Review Article

The impact of the activities of Ghana AIDS Commission on new HIV infections in Ghana: An intervention time series analysis

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ABSTRACT

The study examines the impact of Ghana AIDS Commission (GAC) activities on new HIV infections. Secondary data from 1 January 1996 to 31 December 2007 were obtained from the Ghana National AIDS Control Programme and Biostatistics Department of the Health Ministry. Intervention time series analysis was applied separately to the data from the northern and southern sectors due to data collection mechanism and location of two tertiary teaching hospitals. The impact of GAC activities is measured by the statistical significance of the coefficients of the intervention variable. The intervention variable is coded as zero (0) for the period before and one (1), the period after the GAC activities commenced. It was shown that the HIV incidence in the northern follows an integrated moving average model, whilst in the southern sectors an autoregressive integrated moving average model was the appropriate model. No significant impact of GAC activities was observed in the northern sector. In contrast the GAC activities in the southern sector were associated with a reduction in new HIV infections (male = -0.20 ± 0.13, $p < 0.05$; female = 0.14 ± 0.10, $p < 0.05$), corresponding to a 15% and 18% reduction in male and female new HIV infections respectively in the sector. It can therefore be concluded that the GAC activities were a success. However, greater focus of GAC efforts in the northern sector is required to ensure that its activities have an impact on the incidence there.

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1. Introduction

In the early stage of HIV/AIDS epidemic, the Ministry of Health (MOH) was the main body driving the national HIV responses. It also spearheaded the development of sector responses in collaboration with other ministries. As the prevalence rates of the HIV/AIDS epidemic soared, there was international recognition of the multi-sectoral nature of the epidemic, which called for emergency international and national responses involving the mobilisation of sectors beyond health. In response to containing the spread of the HIV/AIDS epidemic, National AIDS Commissions (NACs) were established in many countries with 60 countries having a NACs by 2005 [1]. A World Bank evaluation of the effectiveness of NACs concluded that the setup of the NACs was too quick, resulting in disengagement of the health sector because of conflicts arising out of the set priorities and the implementation of a multisectoral approach [1].

In January 2002, the Parliament of Ghana enacted (ACT 613) the legislation to establish the Ghana AIDS Commission (GAC). The main aim of the GAC is to provide leadership in the management and coordination of the national response to the HIV/AIDS epidemic in Ghana. The functions of GAC include the development of policies and strategies, the establishment of programme priorities; provision of high level advocacy for HIV/AIDS prevention and control; mobilisation and management of resources for HIV/AIDS related programmes. It also coordinates and promotes research, information and documentation on the HIV/AIDS epidemic monitoring and evaluation of all on-going activities [2]. GAC also provides financial support for HIV/AIDS intervention activities from the Ghana AIDS Response Fund established by the government of Ghana with assistance from the World Bank. The work of the GAC targets strategies aimed at the reduction of the number of new cases of HIV infection in the country. The National AIDS Control Programme (NACP) on the other hand is the body which provides analysis of HIV/AIDS incidence in Ghana and spearheads the campaign to reduce the spread of the epidemic. NACP also collates and manages HIV/AIDS data on all positive cases from all hospitals, clinics and testing centres for reporting. In addition, they provide HIV/AIDS response for national and

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international management of the epidemic in Ghana. They have also established a multisector and multidisciplinary institutional framework to coordinate and monitor programme implementation. They work in collaboration with GAC to minimise the spread of the epidemic. However, there appears to be conflict between policy direction and activities [2].

Fobil and Soyiri in 2006 assessed the GAC activities by reviewing the policy documents, technical reports and programme documents of the commission. Their review revealed that the activities of GAC have been a success. However, there were no quantitative empirical data or any quantitative analysis to support the findings. This lack of quantitative assessment of the effectiveness of GAC activates is what this study seeks to provide. The government of Ghana, legislators and other stakeholders will have an interest in evaluating the impact of the GAC activities on HIV/AIDS epidemic in the country. Stakeholders have, over the years relied on new recorded HIV/AIDS cases to evaluate the impact of interventions without recourse to serious mathematical or statistical modelling. They have mostly depended on descriptive statistical techniques such as graphical and/or data presentation through tables to assess the impact of various intervention policies.

