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Statistical Comparison and analysis of Database of HIV/AIDS Infections using Mathematical Tools

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ABSTRACT: In this paper we have to explain about HIV/AIDS (Human Immunodeficiency Virus / Acquired Immuno Deficiency Syndrome).The AIDS epidemic has been accompanied by intensely negative public reactions to persons presumed to be infected by the human immunodeficiency virus (HIV). We discuss about history, signs and symptoms, transmission of HIV/AIDS, classification of HIV infection, some population based statistical studies, diagnosis of disease, test of HIV infection, transmission routes, prevention, vaccination and current treatment process. Collection of data is based on survey of world Health Organization and other associations. Also there is a simulation of data of a population whose are infected from HIV/AIDS of all age groups.

I. INTRODUCTION

Human immunodeficiency virus infection / acquired immunodeficiency syndrome (HIV/AIDS) is a disease of the human immune system caused by infection with human immunodeficiency virus (HIV). During the initial infection, a person may experience a brief period of influenza-like illness. This is typically followed by a prolonged period without symptoms. As the illness progresses, it interferes more and more with the immune system, making the person much more likely to get infections, including opportunistic infections and tumors that do not usually affect people who have working immune systems. HIV is transmitted primarily via unprotected sexual intercourse (including anal and even oral sex), contaminated transfusions, hypodermic, and from mother to child during pregnancy, delivery, or breastfeeding. Some bodily fluids, such as saliva and tears, do not transmit HIV. Prevention of HIV infection, primarily through safe sex and needle-exchange programs, is a key strategy to control the spread of the disease. There is no cure or vaccine; however, antiretroviral treatment can slow the course of the disease and may lead to a near-normal life expectancy. While antiretroviral treatment reduces the risk of death and complications from the disease, these medications are expensive and may be associated with side effects [1].

II. HISTORY

Genetic research indicates that HIV originated in west-central Africa during the early twentieth century. AIDS was first recognized by the Centers for Disease Control and Prevention (CDC) in 1981 and its cause HIV infection was identified in the early part of the decade. Since its discovery, AIDS has caused nearly 30 million deaths (as of 2009). As of 2010, approximately 34 million people are living with HIV globally. AIDS is considered a pandemic; a disease outbreak which is present over a large area and is actively spreading [2].

HIV/AIDS has had a great impact on society, both as an illness and as a source of discrimination. The disease also has significant economic. There are many misconceptions about HIV/AIDS such as the belief that it can be transmitted by casual non-sexual contact. The disease has also become subject to many controversies involving religion. It has attracted international medical and political attention, and large-scale funding, since it was identified in the 1980s [1-2].

III. SIGNS AND SYMPTOMS

There are three main stages of HIV infection: A. acute infection, B. clinical view, C. AIDS.

A. Acute Infection

The initial period following the contraction of HIV is called acute HIV, primary HIV or acute retroviral syndrome. Many individuals develop an influenza-like illness or a mononucleosis-like illness 2–4 weeks post exposure while others have no significant symptoms [13-14]. Symptoms occur in 40–90% of cases and most commonly include fever, large tender lymph nodes, throat inflammation, a rash, headache, and/or sores of the mouth and genitals. The rash, which occurs in 20–50% of cases, presents itself on the trunk and is maculopapular, classically. Some people also develop opportunistic infections at this stage. Gastrointestinal symptoms such as nausea, vomiting or diarrhea may occur, as may neurological symptoms of peripheral neuropathy or Guillain-Barre syndrome. The duration of the symptoms varies, but is usually one or two weeks [3].

Due to their nonspecific character, these symptoms are not often recognized as signs of HIV infection. Even cases that do get seen by a family doctor or a hospital are often misdiagnosed as one of the many common infectious diseases with overlapping symptoms. Thus, it is recommended that HIV be considered in patients presenting an unexplained fever who may have risk factors for the infection.

B. Clinical View

The initial symptoms are followed by a stage called clinical latency, asymptomatic HIV, or chronic HIV. Without treatment, this second stage of the natural history of HIV infection can last from about three years to over 20 years (on average, about eight years). While typically there are few or no symptoms at first, near the end of this stage many people experience fever, weight loss, gastrointestinal problems and muscle pains. Between 50 and 70% of people also develop persistent generalized lymphadenopathy, characterized by unexplained, non-painful enlargement of more than one group of lymph nodes (other than in the groin) for over three to six months.

Although most HIV-1 infected individuals have a detectable viral load and in the absence of treatment will eventually progress to AIDS, a small proportion (about 5%) retain high levels of $CD4^+$ T cells (T helper cells) without antiretroviral therapy for more than 5 years. These individuals are classified as HIV controllers or long-term nonprogressors (LTNP). Another group is those who also maintain a low or undetectable viral load without anti-retroviral treatment who are known as "elite controllers" or "elite suppressors". They represent approximately 1 in 300 infected persons [3].

C. Acquired Immunodeficiency Syndrome

Acquired immunodeficiency syndrome (AIDS) is defined in terms of either a $CD4^+$ T cell count below 200 cells per µL or the occurrence of specific diseases in association with an HIV infection. In the absence of specific treatment, around half of people infected with HIV develop AIDS within ten years. The most common initial conditions that alert to the presence of AIDS are pneumocystis pneumonia (40%), cachexia in the form of HIV wasting syndrome (20%) and esophageal candidacies. Other common signs include recurring respiratory tract infections.

Opportunistic infections may be caused by bacteria, viruses, fungi and parasites that are normally controlled by the immune system. Which infections occur partly depends on what organisms are common in the person's environment. These infections may affect nearly every organ system.

People with AIDS have an increased risk of developing various viral induced cancers including: Kaposi's sarcoma, Burkitt's lymphoma, primary central nervous system lymphoma, and cervical cancer. Kaposi's sarcoma is the most common cancer occurring in 10 to 20% of people with HIV. The second most common cancer is lymphoma which is the cause of death of nearly 16% of people with AIDS and is the initial sign of AIDS in 3 to 4%. Both these cancers are associated with human herpesvirus 8. Cervical cancer occurs more frequently in those with AIDS due to its association with human papillomavirus (HPV).

