

Rational Data Analysis—Getting the Best Return Putting it All Together Exercises

Discrete data exercises—the p-chart:

- (1) Analyze the p-chart from a performance perspective.
- (a) Identify the rules your group would apply to the chart.
 - (b) Calculate the first three p-values for the dataset.
 - (c) Calculate p-bar for your dataset.
 - (d) Calculate $\frac{1}{p - \bar{p}}$ to determine the minimum subgroup size for analysis.
 - (i) For each month, indicate whether the denominator meets the minimum subgroup size.
 - (e) Calculate $\frac{4}{p - \bar{p}}$ to determine how large “n” would have to be to safely identify outliers.
 - (i) For each month, indicate whether the denominator meets the minimum “n” needed to identify outlier values.
 - (f) Identify any special cause variation present in the chart.
 - (g) Interpret the p-chart.

Continuous data exercises—the XmR or X-bar and s Charts:

- (1) Analyze the XmR or X-bar and s-chart from a performance perspective.
- (a) Identify the rules your group would apply to the upper chart.
 - (b) Calculate the missing moving range values for the dataset
 - (c) Identify the rules your group would apply to the lower chart.
 - (i) If special cause variation is present in the lower chart, comment on any affect this might have on the X upper chart
 - (d) Identify any special cause variation present in the chart.
 - (e) Interpret the XmR or X-bar and s-chart.

Control Chart Rules	
Type of Special Cause	Criteria
Outliers	Any data point above the Upper Control Limit (UCL) or below the Lower Control Limit (LCL).
Shifts in the process	Eight or more consecutive data points on the same side of the centerline (CL). Data points falling on the centerline are not counted in shifts in the process.
Trends	Six or more consecutive data points whose values either steadily increase or decrease. Data points falling on the centerline are counted in trends.
Data Oscillations	Fourteen or more consecutive data points whose values alternate up and down. Data oscillations can occur anywhere on the chart.

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Scenario #1:

A facility wishes to examine outcomes related to left ventricular assessment for heart failure patients from 1st Quarter 2004 through 3rd Quarter 2004. If performance improvement is the reason for creating the p-chart:

	Heart failure patients with LVF assessment	Heart failure patients
JAN 04	25	30
FEB 04	18	24
MAR 04	9	17
APR 04	21	30
MAY 04	15	31
JUN 04	9	21
JUL 04	12	20
AUG 04	23	36
SEP 04	11	42

- (1) Which of the following rules would you apply to interpret the chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

- (2) What is each month's p-value?

$$p\text{-value} = \frac{\text{Heart failure patients with LVF assessment}}{\text{Heart failure patients}}$$

	Heart failure patients with LVF assessment	Heart failure patients	p value (Num) / (Den)
JAN 04	25	30	
FEB 04	18	24	
MAR 04	9	17	
APR 04	21	30	0.700
MAY 04	15	31	0.484
JUN 04	9	21	0.429
JUL 04	12	20	0.600
AUG 04	23	36	0.639
SEP 04	11	42	0.262
	Total = 143	Total = 251	

- (3) What is the value of p-bar?

$$p\text{-bar} = \frac{\text{Total heart failure patients with LVF assessment}}{\text{Total heart failure patients}}$$

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$$p\text{-bar} = \frac{\quad}{\quad}$$

$$p\text{-bar} = \underline{\hspace{2cm}}$$

(4) Are the subgroup sizes for each month large enough for analysis?

Subgroup size would have to be $\geq \frac{1}{p\text{-bar}} = \frac{1}{\quad}$ or $\underline{\hspace{2cm}}$

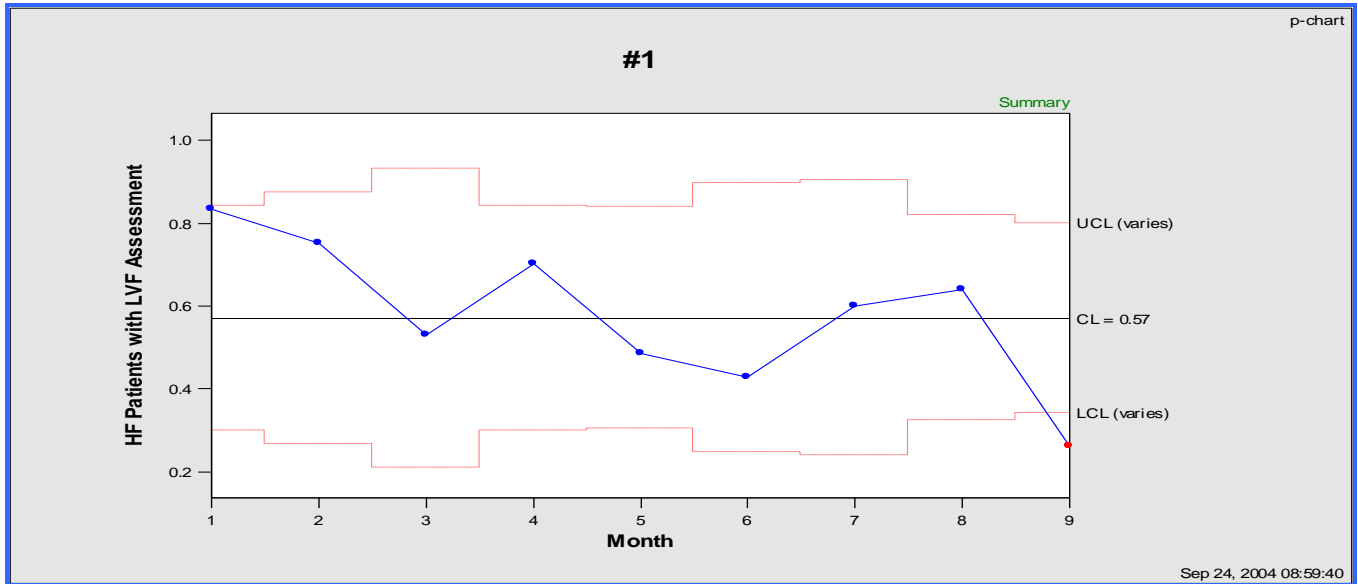
(5) In order to safely predict outliers, how large would "n" for each month have to be?

Subgroup size would have to be $\geq \frac{4}{p\text{-bar}} = \frac{4}{\quad}$ or $\underline{\hspace{2cm}}$

(6) Does the denominator for each month meet the $\frac{1}{p\text{-bar}}$ and the $\frac{4}{p\text{-bar}}$ requirement?

