Oral Cancer Screening Among Indian Women within Reproductive Age-Group: Coverage, Determinants, Socio-Economic Disparities

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Abstract: Objective: This study was conducted to assess the coverage, determinants, and socio-economic disparities in oral cancer screening among Indian women within reproductive age group.

Materials and Methods: A sample of 724,115 women aged 30-49 years from National Family Health Survey-5 (2019-21) were analysed. Self-reported ever screening for oral cancer was used as outcome variable. A set of socio-economic and risk factors associated with oral cancer screening were used as predictors. Logistic regression was used to assess the factors associated with cancer screening, concentration index and concentration curve were used to assess the socio-economic inequalities in oral cancer screening uptake.

Results: A total of 348,882 participants were included in final analysis after all exclusions. Uptake of oral cancer screening was increasing with increase in wealth Index [Middle wealth index, adjusted odds ratio, AOR 1.35 (1.07-1.70), Richer AOR 1.43 (1.12-1.84), Richest AOR 1.60 (1.20-2.13)], higher educational status and in obese women [AOR 1.28 (1.02-1.63)]. While the women belonged to Muslim religion [AOR 0.68 (0.56-0.84)] and schedule tribes [AOR 0.70 (0.53-0.84)] had lower odds for screening uptake. Women from South Indian states [AOR 9.58 (7.60-12.07)], West Indian states [AOR 3.81 (2.88-5.04)], Central India [2.48 (1.95-3.14)] and North-east Indian states [1.65 (1.20-2.27)] had higher odds of oral cancer screening uptake compared to North Indian states.

Conclusion: Screening uptake varies among the socio-economic status and different regions of country. Despite the operational guidelines and provision for screening at public health centres, the screening uptake is low in the country.

Keywords: Oral cancer screening, socio-economic disparity, National Family Health Survey.

INTRODUCTION

Cancers remain a leading cause of morbidity and mortality Globally and in India. In year 2023, the estimated number of new cancer cases worldwide was approximately 20 million, with around 9.7 million cancer-related deaths [1] . This is causing significant amount of Disability-Adjusted Life Years (DALYs) loss. The total global cancer burden in 2019 was estimated to be around 250 million DALYs, underscoring the extensive impact of cancer on global health systems and economics[2]. Oral cancers, including cancers of lip, oral cavity, and pharynx, contributes significantly to the global cancer burden. In year 2022, it was estimated that there were approximately 537,000 new cases of lip, oral cavity, and pharyngeal cancers worldwide, resulting in 313,000 deaths[1]. DALYs lost due to oral cancers were 8.7 million, reflecting the severe impact on health and quality of life [3]. In India total 1.5 million new cases were estimated in year 2022, with over 850,000 cancer-related deaths. The DALYs attributable to cancer in India are significantly high. Oral cancers are prevalent in India due to high-risk behaviours such as tobacco chewing, smoking, and alcohol consumption [4]. In year 2022, India accounted for a significant proportion of the global burden of oral cancer, with an estimated 135,000 new cases and about 75,000 deaths from oral cancer [1].

Despite the high burden, oral cancer screening coverage in India remains inadequate[5]. Several determinants influence the uptake of oral cancer screening among Indian population. These determinants can broadly be categorized into individual, health care system, and societal factors. Individual factors include knowledge and awareness about oral cancer and its risk factors, personal attitude towards health, and previous health care experiences. Health care system, factors encompass the availability and accessibility of screening services, the quality of health care infrastructure, and the training and attitude of healthcare providers. Societal factors include cultural beliefs, social norms, and economic condition that can either facilitate or hinder access to screening [6,7,8,9]. Socio-economic disparity also plays a significant role in the utilisation of oral cancer screening services. Women from lower socio-economic backgrounds often face multiple barriers to accessing healthcare, including financial constraints, lack of education, and limited access to information, these disparities are exacerbated by the rural-urban divide, with rural being particularly disadvantaged in terms of healthcare access and quality. There is paucity of literature on oral cancer screening uptake among Indian women within the reproductive age group. Understanding the determinants and the socio-economic disparities, effective strategies can be

made to improve screening uptake and early diagnosis. With this background this study was conducted to estimate the coverage of oral cancer screening, identify the different demographic, socio-economic and health related determinants associated with oral cancer screening.

