

Role of Mathematical Modeling to Predict Aids Infection in Working Women Migrants

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Abstract:

Mathematical modeling is a valuable tool for understanding the role of AIDS infection in female migrants in India and for developing effective prevention and treatment strategies. By incorporating migration patterns, risk behaviors, and intervention strategies, these models can help policymakers to make informed decisions and improve the health of vulnerable populations. Mathematical and Statistical models are serving as tools for study epidemiology of Human Immunodeficiency Virus (HIV) if they are constructed properly. The present paper, deals with AIDS-related mathematical biology for urban female population in India. An applicable dynamical model is also explained. Model predictions are subject to uncertainty, and it is importantto interpret female migrants. Workas less than30 years ofage having number of losed boyfriends. Theyare clearly attached with their boyfriends. Proposed model is fitted satisfactorily. Estimated values indicates an increasing the living and working conditions and they need adequate support should be provided to single young migrants women that might be make vulnerable to STDs and HIV/AIDS infection. The obtained accurate analytical results can be employed torunsensitivityanalysis of the parametersof governing system better understand the spread mechanism of the disease and suggest effective preventionmeasures.

Keyword: Mathematical modeling, STDs, HIV/AIDS, HIV dynamics.

INTRODUCTION:

Humanimmunodeficiencyvirus(HIV)isa virusthat infectsCD4+T lymphocytes, leading to a weakened immune system in individuals. On the other hand, Acquired immune deficiency syndrome (AIDS) refers to the symptoms that occur as a result of a weakened immune system due to HIV infection [9,17]. HIV can be transmitted through bodily fluids such as blood, semen, genital fluids, and breast milk.

The presence of HIV in India became evident when first cases were documented in the southern city of Chennai in 1986. Prevalence of HIV is broadly divided into three

groupsasperstates and union territories [17] High prevalences tates: Forty-five districts in 6 HIV prevalence states fall in this category–Moderate prevalence states: Three states fall into this group where the HIV prevalence is more than 5% among high risk groups.–Low prevalence states: The remaining states in the country are classified within this group

Heterosexuality is the main cause of HIV transmission. Commercial sex workers, homosexuals, and intravenous injection drug users are classified among the high risk groups, whereas migrant population workers of unorganized sectors, street children, and youth adolescent are among the most vulnerable



groups [1,9].

The present paper aims to find an analytical solution to a mathematical model for the transmission dynamics of HIV/AIDS epidemic with emphasis on the role of female workersinthediseaseprevalence.It isbelievedthat analytical solutions are moreuseful in the study of disease transmission dynamics than numerical solutions because they enable us to obtain quantitative information on the variables that cannot be measured easily.

Only in early nineties was there a noticeable media exposure. Currently, there are more than 320 surveillance centres across India.

There is a lot of information on the HIV dynamics allover the world now. Despite an identification of major risk groups and their behavior, the picture of the dynamics of AIDS virus spread is not very clear.

A. Kimbir and H. Oduwole Kermack and Mckendrick's treatment of HIV proved the capability of

mathematical models in understanding and predicting epidemics.

This isprimarilydue tothe absence of scientific means of gathering and modeling- information on the infectious period of HIV virus injected time to onset of symptoms of AIDS, sexual behavior of high risk and low risk individuals in the population, probability of transmission from the injected to the susceptible per partnership and other relevant parameters.

Mathematical models have also been developed recently for other sexually transmitted disease.

Isham, V. and Medley, G. has presented a simple and usefuldiscussion on various mathematical models for STPs.

N. Kaur, et.al., represents modeling data on AIDS. This model used annualized south Asian regional data and extrapolated to AIDS in future. Shukla, U.S. attempt to model the spread of AIDS in a comprehensive manner with limited data. The incubation period of AIDS in India, estimated through deconvoluting HIV epidemic density and reported AIDS cases, in between 8 and 12 years. Quantitative information on commercial sex activity and female commercial sex workers number in India are available in various sources.

The complexity of the complete formalization of mathematical models is probably responsible for the discomfort with which biologists treat mathematical research literature on medicine and biology Shukla, U.S.[1,2,3,4,5,6].

They also appear to have reservations about the convergence between epidemiological and their mathematical models. However, there are instance of success in constructing models capable of predicting the outcome of infections.

Such instances inspire our confidence in proposing realistic model. Hence present modeling attempts should be aimed at determining HIV spread mechanisms through testing the sensitivity of the assumptions.

The focuses of the present work is to discuss the applicability of various models to predict AIDS in India, beginning from classic simple epidemic models to more complex heterosexual transmission models proposed and back calculation method. A major portion of the main text is written in a non-mathematical language for clear understanding.

Specialized terminology and relevant equations are given in the appendix for readers who wish to explore the study further. The latest models prepared for HIV spread in India are presented as explained.

$$P(x=0) \quad |\alpha k=0$$

$$P(X=\underline{K})=\alpha pg^{k-1}, \quad K=1,2 \qquad \dots (1)$$



MaterialsandMethods

The proposed model (1) involves two parametersα and p, to be estimated by methodof moment bytaking zerothcelland the theoretical meanto their observed values, that is

Data:

Thestudyisbasedonsurveyedof415unmannedworkingwomen, lessthan 30 years of age in NCR Delhi, while they have wanted lavish life styles and havingnumber ofrich boyfriends, randomly selected from 12 working women's hostels in Delhi.

