**Дослідження**

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# HPV-Associated Cervical and Lower Urinary–Genitourinary Cancer Precursors Among Female Commercial Sex Workers: Urological Implications for Urinary Tract Health

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**Abstract**

Women commercial sex workers (CSWs) remain a high-risk group of people with cervical abnormalities and lower genitourinary (GU) diseases, but integrated screening of both has been minimal. Infection with human papillomavirus (HPV) is a cause of lesions in the cervix and can also cause peri-urethral and lower urinary tract inflammation, and thus this group is especially important to the urological research. The aim of the study was to find out the incidence of HPV-related cervical abnormalities and the evaluation of GU inflammatory disease with a possible urological implication among female CSWs. A total of 307 CSWs who were aged 30-65 years in Budhwar Peth, Pune, were involved in a descriptive cross-sectional study. Pap smear results were done and results with suspicious cytology were sent out to testing of HPV DNA. The cervical lesions, HPV positivity and GU abnormalities were identified using descriptive statistics. Aboriginal cytology was found in 214 women (70%). The pre-cancerous lesions (HSIL and LSIL) contribute 9% and 1 case of cervix cancer proved. Major GU-abnormalities were cervicitis (46%), squamous metaplasia (24%), and ASCUS (22%). Of the 23 women who had been tested on HPV, 6 (26%) were found to be the high-risk HPV positive, and four of them were HIV co-infected. LSIL was more common in women of younger age, whereas HPV positivity was more common in older ages. The presence of inflammatory and epithelial lesion is a significant burden, which raises the need to examine the cervical and lower urinary tract as a whole.

**Keywords:** HPV infection; lower urinary tract; cervicitis; urological screening; commercial sex workers; genitourinary inflammation.

## 1. Introduction

Cervical cancer remains one of the greatest health challenges in the world especially in low and middle-income nations whereby the lack of access to screening and preventive services has led to a consistent morbidity and mortality. According to the latest GLOBOCAN 2022 findings, the incidence and fatalities rates continue to increase, even though the numbers have improved due to the increase in vaccination rates, early diagnosis rates, and community health awareness initiatives [1]. Cervical cancer is among the most common causes of cancer deaths among women in India where there is high disease burden and regional variation in seeking care [2]. Against this broader background, female commercial sex workers (CSWs) constitute a very distinct vulnerable group as of occupational exposure, low power of negotiation and pervasive stigma. The research always shows that CSWs experience significant obstacles such as discrimination in the healthcare facilities that hinder their prompt involvement in routine screening and follow-up care [3]. Sex workers worldwide have been reported to have high rates of cytological abnormalities including LSIL, HSIL, inflammation, and atypical findings. Indicatively, a study conducted in South Africa found that there was a high prevalence of abnormal Pap in unvaccinated CSWs, which supported their high vulnerability to developing HPV-related disease [4]. Those same issues


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remain reported in India, where there is an uneven distribution of measures to prevent cervical cancer [5], and sex worker-specific screen-and-treat initiatives have shown encouraging results with the support of community involvement [6]. There are also rural indications that local screening campaigns in conjunction with awareness campaigns can significantly enhance early identification [7]. Pap smear testing remains a useful and easily available diagnostic method that has been significant in the identification of precancerous lesions and in the provision of proper clinical management [8]. In addition to the gynecological risks that are well documented, CSWs are also vulnerable to various lower genitourinary (GU) and urological complications that tend to accompany the cervical abnormalities. These risks are further aggravated by socioeconomic issues, mobility trends and shun avoidance of healthcare facilities due to stigmatization [9]. The high HIV rates among sex workers also enhance susceptibility to chronic HPV infection and are among the factors that drive faster progression of the disease [10]. Despite numerous studies that have focused on cervical abnormalities or prevalence of HPV alone, limited studies have been done to determine the overlapping of HPV-related cervical disease and lower urinary tract health, despite the new evidence showing there is a clinically relevant overlap. Some of the international researches point out biological and behavioral risk factors of HPV infection, young sexual initiation and reproductive risk factors that jointly affect disease burden among CSWs [11-13]. However, the study in India has not adequately addressed the role of HPV-related inflammation in the cervico-vaginal area to impact the peri-urethral mucosa, lower urinary tract irritation, and pre-exposure to women to repetitive urinary symptoms and GU infections which are all under the urology and urinary system disorder category [14]. Maybe, hygiene constraints in red-light areas can also raise the possibility of urethral and peri-urethral inflammation, which creates potential pathways wherein the chronic HPV-related epithelial alterations can influence the health of the urinary system [15].

