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Effectiveness of a Structured Educational Intervention on Knowledge and Awareness of Hereditary Cancer, Genetic Counselling, and Genetic Testing Among Adult Women: A Pre-Post Interventional Study from a Tertiary Cancer Centre in Central India

Abstract

Background: Hereditary cancers account for approximately 5-10% of all cancers and result from inherited pathogenic genetic variants that substantially increase an individual's lifetime risk of developing cancer. Early identification of individuals at increased genetic risk through family history assessment, genetic counselling, and appropriate testing enables personalized risk assessment, targeted surveillance, and preventive interventions. However, awareness of hereditary cancer and the availability of genetic services remain limited among women in many low- and middle-income countries, including India.

Structured educational interventions may improve knowledge and awareness, facilitate informed decision-making, and promote the appropriate utilization of preventive healthcare services

Objectives: To assess baseline knowledge and awareness regarding hereditary cancer, genetic counselling, and genetic testing among adult women and to evaluate the effectiveness of a structured educational intervention.

Methods: A single-centre pre-post interventional study was conducted among 300 adult women attending National Cancer Institute, Nagpur, Maharashtra, India, between April and June 2026. Participants were recruited using consecutive sampling. Baseline knowledge and awareness were assessed using a structured, expert-validated questionnaire. Following the pre-test, participants received the Hereditary Cancer Awareness Education Module (HCAEM), an investigator-developed standardized educational programme. Post-intervention awareness was reassessed using the same questionnaire 60-80 minutes after the educational session. Data were analysed using descriptive statistics, paired-samples t-test, one-way analysis of variance (ANOVA), and Cohen's d effect size. Written informed consent was obtained from

Research Article

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all participants, and the study was approved by the Institutional Scientific Committee and Institutional Ethics Committee.
All 300 participants completed both the pre-test and post-test assessments, yielding a response rate of 100%. The mean hereditary cancer awareness score increased significantly from 5.56+ 1.92 before the intervention to 7.10 +1.14 after the intervention (t (299) = 14.32, p< 0.001), representing a mean improvement of 1.54 points. The intervention demonstrated a large educational effect (Cohen's d =0.83). Baseline awareness was significantly associated with educational effect (Cohen's d =0.83). Baseline awareness was significantly associated with educational qualification (p <0.001) and occupation (p <0.001), whereas age, marital status, and family history of cancer showed no statistically significant association. Educational disparities observed at baseline were substantially reduced following the intervention.
Conclusion: The investigators-developed Hereditary Cancer Awareness Education Module (HCAEM)
significantly improved knowledge and awareness regarding hereditary cancer, genetic counselling, and genetic testing among adult women. The findings support the integration of structured hereditary cancer education into routine clinical practice, community-based health promotion programmes, and national cancer prevention strategies. Expanding access to culturally appropriate educational resources and genetic counselling services may facilitate earlier identification of individuals and families at increased hereditary cancer risk and strengthen cancer prevention efforts in India.

Introduction

Cancer remains one of the leading causes of morbidity and mortality worldwide and continues to pose a major public health challenge. According to the World Health Organization (WHO), cancer accounted for an estimated 20 million new cases and approximately 9.7 million deaths globally in 2022, representing nearly one in six deaths worldwide. The global cancer burden is projected to increase substantially over the coming decades owing to population growth, population ageing, and changes in the prevalence of modifiable risk factors. Breast, cervical, ovarian, colorectal, prostate, and lung cancers contribute significantly to this burden, particularly in low- and middle-income countries where access to preventive healthcare services remains limited [1,2].

Although the majority of cancers are sporadic and result from complex interactions among environmental exposures, lifestyle factors, ageing, and acquired genetic alterations, approximately 5-10% arise because of inherited pathogenic germline variants that substantially increase an individual's lifetime risk of developing cancer [3-7].Hereditary cancer syndromes are characterized by early age at disease onset, clustering of specific cancers within families, multiple primary malignancies, bilateral disease in paired organs, and recognizable patterns of inheritance. Early identification of individuals and families at increased hereditary cancer risk enables personalized risk assessment, evidence-based surveillance, risk-reducing interventions, and cascade testing of at-risk relatives [3-7].

