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Trend of HIV/AIDS Reported Cases in Morocco Between 1986 and 2019: A Time Series Analysis

Khoudri I*, Ghannam M, El Kettani A, Sakhri N, Mahdaoui E, Ghargui L, Salem H, Lmchalhi R, El Omari B and Youbi M

Directorate of Epidemiology and Diseases Control. Ministry of Health. Rabat, Morocco

***Corresponding author:** Khoudri I, Directorate of Epidemiology and Diseases Control. Ministry of Health. Rabat, Morocco. Tel: 00 212 6 62 82 38 81, Email: ibtissamkhoudri@gmail.com

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Abstract

Background: Morocco is a low endemic country of HIV/AIDS that achieved the goal of the second and third 90-90-90 targets in 2019 while still 78% of people living with HIV know their HIV status. The aim of this study was to analyze time trends of HIV/AIDS reported cases during the last 33 years taking into consideration the implementation of voluntary HIV counseling and testing (HCT) services in primary health care facilities.

Methodology: This was a time series of HIV/AIDS reported cases at national level between 1986 and 2019. Variable collected for each year were HIV/AIDS reported per 100000 H, age category, gender, origin, CD4 count and route of transmission. Trend of HIV/AIDS reported cases was assessed by Joinpoint Regression Analysis. Annual percentage changes (APCs) were estimated to identify the years (joinpoint) when significant changes occurred in the trend. We therefore examined trends in HIV/AIDS reported cases according to epidemiological variables.

Results: Cumulative HIV/AIDS reported cases during the study period was of 17 000. Joinpoint regression showed an increase in HIV/AIDS reported cases between 1986 and 2019. The APC for the period 1986-2012 was of 13.4 (95% CI: 12.0 to 14.8, $p < 0.05$) and the APC from 2012 to 019 was of 5.4 (95% CI: 2.5 to 8.5, $p<0.05$) with a significant break in the same joinpoint year than HCT implementation in primary health care settings. In stratified analysis, HIV/AIDS reported cases increased but not significantly after joinpoint. A significant decrease was noted in 2015 in urban areas (APC = -10.0, 95% CI: -17.0 to -2.3, $p<0.05$).

Conclusions: HIV/AIDS reported cases were increasing over 33 years, with a significant rise after 2012by 5% per year, corresponding to HCT integration into primary health care setting. Furthermore, Morocco is may be on the right way to eliminate HIV/AIDS in urban areas.

Keywords: HIV, AIDS, Case Reporting, Trends

List of abbreviations

ACP: Annual Percentage Change
AIDS: Acquired Immune Deficiency Syndrome
ART: Anti-Retroviral Therapy
CD4: T Cells
CI: Confidence Interval
HCT: HIV Counseling and Testing
HIV: Human Immunodeficiency Virus
NACP: National AIDS Control Program
NGO: Non-Governmental Organizations
UN: United Nations
UNAIDS: Joint United Nations Program on HIV/AIDS
WHO: World Health Organization

Introduction

Human immunodeficiency virus (HIV) infection is one of the leading cause of morbidity and mortality all over the word. Globally, 38 million people were living with HIV in 2019 with 1.7 million new HIV infection and 690 000 AIDS related deaths [1]. Middle East and North Africa contributed with less than 1.5% of global HIV-infected people, new infections and deaths.

Morocco is a concentrated epidemic country of HIV/AIDS that adopted the global 90-90-90 HIV prevention targets by 2020 in order to eliminate HIV/AIDS by 2030 [2]. Achieving these targets at country level highly depends on the trend of HIV infection, the burden of the disease, national response strategy, commitment and capacity of implementation. Morocco has achieved the second and third 90-90-90 targets in 2019 while still 78% of people living with HIV know their HIV status [3].

