International Journal of Research
Available at https://pen2print.org/index.php/ijr
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 02
February 2019

Statistical Analysis of Fertility Rate In Saki Metropolis in Oyo State Hospital from 2007 – 2016

By

Bature, Tajudeen Atanda,

Danjuma, Habiba

Department of Science and Technology Education, Al-Hikmah University, Ilorin,

Department of Statistics Federal Polytechnic, Bali

Email: tajudeenatanda1@gmail.com

ABSTRACT

This research work is designed to investigate on the fertility rate in general hospital, Saki,Oyo State from 2007-2016. Time series analysis was carried out to examine the trend in monthly birth rate and to advise the hospital management board on the steps to be taken in order to standardize the fertility rate. Various Statistical methods is used to compute and analyze the fertility rate of state general hospital, Saki, it used to forecast and detect how the data fluctuate, The approach consist Least square method, Moving average method, Irregular, Cyclical, Seasonal variations and deseasonalized of data were used.

Keywords: Additive model, Forecast, Moving average, Multiplicative model, Time series, and Trend.

1.0 INTRODUCTION

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 02
February 2019

Statistics is a body of scientific method and theory of collecting, organizing, presenting and analyzing of data as well as drawing a valid conclusion and making a reasonable decision.

Formerly, statistics deals with only affairs of the state and this account for its name "statistics" but the influence of statistics has now spread to nearly all phases of human life, from Manufacturing companies, Agricultural sectors, Banks, Business communication, Economic, Education and other numerous held of life.

The knowledge of statistics has helped a lot in the economic growth and development of a country, in adequately studying economic growth and development, a lot of predictors or determinants must be studied as well to have a comprehensive grip on the socio-economic development of the nation. One of the cardinal factors that may influence the socio-economic of a state is the "fertility rate" (live birth), state or country that wants to be wealthy must not joke with the study of birth rate in relationship to their countries/state.

Furthermore, this research is to explain and to analyze more on fertility rate of state General hospital, Saki. State general hospital, Saki was establish in the year 1997 by Oyo State Government aiding to the numerous important of medical service in the town .The hospital is situated along Sango area behind Saki West local government police station .The area has an estimated population of 323, 910 in 2011 population census while it was 273, 268 in 2006 head count (Source: NPC web).The area (Saki west) has an area of 2,014km with density of 160.83 (Source: Wikipedia).

It is made up of about 60% low income of workers with food, beverages, shops, filling stations and

Banks. 10% of the total population of people of Saki West are mainly farmers and traders.

2.0 LITERATURE REVIEW

Studies of the causes of fertility levels and their changes often seek to measure directly the impact of Socio economics factors on fertility, Substantial insights can be gained if, in addition to the social economic factors influencing fertility, the specified mechanisms through which these factors operate are identified. For example, the level of education of women is a socio economic indicator that is frequently found to be negatively related to fertility.

In general, the biological and behavioral factors through which socio economics, cultural and environmental variables affect fertility are called "intermediate fertility variables". The primary characteristic of an intermediate fertility variable its direct influence on fertility. If an intermediate fertility variable, such as prevalence of contraception, changes, then fertility necessarily changes also (Assuming the other intermediate fertility variables remain constant).While this is not necessarily the case of an indirect determinant such as income or education.

Fertility levels have been declining over the last three decades with most prominent declines observed between 1985 and 1995.Fertility reductions have occurred fastest in Asia and have been slowest in least developed countries mainly in sub- Sahara Africa. However, significant declines have occurred in the least developed countries as well as in developed countries. For example Bangladesh had some of

the worst social indicators and lowest income of all countries with a total fertility rate (TFR) of about 7 children per women and today the TFR is about 3 children per women (source; World Bank 2007). By themid-1970s about 60% of all countries had total fertility rate of 45 births per women and by the mid-1990s, 44% of the world population lived in countries where total fertility rate was at or below replacement fertility at 2.1births per women. Fertility rates are lowest in Europe, East Asia and pacific where they are at or below 2.1 children per women and they are highest for sub-Sahara Africa at 5.2 children per woman (World Bank 2003). Consequently, fertility differences among populations and trends in fertility over time can always be traced to variations in one or more of the intermediate fertility variables.

