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Exploring Predictors of Cancer Knowledge and Attitudes among Frontline Anganwadi Workers in North Karnataka India

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Abstract

Background

Cancer is a leading public health challenge in India, with delayed diagnosis contributing to high mortality. Anganwadi Workers (AWWs), as frontline community health functionaries, are well positioned to promote cancer awareness; however, their knowledge and attitudes remain insufficiently characterised. This study assessed cancer knowledge, attitude, and associated sociodemographic predictors among AWWs in Belagavi Taluka, Karnataka.

Methods

A community-based cross-sectional study was conducted among 180 AWWs from four randomly selected Primary Health Centres between June and December 2023. Data were collected using a validated, pre-tested structured questionnaire. Knowledge (0–30) and attitude (0–70) scores were categorised using a 50% threshold. Bivariate associations were assessed using Chi-square tests, and independent predictors were identified through binary logistic regression. Pearson's correlation examined the relationship between knowledge and attitude.

Results

The mean knowledge score was 16.03 ± 3.94, with 57.22% demonstrating poor knowledge. The mean attitude score was 41.17 ± 8.15, with 64.44% showing favourable attitudes. Working ≥ 8 hours/day was the only independent predictor of good knowledge (Adj. OR = 2.32; 95% CI: 1.05–5.13; p = 0.037). For attitude, significant predictors included working ≥ 8 hours/day (Adj. OR = 2.25; p = 0.050), joint family structure (Adj. OR = 0.52; p = 0.050), and 24–36 months' work experience (Adj. OR = 3.43; 95% CI: 1.29–9.11; p = 0.013). Knowledge and attitude were moderately correlated (r = 0.458, p < 0.001).

Conclusions

AWWs demonstrated suboptimal cancer knowledge despite favourable attitudes. Occupational engagement and work experience significantly influenced both domains. Integrating structured cancer education into AWW training programmes may strengthen community-level cancer prevention and early detection in India.

Clinical Trial Registration

Not Applicable

1. Introduction

Cancer remains one of the foremost global public health challenges of the 21st century. According to GLOBOCAN 2022 estimates, approximately 20 million new cancer cases and 9.7 million cancer deaths were recorded worldwide [1]. In India, the burden is particularly alarming: GLOBOCAN 2022 reported 1,413,316 new cancer cases and 916,827 deaths, with approximately three in every five diagnosed individuals succumbing to the disease [2]. Projections based on the Global Burden of Disease Study indicate that cancer incidence rates in India are expected to rise from 529.40 per 100,000 population in 2022 to 549.17 per 100,000 by 2031 [3].

Despite this escalating burden, a large proportion of cancers in India continue to be diagnosed at advanced stages, substantially reducing survival prospects [4]. Late-stage diagnosis is a critical driver of cancer mortality, particularly in low-resource and rural settings where access to specialist healthcare infrastructure is limited [5]. Early detection through community-level awareness, health education, and promotion of screening uptake therefore represents a pivotal strategy for reducing cancer-related morbidity and mortality [6].

The Integrated Child Development Services (ICDS) scheme, launched by the Government of India in 1975, deploys more than 1.4 million AWWs across the country through Anganwadi Centres (AWCs) [7]. AWWs are community-selected, trained frontline functionaries who serve as the primary interface between government health programmes and rural households [8]. Their mandated roles include supplementary nutrition, immunisation support, pre-school education, health check-ups, and referral services [9]. Beyond these traditional mandates, AWWs have been increasingly recognised for their potential to serve as effective behaviour change communicators in health promotion campaigns, including those targeting non-communicable diseases [10].

A systematic review by Okasako-Schmucker et al. (2023) found that community health worker (CHW)-led interventions increased cervical cancer screening by a median of 12.8 percentage points and breast cancer screening by 11.5 percentage points [6]. In India, qualitative research has documented both the critical contributions and structural barriers CHWs face in facilitating early cancer detection and referral pathways [5].

Despite this recognition, few studies have specifically characterized cancer knowledge and attitude of AWWs in Karnataka, a state with significant urban–rural health disparities. Belagavi district, situated in northern Karnataka, presents an epidemiologically relevant study setting given its mixed urban–rural composition. Knowledge and attitude assessment constitutes a foundational step in designing context-appropriate cancer education interventions, as the knowledge–attitude nexus is a key determinant of health-promoting behaviour among frontline workers [11, 12].