Additionally, people with AIDS frequently have systemic symptoms such as prolonged fevers, sweats (particularly at night), swollen lymph nodes, chills, weakness, and weight loss. Diarrhea is another common symptom present in about 90% of people with AIDS. They can also be affected by diverse psychiatric and neurological symptoms independent of opportunistic infections and cancers [4].

IV. TRANSMISSION OF HIV/AIDS

HIV is transmitted by three main routes: sexual contact, exposure to infected body fluids or tissues, and from mother to child during pregnancy, delivery, or breastfeeding (known as vertical transmission). There is no risk of acquiring HIV if exposed to feces, nasal secretions, saliva, sputum, sweat, tears, urine, or vomit unless these are contaminated with blood.

Table 1: Chance of infection in percentage.

S. No.	Exposure Route	Chance of infection in percentage (%)
1	Blood Transfusion	90%
2	New born Child	25%
3	By sharing of injection	0.67%
4	Percutaneous needle stick	0.30%
5	Receptive anal intercourse*	0.04 – 3.0%
6	Insertive anal intercourse*	0.03%
7	Receptive penile-vaginal intercourse*	0.05 – 0.30%
8	Insertive penile-vaginal intercourse*	0.01 – 0.38%
9	Receptive oral intercourse*#	0 – 0.04%
10	Insertive oral intercourse*#	0 – 0.005%
Note: * stand for without using condom and # stands for source refers to oral intercourse performed on a man.		

Average risk of getting infection of HIV/AIDS based on possible activities. The analysis is given in table format which based on population infected by the disease.

This is the graphical representation of the table given above. We can see here that the highest risk of infection is in blood transfusion; similarly we can analysis other conditions (Fig. 1).

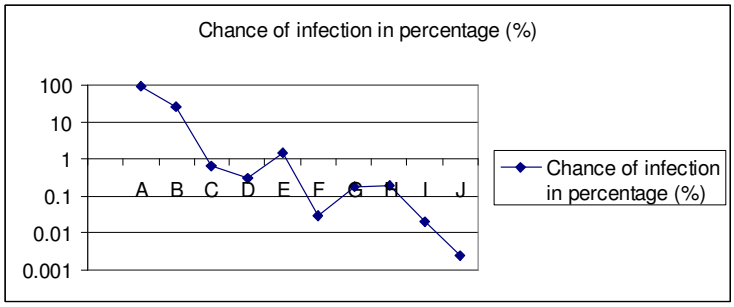

Fig. 1: Chance of infection in percentage.

V. DIAGNOSIS

HIV/AIDS is diagnosed via laboratory testing and then staged based on the presence of certain signs or symptoms. HIV screening is recommended by the United States Preventive Services Task Force for all people 15 years to 65 years of age including all pregnant women. Additionally testing is recommended for all those at high risk, which includes anyone diagnosed with a sexually transmitted illness. In many areas of the world a third of HIV carriers only discover they are infected at an advanced stage of the disease when AIDS or severe immunodeficiency has become apparent.

VI. TEST OF HIV INFECTION

Most people infected with HIV develop specific antibodies within three to twelve weeks of the initial infection. Diagnosis of primary HIV before seroconversion is done by measuring HIV-RNA or p24 antigen. Positive results obtained by antibody or PCR testing are confirmed either by a different antibody or by PCR.

Antibody tests in children younger than 18 months are typically inaccurate due to the continued presence of maternal antibodies. Thus HIV infection can only be diagnosed by PCR testing for HIV RNA or DNA, or via testing for the p24 antigen.[12] Much of the world lacks access to reliable PCR testing and many places simply wait until either symptoms develop or the child is old enough for accurate antibody testing. In sub-Saharan Africa as of 2007–2009 between 30 and 70% of the population was aware of their HIV status. In 2009, between 3.6 and 42% of men and women in Sub-Saharan countries were tested which represented a significant increase compared to previous years.

VII. CLASSIFICATION OF HIV INFECTION

The World Health Organization first proposed a definition for AIDS in 1986. Since then, the WHO classification has been updated and expanded several times, with the most recent version being published in 2007. The WHO system uses the following categories [15].

S. No.	Conditions	Discription
1	Primary HIV infection	May be either asymptomatic or associated with acute retroviral syndrome
2	Stage 1	HIV infection is asymptomatic with a CD4+ T cell count (also known as CD4 count) greater than 500 per microlitre (µl or cubic mm) of blood.May include generalized lymph node enlargement.
3	Stage 2	Mild symptoms which may include minor mucocutaneous manifestations and recurrent upper respiratory tract infections. A CD4 count of less than 500/µl.
4	Stage 3	Advanced symptoms which may include unexplained chronic diarrhea for longer than a month, severe bacterial infections including tuberculosis of the lung, and a CD4 count of less than 350/µl.
5	Stage 4 or AIDS	the esophagus, trachea, bronchi or lungs and Kaposi's sarcoma. A CD4 count of less than 200/µl.

The United States Center for Disease Control and Prevention also created a classification system for HIV, and updated it in 2008.

This system classifies HIV infections based on CD4 count and clinical symptoms, and describes the infection in three stages:

S.No.	Conditions	Discriptions
1	Stage 1	CD4 count ≥ 500 cells/µl and no AIDS defining conditions
2	Stage 2	CD4 count 200 to 500 cells/µl and no AIDS defining conditions
3	Stage 3	CD4 count ≤ 200 cells/µl or AIDS defining conditions
4	Unknown	If insufficient information is available to make any of the above classifications

Some Population Model

To understand the disease and other related issues such as population of suspected, infected and recovered individuals. Statistical study of growth of HIV/AIDS virus, diagnosis and treatment we are taking the data from United Kingdom from 2001 to 2011 and earlier from 2001 it is from 1996 to 2011.

Up to the end of 2011, 120,756 people in the United Kingdom had been diagnosed with HIV, 27,361 had been diagnosed with AIDS and 20,335 HIV-diagnosed individuals had died. In the given graph (Fig. 2) highlights trends in annual HIV and AIDS diagnoses since 1996. The lowest number of AIDS diagnoses ever recorded was observed in 2011. HIV diagnoses have also fallen recently, but remain almost twice as high as those seen at the end of the 1990s.

