Completed Study and Monograph Report for Backpack and Handgun Application of Liquid Spray in Utility Rights of Way (Agricultural Handlers Exposure Task Force)

Science (Statistics) Review : Discussant: George Fernandez

- Discuss the inadequacies in the current method of estimating standard deviation and 95% upper limit.
- Suggest currently available alternate methods to estimate arithmetic mean, its 95% Confidence Interval and 95% upper limit assuming the distribution of interested response variable is lognormal.

Table 4. Handgun ROW Application – Results of Primary Benchmark Analysis for Inhalation Exposure

Statistic	Inhalation		
	Unit Exposure (ug/lb ai)		fRA95
	Estimate	95% CI	
GM_S	3.24	1.77 – 5.89	1.8
GSD_S	4.07	2.65 – 6.23	--
GM_M	3.24	1.77 – 5.94	1.8
GSD_M	4.07	2.65 – 6.32	--
ICC	0.00	0.00 – 0.68	--
GM_S = geometric mean assuming SRS = "exp(average of 21 ln(UE)) values". GSD_S = geometric standard deviation assuming SRS = "exp(standard deviation of 21 ln(UE)) values" GM_M = variance component model-based geometric mean GSD_M = variance component model-based geometric standard deviation ICC = intra-cluster correlation			
AM_S	7.31	3.56 – 20.4	2.4
AM_U	8.68	3.84 – 21.7	2.4
AM_M	8.68	3.84 – 22.4	2.4
AM_S = simple average of 17 unit exposures AM_U = arithmetic mean based on GM_S = GM_S*exp{0.5*((lnGSD_S)^2} AM_M = variance component model-based arithmetic mean = GM_M* exp{0.5*((lnGSD_M)^2}			
$P95_S$	31.9	8.73 – 78.5	3.3
$P95_U$	32.6	12.6 – 82.5	2.6
$P95_M$	32.6	12.7 – 85.4	2.6
$P95_S$ = 95th percentile (i.e., the 20th unit exposure out of 21 ranked in ascending order) $P95_U$ = 95th percentile based on GM_S = GM_S * GSD_S^1.645 $P95_M$ = variance component model-based 95th percentile = GM_M* GSD_M^1.645			