Therefore, this study aimed to assess cancer knowledge and attitudes among Anganwadi Workers in Belagavi Taluka, Karnataka, and to identify their associated sociodemographic factors.

2. Methods

2.1 Study design and setting

A community-based cross-sectional study was conducted in Belagavi Taluka, Karnataka, India, between June and December 2023. The study area includes both urban and rural Primary Health Centre (PHC) catchment populations.

2.2 Study population and sampling

The study population comprised Anganwadi Workers (AWWs) working under selected PHCs in Belagavi Taluka. Four PHCs (Ramnagar, Khasbag, Vantamuri, and Kiniye) were selected using simple random sampling from the list of all PHCs in the taluka. All eligible AWWs within these PHCs were invited to participate.

Inclusion criteria

AWWs with ≥ 6 months of service and willingness to provide written informed consent.

Exclusion criteria

AWWs on prolonged leave, unavailable during data collection, or previously exposed to structured cancer awareness training.

2.3 Sample size

Sample size calculation: The sample size was calculated using the standard formula $n = Z^2pq/d^2$, where $Z = 1.96$ (95% confidence interval), $p = 0.50$ (proportion of AWWs with good cancer knowledge, taken as 0.50 as a conservative estimate in the absence of prior local data for this specific population), $q = 1 - p = 0.50$, and $d = 0.073$ (absolute permissible error of 7.3%) [13]. This yielded $n = (1.96^2 \times 0.50 \times 0.50) / 0.073^2 = 180.2 \approx 180$. All eligible AWWs present during data collection were included, resulting in a final sample of 180 participants. The study achieved a 100% response rate with no non-response attrition.

2.4 Data collection tool and procedure

Data were collected using a validated, pre-tested structured questionnaire in Kannada. The tool consisted of three sections:

1. Sociodemographic profile (age, education, marital status, monthly income, family type, religion, socioeconomic status, working hours, and work experience).
2. Cancer knowledge (15 items covering risk factors, warning signs, and preventive measures; maximum score = 30).
3. Cancer attitude (10 items assessing perceptions of screening, willingness to promote community awareness, and stigma reduction; maximum score = 70).

Content validity was established by a panel of five experts in Community Medicine and Oncology. A pilot study conducted outside the study area confirmed clarity and feasibility. Internal consistency was acceptable (Cronbach's α = 0.82 for knowledge and 0.79 for attitude).

Data were collected during routine monthly PHC review meetings following prior written permission from the respective Medical Officers. Questionnaires were self-administered in Kannada, with approximately 30 minutes allocated per session. All completed forms were cross-checked by the investigators for completeness and accuracy.

2.5 Outcome measures

Knowledge and attitude scores were categorized using a 50% cut-off:

- Knowledge: poor (< 15) and good (≥ 15)
- Attitude: low (< 35) and high (≥ 35)

2.6 Statistical analysis

Data were entered into Microsoft Excel 2019 and analyzed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation (SD), and categorical variables as frequencies and percentages.

Bivariate associations were assessed using Chi-square or Fisher's exact test, as appropriate. Variables with $p < 0.05$ and clinically relevant variables were included in binary logistic regression models to identify independent predictors of good knowledge and high attitude. Results are reported as adjusted odds ratios (Adj. OR) with 95% confidence intervals (CI).

Pearson's correlation coefficient was used to assess the relationship between knowledge and attitude scores. A p-value < 0.05 was considered statistically significant. Multicollinearity among independent variables was assessed using variance inflation factor (VIF), and no significant collinearity was observed.

2.7 Ethical considerations

Ethical approval

was obtained from the Institutional Ethics Committee, JN Medical College, Belagavi (Ref: JNMC/IEC/2023/330). Written informed consent was obtained from all participants prior to data collection. The study adhered to the principles of the Declaration of Helsinki. Participation was voluntary; confidentiality was ensured through unique numerical identifiers.