Advances in cancer genetics have transformed the prevention and management of hereditary cancer. Pathogenic variants in high-penetrance susceptibility genes, including BRCA1, BRCA2, TP53, PALB2, PTEN, and the DNA mismatch repair genes associated with Lynch syndrome, are well-established causes of hereditary breast, ovarian, colorectal, endometrial, pancreatic, and several other cancers [8-15]. Identification of these variants facilitates individualized cancer risk assessment, targeted surveillance, prophylactic interventions where appropriate, and the use of precision therapies. Early recognition of hereditary cancer susceptibility has therefore become an essential component of modern cancer prevention and precision medicine [5-16].

Genetic counselling is a specialized communication process that helps individuals and families understand inherited cancer risk, patterns of inheritance, available genetic testing options, medical and psychosocial implications, and strategies for cancer prevention and early detection. It promotes informed decision-making, supports shared decision-making between patients and healthcare professionals, and facilitates cascade testing among at-risk relatives. International professional

organizations, including the National Comprehensive Cancer Network (NCCN), the American Society of Clinical Oncology (ASCO), and the European Society for Medical Oncology (ESMO), recommend integrating genetic counselling into routine care for individuals and families at increased hereditary cancer risk [3-7,16-20]. Despite remarkable advances in genomic medicine, awareness of hereditary cancer remains inadequate in many parts of the world. Studies have consistently demonstrated limited public understanding of inherited cancer risk, the importance of family history, indications for genetic counselling, and the availability of genetic testing services. Low health literacy, financial constraints, cultural beliefs, fear of genetic discrimination, and limited availability of trained genetic counsellors continue to impede the effective implementation of hereditary cancer services, particularly in low- and middle-income countries, including India [21-30].

Women represent a particularly important target population for hereditary cancer education because hereditary breast and ovarian cancer syndrome is the most common inherited cancer syndrome worldwide. In many societies, women are primary caregivers and often influence health-related decisions within families. Improving women's awareness of hereditary cancer may therefore enhance recognition of high-risk family history, encourage participation in cancer screening programmes, facilitate timely referral for genetic counselling, and promote informed decisions regarding preventive healthcare for themselves and their relatives.

Educational interventions have been shown to improve knowledge, health literacy, and participation in preventive health programmes. Recent systematic reviews have demonstrated that structured educational programmes, particularly those using culturally appropriate communication, visual teaching aids, and interactive counselling, significantly improve awareness of hereditary cancer, increase acceptance of genetic counselling and genetic testing, and enhance communication of hereditary cancer risk within families [24,25].However, evidence regarding the effectiveness of structured hereditary cancer education among adult women in India remains limited, especially in tertiary cancer centres serving populations with diverse educational and socioeconomic backgrounds.

The National Cancer Institute, Nagpur, Maharashtra, is a comprehensive tertiary cancer centre serving patients from Central India and neighbouring states. The institute provides an appropriate setting for evaluating educational strategies aimed at improving awareness of hereditary cancer and related genetic services among women attending cancer prevention and outpatient clinics.

To address this important knowledge gap, the present study was undertaken to assess baseline knowledge and awareness regarding hereditary cancer, genetic counselling, and genetic testing among adult women attending the National Cancer Institute, Nagpur, and to evaluate the effectiveness of the investigators-developed Hereditary Cancer Awareness Education Module (HCAEM) in improving awareness.The study also examined the association between selected socio-demographic characteristics and hereditary cancer awareness before and after the educational intervention. The findings are expected to contribute to the growing evidence supporting educational strategies for hereditary cancer prevention and may help inform future public health policies aimed at integrating hereditary cancer education and genetic counselling into routine healthcare services in India.

