

Exploring + Modeling Seattle's Aging and Disability Services

By Leo Harth + Jane Christen

Exploring + Modeling Seattle's Healthy Aging Services | Planning by Numbers Term Project

4.24.2019

Our Curiosity was Piqued

With increasing life spans, how will Seattle's Aging and Disability Services (ADS) continue to address **the environmental, economic, and social factors that influence the health and well-being** of older adults?



A Growing + Aging Population

A snapshot of King County underscores that **17% of the population is 60+.**

This aging population is **expected to grow more than 25% by 2040** as the “age wave” hits.

King County Population Age 60+ Snapshot ¹

| Age | Population | % Total | Male | % Total | Female | % Total |
|---------------|------------|---------|-----------|---------|-----------|---------|
| Total King | 2,007,779 | 100% | 1,001,982 | 100% | 1,005,797 | 100% |
| 60 - 69 | 191,838 | 10% | 92,397 | 9% | 99,441 | 10% |
| 70 - 79 | 87,790 | 4% | 39,935 | 4% | 47,854 | 5% |
| 80+ | 64,907 | 3% | 23,885 | 2% | 41,022 | 4% |
| Total Age 60+ | 344,535 | 17% | 156,218 | 16% | 188,317 | 19% |

The Datasets

- 328,000 rows >> ~14,000
- 45 variable columns
- Limited to **age 65+**
- 4 independent variables:
 - Transportation** (9,960)
 - Nutrition** (78,102)
 - Case Mgmt.** (108,827)
 - Info + Assist.** (25,923)
- **Predictive model** (2015 + 2016)

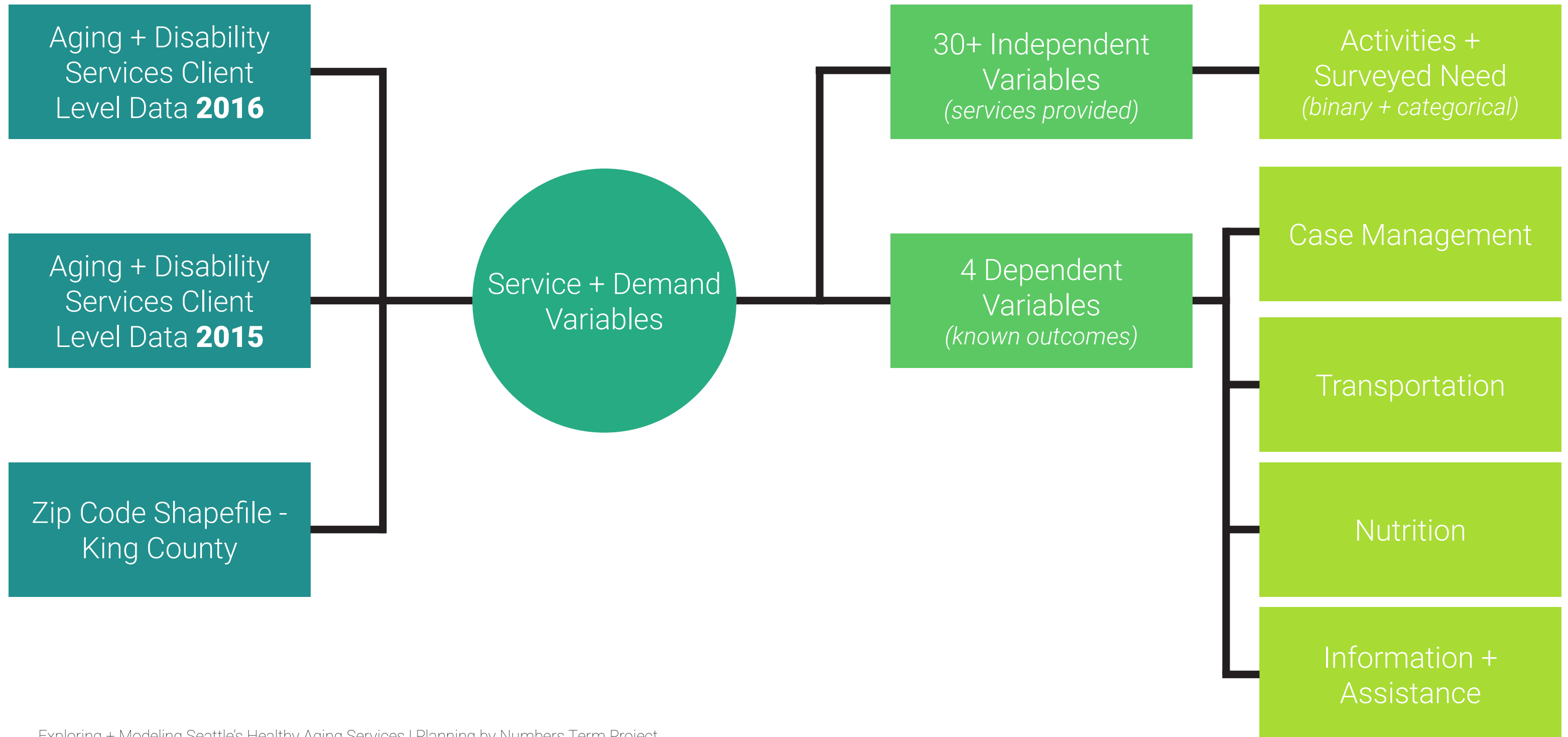
```
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'data.frame': 13776 obs. of 74 variables:
 $ ActivityID      : int  3990581 3925885 3782472 3806424 3882504 4060905 4041876 3948448 4013284
 $ ClientID       : int  155307 155307 155307 155307 155307 155307 155307 155307 155307 ..
 $ GeographicLocation : Factor w/ 20 levels "","East Rural",...: 19 19 19 19 19 19 19 19 19 ...
 $ AgeRange       : Factor w/ 25 levels "","-423","10 to 14",...: 21 21 21 21 21 21 21 21 21 ..
 $ EthnicityCode  : Factor w/ 7 levels " ","n","N","u",...: 7 7 7 7 7 7 7 7 7 ...
 $ RaceCode       : int  6 6 6 6 6 6 6 6 6 ...
 $ IncomeCode     : int  1 1 1 1 1 1 1 1 1 ...
 $ LiveAlone      : Factor w/ 7 levels " ","0","n","N",...: 4 4 4 4 4 4 4 4 4 ...
 $ LimitedEnglish : Factor w/ 6 levels " ","0","n","N",...: 4 4 4 4 4 4 4 4 4 ...
 $ Language       : Factor w/ 148 levels ""," ","16","19",...: 47 47 47 47 47 47 47 47 47 ...
 $ NutritionalRisk : Factor w/ 14 levels ""," ","1","2",...: 12 12 12 12 12 12 12 12 12 ...
 $ SingleParent   : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ HouseholdwithChildren : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ Homeless       : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ DisabilityStatus : Factor w/ 6 levels "","-"," ","N",...: 6 6 6 6 6 6 6 6 6 ...
 $ Unincorporated : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ NumberOfChildren : int  0 0 0 0 0 0 0 0 0 ...
 $ RelationshipToRecipientCode: int  0 0 0 0 0 0 0 0 0 ...
 $ Kinship        : Factor w/ 6 levels ""," ","0","N",...: 2 2 2 2 2 2 2 2 2 ...
 $ Veteran        : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ Eating         : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ Toileting      : Factor w/ 5 levels ""," ","N","U",...: 3 3 3 3 3 3 3 3 3 ...
 $ Walking        : Factor w/ 5 levels ""," ","N","U",...: 5 5 5 5 5 5 5 5 5 ...
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 $ Transferring   : Factor w/ 5 levels ""," ","N","U",...: 5 5 5 5 5 5 5 5 5 ...
 $ Dressing       : Factor w/ 5 levels ""," ","N","U",...: 5 5 5 5 5 5 5 5 5 ...
 $ Bathing        : Factor w/ 6 levels ""," ","1","N",...: 6 6 6 6 6 6 6 6 6 ...
 $ MedicalManagement : Factor w/ 17 levels ""," ","1","10",...: 17 17 17 17 17 17 17 17 17 1
 $ Cooking        : Factor w/ 6 levels ""," ","2015",...: 6 6 6 6 6 6 6 6 6 ...
 $ Shopping       : Factor w/ 6 levels ""," ","1034",...: 6 6 6 6 6 6 6 6 6 ...
 $ Chores         : Factor w/ 6 levels ""," ","2693",...: 6 6 6 6 6 6 6 6 6 ...
 $ Driving        : Factor w/ 6 levels ""," ","11","N",...: 6 6 6 6 6 6 6 6 6 ...
 $ HeavyHousework : Factor w/ 6 levels ""," ","30","N",...: 6 6 6 6 6 6 6 6 6 ...
 $ Phoning        : Factor w/ 9 levels ""," ","32","36",...: 9 9 9 9 9 9 9 9 9 ...
 $ MoneyManagement : Factor w/ 6 levels ""," ","Meals",...: 4 4 4 4 4 4 4 4 4 ...
 $ DivisionID     : int  1 1 1 1 1 1 1 1 1 ...
 $ ServiceMonth    : int  9 7 1 2 5 12 11 8 10 3 ...
 $ ServiceYear     : int  2015 2015 2015 2015 2015 2015 2015 2015 2015 2015 ...
 $ AgencyID        : int  1151 1151 1151 1151 1151 1151 1151 1151 1151 1151 ...
 $ SiteID          : int  2768 2768 2768 2768 2768 2768 2768 2768 2768 2768 ...
 $ ServiceAreaID   : int  11 11 11 11 11 11 11 11 11 11 ...
 $ ServiceTypeID   : int  31 31 31 31 31 31 31 31 31 31 ...
 $ UnitsProvided   : num  3 11 7 3 3 4 6 4 5 9 ...
 $ UnitsProvidedType : Factor w/ 11 levels "","Activity",...: 7 7 7 7 7 7 7 7 7 7 ...
 $ ContractID      : int  3595 3595 3595 3595 3595 3595 3595 3595 3595 3595 ...
 $ dummy_hispanic  : num  1 1 1 1 1 1 1 1 1 ...
 $ is_white        : num  1 1 1 1 1 1 1 1 1 ...
 $ is_black        : num  0 0 0 0 0 0 0 0 0 ...
 $ is_asian        : num  0 0 0 0 0 0 0 0 0 ...
 $ Income          : chr  "Very_Low" "Very_Low" "Very_Low" "Very_Low" ...
 $ dummy_livealone : num  0 0 0 0 0 0 0 0 0 ...
 $ dummy_nutrisk   : num  0 0 0 0 0 0 0 0 0 ...
 $ speak_english  : num  0 0 0 0 0 0 0 0 0 ...
 $ is_sigleparent  : num  0 0 0 0 0 0 0 0 0 ...
 $ has_children    : num  0 0 0 0 0 0 0 0 0 ...
 $ is_homeless     : num  0 0 0 0 0 0 0 0 0 ...
 $ is_disabled     : num  1 1 1 1 1 1 1 1 1 ...
 $ live_outbounds  : num  0 0 0 0 0 0 0 0 0 ...
 $ is_veteran      : num  0 0 0 0 0 0 0 0 0 ...
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 $ help_toileting  : num  0 0 0 0 0 0 0 0 0 ...
 $ help_walking    : num  1 1 1 1 1 1 1 1 1 ...
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 $ help_money      : num  0 0 0 0 0 0 0 0 0 ...
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The Datasets

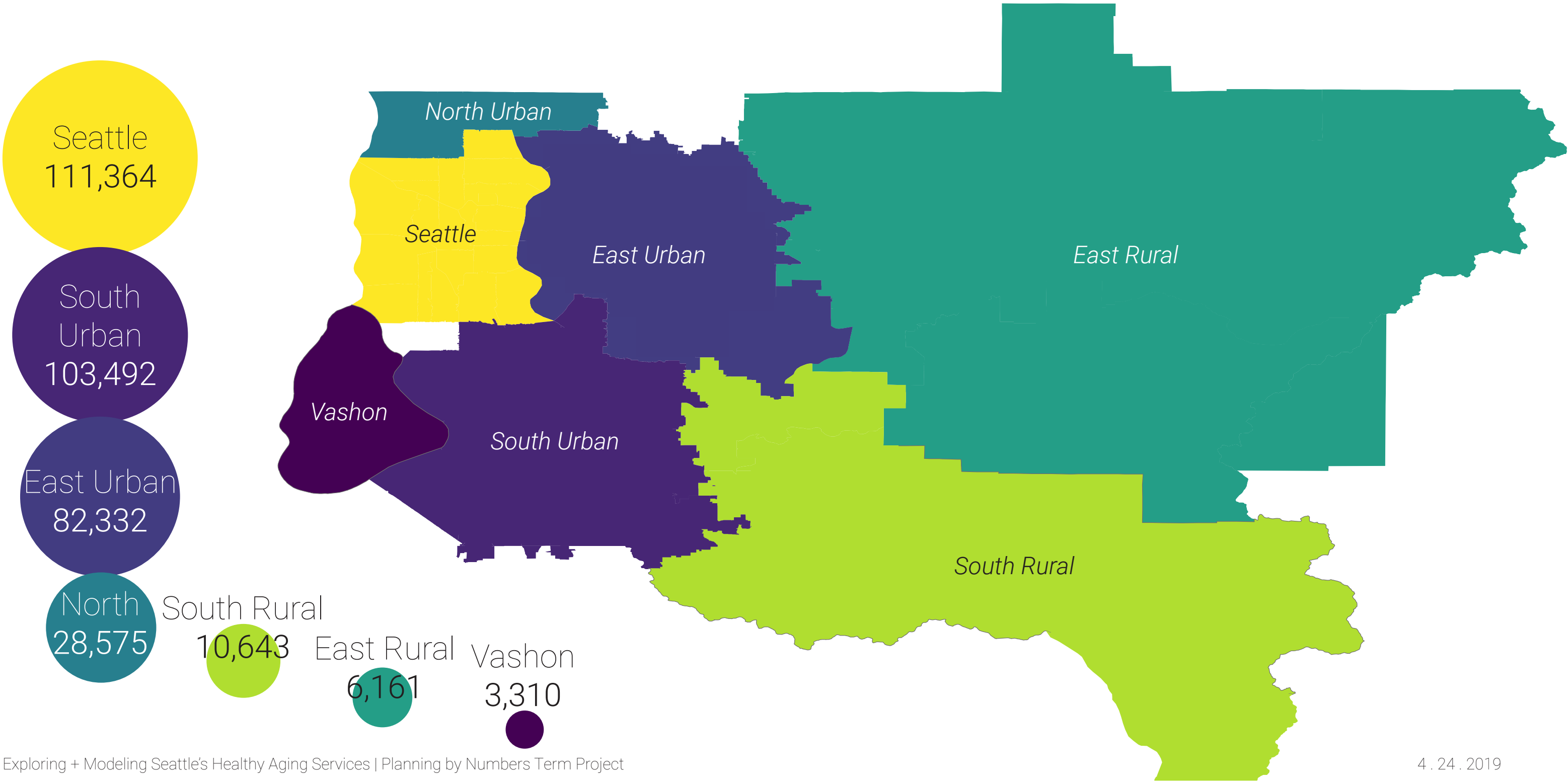
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 $ help_money     : num  0 0 0 0 0 0 0 0 0 ...
```