METHODOLOGY

Study design- Data from the fifth round of the nationally representative cross-sectional survey (National Family Health Survey, NFHS-2019–2021) were used in the present research[10]. This extensive survey is carried out using a multi-phase, stratified cluster sampling methodology. Because the NFHS survey primarily focuses on women of reproductive age and children under five, it has an uneven proportion of women and men. Consequently, more women than men were covered by the state module. Data on emerging family and health-related issues are gathered for the survey from the NFHS rounds that follow. It provides solid evidence to support, monitor and evaluate ongoing national programmes and opens new avenues for finding unmet needs in the population. Four different questionnaire types—the Household, Woman's, Man's, and Biomarker—were used to gather the data, and computer-assisted personal interviewing (CAPI) was used to translate the results into the local languages. All regular household members and guests who spent the night before were asked to fill out a Household Schedule. Other details included socioeconomic status, health insurance status, land ownership, water,

sanitation, and hygiene practices, the number of deaths in the household in the three years prior to the survey, and the use and ownership of mosquito nets. The Woman's Schedule addressed a broad range of subjects, such as the attributes of women, marriage, fertility, contraception, children's healthcare and vaccinations, nutrition, sexual behaviour, HIV/AIDS, women's empowerment, and domestic abuse. The Man's Schedule addressed the man's attributes, including his marital status, the number of children he had, his choice for contraception, nutrition, sexual behaviour, health problems, views on gender roles, and HIV/AIDS. The Biomarker Questionnaire included measures of children's height, weight, and haemoglobin; for women aged 15–49 and males aged 15–54, measurements of height, weight, waist, hip circumference haemoglobin, blood pressure, and random blood glucose were included [10].

Missing value analysis and Data pertaining to present study- A total of 636,699 households were included in NFHS-5, comprising 724,115 women (15 to 49 years) and 101,839 men (15 to 54 years). As population-based screening (PBS) directed by Ministry of Health & Family Welfare, Government of India (MoHFW), women aged ≥ 30 years are recommended to undergo regular oral cancer screening[11]. Thus, we have only included women in this age category. After adjusting missing variables and outliers by complete case analysis (row wise complete deletion) the final sample size was 348882. (Figure 1)
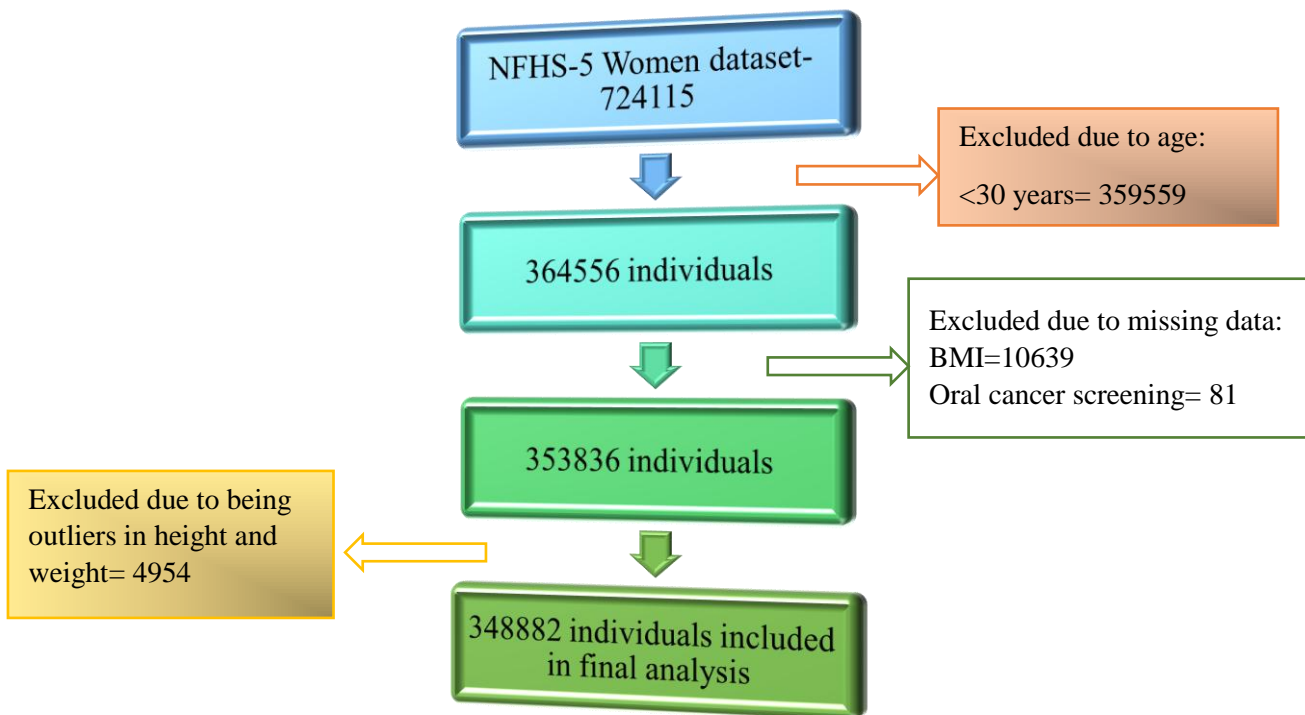