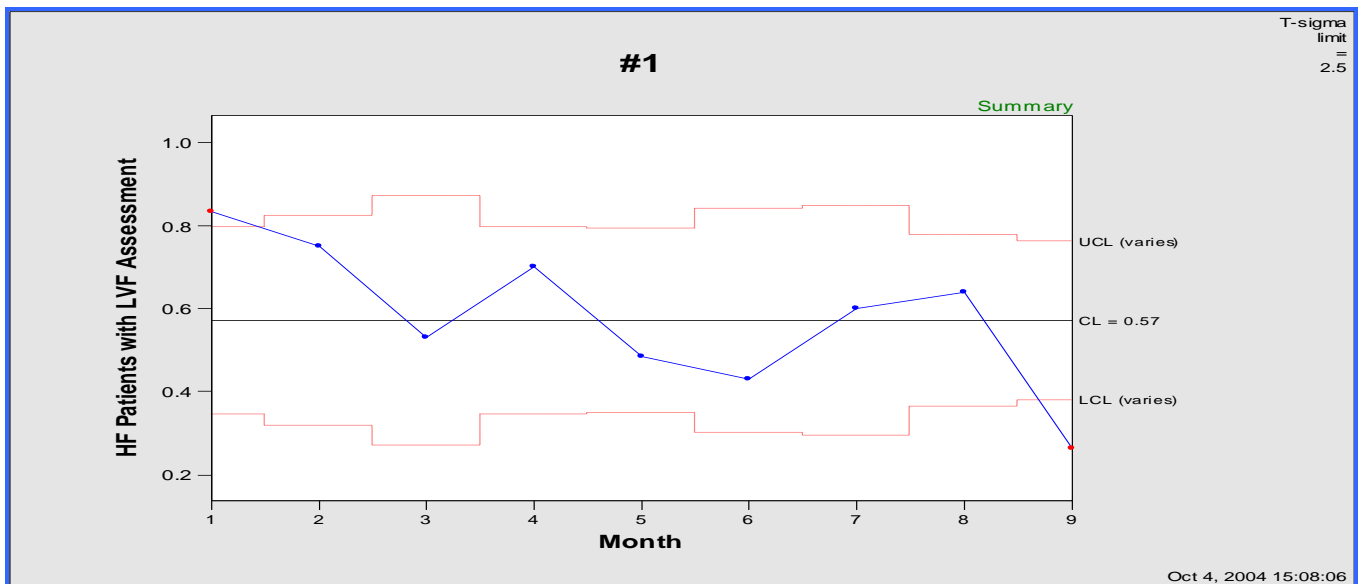
Denominator (Heart failure patients)		Satisfies $\frac{1}{p\text{-bar}}$	Satisfies $\frac{4}{p\text{-bar}}$
JAN 04	30	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
FEB 04	24	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAR 04	17	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
APR 04	30	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAY 04	31	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUN 04	21	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUL 04	20	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
AUG 04	36	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
SEP 04	42	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

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	This type of special cause noted in the p-chart?	What is your interpretation of the p-chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

- (7) In order to keep the total α -risk under control without increasing the risk of type 1 errors, so called T-sigma limits are applied whenever there are few data points on control charts. For 5 to 9 data points, the recommended T-sigma limit = 2.5. The following p-chart regarding outcomes related to left ventricular assessment for heart failure patients is based on T-sigma limits of 2.5. Would this change in control limits affect the interpretation of the data?



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	This type of special cause noted in the p-chart?	What is your interpretation of the p-chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #2:

A facility wishes to examine outcomes for ACEI prescribed at discharge from 1st Quarter 2004 through 3rd Quarter 2004. If performance improvement is the reason for creating the p-chart:

	Heart failure patients prescribed ACEI at discharge	Heart failure patients without ACEI contraindications
JAN 04	2	5
FEB 04	0	3
MAR 04	2	4
APR 04	0	4
MAY 04	1	5
JUN 04	0	3
JUL 04	0	6
AUG 04	1	3
SEP 04	2	5

(1) Which of the following rules would apply to interpret the chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) What is each month's p-value?

$$p \text{ value} = \frac{\text{Heart failure patients prescribed an ACEI on discharge}}{\text{Heart failure patients without ACEI contraindications}}$$

	Heart failure patients prescribed ACEI at discharge	Heart failure patients without ACEI contraindications	p value (Num) / (Den)
JAN 04	2	5	
FEB 04	0	3	
MAR 04	2	4	
APR 04	0	4	0.000
MAY 04	1	5	0.200
JUN 04	0	3	0.000
JUL 04	0	6	0.000
AUG 04	1	3	0.333

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	Heart failure patients prescribed ACEI at discharge	Heart failure patients without ACEI contraindications	p value (Num) / (Den)
SEP 04	2	5	0.400
	Total = 8	Total = 38	

(3) What is the value of p-bar?

$$p\text{-bar} = \frac{\text{Total heart failure patients prescribed an ACEI on discharge}}{\text{Total heart failure patients without ACEI contraindications}}$$

$$p\text{-bar} = \frac{\boxed{}}{\boxed{}}$$

$$p\text{-bar} = \underline{\hspace{2cm}}$$

(4) Are the subgroup sizes for each month large enough for analysis?

$$\text{Subgroup size would have to be } \geq \frac{1}{p\text{-bar}} = \frac{\boxed{1}}{\boxed{}} \text{ or } \underline{\hspace{2cm}}$$

(5) In order to safely predict outliers, how large would "n" for each month have to be?

$$\text{Subgroup size would have to be } \geq \frac{4}{p\text{-bar}} = \frac{\boxed{4}}{\boxed{}} \text{ or } \underline{\hspace{2cm}}$$