The Process

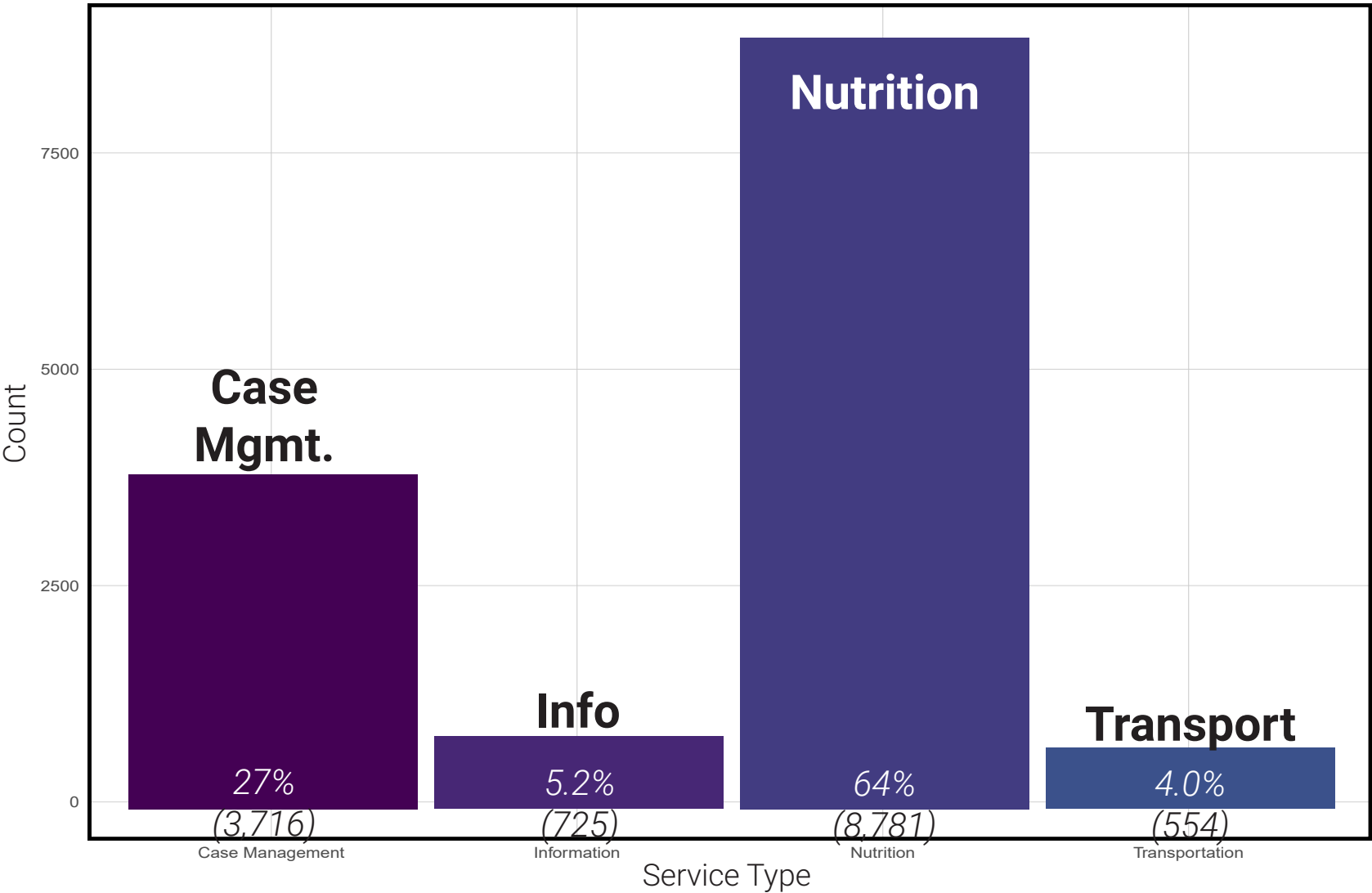


Sub-Regional Distribution

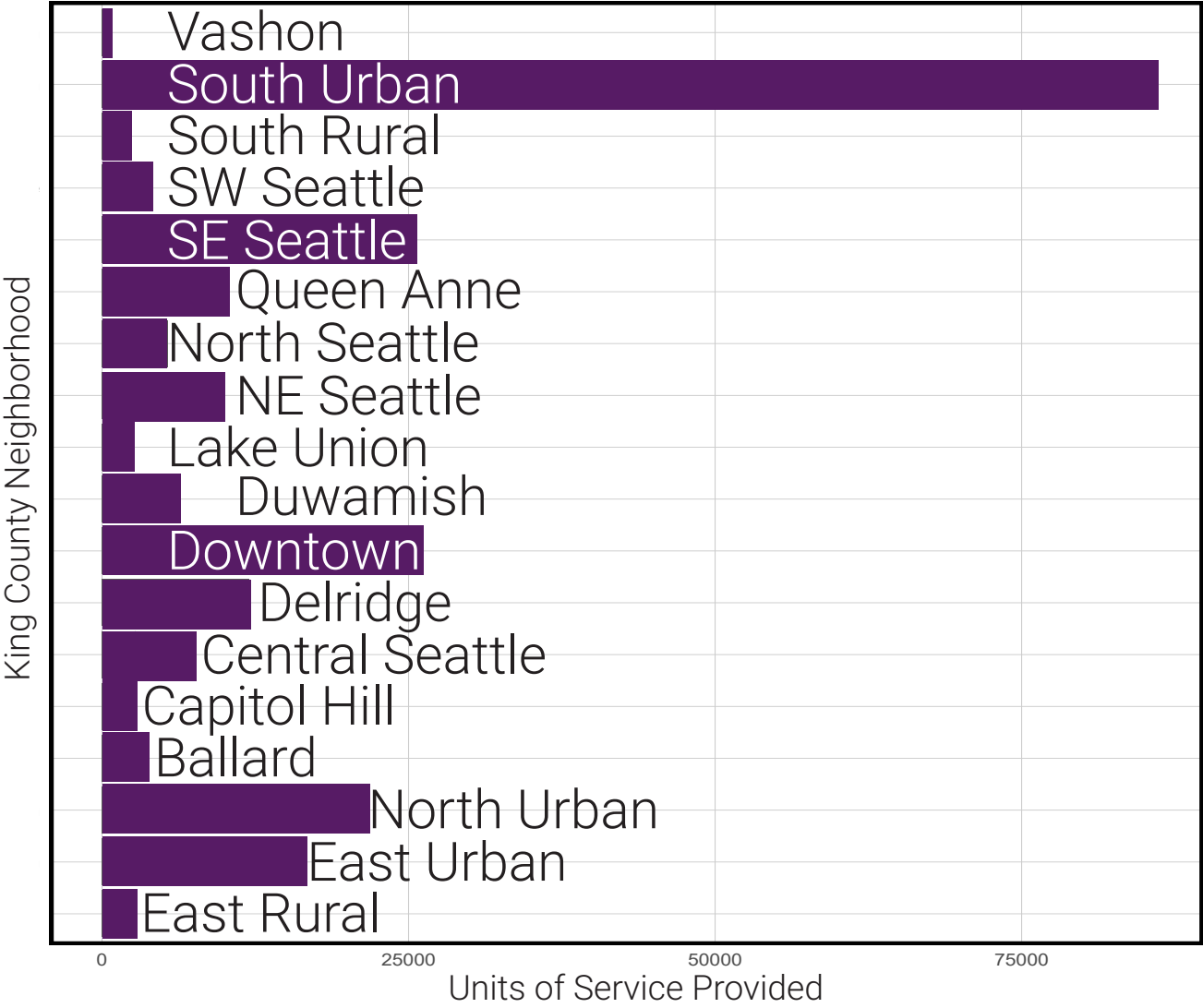


Understanding Service Use

Service Use Frequency

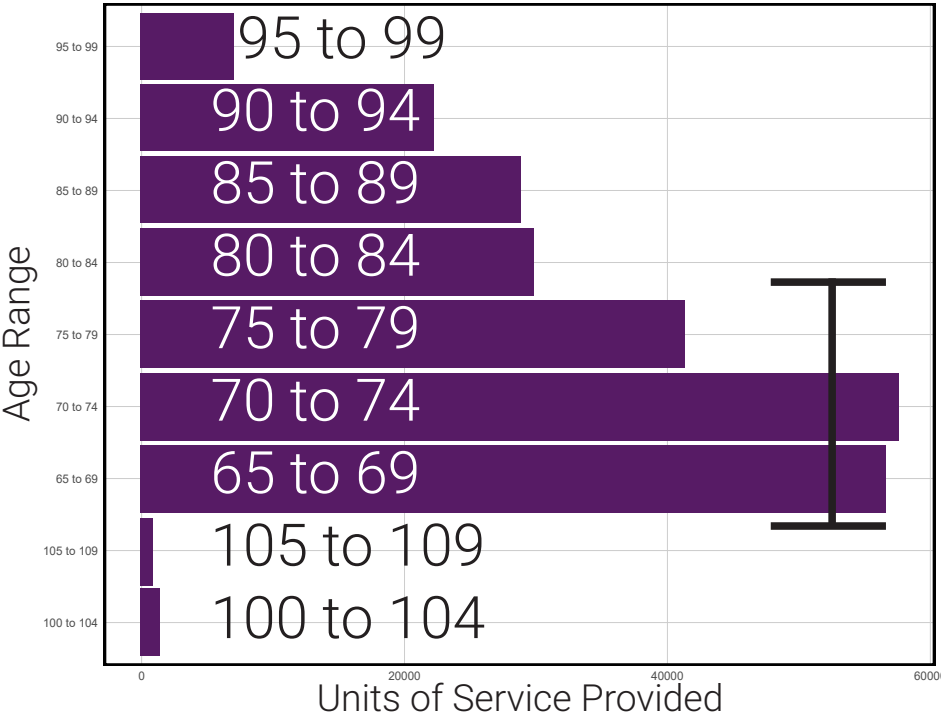


Service Provided by Area

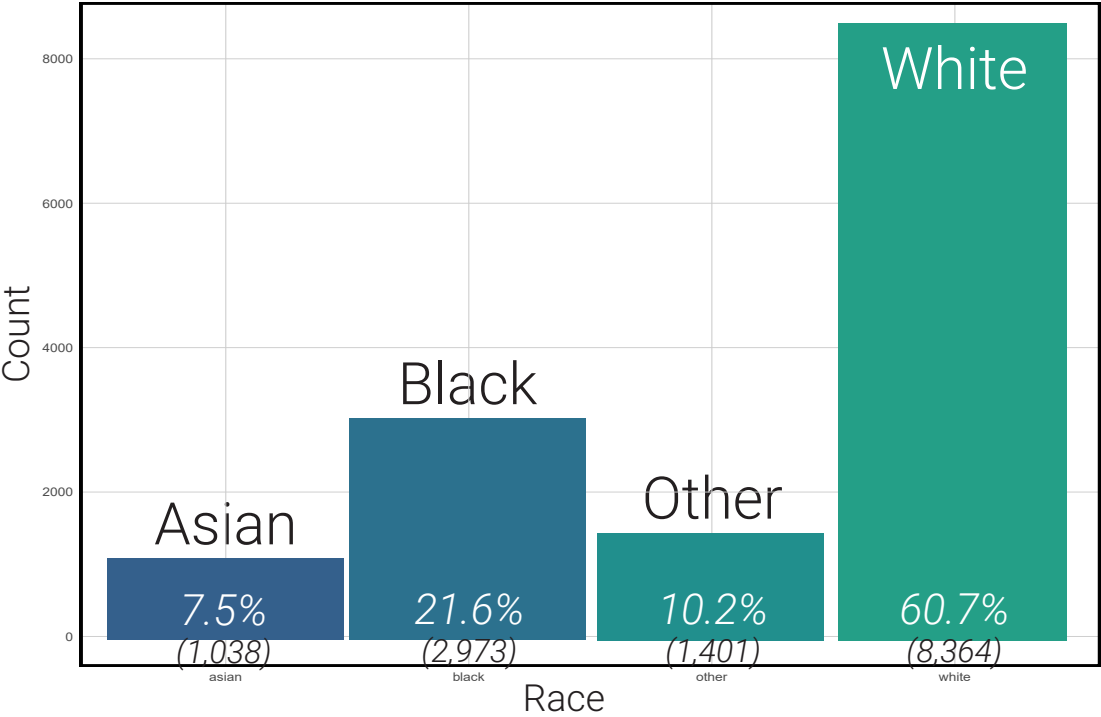


The Users' Demographic Profile

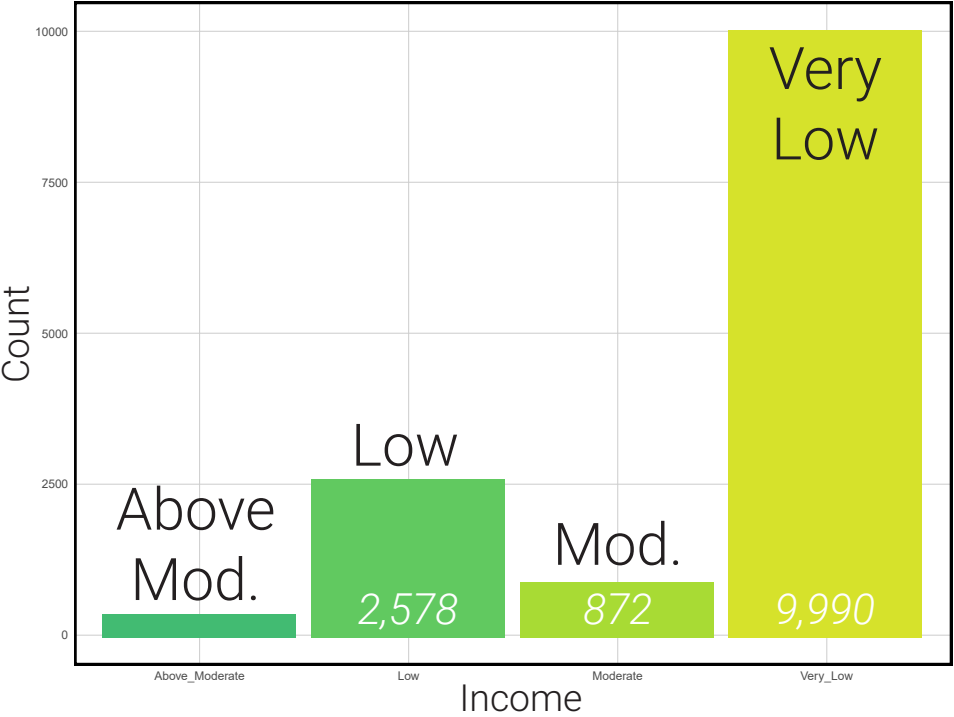
Age Range



Racial Grouping

