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Original Article

Effect of gender gap in internet access on the comprehensive knowledge of HIV

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Abstract

Introduction: India is committed to achieving the United Nations Sustainable Development Goals, aiming to eradicate human immunodeficiency virus (HIV) by 2030. India has 2.4 million people living with HIV. This study aims to identify gender gaps in internet access and their impact on comprehensive HIV knowledge.

Methods: India's National Family Health Survey-5 (NFHS-5) data, which is public and anonymised, is used for the study. The sample is divided into urban and rural men and women. Correlation coefficient analysis, linear regression analysis, and descriptive statistical analysis were performed.

Results: National-level data on internet access show a greater number of men with internet access (total 57.1%, urban 72.5%, and rural 48.7%) than women (total 33.3%, urban 51.8%, and rural 24.6%). The descriptive analysis shows that in every region of India; men are more numerous compared to women with access to the internet and comprehensive knowledge of HIV. Linear regression analysis at a significance level of 0.05, when compared with the total women population (0.347), urban women (0.3529), and rural women (0.3963), with values for total men population (0.6051), urban men (0.4159), and rural men (0.5538) for the study variables, shows a significant gender difference. Correlation coefficient analysis at a significance level of 0.05 shows a linear association between the study variables.

Conclusion: This study identified an urban-rural and gender disparity. As a result, differences were discovered in internet access and HIV awareness. Men have more access to the internet than women. Our findings revealed a clear link between internet access and HIV knowledge. Gender inequalities affect social variables such as access to technology, with men having greater access to the internet than women. Men, irrespective of cities or rural areas, have greater access to the internet than women, which may explain why they are more knowledgeable about HIV. Compared to rural women, urban women have better internet access, which could explain why urban women have a higher level of HIV knowledge. Gender inequality in information access has an impact on health outcomes.

Introduction

In terms of the total number of persons living with HIV, India ranks third in the world. In 2021, 2.3 million people were living with HIV, including 63,000 new infections.[1] Women have a higher likelihood than men of contracting HIV during vaginal intercourse due to the larger surface area of the vagina compared with the penis, which is exposed to HIV-infected semen,[2,3] along with various other gender-specific risks associated with transmission.[4]

While other socioeconomic determinants of health, such as work, income, and education, may fluctuate over the course of a person's life, gender remains a constant throughout their lives.[5] Health outcomes are impacted by gender disparities. When it comes to preventable and unnecessary differences in morbidity, mortality, and access to healthcare services between men and women in society, gender inequalities in health are prominent.[6]

The risky behaviours that result in HIV and other sexually transmitted infections (STIs) can be mitigated through comprehensive knowledge of HIV. There is noticeable gender-based differences in HIV knowledge and rates among young people worldwide.[7]

The improvement and understanding of public health is greatly assisted by the internet.[8,9] Currently, 759 million Indians, or more than half of the population, use the internet; by 2025, this figure is expected to rise to 900 million. As of 2022, 399 million of India's 759 million active internet users live in rural areas, while 360 million live in urban areas.[10]

The COVID-19 pandemic has drawn attention to our reliance on broadband internet, which is now seen as a critical necessity, much like electricity and water, rather than an indulgence.[11] Since many other socioeconomic determinants, including education, healthcare, nutrition,

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and income, rely on broadband internet connection, it is an important factor affecting health.[12]

There is no research available to show whether internet access affects people's comprehensive knowledge of HIV. At the same time, it is vital to investigate how gender affects people's ability to access the internet. Studying the relationship between internet access and comprehensive knowledge of HIV may help to frame strategic policies for gender-based interventions.

Methods

Data

We used publicly available, categorised secondary data from the India National Family Health Survey-5 (2019–2021). The Ministry of Health and Family Welfare (MoHFW), Government of India, carried out this survey. Information for 707 districts, 28 states, and 8 Union territories (UTs) is accessible from it. The NFHS-5 program was conducted in two different phases. Eleven states and three UTs completed the second phase, whereas 17 states and five UTs have finished the first.