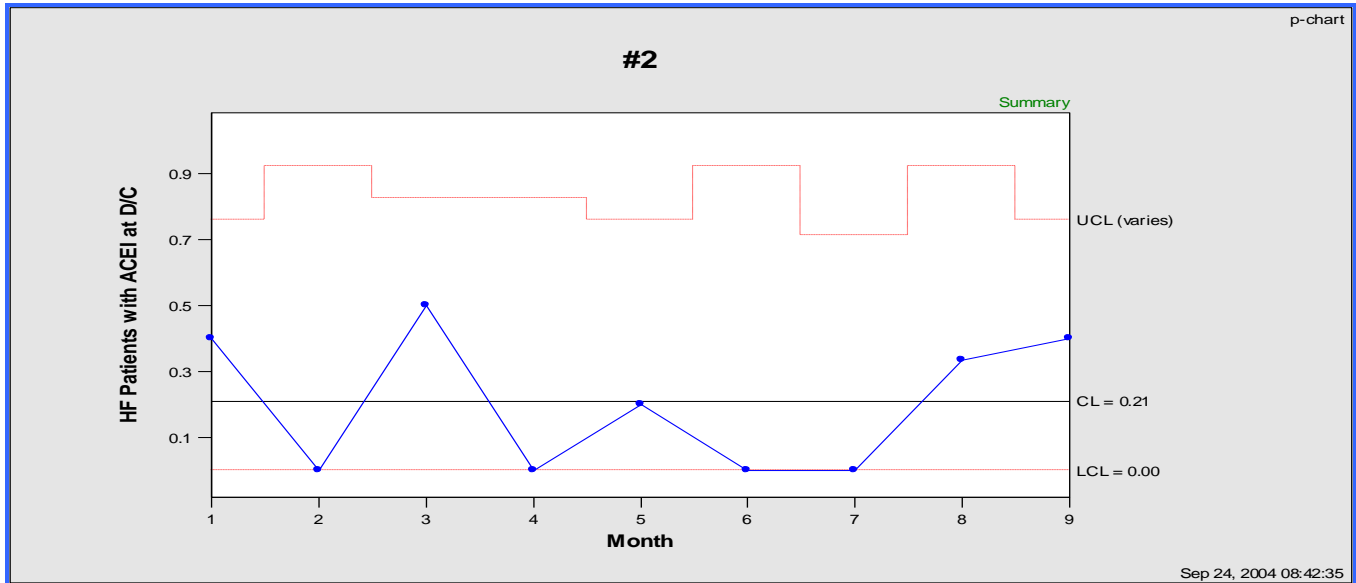
(6) Does the denominator for each month meet the $\frac{1}{p\text{-bar}}$ and the $\frac{4}{p\text{-bar}}$ requirement?

Denominator (HF patients without ACEI contraindications)		Satisfies $\frac{1}{p\text{-bar}}$	Satisfies $\frac{4}{p\text{-bar}}$
JAN 04	5	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
FEB 04	3	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAR 04	4	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
APR 04	4	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAY 04	5	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUN 04	3	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUL 04	6	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
AUG 04	3	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

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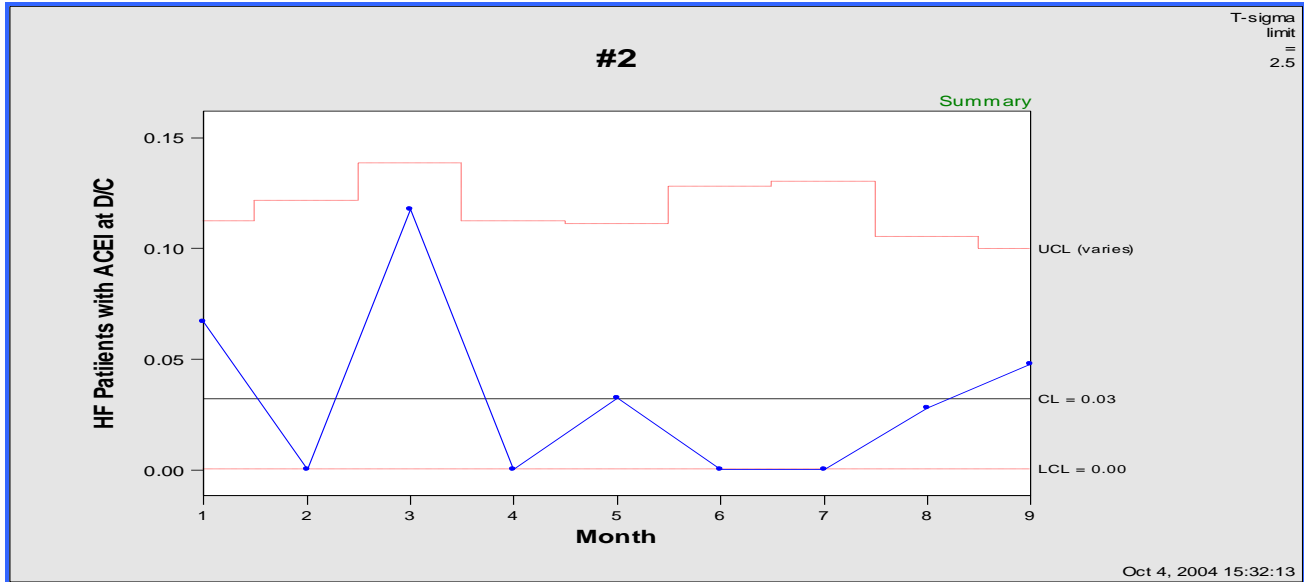
	Denominator (HF patients without ACEI contraindications)	Satisfies $\frac{1}{p - \bar{p}}$	Satisfies $\frac{4}{p - \bar{p}}$
SEP 04	5	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No



	This type of special cause noted in the p-chart?	What is your interpretation of the p-chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

- (7) In order to keep the total α -risk under control without increasing the risk of type 1 errors, so called T-sigma limits are applied whenever there are few data points on control charts. For 5 to 9 data points, the recommended T-sigma limit = 2.5. The following p-chart regarding outcomes related to heart failure patients prescribed an ACEI at discharge based on T-sigma limits of 2.5. Would this change in control limits affect the interpretation of the data?

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	This type of special cause noted in the p-chart?	What is your interpretation of the p-chart?
Outliers?		
Shifts in the process?		
Trends?		
Data Oscillations?		