The first AIDS patient was diagnosed in Morocco in 1986, five years after first HIV case was detected globally by the United States Centers for Disease Control and Prevention. The National AIDS Control Program (NACP) of Ministry of Health is the main body that ensures the governance of the national response according to a participatory approach involving government departments and civil society. NACP provide the framework for the national response through successive strategic plans. In Morocco, great efforts were undertaken over several decades to control HIV/AIDS. The estimated number of new infections decreased by 25% during the past ten years and the proportion of people living with HIV who know their HIV status increased from 24% in 2012 to 78% in 2019. Since 1999, the World Health Organization (WHO) has promoted the implementation of population-based surveillance systems, for the new HIV cases [4]. In Morocco, AIDS has been a mandatory notified disease since 1986 and HIV testing is anonymous and voluntary in the country. Since the beginning of the epidemic until the end of 2019, new HIV/AIDS cases reported in Morocco increased progressively to reach 17 000 cumulative new cases reported by the end of 2019, of which 62% have been reported from 2012 to 2019 [3]. HIV testing and counseling was for several years limited to civil society settings. Since 2012, NACP has extended HIV screening strategy and introduced voluntary HIV counseling and testing (HCT) in primary health care facilities with national screening campaigns using rapid tests [5].

The aim of this study was to examine the trends of HIV/AIDS reported cases in Morocco between 1986 and 2019 and evaluate whether HIV testing strategy was associated with an increase in cases reported. The evidence generated will be used as a baseline information for planning, monitoring and evaluating NACP interventions throughout the health care system.

Material and Methods

Study Design

We performed a time series study based on HIV/AIDS reported data registered in Morocco between 1986 and 2019. Morocco is a northwestern African country of 35 million habitants that includes 12 administrative regions and more than 70 provinces, 60% of the general population are in urban areas. We estimated the number of people living with HIV in 2019 to 21 500 person [3]. All data recorded and analyzed in the study are anonymized.

Data Collection

HIV/AIDS reported cases per 100 000 habitants were calculated from the NACP database and population data obtained from *le Haut Commissariat au Plan* [6] for the period 1986-2019. Data collected, for each year, were also age category (adult, child), gender, rural or urban origin, possible route of transmission (sexual, blood or mother to child) and CD4 cell count. Data were recorded for all the new cases registered during the same period.

Medical practitioners in public health centers ensure HIV/AIDS case notification, before initiating antiretroviral therapy (ART). A total of 20-health facilities ensured treatment and follow up of people living with HIV in 2019. HIV/AIDS new cases confirmed in hospital facilities are reported semi-annually on an electronic or paper form to NACP.

Statistical Analysis

Observed trend of HIV/AIDS reported data was first described between 1986 and 2019. Then, a Joinpoint Regression Analysis was conducted to assess the time trends [7]. Joinpoint regression detects years when a significant change in HIV/AIDS reporting trend has occurred. This method is widely used in trend analysis of incidence rate or mortality of several diseases [8,9].

Joinpoint regression analysis was adjusted to estimate the Annual Percent Changes (APCs) and to identify the joinpoints or years where significant changes over time in the linear slope of the trend had occurred. Statistical significance was tested using the Monte Carlo Permutation method [7]. A maximum of one joinpoint was allowed in the model and each APC segment was calculated using a log-linear model. The 95% confidence intervals (95% CI) were calculated for each APC and were used to determine whether the APC for each segment was significantly different from the previous time segment. A p value <0.05 was considered statistically significant. Furthermore, a stratified analysis by age, gender, origin, region, route of transmission, origin and CD4 count were also studied. Joinpoint regression analysis was performed using Joinpoint Regression Program, version 4.2.0.2 (United states National Cancer Institute, Bethesda, MD, USA) [10].