3.0 RESEARCH METHODOLOGY

This is the general research strategy that outlines the way in which research is to be undertaken and among other things identifies the method to be used in it. It also defines the means or modes of data collection and how a specific result is to be calculated.

3.1 THE COMPONENT OF TIME SERIES

These are the characteristic that are inherent in time series or the various types of variations/movements which exist in any time series.
These are:

i. Trend (Tt)
ii. Seasonal Variation (St)
iii. Cyclical variation (Ct) and
iv. Irregular variation (It)

3.1.1 TREND

This is the general direction in which time series data appears to be moving, the trend may be one of growth or decline depending on the nature of the series

A time series is said to contain a trend if the mean changes with systematically with time. Trend is denoted by Tt.

3.1.2 SEASONAL VARIATION

These are the identical pattern which a time series appears to follow during a successive corresponding months (or quarters) of successive years. These movement re-occur regularly during specific periods of the year, depending on the season of the year,, e.g. some recurring event like Christmas, sales of

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 02
February 2019

greetings cards during festival, sales of ram during Ileya festival. The duration of these periodic fluctuations are usually less than one year, seasonal variation is denoted by St.

3.1.3 THE MOVING AVERAGE METHOD

Here, the trend is represented by a series of moving averages; the moving averages of a series are series of successive averages based on a specified number of terms obtained by omitting the first term in the preceding moving averages and including the next term in the series to compute the next average. The process continues until all the term in the series have been utilized.

Suppose we are given $X_1, X_2 \ldots X_n$ on (X_t) then n – point moving averages are

$$Y1 = \frac{X_1 + X_2 + \ldots + X_n}{n}$$

$$Y2 = \frac{X_2 + X + \ldots X_n}{n}$$

$$YN\text{-}n = \frac{X_{N-n} + X_{N-n} + \ldots + X_n}{n}$$

3.2.1 ADDITIVE METHOD

Recall that the additive model is: $X_t = T_t + S_t + R_t$
Where $R_t = C_t + I_t$.

1. Derive the equation of the trend line from the original series using the least square method.
2. By adjusting the independent variable value (X_t) for the periods desired and substituting same into the derived equation in (1) we could obtain the forecasted value for the period for which forecasts are sought. It is hoped that the residual variations $(C_t + I_t)$ are preserved in the predicted trend values since least squares method is adopted.
3. Use the additive model procedure to determine the seasonal variation of the original series. For continued preservation of the residual variations, the trend values of the original data obtained from the equation of the trend line should be used to compute the seasonal variation.
4. The forecasted values are the forecasted trend values in (2) plus the seasonal variation in (3).

Hence, before we can forecast, we need to assume either the additive or multiplicative model i.e.
For Additive model - The forecasting for period p is given as:

$$X_p = T_p + SI_p.$$

Where: X_p = The observed value at period p

T_p = The trend value at period p

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 02
February 2019

SI_p = The seasonal index at period p

3.2.2 MULTIPLICATIVE METHOD

This model is written as: $X_t = T_t \times S_t \times R_t$.
Where: $R_t = C_t \times I_t$.

1. Use the least square method to compute the trend values (T_t) for the period of interest as in the additive model case. It is hoped that the residual variation ($R_t = C_t \times I_t$) will be preserved in the trend.
2. Use the multiplicative model procedure to determine the seasonal variation (S_t) of the original series.
3. The forecasted series are the respective products in ($T_t \times SI_t$) of the computed trend varies in (1) and their corresponding seasonal variations in (2).

The additive and multiplicative model must be assumed before forecasting.
For Multiplicative model – The forecasting for period p is:

$X_p = T_p \times SI_p$.

Where:

X_t =observed data/original data
T_t = trend value
C_t = cyclical variation
I_t = irregular variation
R_t = residual.