Ethics statements

Ethics approval

Our analysis is based on the NFHS-5 survey dataset, which is freely accessible from the NFHS website and contains no personally identifiable participant information. The information indicates that ethical approval was granted by the International Institute for Population Sciences (IIPS) ethics review board in Mumbai, India. The ICF Institutional Review Board in the United States reviews and approves these surveys. According to the data, the respondents gave their informed written agreement to participate in the study. According to the standard procedure used in these nationwide surveys, each respondent's consent is obtained prior to the interview.

Survey protocol

A consistent sample design representative at the district, state/union territory, and national levels was used in every survey round. The NFHS-5 survey process was reviewed and approved by the IIPS' Institutional Review Board.

The survey protocol states that comprehensive knowledge includes denying two widespread myths about HIV/AIDS prevention or transmission, realising that a healthy-looking person can have HIV/AIDS, and knowing that the risk of HIV/AIDS can be decreased by using condoms consistently during sexual activity and by having only one faithful, uninfected partner.

Sample design

Of the 664,972 households selected for the sample, 653,144 were occupied. A 98% response rate was obtained from the successful interviewing of 636,699 of the occupied households. A total of 747,176 eligible women between the ages of 15 and 49 were selected from the interviewed households to participate in one-on-one interviews. 724,115 women were interviewed, yielding a 97% response rate. A total of 111,179 eligible men between the ages of 15 and 54 lived in households chosen for the state module. A total of 101,839 men were interviewed, yielding a 92% response rate.

Patient and public involvement

Patients and the general public were not involved in the study design because it is based on publicly accessible data.

Study population

India's rural and impoverished areas account for the majority of the country's population, while the affluent urban population is responsible for the increase in income. Therefore, researching both populations would aid in a deeper understanding of the problem. The study uses four sub-samples of the population- urban women, rural women, urban men, and rural men. To facilitate better data analysis, the country is divided into six regions.

The six states that make up the northern region are Himachal Pradesh, Punjab, Uttarakhand, Haryana, Delhi, and Uttar Pradesh. Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Telangana make up the southern region. Bihar, Jharkhand, Odisha, and West Bengal make up the eastern region. Rajasthan, Maharashtra, Gujarat, and Goa make up the western region. There are two states in the central region, Madhya Pradesh and Chhattisgarh.

The North-East region is made up of the eight states-Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. The UTs—Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Lakshadweep, Puducherry, Jammu and Kashmir, and Ladakh—are categorised based on their geographical locations.

Statistical analysis

The data's descriptive statistical analysis has been done. Linear regression was used to analyse data on the proportion of men and women with connectivity to the internet (%) and those who were fully informed about HIV (%). Using a line-of-best fit, linear regression models the relationship between two variables and estimates the value of a response. The degree of a linear relationship between internet access and thorough HIV knowledge in men and women was assessed using a Pearson correlation coefficient analysis. This analysis is conducted using the Dotmatics biostatistical analysis program, GraphPad Prism 10.

Results

Data on internet access at the national level reveals that more men (total 57.1%, urban 72.5%, and rural 48.7%) have access to the internet than women (total 33.3%, urban 51.8%, and rural 24.6%) (Figure 1). The percentage of men with comprehensive HIV knowledge (total 30.7%, urban

37.5%, and rural 27.1%) is higher than that of women (total 21.6%, urban 28.6%, and rural 18.2%) (Table 1).

The proportion of urban women and men with internet connection is higher than that of rural women and men in all northern Indian states. Similarly, compared to rural areas, a significantly higher proportion of men and women in metropolitan areas are aware of HIV. The percentage of women who are aware of HIV has decreased in all states when compared to NFHS-4 data, whereas the percentage of men who are aware of HIV has grown in Delhi, Ladakh, and Jammu & Kashmir (Table S1).

The average percentage of men in northern India who have internet access is 74.34%, which is greater than the average percentage of women (51.92%) (Table S2). In northern India, 63.58% of urban women and 40.31% of rural women have an internet connection. In both rural and urban areas, men have greater access to the internet than women (82.53% and 61.42%, respectively).

In terms of comprehensive awareness of HIV, there are more urban women (25.19%) than rural women (20.39%). There are fewer women with comprehensive knowledge about HIV when comparing the overall proportion of women with this knowledge in the NFHS5 data (22.67%) with the NFHS4 data (30.72%). A comparable pattern was observed in men as well.

