



# Association between Health Literacy and Screening Behavior on Colorectal Cancer among the Adult Population in Sarawak, Malaysia

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## ABSTRACT

**Introduction:** Colorectal cancer screening is proven to reduce the mortality associated with colorectal cancer. However, currently, there is no well-established population-based colorectal cancer screening program in Malaysia.

**Objective:** This study aims to determine the relationship between screening behaviour on colorectal cancer and health literacy among Sarawak's adult population.

**Methods:** This was a cross-sectional study done in Sarawak. Data collection was done via face-to-face interviews using a validated structured questionnaire. Descriptive analysis was done using IBM SPSS version 22.0 to describe the sociodemographic characteristics and determine the respondents' health literacy level, colorectal cancer-related knowledge, belief, and screening behaviour. WarpPLS 7.0 stable version was performed to examine the relationship between screening behaviour on colorectal cancer and health literacy.

**Results:** A total of 829 respondents participated in this study, with 50.5% males and 49.5% females. The mean (SD) age of the respondents was 55.78 (5.0) years. Structural path analysis revealed a non-significant relationship between health literacy and screening behaviour ( $p > 0.05$ ). The perceived threat has a positive effect on the screening behaviour ( $p < 0.001$ ), while perceived benefits and barriers did not have any impact on screening behaviour on colorectal cancer ( $p > 0.05$ ).

**Conclusion:** Health literacy did not have any significant association with the screening behaviour of colorectal cancer. The perceived threats have a positive effect, while the perception of benefits and barriers did not significantly impact screening behaviour. This finding could guide the development and formulation of successful health promotion and education to adopt healthy behaviour by focusing on health belief component apart from health literacy, thus reducing the cancer disparities and ensuring health equity.

**Key Words:** Colorectal cancer, Health literacy, Sarawak, Screening

## INTRODUCTION

Colorectal cancer represents a major public health problem, ranked as the third commonest cancer and the fourth most common cancer death.<sup>1</sup> The number of people having colorectal cancer grew by two-folds in 2013 compared to 1990, i.e., it rose from 818 000 in 1990 to 1.6 million in 2013.<sup>1</sup> In Malaysia, colorectal cancer is the most frequent cancer among men and the second most frequent cancer among women after breast cancer.<sup>2</sup> Most colorectal cancer patients presented late to health facilities, with only 34.1% and 34.8% of cancer cases detected stage I and II, respectively, for both men and women.<sup>2</sup> This differs from other developed countries such as the United States, Europe, and Singapore. A higher number of patients presented at an early stage, contributed

by well-developed colorectal cancer screening programs in those countries.<sup>3</sup> Colorectal cancer screening is proven to reduce the mortality associated with colorectal cancer.<sup>4</sup> However, currently, there is no well-established population-based colorectal cancer screening program in Malaysia.<sup>5</sup> The low prevalence of colorectal cancer might explain this detection early among Malaysians.<sup>6</sup> Furthermore, the low proportion of colorectal cancer presented at an early stage could be attributed to patient factors such as low socio-economic status and lack of colorectal cancer knowledge, and the health system factor such as poor accessibility to cancer awareness and screening, and lack of skilled healthcare workers, and well-established referral systems.<sup>6,7</sup> Most Malaysians have low participation with negative perception towards colorectal cancer screening.<sup>7-10</sup> Low participation in colorectal

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cancer screening contributed by poor knowledge on colorectal cancer and its screening test, negative perception towards screening method, time constraint, limited access to screening tests, and lack of physician's recommendation.<sup>7-10</sup> Health literacy may play a role that influence and mediate colorectal cancer screening behaviour. Low health literacy leads to inadequate knowledge regarding cancer screening, poor screening uptake, and unfavourable clinical outcomes.<sup>11,12</sup>