4.0 DATA ANALYSIS

International Journal of Research
Available at https://pen2print.org/index.php/ijr
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 02
February 2019

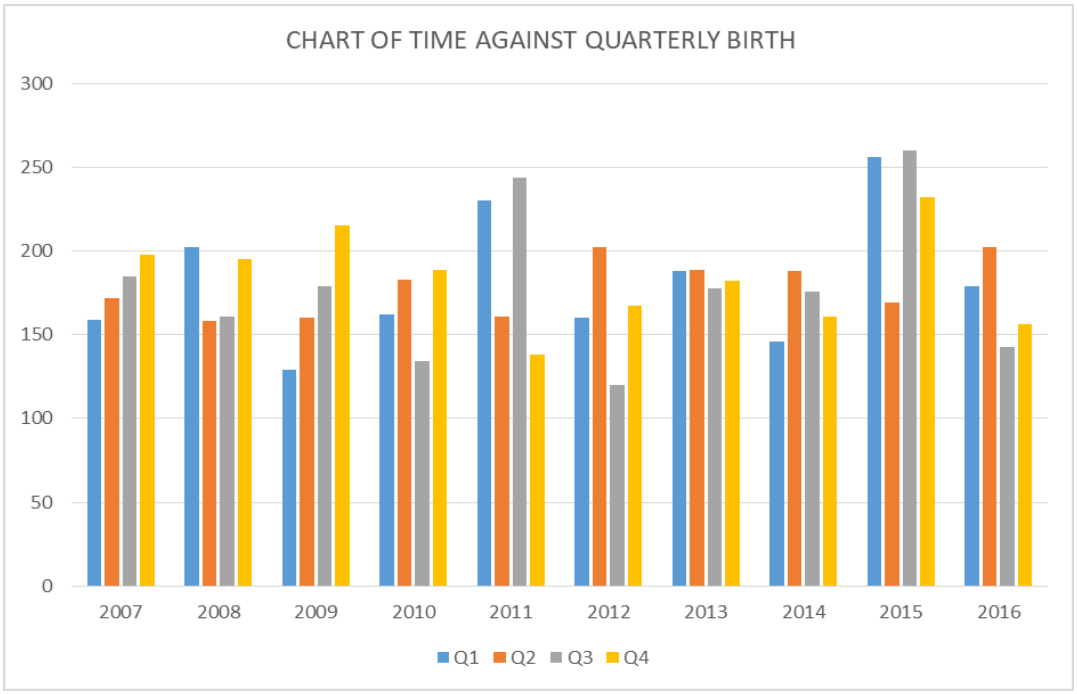

TABLE 4.1 COMPUTATION OF TREND USING LEAST SQUARE METHOD

YEAR	QTR	T	X_t	tX_t	t^2	T
2007	1	1	159	159	1	171.8518
	2	2	172	344	4	172.2894
	3	3	185	555	9	172.7170
	4	4	198	792	16	173.1446
2008	1	5	202	1010	25	173.5722
	2	6	158	948	36	173.9998
	3	7	161	1127	49	174.4274
	4	8	195	1560	64	174.8550
2009	1	9	129	1161	81	175.2826

	2	10	160	1600	100	175.7102
	3	11	179	1969	121	176.1378
	4	12	215	2580	144	176.5654
2010	1	13	162	2106	169	176.9930
	2	14	183	2562	196	177.4206
	3	15	134	2010	255	177.8482
	4	16	189	3024	256	178.2758
2011	1	17	230	3910	289	178.7034
	2	18	161	2898	324	179.1310
	3	19	244	4636	361	179.5586
	4	20	138	2760	400	179.9862
2012	1	21	160	3360	441	180.4138
	2	22	202	4444	484	180.8414
	3	23	120	2760	529	181.2690
	4	24	167	4008	576	181.6966
2013	1	25	188	4700	625	182.1242
	2	26	189	4914	676	182.5518
	3	27	178	4806	729	182.9794
	4	28	182	5096	784	183.407
2014	1	29	146	4234	841	183.8346
	2	30	188	5640	900	184.2622

	3	31	176	5456	961	184.6898
	4	32	161	5152	1024	185.1174
2015	1	33	256	8448	1089	185.5450
	2	34	169	5746	1156	185.9726
	3	35	260	9100	1225	186.4002
	4	36	232	8352	1296	186.8278
2016	1	37	179	6623	1369	187.2554
	2	38	202	7676	1444	187.6830
	3	39	143	5577	1521	188.1106
	4	40	156	6240	1600	188.5382

