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A NOVEL WEB-BASED SYSTEM TOLOCATE, TRACK AND ASSIST HIV PATIENTS

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ABSTRACT

In this paper, we first discuss *Human Immunodeficiency Virus* (HIV) *and Acquired Immune Deficiency Syndrome* (AIDS) and its history/impact across the globe. Secondly, we analyze the available methods and tools for locating areas with HIV/AIDS, the relevant fieldwork carried out, and identify the uncovered gaps in them despite their great job done in the course of combating it. Next, we present our novel web-based system which is intended to cover up gaps left in the existing web-based systems through gathering of detailed geographical, social, economic, political, and statistical information in line with combating or impact of HIV/Aids in the smallest sub- divisions of the world community across the globe. Lastly, we discuss the research conducted so far and highlight some of the problems faced by communities due to HIV/Aids mainly in areas affected by poverty.

KEYWORDS: HIV, AIDS, HIV/Aids statisticalanalysis, HIV/Aids social impact, donations.

I. INTRODUCTION

Human Immunodeficiency Virus (HIV) *and AcquiredImmune Deficiency syndrome* (AIDS) is a spectrum of conditions caused by infection of the Human Immunodeficiency Virus (HIV).

HIV is a virus that targets and harms the immune system, increasing the risk and impact of other infections and diseases.[1]

"Almost 1 million people die from HIV/AIDS each year; in some countries it's the leading cause of death".[1]

HIV/AIDs is still incurable.[2] and for someone to live longer with the disease, treatment is so costly,[3] whereby the financially disabled victims are at high risk of falling sick and dying at an early age.

According to **Centers for Disease Control and Prevention,**[4] body fluid like blood, semen (cum), pre-seminal fluid (pre-cum), rectal fluids, vaginal fluids, and breast milk from a person who has HIV can transmit HIV.

Symptoms of HIV vary depending on the stage of infection. In some people the infection manifest in the first few months after being infected while many stay unaware of their status until the later stages according to **World Health Organization.**[5] Among the symptoms include Fever, Fatigue, Swollen lymph, Diarrhea, Weight loss, Oral yeast infection, Shingle and Pneumonia.

"HIV-1 is transmitted by sexual contact across mucosal surfaces, by maternal-infant exposure, and by percutaneous inoculation.".[6] However, early access to treatment reduces the risk of ill health or death and also prevents new HIV infections, as someone with HIV who is virally suppressed on treatment reduces risks of passing on the virus to sexual partners.[7]

It is believed that the earliest case of HIV in a blood sample of a human came from the Democratic Republic of Congo.

The most common form of the virus spread from chimpanzees to humans sometime before 1931, most likely during "bush meat trading". It so happened that hunters came into contact with animal blood while hunting chimpanzees. About 100,000 to 300,000 people were infected with HIV before the 1980s.

According to ***Global HIV & AIDS statistics — 2020 fact sheet,***[8] more than 75.7 million people have been infected with the HIV virus and about 32.7 million people have died of

HIV since the beginningof the epidemic.

The vast majority of people living with HIV are located in low- and middle- income countries, with anestimated 66% living in sub-Saharan Africa. Amongthis group 19.6 million are living in East and Southern Africa which saw 800,000 new HIV infections in 2017. Most of these children live in sub-Saharan Africa and were infected by their HIV- positive mothers during pregnancy, childbirth or breastfeeding.

The purpose of this research is to explore, analyze the current technological initiatives that attempt to help in fighting the human immunodeficiency virus (HIV) and finally propose a web-based system that will bridge all the gaps left behind by the existing online platforms.

II. LITERATURE REVIEW

In order to combat HIV/Aids, several works have been carried out and measures taken/put in place. Here we look at the approach to HIV/AIDs epidemicthrough use of technological tools mainly existing web applications used to collect and publish HIV/AIDs related information.

1. World by Map,[9] is a website which gives details about so many different topics concerning the wholeworld among which there is Health related information. In line with our research, under the topic of Health, we focused more on HIV/Aids information which is displayed in a statistical format per countryin the world as shown in **(Figure 1).**

2. However, both the statistical and the additional non- statistical information provided are not detailed enough to indicate the impact based on gender, age, living condition, financial/social/political climates, among others. Therefore, the information to gather here is inadequate to help in the purpose of research and proposing effective strategies to combat the virusfrom deep down in the communities under investigation.