Scenario #3:

A facility wishes to examine inpatient mortality from 1st Quarter 2002 through 3rd Quarter 2004. If performance improvement is the reason for creating the p-chart:

	Inpatient deaths	Discharges
JAN 02	73	2,707
FEB 02	48	2,601
MAR 02	80	2,969
APR 02	78	2,690
MAY 04	92	2,808
JUN 02	76	2,688
JUL 02	84	2,678
AUG 02	67	2,910
SEP 02	83	2,717
OCT 02	69	2,888
NOV 02	83	2,803
DEC 02	61	2,587
JAN 03	80	2,732
FEB 03	64	2,651
MAR 03	92	2,971
APR 03	85	2,704
MAY 03	79	2,781
JUN 03	74	2,526
JUL 03	71	2,650

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	Inpatient deaths	Discharges
AUG 03	62	2,684
SEP 03	65	2,849
OCT 03	51	2,998
NOV 03	67	2,318
DEC 03	72	2,843
JAN 04	63	2,651
FEB 04	92	2,109
MAR 04	70	2,166
APR 04	73	2,417
SEP 04	62	2,037
JUN 04	71	2,330
JUL 04	55	2,890
AUG 04	50	2,197
SEP 04	35	2,633

(1) Which of the following rules would apply to interpret the chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) What is each month's p-value?

$$p\text{-value} = \frac{\text{Inpatient deaths}}{\text{Discharges}}$$

	Inpatient deaths	Discharges	p-value (Num) / (Den)
JAN 02	73	2,707	
FEB 02	48	2,601	
MAR 02	80	2,969	
APR 02	78	2,690	0.029
MAY 04	92	2,808	0.033
JUN 02	76	2,688	0.028
JUL 02	84	2,678	0.031
AUG 02	67	2,910	0.023
SEP 02	83	2,717	0.031
OCT 02	69	2,888	0.024
NOV 02	83	2,803	0.030
DEC 02	61	2,587	0.024
JAN 03	80	2,732	0.029

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	Inpatient deaths	Discharges	p-value (Num) / (Den)
FEB 03	64	2,651	0.024
MAR 03	92	2,971	0.031
APR 03	85	2,704	0.031
MAY 03	79	2,781	0.028
JUN 03	74	2,526	0.029
JUL 03	71	2,650	0.027
AUG 03	62	2,684	0.023
SEP 03	65	2,849	0.022
OCT 03	51	2,998	0.017
NOV 03	67	2,318	0.030
DEC 03	72	2,843	0.025
JAN 04	63	2,651	0.024
FEB 04	92	2,109	0.044
MAR 04	70	2,166	0.032
APR 04	73	2,417	0.030
SEP 04	62	2,037	0.030
JUN 04	71	2,330	0.030
JUL 04	55	2,890	0.019
AUG 04	50	2,197	0.023
SEP 04	35	2,633	0.013
	Total = 2,327	Total = 87,183	

(3) What is the value of p-bar?

$$p\text{-bar} = \frac{\text{Total inpatient deaths}}{\text{Total discharges}}$$

$$p\text{-bar} = \frac{\boxed{}}{\boxed{}}$$

$$p\text{-bar} = \underline{\hspace{2cm}}$$

(4) Are the subgroup sizes for each month large enough for analysis?

$$\text{Subgroup size would have to be } \geq \frac{1}{p\text{-bar}} = \frac{\boxed{1}}{\boxed{}} \text{ or } \underline{\hspace{2cm}}$$

(5) In order to safely predict outliers, how large would "n" for each month have to be?

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Subgroup size would have to be $\geq \frac{4}{p - \bar{p}} = \frac{4}{\frac{4}{4}}$ or _____

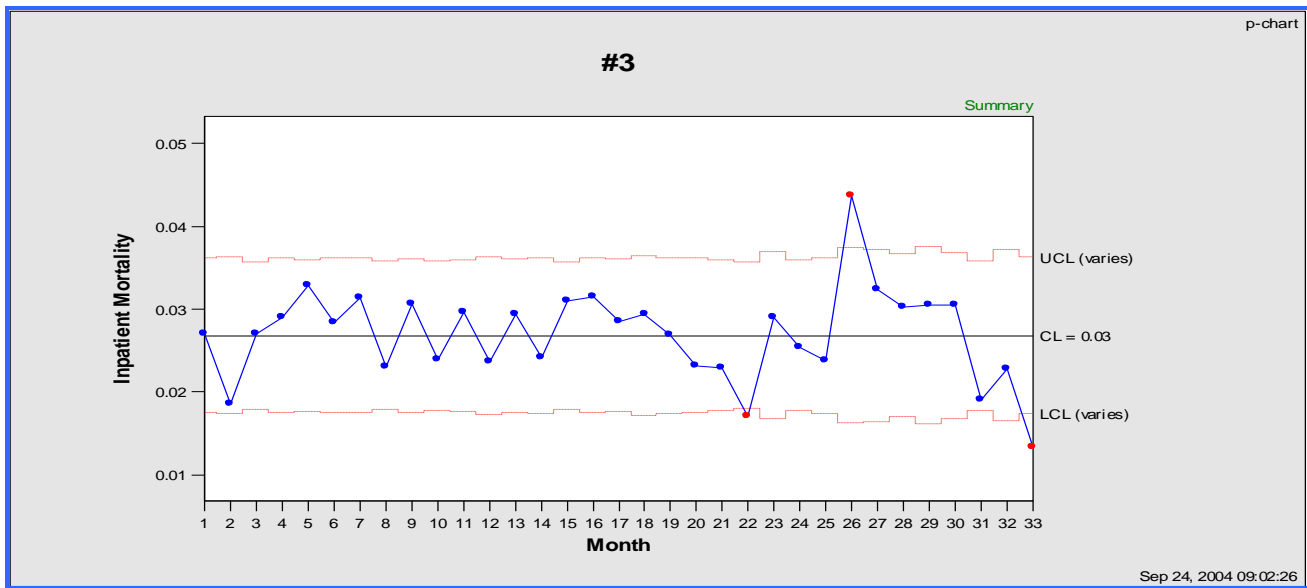
(6) Does the denominator for each month meet the $\frac{1}{p - \bar{p}}$ and the $\frac{4}{p - \bar{p}}$ requirement?

	Denominator (Discharges)	Satisfies $\frac{1}{p - \bar{p}}$	Satisfies $\frac{4}{p - \bar{p}}$
JAN 02	2,707	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
FEB 02	2,601	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAR 02	2,969	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
APR 02	2,690	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAY 04	2,808	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUN 02	2,688	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUL 02	2,678	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
AUG 02	2,910	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
SEP 02	2,717	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
OCT 02	2,888	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
NOV 02	2,803	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
DEC 02	2,587	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JAN 03	2,732	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
FEB 03	2,651	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAR 03	2,971	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
APR 03	2,704	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAY 03	2,781	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUN 03	2,526	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUL 03	2,650	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
AUG 03	2,684	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
SEP 03	2,849	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
OCT 03	2,998	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
NOV 03	2,318	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
DEC 03	2,843	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JAN 04	2,651	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
FEB 04	2,109	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
MAR 04	2,166	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
APR 04	2,417	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
SEP 84	2,037	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

