REGIONAL PATTERN OF HIV CASES IN PAKISTAN

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ABSTRACT

Objective: To forecast the HIV cases by location and geographical area of residence in Pakistan.

Methodology: The record of monthly number of HIV cases from 18 HIV treatment centres for the period of January 2013 to July 2014 taken from Pakistan Bureau of Statistics (PBS). Descriptive frame work along with time series smoothing models (single parameter exponential smoothing, double parameter exponential smoothing, Holt's and Winter's multiplicative model) were applied.

Results: On the average Punjab (3234 ±556) and Sindh (2606 ±345) had higher monthly HIV cases, while the HIV cases in Islamabad were more consistent due to least coefficient of variation (7%). Among the competing time series models Winter's (overall, Islamabad, Punjab, Sindh, Balochistan) and Holt's (Khyber Pakhtunkhwa) models were found to be superior in forecasting the HIV cases due to least forecasting error. The increasing trend in HIV cases is expected for all over Pakistan (2.2%), Islamabad (1.3%), Punjab (3.4%), Sindh (1.9%), Balochistan (4%) and Khyber Pakhtunkhwa (1.3%).

Conclusion: Increasing trend is expected for HIV cases in Pakistan.

Key Words: Forecast, HIV cases, Pakistan, Time series models

INTRODUCTION

Globally 35 million people were living with HIV in 2013 whereas around 78 million people have been infected since the start of the epidemic and 39 million people have died of AIDS-related illness[1]. In 2013 the new HIV infection has been dropped down by 38% since 2001 whereas mortality due to AIDS have been fallen to 35% in 2013 as compared to 2005[1]. Higher proportion of people living with HIV lived in Sub-Saharan Africa (24.7 million) followed by Asia and the pacific (4.8 million); Western and Central Europe and North America (2.3 million); Latin America (1.6 million); Eastern Europe and Central Asia (1.1 million); and Middle East and North Africa (230000)[1].

HIV/AIDS is a social disease and a major health concern which remains incurable. Ignorance and unsafe reproductive health behaviour are the important causes of HIV transmission and social scientists believed that the HIV/AIDS can only be prevented by social vaccine which involves spreading education on how to protect oneself, 100% condom uses, and changing sexual behaviour[2]. HIV prevalence is usually higher among the people who inject drugs in Asian countries. Needle sharing continues at high levels through out the world[3].

Large population of injection drug users (IDUs) in the world live in Asia and the ratio of IDUs is higher in low and middle income counties[4]. Pakistan, the second most populous Muslim country (after Indonesia) in the world, where the society is still not accepting the HIV/AIDS and other sexually transmitted diseases (STDs) due to low literacy, poverty and social norms. Particularly in remote areas where these diseases are considered as a very shameful and people hide their diseases and not seeking any sort of treatment due to stigma and taboos related to these diseases.

According to USAID estimates of 2007, HIV cases increased from 51,000 to 96,000 and majority being male (72%)[5]. Pakistan moved up from low prevalence to concentrated epidemic category[4]. Most serious transmission modes of HIV are people who inject drugs, transgender, male and female sex workers with prevalence rate are of 27.2%, 5.2%, 1.6% and 0.6% respectively[6]. The surveillance round among twenty cities conducted in 2011 and the results suggested that an overall HIV prevalence was 7.2% and 3.1% among hijra sex workers and male sex workers respectively[7].

Effective implementation of statistical models maximizes the likelihood of adopting optimum planning,

preventive measures and intervention at right time towards the HIV/AIDS epidemic. As HIV/AIDS is a fatal disease so it is a significant concern to allocate resources, relevant vaccination, antiretroviral therapy and intervention in affected areas. The objective of present study was to determine the pattern of HIV cases in Pakistan that can be emerging for the development of effective polices to address these cost effective diseases with the purpose of optimizing future needs.

METHODOLGY

The record of monthly number of HIV cases of more than 18 HIV treatment centres from January 2013 to July 2014 for the present study was taken from Pakistan Bureau of Statistics (Statistics House), Islamabad, Pakistan. Time series smoothing models namely single parameter exponential smoothing, double parameter exponential smoothing, Holt's and Winter's multiplicative model were applied to forecast the HIV cases by location and geographical area of residence in Pakistan by using the statistical software Zaitun time series.

