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Letter to the Editor

Food Outbreak: An Overview on Selected Cases over Long-Term Web-Based Monitoring

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Dear Editor,

Despite great advancement in food technology and manufacturing, epidemiological diseases that stemmed from food consumption are still a persistent threat to human health or even his life. Great awareness and understanding about food metabolism and excellence in quality of production have been achieved through the last decades [1]. However, food safety is still a prime challenge that requires great efforts to truncate the risks encountered from consumption of spoiled or contaminated food by biological and non-biological extraneous matters. Due to this problem, western countries have developed rigorous system for detailed observation and recording of outbreaks [2]. One of an important and comprehensive outbreaks dataset could be obtained for USA [3].

Epidemiological observations could be extracted from the database of the National Outbreak Reporting System (NORS). NORS is a web-based internet site that was founded since 2009 by Centers for Disease Control and Prevention (CDC). Illness record values were obtained from "National Outbreak Public Data Tool" where data were stratified and food-borne outbreaks were isolated and interpreted [4]. Records were segregated into individual selected food types then each data set were processed and presented as control charts using statistical program GraphPad Prism V6.01 and Minitab® V17.1.0 [5-7]. Control charts demonstrate a process visually showing mean value, upper threshold of the inspection characteristic and out-of-control points (marked by red dots) in chronological order.

Laney attribute chart was used to compensate for non-conforming distribution of data (indicated by σ Z value) to the prerequisite of Poisson distribution [8,9]. Y-axis indicates number of illness per outbreak, while X-axis is the outbreaks of specific food stuff arranged in chronological order as could be demonstrated in Figure 1. The lower part of the graph is showing column plot the average number of illness cases per outbreak for each type with standard deviation. Table 1 shows statistical estimation of the number of excursions in outbreaks and the rate of each for each food type during 20 years of monitoring. Outbreak data show non-Gaussian distribution tendency and most of them followed either Log-normal or Weibull (3) distributions at $p = 0.05$. Outbreak food groups are showing significant difference between each other when non-parametric comparison test was conducted ($P < 0.05$). Dunn's multiple comparisons test with mean rank difference are significant for all except the following outbreaks: cake w/o other food components versus chocolate w/o other food/127.2, chocolate w/o other food versus beef w/o other food component/392.7, chocolate w/o other food versus fruit w/o other food component/-547.5, chocolate w/o other food versus ice cream w/o other food/304.4, chocolate w/o other food versus chicken w/o other food/446.9, beef w/o other food component versus ice cream w/o other food/-88.28, beef w/o other food component versus chicken w/o other food/54.24 and ice cream w/o other food versus chicken w/o other food/142.5.

The reported outbreaks are part of an investigation covering other food types which provide evidence for the high rate of illness cases from ingestion of contaminated food by hazardous materials which have been reported previously [10,11]. Various outbreaks sourced from different food types are showing different levels of risk based on the frequency of the incidents between 1998 and 2017, the mean value of the affected population, an upper threshold (UCL) and the rate of excursions in the number of impacted population by consumption of a specific food type. Accordingly, major contributors to the outbreaks could be spotted and suitable actions could be determined and executed. However, the lack of sufficient comprehensive records about outbreaks in poor countries is a barrier for visualizing the main problems and their root causes [12,13].

The analysis demonstrated by statistical process control (SPC) could facilitate determination of risk assessment quantitatively using Failure Mode and Effect Analysis (FMEA) [14,15]. The mean value of illness cases for each outbreak type could represent severity (S), the number of outbreaks per 20 years is the frequency (O) and UCL is the brink of excursions (D) in the number of outbreak cases. Thus, quantitative risk probability number (qRPN) could be calculated.