Figure 1: Study flow diagram- selection of the participants for analysis

Outcome variable- The outcome variable was self-reported oral cancer screening. The participants were asked- "ever undergone a screening test for oral cancer?" Answers were recorded in dichotomous format- "no, yes."

Explanatory variables:

We have classified explanatory variables as demographic and socio-economic, health related and behavioural factors. Under socio-demographic factors, we have included age-group in years (30-34, 35-39, 40-44 and 45-49), religion (Hindu, Muslim, Christian and Others), caste (schedules

caste, scheduled tribe, OBC/ other backward caste and others), wealth quintile (poorest, poorer, middle, richer and richest), education (illiterate, primary secondary and higher secondary), gender of head of household (Male, female), marital status (married, others), health insurance (no, yes) and region (north, central, east, northeast, west and south). Categorisation of states and union territories (UT) into regions were shown in Supplementary Table S1. Under health-related factors, we have included- Body Mass Index/ BMI (Underweight (<18.5), Normal (18.5-22.9), Overweight (23.0-24.9) and Obesity (≥25.0)), diabetes (no, yes and don't know) and hypertension (no, yes and don't know). Under behavioural factors, we have included eat fruits (never, daily, weekly and occasionally), eat fried food (never, daily, weekly and occasionally), chew tobacco (no, yes), smoking (no, yes), alcohol consumption (no, yes) and exposure to media i.e. television or radio or phone (no, yes) [10].

Data analysis:

Data was analyzed using STATA v17 (StataCorp LLC, College Station, TX)[12]. Bivariate analysis was conducted to document the coverage of oral cancer prevalence with respect to various demographic, socio-economic, health related and behavioural factors. Chi-square test was applied to interpret the significance in difference across groups. Appropriate survey weights were used. Furthermore, we have documented the association of oral cancer screening with various factors using multivariable logistic regression. P-value <0.05 was considered as statistically significant.

We have created a dot plot showing distribution of coverage of oral cancer screening across wealth quintile as per Indian regions. The socio-economic disparities in coverage of oral cancer screening among Indian women within reproductive age-group were disaggregated as per wealth quintile at national level using concentration index [13]. Detailed methods have been described elsewhere [14,15]. The area between the concentration curve and the line of equality was computed by first plotting the cumulative proportion of the population ranked by wealth quintile against the cumulative proportion of coverage of oral cancer screening. A concentration index of zero indicating no socioeconomic inequality. A positive value depicts that coverage of oral cancer screening is distributed more among the richest while a negative value depicts that coverage of oral cancer screening is distributed more among poorest. Higher value shows greater inequality (both in negative and positive directions). Following STATA command was used to calculate the concentration index "conindex var iable, rank (wealth_quintile) truezero bounded limits(0 1) erreygers graph loud" where erreygers correction were included [16].