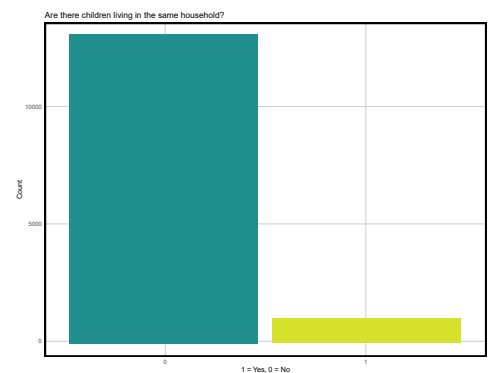


Income

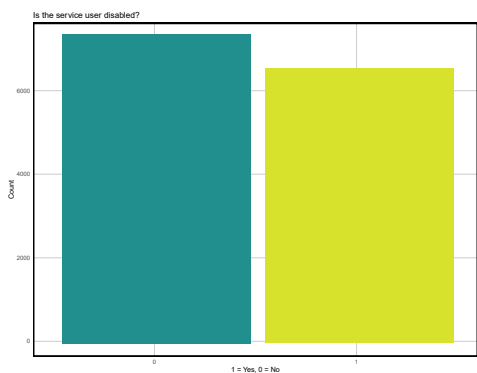


Binary Variables

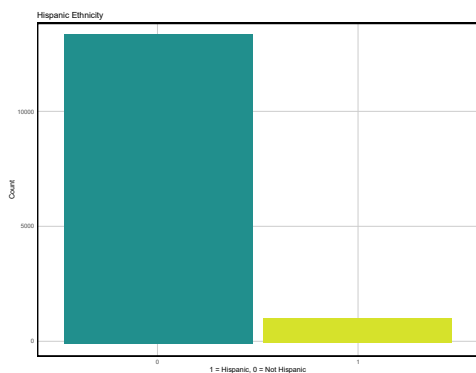
Who are the service users?



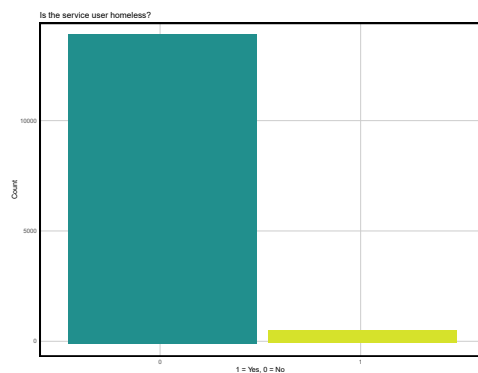
Are there **children in Household**?



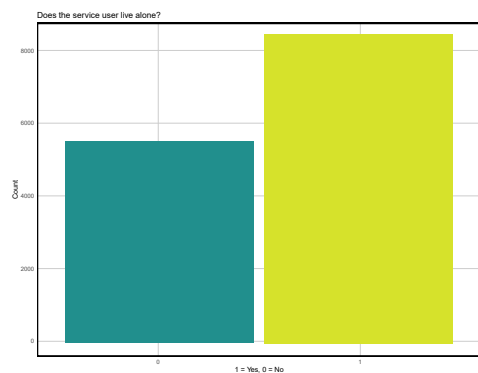
Is the user **disabled**?



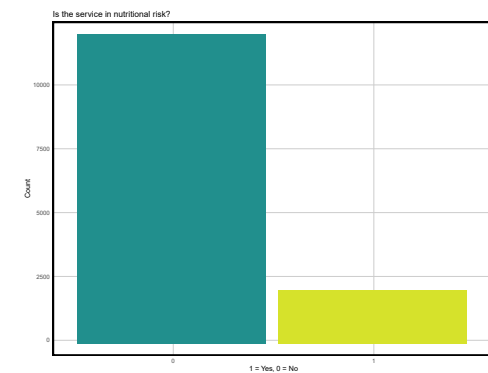
Is the user **hispanic**?



