

Association Between Education Level and Level of Knowledge of Skin Cancer among Basal Cell Carcinoma Patients at the Dr. Moewardi Hospital, Surakarta, Indonesia

Nugrohoaji Dharmawan^{1,2}, Laura Noviani^{1,2}, Merlina Wijayawati^{1,2}

¹)Department of Dermatology, Venereology and Aesthetics, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

²)Dr. Moewardi General Hospital, Surakarta, Central Java, Indonesia

Received: June 06, 2026; Accepted: July 06, 2026; Available online: July 16, 2026

ABSTRACT

Background: Basal cell carcinoma (BCC) is a non-melanoma skin cancer from basal cells. Limited knowledge of risk factors and prevention contributes to BCC. This study examined the relationship between knowledge of skin cancer and education level in BCC patients at the Dermatology and Venereology Outpatient Clinic, Dr. Moewardi General Hospital.

Subjects and Method: A cross-sectional study was conducted on 64 BCC patients diagnosed clinically and histopathologically from January 2022 to December 2024. The study was conducted at the Dermatology and Venereology Outpatient Clinic of Dr. Moewardi General Hospital, Surakarta, Central Java, Indonesia. Sample were recruited using a consecutive sampling. The dependent variable was the level of skin cancer knowledge. The independent variable was education level. Data were analyzed using a multiple logistic regression.

Results: Education level was significantly associated with skin cancer knowledge after adjustment for age (OR= 7.26; 95% CI= 3.45–86.45; $p < 0.001$).

Conclusion: Education level is significantly associated with skin cancer knowledge. Strengthening skin cancer education for low-education, high-exposure groups may support earlier detection and prevention.

Keywords: Basal cell carcinoma, skin cancer, knowledge, awareness, education level

Correspondence:

Nugrohoaji Dharmawan. Department of Dermatology and Venereology Faculty of Medicine, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta, Central Java 57126, Indonesia. Email: nugrohoaji_d@staff.uns.ac.id.

Cite this as:

Dharmawan N, Noviani L, Wijayawati M (2026). Association Between Education Level and Level of Knowledge of Skin Cancer among Basal Cell Carcinoma Patients at the Dr. Moewardi Hospital, Surakarta, Indonesia. *J Epidemiol Public Health*. 11(3): 327-336. <https://doi.org/10.26911/jepublichealth.2026.11.03.09>.



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BACKGROUND

Basal cell carcinoma (BCC) is a common malignant skin tumor originating from basal cells, grouped as a non-melanoma skin cancer (NMSC). It grows slowly and rarely metastasizes but can damage the skin and underlying tissue (Niculet et al., 2021; Baba et al., 2024; Darjania et al., 2024).

Globally, BCC is the most common malignant skin tumor, accounting for 80-90% of skin cancers, with rising incidence rates in Europe and the United States (Dika et al., 2020; Niculet et al., 2021; Naik and Desai, 2022). While specific data for Indonesia is limited, a 2019 study showed that BCC was the most common skin cancer in Jakarta

(Wibawa et al., 2019). A previous study at Dr. Moewardi General Hospital in 2019 found that BCC was dominated by elderly women and farmers (Toha et al., 2019).

The development of BCC is caused by a complex interaction between environmental and genetic factors, with prolonged exposure to UVB rays being a primary cause (Wibawa et al., 2019; Krakowski et al., 2022; Naik and Desai, 2022; Darjania et al., 2024). This exposure can be avoided through prevention, which requires knowledge and awareness of skin cancer. A high level of education is linked to greater awareness of BCC prevention (Darjania et al., 2024).

This study aims to investigate the relationship between the level of skin cancer knowledge and education in BCC patients at the Dermatology and Venereology Outpatient Clinic of Dr. Moewardi Hospital Surakarta from January 2022 to December 2024. The findings are expected to serve as a consideration for policy-making to increase patient vigilance and promote earlier management in clinical practice.

Although basal cell carcinoma has been extensively studied, most previous research, including earlier reports from this hospital has focused on its histopathological subtypes and epidemiological distribution rather than on patients' knowledge and awareness of skin cancer. Evidence directly linking educational attainment to skin cancer knowledge among Indonesian BCC patients remains scarce. This study addresses that gap by quantifying the relationship between education level and skin cancer knowledge, providing locally relevant evidence to inform targeted prevention and early-detection strategies.

SUBJECTS AND METHOD

1. Study Design

This study was a cross-sectional study conducted at the Dermatology and Venereology Outpatient Clinic of Dr. Moewardi General Hospital, Surakarta, Central Java, Indonesia. Data were collected from January 2022 to December 2024.