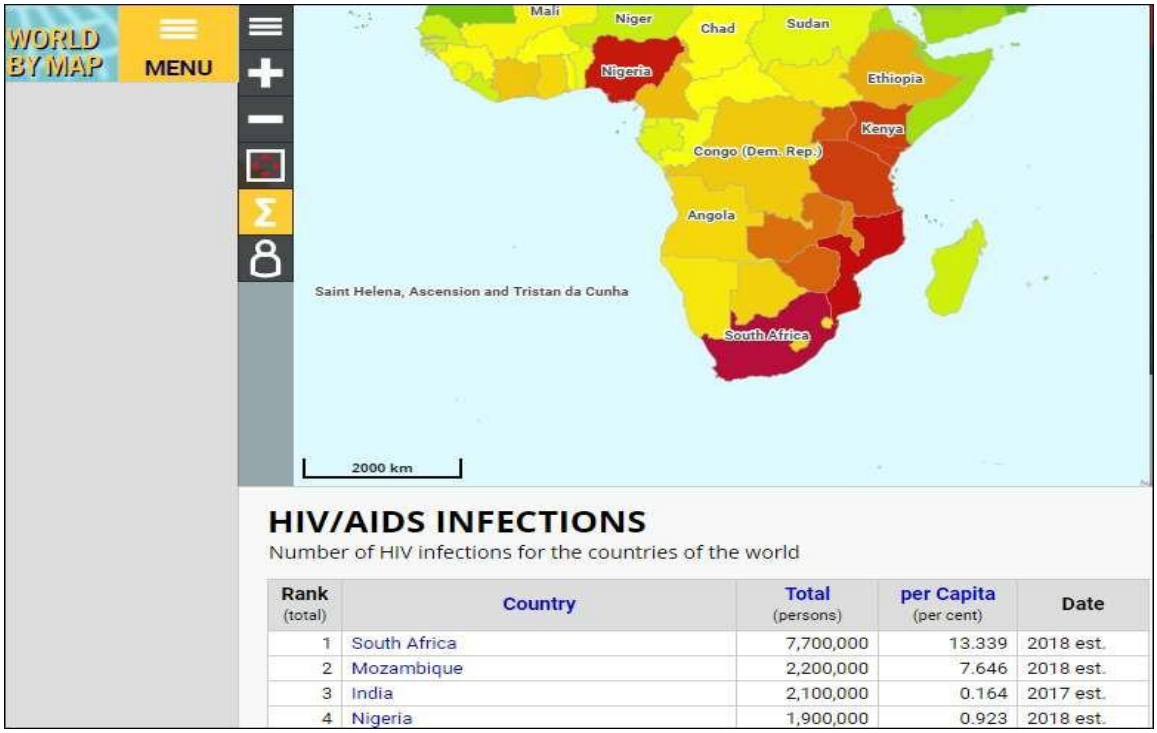

Figure 1: Web interface of World by Map.

3. World atlas,[10] is another website which describes countries with the highest rate of HIV/Aids in the world depending on data provided by CIA World Fact book [4] as shown in (Figure 2). It goes ahead to explain HIV/Aids information for the listed countries as shown in (Figure 3). Total percentage infected out of the total country population, gender percentage and age percentage of HIV/AIDS is give given per country. It also outlines the major causes and channels of spread as shown in (Figure 3).