4.2 ESTIMATION OF TREND USING MOVING AVERAGE

TABLE 4.2: 4 point moving average Procedure

YEAR	QTR	T	X_t	4 – POINT M.A	2 OF 4 POINT M.A	T_t
2007	1	1	159	_____	_____	_____
	2	2	172	_____	_____	_____
	3	3	185	714 757	1471	183.87
	4	4	198	743	1500	187.50

2008	1	5	202	719	1462	182.75
	2	6	158	716	1435	179.37
	3	7	161	643	1359	169.87
	4	8	195	645	1288	161.00
2009	1	9	129	663	1308	163.50
	2	10	160	683	1346	168.25
	3	11	179	716	1399	174.88
	4	12	215	739	1455	181.88
2010	1	13	162	694	1433	179.12
	2	14	183	668	1362	170.25
	3	15	134	736	1404	175.50
	4	16	189	714	1450	181.25
2011	1	17	230	824	1538	192.25
	2	18	161	773	1597	199.62
	3	19	244	703	1476	184.50
	4	20	138	744	1447	180.87
2012	1	21	160	620	1364	170.50
	2	22	202	649	1269	158.63
	3	23	120	677	1326	165.75
	4	24	167	664	1341	167.62
2013	1	25	188	722	1386	173.25

	2	26	189	737	1459	182.38
	3	27	178	695	1432	179.00
	4	28	182	694	1389	173.62
2014	1	29	146	692	1386	173.25
	2	30	188	671	1363	170.37
	3	31	176	781	1452	181.50
	4	32	161	762	1543	192.87
2015	1	33	256	846	1608	201.00
	2	34	169	917	1763	220.37
	3	35	260	840	1757	219.62
	4	36	232	873	1713	214.12
2016	1	37	179	756	1629	203.62
	2	38	202	680	1436	179.50
	3	39	143	-----	-----	-----
	4	40	156	-----	-----	-----

4.3 ESTIMATION OF SEASONAL VARIATION BY MOVING AVERAGE USING MULTIPLICATIVE MODEL

TABLE 4.3 **Computation of $\frac{Xt}{Tt}$ values**

YEAR	QTR	Xt	Tt	St=$\frac{Xt}{Tt}$	St

2007	1	159	_____	_____	0.9965
	2	172	_____	_____	0.9971
	3	185	183.87	1.0061	0.9879
	4	198	187.50	1.0560	1.0191
2008	1	202	182.75	1.0153	0.9965
	2	158	179.37	0.8809	0.9971
	3	161	169.871	0.9478	0.9879
	4	195	161.00	1.2112	1.0191
2009	1	129	163.50	0.7889	0.9965
	2	160	168.25	0.9509	0.9971
	3	179	174.88	1.0236	0.9879
	4	215	181.88	1.1821	1.0191
2010	1	162	179.12	0.9044	0.9965
	2	183	170.25	1.0749	0.9971
	3	134	175.50	0.7635	0.9879
	4	189	181.25	1.0428	1.0191
2011	1	230	192.25	1.1963	0.9965
	2	161	199.62	0.8065	0.9971
	3	244	184.50	1.3225	0.9879
	4	138	180.87	0.7629	1.0191
2012	1	160	170.50	0.9384	0.9965

	2	202	158.63	1.2734	0.9971
	3	120	165.75	0.7239	0.9879
	4	167	167.62	0.9963	1.0191
2013	1	188	173.25	1.0851	0.9965
	2	189	182.38	1.0363	0.9971
	3	178	179.00	0.9944	0.9879
	4	167	173.62	1.0483	1.0191
2014	1	146	173.25	0.8427	0.9965
	2	188	170.37	1.1034	0.9971
	3	176	181.50	0.9696	0.9879
	4	161	192.87	0.8348	1.0191
2015	1	256	201.00	1.2736	0.9965
	2	169	220.37	0.7669	0.9971
	3	260	219.62	1.1839	0.9879
	4	232	214.12	1.0835	1.0191
2016	1	179	203.62	0.8791	0.9965
	2	202	179.50	1.1253	0.9971
	3	143		_____	0.9879
	4	156		_____	1.0191

