



GROUP EXERCISES

Using Cost Accounting to Achieve Strategic Advantage

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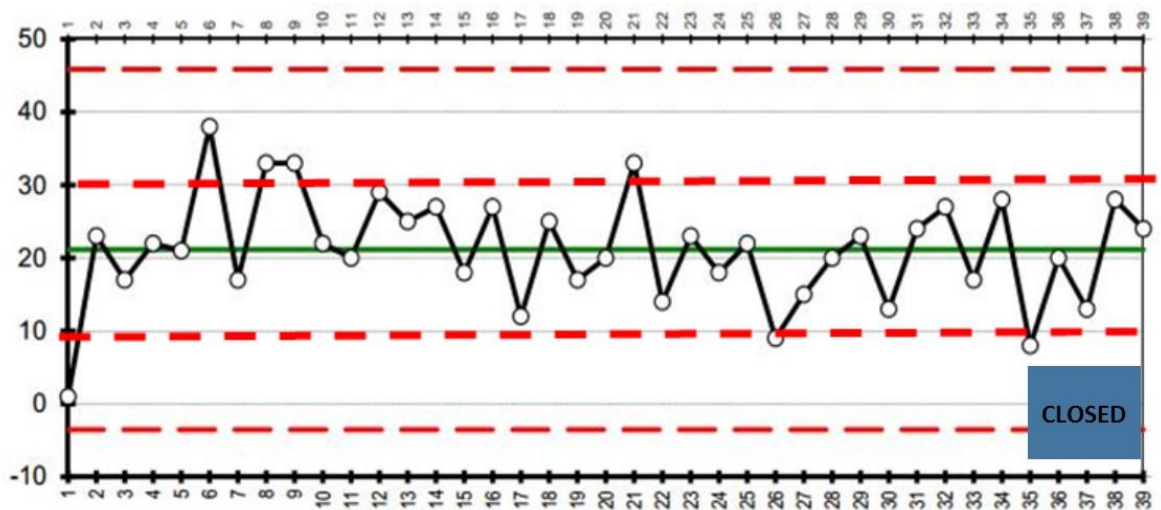
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Applying Chart-Interpretation Rules

Problem: One of two operating rooms were closed for construction for 5 weeks. Management wants to know how many cases were lost and the dollar impact. In the chart below, the green line represents the average surgery volume during the year—22 cases per week. During the closure weeks (35-39) the average was 18.6 cases per week. The dotted red lines represent 1 and 2 standard deviation intervals. Because 22 and 18.6 are averages, we cannot draw a valid conclusion by computing a variance (i.e. $22 - 18.6 = 3.4$ cases/week lost). Instead we must use measures of variation that appropriately factor in the underlying diversity of the population.

Is the difference due to random noise or was there a Special Cause, (i.e. Room Closure) that caused the change?



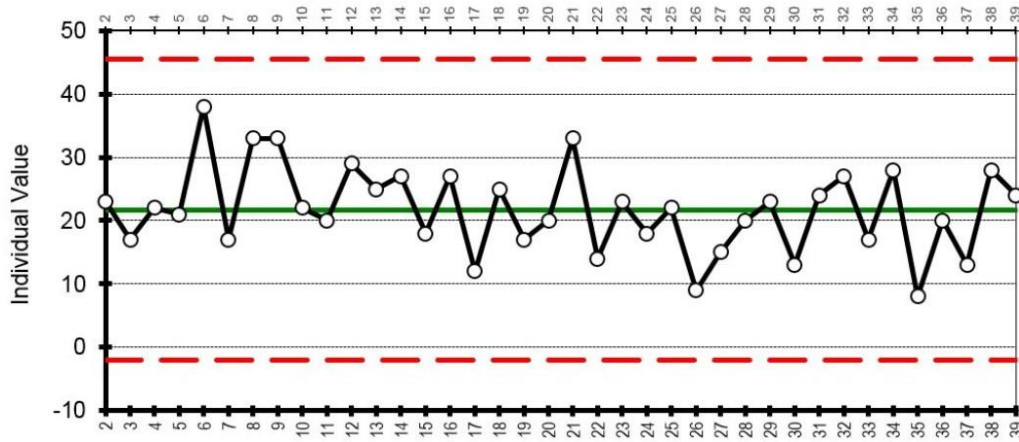
Basic Control Chart Interpretation Rules:

- 6 successive increases or decreases
- 8 consecutive points on either side of the centerline
- Any point outside 3 standard deviations
- Same-side variations
 - 2 of 3 points outside 2 standard deviations
 - 4 of 5 points outside 1 standard deviation

Conclusion:

volume

Special Cause Flag



No Special Cause Detected

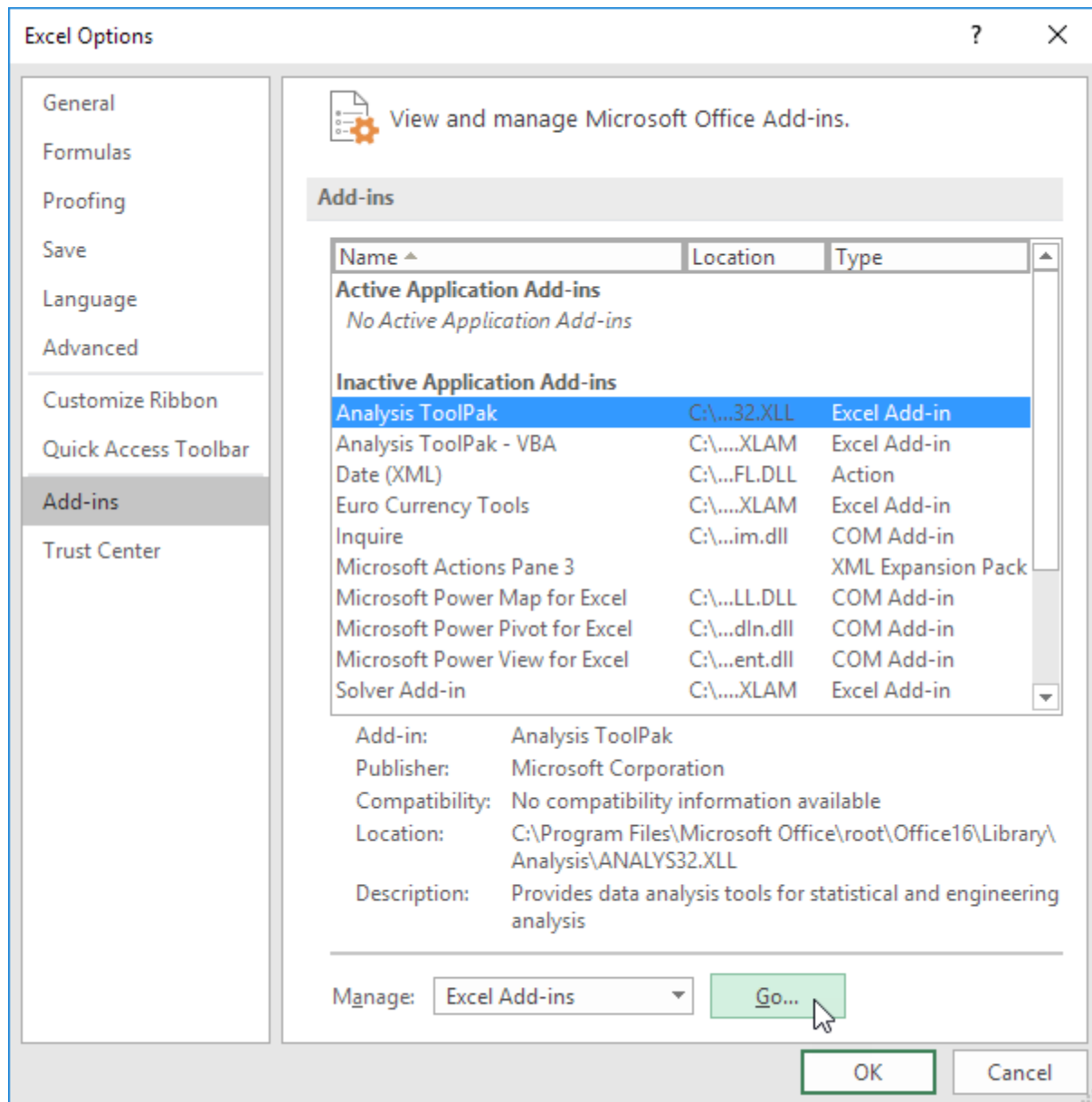
Avg of Data Shown 21.71053
 Median Data Shown 22
 Sigma for Limits 7.931
 Base for Limits Average MR