RESULTS

Descriptive statistics of monthly HIV cases from January 2013 to July 2014 in various provinces, and capital of Pakistan are shown in Table1. On the average, monthly HIV cases in Islamabad, Punjab, Sindh, Khyber Pakhtunkhwa (KP), Balochistan and overall are 1647, 3234, 2606, 1427, 170 and 9084 respectively. Punjab (3234) on average had higher HIV cases followed by Sindh (2606). HIV cases in Islamabad are more consistent (C.V= 7%) compared to other parts of Pakistan (Table 1).

Accuracy measure was taken into account to achieve an efficient forecasting model of the monthly HIV cases for Pakistan and by region. The detail description of various smoothing models along with mean square error was illustrated in Table 2.

The established efficient forecasting models for HIV cases were Winter's (overall, Islamabad, Punjab, Sindh, Baluchistan) and Holt's (KP) due to least forecasting error. The time plots of actual and predicted were showed from Figure 1 through 6.

Under the best selected model the one period ahead forecast was made and expected percentage is calculated in Table 3. The selected models revealed that the increasing trend in HIV cases are expected for overall (2.2%), Islamabad (1.3%), Punjab (3.4%), Sindh (1.9%), Balochistan (4%) and KP (1.3%).

DISCUSSION

The findings of this study showed that on the average Punjab (3234 ±556) and Sindh (2606 ±345) had higher monthly HIV cases, while the HIV cases in Islamabad were more consistent due to least coefficient of variation(7%) compared to other parts of Pakistan. Among the competing time series models Winter's (overall, Islamabad, Punjab, Sindh, Balochistan) and Holt's (KP) models were found to be superior in forecasting the HIV cases due to least forecasting error. The selected models showed that the increasing trend in HIV cases is expected for overall in Pakistan (2.2%), Islamabad (1.3%), Punjab (3.4%), Sindh (1.9%), Balochistan (4%) and KP (1.3%).

Table 1: Descriptive statistics

	Minimum	Maximum	Mean	Std. Deviation	C.V.
Islamabad	1455	1851	1647	121	7%
Punjab	2508	4288	3234	556	17%
Sindh	2106	3208	2606	345	13%
KP	1193	1656	1427	145	10%
Balochistan	133	220	170	26	16%
Total	7395	11223	9084	1188	13%

Table 2: Detailed summary of forecasting error

Area of Residence	Mean square error			
	SES	Brown	Holt	Winter
Overall	66182.83	6375.84	7798.27	5145.73*
Islamabad	784.69	98.14	80.57	80.28*
Punjab	14297.33	1863.01	2878.66	1173.35*
Sindh	5637.15	752.35	745.79	640.16*
Kp	2490.53	1122.39	1011.42*	1276.85
Balochistan	40.08	10.20	10.48	8.44*

*selected model due to lowest MSE

Table 3: Actual, forecasted and expected percent change by region under selected models

Region	Actual July 2014	Forecasted August 2014	% change
Pakistan	11223	11472	2.2
Islamabad	1851	1875	1.3
Punjab	4288	4432	3.4
Sindh	3208	3270	1.9
KP	1656	1678	1.3
Balochistan	220	229	4.0

