apply.

With all of these potential opportunities, careful demand and supply analysis needs to be completed in order to ensure there isn't a surplus of dog owners on Wag in comparison to dog walkers.

When looking at weather patterns from 2018 to Feb 2019, the cities that prove to be the most outdoor-friendly are Los Angeles, Seattle and San Francisco. Since San Francisco is both outdoor-friendly *and* high in median income, and Seattle is both outdoor-friendly *and* high in potential dog-ownership population given the ethnicity breakdown, our recommendation is to first strengthen customer base in these two cities, as it seems to be a low-hanging fruit. Finally, Wag can focus on strengthening its customer base in the remaining cities, and also onboard more walkers.

Next steps

If we could be given data from Wag's business, such as walk rates, revenue, customer demographics, and new customer acquisition rate, we would be able to establish a true claim about the effect of weather or demographics on Wag. Given such business data, we would be able to construct analytical models to test our various hypotheses. For example, time-series analysis of a certain Wag KPI alongside weather patterns could be insightful, especially when taking into account demographic effects that remain fixed across cities. A few metrics that can be examined vis-a-vis the weather and demographic data are:

- cancellation rates
- average number of walks scheduled
- average duration of a walk and how it is affected by the weather conditions