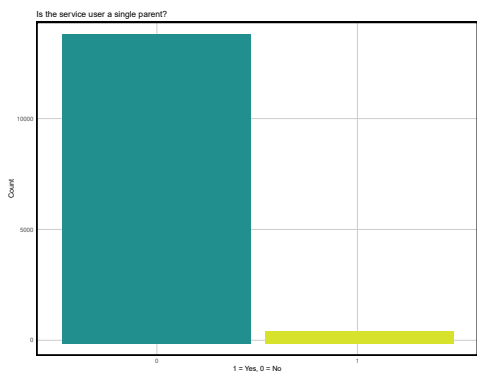
Is the user **homeless**?



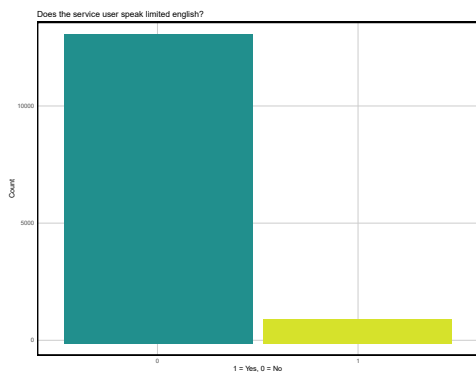
Does the user **live alone**?



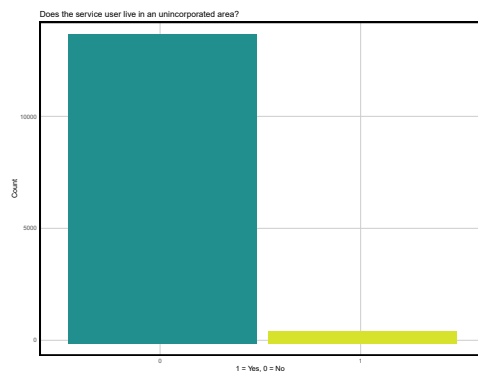
Is the user in **nutritional risk**?



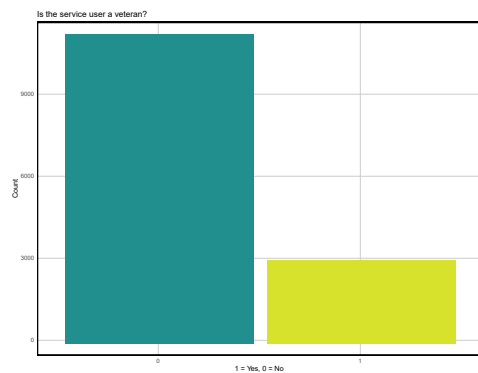
Is the user a **single parent**?



Does the user have **limited english**?



Does the user live in an **unincorporated area**?

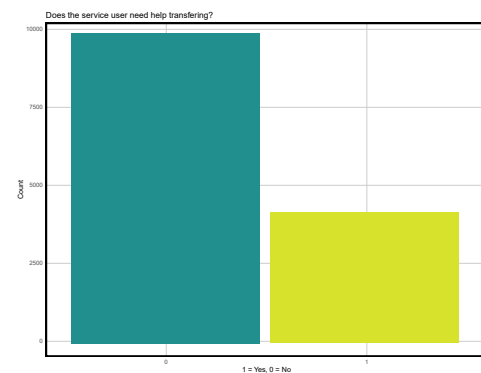


Is the user a **veteran**?

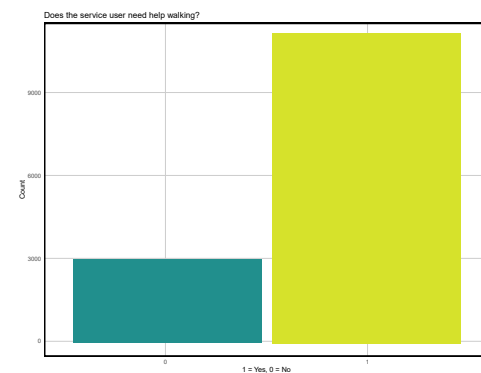
Binary Variables

Activities of Daily Living (ADLs) help needed by users.

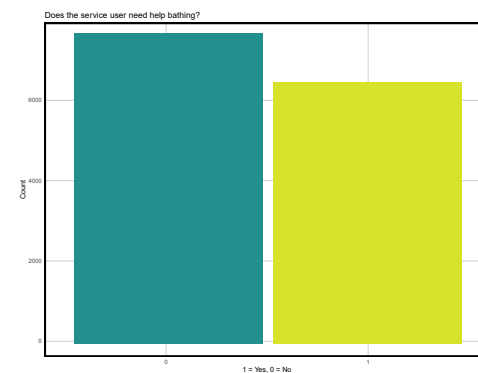
Yes
No



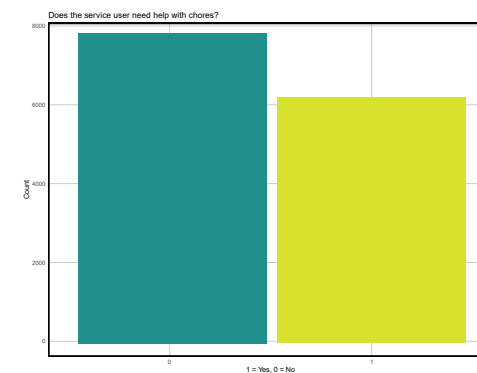
Need **help** transferring?



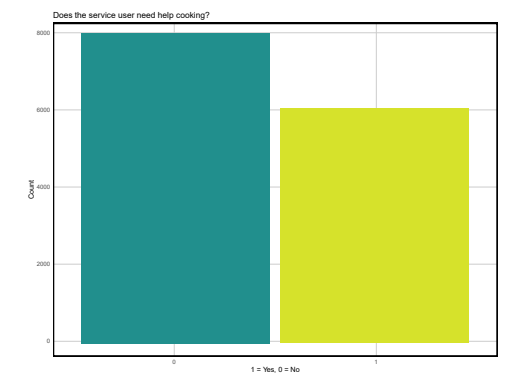
Need **help** walking?



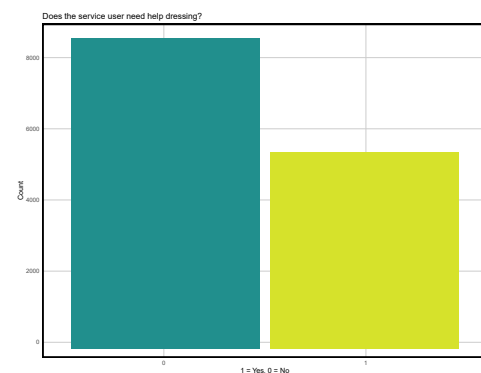
Need **help** bathing?



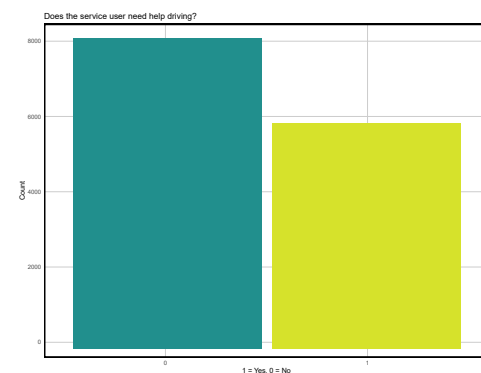
Need **help** with chores?



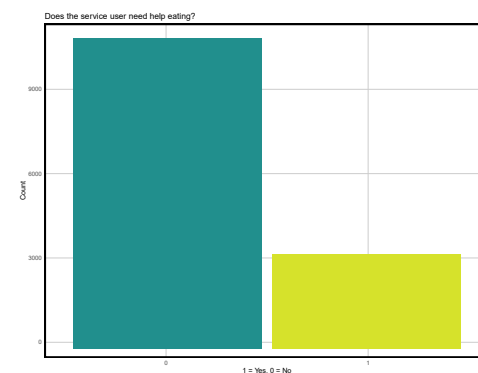
Need **help** cooking?



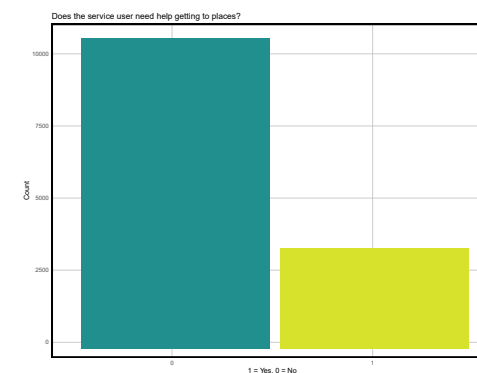
Need **help** dressing?



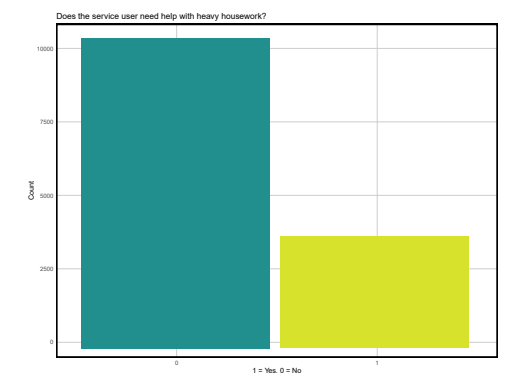
Need **help** driving?



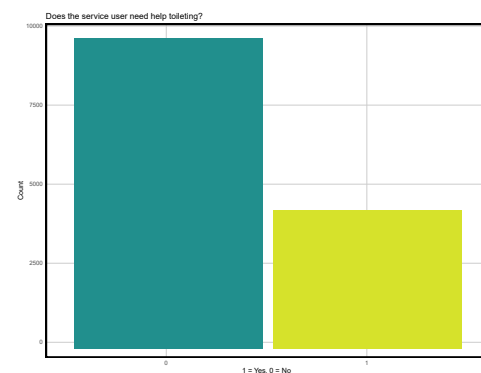
Need **help** eating?



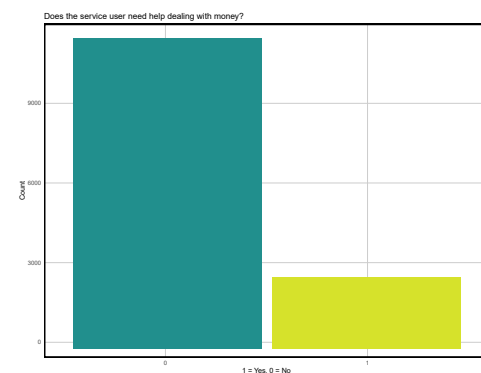
Need **help** getting places?



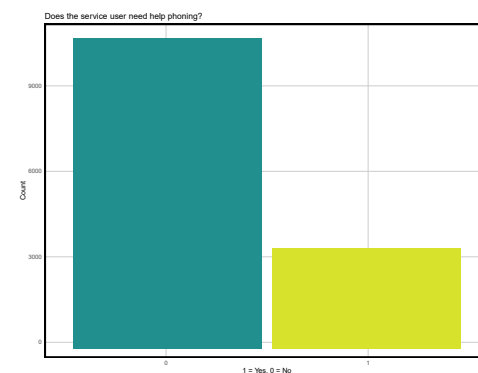
Need **help** with heavy housework?