In the southern region, the urban-rural divide in women's internet access and HIV knowledge is evident in every state. Across all southern states, the mean internet access among urban residents is 52.68% and among rural residents is 33.38%. As far as the mean of HIV knowledge in southern women is concerned, it is 30.83% in urban and 26.34% in rural areas. The mean of total women with HIV knowledge is 28.78% which is slightly higher compared to the NFHS4 survey (25.48%).

A similar trend is observed in men of South India for internet access. As far as HIV knowledge is concerned, the greater number of men are noticed in rural Kerala and Lakshadweep. When compared to the NFHS4 survey, barring Karnataka, Tamil Nadu, Puducherry and Lakshadweep, the percentage of men with HIV knowledge has reduced.

In the Eastern region of India, an urban-rural divide in both internet access and HIV knowledge is observed among men as well as women. Compared to the NFHS4 survey, the percentage of women with HIV knowledge is more or less similar. The results are similar to women for internet access and knowledge of HIV for men in this region. When compared with NFHS4 data, the state of Jharkhand has shown improved values for the percentage of men with HIV knowledge. In other states, these values have dwindled.

In the western region of India, the most striking feature of data analysis shows for women with HIV knowledge. When women were compared for HIV knowledge, a

Table 1. NFHS5 national level data on internet access and knowledge of HIV in the population

	Internet access to women (%)	Knowledge of HIV in women (%)	Internet access to men (%)	Knowledge of HIV in men (%)
Total	33.3	21.6	57.1	30.7
Urban	51.8	28.6	72.5	37.5
Rural	24.6	18.2	48.7	27.1

HIV, Human immunodeficiency virus.

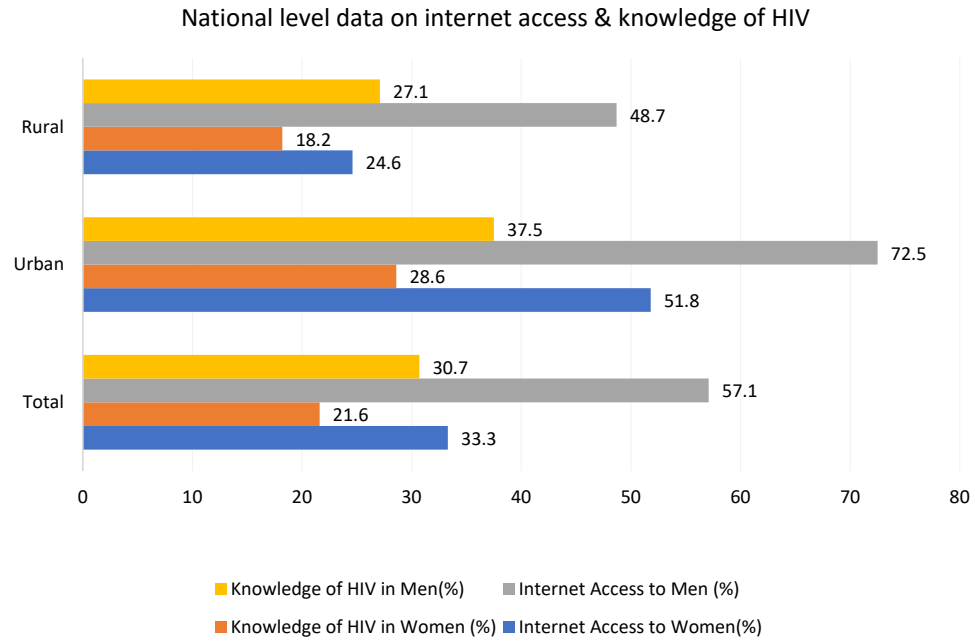

Figure 1. National level data on internet access (%) and knowledge of HIV (%) in rural, urban, and Total men and women. Percentage of men for Internet Access and HIV knowledge is more compared to women in rural, urban and total population

higher proportion of women was observed compared to the NFHS4 data. When comparing the percentage of males with HIV knowledge with NFHS4 data, the percentage of men with HIV knowledge has improved in Gujarat, Goa, and the UTs of Dadra & Nagar Haveli, Diu, and Daman. The gap between urban and rural areas is evident in terms of internet access and HIV knowledge.