Thus, to achieve a good knowledge, positive attitude, belief, and behaviour regarding cancer, one should have the basic reading skills and cognitive skills to access, synthesize and appraise basic health information and services. This is also guiding the right decision making on health through the concept of health literacy. Individuals with low literacy levels may be unlikely to have positive cancer-related health behaviour, such as using preventive services and undergo cancer screening.<sup>13-15</sup> Furthermore, the perception of cancer itself, such as perceived susceptibility and perceived severity towards the disease, could have contributed to the behaviour or mediate the relationship between health literacy and health behaviour. Previous studies attempt to investigate the relationship linking health literacy to health behaviour through health belief or perception mediation. However, the mechanism remains ambiguous.<sup>16-18</sup> Previous studies examine the direct relationship between health literacy and health behavior.<sup>18-24</sup> These concepts necessitate further investigation to understand better the linkage between low health literacy and screening behaviour, including health literacy's effect on health belief constructs in predicting health behaviour. Such a relationship is not well established in Malaysia, particularly in Sarawak. Factors that might influence the screening behaviour among adults deserve further assessment.<sup>25-28</sup>

This study explains the pathway linking health literacy to screening behaviour by applying the Health Belief Model (HBM). Intervention to promote screening behaviour could be focused on health literacy and other factors such as health belief. Group of the population with low literacy level could be identified, which indicate a higher risk of having poor health behaviour and health outcomes, thus assist in designing and developing targeted educational campaigns for low health literacy group. This study examined the relationship between health literacy and screening behaviour and to determine the factors associated with screening behaviour on colorectal cancer among the adult population in Sarawak.

## MATERIALS AND METHODS

### Study setting and sampling

A cross-sectional study design using the quantitative research method. The study was conducted in the southern part of Sarawak from June 2018 to May 2019. Sarawak is located

at the Borneo island, the east part of Malaysia. Sarawak's population is estimated at 2.47million<sup>25</sup> and consists of Iban, Chinese, Malay, Bidayuh, Melanau, Kenyah, Kayan, Penan many more. Multistage random sampling was adopted as a sampling procedure. The inclusion criteria include the adult population 50 years and above, based on the recommended age to start colorectal cancer screening.<sup>26</sup> Those with a self-history of colorectal cancer and medical or health personnel were excluded from the study. Since there was no published local data on screening rates, the sample size was determined based on the proportion of respondents having either poor, moderate, or good knowledge and perception regarding colorectal cancer and screening in Peninsular Malaysia.<sup>8</sup> The required sample size was 905 based on the double design effect with a degree of precision of 5% and after considering a non-respondent rate of 20%. We analysed 902 participants' data with a response rate of 99.7%.

### Data collection instruments and procedure

We collect data by face-to-face interviews using a validated structured questionnaire. The instruments used either in English or Bahasa Malaysia (Malay language) depending on respondent preferences. The questionnaire has five parts. The first part was used to determine the sociodemographic characteristics, followed by the second part to assess health literacy. The questions to assess the knowledge of colorectal cancer was in the third part. The fourth part was in the evaluation of beliefs on colorectal cancer. The final part aims to assess the screening behaviour regarding colorectal cancer. We conducted a pilot study to determine the acceptability, feasibility, and comprehensibility of the instrument. Cronbach alpha was assessed for the internal consistency of the items within each domain. Cronbach alpha ranged from 0.764 to 0.925 for all domains.

### Measurements

Screening behaviour of colorectal cancer was the outcome variable of screening behaviour of colorectal cancer. Respondents were assessed whether they have ever done any of the screening tests, e.g., faecal occult blood test (FOBT), colonoscopy, and sigmoidoscopy, and the duration from the most recent screening. A score of zero was given if the respondents did not undergo any screening test. A score of one was given if the respondents had undergone any type of screening. A score of two was given if the respondents reported the latest screening done based on the recommended guideline.

Health belief of colorectal cancer assessed the perceived susceptibility, perceived severity, perceived benefits, perceived barriers. It consists of 35 items and was adopted from the Champion's Health Belief Model Scale.<sup>27</sup> The response in this section ranged from zero (0) to four (4). A point of four was given for "strongly agree," three for "agree," two for

“somewhat agree,” one for “disagree,” and zero for “strongly disagree.” A total score was computed for each of the constructs, the perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers scores. The maximum score ranged from 20 to 68 for each of the constructs.

Knowledge of colorectal cancer consists of 19 items intended for assessment of knowledge on colorectal cancer. All items consist of closed-ended questions. The item questions were adopted from the Bowel/Colorectal Cancer Awareness Measure (Bowel/Colorectal CAM) questionnaire.<sup>28,29</sup> The response was “yes,” “no,” and “do not know.” Each correct answer was given one point while an incorrect answer or “don’t know” was given zero points. The total score of knowledge level was summed up, giving a minimum of zero and a maximum score of 19.

