

Analyzing Hospitals for Orthopedic Sales in the Eastern United States.

By Michael Candella

Executive Summary: In this report we are looking to find our target audience for an upcoming push to sell our orthopedic equipment. Although most selling efforts would eventually increase our profits, it is important to find the demographic that will yield the greatest return. Using various statistical methods, such as factor analysis, clustering and regression, we were able to find an ideal target market and the expected sales from that market.

Introduction:

Identifying a target market in a huge valley of options can be a daunting task. The initial data-set contained 4703 observations, but for our analysis, a sample was taken from the original data-set comprised of 24 states, mainly eastern states, and 2227 hospitals. With this minimized data-set, I focused on our goal of finding sub-groups that are more likely to align with the business objective of finding new potential sales and ultimately maximizing profits.

The states selected are: MA, RI, NH, ME, VT, CT, NJ, NY, PA, DE, MD, DC, VA, WV, NC, SC, GA, FL, AL, MO, TN, MS, KY, OH

The variables in the dataset are: ZIP (Zip Code of Hospital), HID (Hospital ID), CITY (City of Hospital), STATE (State of Hospital), BEDS (No. of Beds), RBEDS (No. of Rehab Beds), OUTV (No. of Outpatient Visits), ADM (Administrative Costs in Thousands of Dollars), SIR (Revenue from Inpatients), SALESY (Sales in Rehab Equipment since Jan 1), SALES12 (Sales in Rehab Equipment in the Last 12 months), HIP95 (No. of Hip Operations for 1995), KNEE95 (No. of Knee Operations in 1995), TH (Whether The Hospital is a Teaching Hospital, 0 = No, 1= Yes), TRAUMA (Whether the Hospital has a Trauma Unit, 0 = No, 1 = Yes), REHAB (Whether the Hospital has a Rehab Unit, 0 = No, 1 = Yes), HIP96 (No. of Hip Operations of 1996), KNEE96 (No. of Knee Operations of 1996), FEMUR96 (No. of Femur Operations of 1996). Since ZIP, HID, CITY, and STATE are categorical variables, it doesn't make sense to transform them. The variable BEDS had a bell-shaped distribution that is very much left-skewed. The transformation $BEDS = \log(1 + 0.1 * BEDS)$ corrected this. The variable RBEDS had a distribution that became normal once the transformation $RBEDS = -RBEDS^{(-0.25)}$ was applied. The variable OUTV had an approximately log-normal distribution that was corrected into a normal distribution once the transformation $OUTV = \log(OUTV)$ was applied. ADM had a left-skewed bell-shaped distribution that was corrected into a normal distribution once the transformation $ADM = \log(1 + 0.001 * ADM)$ was applied. The variables SIR, SALESY, SALES12, HIP95, KNEE95, HIP96, KNEE96, and FEMUR96 were all approximately log-normal in their distributions, and were corrected into normal distributions with $SIR = \log(SIR)$, $SALESY = \log(SALESY)$, and so on. The variables TH, TRAUMA, and REHAB are categorical 0/1 variables and thus it does not make sense to transform them.

Part 1: Analysis

To first find the most optimal model for our selection, we must reduce the number of variables we use in our estimation. Even though the number of variables may help us obtain a larger R-squared value, with each additional variable we add we risk multicollinearity which would give us artificially inflated significance. From the start, we have 15 variables to work with which is way too much for any accurate results and our first task is to reduce these variables down to around two or three variables.

To reduce our model we must introduce the process of dimensionality reduction. The goal is to run a factor analysis on all the variables and see which values can be combined to create new, more grouped variables which keep information while also lowering the mathematical planes our data exists on. A general rule of thumb is that you want to omit any factors with a Correlation Matrix Eigenvalue less than 1, as they do not represent enough variance in our factors to include.

We must first separate our data set into three groups, The Response Variables (Places which have sales and places which don't), the Dependent Variables, and The Operation Numbers. Running Proc FACTOR for our Dependent Variables we get (*Table 1*). Taking a look at the Eigenvalues, we note that only the first two are significant, with the first having an Eigenvalue of 3.88 and the second with an Eigenvalue of 1.46.

With this information we can simply assume that this data only requires two factors as the other factors are statistically insignificant as they are lower than one. Sorting these factors into two groups creates the following breakdown of the factor scores(*Table 2*): The variables BEDS, RBEDS, OUTV, ADM, SIR, and REHAB are better representations of factor 1, while TH, and TRAUMA are better representations of factor 2. Since all the variables in factor 1 represent the size and population of the hospital we can consider factor 1 to be representative of the size of the hospital. The variables in factor 2 represent dummy variables that tell us whether or not the hospital is a specialty form of hospital, so factor 2 can be described as whether or not the hospital is a specialty hospital.

For the Operation Variables we see the following (*Table 3*): With this procedure, only one factor has a significant Eigenvalue, with a value of 2.62, while the others do not. Thus, the grouping of the operation variables will fall into only one factor. Since we only have one factor we denote this factor as the factor that represents the number of surgery.

