Original Article

Deploying machine learning to find out the reasons for not using condom in a questionnaire-based study of 120 patients

Balaji Govindan, Karunakaran Maduravasagam[1]

Department of Dermato-Venereo-Leprology, Government Thiruvarur Medical College, Thiruvarur, [1]Department of Dermato-Venereo-Leprology, Government Mohan Kumaramangalam Medical College, Salem, Tamil Nadu, India

Address for correspondence:
Dr. Balaji Govindan, 5/32, V. Arumuga Nagar, Alagapuram, Salem - 636 016, Tamil Nadu, India. E-mail: ezhilbalaji@gmail.com

Abstract

Context: Even though condom offers more than 90% protection against human immunodeficiency viral infections (human immunodeficiency virus) and few sexually transmitted infections (STIs), the overall use of condom in India is low. Many studies revealed that the significant barriers for not using condom were lack of privacy in stores, cultural differences, etc. **Aims:** We intended to find out the reasons for not using condoms in patients attending the STI clinic, by using questionnaire, and had applied machine learning tool to predict those reasons for not using condoms, from the data collected. **Subjects and Methods:** A questionnaire was administered on 120 patients of age above 10 years attending the STI clinic in a tertiary hospital. From the dataset obtained, we intended to understand if the demographic profile of the candidate could predict the reasons for the avoidance of condoms during sexual activity, by using machine learning algorithm called Support Vector Machine. **Statistical Analysis Used:** MS Excel worksheet to enter the data and Support Vector Machine algorithm were used for statistical analysis. **Results:** Respondents were 53% male, 45% female, and 2% transgender. Despite the knowledge of the condoms, 68% of the patients in the study did not use condom. The majority of the patients (41%) stated that condoms were not necessary when they have sexual activity with a known and consistent partner. With machine learning, we found that the prediction accuracy was significantly more than chance (73.47% ±14%) when the feature vectors include only the response to Question 1. **Conclusions:** Results of the study identify the specific reasons for not using condom and help us in devising specific strategies to promote the condom usage. Our results from machine learning suggest that gender of the respondent is the best predictor in predicting the reason for the nonusage of condom.

Key words: Condoms, human immunodeficiency virus, machine learning, questionnaire, sexually transmitted infection

INTRODUCTION

Condom when used correctly and consistently provides more than 90% protection against human immunodeficiency viral infections (human immunodeficiency virus [HIV]) and few sexually transmitted infections (STI) such as Hepatitis B virus and gonorrhea.[1] A survey on condom usage pointed out that 42% of the males did not use a condom from the start to the completion of penetrative sex.[2] A study by Grimley *et al.* revealed that incorrect use of condom leads to STI.[3] The most significant barriers for not using condoms vary from lack of privacy in stores, cultural differences to less comfort, lack of sexual satisfaction with condoms, husband's

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alcohol use, depression, anxiety, and not available at that instant.[4] To overcome these barriers, we have to develop specific strategies to bring down HIV and STI transmission. Hence, we planned a questionnaire-based study to find out the various reasons for not using condom in the attendees of STI clinic in our tertiary care center. From the dataset, using machine learning, we intended to understand if the demographic profile of the candidate could predict the reason for the avoidance of condoms during sexual activity. Machine learning is a process by which algorithms learn from the dataset without explicit programming. Once an algorithm learns patterns in the dataset, it can predict data points.[5] Here, we have used support vector machine (SVM) algorithm to predict the reasons for non use of condoms.

SUBJECTS AND METHODS

Totally, 120 patients attending STI clinic in November–December 2015 were included in this study. All the patients aged above 10 years were included in the study and oral consent was obtained before the administration of the questionnaire. Fifteen questions in the regional language were given to the patients. For those who could not read or write, the faculty members of the department explained the questions non-judgmentally and filled the responses given by them. All the participants were given 10 min to complete the questionnaire. The study was anonymous and participants were informed that their responses were confidential. First, three questions were directed to know the demographic details of the patients' gender, age, and educational status. Questions four to nine were asked to assess their knowledge and the availability of condoms in different places such as government hospitals and medical shops. The remaining six questions were raised to know their attitude and behavior in condom usage against their sexual partners, especially the last question was directed to know the reasons for nonusage of condoms. Data were entered in MS Excel worksheet and analyzed. This study was approved by our hospital's ethical committee.