Materials & Methods

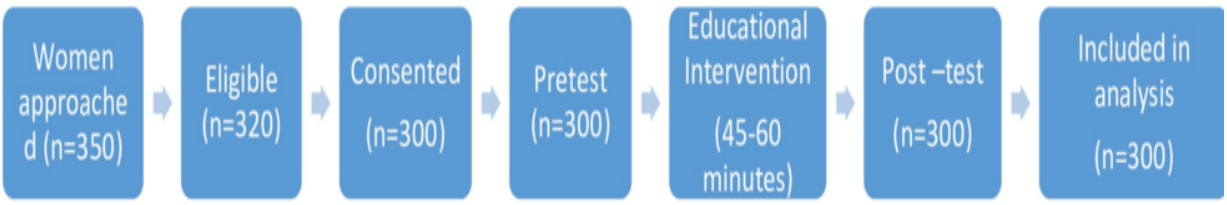

Figure 1: Flowchart of participant's recruitment, enrolment, intervention and analysis

Figure *1* illustrates the flow of participants throughout the study. A total of 350 women were approached for participation, of whom 320 met the eligibility criteria. Among the eligible participants, 300 provided informed consent and were enrolled in the study. All enrolled participants completed the baseline (pre-test) assessment before receiving an educational intervention that lasted 45-60 minutes. Following the intervention, all 300 participants completed the post-test assessment after 60-80 minutes. No participants were lost to follow-up or excluded after enrolment; therefore, all 300 participants were included in the final data analysis, resulting in a 100% completion rate among enrolled participants.

Study Design and Setting

This single centre pre-post interventional prospective observational study was conducted at National Cancer Institute Nagpur, Maharashtra, India from 7Th April 2026 to 7Th July 2026. The study evaluated the effectiveness of a structured educational intervention on knowledge and awareness of hereditary cancer, genetic counselling and genetic testing among adult women.

The structured educational programme was developed by the principle investigator after reviewing current recommendations from the world health organization, National comprehensive cancer network and relevant peer reviewed literature on hereditary cancer education. The educational content was validated by expert in gynaecological oncology, preventive oncology and genetic counselling prior to implementation. The programme subsequently focused on hereditary breast and ovarian cancer syndrome, Lynch syndrome, and other important hereditary cancer syndromes.

Participants were educated regarding hereditary cancer risk factors, the importance of family history, recognition of high-risk families, indications for genetic counselling and genetic testing, available preventive strategies, early detection, and appropriate cancer screening. The educational session also emphasized healthy lifestyle practices, timely referral to genetic counselling services, and communication of relevant family history to healthcare professionals.

The Hereditary Cancer Awareness Education Module (HCAEM) was delivered in the local language using PowerPoint presentations, visual illustrations, interactive discussion, and question-and-answer sessions to encourage participant engagement and improve understanding. Each educational session lasted for approximately 45- 60 minutes, followed by an interactive discussion.

Data Collection Procedure

After obtaining written informed consent, participants completed the baseline questionnaire under the supervision of the investigator and social worker. The educational intervention was then delivered using the standardized HCAEM. Approximately 60-80 minutes after completion of the educational session, participants completed the same questionnaire as a post-test to assess changes in knowledge and awareness.

Outcome Measures

The primary outcome measure was the change in hereditary cancer awareness score following the educational intervention.

Secondary outcomes included:

Baseline awareness regarding hereditary cancer, genetic counselling & genetic testing.

Association between socio-demographic characteristics and awareness scores.

Magnitude of educational improvement following the intervention.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA).

Categorical variables were summarized using frequencies and percentages, whereas continuous variables were expressed as mean + standard deviation (SD).

Associations between socio-demographic variables and awareness scores were evaluated using one-way analysis of variance (ANOVA). Changes in awareness scores before and after the intervention were assessed using the paired-samples t-test.

The magnitude of the educational intervention was estimated using Cohen's d effect size. A two-sided p-value of <0.05 was considered statistically significant.