With these factors we can now begin to separate hospitals into clusters. Finding the clusters of the factors allow us to select an ideal subgroup to focus on, in our overall goal of discovering potential sales. After clustering the factors using Proc CLUSTER, it appears that the best cluster to target would be cluster 5. It has a mean of sales are acceptable at 2.822 with the transformed variables (*Table 4*). After undoing the transformation on the mean of sales, we obtained a value of 15.993, in thousands of

dollars. Additionally, it had a moderately-high frequency, with a count of 158 hospitals and 73 of those hospitals had sales not equal to 0. This is important because when calculating the mean of sales, we want the sales to be spread across multiple hospitals, instead of having a handful of hospitals produce all of the sales.

Part 2: Prediction

Using cluster 5 as our target cluster, we want to then predict the potential sales for each hospital in the segment of the data. To do so, we run a regression using Proc REG, with sales as our response variable and the three factors as the dependent variables. Furthermore, we implemented the backward elimination method, in our regression, to prevent the potential issue of multicollinearity and to remove any insignificant factors from our model. After running the regression, it appears that factors 2 and 3 were not significant variables for predicting sales and were left with the prediction equation of:

$$\text{SALES} = 2.884 + 0.878(\text{Factor1}) + e \quad (\text{Table 5})$$

We also produced a list of all the hospitals in our targeted cluster and used our prediction to calculate an expected gain. So, if we were to focus on selling our orthopedic products to these hospitals in cluster 5, we can expect a gain of 145.13, in thousands, in the sales of next year (*Table 6*). One could highlight that looking at the hospitals that have a negative residual (RESID) or no residual, because their sales were equal to 0 in the previous year, could be helpful in determining which hospitals have high potential for an increase in sales. From our results, this holds true and it is noted that the gain would be 1681.40, in thousands, from this subgroup of hospitals alone.

Conclusion:

After reducing our data-set from over 4000 observations from almost all states to 2227 from just 25 states, we then reduced the dimensionality of our data with the use of factor analysis. We started out with 15 variables, but reduced it to three factors: Factor 1 being the Number of Surgeries a hospital has, Factor 2 being the Hospital's Specialty, and Factor 3 being the Size and Wealth of the hospital. Then we analyzed the clusters that were generated from these factors and found cluster 5 to be an ideal subgroup to target. Using cluster 5 as our focus, we estimated a gain of 145.13 thousand dollars in potential sales for the next year.

Appendix:

Table 1:

| The FACTOR Procedure | | | | |
|--|------------|------------|------------|------------|
| Initial Factor Method: Principal Components | | | | |
| Prior Communality Estimates: ONE | | | | |
| Eigenvalues of the Correlation Matrix: Total = 8 Average = 1 | | | | |
| | Eigenvalue | Difference | Proportion | Cumulative |
| 1 | 3.87802755 | 2.41335342 | 0.4848 | 0.4848 |
| 2 | 1.46467413 | 0.53845370 | 0.1831 | 0.6678 |
| 3 | 0.92622044 | 0.16015732 | 0.1158 | 0.7836 |
| 4 | 0.76606312 | 0.20172031 | 0.0958 | 0.8794 |
| 5 | 0.56434281 | 0.35531628 | 0.0705 | 0.9499 |
| 6 | 0.20902653 | 0.07498713 | 0.0261 | 0.9760 |
| 7 | 0.13403940 | 0.07643338 | 0.0168 | 0.9928 |
| 8 | 0.05760602 | | 0.0072 | 1.0000 |

Table 2:

| 2 factors will be retained by the NFACTOR criterion. | | |
|--|-----------|-----------|
| Factor Pattern | | |
| | Factor1 | Factor2 |
| BEDS | 0.90095 | -0.26388 |
| RBEDS | 0.36357 | -0.19005 |
| OUTV | 0.60658 | -0.44178 |
| ADM | 0.93255 | -0.15058 |
| SIR | 0.83724 | 0.02738 |
| TH | 0.69598 | 0.64987 |
| TRAUMA | 0.53931 | 0.76393 |
| REHAB | 0.46940 | -0.36676 |
| Variance Explained by Each Factor | | |
| | Factor1 | Factor2 |
| | 3.8780276 | 1.4646741 |

Table 3:

| The FACTOR Procedure | | | | |
|--|------------|------------|------------|------------|
| Initial Factor Method: Principal Components | | | | |
| Prior Communality Estimates: ONE | | | | |
| Eigenvalues of the Correlation Matrix: Total = 4 Average = 0.8 | | | | |
| | Eigenvalue | Difference | Proportion | Cumulative |
| 1 | 2.62324766 | 1.63974294 | 0.6558 | 0.6558 |
| 2 | 0.98350472 | 0.68600824 | 0.2459 | 0.9017 |
| 3 | 0.29749648 | 0.20174534 | 0.0744 | 0.9761 |
| 4 | 0.09575114 | 0.09575114 | 0.0239 | 1.0000 |
| 5 | 0.00000000 | | 0.0000 | 1.0000 |