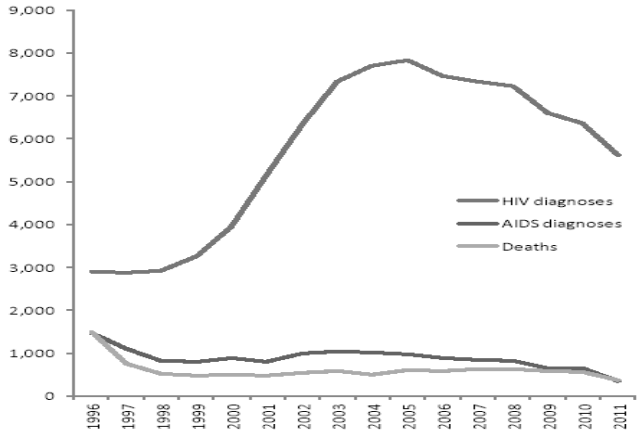

Fig. 2: HIV and AIDS diagnoses and deaths between 1996 – 2011.

Annual numbers of HIV diagnoses in the UK doubled between 2000 and 2005 and remained above 7,000 in each year until 2009. AIDS diagnoses halved between 1996 and 1998, and have fallen year-on-year since 2003 and HIV-related deaths have followed a similar pattern. These trends are largely due to the effectiveness of highly active anti retroviral therapies (HAARTs) in delaying the progression of HIV to AIDS, and reducing HIV-associated morbidity and mortality [11].

VIII. CHARACTERISTICS FOR DIAGNOSES

A. Age factor

In the year of 2011, over half (59%) of new HIV diagnoses were among adults aged between 30 and 49, while adults in their twenties and under accounted for just over a quarter (27%) of diagnoses. As the graph (Fig. 3) shows, the distribution of diagnoses by age has changed slightly over the past decade, with the distribution of diagnoses shifting more towards older age groups.

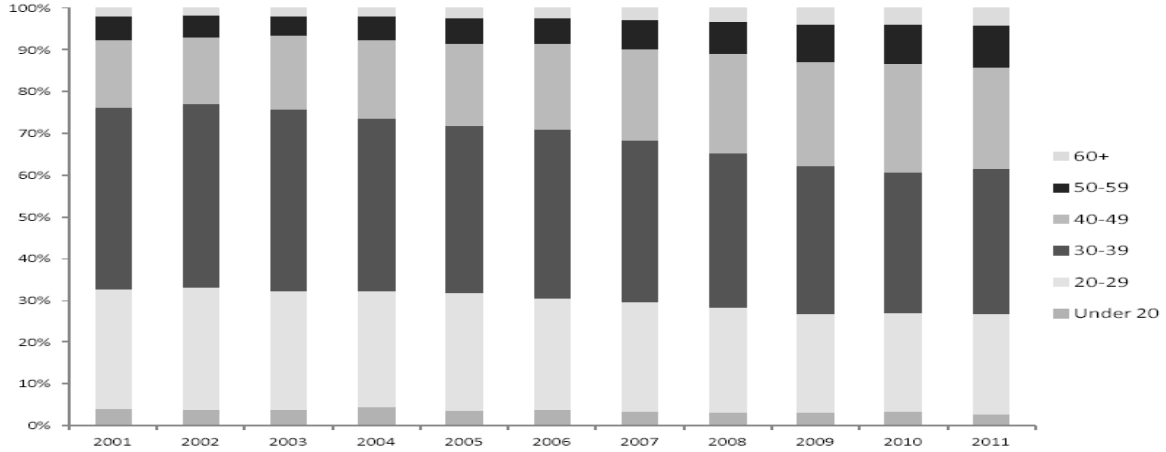

Fig. 3: Proportion of new HIV diagnoses by age.

B. Ethnicity

In the next graph (Fig. 4) the distribution of HIV diagnoses by ethnicity and gender. The most pronounced over-representation occurs among the Black African ethnic group.

According to the Office for National Statistics, 1.8% of men and 1.7% of women are from Black African backgrounds, yet 10.8% of new HIV diagnoses in 2011 were attributed to Black African men and 16.7% to Black African women.

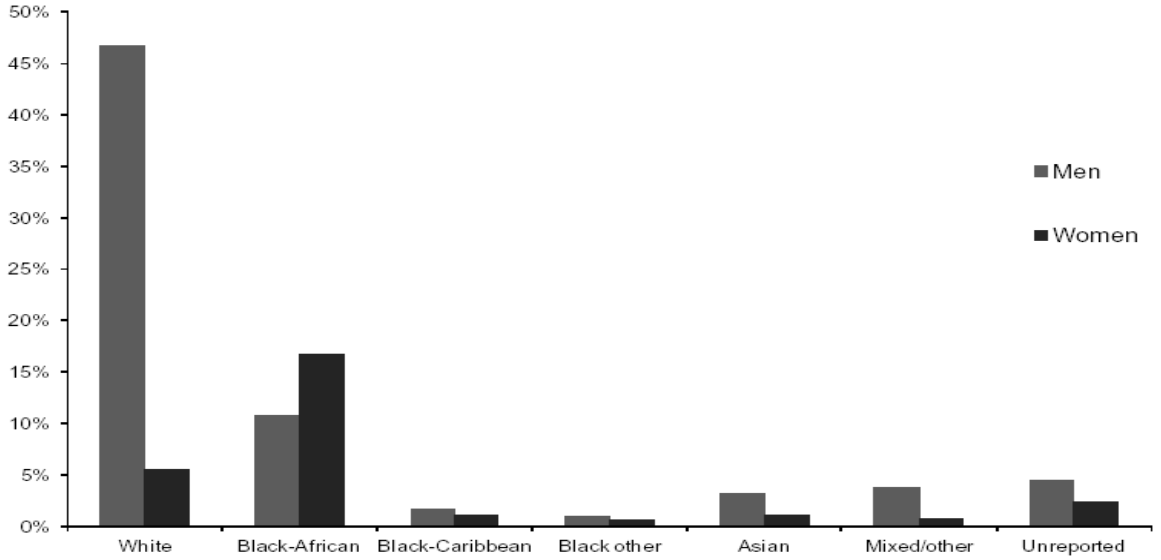

Fig. 4: Proportion of new HIV diagnoses by ethnicity and gender.