To our knowledge, no study has quantitatively modelled the effectiveness of the activities of NACs in relation to reported HIV/AIDS cases. This study aims at filling the gap by examining quantitatively the effectiveness of the activities of GAC on HIV epidemic in the northern and southern sectors of Ghana by gender using the intervention time series analysis approach developed by Box and Tiao [3]. This method is an extension of Autoregressive integral moving average (ARIMA) model developed by Box and Jenkins [4] and Box et al. [5].

2. Methods

2.1. Data description

In Ghana, HIV/AIDS infection was first detected in 1986, five years after its identification in the United States of America by the Centre for Disease Control [6]. The national HIV/AIDS estimates provided by the National AIDS Control Programme (NACP) projected that about 264,567 persons were living with the disease in 2007 in Ghana [7,8]. In this paper, we analysed de-identified monthly reported cases of HIV data from 1 January 1996 to 31 December 2007. The data were divided into two parts; pre-intervention and post-intervention. The pre-intervention consists of the data before the establishment of GAC by law (from 1 January 1996 to 31 December 2001). The post-intervention data covered the period of the operation of GAC by law (from 1 January 2002 to 31 December 2007). Since the pre-intervention period is only 6 years it will not be appropriate to use more than 6 years post-intervention period data to examine the impact of the activities of GAC. To get a fair reliable and accurate analysis the data was limited to the period between 1996 and 2007. This is to enable us to have the equal number of years for both pre- and post-intervention periods.

2.2. Study design and data source

The data used are counts of people residing in Ghana who have been clinically proven to be HIV positive. Temporary residents such as short term visa holders and exchange programme students were excluded because their duration of their stay was less than three months and their percentage was less than 1%. Consequently, their exclusion would not have any significant contribution to the outcome of this study. In addition the information on them was incomplete; in particular some of them have information on their gender missing. Ghanaian HIV data were treated as time series, observed in monthly time intervals. In all, there were 144 consecutive monthly observations of reported cases of HIV infection obtained from the NACP and Biostatistics Department of the Ministry of Health of each of the 10 administrative regions of Ghana. The initial data collected from different sources (i.e. regions) were linked using date of birth, place of birth, first names and surnames to eliminate duplication and de-identified by staff of the NACP to preserve patient confidentiality before releasing it to us for analysis.

The data were grouped into two, northern and southern sectors. Each sector is made up of five regions. The northern sector comprises Ashanti, Brong-Ahafo, Northern, Upper East and Upper West Regions. The southern sector also consists of Greater Accra, Eastern, Western, Volta and Central Regions. The groupings were based on the nature of the available data obtained from NACP and Biostatistics Department of Ministry of Health and the geographical locations of the 10 administrative regions. In addition, the geographical locations of the two tertiary teaching hospitals; Korle-Bu Teaching Hospital in the southern sector and Komfo-Anokye Teaching Hospital in the southern sector were also taken into account. Most of the HIV cases in the regions forming each sector were referred to or diagnosed in either of these two teaching hospitals. There were overlapping of HIV cases across the regions as a result of these tertiary teaching hospitals receiving critical and emergency referral cases from all the primary and secondary hospitals such us district, regional and private hospitals as well as polyclinics in the regions within each sector. This aggregation will help provide more accurate results, reduce the bias in the data collection mechanism, eliminate duplication of reported cases and enable comparisons between the two sectors.

2.3. ARIMA models

The ARIMA models are univariate time series modelling methods developed by Box–Jenkins to describe the stochastic dynamic systems. The model was developed to provide a general framework for modelling non-stationary observed time series data.

Let x_t be a non-stationary observed HIV time series data, then the class of generalised ARIMA models for the noise part of intervention model is of the form:

$$(1 - B^d)\phi(B)x_t = \theta(B)$$

where $\phi(B) = 1 - \phi_1 B - \phi_2 B^2 - \cdots - \phi_p B^p$ is the autoregressive operator of the model; $\theta(B) = 1 - \phi_1 B - \phi_2 B^2 - \cdots - \theta_q B^q$ is the moving-average operator of the model; B is a back-shift operator defined by $Bx_t = x_t - x_{t-1}$; d is the degree or order of differencing and the variable $a_t \sim N(0, \sigma^2)$ is a random error or white noise. This modelling approach is an iterative process to identify a best noise model through three steps:

1. *Model identification*: we first modelled the HIV/AIDS data to tentatively identify their orders of autoregressive (AR) and moving average (MR) as well as the order of differencing (I).
2. *Model estimation*: We estimate the identified model using maximum likelihood estimation and the resultant residuals were checked for white noise.
3. *Diagnostic check*: the model is check for goodness-of-fit by examining the residuals of the model.