Health Literacy measured by the 14-item Health Literacy Scale (HSL-14).<sup>29</sup> It measures the functional, communicative, and critical aspects of health literacy. A 5-point Likert type rating scale, ranging from one (1) “strongly disagree” to five (5) “strongly agree,” was used. A score of five was given for “strongly agree,” four for “agree,” three for “not sure,” two for “disagree,” and one for “strongly disagree” except for the functional health literacy component which was reverse scoring. The scores on the items were summed up to give the total health literacy score, as well as functional, communicative, and critical health literacy scores. The summative score ranged from zero to 56. Higher scores indicate better health literacy.

Sociodemographic characteristics were age, sex, educational background, religion, ethnicity, occupation, marital status, household income, and history of colorectal cancer in self and family members.

### Data entry and analysis

The analysis was carried out by Statistical Package for the Social Sciences (SPSS) version 22<sup>30</sup> and WarpPLS 7.0 stable version.<sup>31</sup> All the data were checked thoroughly and cleaned before analysis. Missing data were imputed using multiple imputations. A total of 73 cases were removed due to the presence of duplication and outliers. A remaining of 829 cases were used as final data for analysis. The descriptive analysis describes the sociodemographic characteristics, health literacy, colorectal cancer-related knowledge, belief, and screening behaviour in frequency, mean, and standard deviation. A structural path analysis was done to examine the relationship between screening behaviour on colorectal cancer and health literacy. A p-value less than 0.05 with a 95% confidence interval was considered as statistically significant.

### Model and hypothesis development

The theoretical model was based on the original Health Belief Model (HBM) that uses four main constructs; perceived

susceptibility, perceived severity, perceived benefit and perceived barrier in predicting health behaviours.<sup>32-34</sup> Screening behaviour was the dependent variable. Health literacy could act as part of the modifying variables<sup>35</sup> as well as have a direct relationship with health behaviour.<sup>36</sup> Education, income, and colorectal cancer knowledge were the modifying factors<sup>37</sup> and served as independent variables. The knowledge also could have a direct relationship with screening behaviour.<sup>38</sup> Perceived threats, perceived benefits and barriers were the intermediate variables in the proposed model. Perceived threats were based on the combination of perceived susceptibility and perceived severity.<sup>33,39</sup> Age, gender, ethnicity, and family history of colorectal cancer served as control variables (Figure 1). From the above discussion, a structural path model was developed to test the following hypothesis:

H<sub>1</sub>: Health literacy directly influences the screening behaviour on colorectal cancer and through the perceived threats, perceived benefits, and perceived barriers of colorectal cancer screening.

H<sub>2</sub>: Knowledge of colorectal cancer directly influence the screening behaviour on colorectal cancer and through the perceived threats, perceived benefits, and perceived barriers of colorectal cancer screening.

H<sub>3</sub>: Perceived threats, perceived benefits and perceived barriers of colorectal cancer screening directly influence the screening behaviour on colorectal cancer.

H<sub>4</sub>: Socio-economic factors such as education and income indirectly influence the screening behaviour on colorectal cancer through perceived threats, perceived benefits, and perceived barriers of colorectal cancer screening.

H<sub>5</sub>: Age, gender, family history of colorectal cancer, and monthly income were considered as control variables.

### Ethical issues

Written informed consent was obtained from the respondents before data collection. They were briefed regarding the objective and the nature of the study. Data confidentiality and privacy were assured to the respondents. Permission to conduct the study was obtained from local district offices and community leaders. Ethical clearance was obtained from the Universiti Malaysia Sarawak (Ref: UNIMAS/NC-21.02/03-02 Jld.2(125)).

## RESULTS

### Sociodemographic characteristics

A total of 829 respondents were included in the analysis. Male constituted half of the respondents. The mean (SD) age of the respondents was 55.78 (5.01) years. Two-thirds (41.0%) of the respondents had an educational background

at least an upper secondary school or higher. Both Iban and Bidayuh were the major ethnic group of the sample population with 32.4% and 31.0%, respectively, followed by Chinese (18.5%) and Malay and other bumiputras (18.0%). In terms of occupation, 36.1% of the respondents were housewives or unemployed, while only 5.5% were retired. Within the working group, most of them were self-employed, 27.3% were employed in the private sector, and 20.4% worked in the public sector. More than 90% of the respondents were married. Most of the respondents had a lower income below the mean income of RM1615.37 (SD = 1186.47). Only 2.5% of the respondents had a family history of colorectal cancer (Table 1).