Results

Epidemiological Characteristics of HIV/AIDS between 1986 and 2019

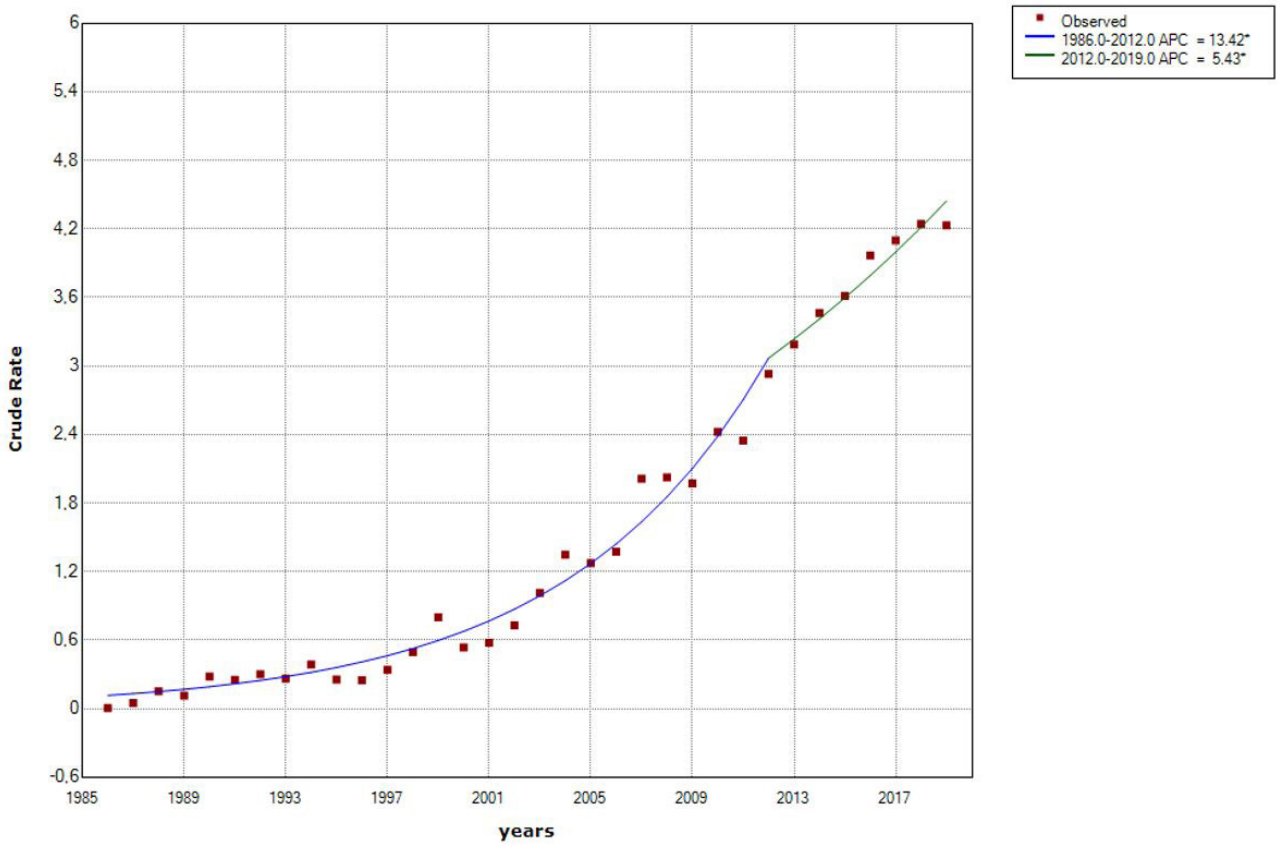
A total of 17 000 cumulative HIV/AIDS cases were recorded at national level between 1986 and 2019. Median of HIV/AIDS reported per year was 265 [67-817]. Globally, 52% were male and 97% were aged over 15 years old. CD4 count was >200 cell/ul in 51% of cases. HIV/AIDS reported cases were from urban area in 88% of cases. Predominant route of transmission was sexual in 94% of cases, reported mother to child transmission represented 3% of cases. Epidemiological characteristics of cases reported are shown in Table 1.

	n (%)
Reported new cases*	265 [67-817]
Gender	
Male	8768 (52)
Female	8186 (48)
Age	
Adult	16015 (97)
Child	451 (3)
CD4 count >200 cell/ul	8542 (51)
≤200 cell/ul	8324 (49)
Origin	
Urban	12710 (88)
Rural	17014 (12)
Route of transmission	
Sexual	15327 (94)
Blood	445 (3)
Mother to child	509 (3)

*Median [quartiles], n(%): number (percentage)

Table 1: Epidemiological characteristics of HIV/AIDS reported cases in Morocco during the period 1986-2019

Time Series of HIV/AIDS Reported Cases



APC: Annual percent change. ^difference statistically significant (p<0.05).

Figure 1: Observed and analyzed trend of HIV/AIDS reported cases in Morocco between 1986 and 2019