4.4 THE DESEASONALIZATION OF DATA

TABLE 4.3: DESEASONALIZE OF DATA USING THE ADDITIVE MODEL

YEAR	QTR	Xt	SV/SI	Xt - SI
2007	1	159	0.44	158.56
	2	172	-2.80	174.80
	3	185	-0.68	185.68
	4	198	3.05	194.95
2008	1	202	0.44	201.56
	2	158	-2.80	160.80
	3	161	-0.68	161.68
	4	195	3.05	191.95
2009	1	129	0.44	128.56
	2	160	-2.80	162.80
	3	179	-0.68	179.68
	4	215	3.05	211.95
2010	1	162	0.44	161.56
	2	183	-2.80	185.80
	3	134	-0.68	134.68
	4	189	3.05	185.95
2011	1	230	0.44	229.56
	2	161	-2.80	163.80
	3	244	-0.68	244.68

	4	138	3.05	134.95
2012	1	160	0.44	159.56
	2	202	-2.80	204.80
	3	120	-0.68	120.68
	4	167	3.05	163.95
2013	1	188	0.44	187.56
	2	189	-2.80	191.80
	3	178	-0.68	178.68
	4	182	3.05	178.95
2014	1	146	0.44	145.56
	2	188	-2.80	190.80
	3	176	-0.68	176.68
	4	161	3.05	157.95
2015	1	256	0.44	255.56
	2	169	-2.80	171.80
	3	260	-0.68	260.68
	4	232	3.05	228.95
2016	1	179	0.44	178.56
	2	202	-2.80	204.80
	3	143	-0.68	143.68
	4	156	3.05	152.95

4.8.1 DESEASONALIZATION OF DATA

TABLE 4.12 **Desaesonalization of data using the additive model**

YEAR	QTR	X_t	SI	$X_t = \frac{X_t}{SI}$
2007	1	159	0.9965	159.56
	2	172	0.9971	172.50
	3	185	0.9879	187.27
	4	198	1.0191	194.29
2008	1	202	0.9965	202.71
	2	158	0.9971	158.46
	3	161	0.9879	162.98
	4	195	1.0191	191.35
2009	1	129	0.9965	129.45
	2	160	0.9971	160.46
	3	179	0.9879	181.92
	4	215	1.0191	210.97
2010	1	162	0.9965	162.57
	2	183	0.9971	183.53
	3	134	0.9879	135.64
	4	189	1.0191	185.46
2011	1	230	0.9965	230.81

	2	161	0.9971	161.47
	3	244	0.9879	246.99
	4	138	1.0191	135.41
2012	1	160	0.9965	160.56
	2	202	0.9971	202.59
	3	120	0.9879	121.47
	4	167	1.0191	163.87
2013	1	188	0.9965	188.66
	2	189	0.9971	189.55
	3	178	0.9879	180.18
	4	167	1.0191	178.59
2014	1	146	0.9965	146.51
	2	188	0.9971	188.55
	3	176	0.9879	178.16
	4	161	1.0191	157.98
2015	1	256	0.9965	254.89
	2	169	0.9971	169.49
	3	260	0.9879	263.18
	4	232	1.0191	227.65
2016	1	179	0.9965	179.63
	2	202	0.9971	202.59

	3	143	0.9879	144.75
	4	156	1.0191	153.08

4.5 ELEMENTARY FORECASTING

TABLE 4.5: FORECASTING USING THE LEAST SQUARE OF ADDITIVE MODEL

YEAR	QTR	T	$X_t = 171.434 + 0.4276t$	SI	XP = TP + SIP
2017	1	41	188.9658	1.35	190.3158
	2	42	189.3934	-1.78	187.6134
	3	43	189.8210	-1.81	188.0110
	4	44	170.2486	2.26	192.5076
2018	1	45	190.6762	1.35	192.0262
	2	46	191.1038	-1.78	189.3238
	3	47	191.5314	-1.81	189.7214
	4	48	191.9590	2.26	194.2190
2019	1	49	192.3866	1.35	193.7366
	2	50	192.8142	-1.78	191.0342
	3	51	193.2418	-1.81	191.4318
	4	52	193.6694	2.26	195.9294
2020	1	53	194.0970	1.35	195.4470
	2	54	194.5246	-1.78	192.7446