CSWs are still one of the most disadvantaged groups of both gynecologic and urologic care systems. Mumbai evidence indicates that HPV and CIN are common among CSWs and it is critical to conduct systematic and integrated screening [16]. Other regional statistics demonstrate unmet reproductive and GU health issues, such as unidentified lower urinary tract symptoms (LUTS) and inflammatory conditions that are not treated [17,18]. These results have highlighted the need to conduct studies that can bridge the gap between the cervical pathology and the urinary system. With such factors in consideration, specific research on cervical abnormalities attributed to HPV and lower genitourinary diseases exhibiting urological significance is necessary. The knowledge about the potential spreading of HPV-related inflammation and cytological alterations to the peri-urethral area can provide a valuable piece of information to clinical practice in the field of urology and health of the urinary system. This paper thus analyses the cumulative effect of the cervical abnormalities and lower GU indicators in female CSWs, and the consequences of this in terms of integrated reproductive-urological screening amongst high-risk populations.

**Research Objectives**

1. To determine the prevalence of HPV-associated cervical abnormalities among female commercial sex workers.
2. To assess the prevalence of lower genitourinary abnormalities (e.g., cervicitis, squamous metaplasia, ASCUS) associated with HPV risk, with emphasis on potential peri-urethral and lower urinary tract involvement.

## 2. Methodology

### 2.1 Study Design

The analytical design that was used in this study was the descriptive, cross-sectional design to determine the prevalence of HPV-related cervical and lower genitourinary abnormalities among female commercial sex workers. The design allowed the researcher to get a clear picture of the cytological and clinical outcomes among the target population at one time. The method is appropriate in estimating prevalence in populations with potential challenges to follow up since of mobility and social cultural restrictions.

### 2.2 Research Setting

The study was conducted in the red-light district in Budhwar Peth, Pune, Maharashtra, where female commercial sex workers are highly concentrated and where there is a substantial involvement of NGOs. One NGO was collaborating to offer a special hygienic clinical area where samples could be collected. This environment allowed the evaluation of the cervical health and lower genitourinary symptoms simultaneously, which ensured privacy and ideal conditions to conduct accurate urological and gynaecological assessment.

### 2.3 Population and Sample

The population of the study was a group of female commercial sex workers who lived or frequented the red-light area of Budhwar Peth. They screened 307 women who were aged 30 to 65 years. To sample the women, purposive sampling was employed to include women who had met the eligibility criteria and were willing to take part. The confidence interval along with the absolute error used in the computation of the sample size, was done based on the prior prevalence of HPV in similar populations of 95% and 5% respectively. With this sample, cervical lesions and GU abnormalities that could be associated with the lower urinary tract were sufficiently detected.

### 2.4 Inclusion Criteria

The participants were eligible and included informed consent of commercial sex workers aged 30 to 65 years. The women with symptoms that were suggestive of lower urinary tract irritation (i.e., dysuria, urinary frequency, or peri-urethral discomfort) were also included as the study involved analysis of the HPV-

related abnormalities of the GU with possible urological implications.

**2.5 Exclusion Criteria**

Pregnant women and women who were menstruating during the time of data collection were excluded in addition to women who had a prior diagnosis or current diagnosis of cervical cancer and women who had undergone hysterectomy. Moreover, people, who had psychological disorders, which might disable their ability to answer the questions or clinical cooperation, were ruled out.

**2.6 Data Collection Tools**

The information was collected with the help of standardized clinical and survey tools. The screening of cervical cytology was performed using a test known as Papanicolaou (Pap) smear test according to the Bethesda System of reporting cytology results. The suspicious results of women were sent to the HPV DNA testing. Sociodemographic factors, sexual and reproductive history, hygiene practices, and clinical symptoms, including lower urinary tract symptoms (LUTS), dysuria, urgency, urinary frequency, suprapubic discomfort, and perceived peri-urethral inflammation, were collected by means of a designed questionnaire. These protocols enabled the characterization of GU malfunctions that could be of urological importance.