**Table 1: Sociodemographic characteristics**

Characteristics	Frequency (%), n=829	Mean (SD)	Median (min-max)
Age (years)		55.78 (5.01)	54.72 (50-75)
50-59	660 (79.6)		
60 and above	169 (20.4)		
Gender			
Male	419 (50.5)		
Female	410 (49.5)		
Education			
No formal schooling	118 (14.2)		
Primary school	199 (24.0)		
Lower secondary school	172 (20.7)		
Upper secondary school and above	340 (41.0)		
Ethnicity			
Malay	146 (17.6)		
Chinese	153 (18.5)		
Iban	269 (32.4)		
Bidayuh	257 (31.0)		
Others	4 (0.5)		
Occupation			
Public sector	99 (11.9)		
Private sector	132 (15.9)		
Self-employed	253 (30.5)		
Housewife/unemployed	299 (36.1)		
Retired	46 (5.5)		
Marital status			
Single	7 (0.8)		
Married	776 (93.6)		
Divorced	9 (1.1)		
Widow/widower	37 (4.5)		

**Table 1: (Continued)**

Characteristics	Frequency (%), n=829	Mean (SD)	Median (min-max)
Monthly income (RM)		1615.37 (1186.47)	1300.00 (0-10000)
Lower	513 (61.9)		
Higher	316 (38.1)		
Family history of colorectal cancer			
No	808 (97.5)		
Yes	21 (2.5)		

\*Lower income= below the mean; higher income= above the mean

### Screening behaviour

Table 2 shows the type of screening done among the respondents. The overall prevalence of colorectal cancer screening was 2.7%. FOBT was the most type of screening done, followed by colonoscopy and sigmoidoscopy. American Gastroenterological Association CRC guidelines were used to determine the up to date with screening which was FOBT within the last year, sigmoidoscopy within the previous five years, or colonoscopy within the previous ten years<sup>40</sup>. Only 1.9% of the respondents adhere to the current recommendation of colorectal screening of either FOBT or colonoscopy or sigmoidoscopy. FOBT was still the most type of screening done, followed by colonoscopy and sigmoidoscopy.

**Table 2: Type of colorectal cancer screening**

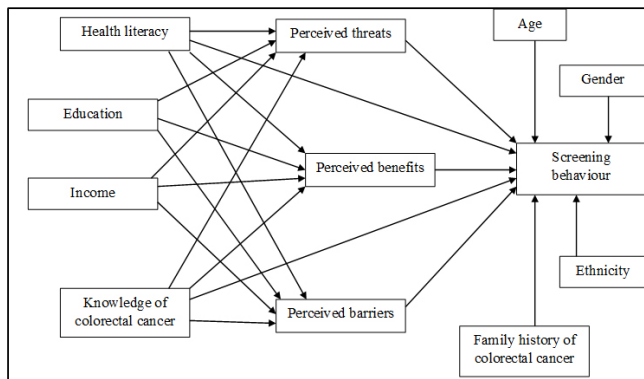
Type of screening	Ever had the screening done, n (%)		Up to date with screening, n (%)	
	Yes	No	Yes	No
Overall (either FOBT or colonoscopy or sigmoidoscopy)	22 (2.7)	807 (97.3)	16 (1.9)	813 (98.1)
FOBT	19 (2.3)	810 (97.7)	10 (1.2)	819 (98.8)
Colonoscopy	10 (1.2)	819 (98.8)	9 (1.1)	820 (98.9)
Sigmoidoscopy	5 (0.6)	824 (99.4)	3 (0.4)	826 (99.6)

### Path analysis

**Model development:** Figure 1 shows the schematic diagrams of the SEM model for the current analysis. The dependent variable, screening behaviour on colorectal cancer was a single item. Both perceived susceptibility and perceived severity of colorectal cancer constituted the perceived threats of colorectal cancer. It consisted of a total of 12 items. A composite score was computed from perceived susceptibility and perceived severity to represent the respondents' perceived threats. A composite score for perceived benefits



and perceived barriers were calculated from six and 17 items, respectively. Knowledge of colorectal was assessed in terms of knowledge on warning signs and risk factors. Similarly, a composite score was calculated from 19 items to represent the respondents' knowledge. For the health literacy variable, it consisted of three main components, functional, communicative, and critical health literacy, with a total of 14 items. A composite score was computed from the 14 items to represent the health literacy of the respondents. Age, gender, family history of colorectal cancer, and ethnicity were included in the model as control variables.