Chart Type: Chart for Individuals
 Centerline: 21.71 Process Limits: Lower: -2.082 Upper: 45.50
 A: 1 Beyond Control Limit
 B: 9 On One Side of Average
 C: 6 Trending Up or Down
 D: 14 Alternating Up & Down
 E: 2 of 3 Beyond 2 Sigma
 F: 4 of 5 Beyond 1 Sigma
 G: 15 Within 1 Sigma
 H: 8 Outside 1 Sigma
 X: Excluded or Missing Data

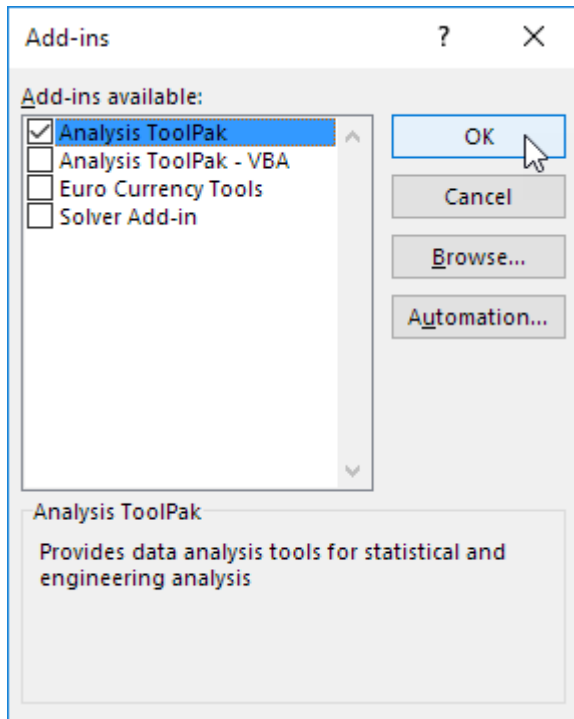
T-Test using Excel

The Analysis ToolPak is an Excel add-in program that provides data analysis tools for financial, statistical and engineering data analysis. To load the Analysis ToolPak add-in, execute the following steps.

1. On the File tab, click Options.
2. Under Add-ins, select Analysis ToolPak and click on the Go button.

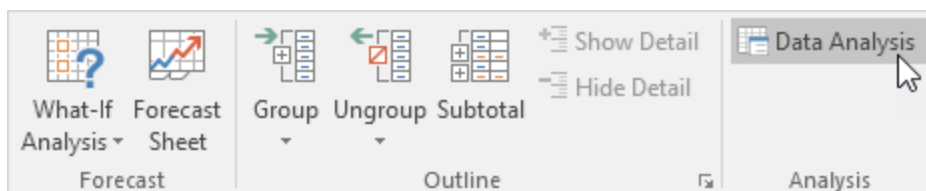


3. Check Analysis ToolPak and click on OK.



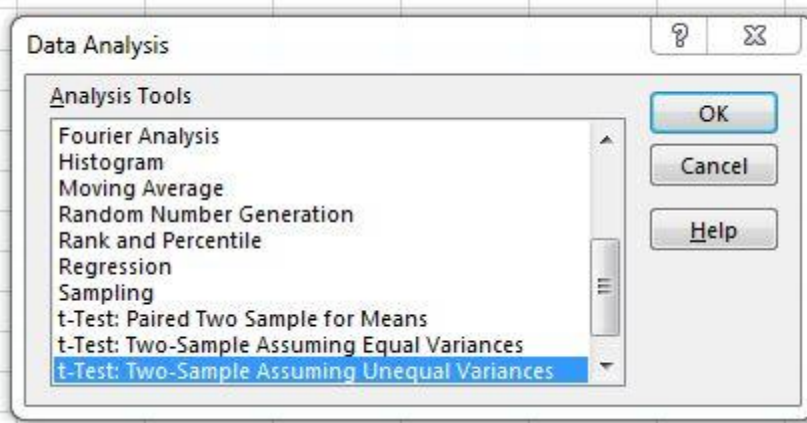
4. Open excel workbook “analyze lost surgery.xlsx” available in the HFMA course materials download from <http://www.never2busy.com> (select “Free software” and look for the HFMA Handouts download)

5. On the Data tab, in the Analysis group, you can now click on Data Analysis.



The following dialog box below appears.