G

A

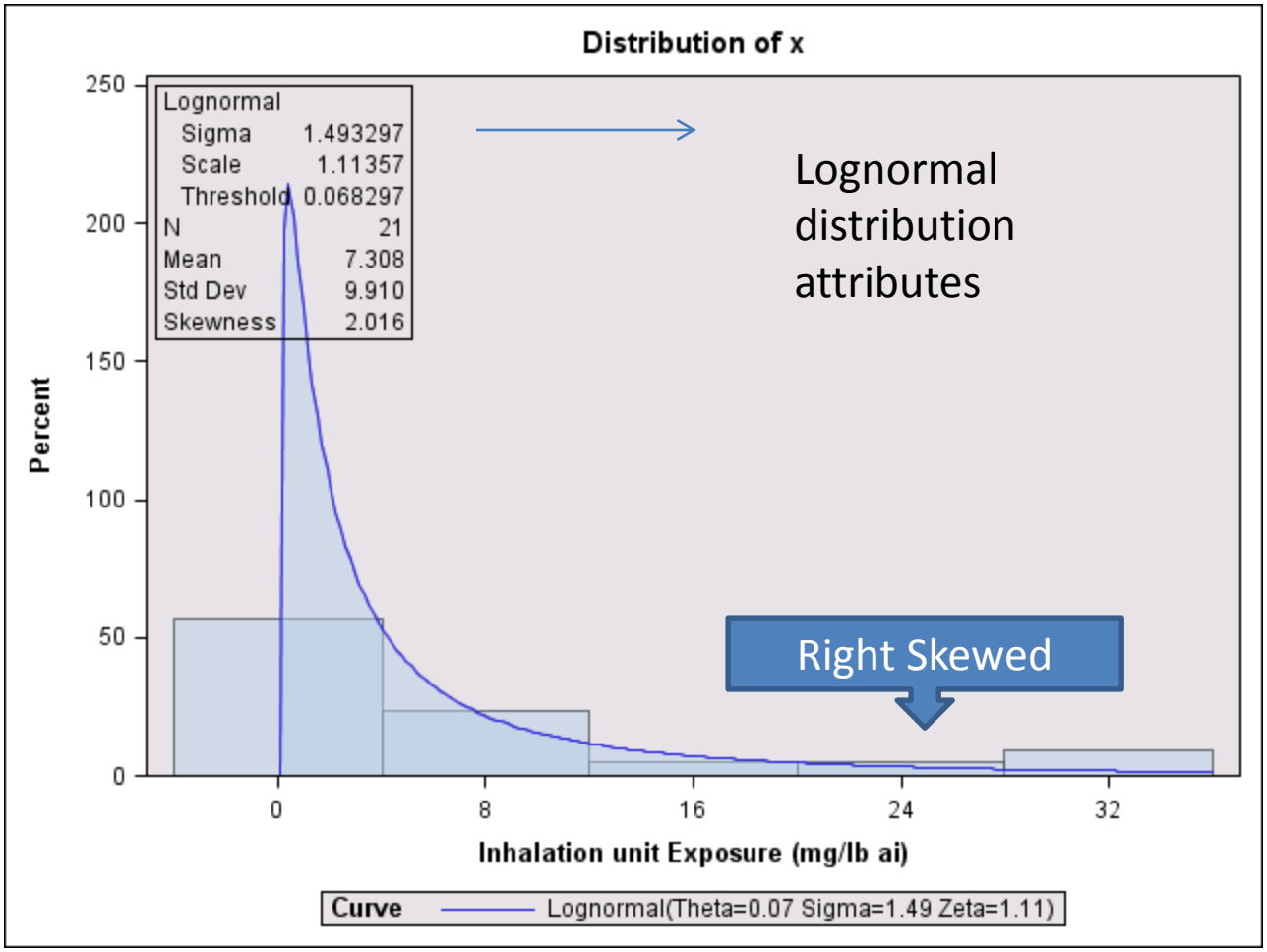
Incorrect adjustment

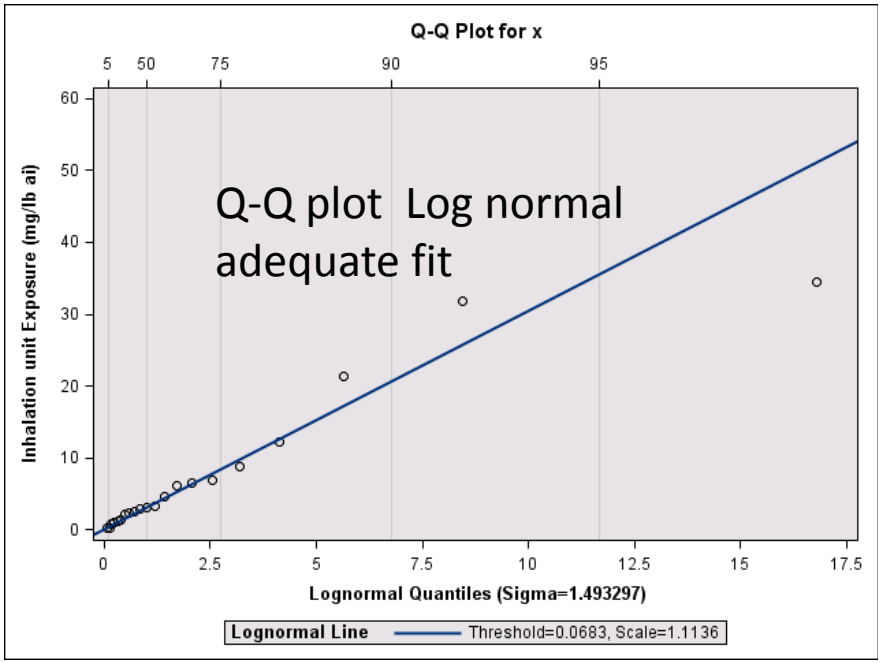
Under-estimate 95% upper limit

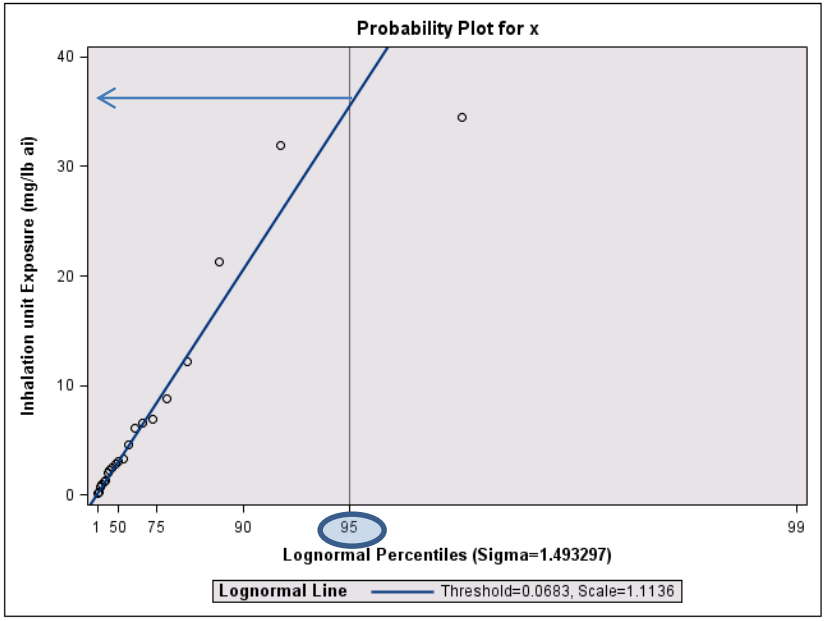
Normalized Inhalation Exposure (µg/lb ai)
34.5
4.6
0.902
6.93
3.35
6.51
0.178
31.9
1.17
2.82
2.43
12.2
2.29
0.737
8.82
1.29
0.272
3.1
2.06
21.3
6.1

Raw data from 21 MU

SAS Proc Univariate distribution analysis







Confidence Intervals for the Mean of a Log-Normal Distribution

Ulf Olsson
Swedish University of Agricultural Sciences

Journal of Statistics Education Volume 13, Number 1 (2005), www.amstat.org/publications/jse/v13n1/olsson.html

3.3 Cox method

Cox (quoted as "personal communication" in Land, 1971) has suggested that a confidence interval for $E(X)=\theta$ can be calculated in the following way:

Calculate a confidence interval for $\log(\theta)$ as

$$\overline{Y}+\frac{S^2}{2}\pm z\sqrt{\frac{S^2}{n}+\frac{S^4}{2(n-1)}} \qquad (4)$$

Handgin ROW applications Results of Primary Benchmark analysis for Inhalation Exposure

The UNIVARIATE Procedure
