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قال تعالى :

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صدق الله العظيم

سورة النازعات (آيات 40 و 41)

Dedication

This work is dedicated to my wife RafiAA, Daughters
Omnia and Aseel, who have been very dear to me
throughout both the good and rough times

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List of Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
ASMRs	Age Specific Mortality Rates
ASSA	Actuarial Society of South Africa
CBR	Crude Birth Rate
CDC	Centers for Disease Control
CDR	Crude Death Rate
CSWs.	Commercial Sex Workers
DNA	Deoxyribonucleic Acid
EPIMODEL	Program That Estimate the Number of AIDS
	Deaths
EPP	Epidemiological Projection Package
FSW	Female Sex Workers
GDP	Gross Domestic Product
GLM	General Linear Model
GNP	Gross National Product
HAART	Highly Active Antiretroviral Treatment
HIV	Human Immunodeficiency Virus
HSS	HIV Sentinel Surveillance
IDS	Intercensal Demographic Survey
IDU	Injecting Drug Users
IWGAIDS	Interagency Working Group on AIDS
LDCs	Least Developed Countries
MDGs	Millennium Development Goals
MSM	Man Having Sex with Man
MTC	Mother to Child
NSGRP	National Strategy for Growth and Reduction of
	Poverty
OLS	Ordinary Least Square
PTR	Perinatal Transmission Rate
RBG	Risk Behavior Groups
RNA	Ribonucleic Acid
SDHS	Sudan Demographic and Health Survey
SNAP	Sudan National AIDS Control Programme
SPSS	Statistical Package for Social Science
STDs	Sexually Transmitted Diseases
STIs	Sexual Transmitted Infections
TB	Tuberculosis
TDHS	Tanzania Demographic and Health Survey
TFR	Total Fertility Rate
UNAIDS	Joint United Nations Program on HIV/AIDS
UNFPA	United Nations Population Fund
ZDHS	Zimbabwe Demographic and Health Survey

Abstract

The main objective of this study was to improve the methodological basis for modeling the HIV/AIDS epidemics in adults in sub-Saharan and to develop estimates of prevalence, incidence and mortality and to study the impact of HIV/AIDS on life expectancy and population growth with examples of Zimbabwe, Tanzania and Sudan. Understanding the magnitude and trajectory of the HIV/AIDS epidemic is essential for planning and evaluating control strategies.

Previous mathematical models were developed to estimate epidemic trends based on sentinel surveillance data from pregnant women. In this study, we have extended these models in order to take full advantage of the available data. The methodology involved a Gauss Newton approach for the estimation of prevalence and incidence of HIV/AIDS in the studied countries using curve fitting procedure. Further back calculation method was used to estimate AIDS cases and mortality. Also life tables were constructed to assess the impact of HIV/AIDS on life expectancy. To trace the impact of HIV/AIDS on population growth, we have projected the population growth with and without AIDS using demographic techniques for estimating population growth.

For every country three models were estimated and the best among them were selected for Zimbabwe, double logistic curve has been selected. The same model was found to be suitable for Tanzania. For Sudan, we used the rational model because it produced suitable fitting of the data. Also the estimated models were compared with the UNAIDS estimate.

Our application to the model revealed the impact of HIV/AIDS in the target countries where adult HIV prevalence is significant. The epidemic has already had a number of serious consequences, including rise in the number of deaths and the reduction of life expectancy and the, particularly deaths of persons aged 15 to 49. Furthermore, some of the serious effects of the epidemic are expected to worsen in the future. By the year 2020 population of studied countries is expected to be lower than it would have been in the absence of AIDS. Increases of mortality have been particularly marked in the Zimbabwe the country with the highest HIV prevalence. Also life expectancy at birth has already fallen dramatically, dropping within a decade or two to levels last recorded before 1985, and in the cases of Tanzania, the impact of HIV/AIDS on mortality and

population growth is of less degree than in Zimbabwe, this due to the fact that Tanzania epidemic is considered as moderate. For Sudan the impact of HIV/AIDS is less effective, because the epidemic is of low level.