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	Denominator (Discharges)	Satisfies $\frac{1}{p - \bar{p}}$	Satisfies $\frac{4}{p - \bar{p}}$
JUN 04	2,330	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
JUL 04	2,890	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
AUG 04	2,197	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
SEP 04	2,633	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No



	This type of special cause noted in the p-chart?	What is your interpretation of the p-chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #4:

A facility wishes to examine the length of time it took from arrival to the administration of the first dose of antibiotics for pneumonia patients from 1st Quarter 2002 through 3rd Quarter 2004. If performance improvement is the reason for creating the XmR chart:

Case	Time to first antibiotic (Minutes)
1	56
2	65
3	50
4	33
5	56
6	77
7	64

Case	Time to first antibiotic (Minutes)
21	30
22	24
23	42
24	35
25	92
26	22
27	36

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Case	Time to first antibiotic (Minutes)
8	55
9	49
10	34
11	20
12	11
13	100
14	33
15	25
16	48
17	43
18	53
19	117
20	21

Case	Time to first antibiotic (Minutes)
28	78
29	55
30	44
31	43
32	30
33	23
34	28
35	31
36	33
37	42
38	44
39	30
40	29

(1) Which of the following rules would we apply to the upper X or I-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) What are the missing moving range values for this data set? Will there be “one to one” cross correlation of data points between the X or I-chart and the moving range (mR) chart?

Case	Time to first antibiotic (Minutes)	Moving Range
1	56	
2	65	
3	50	
4	33	
5	56	
6	77	21
7	64	13
8	55	9
9	49	6
10	34	15
11	20	14
12	11	9
13	100	89
14	33	67
15	25	8
16	48	23
17	43	5
18	53	10
19	117	64
20	21	96

Case	Time to first antibiotic (Minutes)	Moving Range
21	30	
22	24	
23	42	
24	35	
25	92	
26	22	70
27	36	14
28	78	42
29	55	23
30	44	9
31	43	1
32	30	13
33	23	7
34	28	5
35	31	3
36	33	2
37	42	11
38	44	2
39	30	6
40	29	1

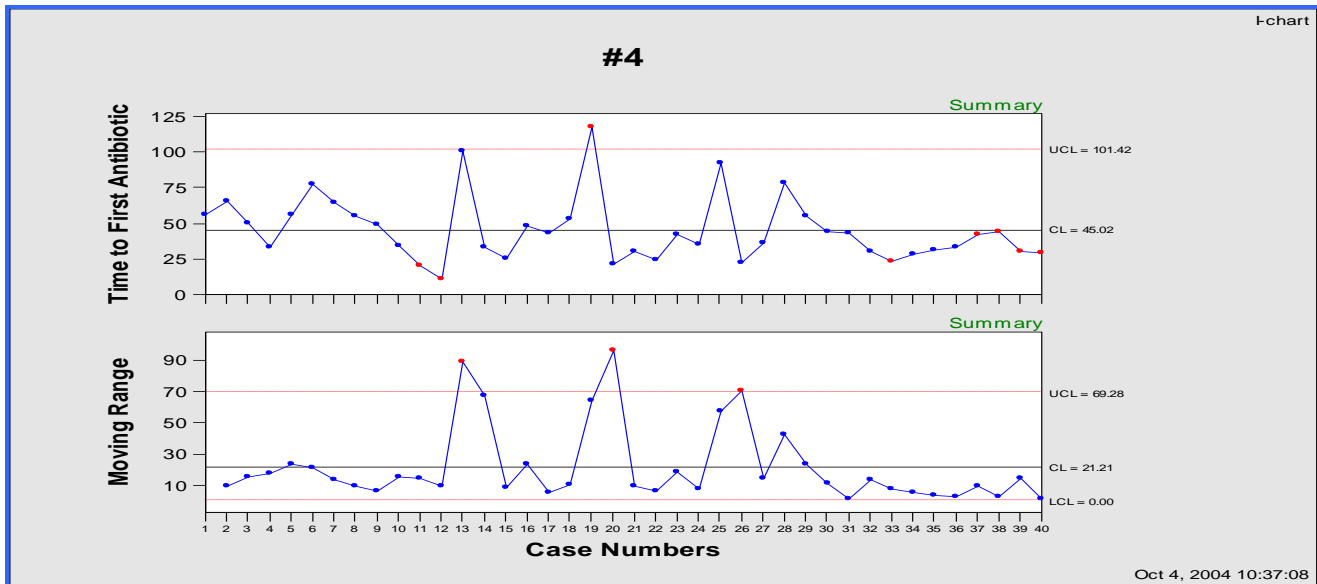
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(3) Which of the following rules would we apply to the lower moving range (mR) chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(4) If special cause variation is present in the moving range (mR) chart, what affect will this have on interpreting the upper X or I-chart?



	This type of special cause noted in the XmR chart?	What is your interpretation of the XmR chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #5:

A facility wishes to examine how long it took to from arrival to PCI for AMI patients from 1st Quarter 2002 through 3rd Quarter 2004. If performance improvement is the reason for creating the XmR chart:

Case	PCI Time (Minutes)
1	65
2	75

Case	PCI Time (Minutes)
21	80
22	75

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Case	PCI Time (Minutes)
3	75
4	60
5	165
6	75
7	85
8	85
9	80
10	95
11	65
12	65
13	85
14	68
15	190
16	120
17	105
18	115
19	58
20	70

Case	PCI Time (Minutes)
23	65
24	75
25	64
26	75
27	65
28	50
29	80
30	75
31	80
32	115
33	75
34	95
35	130
36	125
37	105
38	70
39	72
40	95

(1) Which of the following rules would apply to the upper X or I-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) What are the moving range values for this data set? Will there be “one to one” cross correlation of data points between the X or I-chart and the moving range (mR) chart?