RESULTS

In this study a total of 3,48,882 participants were included in the final analysis out of 7,24,115 women in the NFHS-5 data set (3,59,559 excluded due to age less than 30 years, 10,639 had missing data and 4954 were outliers in height and weight) (Figure 1). More than half of the women were in age group 30-39 years, but there was not significant difference among all age categories. Most of the women (91.1%) were married and belonged to Hindu religion (82.4%). Majority of the women were residing in rural area (66.5%). Only few of the women (10.2%) were educated up to higher secondary of above. Only 16.5% of households had a female household head. One third of women (33.6%) had BMI more than equal to 25. Majority of the women were consuming fruits either once a week or occasionally (86.2%) (Table 1).

Uptake of oral cancer screening was increasing with the wealth index from middle to richest [Middle wealth index, adjusted odds ratio, AOR 1.35 (1.07-1.70), Richer AOR 1.43 (1.12-1.84), Richest AOR 1.60 (1.20-2.13)] compared to poorest. Women who were illiterate underwent less screening uptake for oral cancer as compared with those who had higher secondary educational status [AOR 0.66 (0.51-0.85)]. Christian women had higher odds, whereas Muslim women had lower odds for uptake of oral cancer screening compared to Hindu women [Christian AOR 1.45 (1.11-1.90), Muslim AOR 0.68 (0.56-0.84)]. Women belonged to schedule tribes had lower odds for screening uptake [AOR 0.70 (0.53-0.84)]. Obese women had higher uptake for screening compared with underweight women [AOR 1.28 (1.02-1.63)]. Women in living in Central, North-east, West and South part of India had higher odds of screening uptake compared with North Indian women [Central AOR 2.48 (1.95-3.14), North-east AOR 1.65 (1.20-2.27), West AOR 3.81 (2.88-5.04), South AOR 9.58 (7.60-12.07)] (Figure 2).
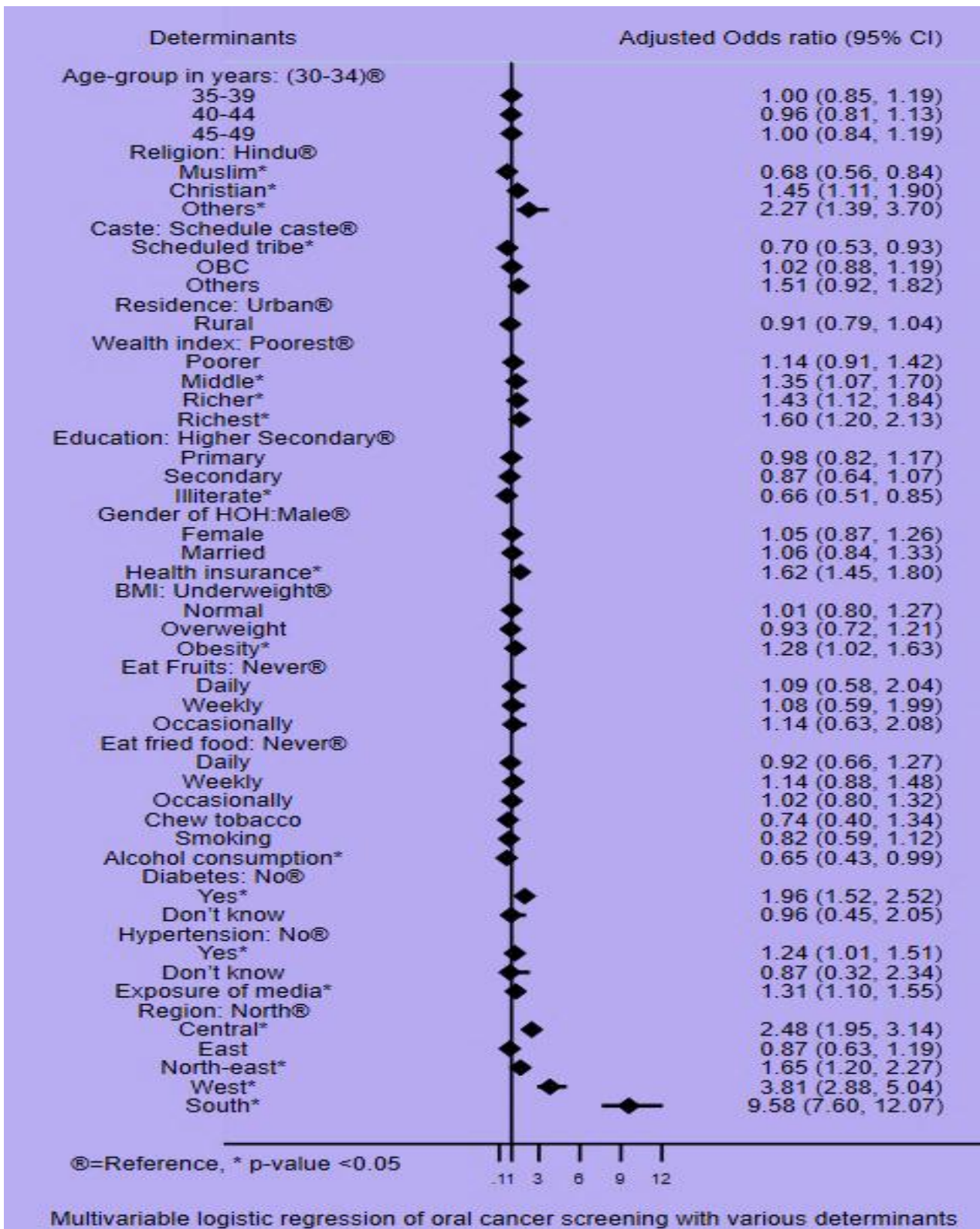
Figure 2: Multivariable logistic regression of coverage of oral cancer screening among Indian women within reproductive age-group with various demographic, socioeconomic and health related determinants