C. Region

The distribution of HIV diagnoses by English region, and in the other UK countries is shown in the graph (Fig. 5). By a wide margin, London accounts for the largest proportion of HIV diagnoses.

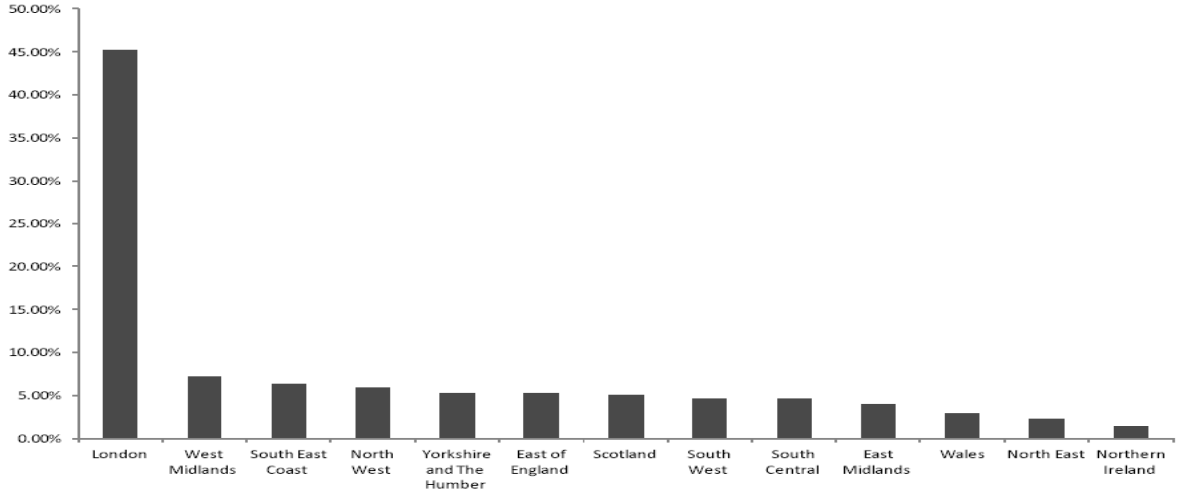

Fig. 5: Regional distribution of new HIV diagnoses in United Kingdom, 2011.

IX. TRANSMISSION ROUTES

Sexual contact is by far the most common HIV transmission route: in 2011, 86% of newly diagnosed cases were acquired in this way. The chart below compares the number of HIV diagnoses arising from heterosexual, male homosexual and non-sexual exposure as shown in the graph (Fig. 6).

Heterosexual sex was the most common cause of HIV infection in the UK between 1999 and2010. HIV cases attributable to heterosexual contact peaked in 2004, at 4,829 representing 63% of all new diagnoses. Since then the number attributable to heterosexual contact has fallen-to 2,359 cases in 2011, representing 42% of all diagnoses. The highest number of HIV cases acquired through sex between men was recorded in 2007, but the proportion of cases attributed to male homosexual contact was still lower than that observed for heterosexual contact. In 2011, although the number of cases acquired through sex between men fell slightly, the proportion of cases (44%) meant that male homosexual contact was the most common cause of HIV infection.

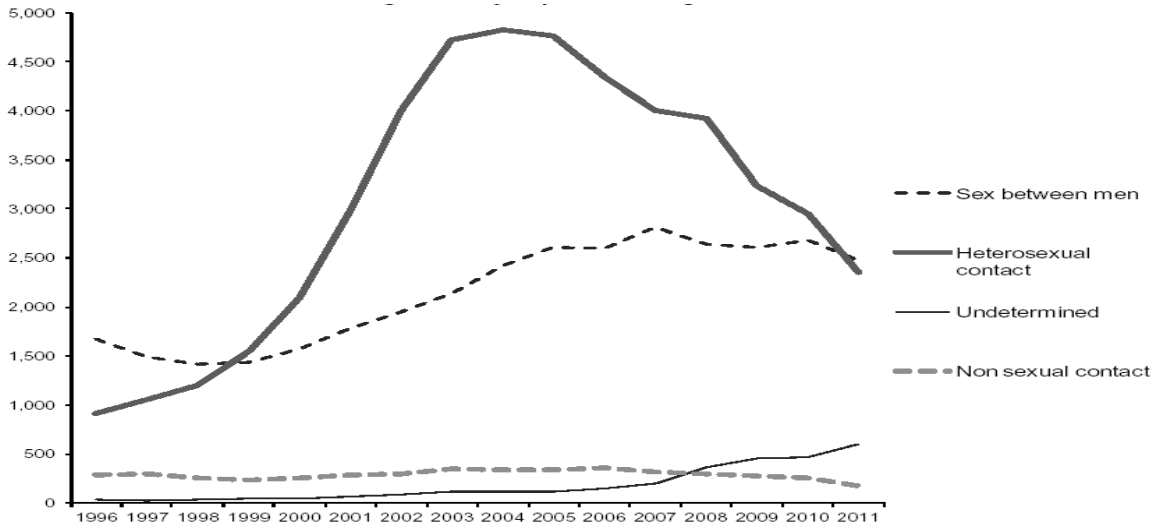

Fig. 6: HIV diagnoses by exposure categories in UK, 1996-2011.

This is the first time since 1999 that male homosexual sex was the most common cause of HIV infection in the UK. Historically, the primary exposure risk for HIV was homosexual male contact: in years prior to 1995, heterosexual contact was the cause of just 18% of all HIV infections, whilst sex between men was the cause of 63% of cases. The importance of injecting drug use as a means of HIV transmission has also declined since 1996, from 196 cases to 102. Blood products in the UK have been routinely screened for HIV since 1985, and are destroyed if it is detected. All blood products (including US imports) in the UK have been 'virtually HIV-free' since 19883 and HIV acquired in this manner is correspondingly extremely rare (around 1.5% of all diagnoses since 1996); it most commonly occurs in individuals treated with infected blood abroad.