Figure 1: A plot of actual and predicted, Overall
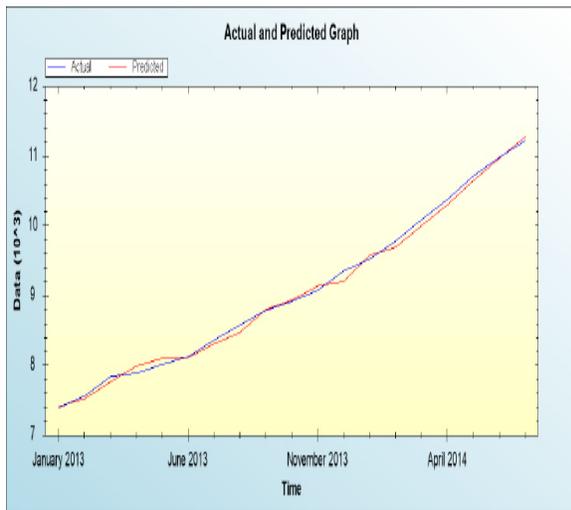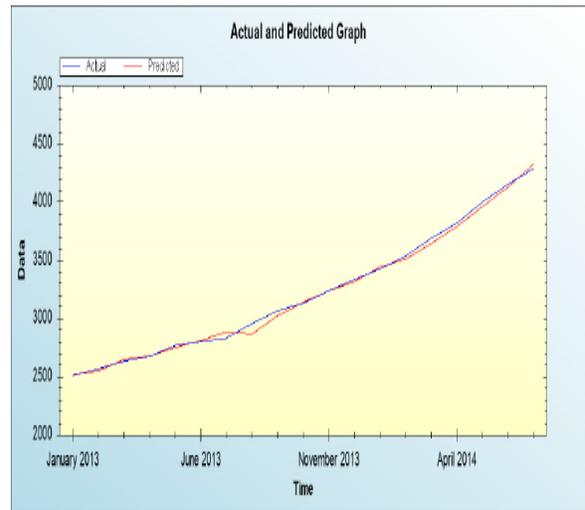

Figure 2: A plot of actual and predicted, Punjab

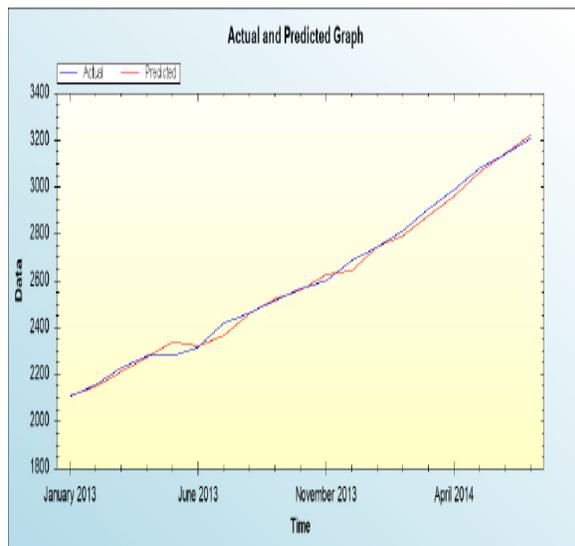**Figure 3: A plot of actual and predicted, Sindh**
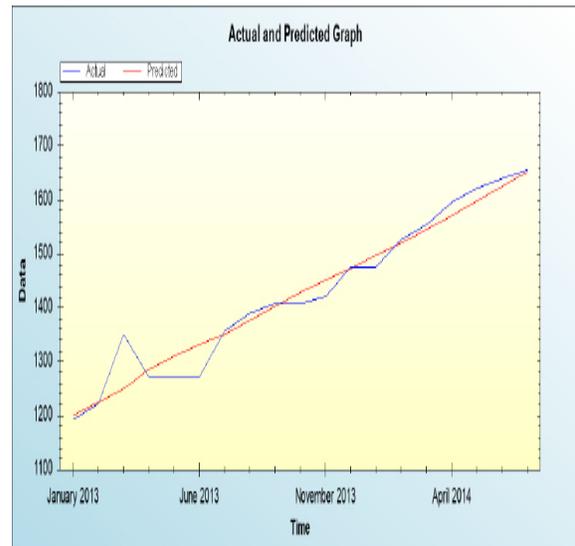