**Figure 1:** Schematic diagram showing the relationship between health literacy and screening behaviour on colorectal cancer.

**Quality of model:** a robust path analysis with non-linear algorithm, bootstrapping resampling method was used for analysis. Model fitting and quality indicated that average path coefficient (APC) = 0.121,  $p < 0.001$  and average R-squared (ARS) = 0.148,  $p < 0.001$ , average block VIF (AVIF) = 1.187 (acceptable if  $\leq 5$ , ideally  $\leq 3.3$ ), average full collinearity VIF (AFVIF) = 1.331, acceptable if  $\leq 5$ , ideally  $\leq 3.3$ . The Tenenhaus GoF (GoF) = 0.384 (small  $\geq 0.1$ , medium  $\geq 0.25$ , large  $\geq 0.36$ ), Sympton's paradox ratio (SPR) = 0.905 (acceptable if  $\geq 0.7$ , ideally = 1), R-squared contribution ratio (RSCR) = 0.997 (acceptable if  $\geq 0.9$ , ideally = 1), Statistical suppression ratio (SSR) = 0.810 (acceptable if  $\geq 0.7$ ), and Nonlinear bivariate causality direction ratio (NLBCDR) = 0.952 (acceptable if  $\geq 0.7$ ).

**Model analysis:** Table 3 and Figure 2 showed the analytic output with the decision on hypothesis. The analysis revealed that health literacy was not associated with screening behaviour on colorectal cancer ( $\beta = 0.018$ ;  $p > 0.05$ ; ES = 0.001). Similarly, knowledge of colorectal cancer did not impact screening behaviour on colorectal cancer ( $\beta = 0.027$ ;  $p > 0.05$ ; ES = 0.003). The analysis found that screening behaviour was positively associated with perceived threats of colorectal cancer ( $\beta = 0.208$ ;  $p < 0.001$ ; ES = 0.048). However, there was no significant association between screening behavior and perceived benefits ( $\beta = 0.031$ ;  $p > 0.05$ ; ES = 0.002) and

perceived barriers ( $\beta = -0.025$ ;  $p > 0.05$ ; ES = 0.001). In contrast health literacy has negative ( $\beta = -0.058$ ;  $p < 0.05$ ; ES = 0.006) while knowledge has positive influence towards the perceived threats of colorectal cancer ( $\beta = 0.176$ ;  $p < 0.001$ ; ES = 0.030). The analysis also established a significant positive relationship between health literacy and perceived benefits ( $\beta = 0.332$ ;  $p < 0.001$ ; ES = 0.113). Similarly, a positive association has been observed between knowledge and perceived benefits ( $\beta = 0.206$ ;  $p < 0.001$ ; ES = 0.048). Health literacy has negative effect towards perceived barriers ( $\beta = -0.118$ ;  $p < 0.001$ ; ES = 0.028). No significant association was observed between knowledge and perceived barriers ( $\beta = -0.040$ ;  $p < 0.001$ ; ES = 0.006). Only a family history of colorectal cancer had an independent influence on screening behaviour on colorectal cancer, while age, gender, and ethnicity did not have any influence.

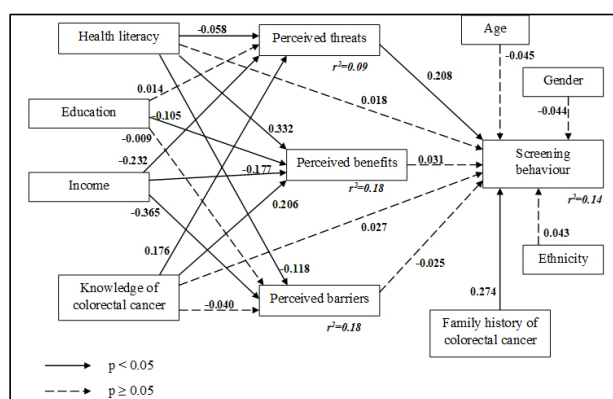
**Table 3: Structural path analysis of screening behaviour on colorectal cancer and health literacy and health belief model**