In the graph (Fig. 7) given below it is shown that by which way the HIV virus will be transmitted to a human body. It was more typical for individuals to be ignorant of a viable transmission route, than to specify a non-viable one. While four-fifths of the British public are aware of the main method of transmitting HIV – sex without a condom between- , almost a fifth mention at least one incorrect method of transmission (such as spitting, sharing a glass, or coughing/ sneezing).

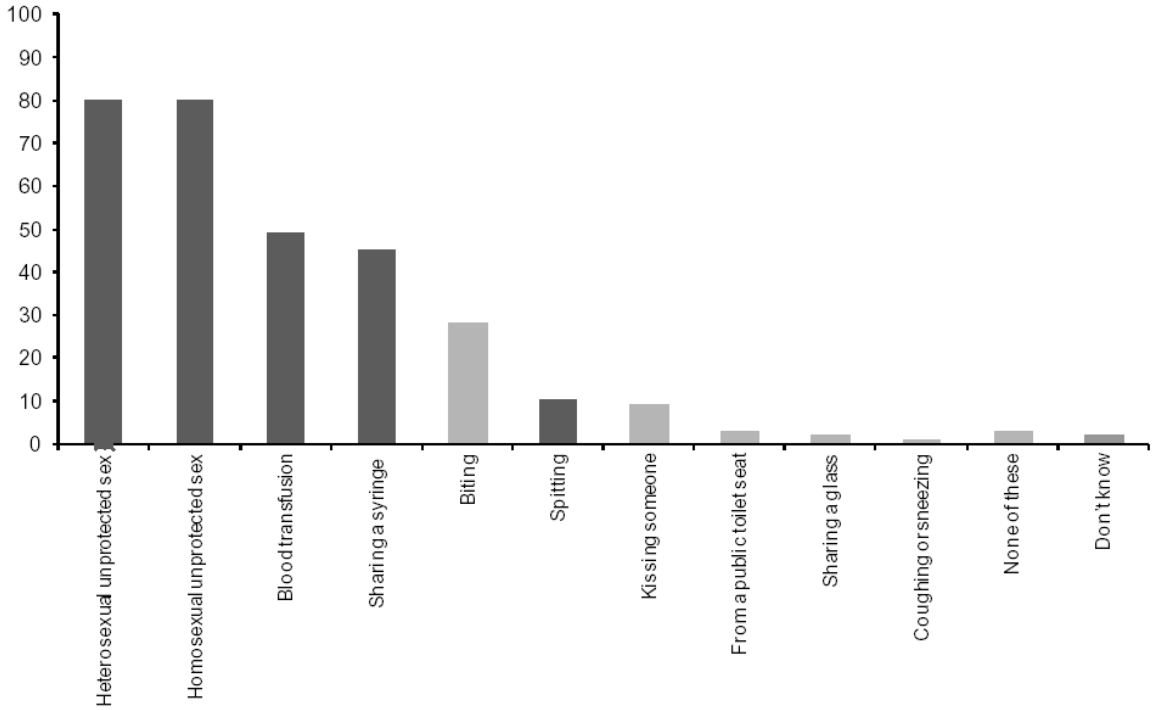

Fig. 7: Proportion of sample in various transmission routes for HIV.

A. Exposure abroad

A significant proportion of individuals diagnosed with HIV in the UK were originally infected abroad. The graph (Fig. 8) below shows trends in HIV diagnoses in the UK following presumed heterosexual exposure outside the UK. Reliable data are not available for other means of exposure.

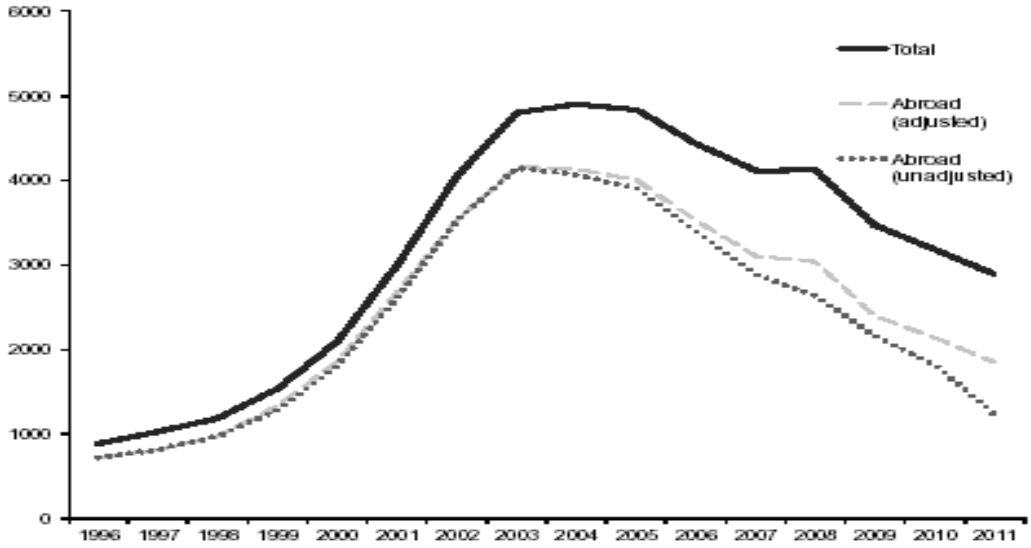

Fig. 8: HIV diagnoses from heterosexual exposure abroad, 1996-2011.

Adjusting for cases where origin of infection has not yet been determined, around two thirds of HIV cases from heterosexual exposure in 2011 were acquired abroad; this is a decline from a peak of over 85% between 1999 and 2004.

X. PREVALENCE OF HIV

A. Diagnosed HIV prevalence

HIV prevalence is estimated using the Survey of Prevalent HIV Infections Diagnosed (SOPHID), a cross-sectional survey of all individuals with diagnosed HIV infection who attend HIV-related care within the NHS in England, Wales, and Northern Ireland (E, W & NI) within a calendar year. In 2011, there were 73,659 individuals in the UK accessing HIV care. Risk factors for these existing cases are broadly similar to those for new diagnoses, with around 43% of individuals acquiring their infection through male homosexual sex, and 34% being of black African ethnicity. As with the diagnosis statistics in Section 2, it is difficult to make inferences about incidence of HIV (the number of new cases in, say, a year) from the SOPHID data. In particular, prevalence over time may be observed to rise even as incidence remains the same for two reasons: firstly, the availability of HAART4 (drugs which slow down the rate at which HIV is able to reproduce) from the mid-1990s onwards has led to dramatic improvements in the life expectancy of people with HIV in the UK; secondly, since the SOPHID data deals only with diagnosed HIV, rising prevalence may reflect a fall in the number of undiagnosed cases.