Results

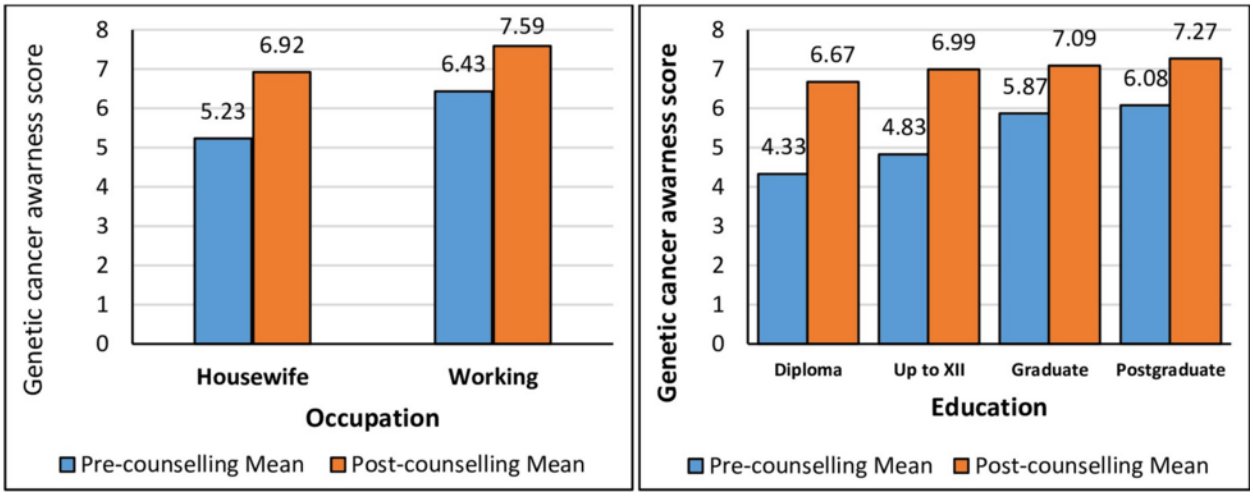

Figure 2: Mean Awareness Scores Before and After Counselling by Occupation and Education.

Comparison of mean hereditary cancer awareness scores before and after counseling by occupation and educational qualification. Post counseling mean scores increased in all groups, demonstrating improved awareness following the educational intervention.

Variable	Category	Pre-counselling Mean ± SD	F-value	p-value	Post-counselling Mean ± SD	F-value	p-value
Age group (years)	30–40	5.15 ± 2.30			7.40 ± 0.60		
	40–50	5.61 ± 1.84			7.19 ± 1.06		
	50–60	5.70 ± 1.97	0.73	0.53	7.08 ± 1.31	1.20	0.31
	≥60	5.38 ± 1.84			6.93 ± 1.10		
Educational qualification	Diploma	4.33 ± 2.08			6.67 ± 2.08		
	Up to XII	4.83 ± 2.01			6.99 ± 1.29		
	Graduate	5.87 ± 1.71			7.09 ± 1.07		
	Postgraduate	6.08 ± 1.81	8.87	<0.001	7.27 ± 1.00	1.02	0.39
Occupation	Housewife	5.23 ± 1.85			6.92 ± 1.19		
	Working	6.43 ± 1.83	25.15	<0.001	7.59 ± 0.82	21.86	<0.001
Family history of cancer	No	5.48 ± 1.89			7.05 ± 1.15		
	Yes	5.78 ± 2.00	1.34	0.25	7.24 ± 1.09	1.47	0.23
Marital status	Unmarried	6.86 ± 1.35			7.14 ± 0.90		
	Married	5.53 ± 1.92	3.33	0.07	7.10 ± 1.15	0.01	0.92
scores before and after the educational intervention							

Table 1: Association of socio-demographic characteristics with genetic cancer awareness.

Association between socio-demographic characteristics and pre- and post-counselling knowledge scores. Data are presented as mean ± standard deviation (SD). Comparisons between groups were performed using one-way analysis of variance (ANOVA), and F-values with corresponding p-values are reported. A p-value <0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA).