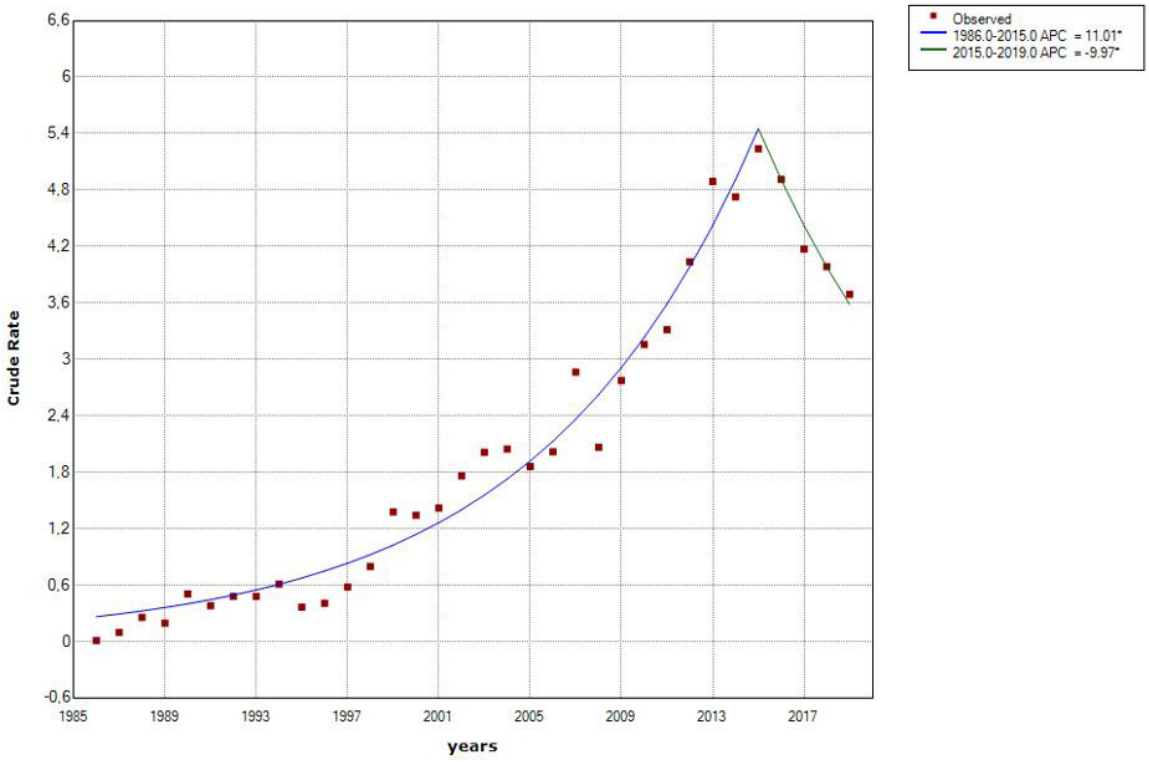
The joinpoint regression analysis showed a significant rise in HIV/AIDS reported cases between 1986 and 2019 (Figure 1). HIV/AIDS notification increased by 13% per year from 1986 to 2012 and continue to increase by 5% from 2012 to 2019. The APC for the period 1986-2012 was of 13.4 (95% CI: 12.0 to 14.8, p <0.05) and the APC for the period 2012-2019 was of 5.4 (95% CI: 2.5 to 8.5, p<0.05). The joinpoint corresponded to the year 2012.

	Period from 1986 to the year joinpoint			*Joint-point* (year)	*Period from the joinpoint to 2019*		
	APC	**CI 95%**	***p***		**APC**	**CI 95%**	***p***
Gender							
Male	11.9	10.7 to 13.1	<0.05	2014	1.3	-3.9 to 6.9	NS
Female	15.5	13.9 to 17.1	<0.05	2014	-2.9	-8.1 to 2.7	NS
Age							
Adult	13.2	12.1 to 14.4	<0.05	2014	-0.3	-4.7 to 4.3	NS
Child	14.6	10.2 to 19.1	<0.05	2013	2.1	-10.7 to 16.7	NS
CD4 count							
>200 cell/ul	16.2	14.0 to 17.5	<0.05	2015	2.7	-7.9 to 14.5	NS
≤200 cell/ul	14.9	12.5 to 17.3	<0.05	2008	0.9	-1.3 to 3.1	NS
Route of transmission							
Sexual	14.7	13.3 to 16.1	<0.05	2014	-0.6	-5.4 to 4.4	NS
Blood	17.6	11.0 to 24.5	<0.05	2012	-1.4	-10.5 to 8.7	NS
Mother to Child	2.9	1.9 to 4.9	<0.05	2014	-10.7	-29.6 to 13.3	NS
Origin							
Urban	11.0	9.9 to 12.2	<0.05	2015	-9.9	-17.0 to -2.3	<0.05