Table 4:

| Obs | CLUSTER | _TYPE_ | _FREQ_ | msales | mf1 | mf2 | mf3 |
|-----|---------|--------|--------|---------|----------|----------|----------|
| 1 | 1 | 0 | 127 | 3.79090 | -1.03274 | -1.04597 | 2.84383 |
| 2 | 2 | 0 | 383 | 3.33770 | 0.45020 | -0.23339 | -0.65069 |
| 3 | 3 | 0 | 445 | 2.54475 | -0.37477 | -0.29583 | -0.60788 |
| 4 | 4 | 0 | 224 | 1.46797 | -1.06890 | -0.98755 | -0.09966 |
| 5 | 5 | 0 | 158 | 2.82181 | -0.14014 | -0.86359 | -0.37872 |
| 6 | 6 | 0 | 152 | 4.09237 | 1.38995 | 0.10801 | -0.30087 |
| 7 | 7 | 0 | 127 | 3.46732 | 0.28248 | 0.80712 | -0.46277 |
| 8 | 8 | 0 | 184 | 2.74318 | -0.65607 | 0.81830 | -0.34387 |
| 9 | 9 | 0 | 103 | 3.55298 | -0.20535 | 2.03856 | -0.28324 |
| 10 | 10 | 0 | 71 | 3.51187 | 0.86210 | 0.07710 | 1.32376 |
| 11 | 11 | 0 | 48 | 3.95752 | 3.16677 | -0.91053 | 0.71748 |
| 12 | 12 | 0 | 118 | 3.80799 | 0.61145 | 1.39162 | 1.52868 |
| 13 | 13 | 0 | 46 | 3.80956 | -0.33467 | 2.64547 | 1.53566 |
| 14 | 14 | 0 | 37 | 2.39343 | -0.62747 | 0.05447 | 1.27748 |
| 15 | 15 | 0 | 4 | 4.65515 | 8.76189 | -4.40429 | 2.73700 |

Table 5:

| Analysis of Variance | | | | | |
|----------------------|----|----------------|-------------|---------|--------|
| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
| Model | 1 | 9.81609 | 9.81609 | 6.72 | 0.0116 |
| Error | 71 | 103.72981 | 1.46098 | | |
| Corrected Total | 72 | 113.54590 | | | |

| Variable | Parameter Estimate | Standard Error | Type II SS | F Value | Pr > F |
|-----------|--------------------|----------------|------------|---------|--------|
| Intercept | 2.88426 | 0.14351 | 590.16595 | 403.95 | <.0001 |
| Factor1 | 0.87781 | 0.33865 | 9.81609 | 6.72 | 0.0116 |

Table 6:

| Obs | _NAME_ | ZIP | CITY | STATE | HID | SALES12 | PRED | STDP | RESID | rowp | epred | gain |
|-----|--------|-------|------------|-------|--------|---------|---------|---------|----------|---------|---------|----------|
| 1 | OB761 | 37841 | Oneida | TN | 109352 | 189 | 2.67963 | 0.15173 | 2.56739 | 13.7485 | 13.5797 | -175.251 |
| 2 | OB209 | 13126 | Oswego | NY | 390021 | 194 | 3.17087 | 0.19532 | 2.10213 | 23.2871 | 22.8282 | -170.713 |
| 3 | OB154 | 10128 | New York | NY | 274021 | 193 | 3.45999 | 0.28395 | 1.80787 | 32.1254 | 30.8165 | -160.875 |
| 4 | OB955 | 64836 | Carthage | MO | 009063 | 124 | 2.53489 | 0.17963 | 2.29342 | 11.8202 | 11.6150 | -112.180 |
| 5 | OB490 | 28721 | Clyde | NC | 154036 | 120 | 3.06259 | 0.16924 | 1.73320 | 20.6912 | 20.3828 | -99.309 |
| 6 | OB741 | 37066 | Gallatin | TN | 029752 | 100 | 3.06969 | 0.17076 | 1.54543 | 20.8516 | 20.5353 | -79.148 |
| 7 | OB205 | 12816 | Cambridg | NY | 116021 | 87 | 2.51761 | 0.18381 | 1.95973 | 11.6101 | 11.3989 | -75.390 |
| 8 | OB598 | 32578 | Nicevill | FL | 067339 | 85 | 2.59607 | 0.16613 | 1.85827 | 12.5973 | 12.4110 | -72.403 |
| 9 | OB724 | 35957 | Boaz | AL | 030853 | 90 | 2.96298 | 0.15159 | 1.54788 | 18.5792 | 18.3555 | -71.421 |
| 10 | OB238 | 14760 | Olean | NY | 378021 | 101 | 3.62282 | 0.33987 | 1.00216 | 38.6691 | 36.4429 | -62.331 |
| 11 | OB2207 | 64850 | Neosho | MO | 076083 | 69 | 2.52936 | 0.18095 | 1.71913 | 11.7526 | 11.5455 | -57.247 |
| 12 | OB1459 | 19047 | Langhorm | PA | 903023 | 60 | 3.05589 | 0.16779 | 1.05518 | 20.5370 | 20.2359 | -39.463 |
| 13 | OB2201 | 64701 | Harrison | MO | 023163 | 55 | 2.83255 | 0.14153 | 1.19280 | 16.1598 | 15.9888 | -38.840 |
| 14 | OB1735 | 30535 | Demorest | GA | 049538 | 49 | 2.59810 | 0.16572 | 1.31392 | 12.6240 | 12.4382 | -36.376 |
| 15 | OB1882 | 35978 | Guntersv | AL | 051253 | 57 | 3.18178 | 0.19824 | 0.87666 | 23.5676 | 23.0896 | -33.432 |
| 16 | OB2168 | 63385 | Wentzvil | MO | 145063 | 43 | 2.48469 | 0.19217 | 1.29950 | 11.2210 | 10.9975 | -31.779 |
| 17 | OB1157 | 03584 | Lancaste | NH | 021012 | 42 | 2.55731 | 0.17443 | 1.20389 | 12.0988 | 11.9011 | -29.901 |
| 18 | OB1097 | 01082 | Ware | MA | 210014 | 36 | 2.35884 | 0.22785 | 1.25208 | 9.8569 | 9.5787 | -26.143 |
| 19 | OB1442 | 18201 | Hazleton | PA | 096023 | 44 | 3.05578 | 0.16781 | 0.75089 | 20.5388 | 20.2377 | -23.461 |
| 20 | OB1840 | 33830 | Bartow | FL | 001039 | 34 | 2.65058 | 0.15613 | 0.90476 | 13.3380 | 13.1623 | -20.664 |
| 21 | OB2198 | 64429 | Cameron | MO | 006363 | 33 | 2.64133 | 0.15768 | 0.88503 | 13.2073 | 13.0318 | -19.793 |
| 22 | OB1787 | 32541 | Destin | FL | 016839 | 29 | 2.52622 | 0.18171 | 0.87498 | 11.7143 | 11.5061 | -17.286 |
| 23 | OB1180 | 03860 | North Co | NH | 033012 | 25 | 2.41341 | 0.21175 | 0.84469 | 10.4253 | 10.1720 | -14.575 |
| 24 | OB1154 | 03458 | Peterbor | NH | 034012 | 21 | 2.46080 | 0.19852 | 0.63025 | 10.9473 | 10.7141 | -10.053 |
| 25 | OB1402 | 15963 | Windber | PA | 352023 | 25 | 2.76593 | 0.14310 | 0.49216 | 15.0575 | 14.8939 | -9.943 |