In the central region, like any other region of India, the urban-rural divide for internet access and HIV knowledge is seen for men as well as women. Compared to NFHS4 data, the data indicate that a higher percentage of women in both Madhya Pradesh and Chhattisgarh states are knowledgeable of HIV. When NFHS4 data were compared for men with HIV knowledge, men in Madhya Pradesh showed an improvement in the number, whereas the number is reduced in Chhattisgarh.

Some of the most notable aspects have been revealed via data analysis for the northeast region. The proportion of men having HIV awareness is higher in rural than in urban areas in states like Nagaland and Arunachal Pradesh. The percentage of men having HIV awareness has improved in Arunachal Pradesh, Assam, Meghalaya, and Nagaland as compared to the NFHS4 statistics for this region. In comparison to NFHS4 statistics, the same states have demonstrated a higher percentage of women who are knowledgeable about HIV.

Data analysis at the state, regional and national levels show a clear gender gap in access to the internet. It has also shown the gender gap in knowledge of HIV. Men outnumber in both internet access and comprehensive knowledge of HIV. When mean data for different geographical regions are compared, the percentage of women in India who have access to the internet is highest in the north (51.92%). It is followed by the following regions: centre (26.8%), east (25.6%), south (42.95%), west (43.22%), and north-east (47.21%). In all these areas, fewer than half of women have access to the internet. However, men have more access to internet technologies in the same state.

As far as the percentage of women with HIV knowledge is concerned, western India (32.8%) has shown the highest value, followed by south (28.78%), north-east (28.20%), north (22.67%), central (20.90%), and east (16%). When the percentage of men with HIV knowledge is compared in these regions, it has shown the values- western (41.92%), south (37.55%), north-east (35.59%), north (37.08%), central (28.5%), and east (24.13%). In every part of India, there are more males than women who are fully informed about HIV.

The change in the range for both variables was displayed when the data for these two variables' ranges in various geographic locations were compared. Accordingly, in every geographic region there are states where both men and women have relatively higher and lower levels of internet access. In a similar vein, disparities in comprehensive knowledge of HIV for both men and women have been noted among states and regions (Table S3).

The study's regression analysis reveals a linear relationship between internet availability and HIV awareness in India (Figure S1). Analysis of the relationship between internet access and HIV awareness among all women reveals a moderately positive association (R-0.4814, Rsquare-0.2318). According to the slope (b1-0.347), the proportion of women who are knowledgeable about HIV increases by 0.347 percentage points for every 1% increase in internet access (Table 2). There is a considerable gender difference when comparing the b1 values for the overall population of women (0.347), urban women (0.3529), and rural women (0.3963) with those for the entire population of males (0.6051), urban men (0.4159), and rural men (0.5538).

The findings of the Pearson correlation coefficient analysis reveal the gender and urban-rural gaps in internet access and thorough HIV knowledge (Table 3).

Discussion

This study demonstrates that there is a gender disparity in internet access. Men are more likely than women to have access to the internet. At the same time, it shows a gender gap in comprehensive knowledge of HIV. Lack of access to internet technology might be the reason for this gap related to comprehensive knowledge of HIV. Along with a gender gap, there is an urban-rural gap for internet access as well as for comprehensive knowledge of HIV.

More women and men have access to the internet in cities than in rural areas. A disparity in access to internet technology exists between urban and rural areas. According to this study, internet access and HIV knowledge are positively correlated. The more people who have access to the internet, the more knowledgeable they are about HIV. The proportion of people in India's cities who have access to the internet is significantly higher

Table 2. Inference for linear regression (at 0.05 significance level) analysis of men and women population for Internet access and comprehensive HIV knowledge

Independent variable	Dependent variable	Population	b1	b 0	R2	*P* value	Inference
Internet access	HIV knowledge	Total women	0.347	10.777	0.2318	0.002953	Moderate direct relationship
Internet access	HIV knowledge	Urban women	0.3529	9.4065	0.1408	0.02414	Weak direct relationship
Internet access	HIV knowledge	Rural women	0.3963	9.7515	0.3244	0.0002879	Moderate direct relationship
Internet access	HIV knowledge	Total men	0.6051	-3.6755	0.3972	0.000038	Strong direct relationship
Internet access	HIV knowledge	Urban men	0.4159	7.902	0.1465	0.02121	Weak direct relationship
Internet access	HIV knowledge	Rural men	0.5538	0.8185	0.3208	0.000317	Moderate direct relationship

