



Cancer awareness & its association with demographic variables & mobile phone usage among the rural population of a district in north India

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Background & objectives: Lack of awareness is one of the major reasons for the high morbidity and mortality associated with cancers. The present study was aimed to evaluate the awareness of prevalent cancers among the rural population in a district of north India and its association specifically with mobile phone usage.

Methods: Using a stratified random sampling technique, households in three villages of Gautam Buddha Nagar district of India were selected. A house-to-house survey on cancer awareness was conducted among adults in selected households and data were analyzed to check for the association of such an awareness with sociodemographic factors and internet usage.

Results: The study included 59 males and 145 females, with majority (115) being in the age group of 18-30 yr. Although most (96.5%) of the participants were aware of cancer, the common risk factors and warning signs of cancer were known to only a few. Specific risk factors for cervical and breast cancers were, however, not known to a majority (79.9% and 72.2%). A significant association between the awareness of general risk factors and warning signs as well as specific aspects including risk factors for breast, cervical and oral cancer, HPV vaccine and the education level of the participants ($P < 0.05$ for all). Knowledge of risk factors, warning signs and cancer prevention modalities was higher among mobile phone users who accessed internet for health information. There was no significant association between age group and cancer risk factor awareness, though females were more aware of the risk factors for breast cancer ($P = 0.002$).

Interpretation & conclusions: The findings of this study highlight the existing low level of awareness of cervical and breast cancers among the rural population. The association of cancer awareness with education level and mobile phone-based internet usage suggests the potential utility of internet-based platforms such as m-health programmes for cancer prevention activities.

Key words Breast cancer - cancer awareness - cervical cancer - mobile phone usage - risk factors - warning signs

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The annual incidence of cancer which is the second leading cause of death, is about 18.1 million worldwide and 1.15 million in India¹. Breast, cervical and oral cancers constitute the three main cancer sites in India¹. The widespread lack of awareness especially regarding the risk factors and symptoms or signs of common cancers contributes to the frequent presentation of patients in late stages. This, in turn, leads to higher mortality due to the drastic reduction in survival rates at advanced stages^{2,3}. Various studies from different States and across sociodemographic and educational strata in India have highlighted the low level of awareness of these three cancers, especially among the uneducated individuals and low socio-economic strata³⁻⁶. Few studies have also underscored the myths and misconceptions regarding cancer, as a by-product of the lack of awareness⁷.

The increasing availability and societal penetration of internet services with social media platforms have provided an immense opportunity to promote community participation, behavioural change and adherence to cancer prevention activities^{8,9}. Previous studies have highlighted the internet, apart from other mass media, as an important source of information regarding cancer in their participants^{3,10}. Health information-seeking internet usage has been shown to have a positive impact on the awareness about HPV vaccination¹¹. However, the role of internet access through mobile phone devices as a determinant for cancer awareness has not been explored as yet in the available literature.

The present study aimed to assess the awareness of breast, cervical and oral cancers among the rural population in a district of north India. Furthermore, evaluating the association of this awareness with the sociodemographic factors and specifically with mobile phone usage was also undertaken.

Material & Methods

This study was undertaken at the Divisions of Cytopathology and Clinical Oncology, ICMR-National Institute of Cancer Prevention and Research, Noida, after obtaining approval by the Institutional Ethics Committee. All the participants were explained the purpose of the study and written informed consent was taken before inclusion in the study.

Study design and sampling: This was a cross-sectional house-to-house survey conducted over a six month (January-June 2019) period among adults aged ≥ 18 yr residing in Gautam Buddha Nagar district, Uttar Pradesh,

India. A stratified random sampling technique was used to choose three villages (Harola, Morna and Sadarpur) in the selected district. Based on a previous study⁶, it was anticipated that 87 per cent of adults would be aware of the entities 'breast/cervical/oral cancer'. Considering the population of Gautam Buddha Nagar district to be 1,648,115, confidence limit of 95 per cent, margin of error five per cent and a non-response rate of 10 per cent, the required sample size was calculated to be 194 (using the formula $N=4pq/d^2$). During the conduct of the study, more willing adults were included, and hence, the final number of participants was 204.