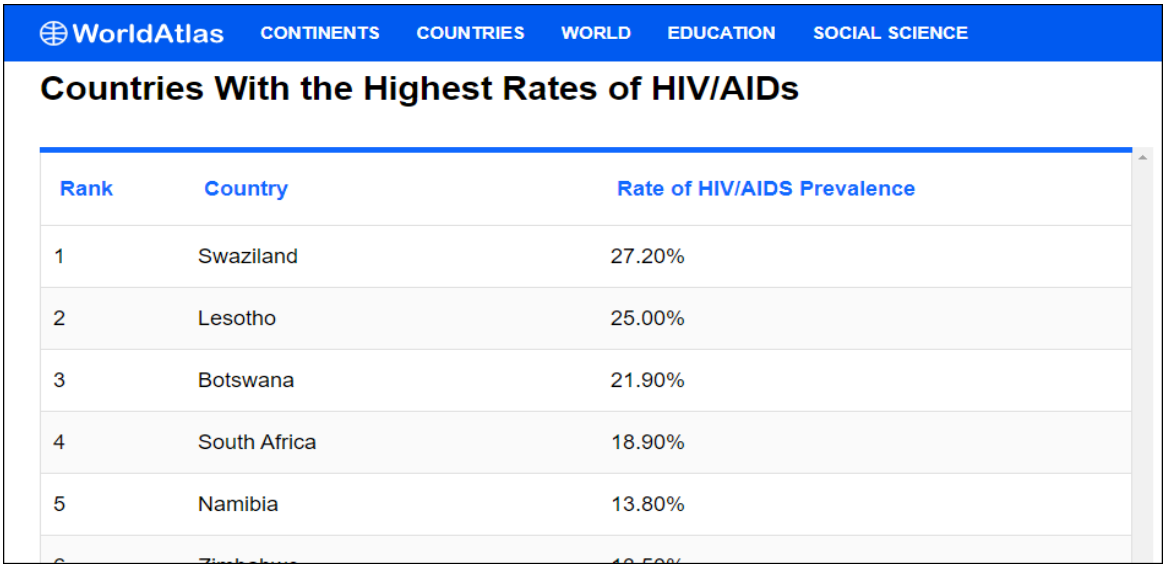

Figure 2: World Atlas showing highest rates of HIV/Aids in the world.

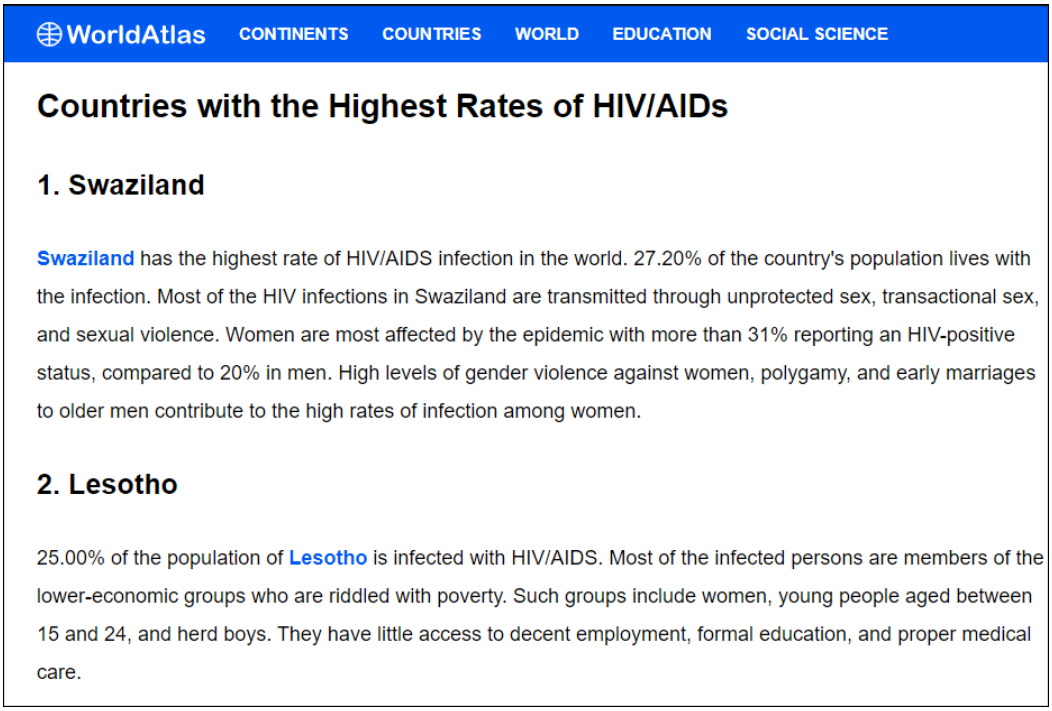

Figure 3: World Atlas listing countries infected by HIV/Aids.