2. Population and Sample

The target population comprised patients diagnosed with basal cell carcinoma (BCC). The source population consisted of patients clinically and histopathologically diagnosed with BCC who visited the Dermatology and Venereology Outpatient Clinic of Dr. Moewardi General Hospital, Surakarta, during the study period. Of 87 patients diagnosed with BCC, 77 patients had histopathologically confirmed BCC. After applying exclusion criteria — including patients with incomplete medical record data and deceased patients — and accounting for 13 patients who could not be contacted or refused to participate, the final sample comprised 64 subjects. Sampling was performed using a consecutive sampling technique, in which questionnaires were administered to all eligible BCC patients sequentially. The minimum sample size was calculated using the formula for a single correlation coefficient based on the Fisher z transformation. The following parameters were used: a two-tailed significance level of $\alpha = 0.05$ ($Z_{1-\alpha/2} = 1.96$), a statistical power of 80% ($Z_{1-\beta} = 0.842$), and an expected correlation coefficient of $r = 0.35$, yielding a minimum required sample of 62 subjects.

3. Study Variables

The dependent variable was the level of skin cancer knowledge. The independent variable was the level of education.

4. Operational Definition of Variables
Level of skin cancer knowledge was defined as the degree of understanding of

BCC patients regarding skin cancer, including its definition, risk factors, clinical features, and management, as measured by a validated questionnaire. Knowledge was categorized based on the total questionnaire score.

Education level was defined as the highest formal education attained by the patient, categorized as primary, secondary, or tertiary education.

Age range was classified according to the World Health Organization (WHO) 2023 criteria: adolescents (10–19 years), young adults (15–44 years), middle adults (>44–60 years), and elderly (>60 years).

5. Study Instruments

Demographic data, including age, sex, and education level were obtained through a structured questionnaire administered directly to study subjects. The level of skin cancer knowledge was measured using a questionnaire specifically designed for this study. The validity of the questionnaire was assessed using Pearson product-moment correlation analysis, and its reliability was assessed using Cronbach's alpha analysis. Histopathological diagnosis of BCC was obtained from medical records.

The skin cancer knowledge questionnaire was developed by the research team based on established literature on BCC and skin cancer prevention, covering the definition, risk factors, clinical features, and management of skin cancer. It comprised 25 items answered in a true/false format. Each correct answer was scored 1 and each incorrect answer 0, giving a total score of 0–25. Total scores were converted to percentages and categorised as “less” (0–55%), “sufficient” (56–74%), or “good” (75–

100%) knowledge. Item validity was assessed using Pearson product-moment correlation and internal consistency using Cronbach's alpha in a pilot test prior to data collection. All 25 items were valid, with item-total correlations ranging from 0.251 to 0.588 (all exceeding the r-table value of 0.208), and the questionnaire was reliable (Cronbach's alpha=0.805).

6. Data Analysis

Data were analyzed using univariate and bivariate approaches and presented as frequency distributions and percentages. For bivariate analysis, the association between the level of skin cancer knowledge, age, sex, and occupation with education level was assessed using the Fisher-Exact test. For multivariate analysis, logistic regression analysis was conducted. A p-value of <0.05 was considered statistically significant.

7. Research Ethics

Research ethical issues, including informed consent, anonymity, and confidentiality, were carefully addressed throughout the study. Ethical approval was obtained from the Institutional Review Board of Dr. Moewardi General Hospital, Surakarta, Indonesia (Ethical Clearance Number: 1.956/IX/HREC/2025).

RESULTS

1. Subjects Characteristics

This study included 64 BCC patients who met the inclusion criteria. The number of diagnosed patients was highest in 2024 with 37 people, followed by 16 in 2023, and 11 in 2022. Subject's characteristics was presented in Table 1.

Table 1. Sociodemographic characteristics, lesion development, and social factors

Variable	Frequency	Percentage (%)
Sex / Gender		
Male	25	39.1
Female	39	60.9
Age		
10-19 years old	0	0
19-44 years old	3	4.7
44-60 years old	18	28.1
>60 years old	43	67.2
Education		
No School	18	18.8
Elementary School	27	42.2
Junior High School	12	18.8
Senior High School	7	10.9
Diploma 3	1	1.6
Bachelor's Degree	4	6.2
Master's Degree	1	1.6
Occupation		
Farmer	24	37.5
Housewife	6	9.4
Daily Laborer	15	23.4
Civil Servant	4	6.2
Private / Trader	14	21.9
Professional Worker	1	1.6
Lesion Development		
Initial Lesion Shape		
Pinkish Brown Patch	13	20.4
Blackish White Nodule	41	64
Non-healing Wound	10	15.6
Complaints		
Enlarging and Discoloring	64	100
Bleeding	57	89
Itching	19	29.6
Pain	21	32.8
Scratching Behavior on Lesion		
Yes	52	81.25
No	12	18.75
Lesion Location		
Nasal	21	32.8
Orbital	17	26.4
Buccal	16	25
Frontal	6	9.4
Mental	2	3.2
Upperlip	1	1.6
Auricular	1	1.6
Awareness of Skin Cancer		
Unaware	48	75
Doubtful	15	23.4
Aware	1	1.6
Self-medication		
Never	26	40.6
Over-the-counter medication from pharmacy	23	36