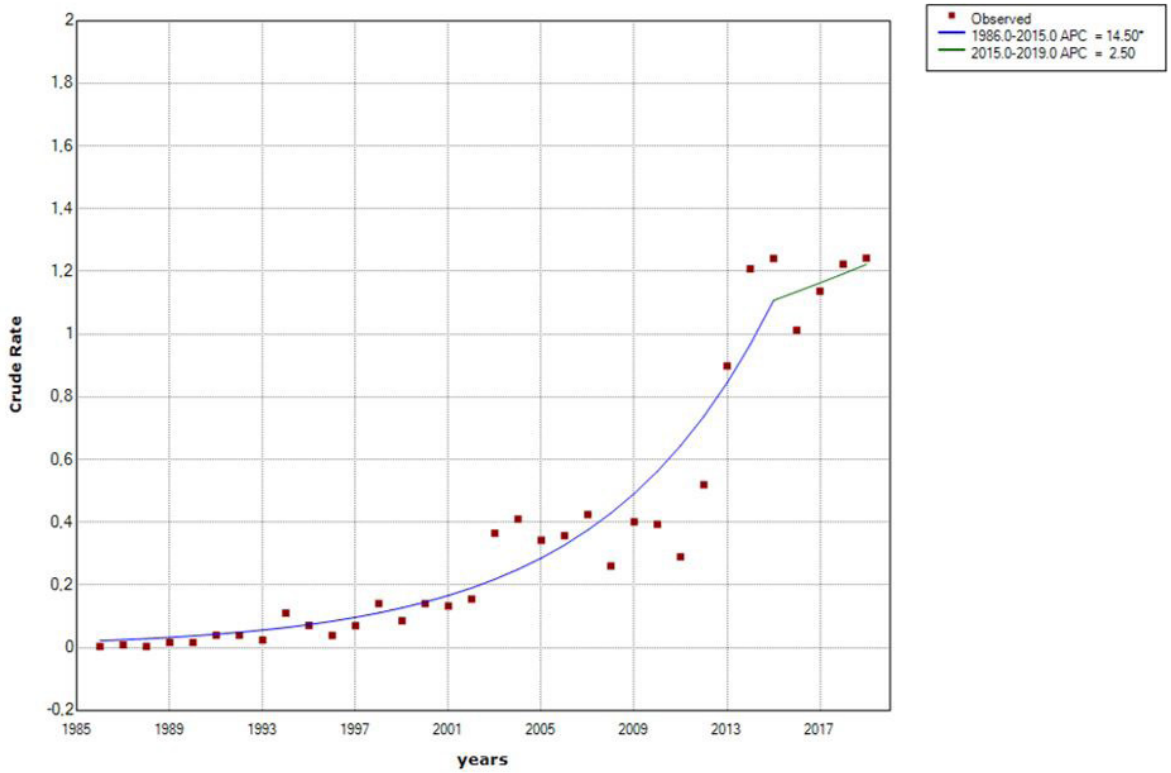
AIDS: Acquired Immunodeficiency Syndrome, APC: annual percent changes, CI: confidence interval, NS : difference statistically non significative (p≥0.05)

Table 2: Stratified join point regression analysis for HIV/AIDS reported cases during the period 1986-2019

A



B



APC: Annual percent change. ^difference statistically significant ($p<0.05$).

A: Urban area

B: Rural area

Figure 2: Join point regression for HIV/AIDS reported cases in urban and rural areas during the period 1986-2019

The stratified joinpoint regression analysis (Table 2) showed that the HIV/AIDS notification increased significantly before the joinpoint years with regard to age, gender, CD4 count, route of transmission and origin. There was also an increase noted after the joinpoint years but not significantly in male, children, CD4 count ≤ and >200 cell/ul, and in rural areas (Table 2). However, HIV/AIDS notification decreased significantly after the joinpoint years in urban areas (APC = -10.0, 95% CI: -17.0 to -2.3, $p<0.05$) (Figure 2).

Discussion

This study shows that HIV/AIDS reported cases in Morocco was significantly increasing over years with a significant rise by 5% since the introduction of HIV testing and counseling in primary health care level in 2012. Stratified analysis has shown that HIV/AIDS notification decreased significantly by 10% after 2015 in urban areas.