Participant Characteristics A total of 300 adult women were enrolled in the study. All participants completed both the pre-intervention and post-intervention assessments, resulting in a 100% response rate. The largest proportion of participants belonged to the 50-60 years age group (35.0%), followed by 40-50 years (34.0%), while 24.3% were aged 60 years or older and 6.7% were between 30 and 40 years.

Regarding educational status, 38.7% were graduates, 34.0% had completed education up to higher secondary level (Class XII), 26.3% were postgraduates,

Most participants were housewives (72.7%), whereas 27.3% were employed. A positive family history of cancer was reported by 25.3% of participants, while 74.7% reported no known family history of cancer. Nearly all participants were married (97.7%), with only 2.3% being unmarried.

No statistically significant association was observed between age group and hereditary cancer awareness either before (F = 0.73, p = 0.53) or after (F = 1.20, p = 0.31) the educational intervention.

Educational qualification demonstrated a significant association with baseline awareness (F = 8.87, p < 0.001).

Following the educational intervention, differences in awareness according to educational qualification were no longer statistically significant (F =1.02, p = 0.39).

Occupation was significantly associated with awareness both before (F = 25.15, p < 0.001) and after (F = 21.86, p < 0.001) the intervention. Working women demonstrated significantly higher awareness.

No statistically significant association was found between family history of cancer and hereditary cancer awareness before (F = 1.34, p = 0.25) or after (F = 1.47, p = 0.23) the intervention. Similarly, marital status was not significantly associated with awareness either before (F = 3.33, p = 0.07) or after (F = 0.01, p = 0.92) the intervention. Although unmarried participants had slightly high mean awareness scores, the small number of unmarried women limits meaningful comparison.

Awareness domain	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value
Genetic awareness	5.56 ± 1.92	7.10 ± 1.14	1.54	14.32	<0.001

Table 2: Comparison of Pre and Post-Intervention Genetic Cancer Awareness Scores (N = 300).

The comparison of pre-intervention and post-intervention awareness scores is presented in Table *2*.

The mean hereditary cancer awareness score increased significantly from 5.56 ± 1.92 before the intervention to 7.10 ±1.14 after the intervention. The mean improvement was 1.54 points, and the difference was statistically significant (paired t = 14.32, p < 0.001), indicating a marked increase in participants' knowledge and awareness following the educational programme.

Domain	Cohen's d	Cohen's d
Genetic awareness	0.83	Large

Table 3: Effect Size of the Educational Intervention on Genetic Cancer Awareness.

The magnitude of improvement produced by the educational intervention was evaluated using Cohen's d.

As shown in Table *3* the effect size was 0.83, indicating

a large educational effect. This finding demonstrates that the intervention produced not only statistically significant but also educationally meaningful improvement in awareness regarding hereditary cancer, genetic counselling, and genetic testing.

Discussion

The present pre-post interventional study evaluated baseline knowledge and awareness regarding hereditary cancer, genetic counselling, and genetic testing among adult women attending a tertiary cancer centre in Central India and assessed the effectiveness of a structured educational intervention in improving awareness. Baseline awareness was modest, with significant differences according to educational qualification and occupation. Following the intervention, participants demonstrated a statistically significant improvement in hereditary cancer awareness, with a mean increase of 1.54 points and a large educational effect (Cohen's d = 0.83). These findings indicate that a brief, structured educational programme can substantially improve understanding of hereditary cancer and related genetic services among adult women.

The significant improvement observed following the intervention is consistent with the growing body of evidence demonstrating that educational programmes improve knowledge of hereditary cancer, facilitate informed decision-making, and enhance acceptance of genetic counselling and genetic testing. International guidelines emphasize that public education is a fundamental component of hereditary cancer prevention because the identification of individuals at increased genetic risk depends not only on healthcare providers but also on public awareness of family history and the timely recognition of inherited cancer risk [3-7,16-20]. Systematic reviews have similarly concluded that structured education and counselling significantly improve knowledge, perceived cancer risk, communication within families, and willingness to consider genetic counselling and genetic testing [24,25].