Inclusion criteria: Adults aged ≥ 18 yr residing in the selected village for at least six months were included in the study after obtaining informed consent.

Exclusion criteria: Individuals below 18 yr and those unwilling to participate or provide informed consent were excluded from the study.

Study tool: A questionnaire (Supplementary file), designed by the authors and validated by external experts was used to collect data on sociodemographic profile, general cancer awareness, specific questions regarding breast, cervical and oral cancer, prevailing myths about cancer and mobile phone-based internet usage pattern in the last six months. The questionnaire was translated into Hindi and then back translated to English to check for accuracy. Either the English or Hindi version of the questionnaire was used depending on the understanding of the participants.

Data analysis: For the data analysis, the questions were coded and the questionnaires that were complete in all respects were entered into the IBM Statistical Package for the Social Sciences (SPSS) version 22.0 software (IBM Corp., Armonk, NY, USA). The entered data was verified and cleaned by a senior author to eliminate errors and ensure completeness. Quantitative variables were summarized using measures of central tendency as mean and standard deviation while categorical variables were depicted using frequencies and percentages. Chi-square test was applied to association between various characteristics and cancer awareness.

Results

Table I provides the sociodemographic details of the participants enrolled in the study. Of the 204 participants, 59 were male and 145 female (M:F: 1:2.4)

Table I. Sociodemographic details of the participants

| Study Parameters | Frequency, n (%) |
|---|------------------|
| Age (yr) | |
| 18-30 | 115 (56.4) |
| 31-40 | 54 (26.5) |
| 41-50 | 26 (12.7) |
| 51-65 | 9 (4.4) |
| Gender | |
| Male | 60 (29.4) |
| Female | 144 (70.6) |
| Highest education attained | |
| Illiterate | 8 (3.9) |
| Up to middle school | 72 (35.3) |
| Intermediate | 73 (35.8) |
| College and above | 51 (25) |
| Income per month | |
| Up to ₹ 5000 | 5 (2.4) |
| ₹ 6000-10,000 | 51 (25) |
| ₹ 11,000-15,000 | 67 (32.9) |
| ₹ 16,000-20,000 | 35 (17.2) |
| >₹ 20,000 | 46 (22.5) |
| Occupation | |
| Not working/unemployed/housewife | 106 (51.9) |
| Healthcare worker | 24 (11.8) |
| Doctor/researcher/physician | 10 (4.9) |
| Others/business/artist | 64 (31.4) |
| Internet usage | |
| Frequently | 85 (41.7) |
| Occasionally | 35 (17.1) |
| Rarely | 52 (25.5) |
| Never | 32 (15.7) |
| Mode of internet access | |
| Mobile phones | 171 (99.4) |
| Computer | 1 (0.6) |
| Did you use internet to access health-related information? | |
| Yes | 65 (37.8) |
| No | 90 (52.3) |
| Don't remember | 17 (9.9) |

with more than half of the individuals (56.4%) in the 18-30 yr age group. There were equal proportions of individuals with education up to middle school (eighth standard) and those with completed school

education (35% each). The mean age of participants was reported to be 31.66 yr (± 10.43).

Majority of the participants (84.3%) reported internet usage in the last six months. Of these, half of the respondents accessed the internet daily, whereas others used the internet occasionally or rarely. The most common mode of internet access was on mobile phones, whereas only one participant used a computer for internet access. About half of the participants had not accessed health-related information on the internet, whereas a quarter (25.5%) affirmed using the internet through mobile phone to access health-related information.

General awareness about cancer: The response of the participants to questions related to general cancer awareness are listed in Table II. Majority of the participants (96.6%) had heard about cancer as a disease, the most common information source being family or friends (64.2%). Breast cancer as the most common cancer in India was known only to 20.6 per cent of participants. Although more than 70 per cent of the individuals were aware of tobacco as a risk factor for cancer, other factors such as alcohol, family history and obesity were known to only a minority of participants. About half of the participants (53.4%) did not have knowledge of the major warning signs of cancer that is instances when medical attention should be sought.