6. Select t-Test: Two Sample Assuming Unequal Variances. The T-test compares to 2 groups of numbers



and tells you if they are different and how significant the difference is. In other words, could the difference have happened by chance or was there a special cause.

7. Enter the values as follows:

E	F
before	closed
23	8
17	20
22	13
21	28
38	24
17	
33	
33	
22	
20	
29	
25	
27	
18	
27	
12	
25	
17	
20	
33	
14	
23	
18	
22	
9	
15	
20	
23	
13	
24	
27	
17	
28	

t-Test: Two-Sample Assuming Unequal Variances

Input

Variable 1 Range:

Variable 2 Range:

Hypothesized Mean Difference:

☒ Labels

Alpha:

Output options

☐ Output Range:

☐ New Worksheet Ply:

☒ New Workbook

[illegible]

How Sampling Error Works

	A	B	C	D
1		Population	Sample1	Sample2
2		3	2	4
3		9	1	3
4		5	9	6
5		1	3	10
6		4		
7		7		
8		2		
9		8		
10		6		
11		10		
12	Avg	5.5	3.75	5.75
13	Std Dev	2.872281323	3.593976	3.095696

Using “DRG VARIANCE3.xls” to Evaluate Variation in Bundles

The main part of the spreadsheet is the “viewer” tab. It will provide a visual graph of the variation in a given sort key, typically defined to be a DRG or other logical clinical or marketplace grouping. The second part of the spreadsheet, the “compare” tab, allows you to compare two populations for the 10 attributes pre built into the model, essentially drilling down for the specific cause of the variation.

1. Open excel workbook “drg variance3.xls” available in the HFMA course materials download from <http://www.never2busy.com> (select “Free software” and look for the HFMA Handouts download
2. Familiarize yourself with the **Raw Data Tab**. It contains all of the data elements from which analysis can be done. These sample data elements were selected as representative of what most hospital financial reporting systems are capable of generating and storing. Additional columns can be added or the existing columns can be changed to fit your needs. The initial data set consists of approximately 32,000 records where the default sortkey is DRG. Any time you make a change to this table, you must recalc (if autocalc is off) and also refresh the appropriate pivot tables on the appropriate tabs. (for those in manual mode, the index column is computed from scale pivot, so scale pivot must be refreshed and recalculated first before Raw Data tab is recalculated)