The educational intervention used in the present study was intentionally designed to introduce participants to fundamental concepts of human genetics before discussing hereditary cancer syndromes, family history, genetic counselling, and genetic testing. This stepwise approach enabled participants to develop a basic understanding of cells, chromosomes, DNA, genes, and patterns of inheritance before learning more complex concepts related to inherited cancer susceptibility. Presenting information in a logical sequence, together with the use of simple language, visual teaching aids, and interactive discussion, likely contributed to the substantial improvement in awareness observed after the intervention. Such educational strategies have consistently been shown to be more effective than passive dissemination of printed information because they encourage active participation, improve comprehension, and provide opportunities for immediate clarification of misconceptions [24,25].

The large effect size observed in this study further strengthens the clinical and educational significance of the findings. Although statistical significance indicates that the observed improvement was unlikely to have occurred by chance, Cohen's d reflects the practical importance of the intervention. The large effect size (0.83) suggests that the educational programme produced meaningful improvements in participants' understanding rather than merely statistically significant differences. This finding supports previous evidence that structured educational interventions can substantially enhance genetic literacy and improve understanding of hereditary cancer risk across diverse populations [24,25].

Despite being conducted in a tertiary cancer centre, baseline awareness regarding hereditary cancer remained modest. Similar findings have been reported across different countries, where many individuals remain unaware that features such as early-onset cancer, multiple affected relatives, bilateral cancers, multiple primary malignancies, or clustering of specific cancers within a family may indicate an inherited cancer predisposition syndrome. Misconceptions regarding hereditary cancer, uncertainty about the purpose of genetic counselling, and concerns related to genetic testing continue to limit the appropriate utilization of hereditary cancer services [24,25]. The findings of the present study reinforce the need for broader public education to improve recognition of hereditary cancer risk and facilitate timely referral for specialist genetic services.

Overall, the findings demonstrate that a structured educational intervention is an effective strategy for improving awareness regarding hereditary cancer,

genetic counselling, and genetic testing among adult women. These results support the incorporation of structured educational programmes into routine hereditary cancer services and community-based cancer prevention initiatives to strengthen genetic literacy and promote informed participation in cancer prevention.

The present study identified educational qualification as one of the strongest determinants of baseline hereditary cancer awareness. Participants with postgraduate education demonstrated significantly higher awareness scores than those with lower educational attainment. This finding is consistent with previous studies reporting that individuals with higher educational levels generally possess better health literacy, greater access to reliable health information, and a better understanding of disease prevention and available healthcare services. They are also more likely to seek health information from multiple sources, critically evaluate medical information, and actively participate in healthcare decision-making, resulting in greater awareness of hereditary cancer risk, family history assessment, genetic counselling, and genetic testing [26].

An encouraging finding was that the significant differences in awareness according to educational qualification observed at baseline were no longer evident after the intervention. This suggests that the structured educational programme effectively improved awareness across all educational groups and substantially reduced disparities associated with educational attainment. The use of simple language, visual teaching aids, and interactive discussions enabled participants with diverse educational backgrounds to understand complex genetic concepts. From a public health perspective, these findings demonstrate that well-designed educational interventions can promote equitable dissemination of hereditary cancer knowledge regardless of formal education, supporting their incorporation into community-based cancer prevention programmes, particularly in populations with heterogeneous educational backgrounds.

Occupation was another important determinant of awareness. Working women demonstrated significantly higher awareness than housewives both before and after the intervention. Similar findings have been reported previously, where employment has been associated with greater exposure to health information through workplaces, social interactions, digital media, educational activities, and more frequent contact with healthcare services. Working women may also be more familiar with preventive healthcare practices and have greater opportunities to participate in health promotion activities [24-26].

Although housewives had lower baseline awareness, they demonstrated substantial improvement following the educational intervention, indicating that structured educational programmes can effectively address knowledge gaps among women who may have limited access to reliable health information. This finding has particular relevance in India, where many middle-aged and older women are homemakers. Integrating hereditary cancer education into community outreach activities, primary healthcare centres, cancer screening programmes, women's self-help groups, and other community platforms may therefore represent an effective strategy for improving awareness in this population.