Variable	Frequency	Percentage (%)
Herbal Medicine	9	14
Wound cleaning with Betadine	3	4.6
Warm compress	1	1.6
Cutting the lesion with a razor blade	1	1.6
Dish soap paste	1	1.6
Previous Place of Treatment		
Community Health Center	28	44
General Practitioner's Private Practice	15	23.4
Dermatologist's Private Practice	1	1.6
Midwife/Nurse's Practice	11	17
Other Hospital	9	14
Reason for Treatment		
Unimproved complaint	30	46.7
Family advice	28	44
Medical staff advice	4	6
Friend/neighbor advice	2	3.3
Condition of Skin Lesion		
Serious and needs immediate treatment	11	17
Needs treatment but not urgently	37	58
Does not need hospital treatment	16	25
Time from lesion appearance to treatment		
<1 year	14	21.9
1-2 year	14	21.9
2-5 year	20	31.2
>5 year	16	25
Received Information on Skin Cancer		
Never	61	95.3
Ever	3	4.7
Where the skin cancer information came from		
Source from neighbor/friend	2	3.2
Source from journal	1	1.6
No information available	61	95.3
Treatment Barriers		
No barriers	31	48.8
Fear of treatment	14	22
Distant access to services	7	11
No family to accompany	4	6
Busy	1	1.6

2. Bivariate Analysis

Based on the knowledge category criteria, 78.1% of patients had a "less" level of know-

ledge. This was followed by a "sufficient" level in 14.1% of patients and a "good" level in 7.8% of patients (Table 2).

Table 2. Patient's Level of Knowledge About Skin Cancer

Level of Knowledge About Skin Cancer	Score	n	%
Less	0%-55%	50	78.1%
Sufficient	56%-74%	9	14.1%
Good	75%-100%	5	7.8%

A significant correlation was found between education level and knowledge of skin cancer ($r=0.77$, $p<0.001$), meanwhile other parameters such as age ($r=0.30$, $p=0.060$),

sex ($r=0.04$, $p=0.366$), and occupation was found non significant ($r=0.18$, $p=0.371$) (Table 3).

Table 3. Bivariate Analysis of Factors Associated with the Level of Skin Cancer Knowledge in Basal Cell Carcinoma Patients

Independent variables	Knowledge Level	
	r	p
Education level	0.766	<0.001
Age	0.296	0.060
Sex	0.036	0.366
Occupation	0.176	0.371

3. Multivariate Analysis

The results of multivariate analysis were shown in Tabel 4. After simultaneous adjustment, education level remained independently associated with the level of skin cancer knowledge. Patients with lower education had significantly higher odds of poor knowledge than those with higher education (OR= 7.26; 95% CI

3.45–86.45; $p < 0.001$), indicating that the association observed in the bivariate analysis was not attributable to age. In contrast, age was no longer significantly associated with the level of knowledge once education level was taken into account (OR= 0.51; 95% CI 0.10–2.61; $p=0.422$).

Table 4. Multivariable Logistic Regression Analysis of Factors Associated with the Level of Skin Cancer Knowledge

Variable	OR	95% IC	p
Education level	7.26	3.45 to 86.45	<0.001
Age	0.51	0.10 to 2.61	0.422

DISCUSSION

This study demonstrated a significant and positive relationship between education level and the level of skin cancer knowledge among BCC patients which persisted after adjustment for age. The results are in line with existing literature on BCC, which is the most common type of skin cancer globally and increases with age (Lang et al., 2019; Tang et al., 2019; Peris et al., 2023). This is consistent with the data in this study, where the most common age group was the elderly, at 67.2%. Our data, showing that the majority of patients were women (59.4%), is consistent with some regional studies, despite literature often citing a

male predominance (Wilvestra et al., 2018; Darjania et al., 2024). The significant correlation between low education and BCC incidence found in our study aligns with international findings, as individuals with lower education tend to have less knowledge of skin cancer risk factors (Bauer et al., 2020; Darjania et al., 2024). This is further supported by the patient demographics, which were dominated by farmers, an outdoor occupation group with a high risk of BCC due to prolonged UV exposure (Szewczyk et al., 2016; Toha et al., 2019). The clinical manifestations of the lesions, such as ulceration and an enlarging size, also indicate a chronic process that is often

exacerbated by patient behavior, such as scratching, which can induce chronic inflammation (Ciężyńska et al., 2021; Knecht-Gurwin et al., 2024).