	3	55	194.9522	-1.81	193.1422
	4	56	195.3798	2.26	197.6398
2021	1	57	195.8074	1.35	197.1574
	2	58	196.2350	-1.78	194.4550
	3	59	196.6626	-1.81	194.8526
	4	60	197.0902	2.26	199.3502
2022	1	61	197.5178	1.35	198.8678
	2	62	197.9454	-1.78	196.1654
	3	63	197.3730	-1.81	196.5630
	4	64	197.8006	2.26	201.0606

4.6 ELEMENTARY FORECASTING

TABLE 4.6: FORECASTING USING THE LEAST SQUARE OF MULTIPLICATIVE MODEL

YEAR	QTR	T	$X_t = 171.4342 + 0.4276t$	SI	XP = TP x SIP
2017	1	41	188.9658	1.0026	189.4571
	2	42	189.3934	0.9855	186.6472
	3	43	189.8210	1.0015	190.1057
	4	44	170.2486	1.0103	192.2082
2018	1	45	190.6762	1.0026	191.1720
	2	46	191.1038	0.9855	188.3328
	3	47	191.5314	1.0015	191.8187
	4	48	191.9590	1.0103	193.9362

2019	1	49	192.3866	1.0026	192.8868
	2	50	192.8142	0.9855	190.0184
	3	51	193.2418	1.0015	193.5317
	4	52	193.6694	1.0103	195.6642
2020	1	53	194.0970	1.0026	194.6016
	2	54	194.5246	0.9855	191.7039
	3	55	194.9522	1.0015	195.2446
	4	56	195.3798	1.0103	197.3922
2021	1	57	195.8074	1.0026	196.3165
	2	58	196.2350	0.9855	193.3896
	3	59	196.6626	1.0015	196.9576
	4	60	197.0902	1.0103	199.1202
2022	1	61	197.5178	1.0026	198.0313
	2	62	197.9454	0.9855	195.0752
	3	63	197.3730	1.0015	198.6706
	4	64	197.8006	1.0103	200.8482

5.0 CONCLUSION.

The national population commission (NPC) in 2006 c0nducted census whereby the Nigerians population was put at 140 million, this is undoubtedly an alarming figure for a country with distressed economy. The consequences of over population is known with characteristic of socio economic

problems such as Unemployment, Low level of per capital income ,Poverty, low standard of living, and many more social vices become manifested

We predict the registration of fertility rate at state General Hospital, Saki for the next five years using Time series analysis. In time series analysis, it is believed that what happened in the past will determine the trend at which will things will happen in the future. The determination of the trend at which things are expected to happen in the future is known as FORECASTING

Forecasting is one of the instruments used in time series analysis to forecast or predict what the future has in stock, this can be achieved by using the values of the trend (T) calculated by least square method and the seasonal index. The trend value is calculated for any future period and adjusts for the seasonal variations.

Time series analysis procedure were used to analyze the quarterly registration of fertility rate in state general hospital, Saki from 2007-2016. All the components of time series such as seasonal trends and seasonal variations were used in estimating the data.

From the analysis made so far, there is a tendency for increase in the rate of fertility in the nearest future, and we all know the implications of high birth rate in the society, high in fertility rate led to a fall in standard of living and a times leads to social problems like unemployment, Overpopulation and many more.

REFERENCES

OSENI B.A(2008). Applied statistics for managerial studies (Revised Edition).Published Highland publisher

Box G.E.P and jerkins G.M (1979). Time series Analysis: Forecasting and Control.

Bruno Dupire (1994). Issues of risk Changes. European Central Bank Working Paper Series, 85, Control, AC–19, 716–723.

Sadorsky, P. (2006). Modeling and forecasting petroleum futures volatility. *Energy Economics*, 28, 467-488.

Tatyana Gileva(2010). Econometric of crude oil market time? A test for time-varying long-range dependence in prices and volatility. *Energy Economics*, 29 (1), 28-36. Uri, N.D. (1996).