Table 3. Inference table for Pearson correlation coefficient (at 0.05 significance level)

Independent Variable	Dependent variable	Population	R-score	*P* value	Result
Internet access	HIV Knowledge	Total women	0.4814	0.00295	Significant
Internet access	HIV Knowledge	Urban women	0.3752	0.0241	Significant
Internet access	HIV Knowledge	Rural women	0.5696	0.000288	Significant
Internet access	HIV Knowledge	Total men	0.6302	0.000038	Significant
Internet access	HIV Knowledge	Urban men	0.3828	0.021206	Significant
Internet access	HIV Knowledge	Rural men	0.5664	0.000317	Significant

than the national average. Similarly, a significantly higher proportion of people in urban areas are aware of HIV than the national average.

One review based on 15 research publications examined gender differences in HIV awareness among adolescents and young people in low-and middle-income countries. Its findings included general knowledge, facts vs myths, attitudes, actions, and beliefs. As this review highlights, men were regularly found to know more about HIV than women.[13]

According to a study done on teenagers between the ages of 10 and 19 in the Indian states of Bihar and Uttar Pradesh, teenage boys' and girls' internet use was positively correlated with their awareness of HIV in relation to their peers. It also emphasises how peers, a significant educational gap between men and women, educational institutions attended, age, and cultural double standards all contribute to the gender gap in HIV knowledge. According to the study, another relevant factor of increased awareness among male adolescents may be the cultural double standards that are placed on men and women, encouraging men to talk more openly about HIV/AIDS and related sexual matters while discouraging or even prohibiting women from doing the same. It emphasises that one of the key factors influencing a thorough understanding of HIV is gender.[14]

According to certain research, HIV testing and thorough knowledge of HIV/AIDS are related.[15,16] Compared to men with comprehensive HIV/AIDS knowledge, men without such knowledge were less likely to test for HIV. Men over 20, married or cohabiting, with at least a secondary education, in the wealthiest quintile, media exposure, condom use, and several sexual partners were more likely to test positive for HIV, according to a study done in 29 countries in Sub-Saharan Africa.[17]

Women who are aware of HIV choose to get tested for the virus, which is similar to the results in men. In India, rural women are more susceptible than urban women due to a lack of education, job prospects, and other social hurdles. These studies advise policymakers to increase comprehensive HIV/AIDS education and awareness-raising using efficient mechanisms.

Despite extensive study over two decades, the digital divide has been deepening globally.[18,19] Lack of basic internet accessibility is often linked to digital exclusion and is still influenced by economic issues.[20] Over the past ten years, India has demonstrated a rapid increase in internet penetration; however, our study shows that gender, regional, state-level, and urban/rural differences remain significant. Of India's cities, 40 have a population of one million or more, 396 have a population of one million to one million, and 2500 have a population of 10,000 to one million.[21] Access to the internet and electricity should be prioritised in these areas.

In four sub-Saharan countries, women from Ghana, Guinea-Bissau, Malawi, and Zimbabwe who reported ever using the internet were more likely to know more about how HIV is spread than those who did not, according to research that supports our findings.[22] Women's awareness of HIV/AIDS varies between rural and urban areas, although media-exposed and rural women have shown notable progress during this time. Age, geography, religion, socioeconomic status, education, and use of contraceptives all significantly impact women's knowledge of HIV/AIDS, according to the study.[23] Our findings are corroborated by another study conducted in Angola, which found that urban dwellers were more likely than rural residents to possess thorough knowledge of HIV and AIDS.[24]

A potential cause of the disparity in HIV knowledge between urban and rural women is that rural women frequently face significant barriers to accessing health-related information, education, media, and medical facilities. Additionally, women living in rural regions were less likely to be exposed to HIV/AIDS-related information, including HIV testing and counselling campaigns, as well as various training sessions that raise awareness of the disease.[25,26]

Women have been denied economic, social, and sexual autonomy due to gender inequality, which has negatively impacted their health. Due to these disparities, women are disproportionately affected by and have a continually rising risk of contracting HIV.[27-29]