3. Results

3.1 Sociodemographic Characteristics

Table 1

Table 1
Sociodemographic characteristics of Anganwadi workers (n = 180)

Characteristics	Category	n (%)
Age group (years)	18–30	69 (38.33)
	30–60	111 (61.67)
Location	Urban	92 (51.11)
	Rural	88 (48.89)
Marital status	Married	128 (71.11)
	Divorced/Widowed	52 (28.89)
Education level	Secondary	93 (51.67)
	Undergraduate	49 (27.22)
	Graduate and above	38 (21.11)
Monthly income (INR)	≤ 10,000	124 (68.89)
	> 10,000	56 (31.11)
Working hours/day	< 8 hours	132 (73.33)
	≥ 8 hours	48 (26.67)
Religion	Hindu	127 (70.56)
	Muslim	47 (26.11)
	Christian and others	6 (3.33)
Type of family	Nuclear	127 (70.56)
	Joint	53 (29.44)
Socioeconomic status	BPL	137 (76.11)
	APL	43 (23.89)
Work experience	12–24 months	45 (25.00)
	24–36 months	47 (26.11)
	> 36 months	88 (48.89)

BPL Below Poverty Line; APL Above Poverty Line

A total of 180 Anganwadi Workers (AWWs) participated in the study, yielding a response rate of 100%. The sociodemographic characteristics are presented in Table 1. The majority of participants were aged 31–60 years (61.67%). The distribution between urban (51.11%) and rural (48.89%) areas was nearly equal. Most participants were married (71.11%), had secondary-level education (51.67%), and belonged to nuclear families (70.56%). A large proportion were from Below Poverty Line households (76.11%) and reported Hindu religion (70.56%). Most AWWs earned ≤ INR 10,000 per month (68.89%) and worked fewer than 8 hours per day (73.33%). Nearly half (48.89%) had more than 36 months of work experience.

3.2 Cancer knowledge and attitude levels

Table 2

Table 2
Cancer knowledge and attitude levels among Anganwadi workers (n = 180)

Variable	Category	n (%)
Knowledge level	Poor (< 50%)	103 (57.22)
	Good (≥ 50%)	77 (42.78)
Attitude level	Low (< 50%)	64 (35.56)
	High (≥ 50%)	116 (64.44)

Overall, 57.22% of participants had poor knowledge (< 50%), while 42.78% demonstrated good knowledge (≥ 50%). In contrast, 64.44% of participants exhibited a high attitude level (≥ 50%), and 35.56% had low attitude scores.

3.3 Descriptive statistics of cancer knowledge and attitude scores

Table 3: The knowledge score ranged from 8.00 to 26.00 (maximum attainable = 30), with a mean of 16.03 ± 3.94 (median = 16.00; IQR = 6.00; 95% CI: 15.45–16.61). The attitude score ranged from 22.00 to 62.00 (maximum attainable = 70), with a mean of 41.17 ± 8.15 (median = 40.00; IQR = 10.50; 95% CI: 39.98–42.36).

Table 3
Descriptive statistics of cancer knowledge and attitude scores (n = 180)

Variable	Min	Max	Range	Mean ± SD	Median	IQR	95% CI of Mean
Knowledge score	8.00	26.00	18.00	16.03 ± 3.94	16.00	6.00	15.45–16.61
Attitude score	22.00	62.00	40.00	41.17 ± 8.15	40.00	10.50	39.98–42.36
SD Standard deviation; IQR Interquartile range; CI Confidence interval							

3.4 Factors associated with cancer knowledge

Table 4

Table 4
Bivariate association between knowledge level and sociodemographic characteristics (n = 180)