In contrast, no statistically significant association was observed between age and hereditary cancer awareness either before or after the intervention. Although participants aged 50-60 years demonstrated slightly higher baseline awareness, the differences were not statistically significant. Similar observations have been reported in previous studies, suggesting that awareness of hereditary cancer is influenced more strongly by educational attainment, health literacy, and access to health information than by chronological age alone [24,26]. These findings indicate that educational interventions should target adult women across all age groups rather than focusing exclusively on older individuals.

Family history of cancer was also not significantly associated with awareness in the present study. Although participants reporting a positive family history had marginally higher awareness scores, the differences were not statistically significant. Similar findings have been described in previous studies, demonstrating that many individuals with affected relatives remain unaware of hereditary cancer syndromes, the importance of documenting family history, or the availability of genetic counselling and predictive genetic testing [16,17,27].

Several factors may explain this observation. Family

members are not always informed about the specific type of cancer affecting their relatives or the age at diagnosis, and discussions about cancer within families may be limited because of stigma, fear, or cultural beliefs. Furthermore, comprehensive family history assessment is not consistently incorporated into routine clinical practice, resulting in missed opportunities to identify individuals at increased hereditary cancer risk. These findings emphasize the need to strengthen family history assessment during routine healthcare encounters while simultaneously improving public awareness regarding inherited cancer risk and the importance of communicating relevant family health information.

Marital status was likewise not significantly associated with hereditary cancer awareness either before or after the intervention. Although unmarried participants demonstrated slightly higher awareness scores, they represented only a small proportion of the study population, limiting meaningful statistical comparison. Consequently, these findings should be interpreted cautiously, and future studies involving larger and more diverse populations are warranted to further explore the relationship between marital status and hereditary cancer awareness.

Collectively, these findings indicate that educational qualification and occupation are the principal determinants of baseline hereditary cancer awareness, whereas age, marital status, and family history exert comparatively less influence. More importantly, the marked improvement observed across all participant groups following the intervention demonstrates that structured educational programmes can effectively reduce knowledge gaps and improve awareness irrespective of participants' sociodemographic characteristics. These findings highlight the potential of culturally appropriate educational interventions to promote equitable access to hereditary cancer information and support their integration into routine healthcare and community-based cancer prevention programmes.

Clinical and Public Health Implications

The findings of the present study have important implications for cancer prevention and public health in India. Advances in genomic medicine have created unprecedented opportunities to identify individuals at increased hereditary cancer risk before the development of disease. However, the benefits of genetic counselling, predictive genetic testing, personalized surveillance, and risk-reducing interventions can only be realized when individuals are aware of hereditary cancer and recognize the importance of seeking appropriate healthcare. The modest baseline awareness observed in this study highlights the need to strengthen public education as an integral component of comprehensive hereditary cancer prevention strategies, particularly in low- and middle-income countries where access to genetic services remains limited [3-7,16-20,29,30].

The results support the integration of structured hereditary cancer education into routine healthcare services, including outpatient clinics, women's health services, breast and cervical cancer screening programmes, primary healthcare centres, and community outreach initiatives. Educational interventions delivered using culturally appropriate language and interactive teaching methods can substantially improve genetic literacy, facilitate recognition of high-risk family history, and encourage timely referral for genetic counselling and appropriate genetic testing.

Healthcare professionals, including primary care physicians, gynaecologists, oncologists, nurses, and community health workers, play a pivotal role in improving awareness and identifying individuals who may benefit from hereditary cancer risk assessment. Strengthening family history assessment during routine clinical encounters and improving communication regarding inherited cancer risk may facilitate earlier identification of high-risk individuals and families, thereby supporting evidence-based prevention and personalized cancer care [16-20,29,30].

Overall, the findings demonstrate that structured educational interventions represent a practical, scalable, and cost-effective strategy for improving awareness regarding hereditary cancer, genetic counselling, and genetic testing. Incorporating such programmes into existing cancer prevention initiatives has the potential to improve health literacy, promote informed decision-making, enhance utilization of hereditary cancer services, and ultimately contribute to earlier identification of individuals and families at increased genetic risk.