Support vector machine algorithm

We delineated the original dataset into training (80%) and test data (20%). The test data were to see whether this algorithm could correctly predict. In our study, responses to Questions 1, 2, and 3 were feature vectors. Responses to Question 15 were chosen as the target vector. The algorithm learned patterns of relationship between the feature and target vectors in the test dataset. Using the test data,

we checked if the algorithm could predict the target vector (i.e., the choice of response to Question 15) from the corresponding feature vectors. To maintain the accuracy of the study, we limited the samples to the ones which had responses to question 15 as 4 (n = 49) and 8 (n = 27). The choices for Question 15 which had less number of opting for were removed from the samples. Therefore, the task of the SVM was to predict if the respondent chose choice 4 or choice 8 as the response to Question 15 just from his or her demographic profile (responses to Q1, Q2, and Q3).

RESULTS

The questionnaire was administered to 120 patients in the 2-month period of November–December 2015. Patients aged <10 years and those who were not interested were excluded from the study. The responses of the study population were depicted in Chart 1. Respondents were 53% male (n = 64), 45% female (n = 54), and 2% transgender (n = 2) [Chart 2]. The predominant age spectrum involved in the study was as follows: 11-20 years 3%(n = 3), 21-30 years 30% (n = 36), 31-40 years 33% (n = 40) and above 40 years 34% (n = 41). [Table 1], respectively. The education profile of the patients was as follows: 27% (n = 32) illiterate, 23% primary level (n = 28), 38% secondary level (n = 46), 12% graduate (n = 14), and 0% (n = 0) with postgraduate qualification [Table 2]. Nearly 87% of the study populations were aware of condoms and 13% were unaware [Chart 3]. The knowledge of the patients about the availability of condoms in different places was as follows: government hospital 47%, medical shops 54%, nongovernmental organizations 5%, bus stand 7%, and dabas 1% [Chart 4]. In attitude section, 79% of the patients answered that they "would not use condom" with sexual partners other spouse, only 1% of patients said that they "would use" and 20% of the patients "did not respond" to it. In regard to the condom usage only with commercial sex workers, 6% said "yes," 71% said "no," and 23% gave "no response." Nearly 78% said sex without condom must not be encouraged, nobody said it should be motivated and 22% did not respond. In practice section, 93% of the patients had history of previous sexual activity and only 7% did not have such history. Regarding the condom usage, 20% were using condom, 68% not using and 12% had no sex. The various reasons [Chart 5] for not using the condom among the study group were as follows; 1% (n = 1) increased pleasure, 41% (n = 49) reliable partner, 7% (n = 8) due to unplanned sexual activity, 8% (n = 9) to have a child, 1% (n = 1)
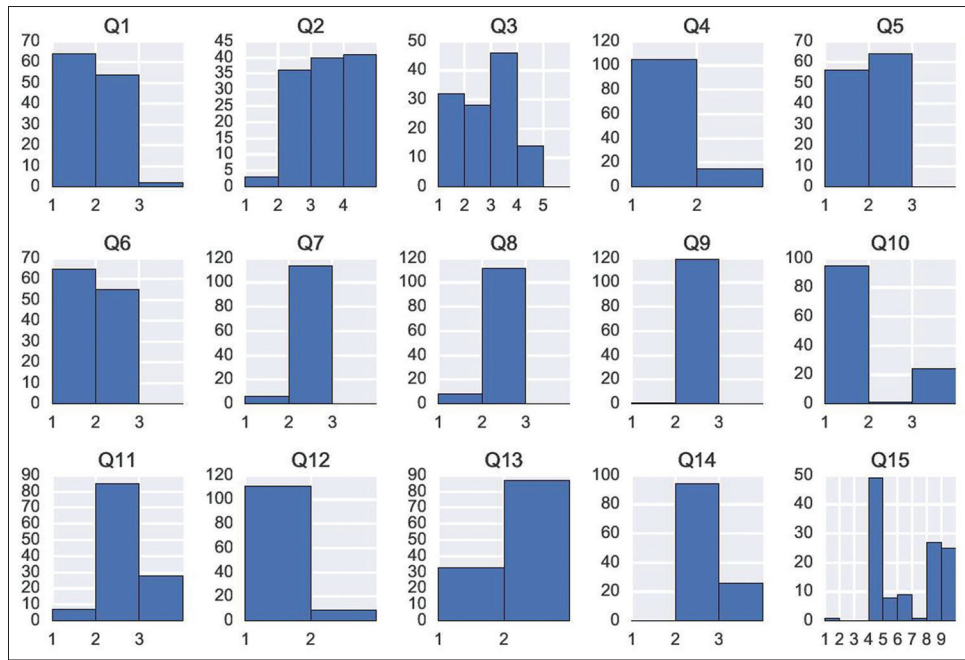
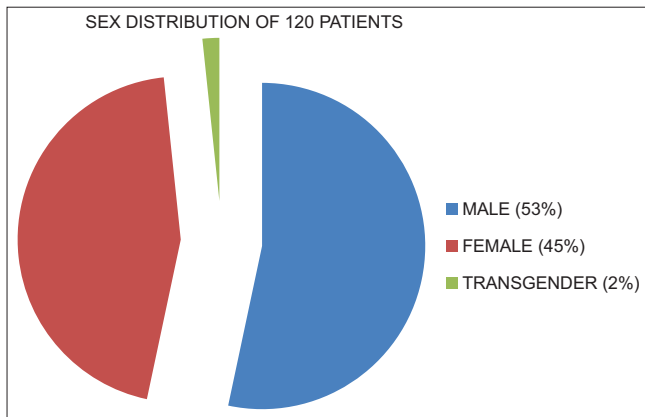Chart 1: Responses of the study population for the questionnaire