Cancer-related myths, such as cancer is contagious or that a family history of cancer means the individual would get cancer, were believed by 14.2 per cent and 15.7 per cent of the individuals, respectively. Majority of the individuals did not believe that a diagnosis of cancer portends a death sentence for the patient. The fact that certain cancers can be prevented was known to 81.9 per cent of the participants, whereas 76.9 per cent of individuals were aware of cancer screening as a modality of prevention of some of the cancers.

Specific questions related to prevalent cancers: More than three-fourths of the participants were unaware of the major risk factors for cervical (79.9%) or breast cancer (72.2%). However, 79.9 per cent knew about tobacco consumption and poor oral hygiene as risk factors for oral cancer (Table III). Awareness of cervical smear (Pap test) as a screening test or HPV vaccine for the prevention of cervical cancer was seen in only 13.7 per cent and 22.1 per cent of the individuals, respectively.

Table II. General cancer awareness of the participants

| Attributes/questions | Response | Frequency, n (%) |
|--|---------------------------------|------------------|
| Have you heard about cancer? | Yes | 197 (96.5) |
| | No | 6 (2.9) |
| | Don't remember | 1 (0.5) |
| What was the source of cancer-related information?* | Relatives/friends/colleagues | 131 (64.2) |
| | Health facility | 54 (26.5) |
| | TV | 48 (23.5) |
| | Internet | 22 (10.8) |
| | Newspaper | 16 (7.8) |
| | Radio | 9 (4.4) |
| | Never heard of it | 2 (0.9) |
| Which is the most common cancer in India? | Oral cancer | 69 (33.8) |
| | Breast cancer | 42 (20.6) |
| | Cervical cancer | 16 (7.8) |
| | Colorectal cancer | 1 (0.5) |
| | Gall bladder cancer | 2 (0.9) |
| | Don't know | 74 (36.3) |
| Which factors increase the risk of cancers?* | Tobacco consumption | 146 (71.6) |
| | Alcohol drinking | 56 (27.4) |
| | Family history of cancer | 39 (19.1) |
| | Obesity | 34 (16.7) |
| | Don't know | 49 (24) |
| What are the warning signs of cancer?* | A sore throat that doesn't heal | 25 (12.2) |
| | Lump in the body | 28 (13.7) |
| | A nagging cough | 16 (7.8) |
| | All of the above | 39 (19.1) |
| | Don't know | 109 (53.4) |
| Can cancer be prevented? | Yes | 167 (81.9) |
| | No | 37 (18.1) |
| Is screening useful for cancer prevention? | Yes | 157 (76.9) |
| | No | 47 (23) |
| If one has a family history of cancer, will one surely get cancer? | Yes | 32 (15.7) |
| | No | 171 (84.3) |
| Is cancer contagious? | Yes | 29 (14.2) |
| | No | 175 (85.8) |
| Does cancer mean death? | Yes | 33 (16.2) |
| | No | 171 (83.8) |

*Multiple responses

Association of cancer awareness with various determinants: The correlation of cancer awareness and myths with the various sociodemographic factors and internet usage through mobile phones is depicted in Table IV. There was no significant association between the age group and awareness of risk factors for cervical,

breast or oral cancer. However, females were found to be more aware of the risk factors of breast cancer compared to males ($P=0.002$), whereas the awareness of risk factors for cervical or oral cancer was not significantly different between males and females. The highest education attained by the participants showed

