

*Checking for Differences in Retesting Positives by Year**The FREQ Procedure*

Table of YEAR by aposdup			
YEAR	aposdup		
Frequency Percent Row Pct Col Pct	0	1	Total
<b>2010</b>	8282	65	8347
	17.67	0.14	17.81
	99.22	0.78	
	17.83	15.55	
<b>2011</b>	8059	85	8144
	17.20	0.18	17.38
	98.96	1.04	
	17.35	20.33	
<b>2012</b>	8718	76	8794
	18.60	0.16	18.76
	99.14	0.86	
	18.77	18.18	
<b>2013</b>	8625	65	8690
	18.40	0.14	18.54
	99.25	0.75	
	18.57	15.55	
<b>2014</b>	7968	81	8049
	17.00	0.17	17.18
	98.99	1.01	
	17.16	19.38	
<b>2015</b>	4794	46	4840
	10.23	0.10	10.33
	99.05	0.95	
	10.32	11.00	
<b>Total</b>	46446	418	46864
	99.11	0.89	100.00

*Statistics for Table of YEAR by aposdup*

Statistic	DF	Value	Prob
<b>Chi-Square</b>	5	6.8248	0.2340
<b>Likelihood Ratio Chi-Square</b>	5	6.8368	0.2331
<b>Mantel-Haenszel Chi-Square</b>	1	0.4081	0.5230
<b>Phi Coefficient</b>		0.0121	
<b>Contingency Coefficient</b>		0.0121	
<b>Cramer's V</b>		0.0121	

*Sample Size = 46864*

# Elevated Blood Lead Levels Among Children <16 Years of Age

City of Flint, May 2011— April 2015

## QUESTION:

Were positive tests for elevated blood lead levels (EBLL) higher than usual for children under age 16 living in the City of Flint during the months of July, August, and September, 2014?

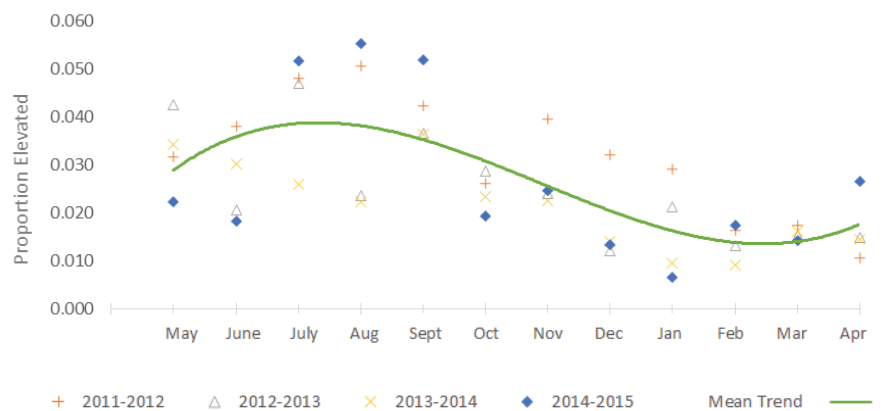
## METHODS:

- The number of children tested for lead poisoning varies from month to month, so the proportion of children with a first-time blood lead level  $\geq 5$   $\mu\text{g/dL}$  was calculated for each month (Figure 1).
- To determine whether or not the difference between the summer of 2014 and the previous three years warrants further investigation, a control chart for proportions (Figure 3) was constructed.
- Monthly data from May 2011 to April 2014 were used to construct upper and lower control limits (UCL and LCL) representing the amount of expected variation in EBLL (Figure 3).
- Finally, proportions of EBLL from May 2014 to April 2015 were plotted in Figure 3.

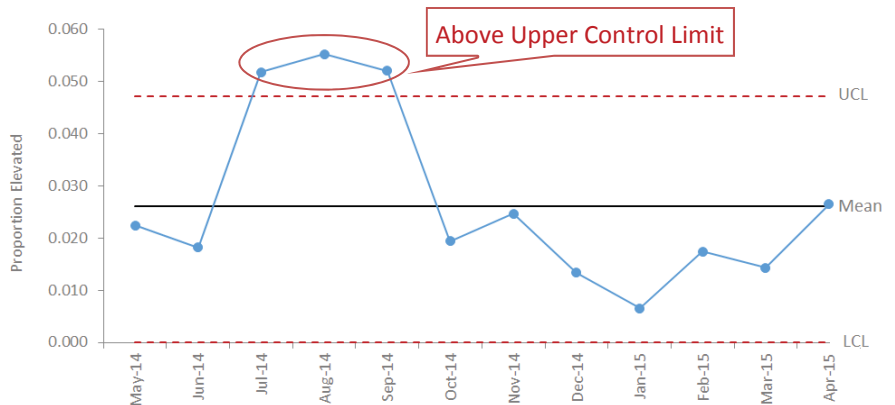
**Figure 1. Formula for Calculating Monthly Proportion of Children with Elevated Blood Lead Levels**

$$\frac{\text{Number of Children with Blood Lead Level } \geq 5 \mu\text{g/dL}}{\text{Total Number of Children Tested}} = \text{Proportion with EBLL}$$