B. Total and undiagnosed HIV prevalence

Some individuals infected with HIV and living in the UK have not yet been diagnosed. Overall prevalence of HIV must therefore take the form of an estimate. This is derived from a number of sources, including SOPHID, data on previously undiagnosed HIV infections seen at GUM clinics, and the National Survey of Sexual Attitudes and Lifestyles. In 2010, the HPA estimated that 91,500 individuals in the UK were living with HIV, a crude prevalence rate of 1.5 per 1,000 individuals. Given that there are 73,659 individuals accessing treatment, the implication of this estimate is that around 20% of individuals with HIV are unaware of their infection. HIV prevalence is high among MSM in the UK. Assuming that 3.4% of the adult male population are MSM, one in 20 gay men are living with HIV nationally (47 per 1,000 population), and one in 11 in London (83 per 1,000). Black African men and women living in the UK also have a high HIV prevalence, at 47 per 1,000 populations (England and Wales only). Among black African men, HIV prevalence was 31 per 1,000 populations, and among black African women it was 64 per 1,000 populations.

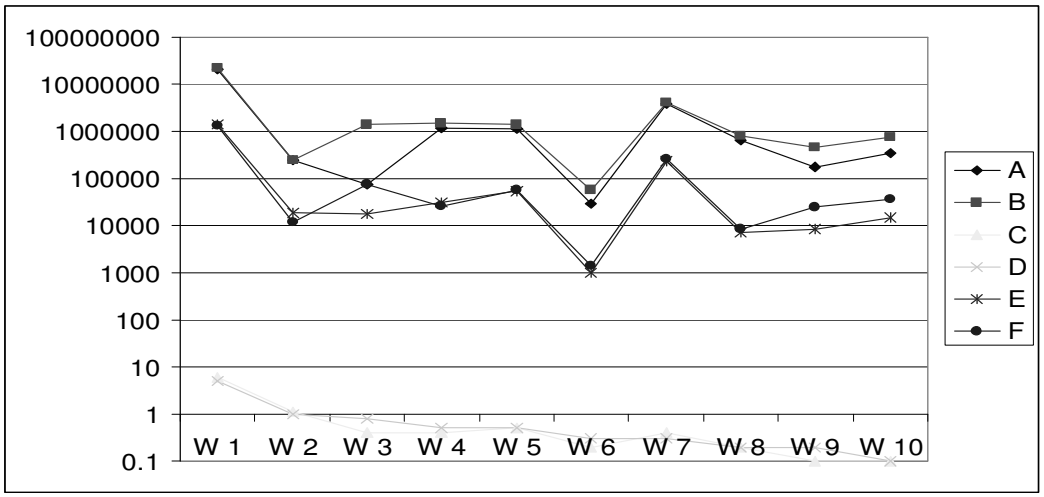

Fig. 9: Summary figures on HIV prevalence and AIDS mortality, world regions, 2001 & 2009.

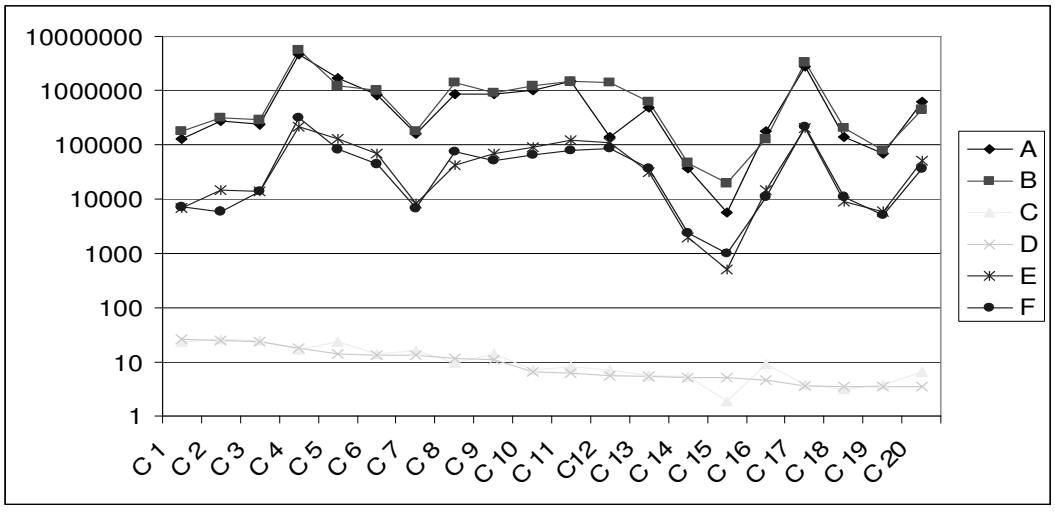

Fig. 10: Summary figures on HIV prevalence and AIDS mortality for the 20 most heavily HIV- infected countries, 2001 & 2009.

XI. PREVENTION STRATEGIES

A. Pharmaceutical

Some commonly considered pharmaceutical interventions for the prevention of HIV include the use of the microbicides for sexually transmitted diseases, pre-exposure prophylaxis, post-exposure prophylaxis, HIV vaccines, circumcision, antiretroviral drugs to reduce viral load in the infected, and condoms, low dead space syringes.

Of these, the only universally medically proven method for preventing the spread of HIV during sexual intercourse is the correct use of condoms, and condoms are also the only method promoted by health authorities worldwide. For HIV positive mothers wishing to prevent the spread of HIV to their child during birth, antiretroviral drugs have been medically proven to reduce the likelihood of the spread of the infection. Scientists worldwide are currently researching other prevention systems.Increased risk of contracting HIV often correlates with infection by other diseases, particularly other sexually transmitted infections. Medical professionals and scientists recommend treatment or prevention of other infections such as herpes, hepatitis A, hepatitis B, hepatitis C, human papillomavirus, syphilis, gonorrhea, and tuberculosis as an indirect way to prevent the spread of HIV infection. Often doctors treat these conditions with pharmaceutical interventions [5].