Some major weaknesses of World Atlas identified are

Firstly, it does not give suggestions on what is to be done to eliminate the problems in the spotted regions/countries. Secondly, it does not go further to capture details of smaller divisions within the countries. Thirdly, it does not explain the impact of HIV/AIDS in the highly affected regions that greatly need assistance either from outside or from within their governance. Also it does not indicate the precise location of infected zones within the countries to enable researchers to carry out in-depth investigation.

4. AVERT[11] is another online system that shows HIV/Aids infection statistics for the major world divisions (East and Southern Africa, West and Central Africa, Asia & the Pacific, Middle East & North Africa, Latin America and the Caribbean, Eastern Europe & Central Asia, Western Europe, Central Europe & North America) as shown in (**Figure 5)**. From the main world divisions, it goes to nation/country levels and provides statistics country-wise (**Figure 4)**). It also shows annual statistics of people infected, number of deaths and number of medications received for adults/children, as shown in(**Figure 6**).

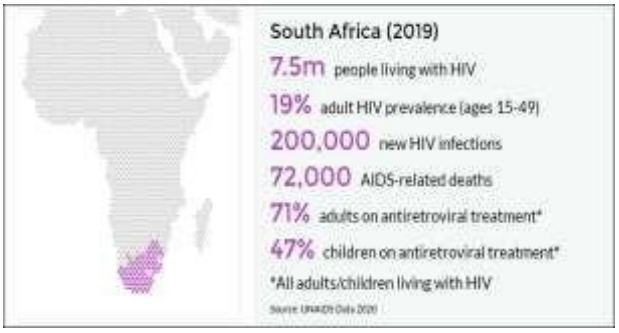

Figure 4: AVERT showing HIV/Aids in the given country.

It also teaches on how the disease is spread, categories of people at risk of getting affected by the disease and spread prevention strategies. In spite of it being such a resourceful system, its functionalities do not efficiently contribute to proper uproot on diseases from its most firm bases.

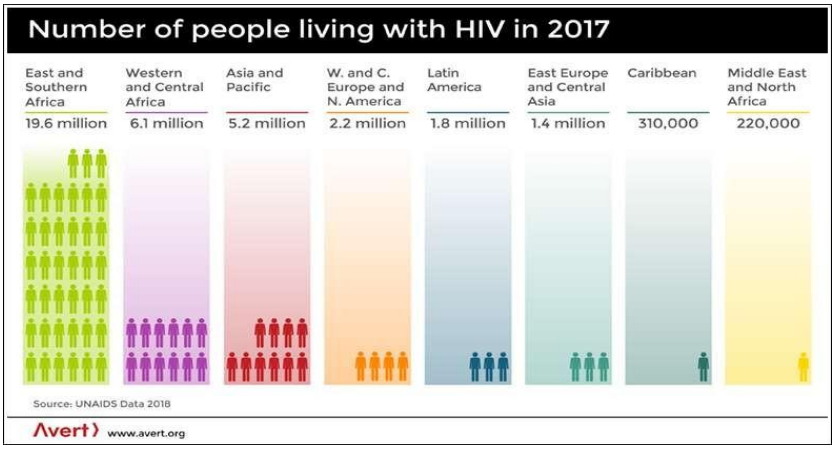

Figure 5: AVERT showing HIV/Aids in the world main divisions.