Figure 4: A plot of actual and predicted, KP

Figure 5: A plot of actual and predicted, Balochistan
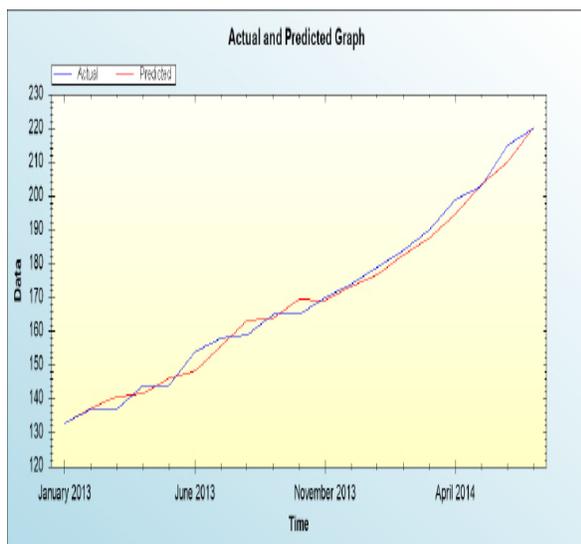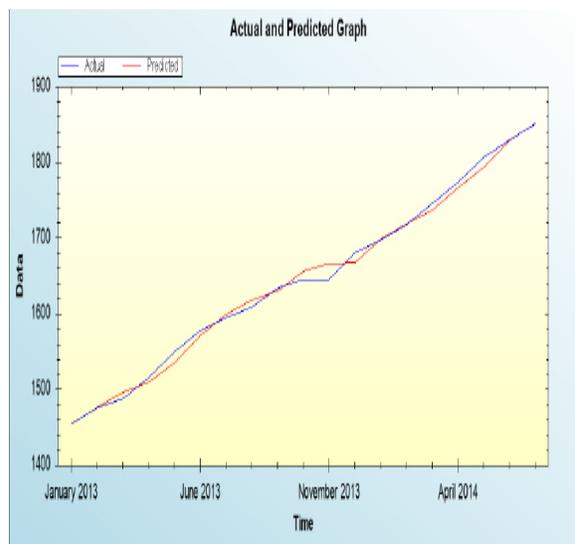

Figure 6: A plot of actual and predicted, Islamabad

Johnson et al[8] used a model based analysis in South Africa to measure the effect of changes in condomn usage and antiretroviral treatment in relation to HIV incidence. Hontelez et al[9] investigated the prospects for elimination of HIV in South Africa through expanded access to antiretroviral therapy using a micro-simulation model. Rao[10] used mathematical modelling of AIDS epidemic in India. UNAIDS reference group on estimates, modelling and projections (2002) gives improved methods and assumptions for estimation of the HIV/AIDS epidemic and its impact[11,12]. Alkema et al[14] used a Bayesian modelling approach to project the HIV prevalence in Uganda[13]. Modelling has also been applied to highly active antiretroviral therapy.

Pakistan is marked as low prevalence and high risk country for HIV spread containing the several contributing factors to HIV/AIDS like poverty, inject drug users, unsafe injection practices, lack of blood transfusion screening and professional donors, lower literacy and awareness level, gender inequalities, low contraception use and facilities, commercial sex, sex education as a taboo & stigmatization and discrimination[15]. Lower literacy rate and lack of awareness regarding HIV/AIDS was a major determinant in a community based cross-sectional survey[16] conducted in 2002 in a rural region of Sindh, to evaluate the awareness and opinions of youth about sexually transmitted infections and HIV/AIDS. Adolescents having education higher than or equivalent to secondary level, those who were capable to read the newspaper, possessed electricity in their homes and were allowed to meet their friends once in six months had significantly more HIV/AIDS awareness. Another study of 733 men and 355 women was conducted among educated adolescence in Lahore to evaluate

the knowledge, attitude and behaviour regarding AIDS among educated young people, only 189 males and 76 female knew the causes of AIDS[17]. Many researchers have explored the mutual significant transmission risk factors in the major cities of Pakistan that caused for HIV/AIDS transmission which are injection drug user (IDUs), sexual contacts and blood transfusion[18,19]. A few researchers have explored the co-infection among the jail inmates. In a cross sectional prevalence survey, prevalence rate was 2.01% and among them 77.78% were co-infection[20].

CONCLUSION

The winter's and Holt's model established as best model to forecast the HIV cases in Pakistan. The selected model showed a rising trend for overall Pakistan and by region. These statistical figures about HIV will serve as a guide for the development of effective polices to address these diseases with the purpose of optimizing future needs as well as minimizing morbidity and mortality due to HIV/AIDS.

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