The identified ARIMA models of HIV/AIDS data become the noise part of the intervention model. The detailed mathematical theory associated with Box–Jenkins ARIMA modelling has been discussed in a textbook by Box et al. [5].

2.4. Intervention theory

Intervention analysis of time series is an extension of the ARIMA [4] to include the effect of intervention policies as exogenous explanatory (independent) variables. This method is used to measure the influence or change that known intervention policies have on an observed time series. Although the Box and Tiao [3] method of measuring the impact of an intervention is relatively old (introduced in 1975) it is still an effective method for assessing the effect and magnitude of impact of policy change or interventions [9–12]. For example, in a health related area it was used to measure the intervention effect on the Severe Acute Respiratory Syndrome (SARS) outbreak in Singapore [13].

To study an intervention, the time series under consideration is split into pre- and post-intervention parts. The pre-intervention part of the series is then modelled in the form of an ARIMA (p, d, q) which will serve as a noise or error part in the intervention modelling. The intervention model to be used in this study can be expressed as:

$$w_t = R(B)I_t + N_t$$

where t denotes time in months, w_t is the stationary transformed number of reported cases of HIV infection from January 1996 to December 2007, the term N_t is the noise model derived from the pre-intervention series, while the operator $R(B)$ measures the effect and magnitude of impact of the intervention I_t and B is the backward shift operator defined as $Bw_t = w_{t-1}$.

Since the activities of the commission are ongoing we employed continuous intervention analysis. For a continuous or permanent intervention like this case, the intervention variable I_t is a step function defined in the form of an indicator variable as:

$$I_t = \begin{cases} 0 & t < 1 \text{ January } 2002 \\ 1 & t \geq 1 \text{ January } 2002 \end{cases}$$

For an expected step change (i.e. effect of the intervention) immediately after the introduction of the intervention, the model for estimating the intervention effect is a regression model of the form:

$$w_t = \omega_0 I_t + N_t \tag{1}$$

where the coefficient ω_0 measures the effect and magnitude of impact of the activities of GAC on the epidemic. In this case $R(B) = \omega_o$. Since the aim of establishing the GAC is to help reduce the number of new HIV infections in Ghana, the activities of the

GAC is deemed to have had an impact if the parameter ω_0 is significant (p-value < 0.05) and negative.

When the interventions introduced do not produce an immediate response (i.e. effect) but a progressive or gradual response or change (i.e. impact), an intervention model of the form:

$$w_t = \frac{\omega_0}{1 - \delta B} I_t + N_t \tag{2}$$

is considered, where δ is the rate of impact (growth). In this case $R(B) = \omega_o(1 - \delta B)^{-1}$. The impact of the intervention approaches the long-run magnitude equal to $\omega_0/(1 - \delta)$. In this case the intervention is deemed to have had an impact if the parameter ω_0 is significant (p-value < 0.05) and negative as well. The detailed mathematical theory and the applications of intervention modelling are discussed in an article by Box and Tiao [3].

All analyses were performed using TSA package in R project software (version 3.1.0; CRAN, R Project for Statistical Computing). It has in-built programme to estimate all the parameters in the model. It is an open source software and easy to use. It provides estimated standard errors for the calculation of confidence intervals and significant levels as well.

3. Empirical analysis

3.1. Preliminary analysis

3.1.1. Northern sector

The graphs for male and female reported cases of HIV infection in the northern sector and the corresponding post-intervention forecast based on pre-intervention data using ARIMA method of time series are presented in Fig. 1. The graphs display the entire series (pre-intervention and post-intervention) and post-intervention forecasts (grey) with the red line separating pre- and post-intervention periods.