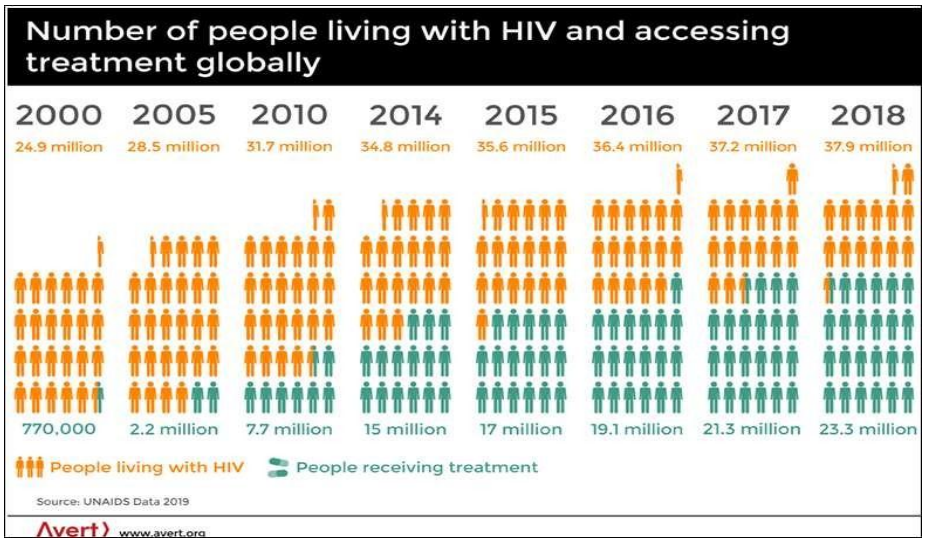

Figure 6: Shows number of people receiving HIV/AIDs medication on a yearly basis.

5. UNAIDS[12] *is a* website for UnitedNations Programme on HIV/AIDS, explains the trend of HIV/Aids over the year from the totals summed up all over the world as shown in (**Figure 7).** Some of the features of this platform are mainly statistical analysis namely number of people living with HIV, spreading rate of new HIV infections by age group, number of death on a yearly basis, people receiving medications and resources available bases on low / middle income countries.

Some of the flaws notice from this platform are that no information is given as to which specific region is mostly affected, the type of assistance required or the urgency for each type of assistance.

	2000	2005	2010	2015	2016	2017	2018	2019
People living with HIV	**24.0 million** [20.0 million–28.2 million]	**27.3 million** [22.8 million–32.1 million]	**30.7 million** [25.6 million–36.1 million]	**34.9 million** [29.1 million–40.9 million]	**35.7 million** [29.8 million–41.9 million]	**36.5 million** [30.4 million–42.8 million]	**37.3 million** [31.0 million–43.6 million]	**38.0 million** [31.6 million–44.5 million]
New HIV Infections (total)	**2.7 million** [2.0 million–3.7 million]	**2.4 million** [1.8 million–3.2 million]	**2.1 million** [1.6 million–2.9 million]	**1.9 million** [1.4 million–2.5 million]	**1.8 million** [1.3 million–2.4 million]	**1.8 million** [1.3 million–2.4 million]	**1.7 million** [1.2 million–2.3 million]	**1.7 million** [1.2 million–2.2 million]
New HIV infections (aged 15+)	2.2 million [1.7 million–3.0 million]	1.9 million [1.4 million–2.6 million]	1.8 million [1.4 million–2.5 million]	1.7 million [1.2 million–2.3 million]	1.6 million [1.2 million–2.2 million]	1.6 million [1.2 million–2.1 million]	1.5 million [1.1 million–2.1 million]	1.5 million [1.1 million–2.0 million]
New HIV infections (aged 0–14)	480 000 [300 000–750 000]	440 000 [280 000–700 000]	310 000 [200 000–500 000]	190 000 [120 000–290 000]	180 000 [110 000–280 000]	170 000 [110 000–270 000]	160 000 [99 000–250 000]	150 000 [94 000–240 000]
AIDS-related deaths	**1.4 million** [1.0 million–2.0 million]	**1.7 million** [1.2 million–2.4 million]	**1.1 million** [830 000–1.6 million]	**830 000** [610 000–1.2 million]	**800 000** [580 000–1.1 million]	**760 000** [550 000–1.1 million]	**730 000** [530 000–1.0 million]	**690 000** [500 000–970 000]
People accessing antiretroviral therapy*	**590 000** [590 000–590 000]	**2.0 million** [2.0 million–2.0 million]	**7.8 million** [6.9 million–7.9 million]	**17.2 million** [14.7 million–17.4 million]	**19.3 million** [16.6 million–19.5 million]	**21.5 million** [19.5 million–21.7 million]	**23.1 million** [21.8 million-23.4 million]	**25.4 million** [24.5 million-25.6 million]
Resources available for HIV (low- and middle-income countries)*	**US$ 4.8 billion****	**US$ 9.4 billion****	**US$ 15.0 billion****	**US$ 18.0 billion*****	**US$ 18.4 billion*****	**US$ 19.9 billion*****	**US$ 19.0 billion*****	**US$ 18.6 billion*****

Figure 7: UNAID website showing Global HIV data.