B. Social strategies

Social strategies do not require any drug or object to be effective, but rather require persons to change their behavior in order to gain protection from HIV. Some social strategies which people consider include the sex education, LGBT, sex education, needle-exchange programmes, safe injection sites, safe sex, serosorting, sexual abstinence and immigration regulation.

These strategies have widely differing levels of efficacy, social acceptance, and acceptance in the medical and scientific communities. An example of an intervention employing these social strategies is the Women's Health Co-Op, which is on the CDC's best evidence based practice list for HIV prevention. Populations which receive HIV testing are less likely to engage in behaviors with high risk of contracting HIV, so HIV testing is almost always a part of any strategy to encourage people to change their behavior to become less likely to contract HIV.Over 60 countries impose some form of travel restriction, either for short or long term stays, for people infected with HIV.

C. Sexual contact

Consistent condom use reduces the risk of heterosexual HIV transmission by approximately 80% over the long-term. Where one partner of a couple is infected, consistent condom use results in rates of HIV infection for the uninfected person of below 1% per year. Some data supports the equivalence of female condoms to latex condoms however the evidence is not definitive. The use of the spermicide nonoxynol-9 may increase the risk of transmission due to the fact that it causes vaginal and rectal irritation. A vaginal gel containing tenofovir, a reverse transcriptase inhibitor, when used immediately before sex, reduce infection rates by approximately 40% among Africa women. Circumcision in sub-Saharan Africa reduces the risk of HIV infection in heterosexual men by between 38 percent and 66 percent over two years. Based on these studies, the World Health Organization and UNAIDS both recommended male circumcision as a method of preventing female-to-male HIV transmission in 2007. Whether it protects against male-to-female transmission is disputed and whether it is of benefit in developed countries and among men who have sex with men is undetermined. Some experts fear that a lower perception of vulnerability among circumcised men may result in more sexual risk-taking behavior, thus negating its preventive effects. Women who have undergone female genital cutting have an increased risk of HIV. Programs encouraging sexual abstinence do not appear to effect subsequent HIV risk. Evidence for a benefit from peer education is equally poor. Comprehensive sexual education provided at school may decrease high risk behavior. A substantial minority of young people continue to engage in high-risk practices despite HIV/AIDS knowledge, underestimating their own risk of becoming infected with HIV. It is not known if treating other sexually transmitted infections is effective in preventing HIV [5].

D. Pre exposure

Early treatment of HIV-infected people with antiretrovirals protected 96% of partners from infection. Pre-exposure prophylaxis with a daily dose of the medications tenofovir with or without emtricitabine is effective in a number of groups including: men who have sex with men, by couples where one is HIV positive, and by young heterosexuals in Africa. Universal precautions within the health care environment are believed to be effective in decreasing the risk of HIV. Intravenous drug use is an important risk factor and harm reduction strategies such as needle-exchange programmes and opioid substitution therapy appear effective in decreasing this risk. Needle exchange programs (also known as syringe exchange programs) are effective in preventing HIV among IDUs as well as in the broader community. Pharmacy sales of syringes and physician prescription of syringes have been also found to reduce HIV risk. Supervised injection facilities are also understood to address HIV risk in the most-at-risk populations. Multiple legal and attitudinal barriers limit the scale and coverage of these "harm reduction" programs in the United States as well as elsewhere around the world. The American Centers for Disease Control and Prevention (CDC) conducted a study in partnership with the Thailand Ministry of Public Health to ascertain the effectiveness of providing people who inject drugs illicitly with daily doses of the anti-retroviral drug Tenofovir as a prevention measure. The results of the study were releases in mid-June 2013 and revealed a 48.9% reduced incidence of the virus among the group of subjects who received the drug, in comparison to the control group who received a placebo. The Principal Investigator of the study stated in the Lancet medical journal: “We now know that pre-exposure prophylaxis can be a potentially vital option for HIV prevention in people at very high risk for infection, whether through sexual transmission or injecting drug use”.

E. Post exposure

A course of antiretrovirals administered within 48 to 72 hours after exposure to HIV positive blood or genital secretions is referred to as post-exposure prophylaxis. The use of the single agent zidovudine reduces the risk of subsequent HIV infection fivefold following a needle stick injury. Treatment is recommended after sexual assault when the perpetrators is known to be HIV positive but is controversial when their HIV status is unknown. Current treatment regimes typical use lopinavir/ritonavir and lamivudine/zidovudine or emtricitabine/tenofovir and may decrease the risk further. The duration of treatment is usually four week and is associated with significant rates of adverse effects (for zidovudine ~70% including: nausea 24%, fatigue 22%, emotional distress 13%, headaches 9%).

F. Mother-to-child

Programs to prevent the transmission of HIV from mothers to children can reduce rates of transmission by 92-99%. This primarily involves the use of a combination of antivirals during pregnancy and after birth in the infant but also potentially include bottle feeding rather than breastfeeding. If replacement feeding is acceptable, feasible, affordable, sustainable and safe mothers should avoid breast-feeding their infants however exclusive breast-feeding is recommended during the first months of life if this is not the case. If exclusive breast feeding is carried out the provision of extended antiretroviral prophylaxis to the infant decreases the risk of transmission.

XII. VACCINATION

A. HIV vaccine

An HIV vaccine is a vaccine which would either protect individuals who do not have HIV from contracting that virus, or otherwise may have a therapeutic effect for persons who have or later contract HIV/AIDS. Currently, there is no effective HIV vaccine but many research projects managing clinical trials seek to create one. There is evidence that a vaccine may be possible. Work with monoclonal antibodies (MAb) has shown or proven that the human body can defend itself against HIV, and certain individuals remain asymptomatic for decades after HIV infection. Potential candidates for antibodies and early stage results from clinical trials have been announced.One HIV vaccine candidate which showed some efficacy was studied in RV 144, which was a trial in Thailand beginning in 2003 and first reporting a positive result in 2009. Many trials have shown no efficacy, including the STEP study and HVTN 505 trials.