Table III. Awareness of participants about breast, oral and cervical cancer

| Attributes | Responses | Frequency, n (%) |
|---|---------------------------------|------------------|
| Risk factors for cervical cancer | HPV infection | 17 (8.3) |
| | Having multiple sexual partners | 5 (2.4) |
| | Early age at marriage | 4 (1.9) |
| | All of the above | 14 (6.8) |
| | Don't know | 163 (79.9) |
| Have you heard about HPV vaccine? | Yes | 67 (32.8) |
| | No | 137 (67.2) |
| HPV vaccination is used for prevention of which cancer? | Cervical cancer | 45 (67.2) |
| | Don't know | 22 (32.8) |
| Screening tests for cervical cancer | Pap smear | 28 (13.7) |
| | Blood test | 11 (5.4) |
| | Urine test | 7 (3.4) |
| | Don't know | 158 (77.4) |
| Risk factors for breast cancer | Late first pregnancy | 18 (22.5) |
| | Not ever being pregnant | 15 (7.3) |
| | Family history | 10 (4.9) |
| | All the above | 14 (6.8) |
| | Don't know | 147 (72.2) |
| Risk factors for oral cancer | Tobacco consumption | 146 (71.6) |
| | Poor oral hygiene | 17 (8.3) |
| | Excessive use of chewing gum | 1 (0.5) |
| | Don't know | 40 (19.6) |
| HPV, human papillomavirus | | |

a statistically significant positive association with an awareness of risk factors for cervical ($P<0.001$), breast ($P=0.013$) and oral cancer ($P=0.002$), respectively.

Among the general cancer awareness and myths, awareness of one risk factor for cancer in general ($P=0.012$) and warning signs of cancer ($P<0.001$) was associated with the level of education. The knowledge that cancer can be prevented or that screening is an effective tool for cancer prevention was not significantly different between the various education levels. Individuals with lower levels of education were found to believe myths such as 'diagnosis of cancer is a death sentence' ($P<0.001$) or 'presence of a family history of cancer means that he/she would definitely get cancer' ($P=0.027$) compared to those who had at least completed school education. A significant association was seen between education level and knowledge about HPV vaccine for cancer prevention ($P<0.001$) as well as the fact that HPV vaccination is protective for cervical cancer ($P=0.009$).

Mobile phone usage and cancer awareness: Statistical analysis was performed for the association of mobile phone usage for health-related information and various aspects of cancer awareness. Mobile phone users were found to have a higher awareness of risk factors of breast cancer ($P<0.001$), whereas the association with risk awareness of cervical cancer was borderline significant ($P=0.06$). Awareness regarding oral cancer was not significantly different between mobile phone users and non-users. Knowledge of at least one risk factor for cancer and awareness of warning signs of cancer was found to be higher in mobile phone users compared to non-users ($P<0.001$ for both). Higher numbers of mobile phone users were aware that cancer can be prevented ($P<0.001$) and that screening can be effective for cancer prevention ($P=0.003$). Myths, such as cancer is contagious, a cancer diagnosis is a death sentence and family history entails a definite risk of getting cancer, were not significantly different between mobile phone users and non-users. Mobile phone users were, however, found to be more aware of

Table IV. Association of cancer awareness and myths with sociodemographic factors and mobile phone usage

