Time Series Prototype

We used a time series analysis to test the hypothesis that the number of neonatal deaths due to neural tube defects per year decreased as a result of the introduction of folic acid. We first decomposed the dataset to only include the baseline data before intervention, i.e. the introduction of folic acid. We computed a baseline graph with year as the x-axis and number of neonatal deaths as the y-axis. The baseline graph showed a general negative linear trend (Figure 1); therefore, we differenced the number of neonatal deaths to make our graph stationary. To account for the variance, we then used a log transformation on number of neonatal deaths (Figure 2). Plots of the auto-correlations (ACF) and partial auto-correlations (PACF) of the log-transformed variables were conducted for identifying the ARIMA model (Figure 3 & 4). All spikes fell within the confidence intervals of both plots, so we diagnosed an ARIMA (1 1 1). Both AR1 and MA1 parameter estimates came out significant to the $p<.05$ level (Table 1). The auto-regressive component indicates that the number of deaths at one year depends on the amount of deaths in the preceding year, and the trend component indicates the number of neonatal deaths due to neural tube defects is generally decreasing over time. We forecasted the ARIMA (1 1 1) model on the data (Figure 5), and the significant Ljung-Box Q (p=.262) indicated that it was a good model. When applying the ARIMA (1 1 1) to all cases in the data, parameter estimates showed folic acid to have a significant effect ($p<.01$) (Table 2). These results showed that number of neonatal deaths decreased about -182.28 units as a result of the introduction of folic acid.
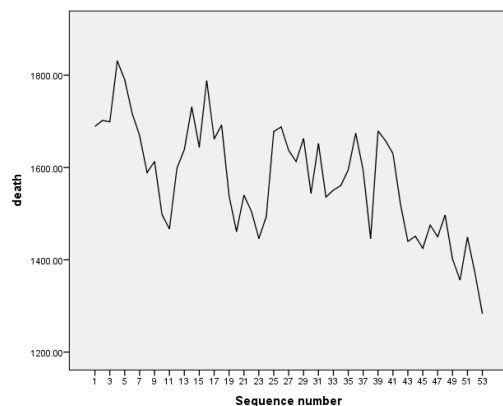
Figure 1 Baseline Graph Transformation

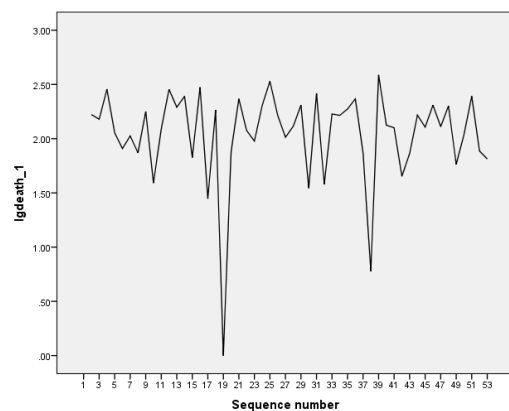Figure 2 Baseline Graph with Log Transformation
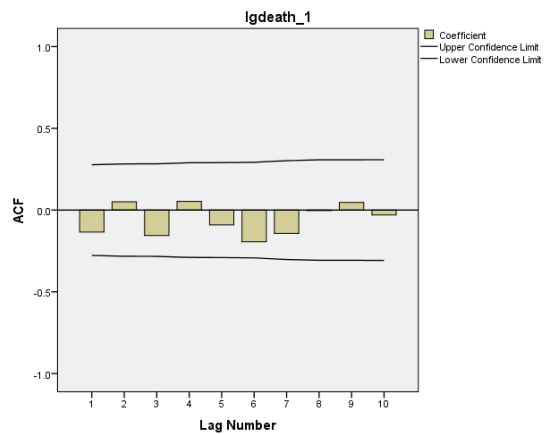
Figure 3 Auto-correlations

Figure 4 Partial Auto-correlations

Figure 5 Forecast of ARIMA (1 1 1)
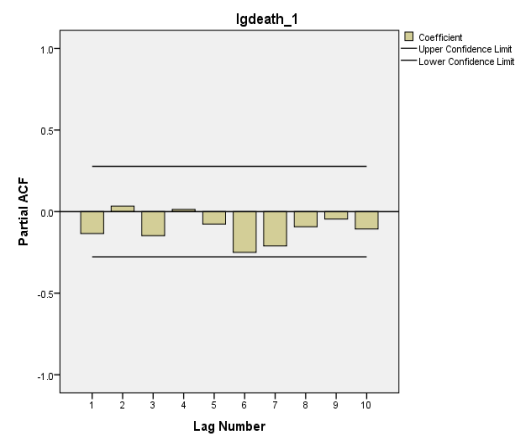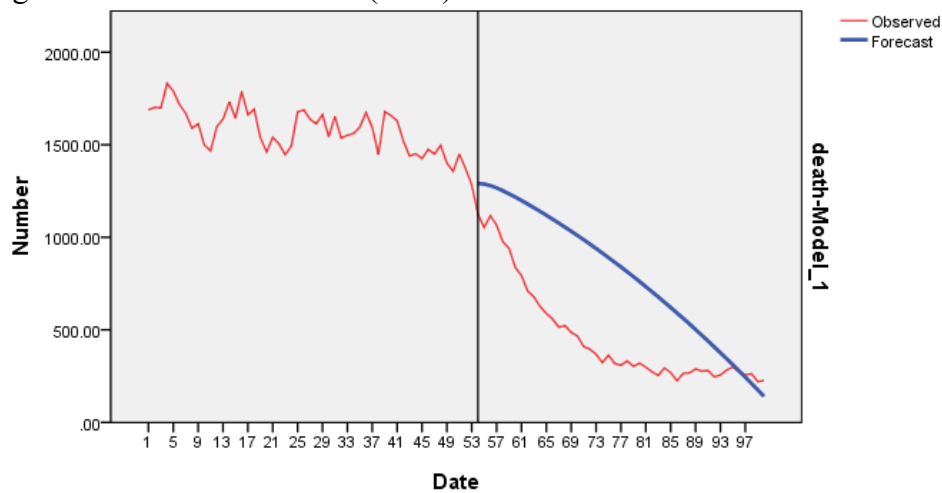

Table 1 Parameter Estimates for Baseline

	Estimates	t	p
AR1	-0.55	2.16	0.04
MA1	0.84	0.19	< 0.001

Table 2 Parameter Estimates for Intervention

	Estimates	t	P
Folic Acid	-182.28	-2.68	< 0.01