Chart 2: Sex distribution of the study population

Table 1: The age distribution of the 120 patients

Age spectrum (years)	Number of patients (%)
11-20	3 (3)
21-30	36 (30)
31-40	40 (33)
>40	41 (34)
Total	120 (100)

Table 2: The education status of the 120 patients

Education status	Number of patients (%)
No education	32 (27)
Primary level	28 (23)
Secondary level	46 (38)
Graduate level	14 (12)
Postgraduate level	0
Total	120 (100)

under the influence of alcohol, 23% (n = 27) due to other reasons like they had undergone family planning (n = 3), do not know about condoms (n = 11) and did not have recent active sexual activity (n = 13). From SVM algorithm, we found that the prediction accuracy was significantly more than chance (73.47% ±14%) when the feature vectors include only the response to Q1. Our results suggest that gender of the respondent is the best predictor of the reason for the nonusage of condom. However, it could vary depending on the sample size and the machine learning algorithm.

DISCUSSION

Despite the increased awareness of condoms, the condom usage to prevent HIV and STI is low due to barriers such as lack of privacy in stores, cultural differences, lack of sexual satisfaction with condoms, and alcohol use.[4] Condoms are stigmatized because of their association with casual sex and multiple partnerships.[5] Condom usage among the couples implies the infidelity or having multiple partners.[6,7] Furthermore, disparities in power enable one partner to unilaterally deny the use of condoms. Woman's ability to negotiate condom use is limited.[8,9] However, Taylor in his study observed that women also oppose condom use for a variety of reasons.[10]

Santhya et al.[11] observed that only 7% of young women and 27% of young men used condoms, but our study revealed that people aged above 30 years (64%) did not use condoms. Majority of
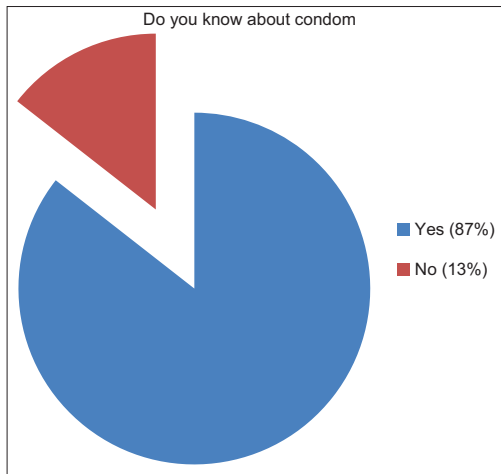
Chart 3: Percentage of the study population regarding whether they know about condom or not
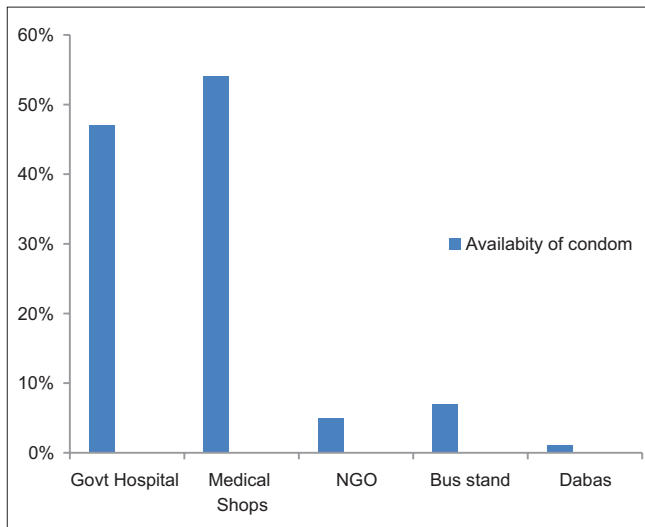