| Factor | Risk factor for cervical cancer | | <i>P</i> * | Risk factors for breast cancer | | <i>P</i> * | Risk factors for oral cancer | | <i>P</i> * |
|----------------------------------|---|-----------|------------|--------------------------------|-----------|------------|------------------------------------|-----------|------------|
| | Aware | Not aware | | Aware | Not aware | | Aware | Not aware | |
| Age group (yr) | | | | | | | | | |
| 18-30 | 27 | 89 | 0.246 | 36 | 79 | 0.37 | 92 | 23 | 0.718 |
| 31-40 | 6 | 48 | | 14 | 40 | | 43 | 11 | |
| 41-50 | 7 | 19 | | 4 | 22 | | 20 | 6 | |
| 51-65 | 2 | 7 | | 3 | 6 | | 8 | 1 | |
| Gender | | | | | | | | | |
| Males | 8 | 52 | 0.139 | 8 | 52 | 0.002 | 47 | 13 | 0.718 |
| Females | 32 | 111 | | 50 | 94 | | 116 | 28 | |
| Highest education attained | | | | | | | | | |
| Illiterate | 1 | 7 | <0.001 | 3 | 5 | 0.013 | 7 | 1 | 0.002 |
| Up to middle school | 7 | 65 | | 14 | 58 | | 48 | 24 | |
| Intermediate | 11 | 62 | | 18 | 55 | | 67 | 6 | |
| College and above | 21 | 29 | | 23 | 28 | | 40 | 10 | |
| Mobile phone-based internet user | | | | | | | | | |
| Yes | 18 | 34 | 0.06 | 31 | 34 | <0.001 | 47 | 5 | 0.277 |
| No | 16 | 64 | | 10 | 80 | | 67 | 13 | |
| Factor | | | | | | | | | |
| Factor | Knows risk factor for cancer | | <i>P</i> * | Warning signs of cancer | | <i>P</i> * | Cancer can be prevented | | <i>P</i> * |
| | Yes | No | | Aware | Not aware | | Aware | Not aware | |
| Highest education attained | | | | | | | | | |
| Illiterate | 3 | 5 | 0.012 | 3 | 5 | <0.001 | 4 | 4 | 0.125 |
| Up to middle school | 50 | 22 | | 47 | 25 | | 60 | 12 | |
| Intermediate | 60 | 13 | | 28 | 45 | | 61 | 12 | |
| College and above | 42 | 9 | | 17 | 34 | | 42 | 9 | |
| Mobile phone-based internet user | | | | | | | | | |
| Yes | 36 | 29 | <0.001 | 56 | 9 | <0.001 | 45 | 20 | <0.001 |
| No | 18 | 72 | | 39 | 51 | | 34 | 56 | |
| Factor | | | | | | | | | |
| Factor | Cancer screening is effective for cancer prevention | | <i>P</i> * | Cancer is contagious | | <i>P</i> * | Cancer diagnosis is death sentence | | <i>P</i> * |
| | Yes | No | | Yes | No | | Yes | No | |
| Highest education attained | | | | | | | | | |
| Illiterate | 5 | 3 | 0.197 | 5 | 3 | <0.001 | 5 | 3 | <0.001 |
| Up to middle school | 61 | 11 | | 10 | 62 | | 16 | 50 | |
| Intermediate | 55 | 18 | | 11 | 62 | | 10 | 56 | |
| College and above | 36 | 15 | | 3 | 48 | | 2 | 47 | |
| Mobile phone-based internet user | | | | | | | | | |
| Yes | 43 | 22 | 0.003 | 15 | 50 | 0.236 | 13 | 52 | 0.738 |
| No | 38 | 52 | | 14 | 76 | | 20 | 70 | |

Contd...

| Factor | Family history of cancer means definite risk of getting cancer | | P* | HPV vaccine can be used for cancer prevention | | P* | HPV vaccine is used for cervical cancer prevention | | P* |
|----------------------------------|--|----|-------|---|----|--------|--|----|-------|
| | Yes | No | | Yes | No | | Yes | No | |
| Highest education attained | | | | | | | | | |
| Illiterate | 4 | 4 | 0.027 | 2 | 6 | <0.001 | 1 | 1 | 0.009 |
| Up to middle school | 6 | 57 | | 6 | 66 | | 2 | 4 | |
| Intermediate | 13 | 48 | | 15 | 58 | | 6 | 9 | |
| College and above | 9 | 35 | | 45 | 6 | | 36 | 9 | |
| Mobile phone-based internet user | | | | | | | | | |
| Yes | 18 | 47 | 0.065 | 38 | 27 | <0.001 | 29 | 9 | 0.02 |
| No | 14 | 76 | | 14 | 76 | | 9 | 8 | |

*Chi-square test

the availability of HPV vaccine ($P<0.001$) as well as the utility of this vaccine in cervical cancer prevention ($P=0.02$).

Discussion

Breast, uterine cervix and oral cancer constitute the top three prevalent cancers accounting for 32.8 per cent of the cancer burden in India¹. Although these cancers are potentially preventable or amenable to early detection, there has been little success in controlling these cancers due to the absence of organized screening programmes. This is also attributable to the rampant lack of awareness about cancer, its risk factors and warning signs^{5,6}. In an effort to control the cancer-related morbidity and mortality, the Ministry of Health and Family Welfare, Government of India, launched the operational framework guidelines for screening and management of common cancers in the country. For the effective rollout of this programme, appraisal of the prevalent cancer awareness among the population to be screened is imperative. The present study aimed at assessing the baseline awareness about the prevalent cancers among the residents of selected villages in Gautam Buddh Nagar district and finding its association with various demographic factors, especially mobile phone usage.