**2.7 Procedures**

Cervical samples were collected by trained healthcare personnel after the eligibility check and informed consent, and using the standard clinical procedures. A cytobrush or spatula was used to apply a sterile speculum so as to see the cervix and epithelial cells were taken off the transformation zone. The samples were placed on slides or into liquid based cytology specimen containers preserved in 95% ethyl alcohol, labeled, and forwarded to the pathologist.

The subjects were also evaluated on lower urinary tract symptoms (LUTS) that included dysuria, frequency, urgency and peri-urethral discomfort. The abnormal cytology women were referred to test HPV DNA, out of the 97 suspected 23 were tested and 6 were found to be the high-risk HPV positive. These women were offered biopsy, two of them followed the procedure and one of them had cervical cancer. Women with pronounced GU inflammation were advised of urology follow-up.

**2.8 Data Analysis**

Descriptive statistical procedures, such as frequencies, percentages, means and standard deviations, were used. The findings were categorized as per the Bethesda System of cytology. The analysis was aimed at revealing cervical abnormalities, HPV infection, and lower genitourinary abnormalities with a special emphasis on inflammatory alterations, peri-urethral involvement, and signs related to the lower irritation of the urinary tract. The framework enabled the incorporation of gynecologic and urological results to indicate applicability of the study to the conditions of the urinary system.

**3. RESULTS**

**3.1 Prevalence of Cervical Cancer, Pre-Cancer, and High-Risk Abnormalities**

Cytological analysis revealed that 1 woman (0.3%) had cervical cancer, 3 women (0.9%) had HSIL and 26 women (8%) had features of LSIL, which added up to 29 pre-cancerous lesions (9%). Out of the women who had undergone HPV testing, 6 of them were found to have high-risk HPV, and 4 of them were HIV co-infected. The presence of high-risk cytologic abnormalities (ASCUS 22%, squamous metaplasia 24% and cervicitis 46%) were observed in a substantial proportion of the participants (Table 1).

**Table 1.** Distribution of Cervical Cancer, Pre-Cancer, Other Cytological Abnormalities and HPV Positivity

| | **Condition** | **Frequency (n)** | **Percentage (%)** |
|---|---|---|---|
| | Confirmed Cervical Cancer | 1 | 0.3% |
| Pre-Cancerous Lesions | HSIL | 3 | 0.9% |
| | LSIL | 26 | 8% |
| Other Cytological Abnormalities | ASCUS | 68 | 22% |
| | Squamous Metaplasia | 75 | 24% |
| | Cervicitis | 141 | 46% |
| | HPV Positive | 6 | 26% |
| | HIV Positive (within HPV+) | 4 | 67% |

**3.2 Overview of Screening Outcomes**

A total of 307 female commercial sex workers underwent cervical cytological screening using the Pap smear test. A total of 214 of them were positive (70%), and 93 (30%) were negative (normal cervical cytology). The abnormalities included inflammatory, pre-cancerous lesions and one definite cervical cancer. Figure 1 demonstrates that of 214 referred out of 97, only 23 women showed up to undergo HPV testing and of all 23, 6 (26) tested positive of having a high-risk HPV. Among these six HPV-positive women, two of them participated in the biopsy, with one being diagnosed with cervical cancer.