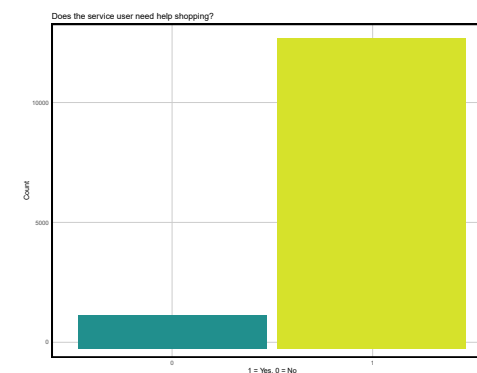
Need **help** toileting?



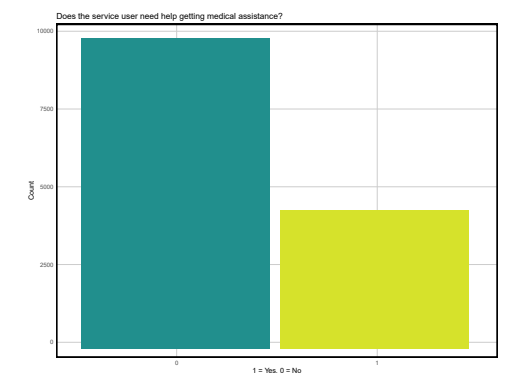
Need **help** with money?



Need **help** phoning?



Need **help** with shopping?



Need **help** getting medical assistance?

Measuring Association

The models were streamlined, and overlapping variables were removed. We then compared the model results to the known outcome.

| | <i>Is_hispanic</i> | <i>Live_alone</i> | <i>Nutri_risk</i> | <i>Speak_english</i> | <i>Has_children</i> | <i>Is_homeless</i> | <i>Is_disabled</i> | <i>Live_outbound</i> | <i>Is_veteran</i> | <i>Help_eat</i> | <i>Help_toilett</i> | <i>Help_walk</i> | <i>Help_get_places</i> | <i>Help_Transfer</i> | <i>Help_dress</i> | <i>Help_bath</i> | <i>Help_medic</i> | <i>Help_cook</i> | <i>Help_shop</i> | <i>Help_chores</i> | <i>Help_drive</i> | <i>Help_heavy_hw</i> | <i>Help_phone</i> | <i>Help_money</i> | <i>Used_transport</i> | <i>Used_nutri</i> | <i>Used_case_mngt</i> | <i>Used_info</i> | |
|------------------------|--------------------|-------------------|-------------------|----------------------|---------------------|--------------------|--------------------|----------------------|-------------------|-----------------|---------------------|------------------|------------------------|----------------------|-------------------|------------------|-------------------|------------------|------------------|--------------------|-------------------|----------------------|-------------------|-------------------|-----------------------|-------------------|-----------------------|------------------|-----------|
| <i>Is_hispanic</i> | | -0.057*** | 0.081*** | 0.253*** | 0.052*** | -0.011 | 0.123*** | -0.028*** | -0.065*** | 0.085*** | 0.093*** | 0.035*** | 0.045*** | 0.118*** | 0.123*** | 0.099*** | 0.105*** | 0.083*** | -0.060*** | 0.073*** | 0.072*** | 0.040*** | 0.139*** | 0.131*** | -0.025** | -0.089*** | 0.095*** | 0.025** | |
| <i>Live_alone</i> | | | -0.103*** | -0.112*** | -0.083*** | 0.042*** | -0.278*** | 0.010 | -0.063*** | -0.261*** | -0.273*** | -0.058*** | -0.051*** | -0.317*** | 0.297*** | -0.325*** | -0.055*** | -0.276*** | -0.010 | -0.2*** | -0.275*** | -0.105*** | -0.296*** | -0.242*** | 0.090*** | 0.118*** | -0.163*** | -0.009 | |
| <i>Nutri_risk</i> | | | | 0.131*** | 0.010*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.166*** | 0.000*** | 0.340*** | 0.100*** | 0.020*** | 0.025*** | 0.378*** | 0.009*** | 0.390*** | 0.382*** | 0.509*** | 0.188*** | 0.203*** | -0.023** | -0.267*** | 0.296*** | 0.005 | |
| <i>Speak_english</i> | | | | | 0.101*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.048*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.018* | 0.008 | 0.118*** | 0.113*** | -0.024** | -0.076*** | 0.069*** | 0.047*** | |
| <i>Has_children</i> | | | | | | -0.014 | 0.007 | -0.034*** | -0.045*** | 0.071*** | 0.090*** | -0.007 | 0.054*** | 0.062*** | 0.117*** | 0.106*** | 0.038*** | 0.041*** | 0.011 | 0.035*** | 0.049*** | 0.057*** | 0.091*** | 0.032*** | -0.036*** | -0.051*** | 0.080*** | -0.016 | |
| <i>Is_homeless</i> | | | | | | | 0.056*** | -0.007 | -0.026 | -0.028** | -0.031** | 0.027** | 0.094*** | 0.021* | 0.016 | -0.048*** | 0.021* | 0.010 | 0.016 | 0.059*** | 0.012 | 0.091*** | -0.029*** | -0.024** | -0.011 | -0.061*** | 0.055*** | 0.031*** | |
| <i>Is_disabled</i> | | | | | | | | 0.000*** | 0.167*** | 0.000*** | 0.031*** | 0.007 | 0.210*** | 0.000*** | 0.000*** | 0.017*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.642*** | 0.291*** | 0.447*** | 0.453*** | 0.035*** | -0.460*** | 0.469*** | 0.027** | |
| <i>Live_outbound</i> | | | | | | | | | 0.036 | 0.007 | 0.000 | -0.021 | 0.018 | 0.021* | -0.018* | 0.003 | 0.021* | 0.018* | -0.066** | 0.018* | 0.008 | 0.056*** | 0.028** | -0.026** | 0.061*** | -0.039*** | 0.009 | 0.014 | |
| <i>Is_veteran</i> | | | | | | | | | | -0.051*** | -0.077*** | 0.010 | -0.050*** | -0.123*** | -0.114*** | -0.101*** | -0.107*** | -0.096*** | -0.003 | -0.105*** | -0.102*** | -0.045*** | -0.074*** | -0.066*** | -0.003 | 0.119*** | -0.118*** | -0.019* | |
| <i>Help_eat</i> | | | | | | | | | | | 0.000*** | 0.166*** | 0.089*** | 0.530*** | 0.557*** | 0.496*** | 0.534*** | 0.456*** | 0.137*** | 0.400*** | 0.455*** | 0.085*** | 0.475*** | 0.384*** | -0.028** | -0.264*** | 0.314*** | -0.031*** | |
| <i>Help_toilett</i> | | | | | | | | | | | | 0.266*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.555*** | 0.000*** | 0.000*** | 0.000*** | 0.116*** | 0.557*** | 0.414*** | -0.048*** | -0.295*** | 0.351*** | -0.020* | | |
| <i>Help_walk</i> | | | | | | | | | | | | | 0.116*** | 0.255*** | 0.163*** | 0.228*** | 0.191*** | 0.216*** | 0.355*** | 0.204*** | 0.243*** | 0.104*** | 0.129*** | 0.096*** | -0.068*** | -0.070*** | 0.119*** | -0.027** | |
| <i>Help_get_places</i> | | | | | | | | | | | | | | 0.225*** | 0.137*** | 0.161*** | 0.238*** | 0.513*** | 0.077*** | 0.510*** | 0.495*** | 0.810*** | 0.184*** | 0.178*** | -0.030*** | -0.190*** | 0.226*** | -0.015 | |
| <i>Help_Transfer</i> | | | | | | | | | | | | | | | 0.618*** | 0.625*** | 0.809*** | 0.704*** | 0.179*** | 0.726*** | 0.703*** | 0.266*** | 0.579*** | 0.513*** | -0.058*** | -0.434*** | 0.495*** | 0.002 | |
| <i>Help_dress</i> | | | | | | | | | | | | | | | | 0.689*** | 0.613*** | 0.526*** | 0.201*** | 0.518*** | 0.544*** | 0.163*** | 0.557*** | 0.412*** | -0.060*** | -0.326*** | 0.383*** | -0.008 | |
| <i>Help_bath</i> | | | | | | | | | | | | | | | | | 0.608*** | 0.543*** | 0.226*** | 0.544*** | 0.549*** | 0.217*** | 0.512*** | 0.419*** | -0.043*** | -0.326*** | 0.373*** | -0.001 | |
| <i>Help_medic</i> | | | | | | | | | | | | | | | | | | 0.705*** | 0.169*** | 0.713*** | 0.712*** | 0.269*** | 0.669*** | 0.595*** | -0.069*** | -0.414*** | 0.475*** | 0.008 | |
| <i>Help_cook</i> | | | | | | | | | | | | | | | | | | | 0.154*** | 0.922*** | 0.892*** | 0.572*** | 0.524*** | 0.489*** | -0.052*** | -0.352*** | 0.403*** | 0.004 | |
| <i>Help_shop</i> | | | | | | | | | | | | | | | | | | | | | 0.171*** | 0.213*** | 0.061*** | 0.162*** | 0.107*** | 0.010 | -0.072*** | 0.103*** | -0.059*** |
| <i>Help_chores</i> | | | | | | | | | | | | | | | | | | | | | | 0.589*** | 0.524*** | 0.493*** | -0.056*** | -0.386*** | 0.438*** | 0.008 | |
| <i>Help_drive</i> | | | | | | | | | | | | | | | | | | | | | | | 0.565*** | 0.553*** | 0.492*** | -0.047*** | -0.374*** | 0.427*** | -0.003 |
| <i>Help_heavy_hw</i> | | | | | | | | | | | | | | | | | | | | | | | | 0.216*** | 0.243*** | -0.036*** | -0.215*** | 0.242*** | 0.015 |
| <i>Help_phone</i> | | | | | | | | | | | | | | | | | | | | | | | | | 0.539*** | -0.062*** | -0.270*** | 0.319*** | 0.001 |
| <i>Help_money</i> | | | | | | | | | | | | | | | | | | | | | | | | | | -0.037*** | -0.262*** | 0.292*** | 0.016 |
| <i>Used_transport</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | -0.048*** |
| <i>Used_nutri</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | -0.313*** |
| <i>Used_case_mngt</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | -0.143*** |
| <i>Used_info</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

The models were streamlined, and overlapping variables were removed. We then compared the model results to the known outcome.

Computed correlation used pearson-method with listwise-deletion

Computed correlation used pearson-method with listwise-deletion.