Weighted proportion for each region and across the wealth index are shown in Figure 3 and Table S2. In North India, the weighted proportion increases from 0.18 to 0.38 from poorest to richest quintile. In Central India, the proportion are higher than North but varying across the wealth index. In East, proportion are lower than North with slight increase inn richest quintile. In Northeast and West India, weighted proportion are more than North India and increasing in richest quintile. In South Inda, weighted proportion in highest. Figure 4 shows the concentration index for oral cancer screening coverage across all the wealth index across India. Downward slope indicates that the screening uptake increases from poorer to richest wealth index with concentration index of 0.004 (0.003-0.005).
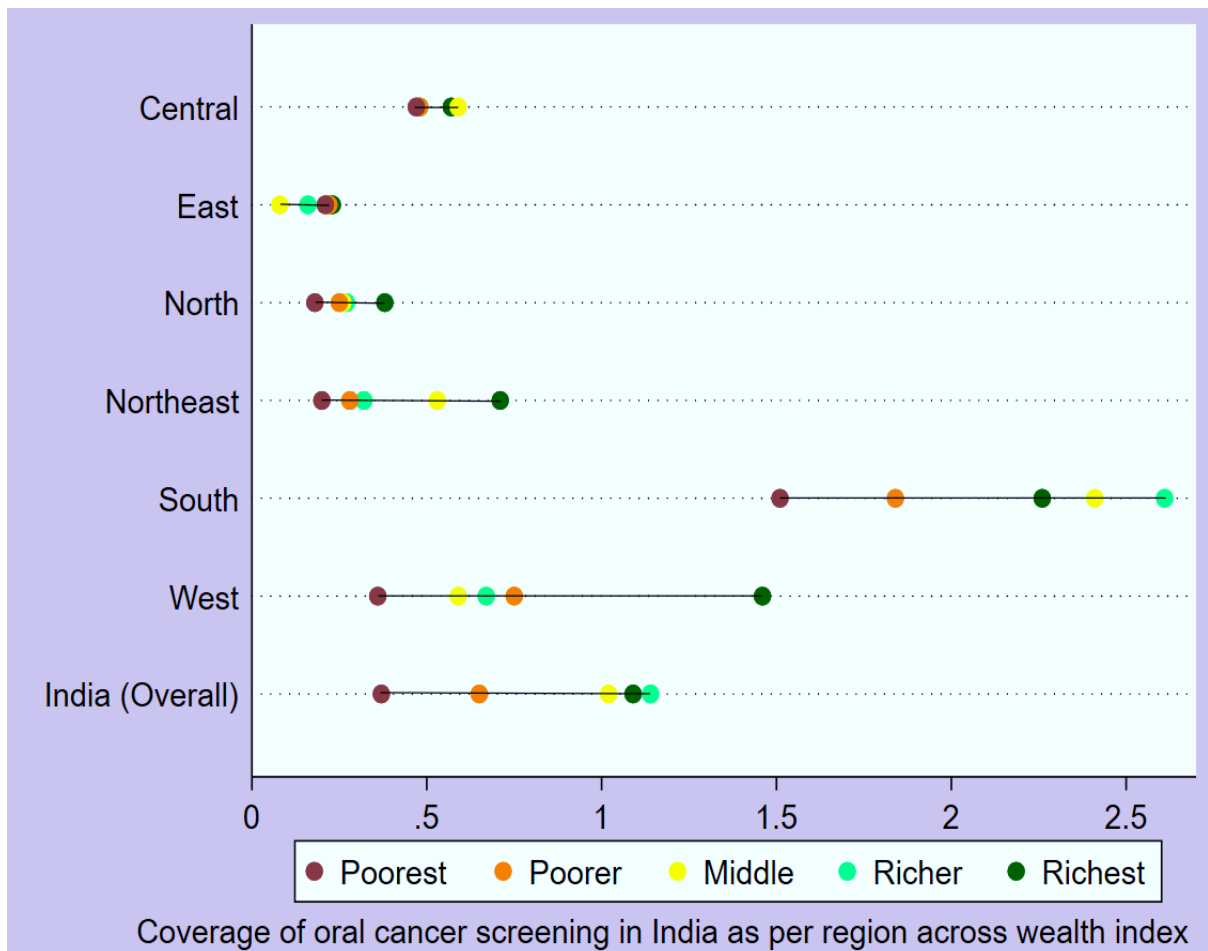
Figure 3: Coverage of oral cancer screening among Indian women within reproductive age-group as per wealth index across regions
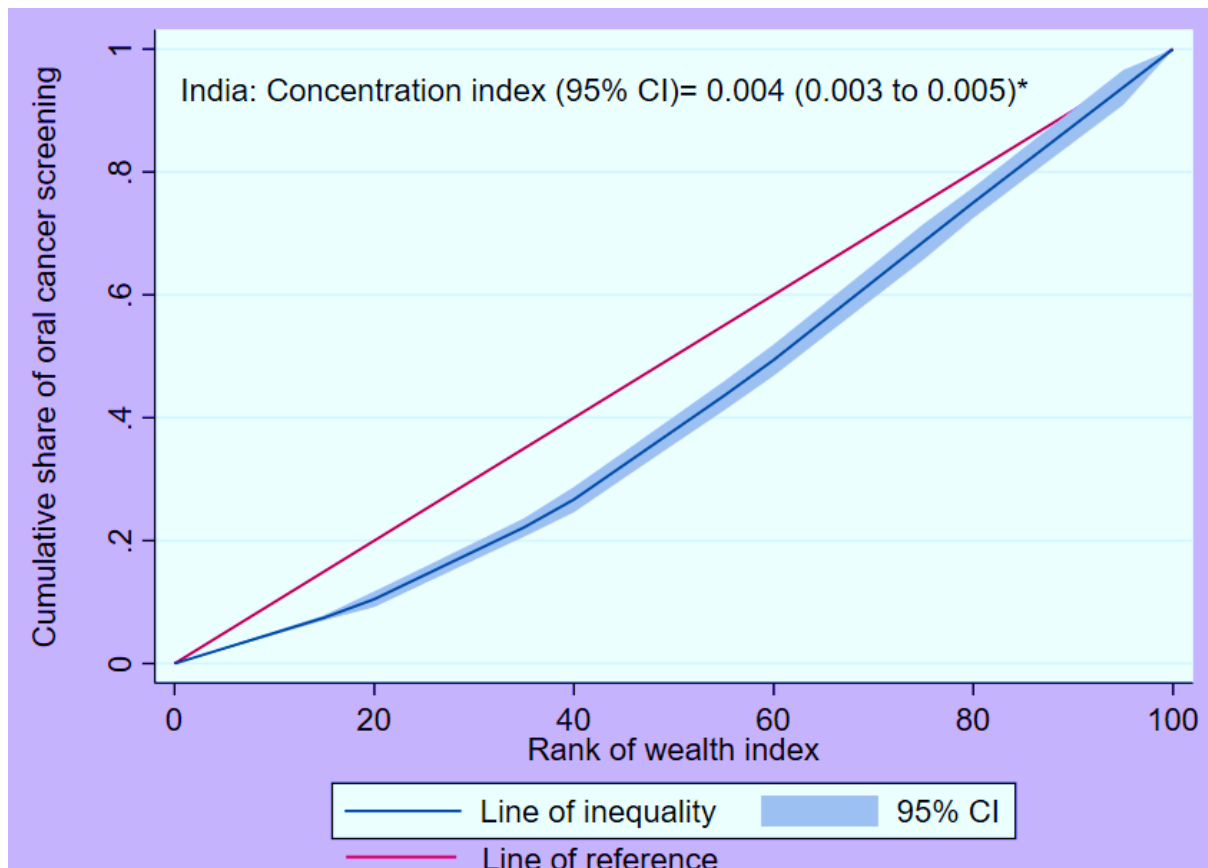