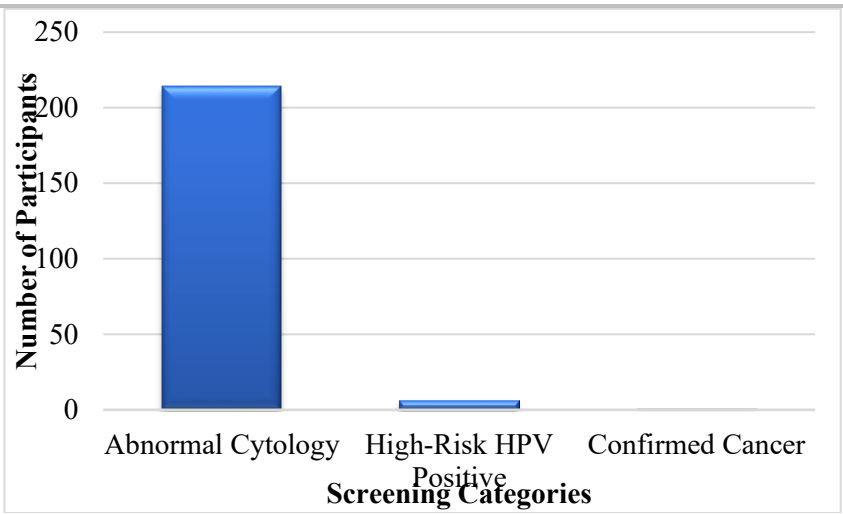


**Figure 1:** Screening Outcomes Among Female Commercial Sex Workers

### 3.3 Distribution of Cervicitis Severity

The most common abnormality detected was cervicitis which was found in 141 women (46%). Of these, 16 (5%), 61 (20%), and 64 (21%) of them had mild, moderate, and severe cervicitis respectively as in Table 2. The overwhelming cervicitis burden and intense inflammation are indicators of possible lower urinary tract implication for chronic inflammation of the pericervical area is known to result in peri-urethral irritation and LUTS in women with high risks.

**Table 2.** Severity of Cervicitis (N = 307)

| Condition | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| No Cervicitis | — | 166 | 54% |
| Cervicitis | Mild | 16 | 5% |
| | Moderate | 61 | 20% |
| | Severe | 64 | 21% |

### 3.4 Age-Wise Distribution of Abnormalities

An age-specific analysis showed that abnormal cervical was present in all age groups but the highest number was among women falling between the age brackets of 30-40 years. The case of single cervical cancer was in the age category of 41-50 (Table 3). The prevalence rate of LSIL fell most within 30-40 years whereas the highest prevalence rate of HPV positivity was in the 51-60 years.

**Table 3.** Age-Wise Distribution of Cervical Pre-Cancer, HPV, and HIV (N = 307)

| Age Group | LSIL | HSIL | Cervical Cancer | HPV Positive (n=6) | HIV Positive (within HPV+) |
|---|---|---|---|---|---|
| 30–40 years | 12 (3.9%) | 3 (0.9%) | — | 3 (0.9%) | 1 (16%) |
| 41–50 years | 8 (2.6%) | — | 1 (0.3%) | 1 (0.3%) | 1 (16%) |
| 51–60 years | 5 (1.6%) | — | — | 2 (0.6%) | 2 (33%) |
| 61–65 years | 1 (0.3%) | — | — | — | — |

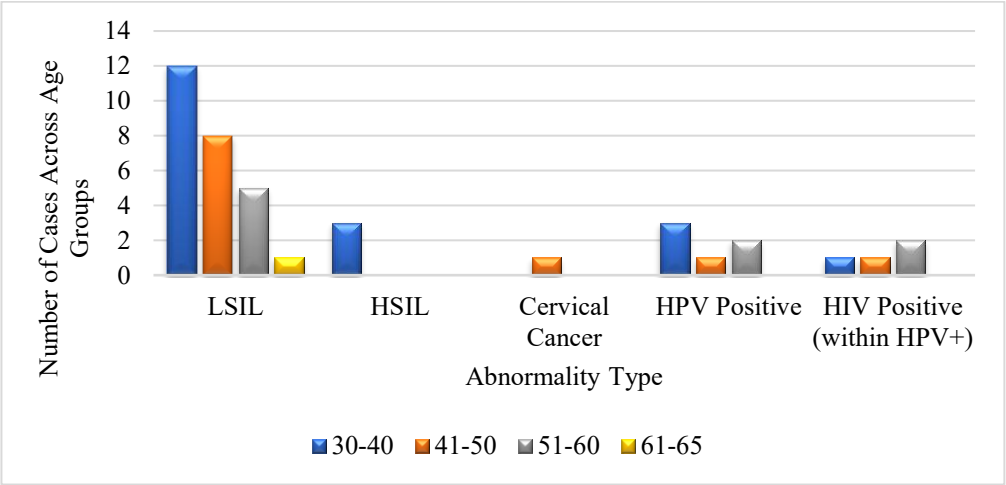


**Figure 2.** Age Distribution of HSIL, LSIL, HPV Positivity, and Cervical Cancer

The trend of younger women having epithelial abnormalities and older women having HPV positivity are again supported by the distribution of HSIL, LSIL, HPV positivity, and cervical cancer by age as illustrated in Figure 2. These age-related trends are interesting in a urologic sense in that aged women who have ongoing inflammation of HPV tend to be more likely to develop chronic genitourinary erythema and lower urinary tract symptoms.