In India, it is well known that females have been participating equally as malesnow days, womenhave startedtaking up professionalroles and theyare now entering new fieldssuchasadministration, science, technology, medicine, journalismetc. We allknown that India is a male dominated country, but we should remove this world from our dictionary. Historically females are totally dependent on the males. Now, we see that females have been migrating ontheir ownirrespective of their maritalstatus. The question arises, why do we need such study ? Answer is simple that STDs and HIV/AIDS are increasing. It is not a particular answer of this question. It is major problem of world and not of India. HIV/AIDS is not clearly related to female migrants, it is related to make migrants also but somehow related to migrants.

Accordingly to an estimate of UNAIDS, although HIV prevalence rate is low, the overall number of people with HIV infection to high. The majority of the reported AIDS cases have occurred in the sexuallyactive and economicallyproductive age group. Earlier men were the main transmitters of the disease but now studies are showing that femalesare also transmitting the disease to males. A study conducted among 379 HIV/infected people in 1991, reported in the journal of the American Medical Association observes an evidence of female to male transmission. In the Indian Context women in the migrant household do play an important role in family survival but unfortunately they remain invisible in the official data because of the way the concepts ae defined and data is collected. Among females, the proportion of migrant and non-migrant workers in white- collar jobs was almost similar in 1971 but the same become smaller in 1991 than that of the non-migrant workers. There are more migrant women than the non-migrant women in the category of blue-collar jobs.

A model is a symbolic and simplified presentation of reality, which aids in the patterning of observed behavior (1,2,3). Model can be clarified in to two categories as deterministic and stochastic. The deterministic model assumes a functional relation between their input and output variables are treated as probabilistic distribution and their relation between the input and output variables are left to probability(17). Formulation of models and their application is becoming very important in the recent times due to its usefulness and applicability in both natural and social science.

The objective of the present work to proposed probability model based on the above studies and applied to risk for sexually transmitted infections of HIV transmissionorunwantedpregnanciesdueto change insexualbehaviorofsingle female migrants. They have wanted to make different close boyfriends and most of them have been taking interest to go out with friends for movies or drama orto restaurants or hotels, while some of themgo to night clubs, discos, bars, pubs or attend late night parties. **Model :** The present model for the number of closed boyfriends to describes. The distribution of single unmarried



female migrants, which based on displaced geometric distribution under the following assumption:

- Letαbetheproportionoffemalemigrantshavingatleastonecloseboyfriend.
- Number of close boyfriend attached with the female migrants follows a displaced geometric distribution.
- Let p be the probability of close boy friend attached with young unmarried female migrants, they are more vulnerable to STD/HIVs infections w.

Results & Discussions

Table and graph No 1 given the distribution of observed and expected number of young female migrants and their number of closed boyfriends. The value of $x^2 = 2.08$ with 3 degree of freedom at 5% level of significance indicates that proposed model fitted wellto the distribution of female migrants. The estimated value (0-8039) of the proportion of female migrants having at least one boyvs. very high because most of the young migrants believe that their friends pornographic materials with us. It also indicate the number of female (0.8039) migrants one having close boyfriends. Theyare more vulnerable to STDs and HIV/AIDS. The probability of closed boyfriends attached with young unmarried female migrant is 0-4788 which is also near to fifty percent.

The first sexual event has clear health implications since it mark initiation into the sexual act which if unprotected, one caries a risk of adverse outcome such as unplanned pregnancy. HIV and sexually transmitted infections (Wellings et.al. 1994).

Table: Observed and expected number of unmarried single female migrants according to their closed boyfriends.

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No.ofclosedboyfriends	Observed%	Expected %
)	72	72.00
1	129	138.25
2	80	72.57
3	55	48.84
4	19	18.45
5	11	12.56
Fotal	366	362.67

Note: a =0-8038,p=0-4789,x²=2.047

Conclusion:

Model predictions are subject to uncertainty, and it is important to interpret them with caution. In conclusion, the proposed model is tested set of data on the number of young unmarried female migrants. Work as less than 30 years of age having number of

closed boy friends. They are clearly attached with their boy friends. Proposed model is

fitted satisfactorily. Estimated values indicates an increasing the living and working conditions and they need adequate support should be provided to single young migrants women that might be make vulnerable to STDs and HIV/AIDS infection.

The obtained accurate analytical results can be employed to runsensitivity analysis of the parameters of the governing system to better understand the spread mechanism of the disease and suggest effective prevention measures. Mathematical models can help to identify the risk behaviors that are most common



among female migrants and prevention messagesaccordingly. But modelsare based onassumptions and simplifications of reality, which may not always accurately reflect the complex dynamics of HIV/AIDS transmission. Models require accurate data on HIV prevalence, transmission rates, and migration patterns, which may be difficult to obtain.

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