| 26 | OB2060 | 43078 | Urbana | OH | 223541 | 23 | 2.63204 | 0.15929 | 0.54601 | 13.0796 | 12.9021 | -9.920 |
| 27 | OB2094 | 44041 | Geneva | OH | 137641 | 19 | 2.34807 | 0.23112 | 0.64766 | 9.7486 | 9.4653 | -9.251 |
| 28 | OB159 | 10512 | Carmel | NY | 120021 | 42 | 3.55889 | 0.31761 | 0.20231 | 35.9413 | 34.1243 | -6.059 |
| 29 | OB877 | 44601 | Alliance | OH | 008041 | 30 | 3.22906 | 0.21142 | 0.20493 | 24.8267 | 24.2559 | -5.173 |
| 30 | OB2152 | 45828 | Coldwater | OH | 094741 | 22 | 2.87566 | 0.14299 | 0.25983 | 16.9194 | 16.7372 | -5.081 |
| 31 | OB1945 | 37854 | Rockwood | TN | 115052 | 20 | 2.78013 | 0.14238 | 0.26439 | 15.2854 | 15.1211 | -4.715 |
| 32 | OB2000 | 39564 | Ocean Sp | MS | 066554 | 14 | 2.39945 | 0.21579 | 0.30860 | 10.2766 | 10.0171 | -3.723 |
| 33 | OB720 | 35661 | Muscle S | AL | 090A53 | 33 | 3.38754 | 0.26009 | 0.13882 | 29.6113 | 28.5932 | -3.389 |
| 34 | OB1177 | 04543 | Damarisc | ME | 022011 | 16 | 2.74173 | 0.14480 | 0.09148 | 14.6774 | 14.5139 | -1.323 |
| 35 | OB2109 | 44484 | Warren | OH | 229241 | 22 | 3.09738 | 0.17696 | 0.03812 | 21.4892 | 21.1398 | -0.511 |
| 36 | OB1838 | 33814 | Tampa | FL | 923539 | 32 | 3.47972 | 0.29058 | 0.01679 | 32.8501 | 31.4507 | 0.850 |
| 37 | OB1907 | 37075 | Henderso | TN | 074552 | 16 | 2.90301 | 0.14490 | -0.06980 | 17.4213 | 17.2289 | 1.421 |
| 38 | OB2010 | 40031 | La Grang | KY | 037051 | 9 | 2.53278 | 0.18013 | -0.23019 | 11.7943 | 11.5884 | 2.794 |
| 39 | OB1656 | 28804 | Banner E | NC | 018036 | 7 | 2.39369 | 0.21747 | -0.31424 | 10.2159 | 9.9538 | 3.216 |
| 40 | OB1197 | 05753 | Middlebu | VT | 012013 | 9 | 2.56983 | 0.17165 | -0.26725 | 12.2575 | 12.0636 | 3.257 |
| 41 | OB457 | 27103 | Winston | NC | 168636 | 20 | 3.19866 | 0.20230 | -0.15214 | 23.9562 | 23.4507 | 3.956 |
| 42 | OB2187 | 64085 | Richmond | MO | 061863 | 7 | 2.46857 | 0.19643 | -0.38913 | 11.0355 | 10.8055 | 4.036 |
| 43 | OB2184 | 64024 | Excelsio | MO | 016083 | 6 | 2.42303 | 0.20900 | -0.47712 | 10.5291 | 10.2800 | 4.529 |
| 44 | OB888 | 45177 | Wilmington | OH | 234541 | 22 | 3.33162 | 0.24228 | -0.19613 | 27.8171 | 26.9837 | 5.817 |
| 45 | OB1897 | 36535 | Foley | AL | 044653 | 9 | 2.75900 | 0.14353 | -0.45641 | 14.9474 | 14.7840 | 5.947 |
| 46 | OB2061 | 43113 | Circlevi | OH | 063041 | 5 | 2.46617 | 0.19707 | -0.67441 | 11.0082 | 10.7772 | 6.008 |
| 47 | OB1587 | 25526 | Hurricane | WV | 216435 | 6 | 2.56245 | 0.17328 | -0.61654 | 12.1637 | 11.9676 | 6.164 |
| 48 | OB1333 | 13089 | Fulton | NY | 163021 | 9 | 2.80547 | 0.14161 | -0.50289 | 15.7015 | 15.5349 | 6.702 |
| 49 | OB1995 | 39501 | Gulfport | MS | 029554 | 6 | 2.61121 | 0.16314 | -0.66530 | 12.7980 | 12.6156 | 6.796 |
| 50 | OB1944 | 37814 | Morristo | TN | 090052 | 8 | 2.78591 | 0.14310 | -0.56869 | 15.0571 | 14.8935 | 7.057 |
| 51 | OB1483 | 19460 | Phoenixv | PA | 239023 | 16 | 3.18942 | 0.20032 | -0.35620 | 23.7662 | 23.2743 | 7.766 |
| 52 | OB2071 | 43351 | Upper Sa | OH | 222541 | 2 | 2.39217 | 0.21791 | -1.29356 | 10.2000 | 9.9372 | 8.200 |