These behavioral patterns, including ignoring symptoms and fear of treatment, often lead to a significant delay in seeking medical care, with most patients in this study waiting 2-5 years. Our findings underscore that low education and lack of awareness are key barriers to early treatment. Higher education levels show greater awareness of cancer prevention from both genetic factors and UV exposure compared to those with lower education levels (Darjania et al., 2024). The data in this study also show a significant correlation between education level and knowledge of skin cancer.

Beyond statistical significance, the magnitude of this association warrants explicit interpretation. After adjustment for age, patients educated to junior high school or below had approximately seven times the odds of poor skin cancer knowledge compared with those educated to senior high school or above (aOR=7.26; 95% CI 3.45–86.45). By conventional benchmarks for epidemiological effect sizes, an OR of this order lies well above the threshold generally taken to represent a large effect (Chen et al., 2010). The association between lower education and poorer skin cancer knowledge may be explained by reduced access to reliable health information, lower health literacy, and the predominantly outdoor occupations of less-educated patients, all of which can independently delay recognition of a malignant lesion (Szewczyk et al., 2016; Bauer et al., 2020; Krakowski et al., 2022). Individuals with higher educational attainment have been reported to show greater awareness of both genetic and ultraviolet-related risk factors for skin cancer, which is consistent

with the direction of the association observed in this study (Darjania et al., 2024). Alternative explanations should also be considered. Because the design was cross-sectional, the direction of causality cannot be established, and unmeasured factors such as socioeconomic status, access to health services, and cultural health beliefs may partly account for the observed relationship. Recall bias in self-reported symptom duration and prior information exposure, together with the possibility that more knowledgeable patients sought care earlier, may also have influenced the findings.

This study has several limitations. First, its cross-sectional design captures data at a single time point and therefore cannot establish a causal or temporal relationship between education and knowledge. Second, subjects were drawn from a single tertiary referral centre using consecutive sampling, which may limit generalisability and introduce selection bias, as patients reaching this hospital may differ from those described in community-based and multicentre Indonesian series.

The clinical significance of an effect of this size lies in its downstream consequences. In this study, most patients had tolerated an enlarging, ulcerating lesion for two to five years before presenting, 75% were unaware that the lesion might be malignant, and 95.3% had never received any information about skin cancer. Educational attainment has been shown to predict both diagnostic delay and tumour stage at presentation in skin cancer, with shorter delays among patients of higher educational level and among those previously exposed to awareness campaigns (Nicoara et al., 2025). Prolonged delay is the principal route by which a lesion that is curable by simple excision progresses to locally advanced disease requiring exten-

sive reconstruction or systemic hedgehog-pathway inhibition (Krakowski et al., 2022; Peris et al., 2023). An association of the magnitude observed here therefore does more than describe a knowledge gap. It identifies the subgroup in which the risk of late, disfiguring presentation is concentrated. From a public-health perspective, the effect size implies that educational attainment, rather than age, sex, or occupation, none of which was independently associated with knowledge should be the primary axis along which awareness interventions are stratified. Since formal education is not modifiable in adults presenting with established disease, the operational implication is that skin cancer information must be delivered in formats that do not depend on schooling, using pictorial and verbal rather than text-based materials. Internationally, lower education and lower socio-economic position have consistently marked the groups least likely to know or practise primary and secondary prevention (Seité et al., 2017). Given that 79.7% of this study participants fell into the lower-education stratum, such an approach would reach the large majority of patients attending this centre.

These findings have practical implications for clinical and public-health practice. Structured skin cancer education and awareness programmes should be prioritised for high-risk groups, particularly elderly, less-educated, and outdoor workers such as farmers using simple, culturally appropriate materials delivered through primary-care and community-health services. Because cumulative ultraviolet exposure remains the principal modifiable risk factor for BCC, counselling on sun-protective behaviour should form a core component of such programmes. Training primary-care providers to recognise suspicious lesions early may further reduce

diagnostic delay and the proportion of patients presenting with locally advanced disease. Future research should employ longitudinal, multicentre designs to identify independent predictors of skin cancer knowledge and to evaluate the effectiveness of targeted educational interventions.

In conclusion, skin cancer knowledge among BCC patients at this centre was generally poor and was significantly and positively associated with education level, which remained the only independent determinant after adjustment for age. Because low education and limited awareness were linked to delayed presentation, improving skin cancer literacy, especially among low-education, high-exposure populations is likely to be an important strategy for promoting earlier detection and prevention of BCC.

FINANCIAL SUPPORT AND SPONSORSHIP

None.

ACKNOWLEDGEMENT

The authors would like to thank the staff of the Dermatology and Venereology Out-patient Clinic, Dr. Moewardi General Hospital, and all patients who participated in this study.

CONFLICT OF INTEREST

There are no conflicts of interest.

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