Case	PCI Time (Minutes)	Moving Range
1	65	
2	75	
3	75	
4	60	
5	165	
6	75	90
7	85	10
8	85	0
9	80	5
10	95	15
11	65	30
12	65	0
13	85	20
14	68	17

Case	PCI Time (Minutes)	Moving Range
21	80	
22	75	
23	65	
24	75	
25	64	
26	75	11
27	65	10
28	50	15
29	80	30
30	75	5
31	80	5
32	115	35
33	75	40
34	95	20

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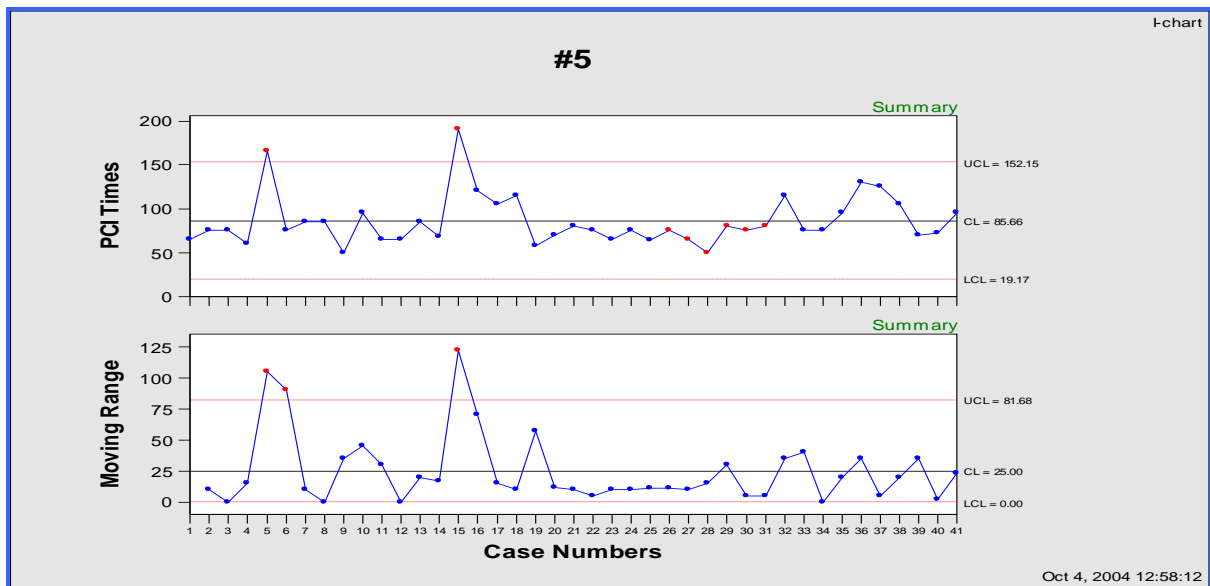
Case	PCI Time (Minutes)	Moving Range
15	190	122
16	120	70
17	105	15
18	115	10
19	58	57
20	70	12

Case	PCI Time (Minutes)	Moving Range
35	130	35
36	125	5
37	105	20
38	70	35
39	72	2
40	95	23

(3) Which of the following rules would we apply to the moving range (mR) chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(4) If special cause variation is present in the moving range (mR) chart, what affect will this have on interpreting the upper X or I-chart?



	This type of special cause noted in the XmR chart?	What is your interpretation of the XmR chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #6:

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A facility wishes to examine how long it took to from arrival to PCI for all AMI patients from 1st Quarter 2004 through 3rd Quarter 2004. There were a total of 351 PCI cases during this period. If performance improvement is the reason for creating the XmR chart:

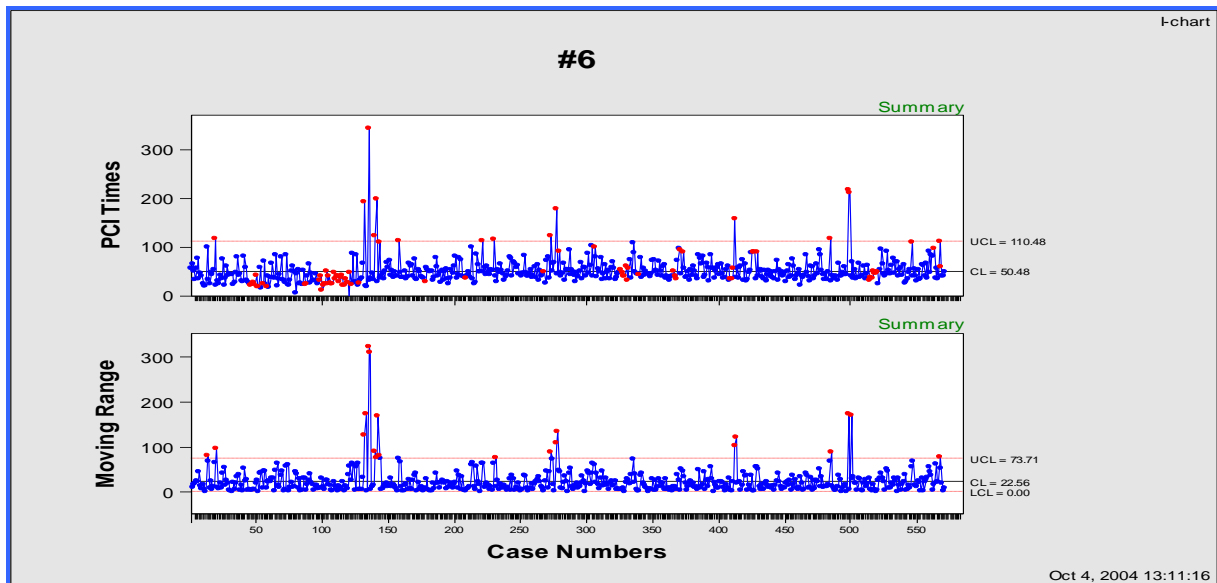
(1) Which of the following rules would apply to the upper X or I-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) Which of the following rules would apply to the moving range (mR) chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(3) If special cause variation is present in the moving range (mR) chart, what affect will this have on interpreting the upper chart?



	This type of special cause noted in the XmR chart?	What is your interpretation of the XmR chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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Scenario #7:

A facility wishes to examine the average time in minutes for a surgical procedure among the 15 members of its Medical and Surgical Staff who are credentialed to perform the procedure. If statistical uniformity is the reason for creating the X-bar and s-chart:

(1) Which of the following rules would apply to the X-bar chart?