Characteristics	Category	Poor n (%)	Good n (%)	χ^2	df	p-value
Age group (in years)	18–30	51 (73.91)	18 (26.09)	12.73	1	< 0.001*
	30–60	52 (46.85)	59 (53.15)			
Location	Urban	50 (54.35)	42 (45.65)	0.64	1	0.425
	Rural	53 (60.23)	35 (39.77)			
Marital status	Married	74 (57.81)	54 (42.19)	0.06	1	0.802
	Divorced/Widowed	29 (55.77)	23 (44.23)			
Education level	Secondary	60 (64.52)	33 (35.48)	5.66	2	0.050*
	Undergraduate	27 (55.10)	22 (44.90)			
	Graduate and above	16 (42.11)	22 (57.89)			
Monthly income (INR)	≤ 10,000	71 (57.26)	53 (42.74)	0.00	1	0.988
	> 10,000	32 (57.14)	24 (42.86)			
Working hours/day	< 8 hours	86 (65.15)	46 (34.85)	12.71	1	< 0.001*
	≥ 8 hours	17 (35.42)	31 (64.58)			
Religion	Hindu	76 (59.84)	51 (40.16)	1.21	2	0.545
	Muslim	24 (51.06)	23 (48.94)			
	Christian/others	3 (50.00)	3 (50.00)			
Family type	Nuclear	71 (55.91)	56 (44.09)	0.31	1	0.580
	Joint	32 (60.38)	21 (39.62)			
Socioeconomic status	BPL	74 (54.01)	63 (45.99)	2.41	1	0.121
	APL	29 (67.44)	14 (32.56)			
Work experience	12–24 months	29 (64.44)	16 (35.56)	1.29	2	0.526
	24–36 months	26 (55.32)	21 (44.68)			
	> 36 months	48 (54.55)	40 (45.45)			

**Statistically significant ($p < 0.05$); BPL Below Poverty Line; APL Above Poverty Line*

Bivariate analysis results are presented in Table 4. Cancer knowledge was significantly associated with age group ($p < 0.001$), education level ($p = 0.050$), and working hours per day ($p < 0.001$). No statistically significant associations were observed with location, marital status, monthly income, religion, family type, socioeconomic status, or work experience.

3.5 Factors associated with cancer attitude

Table 5

Table 5
Bivariate association between attitude level and sociodemographic characteristics (n = 180)

Characteristics	Category	Low n (%)	High n (%)	χ^2	df	p-value
Age group (years)	18–30	27 (39.13)	42 (60.87)	0.62	1	0.430
	30–60	37 (33.33)	74 (66.67)			
Location	Urban	34 (36.96)	58 (63.04)	0.16	1	0.688
	Rural	30 (34.09)	58 (65.91)			
Marital status	Married	45 (35.16)	83 (64.84)	0.03	1	0.861
	Divorced/Widowed	19 (36.54)	33 (63.46)			
Education level	Secondary	40 (43.01)	53 (56.99)	5.12	2	0.077
	Undergraduate	15 (30.61)	34 (69.39)			
	Graduate and above	9 (23.68)	29 (76.32)			
Monthly income (INR)	≤ 10,000	50 (40.32)	74 (59.68)	3.95	1	0.047*
	> 10,000	14 (25.00)	42 (75.00)			
Working hours/day	< 8 hours	53 (40.15)	79 (59.85)	4.56	1	0.033*
	≥ 8 hours	11 (22.92)	37 (77.08)			
Religion	Hindu	46 (36.22)	81 (63.78)	0.97	2	0.617
	Muslim	17 (36.17)	30 (63.83)			
	Christian/others	1 (16.67)	5 (83.33)			
Family type	Nuclear	42 (33.07)	85 (66.93)	1.16	1	0.281
	Joint	22 (41.51)	31 (58.49)			
Socioeconomic status	BPL	47 (34.31)	90 (65.69)	0.39	1	0.532
	APL	17 (39.53)	26 (60.47)			
Work experience	12–24 months	24 (53.33)	21 (46.67)	8.80	2	0.012*
	24–36 months	12 (25.53)	35 (74.47)			
	> 36 months	28 (31.82)	60 (68.18)			

**Statistically significant ($p < 0.05$); BPL Below Poverty Line; APL Above Poverty Line*

Statistically significant associations were observed for monthly income (p = 0.047), working hours per day (p = 0.033), and work experience (p = 0.012). Other variables, including age, location, marital status,

education, religion, family type, and socioeconomic status, were not significantly associated with attitude.

3.6 Independent predictors of cancer knowledge

Table 6: Multivariable logistic regression analysis identified working ≥ 8 hours per day as the only independent predictor of good cancer knowledge (adjusted OR = 2.32; 95% CI: 1.05–5.13; p = 0.037). No other variables showed statistically significant associations after adjustment.