| | | | | | | | | | | | | |
|-----|--------|-------|------------|----|--------|----|---------|---------|----------|---------|---------|--------|
| 53 | OB1110 | 01570 | Webster | MA | 213014 | 2 | 2.45177 | 0.20096 | -1.35316 | 10.8457 | 10.6089 | 8.846 |
| 54 | OB2117 | 44820 | Bucyrus | OH | 024041 | 3 | 2.53776 | 0.17895 | -1.15146 | 11.8555 | 11.6513 | 8.855 |
| 55 | OB2069 | 43326 | Kenton | OH | 147041 | 1 | 2.38050 | 0.22136 | -1.68735 | 10.0784 | 9.8103 | 9.078 |
| 56 | OB2133 | 45236 | Cincinnati | OH | 908041 | 3 | 2.55893 | 0.17406 | -1.17264 | 12.1193 | 11.9220 | 9.119 |
| 57 | OB1203 | 08096 | Winsted | CT | 082016 | 3 | 2.56702 | 0.17227 | -1.18072 | 12.2216 | 12.0289 | 9.222 |
| 58 | OB1848 | 34642 | Seminole | FL | 098039 | . | 2.33596 | 0.23483 | . | 9.6284 | 9.3394 | 9.628 |
| 59 | OB1889 | 29512 | Bennetts | SC | 008037 | 2 | 2.53866 | 0.17874 | -1.44005 | 11.8666 | 11.6627 | 9.867 |
| 60 | OB1950 | 38054 | Millingt | TN | 084052 | . | 2.36141 | 0.22707 | . | 9.8829 | 9.6059 | 9.883 |
| 61 | OB1579 | 24651 | Tazewell | VA | 117534 | . | 2.36849 | 0.22554 | . | 9.9345 | 9.6599 | 9.935 |
| 62 | OB1622 | 27549 | Louisbur | NC | 094536 | 1 | 2.46220 | 0.19814 | -1.76906 | 10.9632 | 10.7306 | 9.963 |
| 63 | OB1094 | 01056 | Ludlow | MA | 125014 | . | 2.36967 | 0.22459 | . | 9.9670 | 9.6938 | 9.967 |
| 64 | OB1788 | 32034 | Fernandi | FL | 020039 | . | 2.37354 | 0.22343 | . | 10.0067 | 9.7354 | 10.007 |
| 65 | OB2119 | 44830 | Fostoria | OH | 132541 | . | 2.37405 | 0.22328 | . | 10.0119 | 9.7406 | 10.012 |
| 66 | OB2177 | 63670 | Ste Gene | MO | 093163 | . | 2.37971 | 0.22159 | . | 10.0703 | 9.8018 | 10.070 |
| 67 | OB1926 | 37355 | Manchest | TN | 086652 | . | 2.38694 | 0.21945 | . | 10.1453 | 9.8801 | 10.145 |
| 68 | OB1873 | 36630 | Florence | AL | 805853 | 14 | 3.20381 | 0.20428 | -0.49576 | 24.1453 | 23.6261 | 10.145 |
| 69 | OB1434 | 17756 | Muncy | PA | 148023 | . | 2.39130 | 0.21817 | . | 10.1909 | 9.9277 | 10.191 |
| 70 | OB1650 | 28462 | Supply | NC | 135036 | . | 2.39557 | 0.21692 | . | 10.2357 | 9.9745 | 10.236 |
| 71 | OB2074 | 43452 | Port Cli | OH | 190041 | . | 2.40123 | 0.21527 | . | 10.2955 | 10.0368 | 10.296 |
| 72 | OB1890 | 36265 | Jacksonv | AL | 053553 | 1 | 2.49819 | 0.18919 | -1.80305 | 11.3554 | 11.1362 | 10.355 |
| 73 | OB2124 | 44875 | Shelby | OH | 201041 | 4 | 2.72221 | 0.14659 | -1.11278 | 14.3783 | 14.2140 | 10.378 |
| 74 | OB2163 | 63141 | Creve Co | MO | 101063 | . | 2.40995 | 0.21275 | . | 10.3882 | 10.1334 | 10.388 |
| 75 | OB1186 | 04915 | Belfast | ME | 012011 | . | 2.41248 | 0.21202 | . | 10.4154 | 10.1617 | 10.415 |
| 76 | OB1734 | 30533 | Dahloneg | GA | 046438 | . | 2.43154 | 0.20680 | . | 10.6218 | 10.3764 | 10.622 |
| 77 | OB1278 | 10522 | Dobbs Fe | NY | 146021 | . | 2.44494 | 0.20286 | . | 10.7695 | 10.5296 | 10.770 |
| 78 | OB231 | 14424 | Canandai | NY | 118021 | 24 | 3.53022 | 0.30774 | -0.31134 | 34.7865 | 33.1314 | 10.786 |