NACP is one of the oldest programs in the Ministry of Health that was set up in 1988. NACP has always adopted new approaches that enhance the efficiency of testing and increase the coverage of treatment, with the support of the Global Fund and UN agencies. To realize the full promise of early HIV diagnosis and treatment for the prevention of additional HIV cases, efforts to ensure prompt notification following a new HIV diagnosis are crucial [11]. The first center of voluntary testing and counselling was created in 1992 by *Association de Lutte Contre le Sida*, a leading Moroccan civil society in HIV/AIDS. The progressive extension of HCT centers of NGOs have widely contributed to increase HIV/AIDS reported cases. HIV/AIDS notification was early based on a sentinel surveillance for a specific population group during the 90s, and then several interventions have led to increase HIV/AIDS cases reported by 13% from 1986 to 2012. Main examples are: strengthening outreach programs for key population in NGO settings, large rising awareness campaigns at national level, introduction of HIV rapid test in 2004, extension of HIV testing services (HTS) for larger coverage in NGO settings.

HIV/AIDS reported cases have been increasing since 1986 with a significant break in the curve occurring in 2012. Morocco has launched the first mass national campaign of HIV testing in the same year, involving for the first time primary health care level in HCT. More than 200 000 rapid tests have been used in 2012 compared to 57 567 in 2011 and 45 704 tests in 2010. It seems therefore that extension of HCT strategy to primary health care settings may be associated with increasing HIV/AIDS notification. Prior to 2012, HCT were performed exclusively in NGO settings where most affected population groups may had easier access. Primary health care presents opportunities to increase diagnosis [12]. Even though stigma and system factors have been found to impede HIV testing [13], engaging primary health care facilities to provide HCT is likely desirable from an efficiency point-of-view [14].

More than 60% of cumulative HIV/AIDS reported cases in Morocco were registered after 2012. Indeed, primary health care presents opportunities to increase diagnosis, compared with general population screening, HIV tests used in routine clinical care have a high probability of detecting a positive person [12] and a continuing education program of practitioners increase intentions to perform routine HIV testing [15].

HIV/AIDS reported cases decreased significantly by 10% in 2015 in urban areas. This may be due to multiple factors like change in sexual risk behavior, higher educational level of urban population, easier access to prevention and healthcare facilities, early implementation of test and treat approach, growing performance of preventing mother-to-child transmission. Morocco seems then to be on the right way to eliminate HIV in urban area. "Cities ending the AIDS epidemic" concept of UNAIDS endorsed by Morocco may contribute to this finding also. Indeed, large numbers of people can be easily reached in cities, including people at high risk of HIV infection, with cost-effective health and other social protection services. Cities also have large and relatively good service infrastructure, resources and regulatory powers, and are centers for education, innovation, creativity, positive social change and sustainable development [16].

The present study is the first one that reported data on HIV/AIDS cases registered in Morocco for more than 30 years. It has the strength to gather information comprising all cases reported nationally through NACP. However, some limitations of the study have to be considered when interpreting findings: 1/ NACP data may present inconsistencies in the quantity and quality of information over time and between the referral centers. Notification maybe underreported despite the progress achieved in terms of HCT strategies, updated treatment protocols, psychosocial support and training of healthcare workers. 2/ Stratified analysis showed that HIV/AIDS reported cases increased significantly prior to 2012. There is no doubt that NACP interventions have played an important role to improve the proportion of people living with HIV who know their HIV status over years and by the way increasing HIV/AIDS reported cases. However, implementation of laws reducing stigma improvements in socioeconomic conditions, education level and other cultural factors should also be considered, even if their contribution remains difficult to assess [8]. These issues deserve further investigations and may provide valuable insights. 3/ The joinpoint regression analysis used in the study is an analytical but exploratory method that does not take into account factors that may influence HIV/AIDS trends. A further study, using interrupted time series analysis with a multivariate approach is required and is currently on the way in order to assess, in statistical terms, how much an intervention changed an outcome of interest and whether factors other than the intervention could explain the change [8, 17]. Despite these limitations, the data analyzed in our study are consistent and representative for a country over a period of several decades.

Conclusions

This time series demonstrated an increase of HIV/AIDS reported cases over many years of targeted and maintained national response. HIV/AIDS reported cases increased by 5% per year since implementation of HCT in primary health care level. This fact can suggest a possible influence of this intervention on HIV/AIDS reporting trend. An interrupted time series analysis is needed to confirm this hypothesis. Other studies are also required to explore the factors related to the drop of HIV/AIDS reported cases in urban areas.

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