Table 6
Binary logistic regression analysis of independent predictors of good cancer knowledge (n = 180)

Factors	Category	B	S.E.	Adj. OR	95% CI	p-value
Age group	*18–30 yrs (Ref.)*	—	—	1.00	—	—
	30–60 yrs	0.53	0.35	1.70	0.85–3.37	0.132
Location	*Urban (Ref.)*	—	—	1.00	—	—
	Rural	-0.37	0.33	0.69	0.36–1.33	0.269
Marital status	*Married (Ref.)*	—	—	1.00	—	—
	Divorced/Widowed	-0.16	0.35	0.85	0.42–1.70	0.643
Education level	*Secondary (Ref.)*	—	—	1.00	—	—
	Undergraduate	0.11	0.37	1.12	0.54–2.32	0.761
	Graduate and above	0.38	0.43	1.47	0.63–3.41	0.374
Monthly income (INR)	*≤ 10,000 (Ref.)*	—	—	1.00	—	—
	> 10,000	-0.30	0.35	0.74	0.37–1.48	0.400
Working hours/day	*< 8 hours (Ref.)*	—	—	1.00	—	—
	≥ 8 hours	0.84	0.40	**2.32**	**1.05–5.13**	**0.037***
Religion	*Hindu (Ref.)*	—	—	1.00	—	—
	Christian/others	0.73	0.91	2.07	0.35–12.33	0.426
	Muslim	0.18	0.42	1.19	0.52–2.73	0.678
Family type	*Nuclear (Ref.)*	—	—	1.00	—	—
	Joint	-0.35	0.36	0.71	0.35–1.42	0.331
Socioeconomic status	*BPL (Ref.)*	—	—	1.00	—	—

**Statistically significant (p < 0.05); Adj. OR Adjusted Odds Ratio; CI Confidence Interval; B Coefficient; S.E. Standard Error; Ref. Reference category; Model fit assessed using Hosmer–Lemeshow test.*

Factors	Category	B	S.E.	Adj. OR	95% CI	p-value
	APL	-0.65	0.42	0.52	0.23–1.20	0.127
Work experience	*12–24 months (Ref.)*	—	—	1.00	—	—
	24–36 months	-0.18	0.45	0.84	0.35–2.01	0.689
	> 36 months	-0.54	0.39	0.58	0.27–1.25	0.166

**Statistically significant (p < 0.05); Adj. OR Adjusted Odds Ratio; CI Confidence Interval; B Coefficient; S.E. Standard Error; Ref. Reference category; Model fit assessed using Hosmer–Lemeshow test.*

3.7 Independent predictors of cancer attitude

Table 7: Multivariable analysis identified three independent predictors of high cancer attitude: working ≥ 8 hours per day (adjusted OR = 2.25; 95% CI: 1.00–5.36; p = 0.050), joint family type (adjusted OR = 0.52; p = 0.050), and 24–36 months of work experience (adjusted OR = 3.43; 95% CI: 1.29–9.11; p = 0.013). Monthly income was not statistically significant after adjustment.

Table 7
Binary logistic regression analysis of independent predictors of high cancer attitude (n = 180)

Factors	Category	B	S.E.	Adj. OR	95% CI	p-value
Age group	*18–30 yrs (Ref.)*	—	—	1.00	—	—
	30–60 yrs	-0.49	0.37	0.61	0.29–1.27	0.187
Location	*Urban (Ref.)*	—	—	1.00	—	—
	Rural	0.23	0.35	1.26	0.64–2.49	0.511
Marital status	*Married (Ref.)*	—	—	1.00	—	—
	Divorced/Widowed	-0.19	0.38	0.83	0.39–1.73	0.612
Education level	*Secondary (Ref.)*	—	—	1.00	—	—
	Undergraduate	0.40	0.39	1.48	0.69–3.19	0.312
	Graduate and above	0.71	0.47	2.03	0.80–5.15	0.134
Monthly income (INR)	*≤ 10,000 (Ref.)*	—	—	1.00	—	—
	> 10,000	0.71	0.39	2.03	0.94–4.36	0.071
Working hours/day	*< 8 hours (Ref.)*	—	—	1.00	—	—
	≥ 8 hours	0.81	0.44	**2.25**	**1.00–5.36**	**0.050***
Religion	*Hindu (Ref.)*	—	—	1.00	—	—
	Christian/others	1.28	1.17	3.61	0.37–35.45	0.271
	Muslim	-0.03	0.44	0.98	0.41–2.32	0.955
Family type	*Nuclear (Ref.)*	—	—	1.00	—	—
	Joint	-0.66	0.37	**0.52**	**0.25–1.07**	**0.050***
Socioeconomic status	*BPL (Ref.)*	—	—	1.00	—	—