## 4. Discussion

The study evaluated the incidence of cervical and lower genitourinary (GU) abnormalities in female commercial sex workers (CSWs) and found out that there is a heavy load of inflammatory, epithelial, and pre-cancer changes in this high-risk group. Out of the 307 women screened, 214 (70%) abnormal cytology was observed to dominate, and this indicates that cervical and GU abnormalities are common in locations that have marginalized socioeconomically, the lack of access to healthcare, and increased exposure to sexually transmitted conditions. Pre-cancerous (CIN) lesions such as HSIL and LSIL represented 9% of changes whereas cervicitis, Squamous metaplasia and ASCUS were common. These states, especially chronic inflammatory lesions, are clinically important to urology due to the possibility of cervical and vaginal inflammation spreading to the peri-urethral tissues, which can be factors in the lower urinary tract symptoms (LUTS), frequent irritation, and predisposition to lower urinary tract infections. The age-related tendency of abnormalities with LSIL more prevalent in women, 30-40 years old, with HPV as a higher prevalence in 51-60 years-old, indicates a variation in susceptibility and chronicity, which could affect both cervical and urinary tract outcomes.

The fact that a large proportion of the individuals who were tested had a high-risk HPV infection (26%), and that two-thirds of the HPV-positive women had HIV co-infection, highlights a biologically vulnerable group in this group. This trend is in line with the findings in South Africa that HIV seroconversion has a fast impact on HPV prevalence and antibody production and consequently contributes to susceptibility to persistent infection and disease progression [19]. The high association found between HPV and HIV in this research enables longstanding evidence, which indicates that immunocompromised women are more likely to develop chronic changes in their epithelia that might go beyond the cervix to the adjacent GU tract. Similar observations have been made in international studies regarding high risk of HPV in sex workers. A study conducted in Vietnam revealed that there were high rates of cervical HPV infection in female sex workers and this study highlighted in what way occupational factors and patterns of sexual behavior affect the acquisition of the virus [20]. The results of Bangladesh also reported a high prevalence of the high risk HPV strains in the sex workers at Dhaka [21], similar to the 26% prevalence rate in this study. Another European study on Spain also indicates that high-risk HPV prevalence and risk factors in sex workers depend on demographic characteristics, such as the place of origin and migration status [22]. Similarly, a study of the genotyping of HPV in Korea revealed that the CSWs widely had pathogenic HPV types including several high-risk HPV types [23]. Together, all these trends in the world are in line with the present study, which is why HPV-related disease, comorbid infections, and epithelial abnormalities continue to disproportionately impact CSWs.

Although the gynecological significance of these results is not a secret, the urological one should be accentuated more. Cervicitis, which was found in almost half of the participants, is especially important to the well-being of the urinary system. Moderate to severe cervicitis can result in adjacent inflammation of peri-urethral mucosa, which predisposes people to dysuria, urinary urgency, frequencies, supra pubic pain, and frequent lower urinary tract inflammation. Squamous metaplasia, which is also largely common in this study, can modify the local epithelial resilience and decrease the mucosal defense and predispose to incidences of urinary tract disturbances. These intersecting mechanisms emphasize the way health of the cervical and lower UTI are interconnected and a good reason to introduce urology screening into the routine cervical examination of CSWs. Regarding the critical issues of public health, the findings of the study highlight a number of priorities. First, the high percentage of abnormal cytology evidences the necessity of providing regular and acceptable cervical screening programs to also assess lower urinary tract symptoms and signs. With the stigma and discrimination that is frequently reported by CSWs, the models of service delivery should be focused on the concept of confidentiality, partnership with the community, and the development of trust. Two, HPV-HIV co-infection is at a high rate, which also underscores the significance of combined STI management pathways. The augmented screening routines may be advantageous to HIV-positive females as of the heightened vulnerability to chronic GU inflammation and unremitting HPV infection. Third, cytological and HPV differences according to age indicate that age-related differences in screening methods should be taken into account, such as the increased risk of chronic inflammation and LUTS among older women.