Case Management

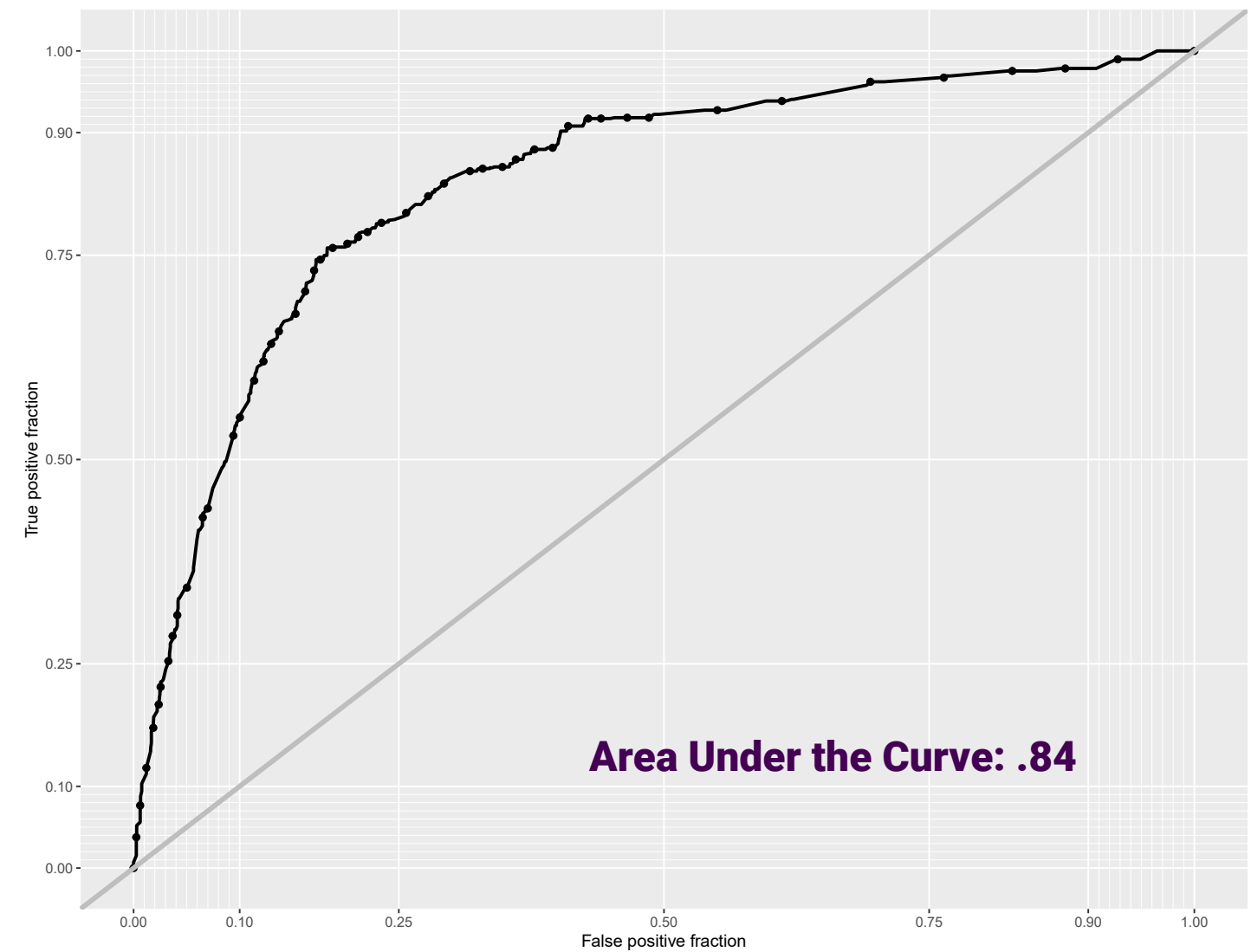
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|--|--------------------------------------------------------------------------------------------|---------------------|------------------|---------------------|------------------|----------------------|------------------|----------------------|------------------|---------------------|--------------------------|---------------------|-------------------|----------------------|------------------|---------------------|-----------------|---------------------|------------------------|----------------------|--|--|--|--|--|--|
| Dependent Variable: | | AgeRange105 to 109 | -0.309 (0.468) | AgeRange65 to 69 | -0.784** (0.343) | AgeRange70 to 74 | -0.980*** (0.344) | AgeRange75 to 79 | -0.976*** (0.345) | AgeRange80 to 84 | -0.690** (0.345) | AgeRange85 to 89 | -0.632* (0.345) | AgeRange90 to 94 | -1.311*** (0.349) | AgeRange95 to 99 | -0.750** (0.378) | dummy_nutriRisk | 0.576*** (0.072) | | | | | | | | |
| Used Case Management | | is_sigleparent | -0.555** (0.268) | has_children | 0.590*** (0.101) | is_disabled | 1.387*** (0.074) | is_veteran | -0.565*** (0.081) | help_toileting | 0.180** (0.075) | help_gettingplaces | 0.641*** (0.067) | help_transferring | 0.575*** (0.089) | help_dressing | 0.538*** (0.076) | help_medical | 0.758*** (0.090) | help_cooking | -0.656*** (0.114) | | | | | | |
| | | speak_english | 0.334*** (0.100) | help_driving | 0.412*** (0.110) | help_phoning | -0.270*** (0.074) | Constant | -1.892*** (0.339) | | | | | | | | | | | | | | | | | | |
| | | <div>Observations12,432 Log Likelihood-5,101.415 Akaike Inf. Crit.10,248.830</div> | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <div>Note: *p<0.1; **p<0.05; ***p<0.01</div> | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <div>==== TRUE ----</div> | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | <div>Train 70%</div> | | | | | | | | <div>Tes 30%</div> | | | | | | | |

Case Management

Density Plot of Test Set Predicted Probabilities



ROC Curve



Threshold

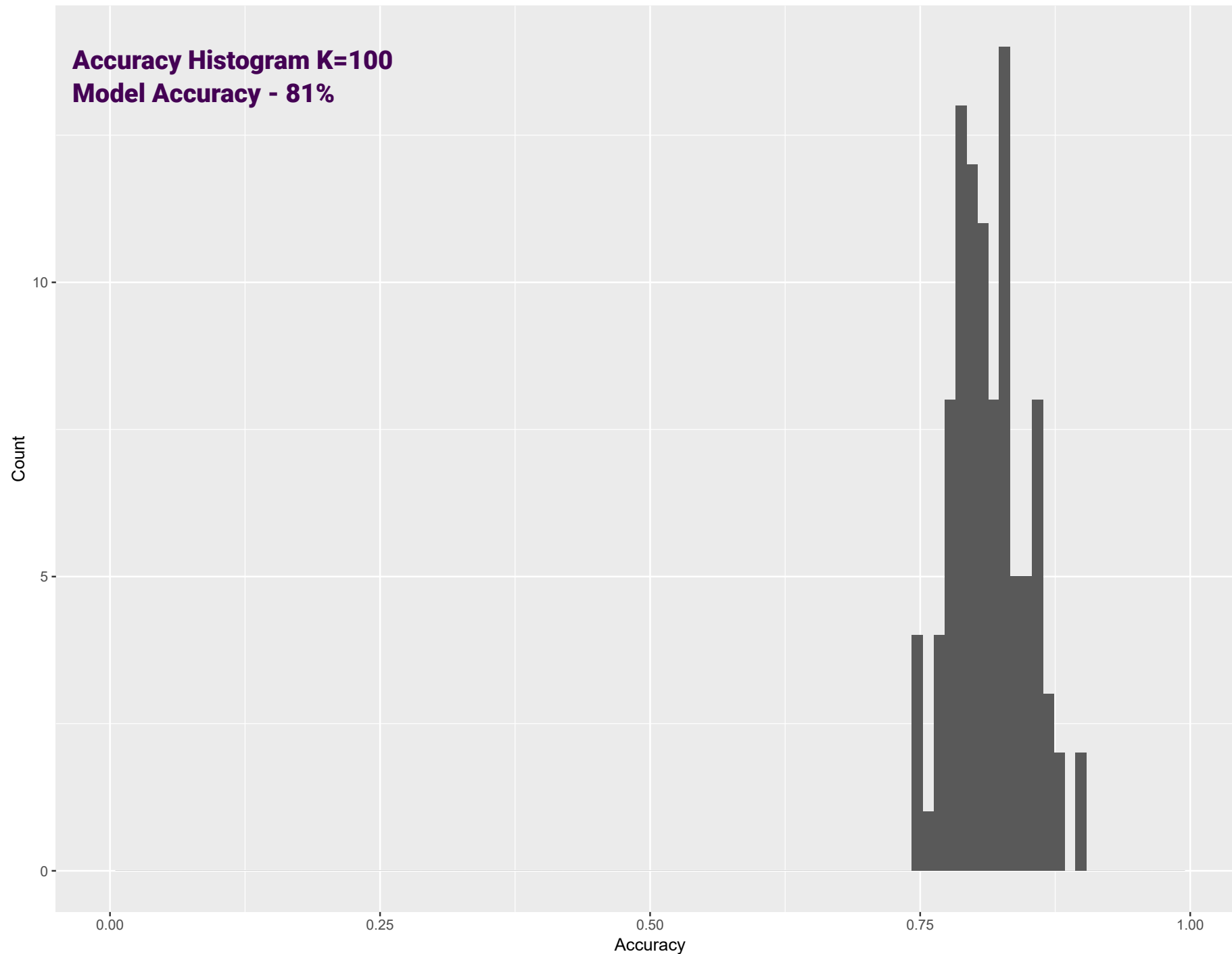
| Threshold | Accuracy | Sensitivity | Specificity |
|-----------|----------|-------------|-------------|
| 0.15 | 72% | 86% | 67% |
| 0.20 | 75% | 82% | 72% |
| 0.25 | 77% | 79% | 76% |
| 0.30 | 78% | 77% | 79% |
| 0.35 | 80% | 74% | 82% |
| 0.40 | 80% | 67% | 85% |

Confusion Matrix

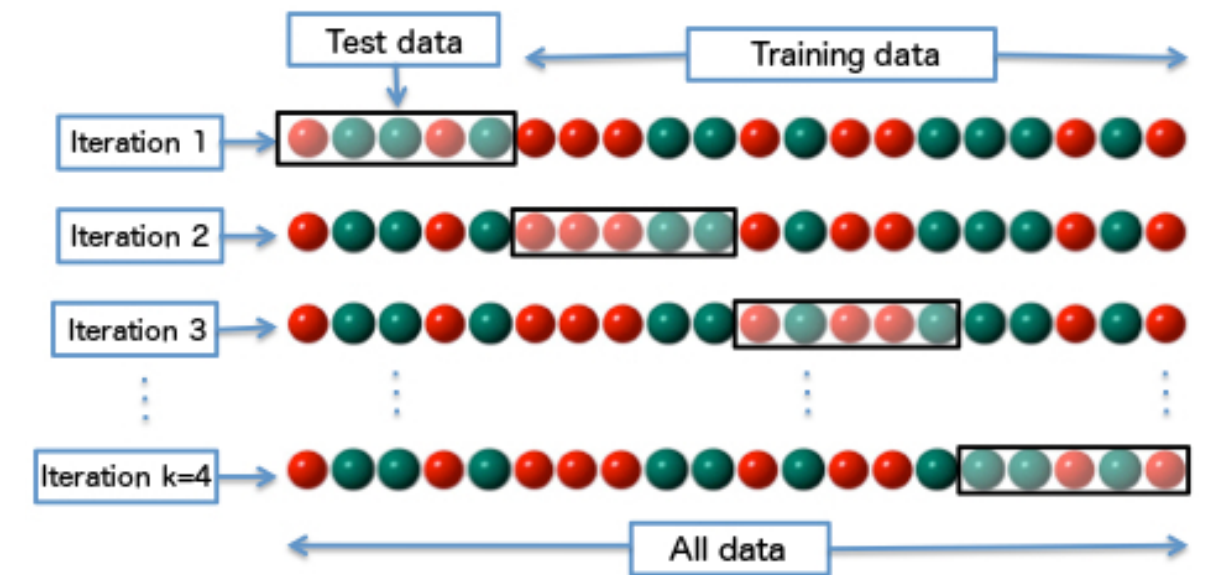
| Case Management | | Observed Data | |
|-----------------|------------------|---------------|-------------|
| Predictions | | Use | Did Not Use |
| | Predicted Use | 2,262 | 250 |
| | Predicted No Use | 482 | 729 |