**Statistically significant (p < 0.05); Adj. OR Adjusted Odds Ratio; CI Confidence Interval; B Coefficient; S.E. Standard Error; Ref. Reference category; Model fit assessed using Hosmer–Lemeshow test.*

Factors	Category	B	S.E.	Adj. OR	95% CI	p-value
	APL	-0.65	0.44	0.52	0.22–1.23	0.139
Work experience	*12–24 months (Ref.)*	—	—	1.00	—	—
	24–36 months	1.23	0.50	**3.43**	**1.29–9.11**	**0.013***
	> 36 months	0.64	0.40	1.89	0.87–4.13	0.110

**Statistically significant (p < 0.05); Adj. OR Adjusted Odds Ratio; CI Confidence Interval; B Coefficient; S.E. Standard Error; Ref. Reference category; Model fit assessed using Hosmer–Lemeshow test.*

3.8 Correlation between knowledge and attitude

Table 8

Table 8
Pearson's correlation between knowledge and attitude scores (n = 180)

Variables	r (Pearson)	t-value	p-value
Knowledge scores vs Attitude scores	0.458	6.87	< 0.001*

**Statistically significant (p < 0.05); r Pearson's correlation coefficient*

A statistically significant moderate positive correlation was observed between knowledge and attitude scores (r = 0.458, p < 0.001).

4. Discussion

This study provides a comprehensive baseline characterization of cancer knowledge, attitude, and their independent predictors among AWWs in Belagavi Taluka, Karnataka. The principal finding is a striking knowledge–attitude paradox: while 57.22% of AWWs demonstrated poor cancer knowledge, 64.44% exhibited favourable attitudes towards cancer prevention and screening promotion. This divergence is not unique to our setting. A comparable pattern was documented by Mubin et al. (2021) among community health care providers in rural Bangladesh, where modest knowledge coexisted with relatively more positive attitudes towards cancer [11]. Zhang et al. (2023) similarly noted that healthcare workers in China demonstrated positive attitudes even when knowledge was moderate [14]. These findings collectively suggest that motivational disposition towards cancer prevention may develop through experiential community engagement, even in the absence of systematic cancer education.

The poor cancer knowledge found in the majority of AWWs (57.22%) is consistent with documented gaps among frontline health workers in South Asia. Khanna et al. (2019) reported significant cancer knowledge deficits among community health workers in Varanasi, Uttar Pradesh [12]. Chawla et al.

(2021), in a systematic review of Indian health professionals, confirmed that baseline cancer knowledge was frequently suboptimal across cadres, including ASHA and ANM workers [13]. Against the backdrop of India's escalating cancer incidence — projected to rise from 529.40 to 549.17 per 100,000 population by 2031 [3] — these knowledge gaps represent a critical systemic vulnerability in India's cancer control architecture.

On multivariate analysis, working ≥ 8 hours/day was the sole independent predictor of good cancer knowledge (Adj. OR = 2.32; 95% CI: 1.05–5.13; p = 0.037). This finding underscores the role of occupational intensity and engagement: AWWs with longer working hours are likely exposed to a greater volume of health-related information, more frequent interactions with PHC clinical staff, and deeper immersion in the health system ecosystem. The attenuation of age and education effects after multivariate adjustment suggests that these variables operate primarily through the pathway of working hours — older, more educated AWWs may be more likely to work longer hours, with working hours serving as the proximal determinant of knowledge acquisition.