Examination of the post-intervention forecast and data do not indicate any departure from each other. Both the forecast and post-intervention cases of HIV infection for males and females appear to exhibit similar growth patterns. Although, no visible departure of the post-intervention forecast from post-intervention data is observed (Fig. 1), we cannot conclude that the GAC activities have no influence on the number of male and female new HIV infections in the sector. The presence of the activities of GAC may have prevented the escalation of both male and female cases of HIV infection and this requires further analysis to ascertain the effect.
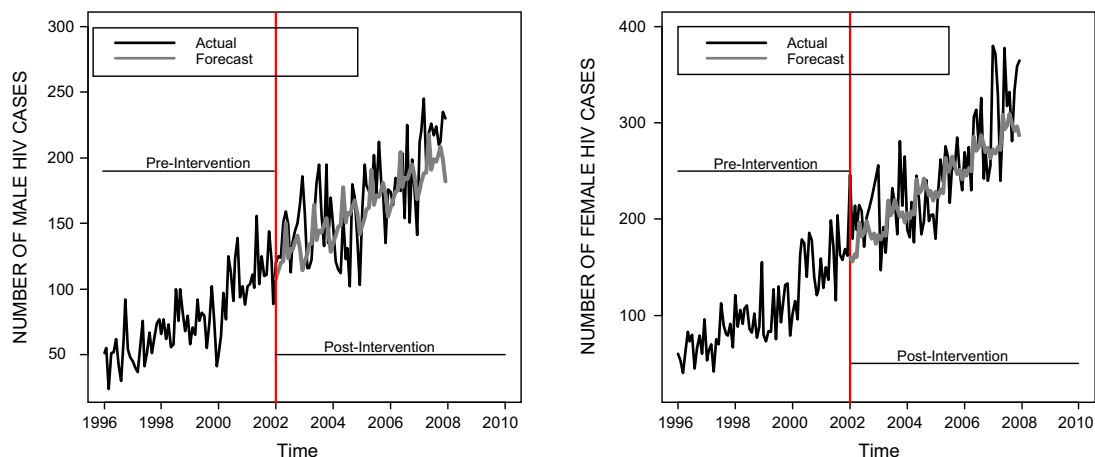

Fig. 1. Male (left graph) and female (right graph) HIV in the northern sector with post-intervention forecast (green).

3.2. Southern sector

Similarly, the post-intervention forecasts generated from the pre-intervention HIV data in the southern sector using ARIMA method are compared graphically to the post-intervention data for both male and female cases in order to establish the presence of any visible impact of the GAC activities in the sector (Fig. 2). A visible departure of the post-intervention forecasts (green) from the post-intervention data for both males and females is observed immediately after the rollover of GAC activities. While both the forecasts and the actual series indicate a growth in the number of cases, the actual numbers are substantially lower than the forecast values (Fig. 2). Here the activities of GAC could be associated with the reduction of the number of HIV infection in the southern sector. This observation needs further analysis to ascertain or confirm the impact of GAC activities in the sector.

In order to establish the effect and magnitude of impact (or otherwise) of the GAC activities on the new cases of HIV infection, intervention analysis of time series is carried out on the reported cases of HIV infection in the two sectors.

3.3. Pre-intervention models

We assumed that no major intervention policies preceded the introduction of the legislation of establishing Ghana AIDS Commission in 1 January 2002. The pre-intervention series from 1 January 1996 to December 2001 were modelled to obtain noise models for each sector. The HIV data for both sectors were nonstationary as they exhibited increasing trend and visible variation (Figs. 1 and 2). Box–Cox transformations and first order differencing were used to stabilise the variance and remove the trend of the series respectively. With the exception of the male cases in the northern sector where a square root transformation was found to be appropriate to stabilise the variance, a logarithm transformation was suitable to minimise the variance of the data in the two sectors.

3.3.1. Northern sector

After examining graphically the sample autocorrelations and partial autocorrelations of the stationary data (graphs not provided) and the analysis of the residuals of the fitted models, integrated moving average (IMA) models of order one were found to provide the best fit for both male and female cases. The noise model for the northern sector data is given by

$$N_t = \begin{cases} \dfrac{(1 - 0.7361B)}{(1 - B)} a_t & \text{for male cases} \\[2mm] \dfrac{(1 - 0.7268B)}{(1 - B)} a_t & \text{for female cases} \end{cases} \tag{3}$$

where $a_t \sim N(0, \sigma^2)$ is white noise (i.e. residuals) with zero mean and constant variance σ.