Case Management

K-fold Cross Validation

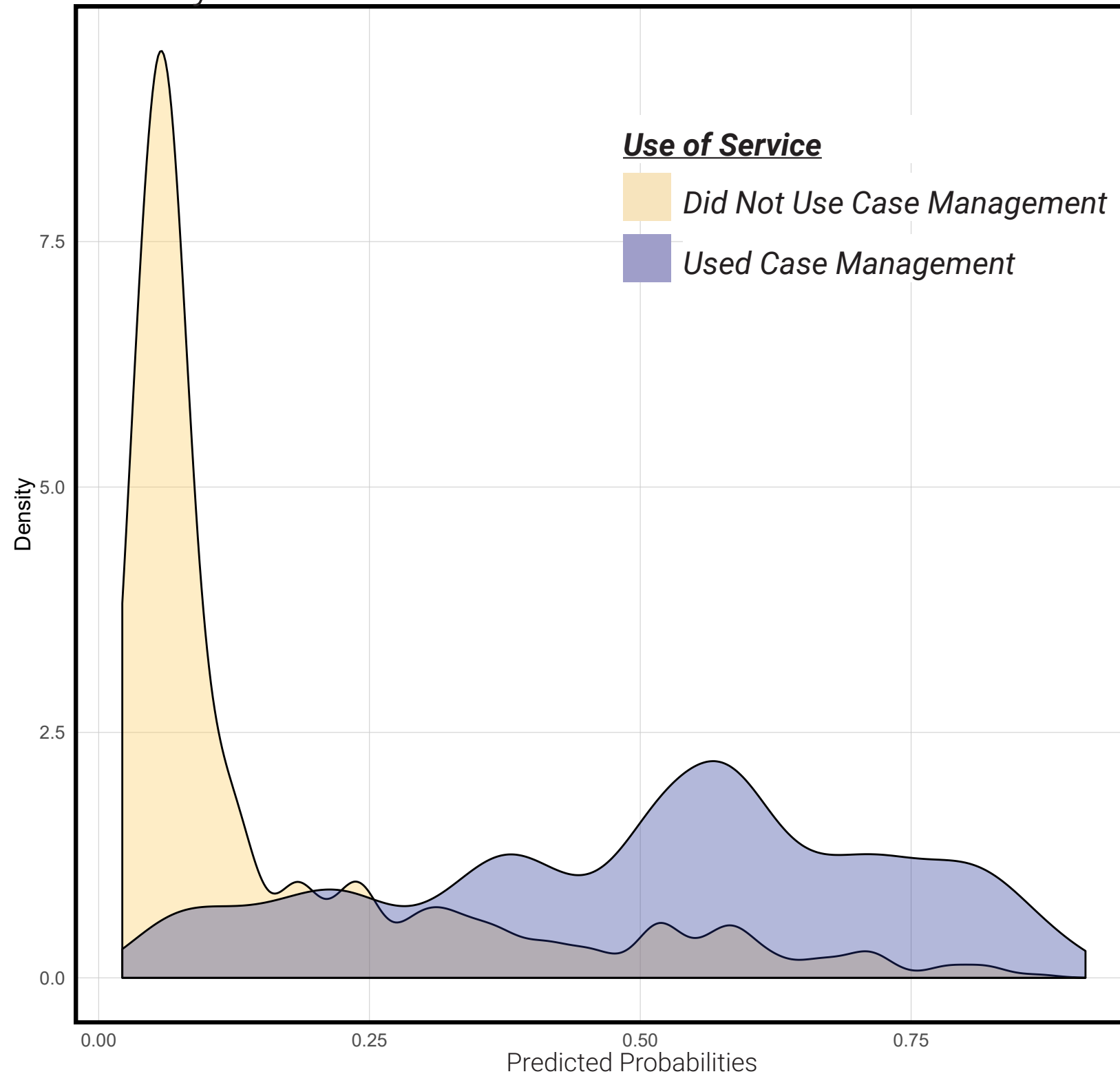


Test + Train K-fold Cross Validation

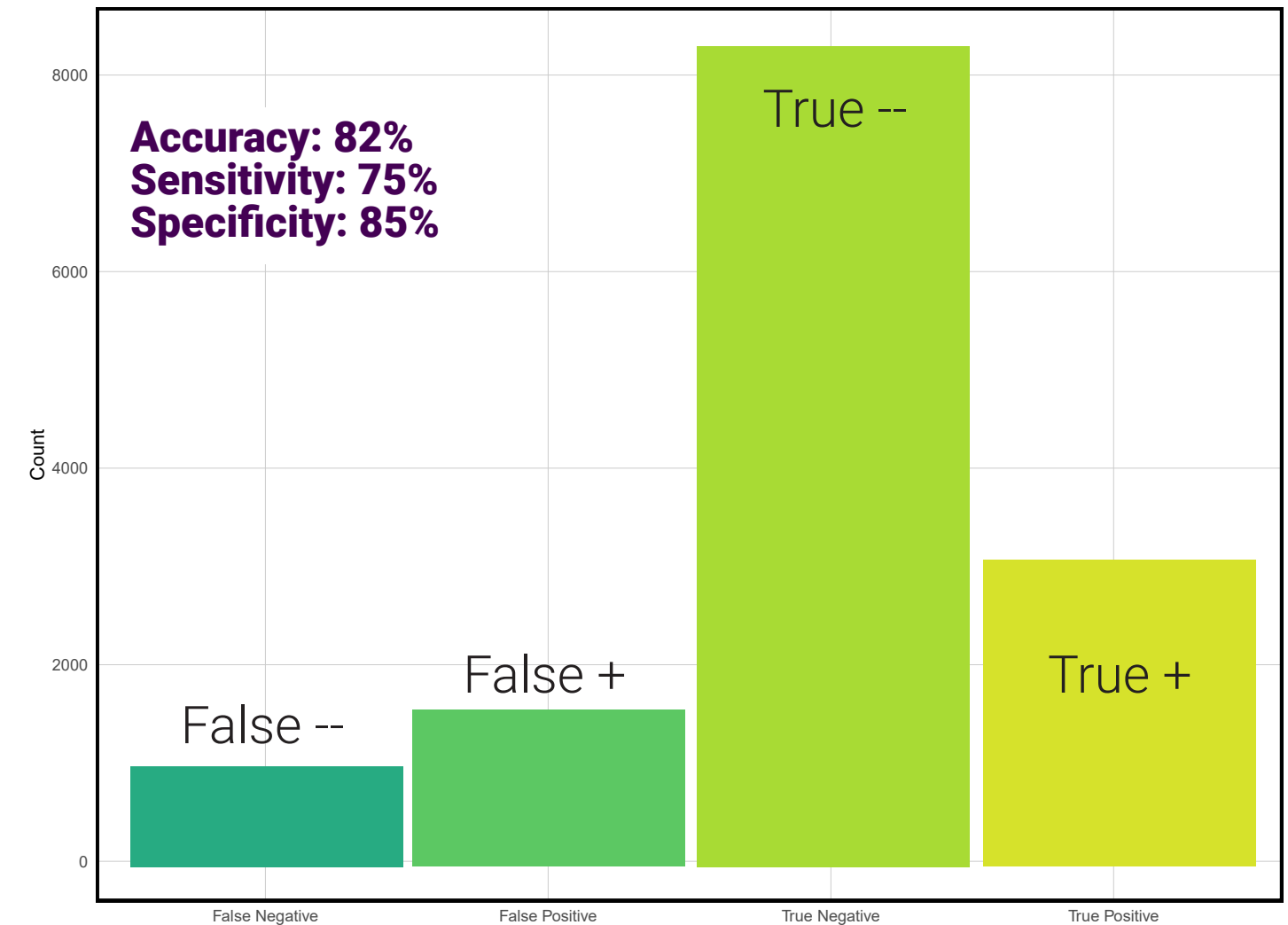


Case Management

Density Plot of Test Set Predicted Probabilities



Confusion Plot: Predicted + Observed



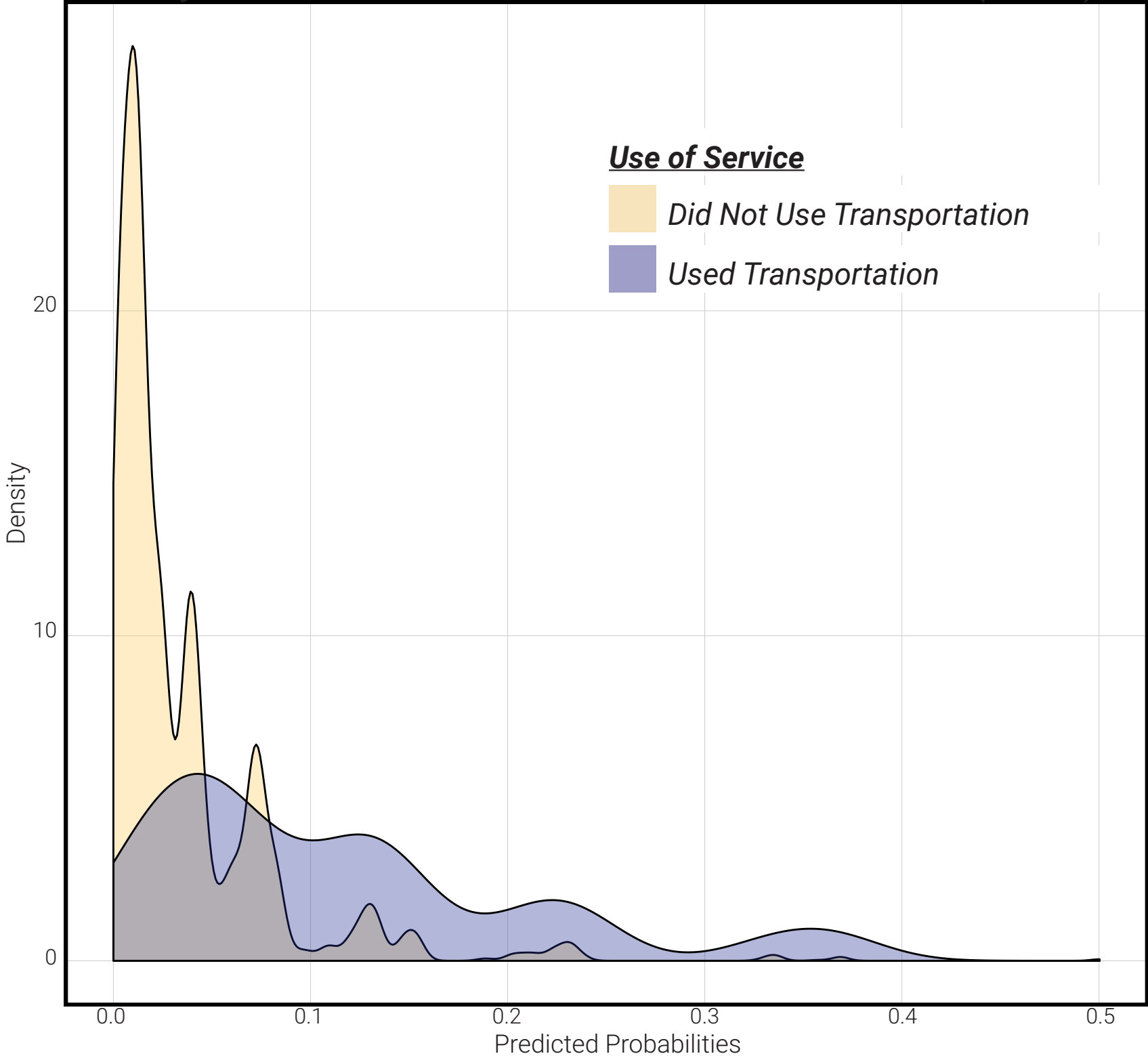
Transportation

| | | | | | |
|--------------------------------------------|---------------------|---------------------------------------|----------------------|-----------------------------|----------------------|
| ===== | | GeographicLocationSeattle: SW Seattle | 0.709 (0.572) | racewhite | 0.831*** (0.263) |
| Dependent Variable: | | GeographicLocationSouth Rural | -13.156 (200.857) | Constant | -5.352*** (0.625) |
| ----- | | GeographicLocationSouth Urban | 0.161 (0.534) | ----- | |
| Used Transportation | | GeographicLocationVashon | -13.650 (533.101) | Observations | 13,776 |
| ----- | | dummy_livealone | 1.139*** (0.124) | Log Likelihood | -1,949.635 |
| GeographicLocationEast Urban | 0.701 (0.543) | is_disabled | 1.409*** (0.111) | Akaike Inf. Crit. | 3,957.271 |
| GeographicLocationNorth Urban | 0.780 (0.540) | live_outerbounds | 1.859*** (0.221) | ===== | |
| GeographicLocationSeattle: Ballard | 0.951* (0.563) | help_walking | -0.672*** (0.108) | == | |
| GeographicLocationSeattle: Capitol Hill | -0.101 (0.658) | help_medical | -0.929*** (0.172) | Note: | |
| GeographicLocationSeattle: Central Seattle | -2.048** (0.893) | help_shopping | 0.696*** (0.188) | *p<0.1; **p<0.05; ***p<0.01 | |
| GeographicLocationSeattle: Delridge | -1.298* (0.733) | help_chores | -1.043*** (0.260) | | |