For attitude, three independent predictors emerged. Working ≥ 8 hours/day (Adj. OR = 2.25; p = 0.050) mirrored its effect on knowledge, affirming that occupational intensity simultaneously builds both informational and motivational capital. The significant protective association of joint family structure (Adj. OR = 0.52; p = 0.050) is a novel finding that warrants further investigation: AWWs in joint families may face greater competing domestic demands, time constraints, or social conservatism regarding cancer-related discussions. AWWs with 24–36 months of experience had significantly higher odds of high attitude (Adj. OR = 3.43; 95% CI: 1.29–9.11; p = 0.013) compared to those with 13–24 months of experience, consistent with the theory of professional socialisation: as AWWs accumulate field experience, they progressively internalise a broader health promotion mandate that encompasses cancer awareness [15]. The non-significant effect of > 36 months' experience (Adj. OR = 1.89; p = 0.110), while showing a trend, may reflect a plateau effect in attitude formation after a critical period of professional development.

The significant moderate positive Pearson's correlation between knowledge and attitude ($r = 0.458$, $p < 0.001$) is in agreement with findings by Khanna et al. (2019) who reported a significant knowledge–attitude association among CHWs in India [12]. While the coefficient of determination ($r^2 = 0.21$) indicates that approximately 21% of attitude variance is explained by knowledge, this is a meaningful effect in the behavioural sciences and supports knowledge-building as a viable lever for attitude change [16]. These data collectively support integrated cancer education interventions targeting both domains simultaneously through structured, iterative learning experiences.

These findings have direct implications for India's National Cancer Control Programme and the Ayushman Bharat framework. Cancer screening at the community level increasingly depends on AWW engagement, yet AWW capacity-building for cancer awareness remains largely ad hoc [5, 17]. Given the ICDS network of over 1.4 million operational AWCs, standardised cancer education modules integrated into AWW training curricula represent a high-impact, cost-effective public health strategy. Okasako-

Schmucker et al. (2023) demonstrated that CHW-led interventions increased cervical cancer screening uptake by a median of 12.8 percentage points [6]. Critically, their integration should prioritise workers with shorter work experience and those in joint family structures, who represent the highest-need subgroups identified in our multivariate analysis.

4.1 Policy implications

Integrate cancer health literacy into Anganwadi Worker training under ICDS, with standardized competency-based modules and dedicated funding. Expand AWW roles to include cancer awareness and referral, supported by clear PHC linkages and monitoring indicators. Strengthen intersectoral coordination to ensure scalable and sustainable implementation.

4.2 Strengths

This study employed a community-based design with a 100% response rate, minimizing non-response bias. It used a pre-tested questionnaire with good internal consistency, ensuring reliable measurement. The study addresses an important evidence gap by focusing on Anganwadi Workers, a key but under-researched frontline workforce. The use of both bivariate and multivariable analyses enabled identification of independent predictors, while the combined assessment of knowledge and attitude provides a comprehensive understanding with direct programmatic relevance.

4.3 Limitations

This study has several limitations. First, the cross-sectional design precludes causal inferences between the identified factors and outcomes. Second, the study was conducted in four Primary Health Centre (PHC) areas within a single taluka, which may limit the generalisability of the findings to other settings. Third, data were collected using a self-administered questionnaire, which may be subject to social desirability bias, potentially leading to overestimation of favourable attitudes. Fourth, although the questionnaire was validated by expert review and pilot testing, it was not externally validated against a standardized instrument. Fifth, the categorization of knowledge and attitude using a 50% cut-off, while commonly used in similar studies, is arbitrary and may affect classification. Finally, no objective measures of cancer knowledge were employed.

5. Conclusions

This study found that most Anganwadi Workers had poor cancer knowledge despite generally favourable attitudes. Working ≥ 8 hours/day was the strongest independent predictor of both good knowledge and high attitude, while 24–36 months of work experience predicted higher attitude, and joint family structure was inversely associated with attitude. A moderate positive correlation between knowledge and attitude ($r = 0.458$, $p < 0.001$) suggests that improving knowledge may also enhance attitudes. Strengthening structured cancer education within routine training programmes may improve frontline capacity for cancer awareness and early detection.

Recommendations

Integrate structured cancer education into routine Anganwadi Worker training with periodic refreshers. Prioritise capacity-building for less-experienced workers and provide simple job aids to support field activities. Strengthen supportive supervision and integrate cancer awareness into primary healthcare services. Future studies should evaluate training effectiveness using longitudinal and implementation designs with validated tools.

Declarations

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Institutional Ethics Committee, J. N. Medical College, Belagavi (Ref: JNMC/IEC/2023/330). Written informed consent was obtained from all participants. The study was conducted in accordance with the Declaration of Helsinki. Participation was voluntary; confidentiality was ensured through unique numerical identifiers.