The sociodemographic profile of the participants in our study was roughly like the earlier studies conducted in India^{6,12}. In the present study, most of the participants were aware of cancer as a disease. At least one risk factor for cancer was known to 76 per cent of the participants. This is similar to a study conducted in six States of India, wherein awareness about tobacco and alcohol as risk factors for cancer was seen in

more than 75 per cent and 50 per cent of participants, respectively⁶. A worrisome finding in the present study was the lack of awareness of warning signs of cancer in about half of the individuals. Similar results were reported by Raj *et al*⁶ and Sheshachalam and Chakravarthy¹³. Enhancing awareness about warning signs of cancer is imperative to ensure that patients seek medical attention promptly, so that the treatment outcomes may be improved. The prevalence of common myths related to cancer was also assessed in the present study. Although the prevalence of cancer-related myths was not common, beliefs, such as cancer is contagious or cancer diagnosis is a death sentence or a family history of cancer means that the individual would definitely get cancer, were still seen in 14.2, 16.2 and 15.7 per cent of the participants, respectively. Similar results were also reported in a study from Chennai, India¹⁴. It is important to dispel the prevailing myths about cancer through community engagement and cancer awareness programmes, so that medical assistance is sought by the individuals at an appropriate time. Majority of the respondents in the present study were aware that certain cancers can be prevented (81.9%) and that regular screening can be helpful in cancer prevention (76.9%). More efforts directed at promoting awareness about cancer prevention and the benefits of screening are required to promote cancers prevention in the country.

Inquiry for specific questions such as risk factors for a particular cancer revealed a dismal awareness level for risk factors for cervical and breast cancer. The knowledge was better for oral cancer where about 80 per cent of the individuals were aware of its risk factors. These results are in consonance with

the previous studies with a similar sociodemographic profile of participants. A recently published systematic review on breast cancer awareness also showed a low level of awareness for major risk factors among women in the community¹⁵. Studies have also reported the lack of awareness of risk factors for cervical cancer, many of which are modifiable^{3,10}. For oral cancer, the awareness of tobacco as a risk factor was known to most of the individuals included in the present study. This may be attributable to the mandatory pictorial warnings on the smoked as well as smokeless tobacco packets as well as the frequent audio-visual information in print and electronic media¹². The awareness of HPV vaccine for the prevention of cervical cancer was lacking in 67 per cent of our participants. Similar results were found in the study by Reichheld *et al*¹⁰ in south India. With the gradual introduction of HPV vaccination for eligible girls in some States of the country, awareness about this modality for cancer prevention needs to be stepped up among the parents, to facilitate the uptake of vaccination.

Association of cancer awareness with sociodemographic factors: A recent study from northeastern part of India showed that participants in the higher income group as well as female participants exhibited better cancer-related knowledge. Daily wage workers and homemakers were found to have poor overall knowledge about cancer³. A few studies^{14,16} reported higher awareness among individuals with higher education, younger age, males and those with high socio-economic status. In the present study, females were found to have a better awareness of risk factors for breast cancer ($P=0.002$). The risk factor awareness for all the three cancers was higher in more educated individuals ($P<0.05$).

The myths associated with cancer often prove to be stumbling blocks in the effectiveness of cancer screening activities. Previous studies have reported a lower prevalence of cancer myths, such as 'cancer is contagious' or that 'cancer is a curse' among literate individuals, younger people and high socio-economic group¹⁴. Our study also revealed that education level significantly correlated in an inverse fashion with the beliefs and myths surrounding this disease. The beliefs that 'cancer is contagious', 'cancer diagnosis means death sentence' or that 'family history of cancer means a 100 per cent chance of one getting cancer' were more prevalent among the individuals with lower education levels. These results suggest that cancer

awareness programmes need to incorporate and stress upon dispelling these myths, especially among the less educated population.