1	Sortkey	SortDescriptor	Discharge D	FinClass	Disc	Disch	Smok	BMI	Sex	Doet	Diabet	Age	Race	DRG	DRG Description	DRG V	Charges	Payment	Cost	Claim Status	inde
2	484	MAJOR JOINT & LIMB REATTACHMEN	1.00	BCB	July	2014	N	19.00	M	13.00	Yes	###	White	484	MAJOR JOINT & LIMB REATTACH	1.74	19,916.59	9,265.18	8,757.47	Paid Claim	6
3	395	OTHER DIGESTIVE SYSTEM DIAGNO	1.00	BCB	July	2014	N	19.00	F	10.00	No	###	Black	395	OTHER DIGESTIVE SYSTEM DIAC	0.79	10,001.65	7,401.22	4,291.04	Paid Claim	5
4	312	SYNCOPE & COLLAPSE	1.00	BCB	July	2014	N	31.00	F	1.00	No	###	White	312	SYNCOPE & COLLAPSE	0.72	8,693.79	6,433.38	2,636.57	Paid Claim	2
5	313	CHEST PAIN	1.00	BCB	July	2014	N	25.00	F	3.00	No	###	Native	313	CHEST PAIN	0.55	12,155.14	4,909.34	3,633.50	Paid Claim	3
6	793	FULL TERM NEONATE W/ MAJOR PR	1.00	COV	July	2014	N	21.00	F	2.00	No	###	Black	793	FULL TERM NEONATE W/ MAJOR	3.30	13,925.26	12,910.05	5,799.85	Paid Claim	2
7	775	VAGINAL DELIVERY W/ MAJOR COMPL	1.00	COV	July	2014	N	19.00	F	2.00	No	###	Black	775	VAGINAL DELIVERY W/ MAJOR COMPL	0.45	4,987.68	3,112.40	2,295.40	Open Claim	3
8	775	VAGINAL DELIVERY W/ MAJOR COMPL	1.00	COV	July	2014	L	19.00	F	10.00	No	###	White	775	VAGINAL DELIVERY W/ MAJOR COMPL	0.45	3,796.11	3,791.85	1,374.48	Paid Claim	2
9	794	NEONATE W/ OTHER SIGNIFICANT P	1.00	COV	July	2014	N	31.00	M	1.00	No	7.00	White	794	NEONATE W/ OTHER SIGNIFICAN	1.17	1,358.10	1,358.10	636.66	Paid Claim	0
10	313	CHEST PAIN	1.00	COV	July	2014	M	19.00	M	4.00	Yes	6.00	Black	313	CHEST PAIN	0.55	10,257.92	4,865.65	3,471.59	Paid Claim	3
11	153	OTITIS MEDIA & URI W/ MAJOR MCC	1.00	MCD	July	2014	N	31.00	F	3.00	No	###	White	153	OTITIS MEDIA & URI W/ MAJOR MCC	0.62	5,140.62	2,037.36	2,367.84	Paid Claim	3
12	774	VAGINAL DELIVERY W/ COMPLICATI	1.00	MCD	July	2014	N	21.00	F	4.00	No	###	Black	774	VAGINAL DELIVERY W/ COMPLIC	0.59	3,881.34	2,874.26	1,880.92	Paid Claim	3
13	443	DISORDERS OF LIVER EXCEPT MALI	1.00	MCD	July	2014	N	19.00	F	7.00	No	###	Black	443	DISORDERS OF LIVER EXCEPT	0.91	11,189.82	8,943.19	3,856.03	Paid Claim	6
14	795	NORMAL NEWBORN	1.00	MCD	July	2014	H	21.00	M	2.00	No	###	Black	795	NORMAL NEWBORN	0.16	1,373.08	366.47	557.50	Open Claim	1
15	775	VAGINAL DELIVERY W/ MAJOR COMPL	1.00	MCD	July	2014	N	19.00	F	1.00	No	###	White	775	VAGINAL DELIVERY W/ MAJOR COMPL	0.45	3,247.70	1,626.00	962.60	Paid Claim	1

3. **Sort rank** tab contains a pivot table that sums and ranks all the sortkeys by Total record count. This is helpful because sortkeys with less than 130 records are usually considered too few records to draw meaningful conclusions about. Counts are also used to project profit in Viewer.

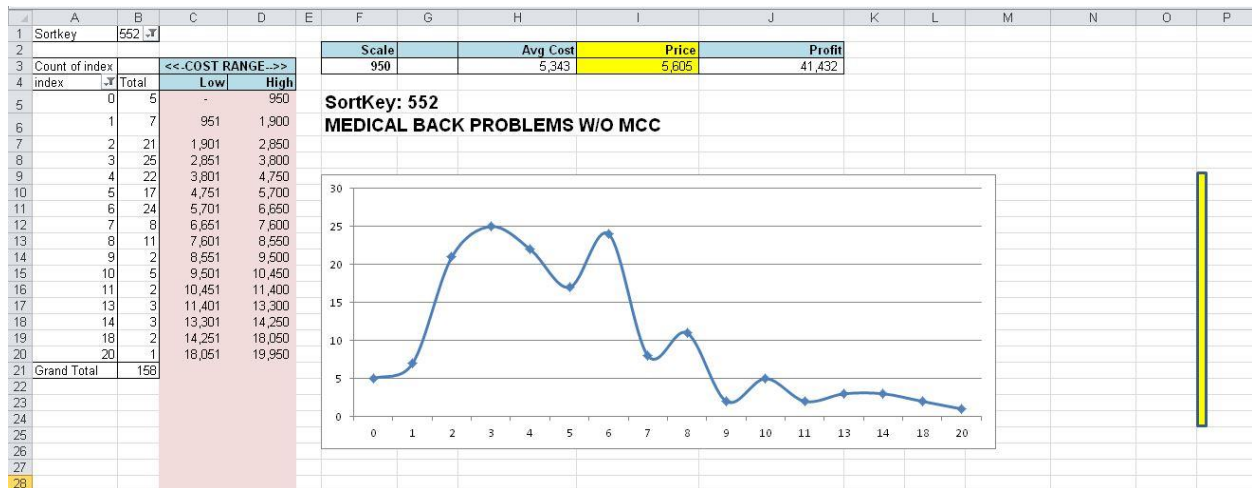
	A	B	C	D
1				
2				
3	Count of ind			
4	Sortkey	SortDescriptor	Total	
5	=775	VAGINAL DELIVERY W/ MAJOR COMPLICATING DIAGNOSES	2956	
6	=470	MAJOR JOINT REPLACEMENT OR REATTACHMENT OF LOWER EXTREMITY W/	1883	
7	=795BCB	NORMAL NEWBORN	1322	
8	=795MCD	NORMAL NEWBORN	1297	
9	=766	CESAREAN SECTION W/ MAJOR COMPLICATING DIAGNOSES	862	
10	=765	CESAREAN SECTION W/ MAJOR COMPLICATING DIAGNOSES	621	
11	=392	ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS W/ MAJOR MCC	596	
12	=794	NEONATE W/ OTHER SIGNIFICANT PROBLEMS	595	
13	=774	VAGINAL DELIVERY W/ MAJOR COMPLICATING DIAGNOSES	529	
14	=795MID	NORMAL NEWBORN	522	
15	=194	SIMPLE PNEUMONIA & PLEURISY W/ MAJOR MCC	370	
16	=743	UTERINE & ADNEXA PROC FOR NON-MALIGNANCY W/ MAJOR MCC	340	
17	=460	SPINAL FUSION EXCEPT CERVICAL W/ MAJOR MCC	321	
18	=603	CELLULITIS W/ MAJOR MCC	315	
19	=795UHC	NORMAL NEWBORN	312	
20	=491	BACK & NECK PROC EXC SPINAL FUSION W/ MAJOR MCC	290	