Consent for Publication:

Not applicable.

Competing Interests:

The authors declare no competing interests.

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Author Contribution

PJ: Conceptualization, data collection, statistical analysis, manuscript drafting. AK: Conceptualization, supervision, manuscript review and editing, corresponding author. VD: Methodology, study design, supervision, manuscript review. All authors read and approved the final version of the manuscript.

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Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author (Dr. Annapurna Kari; drannapurna.kari@gmail.com) on reasonable request.

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Figures

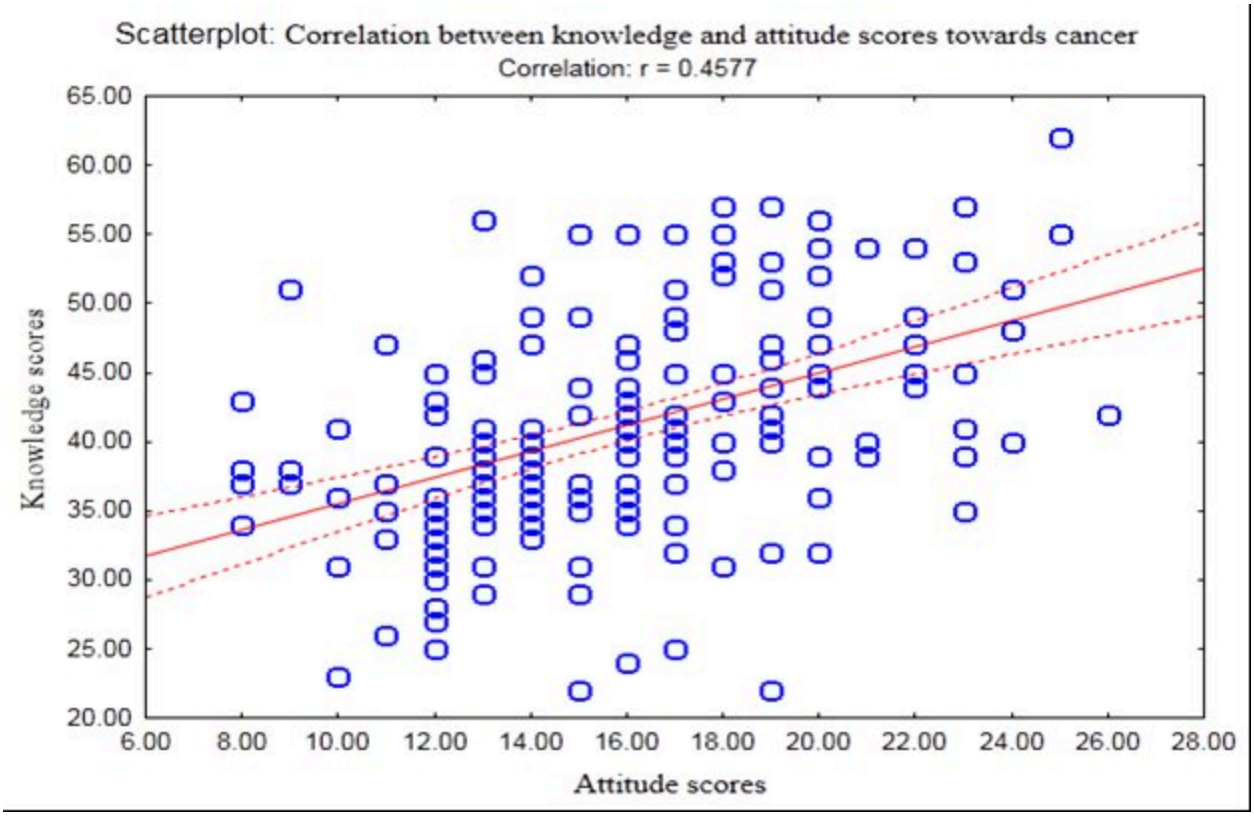


Figure 1

Scatter diagram showing the positive correlation between cancer knowledge and attitude scores among Anganwadi Workers (Pearson's r = 0.458, p < 0.001)

Note: Insert the scatter diagram figure here.