A study conducted across 11 cities in China's Shandong province demonstrates the beneficial effects of social media on HIV awareness. It demonstrates how, due to their convenience and privacy protection, social media and dating apps could effectively reach high-risk groups like sex workers and men having sex with men when compared to traditional approaches. As a result, internet technology and social media should be leveraged to promote health.[30]

Globally, a primary use of social networking sites is to

locate sexual partners.[31] Therefore, social media should be used increasingly by healthcare professionals to produce health-promotion content, share knowledge, and develop peer-mentored educational initiatives.[32-37]

Sex workers may be a bridging population that spreads HIV to the broader public in addition to being at risk for the virus themselves. 52 million people work as prostitutes worldwide, of which 41.6 million are women and 10.4 million are men. Accordingly, women make up 80% of all sex workers worldwide, and the average age of a female prostitute is 14.[38] There are currently more than 0.8 million female sex workers in India, according to NACO.[39]

A higher rate of HIV transmission may result from the risky behaviours of female sex workers, such as not using condoms, having several partners, using drugs or alcohol before sexual encounters, and using intravenous drugs.[40]

The results of our statistical analysis demonstrate a disparity in internet access among the male and female populations of the country. This disparity is also noted at urban and rural levels among men as well as women. A similar disparity was noticed in the comprehensive knowledge of HIV. The results of this study indicate that more men than women have internet access, and as a result, more men are fully informed about HIV. In conclusion, providing internet access to the maximum population can be a potential intervention by the Government. The internet can help the population in four ways: finding information, making support groups, advocating, and escaping. Health educators can use the internet to promote health information not only for AIDS but also for other diseases.

Limitations of the study

Data on internet access for study variables is not available in NFHS-4 for comparison with NFHS-5 data. The general public's understanding of HIV is influenced by numerous factors. This study only controls for one factor, making it impossible to fully account for how other factors—like social and cultural barriers—may have affected the findings. These will be the subject of our upcoming study. Second, the data used in this study were gathered for NFHS-5 which is also subject to the same limitations as any secondary data. A few possible limitations should be taken into account when interpreting the study's findings in light of all these variables. Despite these limitations, our study has several strengths.

Conclusion

This study sought to assess the proportion and access to internet technology as a determinant of comprehensive knowledge of HIV/AIDS among men and women in India. Findings from this study indicate that several individual and household-level factors can influence access to internet technology and can directly or indirectly affect comprehensive knowledge of HIV/AIDS among men and women. The large sample size is the strength of this study. Compared to men, women have less access to internet technology and consequently less comprehensive knowledge of HIV. This study's results can help policymakers plan and conduct region and gender-specific awareness and screening interventions. Policies aimed at promoting HIV-preventive behaviours among the population may help to reduce the spread of HIV.

Our research, based on the NFHS5 data, identifies the characteristics of segments of the Indian population with the lowest level of comprehensive knowledge of HIV and AIDS. It highlights the need to tackle existing gender-based inequalities in the country. This study also emphasises the potential importance of /AIDS campaigns delivered via the internet, especially in local languages, for improving the comprehensive knowledge of the disease.

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Author's Contribution

Conceptualisation: Jaimini Sarkar.
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Competing Interests

The authors declare no competing interests.

Ethical Approval

Our study is based on the publicly available, anonymous NFHS-

Study Highlights

What is current knowledge?

- There are noticeable gender-based differences in HIV knowledge and rates among young people worldwide. Gender inequalities affect social determinants such as access to technology and health outcomes.

What is new here?

- Access to the internet and a comprehensive understanding of HIV were found to differ by gender. The gap between urban and rural areas is one of the factors influencing internet availability. Our analysis found a direct relationship between access to the internet and comprehensive knowledge of HIV.

5 survey dataset. The NFHS website provides free access to it. The International Institute for Population Sciences' ethics review board in Mumbai, India, granted ethical approval for the NFHS-5 surveys based on the data. The ICF Institutional Review Board, USA, examines and approves these surveys. Respondents provide their informed written consent to participate in the survey during the survey. No additional patient consent for publication was required.

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Supplementary Files
Supplementary file contains Table S1-S3 and Figure S1.

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