| 79 | OB1947 | 37879 | Tazewell | TN | 122252 | . | 2.44836 | 0.20192 | . | 10.8076 | 10.5693 | 10.808 |
| 80 | OB1190 | 05080 | Randolph | VT | 020013 | . | 2.45256 | 0.20077 | . | 10.8546 | 10.6180 | 10.855 |
| 81 | OB1564 | 24219 | Big Ston | VA | 005534 | . | 2.45287 | 0.20068 | . | 10.8581 | 10.6217 | 10.858 |
| 82 | OB1830 | 33476 | Pahokee | FL | 073039 | . | 2.45496 | 0.20011 | . | 10.8815 | 10.6460 | 10.881 |
| 83 | OB1451 | 18657 | Tunkhann | PA | 140523 | . | 2.45904 | 0.19900 | . | 10.9274 | 10.6936 | 10.927 |
| 84 | OB1159 | 03766 | Lebanon | NH | 022012 | . | 2.46520 | 0.19733 | . | 10.9972 | 10.7658 | 10.997 |
| 85 | OB1569 | 24277 | Penningt | VA | 068034 | . | 2.46522 | 0.19733 | . | 10.9974 | 10.7660 | 10.997 |
| 86 | OB1632 | 27910 | Ahoskie | NC | 000336 | . | 2.47451 | 0.19485 | . | 11.1035 | 10.8759 | 11.103 |
| 87 | OB1960 | 38242 | Paris | TN | 109552 | . | 2.48899 | 0.19105 | . | 11.2710 | 11.0491 | 11.271 |
| 88 | OB1367 | 14551 | Sodus | NY | 462021 | . | 2.48916 | 0.19100 | . | 11.2731 | 11.0512 | 11.273 |
| 89 | OB1312 | 11944 | Greenpor | NY | 177021 | 5 | 2.84122 | 0.14167 | -1.04946 | 16.3094 | 16.1366 | 11.309 |
| 90 | OB2008 | 39773 | West Poi | MS | 090554 | 2 | 2.65154 | 0.15598 | -1.55293 | 13.3494 | 13.1759 | 11.349 |
| 91 | OB1162 | 03894 | Wolfebor | NH | 041012 | . | 2.49610 | 0.18922 | . | 11.3542 | 11.1350 | 11.354 |
| 92 | OB2077 | 43545 | Napoleon | OH | 178041 | . | 2.50864 | 0.18654 | . | 11.4789 | 11.2636 | 11.479 |
| 93 | OB1713 | 30130 | Cumming | GA | 046338 | . | 2.50725 | 0.18639 | . | 11.4862 | 11.2711 | 11.486 |
| 94 | OB1649 | 28461 | Southpor | NC | 140036 | . | 2.51053 | 0.18557 | . | 11.5253 | 11.3115 | 11.525 |
| 95 | OB1151 | 03235 | Franklin | NH | 013012 | . | 2.51372 | 0.18477 | . | 11.5635 | 11.3508 | 11.563 |
| 96 | OB1420 | 16886 | Tyrone | PA | 326723 | . | 2.51674 | 0.18402 | . | 11.5997 | 11.3882 | 11.600 |
| 97 | OB2185 | 64067 | Lexingto | MO | 059563 | . | 2.52034 | 0.18314 | . | 11.6431 | 11.4326 | 11.643 |
| 98 | OB1653 | 28542 | Camp Lej | NC | 025036 | . | 2.52284 | 0.18253 | . | 11.6733 | 11.4639 | 11.673 |
| 99 | OB1152 | 03264 | Plymouth | NH | 035012 | . | 2.52824 | 0.18170 | . | 11.7146 | 11.5064 | 11.715 |
| 100 | OB1892 | 36380 | Ozark | AL | 076953 | . | 2.53160 | 0.18041 | . | 11.7799 | 11.5736 | 11.780 |
| 101 | OB1342 | 13662 | Massena | NY | 238021 | . | 2.53396 | 0.17985 | . | 11.8088 | 11.6034 | 11.809 |
| 102 | OB1690 | 29520 | Cheraw | SC | 049537 | . | 2.54873 | 0.17639 | . | 11.9914 | 11.7909 | 11.991 |
| 103 | OB1196 | 05661 | Morrisvi | VT | 014013 | . | 2.55852 | 0.17461 | . | 12.0889 | 11.8909 | 12.089 |
| 104 | OB1852 | 34711 | Clermont | FL | 009339 | . | 2.56794 | 0.17206 | . | 12.2334 | 12.0389 | 12.233 |
| 105 | OB1295 | 11229 | Brooklyn | NY | 074021 | . | 2.57034 | 0.17154 | . | 12.2639 | 12.0702 | 12.264 |
| 106 | OB1896 | 36467 | Opp | AL | 076553 | . | 2.58097 | 0.16925 | . | 12.4005 | 12.2099 | 12.400 |