Figure 4: Oral cancer screening coverage as per wealth index across India and states/ union territories(* p-value <0.05)

Table 1: Distribution of various factors as per coverage of oral cancer screening among Indian women within reproductive age-group (*Chi-square p-value <0.05)

Variables (N=348882)	Total participants		Oral cancer screening	
	Unweighted frequency	Weighted proportion	Unweighted frequency	Weighted proportion
Demographic and socio-economic factors				
Age-group in years				
30-34	96867	27.54	549	0.74*
35-39	93813	26.69	588	0.85*
40-44	77829	22.43	529	0.90*
45-49	80373	23.34	586	1.02*
Religion				
Hindu	265110	82.49	1749	0.86*
Muslim	39117	12.03	220	0.61*
Christian	26551	2.57	210	2.34*
Others	18104	2.91	73	0.96*
Caste				
Schedule caste	64905	21.29	395	0.84*
Schedule tribe	65916	9.16	247	0.44*
OBC	132740	42.92	986	0.97*
Others	85321	26.63	624	0.89*
Residence				
Urban	89228	33.43	749	1.08*
Rural	259654	66.57	1503	0.77*
Wealth quintile				
Poorest	70917	18.01	241	0.37*
Poorer	75230	19.34	389	0.65*
Middle	73110	20.65	550	1.02*
Richer	67993	21.15	587	1.14*
Richest	61632	20.84	485	1.09*
Education				
Illiterate	36.52	35.60	725	0.77*
Primary	15.51	15.58	335	0.93*
Secondary	39.07	38.60	946	0.92*
Higher Secondary	8.90	10.22	246	0.97*
Gender of Head of Household (HOH)				
Male	291369	83.46	1871	0.86
Female	57513	16.54	381	0.95
Marital status				
Married	316492	91.11	2026	0.86
Others	32390	8.89	226	1.02
Health Insurance				
No	221721	65.57	1262	0.64*
Yes	127161	34.43	990	1.30*
Region				
North	69933	20.04	233	0.31*
Central	74105	21.24	352	0.51*
East	54572	15.64	103	0.18*
Northeast	52275	14.98	202	0.33*
West	36985	10.60	186	0.86*
South	61012	17.49	1176	2.31*
Health related factors				
BMI				
Underweight (<18.5)	35829	10.26	181	0.63*
Normal (18.5-22.9)	140163	38.61	749	0.68*
Overweight (23.0-24.9)	63972	17.51	371	0.73*
Obesity (>25.0)	108918	33.62	951	1.23*
Diabetes				
No	334544	95.68	2094	0.83*
Yes	9545	3.19	137	2.24*
Don't know	4793	1.13	21	0.44*
Hypertension				
No	320803	91.76	2022	0.85*
Yes	25042	7.53	219	1.19*
Don't know	3037	0.71	11	0.43*
Behavioural factors				
Eat Fruits				
Never	5697	1.87	27	0.61*
Daily	39929	11.93	356	1.15*
Weekly	127415	36.62	913	0.96*
Occasionally	175841	49.59	956	0.75*
Eat fried food				
Never	17400	4.87	129	0.99
Daily	32368	7.31	194	0.62