| GeographicLocationSeattle: Downtown | -1.265** (0.597) | help_driving | 0.552** (0.256) | | |
| GeographicLocationSeattle: Duwamish | 0.737 (0.609) | raceblack | 0.750*** (0.286) | | |
| GeographicLocationSeattle: Lake Union | 1.448** (0.590) | raceother | -0.224 (0.341) | | |
| GeographicLocationSeattle: NE Seattle | 0.181 (0.570) | | | | |
| GeographicLocationSeattle: North Seattle | -1.468* (0.793) | | | | |
| GeographicLocationSeattle: Queen Anne | 0.420 (0.577) | | | | |
| GeographicLocationSeattle: SE Seattle | -1.371** (0.605) | | | | |

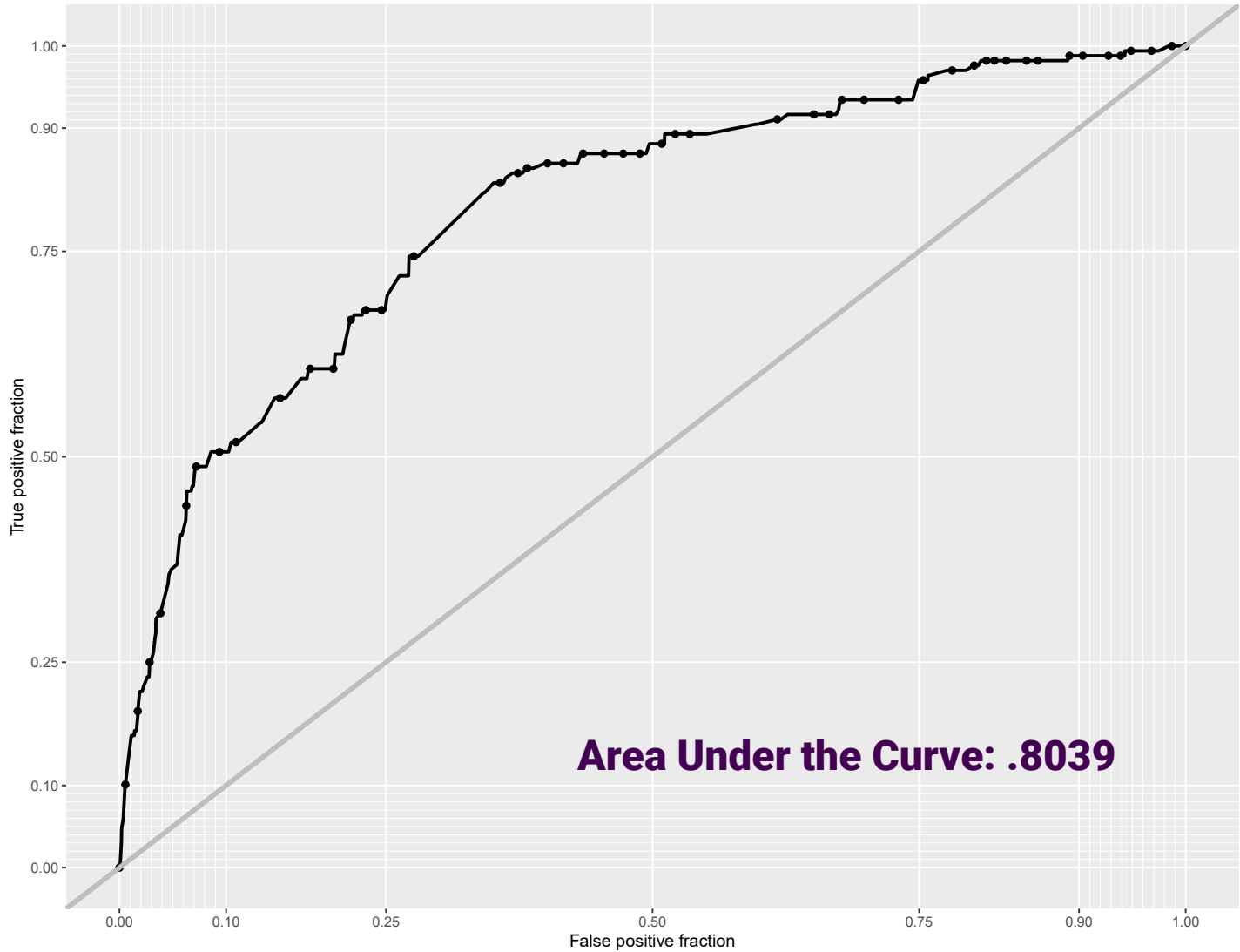


Transportation

Density Plot of Test Set Predicted Probabilities (2015)



ROC Curve



Threshold

| Threshold | Accuracy | Sensitivity | Specificity |
|-----------|----------|-------------|-------------|
| 0.05 | 78% | 67% | 78% |
| 0.06 | 79% | 60% | 80% |
| 0.07 | 81% | 60% | 83% |
| 0.08 | 88% | 50% | 90% |
| 0.09 | 91% | 49% | 93% |
| 0.10 | 91% | 46% | 93% |

Confusion Matrix

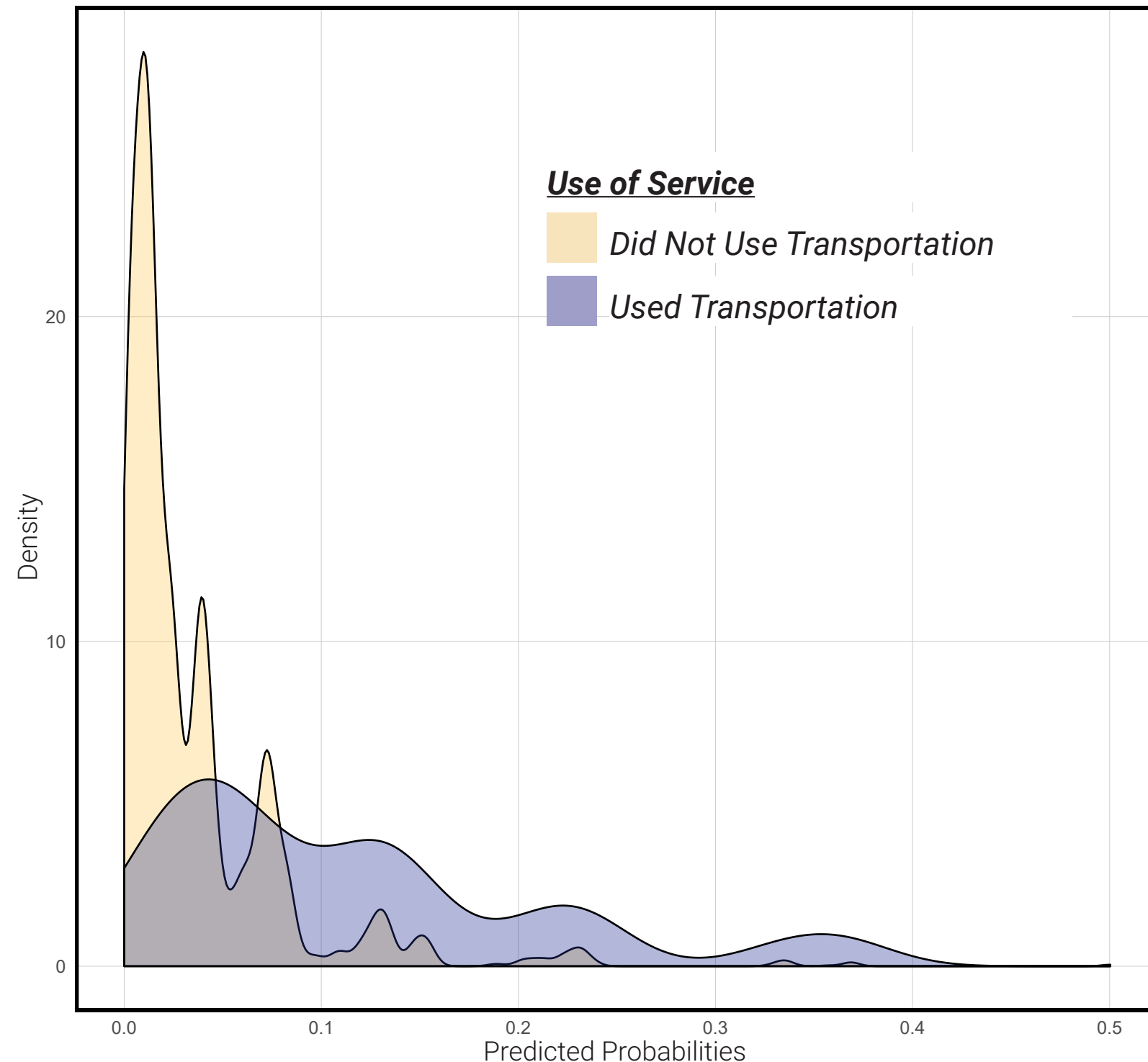
| Transportation | | Observed Data | |
|----------------|------------------|---------------|-------------|
| Predictions | | Use | Did Not Use |
| | Predicted Use | 3,161 | 66 |
| | Predicted No Use | 797 | 102 |

Model Comparison

Case Management Density Plot of Test Set P.P.



Transportation Density Plot of Test Set P.P.



Looking Forward at Potential Implications

Seattle's incoming 65+ "age wave" may have **large potential impacts on service quality, budgetary misalignment + staffing shortfalls.**

It is important to **predict and plan for these future system shocks** to ensure our vulnerable elderly population is well cared for.

QUESTIONS?