III. METHODOLOGY

Our methodology first consists of Statistical Data Analysis and Documentary Analysis. This method allows extracting data from documents and studies that already exist. It fills the informational gap that has notbeen revealed by interviews and questionnaire.

The technique uses all the documents to describe the background of the problem and also to complement the compiled results with the reliable scientific findings. In addition, the documentary analysis produces various statistical data, which add more credibility to our research.

Secondly, we use questionnaire to assess patients' lifestyle, their ongoing treatment, help and support from their local government and NGOs. Few questions are also related to how the spread of HIV/AIDS can be controlled in their communities and here we also list down statements coming from the public in general that are perceived to be key insights.

Finally, a web-based application has been designed and developed to feed in the gathered HIV/AIDs information and data from questionnaires and documents. To achieve this, we use Visual studio 2015 IDE (Integrated Development Environment),[13] ASP.NET framework to build dynamic web pages,[14] SQL Server database,[15] to store the application data, C#(C-Sharp) programming language to write the server side logic,[16] JavaScript programming,[17] language to write the client side script, HTML (Hyper Text Markup Language) 5 for data presentation,[18] bootstrap 3 and CSS 3 (Cascading Style Sheets) to make the website responsive,[19]

IV. OUR APPROACH

We propose a novel web-based system that will collect and present detailed statistical data, non- statistical like geo-location, and any other forms of information in areas with huge population living withHIV/AIDS that can help in combating HIV/AIDS.

Having the information organized and detailed, will help/enable donors make right donations to reach the right needy, and also avail information resources to researchers and scholars in the cause.

First of all, the main assumptions made for this proposed system to work effectively are:-

1. **WHO (World Health Organization)**

- Shall be the system admin (in charge of controlling/ verifying authenticity of users accessing on behalf of Nations/countries all over the world)
- Shall verify authenticity of Researchorganizations and make a reflection on to thesystem.
- Shall verify research done by organizations and approve it for public view.

2. **Nations/Countries**

- All countries in the world shall register on the system
- Shall verify authenticity of Donors and NGOs in their countries and reflect it on the system.
- Provide accurate HIV/AIDs statistics for the smallest division all over around their

boundaries and feed it into the system.

3. Research Organizations

- Shall effectively use the collected information on the system to come up with strategies for the given areas.
- Shall post their research findings on the system for public use and scholars reuse.

Collecting and organizing geographical locations information of areas with HIV/AIDs populations, will provide researchers with adequate resources to formulate plans and strategies suit to combat HIV/Aids for specified societies in those areas. For example, as shown in the assumed/sample data in **Figure 8**, **Nabweru** is a parish found in **Kampla** district, the capital city of **Uganda**. The location of Nabweru parish, together with the related HIV/AIDs information (assumed) were collected and fed into our system. Any user who visits our web-based system shall be able to track the trend of HIV/AIDs information in this place over the years, major channels through which it spreads, its impact to this society, problems being faced and their suggested solutions and the address of Nabweru health officers in case one would like to make a donation.

Figure 8: Location of Nabweru, Kampala, Uganda.

With detailed information of several smallest subdivisions of the Universe like Nabweru parish (talked of earlier) disclosed to the entire world population, it will be easier to uproot HIV/Aids from all the corners of the world.

It will also help donors and other organizations like NGOs to identify which regions are most greatly affected so that they know where to focus urgent attention and intervene for assistance and the type of assistance required.

For example, areas where prostitution habit is too high and it is said to be the major cause of HIV/AIDS spread, NGOs can help through educating and availing resources for the women to find alternative sources of income so as to block that spread channel.

Prostitution is one of the major HIV/AIDs spread channels.[20]

NGOs in fighting against HIV/AIDs, have played a critical role in addressing the issue especially in developing countries.[21,22] Our proposed system shall give a helping hand to them (NGOs) as explained earlier in the previous two paragraphs.

Our system provides the public with consolidated information to distinguish between fake donors or con men and authorized donors sanctioned by the government authorities. For example, some people collecting money from individuals claiming to register them into their organizations as beneficiaries and end up running away.

Our system shall install a direct mechanism between donors and beneficiaries as donors will be exposed directly to the information from the natives in the regions where they have interest of delivering or have delivered services in order to eliminate acts of embezzlement/corruption and under delivery to the targeted beneficiaries.