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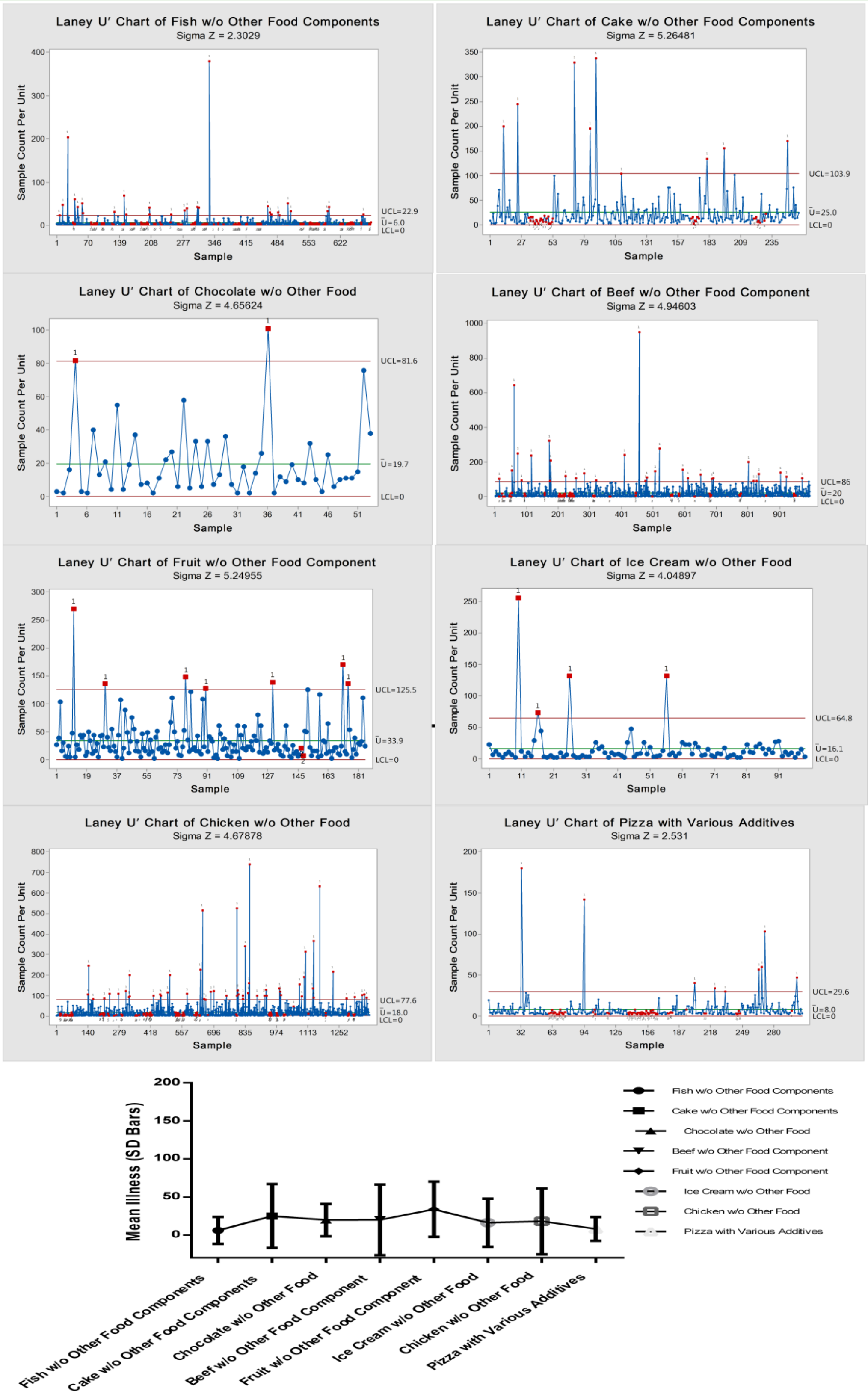

Figure 1: Laney attribute control charts and column plot of mean ± standard deviation (SD) of outbreaks from selected food products.

Table 1: Determination of outliers from normal outbreak cases trends using statistical mean and the rate of their occurrence.

Method	Fish w/o Other Food Components	Cake w/o Other Food Components	Chocolate w/o Other Food	Beef w/o Other Food Component	Fruit w/o Other Food Component	Ice Cream w/o Other Food	Chicken w/o Other Food	Pizza with Various Additives
ROUT (Q = 1.000%)	546 outliers removed ROUT (Q = 1.0%)							
Number of points	688	257	53	997	185	99	1386	307
Analyzed Outliers	107	30	5	136	16	15	187	50
Excursion Ratio	0.16	0.12	0.09	0.14	0.09	0.15	0.13	0.16

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