Strengths

The present study has several important strengths. It employed a pre-post interventional design, enabling objective assessment of changes in awareness following a standardized educational programme. All 300 enrolled participants completed both the pre-intervention and post-intervention assessments, resulting in a 100% response rate and minimizing attrition bias.

The educational module was systematically developed following an extensive review of current scientific literature and international guidelines on hereditary cancer, genetic counselling, and cancer prevention. The intervention adopted a sequential educational approach that introduced participants to fundamental concepts of human genetics before discussing hereditary cancer risk, genetic counselling, and genetic testing, thereby facilitating comprehension among individuals with diverse educational backgrounds.

Furthermore, the study questionnaire underwent expert content validation and pilot testing before implementation, enhancing the validity, clarity, and feasibility of the study instrument. Appropriate statistical analyses, including paired-samples t-test, one-way analysis of variance (ANOVA), and Cohen's d effect size, provided a comprehensive evaluation of the effectiveness of the intervention. Conducting the study at a tertiary cancer centre also enhances its relevance to preventive oncology programmes and hereditary cancer services in India.

Limitations

Despite its strengths, the study has certain limitations. It was conducted at a single tertiary cancer centre, which may limit the generalizability of the findings to other healthcare settings and community populations. Awareness was assessed immediately after the educational intervention; therefore, long-term retention of knowledge and its influence on healthcare-seeking behaviour, uptake of genetic counselling, genetic testing, adherence to surveillance recommendations, and cascade screening among family members could not be evaluated.

The study population consisted predominantly of married women and housewives, while relatively few unmarried women and diploma holders were included, limiting subgroup comparisons. In addition, the study evaluated improvements in knowledge and awareness but did not assess subsequent behavioural outcomes, such as communication of family history to healthcare providers or actual utilization of hereditary cancer services. Future multicentre randomized or longitudinal studies involving larger and more diverse populations are warranted to confirm these findings and evaluate long-term educational, behavioural, and clinical outcomes.

Recommendations

Based on the findings of the present study, structured educational programmes on hereditary cancer should be incorporated into routine cancer awareness and preventive health programmes for adult women. Public awareness initiatives should emphasize hereditary cancer risk, the importance of family history, the role of genetic counselling, and appropriate indications for genetic testing.

Hereditary cancer risk assessment and genetic counselling services should be strengthened within tertiary cancer centres and progressively expanded to secondary healthcare facilities. Development of culturally appropriate educational materials in regional languages may improve awareness among individuals with diverse educational backgrounds and promote equitable access to preventive healthcare. Future multicentre longitudinal studies should evaluate long-term knowledge retention, behavioural changes, uptake of genetic counselling and testing, cascade screening, clinical outcomes, and the cost-effectiveness of educational interventions.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request, subject to institutional policies and ethical requirements regarding participant confidentiality.

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Conclusions

Baseline awareness regarding hereditary cancer, genetic counselling, and genetic testing among adult women attending a tertiary cancer centre was modest and was significantly influenced by educational attainment and occupation. The investigator-developed structured educational intervention resulted in a statistically significant and educationally meaningful improvement in awareness, with a large effect size, demonstrating its effectiveness in enhancing participants' understanding of hereditary cancer and available preventive services.

Importantly, the intervention substantially reduced educational disparities in awareness, indicating that well-designed educational programmes can improve genetic literacy across women with different educational backgrounds. These findings support the integration of hereditary cancer education into routine clinical practice, community-based health promotion programmes, and national cancer prevention strategies.

Expanding access to genetic counselling services, promoting systematic family history assessment, and strengthening public awareness through culturally appropriate educational initiatives may facilitate earlier identification of individuals and families at increased hereditary cancer risk. Such measures have the potential to enhance informed decision-making, improve participation in preventive healthcare, and contribute to reducing the burden of hereditary cancers in India.

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