3.3.2. Southern sector

The graphical analysis of the sample autocorrelations and partial autocorrelations (graph not provided) of the stationary HIV data in the southern sector and the corresponding residuals of the fitted models led to noise models of the form

$$N_t = \begin{cases} \dfrac{(1 - 0.7052B - 0.1421B^3)}{(1 - B)} a_t & \text{for male cases} \\[3mm] \dfrac{(1 - 0.1379B)}{(1 - B)(1 - 5843B^2)} a_t & \text{for female cases} \end{cases} \tag{4}$$

3.4. Models for intervention

3.4.1. Northern sector

From the preliminary analysis, no immediate or permanent effect of GAC activities on HIV infection was observed for both male and female infections (Fig. 1). With this outcome in mind, the northern sector data were modelled by examining whether there was a gradual effect of the activities of GAC on the number of HIV cases in the sector. The noise model in Eq. (3) was extended to include the effect of the intervention to obtain an equation like the regression model (2) which is given by:

$$w_t = \frac{\omega_0}{1 - \delta B} I_t + \begin{cases} \dfrac{(1 - 0.7361B)}{(1 - B)} a_t & \text{for male cases} \\[2mm] \dfrac{(1 - 0.7268B)}{(1 - B)} a_t & \text{for female cases} \end{cases} \tag{5}$$

The model was fitted separately to the entire stationary transformed HIV data for both males and females from January 1996 to December 2007 in the northern sector. The model parameters were estimated using maximum likelihood estimation and the estimated results are presented in Table 1.
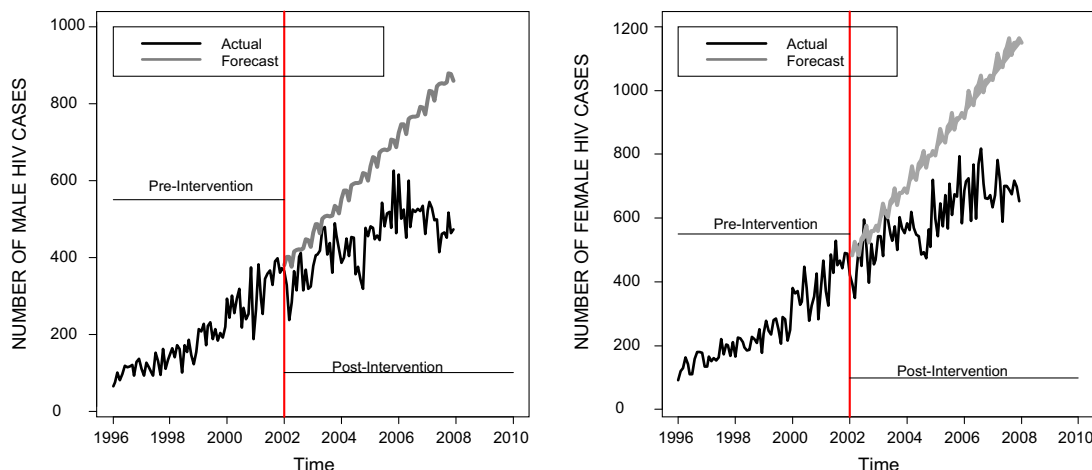

Fig. 2. Male (left graph) and female (right graph) HIV infections in the southern sector and post-intervention forecast (green).

Table 1

Estimates from intervention model for male and female HIV infection in the northern sector.

Series	Parameter	Co-efficient	SE	t-Statistic	p-Value
Male	θ	−0.7480	0.0599	12.489	<0.001[*]
	δ	0.7307	0.3170	2.305	0.011[**]
	ω_0	0.4390	0.4509	0.9736	0.166
Female	θ	−0.7544	0.0489	15.427	<0.001[*]
	δ	−0.6361	0.2790	2.280	0.012[**]
	ω_0	0.3960	0.1701	2.328	0.061

[*] $p < 0.001$.
[**] $p < 0.05$.
SE – standard error.