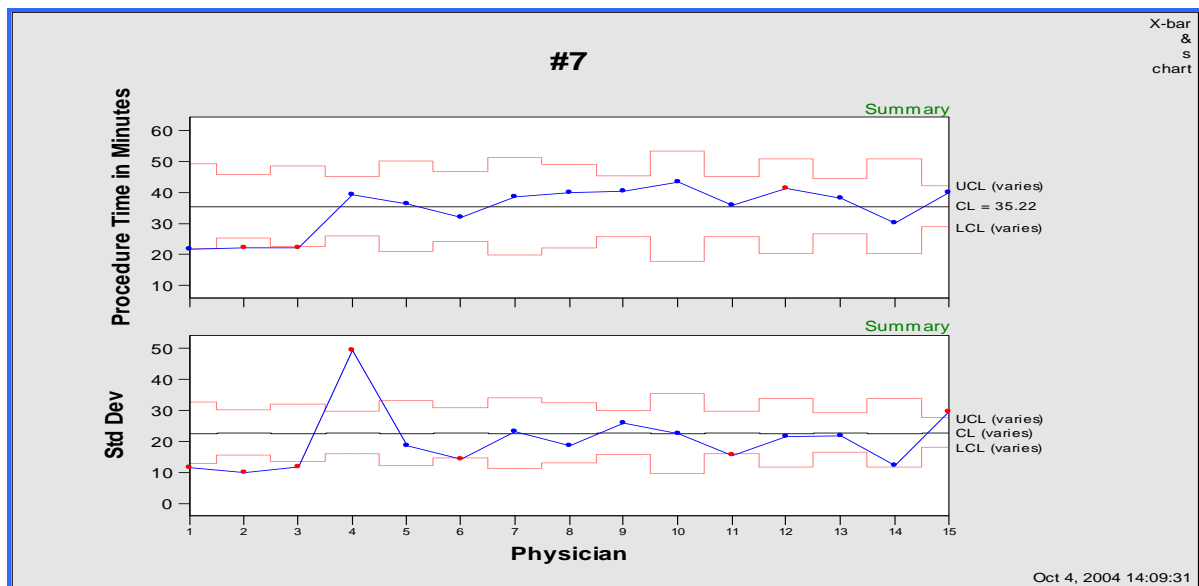
	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) Which of the following rules would apply to the s-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(3) When you compare the X-bar chart with the s-chart, what conclusions might you draw regarding the distribution of the data?

(4) If special cause variation is present in the s-chart, what affect will this have on interpreting the upper chart?



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	This type of special cause noted in the X-bar and s-chart?	What is your interpretation of the X-bar and s-chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #8:

A facility wishes to examine average length of stay (ALOS) in the Emergency Department for emergent cases for the first week of September 2004. If performance improvement is the reason for creating the XmR chart:

Case	Average Length of Stay (Minutes)
1	121
2	96
3	128
4	126
5	140
6	124
7	132
8	129
9	131
10	142
11	131
12	109
13	128
14	112
15	140
16	133
17	127

Case	Average Length of Stay (Minutes)
18	122
19	119
20	110
21	99
22	115
23	120
24	111
25	210
26	118
27	121
28	110
29	119
30	103
31	98
32	83
33	99

(1) Which of the following rules would apply to the upper X or I-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(2) What are the missing moving range values for this data set? Will there be "one to one" cross correlation of data points between the X or I-chart and the moving range (mR) chart??

Case	Average Length of Stay (Minutes)	Moving Range
1	121	
2	96	

Case	Average Length of Stay (Minutes)	Moving Range
18	122	
19	119	

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Case	Average Length of Stay (Minutes)	Moving Range
3	128	
4	126	
5	140	
6	124	16
7	132	8
8	129	3
9	131	2
10	142	9
11	131	8
12	109	22
13	128	19
14	112	16
15	140	28
16	133	7
17	127	6

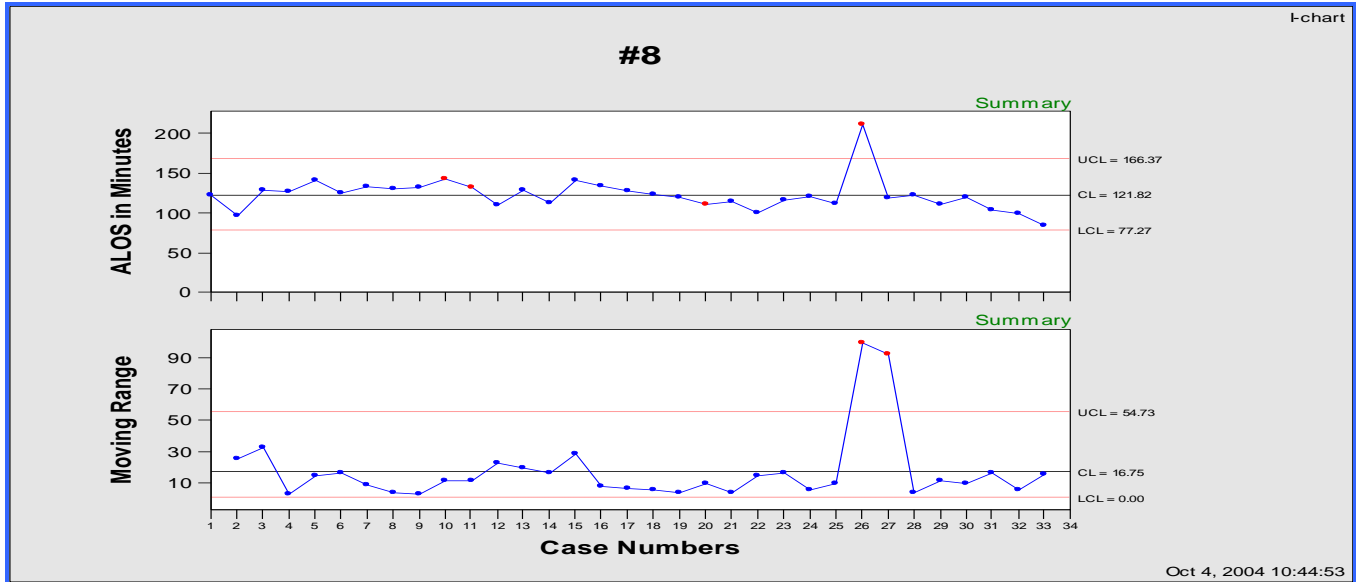
Case	Average Length of Stay (Minutes)	Moving Range
20	110	
21	99	
22	115	
23	120	5
24	111	9
25	210	99
26	118	92
27	121	3
28	110	11
29	119	9
30	103	16
31	98	5
32	83	15
33	99	16

(3) Which of the following rules would we apply to the lower moving range (mR) chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

(4) If special cause variation is present in the moving range (mR) chart, what affect will this have on interpreting the upper chart?