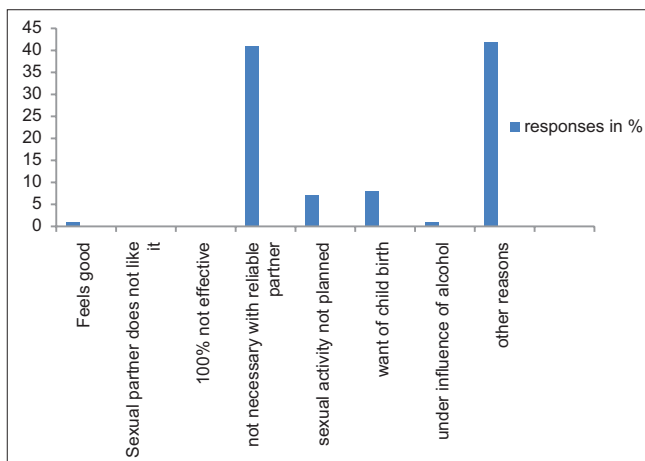**Chart 4: Knowledge of the patients about the availability of condom in different places**

Chart 5: Different reasons given by the patients for not using condoms

the patients in our study had lower educational qualification (50% illiterate and primary level)

associated with nonusage of condom, which was similar to the study conducted by Lagarde et al.[12]

Normal sex suggests that sex with a stable partner is safe, while sex with a casual partner is risky, and people use condom only when they have sex with risky partners.[13] Concurrent with the above statement, condom usage was high in casual partners and multiple partners as published by Mehryar[14] and Soskolne et al.,[15] respectively. Even in our study, the predominant reason mentioned by people (41%) was condoms were not necessary when they have sexual relationship with reliable partners. Nonusage of condom due to unplanned sexual activity (7% in our study) was one of the many reasons stated by Abdool Karim et al.[16] 1992. Alcohol consumption was associated with an increase in unprotected sex in the study by Brown and Vanable,[17] but in our study, it was only 1%.

With this background, we tried a questionnaire with questions namely Q1 (gender), Q2 (age), and Q3 (educational qualification) based on demographic details to predict the reasons of nonusage of condoms using SVM learning algorithm. The prediction accuracy was significantly more than chance (73.47% ± 14%) when the feature vectors include only the response to Q1 than the combined questions.

So far, only few studies utilizing machine learning in sexually transmitted diseases were published. Feaster et al.[18] used machine learning approach to predict STI in sexually transmitted disease clinics. Reginald and Patoli had employed machine learning and path-finding algorithms for syndromic management of sexually transmitted diseases.[19] Till date, up to our knowledge, this is the first machine learning study to predict the reasons for not using condoms. The limitation of this study includes the small sample size and few feature vectors used for prediction.

If we include these machine learning techniques in a large population for predicting nonusage of condoms, we can specifically address the reasons and policy decisions could be made easily and effectively.

CONCLUSIONS

Our results from machine learning algorithm suggest that gender of the respondent was the best predictor of the reason for the nonusage of condom. Hence, this type of study could help us in devising specific strategies to promote the condom usage and thereby we can bring down the new STIs/HIV.

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Conflicts of interest
There are no conflicts of interest.

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