4. The “scale” tab contains a pivot with some formulas that are used to “standardize” or “normalize” the data before it is graphed in the viewer. The upper and lower price or cost range of each sortkey is used arbitrarily group all patient records into 20 categories. Twenty categories is about the maximum that can be reasonably displayed on a computer screen and that still provides sufficient granularity for analysis.

	A	B	C	D	E	F	G	
1								
2								
3		Data						
4	Sortkey	Count of Cost	Sum of Cost2	Average of Cost2	Min of Cost2	Max of Cost2	Scale	
625	922	2	21,565	10,783	5,220	16,346	817	
626	923	5	46,526	9,305	3,800	19,716	985	
627	927	16	1,016,985	63,562	12,228	221,669	11,083	
628	928	53	2,150,442	40,574	4,011	152,877	7,643	
629	929	26	301,451	11,594	1,725	43,965	2,198	
630	934	14	67,662	4,833	731	21,688	1,084	
631	935	99	472,194	4,770	456	24,912	1,245	
632	940	2	17,235	8,617	8,067	9,167	458	
633	941	3	17,435	5,812	2,605	7,607	380	
634	947	20	116,518	5,826	1,229	11,666	583	
635	948	121	636,534	5,261	0	24,352	1,217	
636	951	5	13,866	2,773	1,352	4,059	202	
637	956	7	151,188	21,598	9,155	41,015	2,050	
638	964	2	17,509	8,755	8,295	9,215	460	
639	965	1	9,005	9,005	9,005	9,005	450	
640	974	2	16,903	8,452	7,848	9,056	452	
641	975	4	23,349	5,837	1,923	10,243	512	

5. Viewer tab

shows the histogram for the selected sortkey, as well as certain important elements. Select the sortkey to view in Cell B1. The high and low cost values are then used to compute a scale such that all records in Raw Data will be fit into one of 20 cost bands. The scale is shown in F3 and represents the increment between each of the 20 cost bands. Those ranges are shown in Cells A3:D20. In the example below, 5 patients had costs fell within the range of 0-\$950 for cost band index 0. Similarly, only 1 patient had costs between \$18,050-\$19,950 in cost band index 20. This is all graphically illustrated in the graph to the right, where the Y axis number of patients and the X axis is the 20 cost bands. At the top, in cell H3 is the average cost, and you can model bundled price proposals in I3 and the resulting “profit” is then computed in J3. You will need to be aware of whether autocalc is on or off for your workbook, and if it is off, you will need to manually recalculate after any change. On the other hand, autocalc may cause your spreadsheet to feel unresponsive during frequent recalculations. The yellow bar to the right is an object you can drag onto the chart as a marker for discussions or screenshots.