Consequently embezzlement of HIV/AIDS funds and equipment supplies by government officials especially in developing countries also manifests as a blocking point in fighting HIV/Aids.[23,24]

The screenshots in **Figure 8** and **Figure 9**, show how some HIV/Aids information is displayed on our proposed web-based system. **Figures 9 and 10** show statistics HIV/Aids infection over the years (statistics just assumed for the system proposal purpose) for Nabwere parish which is found in Kampala the capital city of Uganda. The information is assumed to have been entered by Ugandan health officials after having successfully logged into the system.

Figure 9: Shows HIV/AIDs information displayed on a world map for Nabweru parish found in Kampala districtin a country called Uganda.

Figure 10: Shows list HIV/AIDs spread channels in Nabweru, Kampala, Uganda.

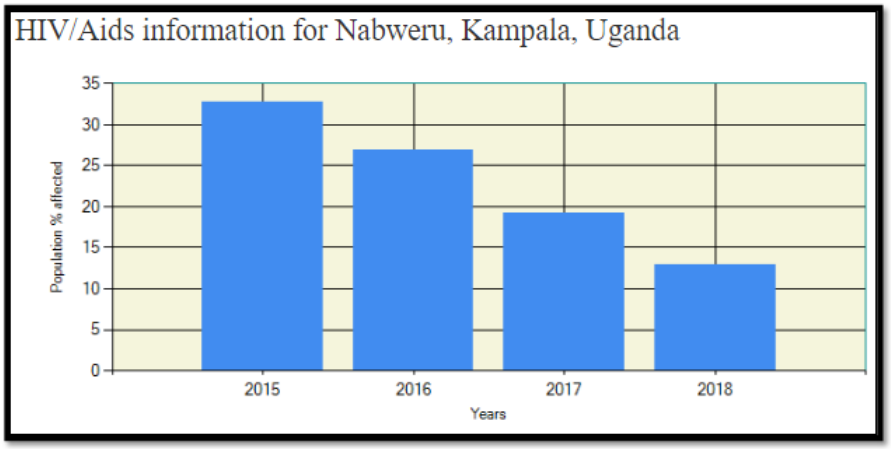

Figure 11: Bar graph showing the trend HIV/AIDs infection over the years in Nabweru, Kampala, Uganda.

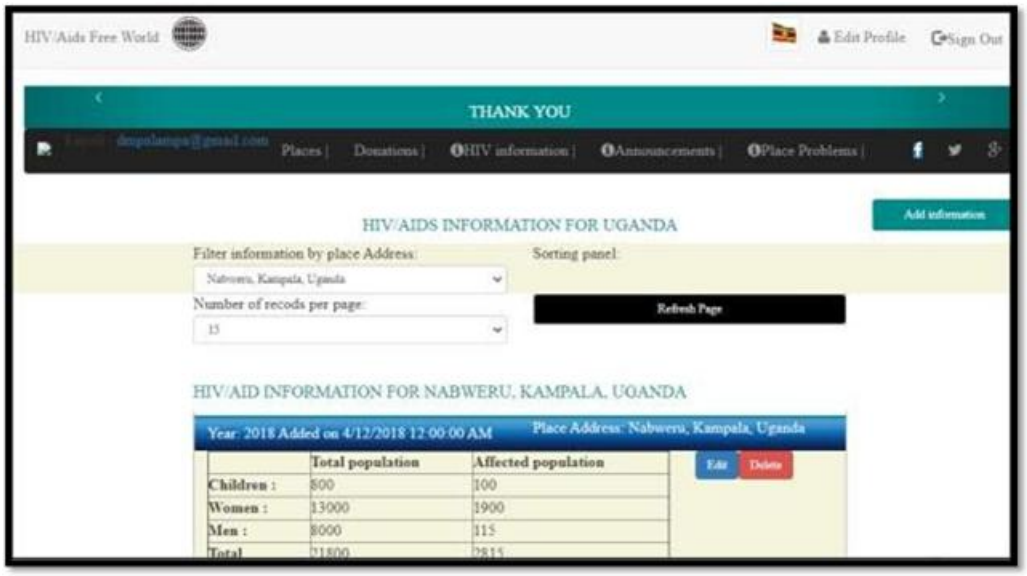

Figure 12: Shows sample data for HIV/AIDs information over the years for a place called Nabweru, found inKampala distric in a country called Uganda.