Hypothesis	Parameters	Coefficient	SE	Effect size	Acceptance
H1	Screening behaviour <- Health literacy	0.018	0.035	0.001	Not accepted
H2	Screening behaviour <- knowledge	0.027	0.035	0.003	Not accepted
H3	Screening behaviour <- perceived threats	0.208***	0.034	0.048*	Accepted
H4	Screening behaviour <- perceived benefits	0.031	0.035	0.002	Not accepted
H5	Screening behaviour <- perceived barriers	-0.025	0.035	0.001	Not accepted
H6	Perceived threats <- health literacy	-0.058*	0.034	0.006	Accepted
H7	Perceived threats <- knowledge	0.176***	0.034	0.030*	Accepted
H8	Perceived threats <- education	0.014	0.035	0.001	Not accepted
H9	Perceived threats <- income	-0.232**	0.034	0.056*	Accepted
H10	Perceived benefits <- health literacy	0.332***	0.034	0.113*	Accepted

H11	Perceived benefits <- knowledge	0.206***	0.034	0.048*	Accepted
H12	Perceived benefits <- education	-0.105**	0.034	0.001	Accepted
H13	Perceived benefits <- income	-0.177***	0.034	0.018	Accepted
H14	Perceived barriers <- health literacy	-0.118***	0.034	0.028*	Accepted
H15	Perceived barriers <- knowledge	-0.040	0.035	0.006	Not accepted
H16	Perceived barriers <- education	-0.009	0.035	0.002	Not accepted
H17	Perceived barriers <- income	-0.365***	0.034	0.145*	Accepted
<b>Control variables</b>					
1	Screening behaviour <- Age	-0.045	0.035	0.002	-
2	Screening behaviour <- Gender	-0.044	0.035	0.001	-
3	Screening behaviour <- Family history	0.274***	0.034	0.081*	-
4	Screening behaviour <- Ethnicity	0.043	0.035	0.001	-

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Effect size: \*small (0.02), \*\*medium (0.15), \*\*\*large (0.35)



**Figure 2:** Structural path analysis of health literacy and screening behaviour on colorectal cancer.

Analysis of the indirect and total effect of different parameters indicated that health literacy did not significantly influence screening behaviour. Knowledge of colorectal cancer significantly affected screening behaviour, although there

was no indirect effect among both variables. Both the income and education level did not affect screening behaviour among the respondents (Table 4).

**Table 4: Indirect effect and the total effect of screening behaviour on colorectal cancer and health literacy and health belief model**

Parameters	Indirect effect	p-value	Total effect	p-value
Screening behaviour <- health literacy	0.001	0.485	0.020	0.285
Screening behaviour <- knowledge	0.044	0.101	0.071	0.020
Screening behaviour <- education	-0.000	0.498	-0.000	0.498
Screening behaviour <- income	-0.045	0.099	-0.045	0.099
Screening behaviour <- perceived threats			0.208	<0.001
Screening behaviour <- perceived benefits			0.031	0.185
Screening behaviour <- perceived barriers			-0.025	0.234
Perceived threats <- health literacy			-0.058	0.048
Perceived threats <- knowledge			0.176	<0.001
Perceived threats <- education			0.014	0.345
Perceived threats <- income			-0.232	<0.001
Perceived benefits <- health literacy			0.332	<0.001
Perceived benefits <- knowledge			0.206	<0.001
Perceived benefits <- education			-0.105	0.001
Perceived benefits <- income			0.177	<0.001
Perceived barriers <- health literacy			-0.118	<0.001
Perceived barriers <- knowledge			-0.040	0.122
Perceived barriers <- education			-0.009	0.402
Perceived barriers <- income			-0.365	<0.001
Screening behaviour <- Age			-0.045	0.096
Screening behaviour <- Gender			-0.044	0.100
Screening behaviour <- Family history of colorectal cancer			0.274	<0.001
Screening behaviour <- Ethnicity			0.043	0.107