6. The **compare** tab looks at frequency of occurrence of one of the 10 patient attributes and allows for comparing between two sortkeys. These pivot tables are separate, so you can make changes to the raw data, refresh the first table (A1:B9) then make changes to the raw data again, and refresh the second table (K1:L9). That will place different sortkeys side by side for comparison. The expectation is that the distribution of values should be the same between the two sortkeys. To the extent they vary significantly, one should investigate a cause for that variation. The number of cases in each attribute as well as the amount of difference should both be considered in assessing the significance of the difference. Low numbers of patients do not present as compelling a conclusion as larger numbers. The comparison below looks at financial class for 795 Normal Newborn and 775 Vaginal delivery. One would expect a strong correlation and indeed there is—in both DRG, 34% are blue cross, 8% are united healthcare. Interesting, 34% of 795 are Medicaid while on 32% of Vaginal Deliverys are. However, given the small difference it is

	A	B	C	D	K	L	M
1	Sortkey	795			Sortkey	775	
2							
3	Count of Cost				Count of Cost		
4	FinClass	Total			FinClass	Total	
5	BCB	1322	34%		ACT	1	0%
6	CHA	92	2%		BCB	1015	34%
7	COM	25	1%		CHA	71	2%
8	COV	214	6%		COM	22	1%
9	MAN	21	1%		COV	166	6%
10	MCD	1297	34%		FIR	1	0%
11	MID	522	14%		MAN	15	1%
12	PTR	3	0%		MCD	958	32%
13	SEL	52	1%		MCR	12	0%
14	UHC	312	8%		MID	416	14%
15	Grand Total	3860	100%		SEL	47	2%
16			0%		UHC	230	8%
17			0%		VA	2	0%
18			0%		Grand Total	2956	

not greatly significant.

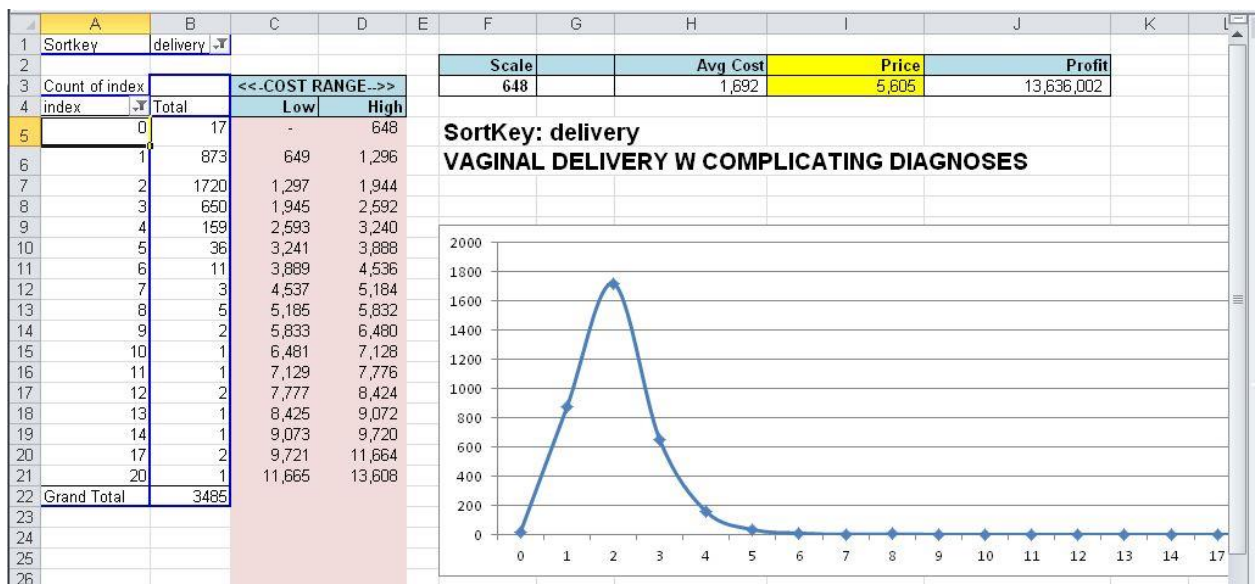
By the way, here are the attributes that are in the default Raw Data tab:

	Data Elements		
	Sortkey		
	SortDescriptor		
	Discharge Date Fiscal Period		
	FinClass		
	Discharge Date Fiscal Period Name		
	Discharge Date Fiscal Year		
	Smoking Status		
	BMI		
	Sex		
	Doctor		
	Diabetes		
	Age		
	Race		
	DRG (MS)		
	DRG Description		
	DRG Weight		
	Charges		
	Payment		
	Cost		
	Claim_Status		

Example: Let's see how obesity might affect the cost of vaginal delivery. In this case, we will combine 775 and 774 since we want to look at the whole universe of delivery and not just one. The workbook should be in automatic calculation mode for this exercise.