3.5. Southern sector

Based on the initial graphical analysis of the southern sector data (Fig. 2) which revealed immediate departure of the post-intervention forecast from the post-intervention data, the noise models in Eq. (4) were extended to incorporate the intervention effect to obtain a regression equation as per model (1) as seen below:

$$w_t = \omega_0 I_t + \begin{cases} \dfrac{(1 - 0.7052B - 0.1421B^3)}{(1-B)} a_t & \text{for male cases} \\ \dfrac{(1 - \theta 0.1379B)}{(1-B)(1-5843B^2)} a_t & \text{for female cases} \end{cases} \quad (6)$$

The model was then fitted to the logarithm of male and female HIV data from January 1996 to December 2007 (pre- and post-intervention) separately. The estimated results from maximum likelihood are provided in Table 2.

4. Results

4.1. Northern sector

The evidence associated with the activities of the GAC indicates a gradual increase in the number of new male and female cases of HIV infection in the sector. For both females and males, the rates of impact (growth), δ (male = 0.731, $p = 0.011$; female = −0.636, $p = 0.012$) are significant, however, the rate for female is negative which indicates a decreased rate while for males the rate is positive indicating an increased rate. The parameters ω_0 (male = 0.439 ± 0.451, $p = 0.166$; female = 0.398 ± 0.170, $p = 0.061$) are positive and insignificant either for females or males. Indicate no association of GAC activities on new male and female HIV infections in the sector.

4.2. Southern sector

For both males and females, the estimated intervention parameters ω_0 (male = −0.204 ± 0.127, $p = 0.036$; female = −0.137

Table 2

Estimates from intervention model for male and female HIV infection in the southern sector.

Cases	Parameter	Co-efficient	SE	t-Statistic	p-Value
Male	θ_1	−0.7123	0.0692	10.293	<0.001[*]
	θ_3	−0.1342	0.0663	2.009	0.023[**]
	ω_0	−0.2037	0.1271	1.603	0.036[**]
Female	θ	−0.1519	0.0916	1.658	0.050[**]
	ϕ_2	−0.5936	0.0684	8.678	<0.001[*]
	ω_0	−0.1371	0.1008	1.360	0.048[**]

[*] $p < 0.001$.
[**] $p < 0.05$.
SE – standard error.

± 0.101, $p = 0.048$) are negative and significant (p-values < 0.05). This indicates that the activities of the GAC were significantly associated with the reduction of new male and female HIV infections in the sector. On the average the monthly reduction in the number of new HIV infections was 15% (i.e. $1 - e^{-0.1371}$) for female cases and 18% (i.e. $1 - e^{-0.2037}$) for male cases. We also observed that the effect of the activities of GAC resulted in immediate and permanent reduction in the number of new HIV infections in the southern sector.

5. Discussion

We examined whether the establishment of GAC has been beneficial and it activities have resulted in a statistically measurable reduction of the number of new cases of HIV infection in the country. To determine the effect intervention analysis of an observed time series was undertaken to model the number of reported cases of HIV infection in the northern and southern sectors of Ghana by sex. The residual analyses of the various intervention models for reported HIV cases for both males and females reveal no obvious inadequacies of the models established. Integrated moving average and autoregressive integral moving average models were identified to fit well for reported cases of HIV infection from the northern and southern sectors respectively.

Our findings indicate that there was no significant effect of the activities of GAC on the number of new male and female HIV infections in the northern sector. However, the rates were significant. Whilst the female cases showed a significantly reduced growth rate, the male cases exhibited an increased growth rate. These suggest that the significant rates of both male and female cases did not facilitate the effect of the activities of GAC. The activities of GAC could not improve significantly the reduction of HIV infections in the sector. The decrease in the growth rate of female cases and the corresponding increase in growth rate of the male cases might be the reason for the insignificant effect of GAC activities on HIV infections in the northern sector as a whole. Although, there was an observable increase in new HIV infections in the northern section as shown by the graphical presentation in Fig. 1, the decline in growth rate of the number of new female HIV infections associated with the activities of GAC is a remarkable improvement but cannot be solely attributed to the activities of GAC since their contribution was found to be insignificant. Inadequate funds and staffing in the northern sector as well as delay in disbursing of limited funds available due to delay in providing financial report on time may contribute partly to the insignificant effect of GAC activities in the northern sector [14]. The number of male and female cases of new HIV infection is forecasted to increase in the northern sector [15], which requires the GAC and other organisations involve in HIV activities to step up their work in the sector.