Weekly	113931	34.30	717	0.89
Occasionally	185183	53.52	1212	0.88
Chew tobacco				
No	340002	98.01	2217	0.88*
Yes	8880	1.99	35	0.34*
Smoking				
No	316630	93.79	2077	0.90*
Yes	32252	6.21	175	0.43*
Alcohol consumption				
No	339322	98.90	2203	0.88
Yes	9560	1.10	49	0.53
Exposure of Media				
No	97042	26.58	415	0.54*
Yes	251840	73.42	1837	0.99*

DISCUSSION

Current study focusses on socio-economic and regional difference in uptake of oral cancer screening in reproductive and the most productive age group women. We estimated that there was significant difference among different wealth index for oral cancer screening uptake, with higher odds of uptake in richest compared to poorest. There was significant socio-economic disparity found. Study by Johnson et al [17], Dhane et al [18], Changkun et al [19] and Karanth et al [20] also reported that screening uptake is higher in higher socio-economic status and households with higher wealth quintile. Possible explanation for this could be difference in awareness for screening among different socio-economic class. Current study estimated that women belonged to Muslim religion and belonged to schedule tribes had lower uptake for oral cancer screening. A systematic review[21] done by Kretzler et al also reported thatcancer screening varies among different religions. Reason for this could be specific beliefs related to the religion. In study we estimated that women with no education had lower odds for screening uptake compared with those who had more than secondary education [AOR 0.66 (0.51-0.85)]. Study by Johnson et al [17] and Changkun et al [19] also reported similar findings that uptake of oral cancer screening increases with increase in educational status. The reason for this could be due to women with higher educational status were more aware regarding the importance of oral cancer screening.

In this study we also estimated that there is regional variation for uptake of cancer screening, with maximum in South Indian (AOR 9.58) states then West (AOR 3.81), Central (AOR 2.48) and North-east (AOR 1.65) Indian states, as compared with North Indian states had maximum uptake for oral cancer screening. Plausible explanation for this could be despite continuous governmental efforts from launch of National Cancer Control Programme in year 1975 [22], launch National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke in year 2010 [23], operational framework for cancer screening in year 2016 [24], effective execution was not uniform in all the states.

Limitations of this study was restricted age from 30 to 49 years, as NFHS collects data on women age 15-49 years. Consequently, we could not analyze cancer screening among women aged 50 years and above. Second, the NFHS provides data on self-reported ever screening which may be subject to self-reporting biases and reporting errors. It was also not possible to differentiate between women who had undergone screening for preventive purposes and those who had undergone it after developing the disease due to non-availability of data.

CONCLUSION

Screening uptake varies among the socio-economic status and different regions of country. Despite the operational guidelines and provision for screening at public health centres, the screening uptake is low in the country. Awareness needs to be raised regarding early screening of oral cancer among general public and all levels of health care providers including community health workers.

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