## DISCUSSION

This study hypothesises that health literacy could significantly influence the screening uptake of colorectal cancer. However, path analysis in this study fails to establish any significant relationship between health literacy and screening behaviour on colorectal cancer. This finding suggests that health literacy might have no significant role in cancer screening among Sarawak population. This contradicted the other findings where a significant relationship has been established. This might be due to different population adopting different health literacy scale.<sup>41-43</sup> Studies were done in smaller sample sizes between 50 to 99 samples but fail to detect any significant relationship between colorectal cancer screening behaviour and health literacy.<sup>44,45</sup> However, our study conducted in a larger population did not establish any association between screening practices and health literacy. This might be a low rate of colorectal cancer screening (2.7%) compared to other studies with a significant association with high prevalence ranged from 33% to 57%.<sup>42,43,46</sup> Therefore, the finding in this study should be taken cautiously before concluding that health literacy.

Literature showed that perceived benefits and barriers appeared to be the strongest predictor of health-related behaviours in HBM.<sup>47</sup> This may contradict the finding in this study in which perceived threats appear to be the only significant construct in HBM that directly relates to colorectal cancer screening behaviour. Few studies observed a direct relationship between colorectal<sup>47-52</sup> and cervical cancer research.<sup>53</sup> The risk and severity of colorectal cancer consistently influenced the participation in screening,<sup>54</sup> support the previous meta-analysis.<sup>48</sup> Other studies, however, conclude that perception of the threat of colorectal cancer did not alter the screening behaviour.<sup>50,55</sup> Intervention to enhance the screening participation could be directed to increase the perceived threats. The non-significant effects of perceived benefits and barriers towards colorectal cancer screening indicated that it might require other mediators or relationships with other constructs to affect.<sup>37</sup>

HBM has been used in many behavioural studies to predict and investigate the underlying mechanism of health behaviour.<sup>53-58</sup> It has also been used in designing a potential intervention to produce desirable behaviour in the domain of disease prevention.<sup>59-63</sup> However, the ability of HBM to predict health behaviour remains limited and inadequate. Evidence shows that average predictive power ( $r^2$ ) of the model was approximately 20%, including four constructs, perceived susceptibility, perceived severity, perceived benefits and perceived barriers.<sup>47</sup> In this study, the model explaining the screening behaviour shows a predictive power of only 14%. This suggests that there could be other factors that are absent in predicting the effect. Carpenter<sup>11</sup> has highlighted this in their meta-analysis to recommend future studies to add some

variables or determinants to strengthen the model's predictive power. Our analysis did establish the direct effect of the predictors. However, few previous studies reported the direct and indirect relationship among the variables.<sup>33,53,65</sup> The lack of a definitive guide in the relationship and combination among the variables could be a reason.<sup>37</sup>

## LIMITATIONS

This study has some limitations that need discussion. Firstly, this study was a cross-sectional design. The path analysis used in this study does not imply the cause-and-effect relationship. Thus, the causal relationship could not be established. Secondly, we use self-reported behaviour data. Self-reported is often associated with recall bias.<sup>64</sup> This would lead to a less precise estimate of the behaviour, either as an over-or underestimate. The study is also limited by excluding the assessment of self-efficacy and cues to action towards screening behaviour. Thus, this might be suffering from underrepresentation in the health belief model, predicting screening behaviour.<sup>65</sup> Thirdly, we collect data from the Southern part of the State. Thus, the results might not be representative of the whole of Sarawak.<sup>64,65</sup>

## CONCLUSION

There was no significant relationship between health literacy and colorectal cancer screening behaviour among the Sarawak population. The low prevalence of screening could limit the predictive power of the model. The perceived threats have a positive effect, while the perception of benefits and barriers did not significantly associate with screening behaviour. Nevertheless, this study guides the development and formulation of successful health promotion and education to promote colorectal cancer screening uptake by focusing on health belief component apart from health literacy. This could remove the barrier to uptake and effectiveness of the preventive intervention, thus ensure health equity among the diverse population in Sarawak.

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## Authors' Contributions

DJ conceptualised the study, data collection, analysis, and drafted the manuscript; ARA conceptualised the study and edited the manuscript. MMR conceptualised the research and statistical analysis and editing of the manuscript. All authors have read and approved the manuscript for publication.

## Conflict of Interest

The authors declare the absence of conflicting interests.

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