In the southern sector, the analysis suggests a reduction in new cases of HIV infection for both males and females from 2002 to 2007. This means that the activities of GAC have contributed to a decline in the number of new male and female HIV infections. The contribution of GAC to the reduction in HIV/AIDS in the southern sector as indicated by our results may partly explain the reduction in prevalence rate in the eastern region [2]; the highest HIV/AIDS endemic region in the southern sector. This may be the result of the robust multiprogramming intervention approach put in place by the GAC to minimise the spread of the disease [2]. These results show a positive effect of the GAC activities in reducing the number of male and female new HIV infections in the sector. The significant contributions of GAC to the management of new cases of HIV infection in the southern sector in particular need recognition.

The success of GAC activities in the southern sector was not insulated from the general challenges facing NACs. Lack of power and institutional structure to effectively coordinate their activates,

as well as conflict of activities with other bodies playing the same role are some of the challenges mitigating against the successful activities of the AIDS commissions [1,2,16]. In the case of Ghana, NACP seem to be playing a multisectoral and multidisciplinary coordinating role as GAC. These conflicts of roles could partly explain the insignificant impact of the GAC activities in the northern sector. To effectively observe the significant impact of the commission activities in all sectors of Ghana, a clear definition of the roles of GAC and NACP should be mutually exclusive so as to maximum the use of scarce resources and provide clear cut policy direction to achieve the desired results. Our results partly support the study by Asante and Fenny [14] findings that the activities of GAC have been improved significantly but contrary to their assertion that it has been improved in all the regions. Our findings indicate the effect is on the southern sector of Ghana where the epidemic is higher. This could be that more of the activities of GAC are concentrated in the southern sector due to the high prevalence and proximity.

The differences in the effect of GAC activities in the two sectors may partly due to the social economic factors and religious differences. While the northern sector is predominantly Muslims who encourage polygamous relationship, the southern sector is largely Christianity and polygamy is discouraged. In addition, the illiteracy rate in the northern sector is higher in Ghana compared to the southern sector [17–21] contributing partly to the differences in the evidence in regard to the impact of GAC activities. The poverty levels in the northern sector are higher than the southern sector, especially people from the northern, upper east and upper west regions [22,23] and may partly hinder or mitigate against the effectiveness of the GAC activities.

5.1. Strength and limitation

Intervention time series modelling is a stochastic process that uses past and present observations and intervention variables; both pre- and post-intervention period to examine the effectiveness of policies over time. The strong theoretical foundation of ARIMA and intervention models makes them attractive tools for examining the impact of policies. In addition, it provides an insight to the dynamics of HIV/AIDS and the intervention model for reliable assessment.

Although, we were able to ascertain statistically that the establishment of GAC has been beneficial to the management of HIV epidemic in Ghana in general and specifically in the southern sector, qualitative research through administration of questionnaires will help to strengthen the findings of this research and explain some of the outcomes. We were not able to examine the activities of GAC by age groups due to inconsistent age groupings of the data. The age groups change consistently year after year making it impossible for us to model age groups. There have been nil or limited published studies on the quantitative assessment of the effectiveness of NACs and this study would add to enhance this area of study.

6. Conclusion

The establishment of GAC have been a success as its activities have contributed to statistical significant reduction of 15% and 18% in new female and male HIV infections respectively in the southern sector in particular. However, GAC needs to redouble its efforts at ensuring that its activities have an impact in reducing new HIV infections in the northern sector.

Contributors

Conception and design of the study; acquisition of the data; formulation of the analysis plan; analysis and interpretation of data; contributing to the draft of the manuscript; revision of article for important intellectual content and incorporating co-author feedback were all done by PAS. UM and JC reviewed and edited it critically for important intellectual content. All authors gave final approval of the submission.

Ethics approval

Only de-identified data were analysed to preserve patient confidentiality. Approval was given by Edith Cowan University ethics committee and GAC and NACP to carry out the study

Conflict of interest

None declared.

Financial disclosure

None declared.

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