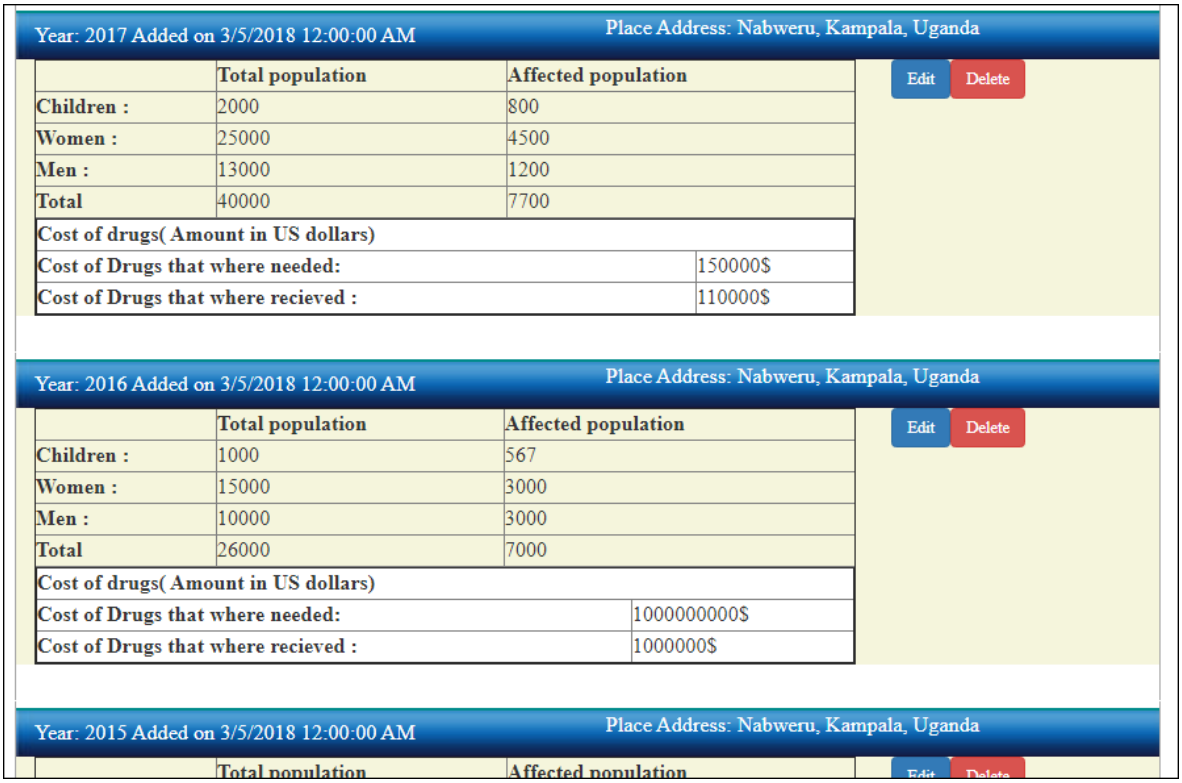

Figure 13: Continuation of Figure 12.

V. CONCLUSION

In Africa, most of the people get infected by HIV/AIDS due to situations of poverty, lack of knowledge on how to protect themselves, primitive culture beliefs like poor methods of circumcision in where on blade is used several times and on several people, polygamous

marriages as explained in,[25] endless wars like ones **South Sudan** and **Democratic Republic of Congo** in which ladies get raped, lack of HIV/AIDs prevention facilities like condoms and many others as explains.

Initiating patients to medication is still a challenge,[26] especially in remote areas like North Easter part of Uganda where they have to walk long distances on foot to find health facilities despite of their poor health conditions.

In addition to the above, inadequate health facilities and increased health workers' work load without corresponding increase in manpower,[26] have also energized the backward pulling forces in fighting HIV/AIDS in various areas across the globe.

This innovative system will assist in addressing of the above mentioned issues and more others effectively.

Lastly, it should be remember that "with our hands joined together, HIV/Aids can remain in history.

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