Fitted Lognormal Distribution for x (Inhalation unit Exposure (mg/lb ai))

Parameters for Lognormal Distribution		
Parameter	Symbol	Estimate
Threshold	Theta	0.068297
Scale	Zeta	1.11357
Shape	Sigma	1.493297
Mean		9.354579
Std Dev		26.75234

Quantiles for Lognormal Distribution		
	Quantile	
Percent	Observed	Estimated
1.0	0.17800	0.16268
5.0	0.27200	0.32944
10.0	0.73700	0.51755
25.0	1.29000	1.18052
50.0	3.10000	3.11351
75.0	6.93000	8.40597
90.0	21.30000	20.70987
95.0	31.90000	35.57868
99.0	34.50000	98.31666

Proc Univariate based calculation

Cox's method

Handgin ROW applications Results of Primary Benchmark analysis for Inhalation Exposure

number of nonmissing values, logx	Arithmatic Mean LN distribution	Standard Deviation LN distribution	95% Upper Confidence interval	Arithmatic mean: LN Geometric Mean	Arithmatic mean: COX Arithmatic Mean	Arithmatic mean: COX 95% Upper CLM for AMean	Quantile: 5% Lower Limit	Quantile: Median	Quantile: 95% Upper Limit
		GSD 4.07			8.68				32.6
21	9.35458	26.7523	21.5321	3.23829	8.67622	21.5894	0.32944	3.11351	35.5787