The urgency of the search for a vaccine against HIV stems from the AIDS-related death toll of over 25 million people since 1981. Indeed, in 2002, AIDS became the primary cause of mortality due to an infectious agent in Africa. Alternative medical treatments to a vaccine do exist. Highly active antiretroviral therapy (HAART) has been highly beneficial to many HIV-infected individuals since its introduction in 1996 when the protease inhibitor-based HAART initially became available. HAART allows the stabilization of the patient's symptoms and viremia, but they do not cure the patient of HIV, nor of the symptoms of AIDS. And, importantly, HAART does nothing to prevent the spread of HIV through people with undiagnosed HIV infections. Introduction of safer sex measures to halt the spread of AIDS has proven difficult in the worst affected countries. Therefore, an HIV vaccine is generally considered as the most likely, and perhaps the only way by which the AIDS pandemic can be halted. However, after over 20 years of research, HIV-1 remains a difficult target for a vaccine.

B. Difficulties in developing an HIV vaccine

In 1984, after the confirmation of the etiological agent of AIDS by scientists at the U.S. National Institutes of Health and the Pasteur Institute, the United States Health and Human Services Secretary Margaret Heckler declared that a vaccine would be available within two years.However, the classical vaccination approaches that have been successful in the control of various viral diseases by priming the adaptive immunity to recognize the viral envelope proteins have failed in the case of HIV-1. Some have stated that an HIV vaccine may not be possible without significant theoretical advances.

There are a number of factors that cause development of an HIV vaccine to differ from the development of other classic vaccines:

- Classic vaccines mimic natural immunity against re-infection generally seen in individuals recovered from infection; there are almost no recovered AIDS patients.
- Most vaccines protect against disease, not against infection; HIV infection may remain latent for long periods before causing AIDS.
- Most effective vaccines are whole-killed or live-attenuated organisms; killed HIV-1 does not retain antigenicity and the use of a live retrovirus vaccine raises safety issues.
- Most vaccines protect against infections that are infrequently encountered; HIV may be encountered daily by individuals at high risk.
- Most vaccines protect against infections through mucosal surfaces of the respiratory or gastrointestinal tract; the great majority of HIV infection is through the genital tract.

XIII. CONCLUSION

In this paper we have discussed about HIV/AIDS (Human Immunodeficiency Virus / Acquired Immuno Deficiency Syndrome). This is most recent disease in the world affecting the human society. As we discussed about disease, virus growth, characteristic, population model, prevention, and vaccination. There is given some results that are concluded from this study:

a). There are three main stages of HIV infection: acute infection, clinical latency, AIDS

b). The highest risk of infection is in blood transfusion.

c). At first stage any person suffers from primary stage and due to ignorance of symptoms it converts in fourth stage which is called AIDS.

d). To understand the disease we have taken population model of United Kingdom since 1996 to 2011.

(i) According to World Health Organization Highest HIV infected found in the year of 2004-05 about 8000 in United Kingdom.

(ii) According to World Health Organization Highest population suffered from AIDS found in the year of 1996 about 1500-1600 in United Kingdom.

(iii) According to World Health Organization Highest population died from AIDS found in the year of 1996 about 1500-1600 in United Kingdom.

e). According to population model the characteristic of diagnoses are:

	Maximum Infected Population			Minimum infected population		
Age Group	Year	Range	Length	Year	Range	Length
Under 20	2004	0-5%	5	2011	0-2%	2
20 - 29	2002	3-32%	29	2011	2-28%	26
30 - 39	2002	32-76%	44	2010	26-61%	35
40 - 49	2003	75-93%	18	2011	62-85%	23
50 - 59	2001	92-98%	6	2011	85-95%	10
60+	2001	96-100%	4	2011	96-100%	4

f). According to HIV diagnosis by ethnicity and gender maximum HIV infected men are white and women Black African similarly minimum infected population from Black other for both genders.

g). According to regional distribution of HIV diagnoses maximum infected population were found in London.

h). According to HIV diagnosis by exposure categories transmission route in 2011, 86% of newly diagnosed cases were acquired. The number of HIV diagnoses arising from heterosexual, male homosexual and non-sexual exposure.

i). Heterosexual sex was the most common cause of HIV infection in the UK between 1999 and2010. HIV cases attributable to heterosexual contact peaked in 2004, at 4,829 representing 63% of all new diagnoses. Since then the number attributable to heterosexual contact has fallen-to 2,359 cases in 2011, representing 42% of all diagnoses.

j). The highest number of HIV cases acquired through sex between men was recorded in 2007, but the proportion of cases attributed to male homosexual contact was still lower than that observed for heterosexual contact.

k). In 2011, although the number of cases acquired through sex between men fell slightly, the proportion of cases (44%) meant that male homosexual contact was the most common cause of HIV infection. This is the first time since 1999 that male homosexual sex was the most common cause of HIV infection in the UK.

l). The primary exposure risk for HIV was homosexual male contact: in years prior to 1995, heterosexual contact was the cause of just 18% of all HIV infections, whilst sex between men was the cause of 63% of cases. The importance of injecting drug use as a means of HIV transmission has also declined since 1996, from 196 cases to 102.

m). Blood products in the UK have been routinely screened for HIV since 1985, and are destroyed if it is detected. All blood products (including US imports) in the UK have been 'virtually HIV-free' since 1983 and HIV acquired in this manner is correspondingly extremely rare (around 1.5% of all diagnoses since 1996); it most commonly occurs in individuals treated with infected blood abroad.

n). Pharmaceutical and social strategies are useful to prevent the disease. We need more aware about all the risks and signs or symptoms.

o). There is no any proper vaccination to cure the patient or any kind of injection or pre-drug to save non-infected persons.

As of 2012 there is no effective vaccine for HIV or AIDS. A single trial of the vaccine RV 144 published in 2009 found a partial reduction in the risk of transmission of roughly 30%, stimulating some hope in the research community of developing a truly effective vaccine. Further trials of the RV 144 vaccine are ongoing.

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