**Figure 2. Proportion of Children Tested for Lead Poisoning with Elevated Blood Lead Levels, May 2011—April 2015**



**Figure 3. Control Chart of Proportion of Children Tested for Lead Poisoning with Elevated Blood Lead Levels, May 2014—April 2015**



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## RESULTS:

- Figure 2 shows that—on average—there appears to be a higher proportion of first-time EBLL during the summer months of July, August, and September.
- However, even compared to the previous three years, the proportion of first-time EBLL is highest during summer 2014 (Figure 2).
- Based on the control chart for proportions (Figure 3), only the summer months of July, August, and September had proportions of EBLL higher than that expected from random variation over time.
- Further, the summer months of 2014 were the only data points between May 2014 and April 2015 with EBLL proportions above the average (mean) of the previous three years (Figure 3).

## CONCLUSION:

- Based on the results depicted in Figure 3, positive tests for EBLL were higher than usual for children under age 16 living in the City of Flint during the months of July, August, and September, 2014.
- However, it's important to note that the purpose of control charts is to monitor data for the quick detection of abnormal variation—not to construct a case for causality.

## SOURCES:

- Data for the City of Flint was provided by the [Childhood Lead Poisoning Prevention Program](#) at the Michigan Department of Health and Human Services (MDHHS). Information is current as of July 27, 2015.
- Control chart methods are based on [The Six Sigma Way Team Fieldbook: An Implementation Guide for Process Improvement Teams](#), by Peter Pande, Robert Neuman, and Roland Cavanagh.

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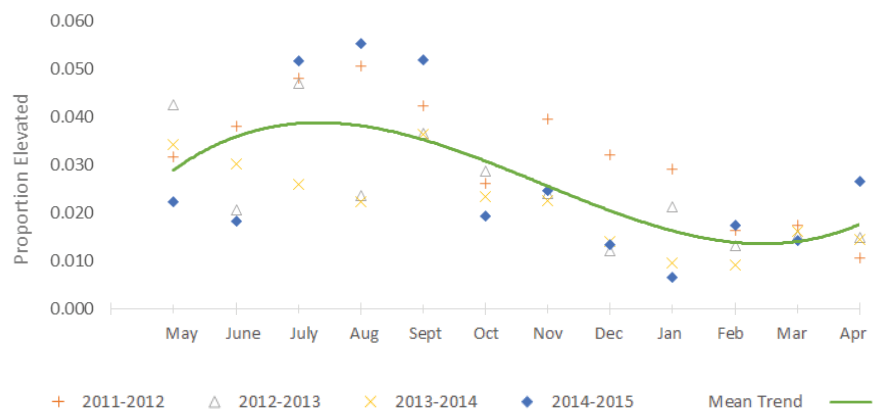
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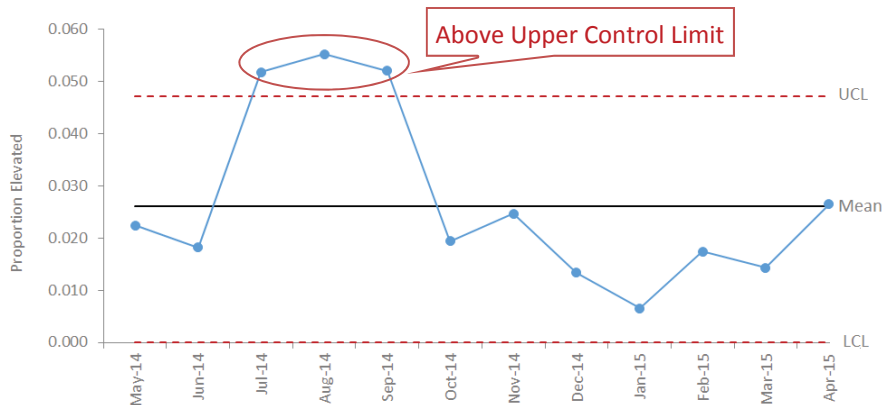
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## RESULTS:

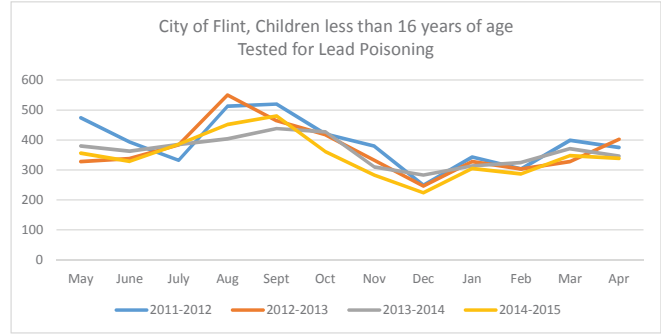
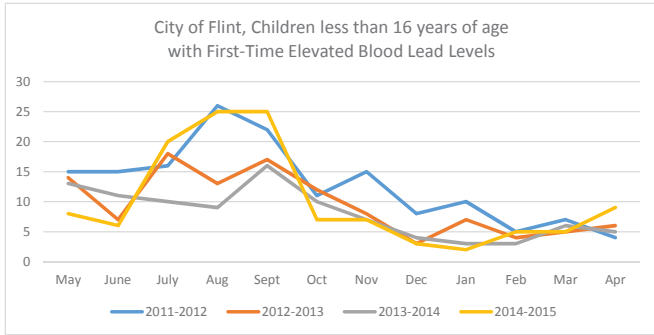
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- Further, the summer months of 2014 were the only data points between May 2014 and April 2015 with EBLL proportions above the average (mean) of the previous three years (Figure 3).