Knowledge of at least one risk factor for cancer as well as the warning signs of cancer was also found to be associated with the education level of the individuals. However, the knowledge of cancer being preventable and the effectiveness of screening for this purpose did not show an association with the education status. This could partly be because the three villages included in this study are regularly visited by teams from our institute for cancer screening. Hence, regular awareness campaigns are being held and the accredited social health workers play an important role in enhancing cancer awareness. In the present survey, it was observed that individuals with higher education had better knowledge about the availability of HPV vaccine as a cancer prevention tool for cervical cancer. This finding is similar to earlier studies by Singh *et al*¹⁷ and Rashid *et al*¹⁸.

Mobile phone usage and cancer awareness: In the present study, health information-seeking mobile phone usage was assessed for association with various aspects of cancer awareness. The use of internet and various search engines has been steadily rising over time with this mode of information being the first stop for some individuals⁸. With the increasing use of social media, these platforms are being viewed as potential means to induce behavioural changes, including cancer awareness and adherence to cancer screening programmes in many countries⁹.

Mobile phone users were found to be more aware of the risk factors of breast cancer than non-users in the present survey. Knowledge of at least one risk factor or the warning signs of cancer was also higher among mobile phone users ($P<0.001$ for both). Individuals seeking health-related information on the mobile phone through internet were also more aware of the possibility of cancer prevention ($P<0.001$), availability of cancer screening ($P=0.003$) and use of HPV vaccination for prevention of cervical cancer. On an extensive literature search, we could not find any previous study that attempted to associate mobile phone use as a determinant of cancer awareness. Few studies were retrieved which dealt with the assessment of the use of the internet as a means of delivering health and specifically cancer-related information and awareness^{11,19}. For instance, Lenoir *et al*¹⁹ evaluated the characteristics of Twitter users

posting sensitizing tweets about #SmearForSmear campaign for cervical cancer screening in the United Kingdom. Another study using data from the National Cancer Institute's Health Information National Trends Survey showed that internet seekers had higher odds of HPV vaccine awareness than non-seekers among the individuals who sought general health information. However, this difference was lost among the cancer information seekers¹¹. The results of the present study provide evidence in support of inclusion of m-health programmes focused on cancer prevention at the primary healthcare level for better community penetration. A recently published systematic review emphasized the utility of mobile health applications in promoting positive behaviour related to health and attendance at cancer screening programmes, especially for breast cancer²⁰.

The present study is not without some limitations. Although the mobile phone usage for seeking health-related information was found to have an association with cancer awareness, the causal link could not be established. This could be partly because of recall bias, *i.e.* quite a few participants did not remember if they had accessed cancer-related information on the internet. In current times, increasing availability and affordability of internet and wide penetration of mobile phone services offer a unique platform to leverage cancer awareness campaigns for wider reach and community penetration; however, this may not be generalizable in the Indian context due to heterogeneous nature of its population and complex demographics. Another limitation of the study is the small sample size. Hence, the data on cancer awareness generated from this study may not be an actual representation of the population. However, the findings of our study do provide the baseline data on association between mobile phone usage and cancer awareness. Further large-scale studies in this population and also across different geographic domains within our country are warranted to corroborate our findings.

In conclusion, the present study reiterates the low level of awareness of risk factors of cervical and breast cancers as well as the warning signs of cancer among the rural population. The awareness was found to be associated with education level and health information-seeking mobile phone use. Hence, cancer awareness campaigns need to incorporate simple language for better communication with the less educated population. Increasing penetration and

affordability of the mobile phone and internet services offers a unique platform through m-health to leverage such campaigns for wider reach and community. This, in turn, would improve the health-seeking behaviour of the rural population and allow them to seek timely medical attention for dreaded diseases such as cancer.

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Conflicts of Interest: None.