The research has various limitations. In purposive sampling, the results cannot be generalized to other populations. HPV testing was only done in the case of women who had suspicious cytology and only 23 out of 97 referred women came to undergo the testing. Such follow-up can be biased and not represent the actual prevalence of HPV. Biopsy confirmation was only done on two HPV-positive women thus limiting a decisive evaluation of the severity of CIN in the other cases. The cross-sectional design does not allow the determination of the temporal or the causal relationship between HPV infection and cytological abnormalities and the GU symptoms. Moreover, behavioral data were self-reported which posed the risk of recall and social desirability bias.

Longitudinal follow up needs to be considered in future studies in order to learn in what way HPV-related epithelial abnormalities evolve, whether they are

persistent, and what their effects are on the health of the lower urinary tract. Additional testing (HPV) and genotyping of HPV and close examination of LUTS symptoms and peri-urethral symptoms would shed more light on the interaction of cervical inflammation and urinary system diseases. The interventions that could be incorporated to increase screening uptake and retention of care among CSWs are community-based interventions such as mobile clinics, peer educators, and combined reproductive-urological health services. Enhancing these efforts would assist in curbing delay in diagnosis, chronic inflammation, and urogenital well-being in this disadvantaged group. Altogether, in this paper, the integrated approach to the screening of cervical and urological programs of CSWs is mentioned. Cervicitis, metaplasia, ASCUS, and chronic HPV infection coexist, thus demonstrating the clinical significance to treat both the cervical and lower UTI in a single clinical model. Including urological assessment and screening cervical cancer, health systems will have a greater opportunity to identify the main symptoms of GU inflammation, slow the progression to chronic LUTS, and enhance the results of women who are at risk of increased biological and social vulnerability.

## 5. Conclusion

This research was able to single out a significant morbidity of cervical and lower genitourinary abnormalities in female commercial sex workers with an emphasis on their high risk to contract HPV-related illness and related urinary tract challenges. Out of the 307 women screened, 70% of them showed abnormal cytology of which 9% showed pre-cancerous lesions with one known case of cervical cancer. Cervicitis, squamous metaplasia and ASCUS are high since they indicate a major load of inflammatory and epithelial disease that can spread to other lower structures of the urinary tract. Of females who were referred to have HPV testing, 26% had been found positive with high-risk HPV and two-thirds of those who became positive had co-infection with HIV, which is a compounded risk factor based on immunosuppression. Age variations such as LSIL being more prevalent in younger women and HPV positivity being highest in older age indicate that different age groups are more vulnerable to incurring chronic inflammation and GU disturbance. The significant inflammatory burden present in the study has an evident urological implication as chronic cervico-vaginal inflammation of HPV is a possible causative factor of peri-urethral irritation, dysuria, urinary frequency, and lower urinary tract susceptibility. These results underline the necessity to implement cervical and lower urinary tract screening methods among high-risk groups. The integration of urological assessment with the routine prevention strategies of cervical cancer can help to make the early diagnosis of the involvement of the urinary system and enhance the clinical outcome.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data is unavailable due to privacy.

**Conflicts of Interest:** The author declares no personal or financial conflicts of interest related to the conduct or outcome of this study.

However, during participant recruitment, assistance was sought from another non-governmental organization (NGO) to help identify and approach commercial sex workers for participation in the study. "The NGO personnel imposed an unethical condition by stating that participants would only be provided if I agreed to share all Pap smear reports with him, with the intention of reporting those results under their organization's name to government authorities. This would have falsely indicated that the NGO conducted the screening services.

The author declined this request in order to preserve the ethical integrity of the research, uphold participant confidentiality, and adhere to the guidelines approved by the institutional ethics committee. No data were shared, and the incident was documented and reported to the appropriate academic authority for record and transparency.

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**Ethical Considerations:**

The study "Ethical approval for the study was obtained from the Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), and all procedures were carried out in compliance with the approved protocol." was conducted in accordance with the approved by the Ethics Committee of Krishna Vishva Vidyapeeth, Deemed to be University, Karad.

Ethical considerations- Ethical approval was obtained from the Institutional ethical committee of Krishna Vishwa Vidyapeeth, formerly known as Krishna Institute of Medical Sciences, “Deemed to be University,” Karad. Permission was obtained from the research guide and Head of the Department of NGO named Rev. Haribhau Waghmode Patil Pratishthan (RHWPP), Redlight area, Budhwarpeth, Pune.

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