## CONCLUSIONS:

- Although the purpose of control charts is to monitor data for quick detection of abnormal variation—not to construct a case for causality—further investigation into the data could help determine drivers of the high EBLL proportions in July, August, and September of 2014.
- Possible future analyses may include:
  - Adding more years of historical data to create more reliable comparisons
  - Using more robust statistical methods for detecting patterns
  - Comparing City of Flint data to similar cities during the same time period
  - Mapping cases of EBLL in children and overlaying with city planning information

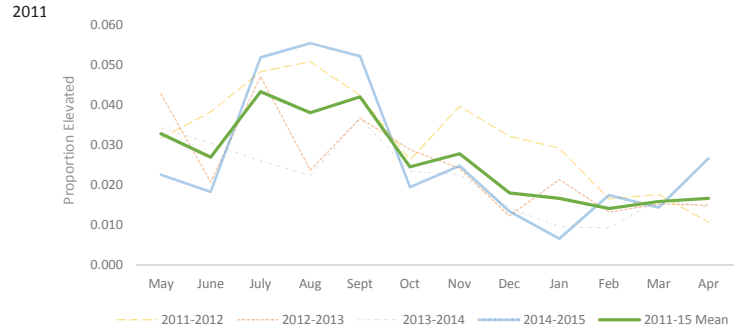
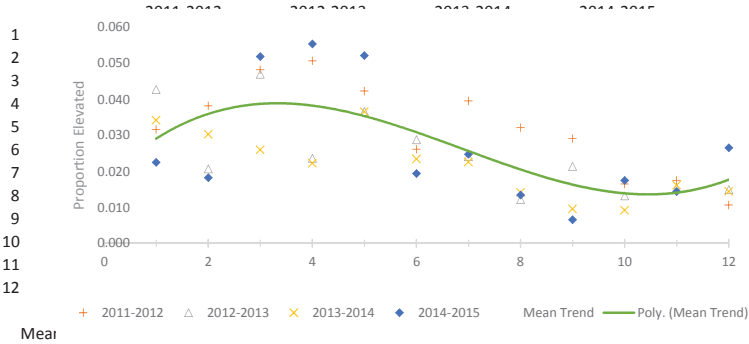
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	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
2011-2012	15	15	16	26	22	11	15	8	10	5	7	4
2012-2013	14	7	18	13	17	12	8	3	7	4	5	6
2013-2014	13	11	10	9	16	10	7	4	3	3	6	5
2014-2015	8	6	20	25	25	7	7	3	2	5	5	9

	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
2011-2012	474	393	332	513	520	420	379	249	343	303	399	375
2012-2013	328	338	383	550	464	417	332	246	328	303	328	402
2013-2014	380	363	385	404	438	427	310	283	313	325	371	346
2014-2015	356	329	386	452	480	361	283	224	305	287	348	339



Mean

Chart Title

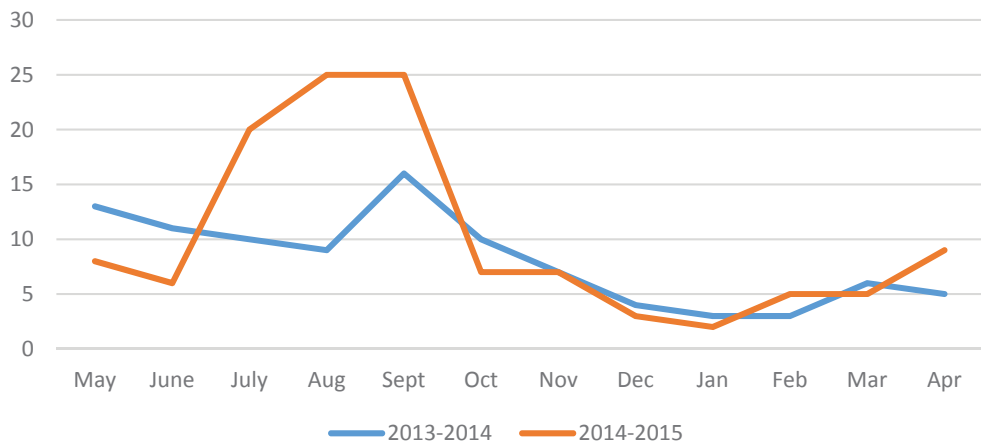


Chart Title