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Questionnaire

ICMR-National Institute of Cancer Prevention and Research

Demographic Data:

1. Participant ID:
2. Age:
3. Sex: Male/Female
4. Occupation:
5. Education: Illiterate/Primary/Middle/Intermediate/College and above
6. Marital status: Single/Married/Divorced/Widow
7. Monthly Income(Economic Status):
8. No of adults in household:
9. No of children in household:
10. Mobile:
11. Address:

(All the following questions are single response type)

Internet Awareness:

1. How often do you use Internet?
 - a) Frequently (every day)
 - b) Occasionally (once a week)
 - c) Rarely (once a month)
 - d) Never
2. How do you access internet?
 - a) Computer
 - b) Laptop
 - c) Mobile
3. Have you used internet to access health related information?
 - a) Yes
 - b) No
 - c) Cant say/ don't remember

General Questions:

1. Have you heard about the term "cancer"?
 - a) Yes
 - b) No
2. What was the first source of your information about cancer?
 - a) Internet
 - b) Health Facility (Hospital etc)
 - c) Heard from others (relatives/neighbor/friends/colleague etc.)
 - d) Newspaper
 - e) Radio
 - f) TV
 - g) Never heard of it

3. Which of the following is the most common cancer in India?
 - a) Colorectal Cancer
 - b) Gall Bladder Cancer
 - c) Breast Cancer
 - d) None of the above
 - e) Don't know
4. Which of the following increases the risk of cancers?
 - a) Smoking/Tobacco
 - b) Healthy Diet
 - c) Exercise
 - d) I don't think any of these increase the risk of cancer
 - e) Don't know
5. What are the warning signs of Cancer?
 - a) A sore throat that doesn't heal
 - b) Unexplained weight loss and loss of appetite
 - c) A nagging cough or persistent hoarseness of voice
 - d) All of the above
 - e) Don't know
6. Can cancer be prevented?
 - a) Yes
 - b) No
 - c) Don't know
7. Do you think screening is an effective tool for cancer prevention?
 - a) Yes
 - b) No
 - c) Don't know

Myths

8. If you have family history of cancer, do you have 100% chances of getting cancer?
 - a) Yes
 - b) No
 - c) Don't know
9. Is cancer a contagious disease?
 - a) Yes
 - b) No
 - c) Don't know
10. Will positive thinking cure cancer?
 - a) Yes
 - b) No
 - c) Don't know
11. Is cancer always a death sentence?
 - a) Yes
 - b) No
 - c) Don't know

12. Do you fear getting cancer anytime in your lifetime?
- a) Very concerned
 - b) Not very concerned
 - c) Already diagnosed with cancer
 - d) Never thought about it
13. Did anyone in your immediate family had a diagnosis of cancer?
- a) Yes
 - b) No
 - c) Don't know
14. Does anyone in your family (including you) have the habit of using the following:
- a) tobacco
 - b) alcohol
 - c) Betel nut/areca nut
 - d) smoking
 - e) No

Specific Questions:

15. Which of the following are the risk factors of Cervical Cancer?
- a) Human Papilloma Virus Infection
 - b) Having multiple sexual partners
 - c) Early age of marriage
 - d) All of the above
 - e) Don't know
16. Are you aware of HPV Vaccine?
- a) Yes
 - b) No
- If yes, then ask Q17.
17. HPV vaccine is used to prevent which cancer?
- a) Lung cancer
 - b) Breast cancer
 - c) Cervical cancer
 - d) Gall bladder cancer
18. Which of the following is the screening test for cervical cancer?
- a) Pap Smear
 - b) ECG
 - c) Blood test
 - d) Urine test
 - e) Don't know
19. What are the risk factors for Breast Cancer?
- a) Female Gender
 - b) Family history of Cancer
 - c) Genetic Factors
 - d) All of the above
 - e) Don't know

20. What are the main risk factors for Oral Cancer?

- a) Tobacco consumption
- b) Poor oral hygiene
- c) Chewing gum
- d) Ice cream
- e) Don't know

21. Which among the following can help in reducing the risk of getting cancer?

- f) Not smoking
- g) Eating fresh fruits and vegetables
- h) Undertaking regular exercise
- i) All of the above
- j) Don't know

Feed back:

1) Have you been benefitted by the website cancerindia.org.in?

- a) Yes
- b) No

How/Why: _____

2) Will you recommend this website to others?

- a. Yes
- b. No

Why: _____

3) Would you like to suggest any improvement in the website?

- a. Yes
- b. No

Suggestions: _____