The study recommends the development of ANC data since it is the only available source and to use different stochastic epidemiological curves for fitting data, and finally to validate the HIV/AIDS impact by other independent studies.

الهدف الرئيس لهذه الدراسة هو تطوير المنهجية المستخدمة لنمذجة اثر وباء الايدز في جنوب الصحراء الافريقية وذلك بالتركيز علي شريحة البالغين. وهدفت ايضا لقياس واسقاط معدلات الحدوث والاصابة والتاثير المباشر لمرض الايدز على الوفيات، توقع الحياة عند الميلاد والنمو السكاني. ركزت الدراسة على ثلاث أقطار هي زيمبابوي، تنزانيا والسودان. وتتبع أهمية هذه الدراسة من حقيقة أن أثر الايدز أصبح جلي على التنمية ولا يمكن السيطرة عليه إلا بتوفر المعلومات الكافية لانفاذ الخطط والاستراتيجيات لمكافحة.

النماذج السابقة تم إعدادها لتقدير اتجاهات الوباء اعتماداً على بيانات نظام الرصد المرضي للنساء الحوامل اللائى راجعن الخدمات الصحية اثناء الحمل وقمن بإجراء اختبار مرض الايدز. اعتمدت منهجية هذه الدراسة على تطوير هذه النماذج مع تعديل بعض الافتراضات، وساعد في ذلك البيانات المتوفرة في الفترة الأخيرة. تضمنت المنهجية أيضاً استخدام طريقة جاوس نيوتن التكرارية لتوفيق منحنيات الإصابة بالأقطار المدروسة. وتم استخدام أسلوب الاسقاط الخلفي لاحتساب عدد المصابين بمرض الايدز والوفيات الناجمة عن المرض. أيضاً تم تكوين جداول الحياة لقياس تأثير المرض على توقع الحياة عند الميلاد. كما تم الاعتماد على الاساليب الديمغرافية لقياس أثر هذا الوباء على النمو السكاني بالأقطار المدروسة. لكل قطر من الأقطار تم توفيق ثلاث نماذج شائعة الاستخدام في علم الوبائيات ومن بينها تم اختيار الأفضل وفقاً للمعايير الإحصائية. وللتأكد من قدرة هذه النماذج على تمثيل البيانات تم مقارنتها بنموذج برنامج الأمم المتحدة المشترك لمرض الايدز.

أثبتت نتائج النموذج أن للايدز أثر عميق على الأقطار المدروسة، حيث أن هناك ارتفاع جلي في معدلات الإصابة بالمرض وزيادة في عدد الوفيات الناتجة عن المرض، كما تم انخفاض توقع الحياة عند الميلاد بصورة واضحة. ومن الآثار المهمة تقليل معدل النمو السكاني في المستقبل بدرجة واضحة مقارنة بسيناريو عدم وجود المرض فمثلاً بمرور العام 2020 ستكون أعداد السكان أقل من ما كان متوقعاً في حالة عدم وجود المرض. تأثير المرض على الدول المختلفة سجل بدرجات متفاوتة، حيث سجلت زيمبابوي الأثر البالغ للمرض على الوفيات وتوقع الحياة عند الميلاد والنمو السكاني. بينما جاءت تنزانيا في المرتبة الثانية من ناحية أثر المرض وذلك ناتج من حجم الوباء (وسيط). أما السودان فجاء في المرتبة الثالثة من ناحية تأثير الوباء وذلك لأن المرض في السودان يوصف بأنه منخفض المستوى.

توصي الدراسة بتطوير نظام الرصد المرضي لأنه المصدر الوحيد لبيانات المرض
بالأقطار المختلفة، والانتقال من الاعتماد على النماذج المحددة إلى النماذج الاحتمالية
لتوفيق منحنيات الإصابة وذلك بجانب إجراء دراسات مستقلة لقياس أثر الأيدز الديمغرافي.