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	This type of special cause noted in the XmR chart?	What is your interpretation of the XmR chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #9:

A facility wishes to examine average treatment time in the Minor Trauma Room of the Emergency Department for the past ten months. If statistical uniformity is the reason for creating the X-bar and s-chart:

- (1) Which of the following rules would apply to the upper X-bar chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

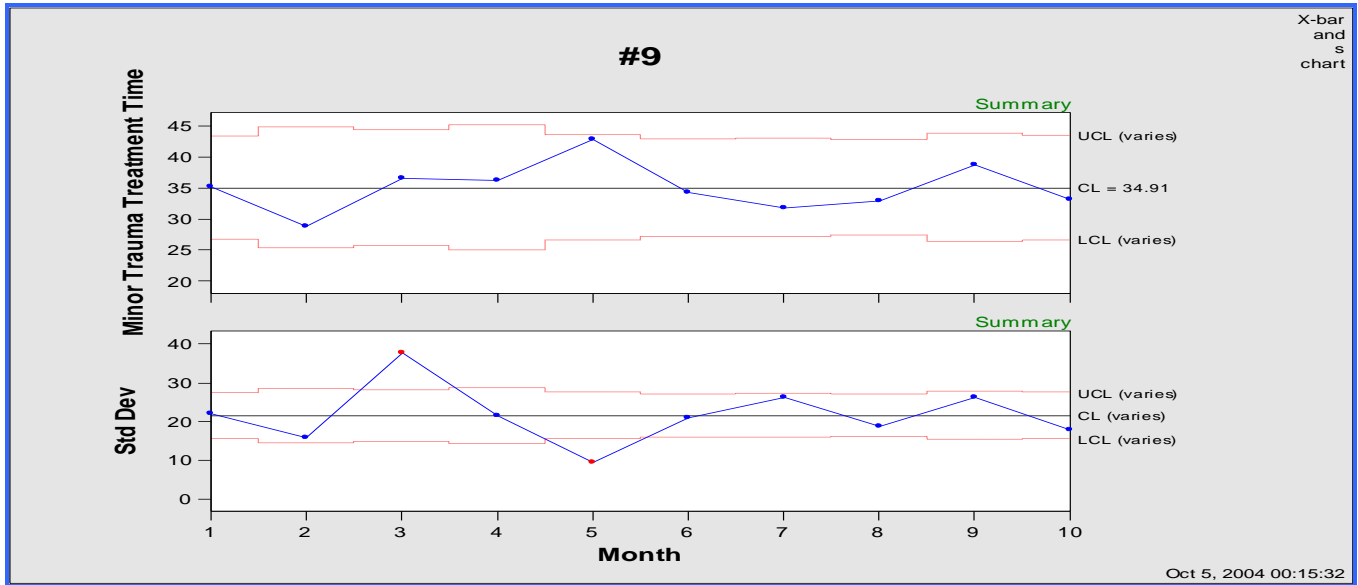
- (2) Which of the following rules would apply to the lower s-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

- (3) When you compare the X-bar chart with the s-chart, what conclusions might you draw regarding the distribution of the data?

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(4) If special cause variation is present in the s-chart, what affect will this have on interpreting the upper chart?



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	This type of special cause noted in the X-bar and s-chart?	What is your interpretation of the X-bar and s-chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scenario #10:

A facility wishes to examine average treatment time in the Minor Trauma Room of the Emergency Department for the 570 cases seen in the past ten months. This scenario is based on the same dataset used in Scenario #9. If performance improvement is the reason for creating the XmR chart:

- (1) Which of the following rules would apply to the upper X or I-chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

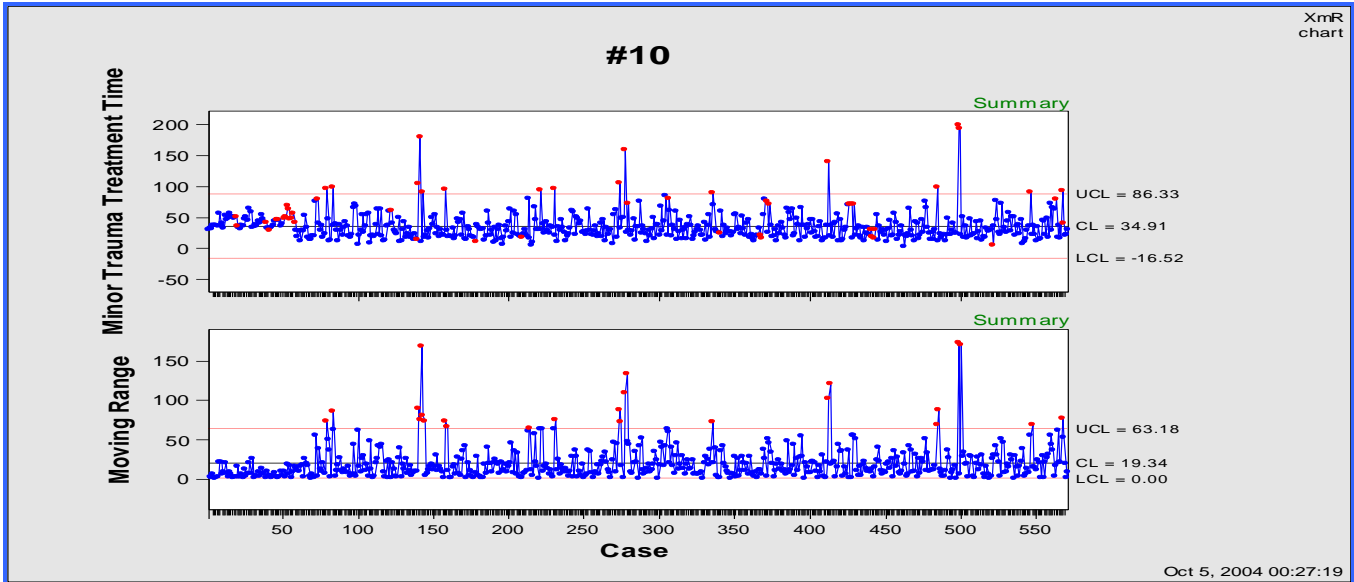
- (2) Which of the following rules would we apply to the lower moving range (mR) chart?

	Apply this rule?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No

- (3) If special cause variation is present in the moving range (mR) chart, what affect will this have on interpreting the upper chart?

- (4) Both Scenario #9 and Scenario #10 use the same dataset. Since the data on which each chart is based are identical, what impact does the choice of the type of continuous data control chart (X-bar and s-chart ^{versus} XmR chart) have on the facility's ability to examine its performance?

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	This type of special cause noted in the XmR chart?	What is your interpretation of the XmR chart?
Outliers?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Shifts in the process?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trends?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Data Oscillations?	<input type="checkbox"/> Yes <input type="checkbox"/> No	