Step 1: is to modify the sortkey for all current 775 and 774 sortkeys in raw data—give it a new sortkey—lets call it “delivery”. Go to raw data, and using filters or whatever technique you prefer, set all the sortkeys that are 775 or 774 to “delivery”.

Step 2: Refresh the sort rank pivot. To do this, right click on the pivot table and select “refresh”. “Delivery” should pop up in the sortkey column. Refresh the scale pivot. Refresh the viewer pivot and then go to Cell B2 and select the dropdown “delivery”. You should have this histogram:



There are 3,485 cases in the database, and the low value is zero while the high value is over \$11,665. The average is \$1,692. Let's split the population into half near the average, and compare BMI between them. To do this, we go back to and using whatever method works for us (I prefer setting filters and copying), we will change the sortkey for any case that cost more than \$1,692 to "deliv-hi" while we will also change the sortkey for delivery less than that amount to "deliv-lo". Then repeat the pivot table refreshes as we have done in Step 2 above.

Step 3 Now we go to compare tab. The first pivot table is shared with viewer scale so it is ready for selection—select "deliv-low" from the drop down in B1, and click on the pivot table to reveal the field list on the left. Uncheck whatever is checked and check "BMI". If more than one item not counting sortkey is checked, the pivot table will expand and overwrite the formulas in column C. so make sure no more than one item is checked by unchecking previous field BEFORE checking "BMI"

Right click on the second pivot (K1:L9) and refresh, then select "Deliv-hi" from the dropdown in L1. From the pivot field list, check BMI and uncheck any other attributes (leaving sortkey checked at the top—same as the prior pivot).

You should have a report that looks like this:

	A	B	C	D	K	L	M
1	Sortkey	deliv-low			Sortkey	deliv-hi	
2							
3	Count of Cost				Count of Cost		
4	BMI	Total			BMI	Total	
5	19	1451	71%		19	1017	71%
6	21	147	7%		21	111	8%
7	25	133	7%		25	80	6%
8	31	313	15%		31	233	16%
9	Grand Total	2044	100%		Grand Total	1441	100%
10			n%				n%

So comparing the high cost and low cost deliveries—BMI of 19 is considered very slender—and the proportion of patients in both populations is the same—thus, we can rule out slenderness as a factor influencing cost. 31 and higher is considered obese, and we find that only a very slight 16% vs 15% (or 1%) of patients in the high cost category were obese. Thus it seems reasonable to conclude that obesity is not a significant causative factor in high cost deliveries.

As we often see that the physician is a significant explanation for cost differences, let's replace BMI with Doctor and see if that reveals anything of interest:

	A	B	C	D	K	L	M
1	Sortkey	deliv-low ▾			Sortkey	deliv-hi ▾	
2							
3	Count of Cost				Count of Cost		
4	Doctor ▾	Total			Doctor ▾	Total	
5	1	142	7%		1	106	7%
6	2	164	8%		2	105	7%
7	3	138	7%		3	114	8%
8	4	157	8%		4	95	7%
9	5	142	7%		5	123	9%
10	6	155	8%		6	109	8%
11	7	123	6%		7	98	7%
12	8	161	8%		8	103	7%
13	9	141	7%		9	97	7%
14	10	156	8%		10	104	7%
15	11	148	7%		11	100	7%
16	12	150	7%		12	105	7%
17	13	123	6%		13	102	7%
18	14	144	7%		14	80	6%
19	Grand Total	2044			Grand Total	1441	

And we find that the two populations appear almost identical, with the exception of doctor 5 who occurs 2% more frequently in the high cost population. Not a very significant number. So who the doctor is does not explain the difference in cost between these populations.

Bonus: Compare financial class to see if self pay or Medicaid patients tend to cost more than commercial.....