| | | | | | | | | | | | | |
|-----|--------|-------|-----------|----|--------|----|---------|---------|----------|---------|---------|--------|
| 107 | OB1180 | 04854 | Machias | ME | 038611 | . | 2.58132 | 0.16918 | . | 12.4051 | 12.2146 | 12.405 |
| 108 | OB1568 | 24273 | Norton | VA | 067534 | . | 2.58644 | 0.16810 | . | 12.4715 | 12.2825 | 12.471 |
| 109 | OB1627 | 27804 | Rocky Ma | NC | 129036 | 3 | 2.79214 | 0.14193 | -1.40585 | 15.4811 | 15.3159 | 12.481 |
| 110 | OB1808 | 33050 | Marathon | FL | 050839 | . | 2.58785 | 0.16785 | . | 12.4872 | 12.2985 | 12.487 |
| 111 | OB1198 | 05855 | Newport | VT | 015013 | . | 2.59117 | 0.16712 | . | 12.5331 | 12.3454 | 12.533 |
| 112 | OB2172 | 63640 | Farmingt | MO | 400063 | . | 2.60733 | 0.16389 | . | 12.7462 | 12.5628 | 12.746 |
| 113 | OB1701 | 29681 | Simpsonv | SC | 089537 | . | 2.61088 | 0.16320 | . | 12.7936 | 12.6111 | 12.794 |
| 114 | OB1174 | 04482 | Millinoc | ME | 038711 | . | 2.61227 | 0.16294 | . | 12.8121 | 12.6299 | 12.812 |
| 115 | OB1808 | 33070 | Tavernie | FL | 030639 | . | 2.61341 | 0.16272 | . | 12.8274 | 12.6455 | 12.82 |
| 116 | OB1104 | 01331 | Alhol | MA | 008514 | . | 2.62861 | 0.15990 | . | 13.0328 | 12.8545 | 13.03 |
| 117 | OB1686 | 28722 | Columbus | NC | 149036 | . | 2.63489 | 0.15879 | . | 13.1186 | 12.9417 | 13.119 |
| 118 | OB1185 | 04901 | Watervil | ME | 058211 | . | 2.63858 | 0.15815 | . | 13.1695 | 12.9934 | 13.169 |
| 119 | OB1346 | 13815 | Norwich | NY | 371021 | . | 2.65303 | 0.15573 | . | 13.3702 | 13.1970 | 13.370 |
| 120 | OB1395 | 15767 | Punxsuta | PA | 281023 | . | 2.65395 | 0.15559 | . | 13.3831 | 13.2100 | 13.383 |
| 121 | OB2058 | 43040 | Marysvil | OH | 166541 | . | 2.65414 | 0.15556 | . | 13.3858 | 13.2128 | 13.386 |
| 122 | OB1338 | 13421 | Oneida | NY | 382021 | . | 2.70120 | 0.14892 | . | 14.0638 | 13.8976 | 14.064 |
| 123 | OB1980 | 39120 | Natchez | MS | 061054 | . | 2.71538 | 0.14731 | . | 14.2751 | 14.1103 | 14.275 |
| 124 | OB1390 | 15425 | Cornells | PA | 050023 | . | 2.73177 | 0.14567 | . | 14.5239 | 14.3800 | 14.524 |
| 125 | OB1460 | 19064 | Springfi | PA | 938523 | 4 | 2.97661 | 0.15356 | -1.36717 | 18.8539 | 18.6212 | 14.854 |
| 126 | OB1155 | 03561 | Littleto | NH | 023012 | 2 | 2.88720 | 0.14370 | -1.78859 | 17.1293 | 16.9431 | 15.129 |
| 127 | OB1902 | 36732 | Demopoli | AL | 034553 | . | 2.80688 | 0.14159 | . | 15.7250 | 15.5582 | 15.725 |
| 128 | OB1927 | 37388 | Tullahoma | TN | 122452 | . | 2.85707 | 0.14212 | . | 16.5872 | 16.4105 | 16.587 |
| 129 | OB1209 | 06480 | Milford | CT | 035016 | . | 2.86363 | 0.14239 | . | 16.7035 | 16.5250 | 16.704 |
| 130 | OB1516 | 21620 | Chestert | MD | 042032 | . | 2.86433 | 0.14242 | . | 16.7160 | 16.5373 | 16.716 |
| 131 | OB1940 | 37743 | Greenevi | TN | 034052 | . | 2.87872 | 0.14316 | . | 16.9748 | 16.7915 | 16.975 |
| 132 | OB2222 | 65613 | Bolivar | MO | 002963 | 1 | 2.93254 | 0.14778 | -2.23909 | 17.9813 | 17.7752 | 16.98 |
| 133 | OB1101 | 01230 | Great Ba | MA | 101014 | . | 2.89811 | 0.14450 | . | 17.3302 | 17.1398 | 17.330 |
| 134 | OB1608 | 27030 | Mount Ai | NC | 103536 | . | 2.91376 | 0.14585 | . | 17.6229 | 17.4259 | 17.623 |
| 135 | OB2081 | 43624 | Toledo | OH | 924041 | . | 2.91384 | 0.14586 | . | 17.6244 | 17.4273 | 17.624 |
| 136 | OB2105 | 44146 | Bedford | OH | 017041 | . | 2.91688 | 0.14613 | . | 17.6781 | 17.4796 | 17.678 |
| 137 | OB1454 | 18848 | Towanda | PA | 984823 | . | 2.94493 | 0.14923 | . | 18.2222 | 18.0093 | 18.222 |
| 138 | OB1399 | 15853 | Ridgway | PA | 290023 | . | 2.98802 | 0.15532 | . | 19.0873 | 18.8464 | 19.087 |
| 139 | OB1313 | 12010 | Amsterda | NY | 016021 | . | 2.99992 | 0.15727 | . | 19.3338 | 19.0839 | 19.334 |
| 140 | OB880 | 44691 | Wooster | OH | 237041 | 10 | 3.40438 | 0.26557 | -1.00648 | 30.1758 | 29.0956 | 20.176 |
| 141 | OB1855 | 34769 | St Cloud | FL | 089539 | . | 3.04797 | 0.16621 | . | 20.3656 | 20.0725 | 20.366 |
| 142 | OB2149 | 45750 | Marietta | OH | 916541 | . | 3.08289 | 0.17366 | . | 21.1530 | 20.8215 | 21.153 |
| 143 | OB177 | 11226 | Brooklyn | NY | 055021 | 1 | 3.14887 | 0.18956 | -2.45572 | 22.7323 | 22.3097 | 21.732 |
| 144 | OB884 | 44270 | Sandusky | OH | 200041 | 5 | 3.30287 | 0.23336 | -1.51111 | 26.9411 | 26.1906 | 21.941 |
| 145 | OB2153 | 45891 | Van Wert | OH | 224041 | . | 3.13087 | 0.18501 | . | 22.2892 | 21.8939 | 22.289 |
| 146 | OB1446 | 18431 | Honesdal | PA | 099023 | . | 3.19438 | 0.20168 | . | 23.8964 | 23.3952 | 23.896 |
| 147 | OB1351 | 14020 | Batavia | NY | 023021 | . | 3.20827 | 0.20497 | . | 24.2108 | 23.6868 | 24.211 |
| 148 | OB2111 | 44505 | Youngsto | OH | 928541 | . | 3.22846 | 0.21125 | . | 24.8104 | 24.2409 | 24.810 |
| 149 | OB1419 | 16873 | Roaring | PA | 292023 | . | 3.23765 | 0.21389 | . | 25.0631 | 24.4737 | 25.063 |
| 150 | OB1939 | 37743 | Greenevi | TN | 032052 | . | 3.24334 | 0.21555 | . | 25.2213 | 24.6192 | 25.221 |
| 151 | OB2103 | 44130 | Panna | OH | 180141 | . | 3.25333 | 0.21847 | . | 25.5012 | 24.8763 | 25.501 |
| 152 | OB1111 | 01752 | Marlboro | MA | 130014 | . | 3.32270 | 0.23949 | . | 27.5419 | 26.7350 | 27.542 |
| 153 | OB1408 | 16214 | Clarion | PA | 905523 | . | 3.32833 | 0.24062 | . | 27.6535 | 26.8359 | 27.654 |
| 154 | OB1035 | 19446 | Lansdale | PA | 115023 | . | 3.44518 | 0.27901 | . | 31.5931 | 30.3488 | 31.593 |
| 155 | OB1070 | 43302 | Marion | OH | 164041 | . | 3.55857 | 0.31750 | . | 35.9281 | 34.1129 | 35.928 |
| 156 | OB1029 | 02174 | Arlingto | MA | 005014 | . | 3.57738 | 0.32401 | . | 36.7082 | 34.7796 | 36.708 |
| 157 | OB846 | 44024 | Chardon | OH | 033541 | 12 | 3.91522 | 0.44492 | -1.35027 | 54.3786 | 49.1600 | 42.379 |
| 158 | OB1008 | 43506 | Bryan | OH | 023041 | . | 3.78581 | 0.39790 | . | 46.7022 | 43.0715 | 46.702 |
| | | | | | | | | | | | | 145.12 |